

[54] **PRINTED CIRCUIT BOARD CONNECTOR**

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[58] Field of Search 339/17 F, 17 LC, 17 LM, 17 L, 339/61 M, 74, 75 MP, 174, 176 MF, 176 MP, 221

[56] **References Cited**

UNITED STATES PATENTS

3,467,944	9/1969	Hammell et al.	339/125 R
3,325,770	6/1967	Hammell et al.	339/221 M
3,328,749	6/1967	Kukla	339/221 R
3,395,377	7/1968	Straus	339/17
3,464,054	8/1969	Mansfield	339/176 MP

3,478,301 11/1969 Conrad et al. 339/75

FOREIGN PATENTS OR APPLICATIONS

1,475,962 2/1967 France 339/217 S

OTHER PUBLICATIONS

IBM Technical Disclosure; C. P. Hill et al., Vol. 8 No. 12, May 1966

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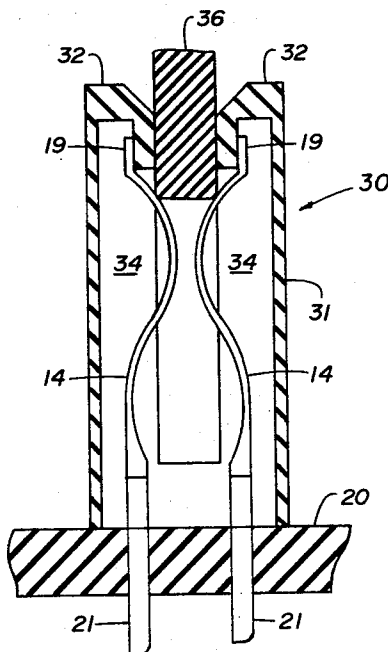
Assistant Examiner—Lawrence J. Staab

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[57] **ABSTRACT**

An apparatus for connecting and terminating contact fingers on the edge of a printed circuit board to connect them to external circuitry. Connector terminals are press fitted into a board and an insulative housing is snapped over the top of the terminals. The structure of the insulative housing permits the contactor portions of the terminals to be preloaded to the proper gap and tension and further provides a closed entryway for a printed circuit board to protect the terminal ends from damage during connection.

12 Claims, 6 Drawing Figures



PRINTED CIRCUIT BOARD CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a connector for contact terminals on a printed circuit board and more particularly, the invention pertains to both a method for making a printed circuit board edge connector and to the connector so constructed.

2. History of the Prior Art

In the past, the majority of printed circuit board connectors have been assembled by first inserting contact terminals into an insulative housing to form a connector and then attaching the connector to a mounting board. Such connectors and methods of manufacture are expensive and relatively slow. Further, since prior art printed circuit board connectors are first loaded with contact terminals from the top of the insulative housing, contact terminals are left exposed. These exposed terminals allow the edges of the board being connected to engage the ends of the contacts upon insertion. This may result in damage to the contact terminals.

Another difficulty encountered with present printed circuit connector designs is that the contacts must be preloaded individually upon insertion to exert a desired pressure against the board contact points. In the manufacture of present connectors, individual preloading of contacts is relatively slow and expensive.

The invention of the present printed circuit board connector is constructed by first press fitting or staking contact terminals into a receiving surface and then attaching an insulative member over the contact terminals. This assembly technique is much more efficient than that of assembling contacts into an insulated holder. Additionally, the present printed circuit board connector features U-shaped end surfaces which cover the ends of the connector terminals to prevent damage to the terminals when the circuit board is inserted and to provide a retaining surface which enables all the contacts to be preloaded simultaneously to exert a desired pressure against the electrical interconnection surfaces and still leave a relatively wide board insertion space.

SUMMARY OF THE INVENTION

The invention relates to an edge connector for a printed circuit board having contact terminals inserted into a substrate and an insulative housing snapped over the outside as well as a method of manufacturing such a connector. More particularly, the invention involves a printed circuit board edge connector which includes a mounting board having a plurality of contact terminals mounted therein and an insulative housing covering the terminals. The housing comprises an outer shell open at the bottom to permit it to fit down over and enclose the contact terminals and has U-shaped edges at the top to define a printed circuit board receiving opening.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and for further objects and advantages thereof, reference may now be had to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of the connector of the present invention with a printed circuit board inserted into place;

FIG. 2 is a perspective view of one of the contacts employed in the connector of the present invention;

FIG. 3 is a cross section view of the printed circuit board connector of the invention; and

FIGS. 4A, 4B and 4C are cross section views illustrating the manner in which the connectors of the present invention is assembled.

DETAILED DESCRIPTION

Referring to FIG. 1, there is shown a printed circuit board connector 10 constructed in accordance with the invention and having a printed circuit board 11 inserted therein. The

printed circuit board mounts a number of electrical components 12 which are interconnected to one another and to an array of plated edge finger terminations 13 by conventional printed circuit techniques. The upper portion of the circuit board is shown cut away and contains components and printed wiring substantially as shown in the lower section. The fingers 13 are electrically connected to those points of the board circuitry which must be interconnected to external circuits. The function of the connector 10 is to terminate and to provide electrical connection to the plated edge finger terminations 13 on the board 11. The connector shown is arranged to terminate a printed circuit board having contact fingers on both the front and rear surfaces of the edge. Connections are made by a plurality of conductive metal contacts 14, one contact for each termination finger 13.

Referring now to FIG. 2, one of the metal contacts 14 is shown and comprises a connector portion 15 and a shank portion 16 which are separated by a shoulder 17 and an enlarged neck section 18 which is greater in width than the shank. A mounting substrate or board 20 upon which the connector is mounted has a plurality of contact receiving holes 21 located at preselected positions. The contact receiving holes 21 are slightly larger than the shank portion 16 of the contact so that a contact will readily pass into the hole. The neck section 18 of the contact is enlarged to such a width that when a contact is staked or press fitted down into a hole, there is a tight frictional engagement between the neck section 18 and the walls of the hole 21. The shoulder 17 limits the depth to which a contact 14 may be pressed into the board. The shank portion 16 of the contact is substantially square in cross section to permit wiring termination by such techniques as wire wrapping.

The connector portion 15 of the contacts 14 is curved into a bowed configuration and is terminated at its end by a flange portion 19 lying in substantially the same plane as the shank portion 16 of the contact. The contact portion 15 is also bifurcated into two sections to provide a more secure, positive, redundant engagement with the printed circuit board edge finger terminations.

Referring now to FIG. 3, there is shown a cross section view of the contact terminals 14 after they have been press fitted down into the receiving holes 21 in the mounting board 20 and an insulative housing 30 placed in position over them. The housing 30 is preferably formed of a moldable insulative material such as nylon or other plastic and includes an outer shell 31 which is open at its bottom portion to allow the shell to fit down over and receive the contacts 14. The shell 31 is partially closed by two U-shaped edge sections 32 at the upper portion to define a top opening through which a printed circuit board edge can be inserted to engage the contacts 14. The housing 30 is preferably divided into a plurality of chambers 33 by wall sections 34. Each of the chambers 33 receives one or more of the circuit connector terminals 14 when the housing 30 is placed down over the terminals. An overhanging lip portion 35 is formed on the innermost part of the U-shaped edge sections 32 to contact the flanges 19 of each of the terminals 14.

It is to be understood that although the connector of the invention illustrates the use of opposed contact pairs, it might only include a single row of contact terminals for engagement with fingers formed on only one side of a printed circuit board. Further, the wall sections 34 could also be spaced from one another so that each of the chambers 33 receives a plurality of single contacts or contact pairs. The circuit board connector is assembled by first inserting all of the terminals into the receiving holes 21 in the board 20 by a technique such as that disclosed and claimed in a patent application entitled Method and Apparatus for Manufacturing Connector Terminals, filed in the name of Jerry A. Kendall on even date herewith.

Once the connector terminals 14 are mounted in the board 20, the insulative housing 30 is placed over the contacts so that a pair of opposed connector terminals are received up within each of the chambers 33. Adjacent contact terminal pairs are separated and insulated from one another by the wall

surfaces 34. The receiving holes into which the opposed terminal pairs are inserted are spaced from one another so that the bowed sections of the contactor portions 15 of opposed terminal parts are separated from one another a distance less than the thickness of the printed circuit boards to be connected.

When the housing 30 is initially placed over the terminals, it comes to rest with the ends of the overhanging lip portions 35 in contact with the ends of the flange portions 19 as shown in FIG. 4A. The final positioning of the housing 30 over the contacts is accomplished by inserting a spacer board 36 having the same thickness as the printed circuit board to be connected into the top opening between the U-shaped edges 32 of the connector housing. The spacer board 36 cams the bowed portions of the contact terminals outwardly, forcing the opposed terminals away from one another and bringing the flanges 19 out from under the overhanging lip portions 35 as shown in FIG. 4B. A downward force is then applied to the housing and the housing moves into position over the connector terminals 14 as shown in FIG. 4C and engages by interference fit with the side edges of shoulders 17 of the contacts 14. When the spacer 36 is withdrawn, the flanges 19 rest against the inside edges of the overhanging lip portions 35 and exert a preselected loading force against them as shown in FIG. 3.

When a printed circuit board is plugged into the top opening of the finished connector, the fingers on the edges of the board are engaged by the bowed sections of the terminals 14 with a preselected force. This ensures a positive electrical connection between the board and the terminals. Preloading contact flanges 19 against the overhanging lip portions 35 allows a force to be exerted against the board while still holding a relatively wide gap between the contact pairs to admit the board edge. The board does not have to perform all the contact flexure to get an adequate force of contact engagement. The preloading feature of the present invention also retains separation of the contact pairs from one another and does not permit accidental touching when a board is removed from the connector. The force of preloading may be increased by initially inserting the terminals into the board 20 closer together and it may be reduced by initially inserting them farther apart. The insulative housing is held in place over the connector terminals by frictional engagement of the separating wall surfaces 34 of the housing with the end surfaces of the contact terminal shoulders 17.

As shown in FIG. 1, the completed connector terminal is used by inserting a printed circuit board having termination fingers 13 thereon into the top opening of the connector. The connector portion 15 of the terminals 14 frictionally engage the fingers 13 and provide electrical connection to external circuitry (not shown) which is interconnected via the shanks 16 of the terminals 14. As can be seen in FIG. 1, the U-shaped edge sections 32 of the insulative housing 30 prevents accidental damage to the ends of the terminals contained therein. This same U-shaped edge enables the contacts to be preloaded and held in place under a desired tension.

As can be seen from the description of the method used in assembling the printed circuit board connector of the present invention, it is much simpler to first insert the terminals into a receiving surface and then snap the insulative housing over the top than it is to individually place the terminals into a receiving insulative housing.

Having described the invention in connection with certain specific embodiments thereof, it is to be understood that further modifications may now suggest themselves to those skilled in the art and it is intended to cover such modifications as fall within the scope of the appended claims.

What is claimed is:

1. An edge connector for a printed circuit board, comprising:
 - a planar mounting substrate
 - a plurality of contact terminals mounted in said planar substrate, and

an insulative housing covering said contact terminals and comprising an outer shell having side walls open at the bottom to permit said shell to fit down over and substantially enclose said contact terminals above said planar substrate, said shell having U-shaped edges at the top to define a printed circuit board receiving opening.

2. An edge connector for a printed circuit board as set forth in claim 1, wherein:

each of said contact terminals includes a flange portion at one end thereof and a bowed section for conductive engagement with the printed circuit board to be connected, said bowed section being structurally located between said flange portion and the point of entry of said contact into said substrate; and

the U-shaped edges of said outer shell defining overhanging lip portions between the top opening and the contact terminals which engage the flange portions of said contact terminals to flex each of said contacts at the point of engagement of said contacts in said substrate and uniformly preload each of said contacts between the contact flange and the point of engagement and hold said terminals against movement toward the top opening.

3. An edge connector for a printed circuit board as set forth in claim 2 wherein:

said contacts are mounted in said planar substrate in opposed contact pairs;

said contacts are initially mounted in said planar substrate spaced so that the flange portions extend into the top opening; and

said contacts are flexed away from the top opening prior to placing the overhanging lip portions into engagement with the flange portions.

4. An edge connector for printed circuit board as set forth in claim 2 wherein said insulative housing includes wall surfaces separating adjacent ones of said contacts.

5. An edge connector for a printed circuit board having edge finger terminations thereon comprising:
 - a mounting board;

a plurality of contact terminals press fit in opposed contact pairs into receiving holds in said board, each of said terminals having a shank portion extending below said board, a neck portion in frictional engagement with the walls of the receiving holes, a shoulder portion in abutting relation with the top surface of said board, a contactor portion and a flange portion at the end, said contactor portion of each terminal being located between said shank portion and said flange portion and bowed toward the opposed contact in each pair; and

an insulative housing enclosing said contacts, said housing having an open bottom and U-shaped edge sections covering the ends of said contacts and forming a top opening to receive a printed circuit board to be connected, the U-shaped edge sections defining overhanging lip portions which engage the flange portions of said contacts and hold said contacts in flexure tension to preload said contacts for engagement with the edge finger terminations on a printed circuit board.

6. An edge connector for a printed circuit board as set forth in claim 5 wherein said housing also includes wall sections which separate each of the adjacent contact terminal pairs.

7. An edge connector for a printed circuit board having edge finger terminations therein comprising:
 - a mounting board;

a plurality of contact terminals press fit in opposed contact pairs into receiving holes in said board, each of said terminals having a shank portion extending below said board, a neck portion in frictional engagement with the walls of the receiving holes, a shoulder portion in abutting relation with the top surface of said board, a contactor portion and a flange portion at the end, said contactor portion of each terminal being bowed toward the opposed contact in each pair; and

an insulative housing enclosing said contacts including wall sections which separate each of the adjacent contact terminal pairs and hold said housing in position by frictional engagement with the shoulders of said contacts, said housing having an open bottom and U-shaped edge sections covering the ends of said contacts and forming a top opening to receive a printed circuit board to be connected, the U-shaped edge sections defining overhanging lip portions which engage the flange portions of said contacts and hold said contacts in flexure tension to preload said contacts for engagement with the edge finger terminations on a printed circuit board.

8. A method of manufacturing a printed circuit board edge connector comprising the steps of:
mounting a pair of contacts each having a bowed portion and a flange in a mounting board;
camming the flanges of the contacts away from each other; and

sliding a housing having a circuit board receiving opening defined by an overhanging lip over the contacts so that the flanges of the contacts are positioned behind the lip of the housing.

9. An edge connector for a printed circuit board having plated contact fingers along at least one edge, comprising:
a planar substrate having aligned contact receiving holes therein;

a plurality of contact each of which includes a neck portion press fitted into said contact receiving holes and a bowed portion for conductive engagement with the plated contact fingers on said board, said contacts being resilient in a direction substantially normal to the longitudinal axes of said contacts and to said aligned holes to apply an engaging force between the bowed portion and said plated contact fingers; and

a layover insulative housing substantially enclosing said contacts and being held in position by frictional engagement with said contacts, said housing having a longitudinally extending opening in the top to receive a printed circuit board and wherein the bowed portions of said contacts extend into the area beneath said top opening prior to insertion of a printed circuit board.

10. An edge connector for a printed circuit board having plated contact fingers along the edge, comprising:
a planar substrate having two parallel rows of aligned contact receiving holes therein;

a plurality of contacts arranged in two opposed parallel rows, each of said contacts including a neck portion press fitted into said contact receiving holes and a bowed por-

tion for conductive engagement with the plated contact fingers on said board, the bowed contact portions in each row extending toward the bowed portions in the opposite row to form contact pairs and said contacts being resilient in a direction substantially normal to the longitudinal axes of said contacts and to said rows of aligned holes to apply an engaging force between the bowed portions and said plated contact fingers; and

a layover insulative housing substantially enclosing said contacts and being held in position by frictional engagement with said contacts, said housing having a longitudinally extending opening in the top to receive a printed circuit board and wherein the bowed portions of said opposed contacts extend into the space beneath said top opening prior to insertion of a printed circuit board.

11. An edge connector for a printed circuit board having plated contact fingers along at least one edge, comprising:
a planar substrate having aligned contact receiving holes therein;

a plurality of contacts press fitted into the holes in said substrate, said contacts each including a bowed portion resilient in a direction transverse to said aligned holes; and

an insulative housing having bottom openings of sufficient size to receive the bowed portions of said contacts and a top opening to receive said printed circuit board, said housing being placed down over said press fitted contacts to substantially enclose said contacts and to receive a printed circuit board in said top opening with the plated fingers of the printed circuit board in conductive engagement with the bowed portions of said contacts.

12. An edge connector for a printed circuit board comprising:

a planar substrate having aligned contact receiving holes therein;

a plurality of contacts press fitted into the holes in said substrate, said contacts each including a bowed portion resilient in a direction transverse to said aligned holes;

an insulative housing having bottom openings of sufficient size to receive the bowed portions of said contacts and a top opening to receive said printed circuit board, said housing being placed down over said press fitted contacts to substantially enclose said contacts; and

a printed circuit board having plated contact fingers along at least one edge inserted into said top opening with the plated fingers of the printed circuit board held in conductive engagement with the bowed portions of said contact by the transverse resilience thereof.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,671,917 Dated June 20, 1972

Inventor(s) John P. Ammon and Frederick T. Inacher

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

cancel "an" and insert--and--; column 4, line 10,
"therein" and insert--thereon-- Column 4, line 65, cancel
"contact" and insert--contacts-- Column 5, line 28, cancel

Signed and sealed this 25th day of December 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

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