

Description

The present invention relates to an electrical connector, and, more particularly, to an electrical connector having two rows of connecting terminals or contactors, one end of each terminal having a bent and protruding tail portion which is disposed in such a manner that the tail portions as a whole are aligned in a row and at which the electrical connector is connected to a flat cable, in particular, to a flat cable for transmitting high speed pulse signals or those each having a short pulse width between computer mainframes or between a computer mainframe and any of its peripherals.

Figure 5 of the drawing shows a female connector 1 of the type described above which is used for high speed signal transmitting flat cable.

The connector 1 has two rows of connecting terminals or contactors 2a, 2b, 2c, 2d, 3a, 3b, 3c, and 3d. Terminals for signal lines 3a, 2b, 3c, and 2d and the terminals for ground lines 2a, 3b, 2c, and 3d among the two rows of terminals 2a, 2b, 2c, 2d, 3a, 3b, 3c, and 3d are located alternately or in a zigzag or checkerboard pattern when viewed from a side of the connector 1 to which pins are to be inserted. One end of each of the terminals of connector 1 is connected to a flat cable 4. In Figure 5, a reference symbol S indicates a signal line terminal, while G designates a ground line terminal. This alternate or checkerboard pattern arrangement of the signal line terminals or the signal lines S and the ground line terminals or the ground lines G is effective to reduce the crosstalk between the signal terminals or the signal lines. In the electrical connector described above, each terminal row is described as having four terminals only for ease and clarification of the explanation. However, it may include five or more, or three or less, terminals.

In the known female connector 1 of the above-described type which is shown in Figures 6 and 7, connecting terminals 101a, 101b, 101c, 101d, 102a, 102b, 102c, and 102d, which respectively correspond to the connecting terminals 2a, 2b, 2c, 2d; 3a, 3b, 3c, and 3d of the connector 1 shown in Figure 5, are each formed of a bent metal sheet 103 having the same shape. The two rows of terminals are disposed in such a manner that those in one row correspond to those in the other row when they are turned by 180 degrees. In the conventional connector 1, tail portions 106a, 107a, 106b, 107b, 106c, 107c, 106d, and 107d bendingly protrude from the sides of the respective terminals 102a, ..., 102d, 103a, ..., 103d at which the terminals are adapted to be connected to an external cable, in such a manner that they are aligned in a row. These tail portions are therefore aligned in the order of G, S, S, G, G, S, S, and G, as shown in

Figure 6.

When the tail portions of the terminals are aligned in the manner shown in Figure 6, the tail portions for the signal lines are brought adjacent to each other, as in the case of the tail portions 107a and 106b or the tail portions 107c and 106d, increasing the possibility of occurrence of the crosstalk of signals to be transmitted through the adjacent respective tail portions.

The present invention is designed to obviate the above-described problem of crosstalk, and an object thereof is to provide an electrical connector which is so improved as to reduce the possibility of occurrence of crosstalk between the tail portions at which the terminals are connected to an external cable.

The above object is achieved according to the present invention by an electrical connector having two rows of connecting terminals, each of said connecting terminals having a tail portion which protrudes from one end thereof in such a manner that the tail portions of adjacent terminals in opposite rows are bent and as a whole are aligned in a row, the connector is adapted to be electrically connected to a cable by means of the tail portions. The tail portions are disposed at positions symmetrical with each other about a plane (A) which is perpendicular to the direction in which the row of tail portions extend and which passes between two of the connecting terminals adjacent to each other in the extending direction (X) of a row.

In the electrical connector of this invention, since the tail portions are disposed at positions mirror symmetrical with each other around a plane (A) which is perpendicular to an extending direction (x) of the row of tail portions and which passes through a midpoint between the connecting terminals adjacent to each other in the extending direction of the rows, the signal line tail portions in the bent and protruding tail portions aligned in a row are always positioned between the ground line tail portions, even if the two rows of connecting terminals are disposed in such a manner that the signal line terminals and the ground line terminals form a checkerboard pattern when viewed from the side of contact of each connecting terminals (the side opposite to that at which the tail portions are provided), and therefore the possibility of occurrence of crosstalk between the signal line tail portions can be reduced.

Figure 1 is a side and front view of a connector, showing a preferred embodiment of the present invention;

Figure 2 is a perspective view of the connector of Figure 1, showing the structure and the arrangement thereof;

Figures 3 and 4 are exploded views of two types of terminal forming metal sheets which are em-

played in the connectors shown in Figures 1 and 2 and which are schematically shown in Figures 1 and 2, respectively;

Figure 5 is a perspective view of a known female connector connected to a flat cable, as viewed from the side thereof to which pins are to be inserted;

Figure 6 is a view similar to Figure 1, showing the known prior art connector of Figure 5; and

Figure 7 is a view similar to Figure 2, showing the known prior art connector of Figure 6.

A female electrical connector 10 according to the preferred embodiment of the present invention will be described with reference to Figures 1 to 4 (this connector looking just like the one shown in Figure 5, when viewed from the side for receiving pins).

A housing 11 of the electrical connector 10 is made of an electrically insulating plastic, and has substantially square column shaped through-holes 13 extending from one end surface 12 thereof to the other end surface (not shown). The through-holes 13 are the same in size and aligned in two rows at the equal spacings. More specifically, the two through-holes 13 in each pair of through-holes adjoin to each other in the direction perpendicular to the extending direction X of the through-hole rows. Each of a pair of through-holes 13a which are disposed alternately in the direction X of extension of each row, houses a first bent metal sheet 14, while the remaining through-holes 13b each accommodate a second bent metal sheet 15.

The first bent metal sheet 14 which is schematically shown in Figures 1 and 2 is a metal sheet pinched into a shape shown in Figure 3 and bent at broken lines 14a and 14b at right angles so that three side surfaces 14g, 14h and 14j out of four side surfaces which form a square tube constitute a female contact pressingly inserted into the corresponding through-hole 13a. A projection 14c which extends from the outer side of the end of the side surface 14g is bent at broken lines 14d and 14e at right angles. The projection 14c has a distal end or a tail portion 14f at which the connecting terminal is adapted to be electrically connected to a wire of a flat cable by soldering.

A second bent metal sheet 15 which is schematically shown in Figures 1 and 2 is a metal sheet punched into a shape shown in Figure 4 and bent at broken lines 15a and 15b at right angles so that three side surfaces 15g, 15h and 15j out of four side surfaces which form a square tube constitute a female contact pressingly inserted into the corresponding through-hole 13b. A projection 15c which extends from the inner side of one end of the side surface 15g is bent at broken lines 15d and 15e at right angles. The projection 15c has a distal end or a tail portion 15f at which the connect-

ing terminal is adapted to be electrically connected to a wire of a flat cable by soldering.

While the projection 14c of each bent metal sheet 14 projects from the outer side of the one end of the side surface 14g, the projection 15c of each bent metal sheet 15 extends from the inner side of the one end of the side surface 15g, i.e., from the vicinity of the broken line 15a. Therefore, the tail portions of the bent metal sheets are positioned mirror symmetrical with each other around or about a virtual mirror plane A which is perpendicular to the X direction and passes through a midpoint between the terminals adjacent to each other in the direction X. The tail portion 15f of each bent metal sheet 15 inserted into the through-hole 13b adjoins the tail portion 14f of the adjacent bent metal sheet 14 inserted into the through-hole 13a in the same row.

Connecting tail portions 19a, 19b, 19c, 19d; 20a, 20b, 20c, 20d of two rows of connecting terminals 17a, 17b, 17c, 17d; 18a, 18b, 18c, 18d of the connector 10 are aligned in a row. However, the tail portions 20a, 19b, 20c, and 19d for connecting signal lines do not adjoin to each other but are disposed between the corresponding tail portions 19a, 20b, 19c, and 20d for connecting ground lines. In other words, the tail portions are disposed as a whole in the order of G, S, G, S, ... with G and S disposed alternately and at the same spacing. In consequence, the possibility of crosstalks of signals which occur at the tail portions is reduced.

In addition, the tail portions which are connected to a flat cable or the like may be buried in a resin.

The connector of this invention may be connected to a coaxial ribbon cable instead of the flat cable.

The bent body which forms a terminal may have any shape instead of that shown in Figures 1 to 4, so long as its tail portion is placed at a location shown in the figure and that it has three or four side surfaces which constitute a contact. The bent body may have the same expanded form.

If the spacings between the through-holes 13 are large compared with the size of the through-hole 13, the tail portions may be disposed at locations which are away from the ends of the through-holes in the X direction toward the intermediate portion thereof. If the size of the through-holes for the signal lines is different or it is different from that of the through-holes for the ground lines, the tail portions may be disposed in any way so long as the alternate arrangement of the S and G is ensured.

The terminal of this connector may be male in place of female.

Claims

1. An electrical connector having two rows of connecting terminals, each of said connecting terminals (14, 15) having a tail portion which protrudes from one end thereof in such a manner that the tail portions (14f, 15f) are bent and as a whole are aligned in a row, and said connector (10) is adapted to be electrically connected to a cable by means of said tail portions (14f, 15f), characterized by the feature that said tail portions (14f, 15f) are disposed at positions symmetrical with each other about a plane (A) which is perpendicular to the direction in which said row of tail portions extend and which passes between two said connecting terminals (14, 15) adjacent to each other in the extending direction (X) of said row.
2. A connector according to claim 1, characterized in that the other end of each of said connecting terminals forms a female contact.
3. A connector according to claim 1 or 2, characterized in that each of said connecting terminals (14, 15) is formed from a bent metal sheet.
4. A connector according to claim 1 or 2 characterized in that in the two rows of connecting terminals, the terminals of pairs of identical electrical terminals (14) are disposed oppositely in adjacent rows in the transverse direction (Y) and alternately with a terminal (15) of a dissimilar pair of terminals in the rows, and that said terminals (14) have first terminal ends or portions disposed in said rows (Y) and projecting tail portions (14f) opposite said first terminal portions for connection to wires of a cable.
5. A connector according to claim 4, characterized in that said pairs of terminals (14,15) are formed of conductive metal sheets of two dissimilar patterns, each having a plurality of fold lines (a,b,d,e) to form a female terminal on said first terminal ends or portions and projecting tail portions (f) which are disposed in a single row and plane at their other ends.
6. A connector according to claim 1 characterized in that each of said terminals (14,15) have a first end disposed in one of said rows and a second tail portion end for connection to a wire of a cable disposed in a single plane, said terminals each having a first (14) or second (15) configuration with each said row having alternating terminals of said first and second

configurations, opposing said terminals in said rows in the direction (Y) perpendicular to said plane have the same configuration, such that the signal line tail portions aligned in said plane are always positioned between the ground line tail portions, even if the two rows of connecting terminals are disposed in such a manner that the signal line terminals and the ground line terminals form a checkerboard pattern when viewed from the other end of said connecting terminals to restrict the possibility of occurrence of crosstalk between the signal line tail portions can be reduced.

Patentansprüche

1. Elektrischer Steckverbinder mit zwei Reihen von Verbindungsklemmen, wobei jede der Verbindungsklemmen (14, 15) einen Schwanzabschnitt besitzt, der so von einem Ende der Verbindungsklemmen absteht, daß die Schwanzabschnitte (14f, 15f) gebogen sind und als Ganzes in einer Reihe ausgerichtet sind, und der Steckverbinder (10) kann mit Hilfe der Schwanzabschnitte (14f, 15f) elektrisch mit einem Kabel verbunden werden, dadurch gekennzeichnet, daß die Schwanzabschnitte (14f, 15f) symmetrisch zueinander in einer Ebene (A) angeordnet sind, die senkrecht ist zu der Richtung, in der die Reihe von Schwanzabschnitten verläuft, und die zwischen den nebeneinanderliegenden Verbindungsklemmen (14, 15) in der Erstreckungsrichtung (X) der Reihe verläuft.
2. Steckverbinder nach Anspruch 1, dadurch gekennzeichnet, daß das andere Ende jeder dieser Verbindungsklemmen einen hülsenartigen Kontakt darstellt.
3. Steckverbinder nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß jede der Verbindungsklemmen (14, 15) aus einem gebogenen Blech hergestellt ist.
4. Steckverbinder nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß in den beiden Reihen von Verbindungsklemmen Paare von identischen elektrischen Klemmen (14) einander gegenüberliegend in nebeneinanderliegenden Reihen in Querrichtung (Y) und einander mit einer Klemme (15) eines davon verschiedenen Paares von Klemmen abwechselnd in den Reihen angeordnet sind, und daß die Klemmen (14) erste Klemmenenden oder -abschnitte besitzen, die in den Reihen (Y) angeordnet sind und herausstehende Schwanzabschnitte (14f) gegenüber den ersten Klemmenabschnitten

zur Verbindung mit den Drähten eines Kabels.

5. Steckverbinder nach Anspruch 4, dadurch gekennzeichnet, daß die Paare von Klemmen (14, 15) aus leitenden Blechen in zwei verschiedenen Mustern hergestellt sind, wobei jedes eine Vielzahl von Falzlinien (a, b, d, e) besitzt, um eine hülsenartige Klemme an den ersten Klemmenenden oder -abschnitten auszubilden, und herausstehende Schwanzabschnitte (f), die in einer einzigen Reihe bzw. Ebene an ihren anderen Enden angeordnet sind.
6. Steckverbinder nach Anspruch 1, dadurch gekennzeichnet, daß jede der Klemmen (14, 15) ein in einer der Reihen angeordnetes erstes Ende besitzt sowie ein zweites Schwanzabschnittende zur Verbindung mit einem in einer einzigen Ebene liegenden Draht eines Kabels, wobei die Klemmen jeweils eine erste (14) oder eine zweite (15) Konfiguration besitzen, und in jeder Reihe die Klemmen der ersten und der zweiten Konfiguration miteinander abwechseln, und wobei die einander gegenüberliegenden Klemmen in den Reihen in Richtung (Y) senkrecht zu der Ebene dieselbe Konfiguration besitzen, so daß die in dieser Ebene ausgerichteten Schwanzabschnitte der Signalleitung immer zwischen den Schwanzabschnitten der Erdleitung positioniert sind, selbst wenn die zwei Reihen von Verbindungsklemmen so angeordnet sind, daß die Signalleitungsklemmen und die Erdleitungsklemmen bei Betrachtung vom anderen Ende der Verbindungsklemmen ein Schachbrettmuster bilden, um ein möglicherweise auftretendes Übersprechen zwischen den Schwanzabschnitten der Signalleitung einzuschränken.

Revendications

1. Connecteur électrique, comportant deux rangées de bornes de connexion, chacune des bornes de connexion (14, 15) comportant une patte qui fait saillie à une extrémité de cette borne d'une façon telle que les pattes (14f, 15f) sont pliées et, dans leur totalité, sont disposées suivant un même alignement en une rangée, le connecteur (10) étant apte à être relié électriquement à un câble au moyen des pattes (14f, 15f), caractérisé en ce que les pattes (14f, 15f) sont disposées en des emplacements symétriques l'un de l'autre par rapport à un plan (A) qui est perpendiculaire à la direction dans laquelle la rangée de pattes s'étend et qui passe entre deux des bornes de connexion (14, 15) adjacentes l'une à l'autre dans la direction (X) suivant laquelle la rangée

s'étend.

2. Connecteur suivant la revendication 1, caractérisé en ce que l'autre extrémité de chacune des bornes de connexion forme un contact femelle.
3. Connecteur suivant l'une des revendications 1 et 2, caractérisé en ce que chacune des bornes de connexion (14, 15) est formée d'un flan de tôle métallique plié.
4. Connecteur suivant l'une des revendications 1 et 2, caractérisé en ce que, dans les deux rangées de bornes de connexion, les bornes constituant des paires de bornes électriques (14) identiques sont disposées d'une manière opposée dans des rangées adjacentes dans la direction transversale (Y) et d'une manière alternée avec une borne (15) d'une paire différente de bornes faisant partie des rangées et en ce que lesdites bornes (14) comportent des premières extrémités ou parties de borne, qui sont disposées dans lesdites rangées (Y), et des pattes (14f) en saillie qui sont disposées d'une manière opposée auxdites premières parties de borne et sont destinées à une connexion avec des conducteurs d'un câble.
5. Connecteur suivant la revendication 4, caractérisé en ce que les paires de bornes (14, 15) sont formées de flans de tôle métallique conductrice ayant deux configurations différentes, chaque flan comportant plusieurs lignes de pliage (a, b, d, e), de façon à former une borne femelle à l'endroit desdites premières extrémités ou parties de borne, et des pattes (f) en saillie qui sont disposées en une rangée unique et dans un seul plan à leurs autres extrémités.
6. Connecteur suivant la revendication 1, caractérisé en ce que chacune des bornes (14, 15) comporte une première extrémité, disposée dans l'une des rangées, et une seconde extrémité formant patte qui est destinée à être reliée à un conducteur d'un câble et est disposée dans un plan unique, les bornes comportant chacune une première (14) ou une seconde (15) configuration, chaque rangée comportant des bornes présentant d'une manière alternée lesdites première et seconde configurations, tandis que lesdites bornes disposées d'une manière opposée dans les rangées dans la direction (Y) perpendiculaire audit plan ont la même configuration, de sorte que les pattes associées aux lignes de signaux qui sont disposées suivant le même alignement dans ledit

plan sont toujours situées entre des pattes associées aux lignes de terre, même si les deux rangées de bornes de connexion sont disposées d'une manière telle que les bornes associées aux lignes de signaux et les bornes associées aux lignes de terre forment un motif en échiquier lorsqu'on les observe par l'autre extrémité des bornes de connexion, de façon à réduire le risque qu'il se produise un couplage parasite entre les pattes associées aux lignes de signaux.

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