

CLIP CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a clip connector for supporting a connectable plate, and electrically and mechanically connecting a conductive portion of the connectable plate to a contact and, more particularly, to a clip connector which is suitable for electrically and mechanically connecting a conductive portion of a connectable plate, such as a liquid crystal glass plate or a liquid crystal film plate, to a conductive portion of a circuit board.

2. Description of the Related Art

In order to mount a connector to a connectable plate, the following methods are conventionally used. According to one method, a claw of a jig or the like is hooked on a spring arranged on a connecting portion of the clip connector. Then, the connectable plate is inserted into the widened space between the connecting portion and the spring, and then the claw is removed. In a second method, the connectable plate is forced into the gap between the connecting portion of the connector and the spring arranged thereon, thereby the gap mentioned above is widened, and the connectable plate is inserted into the gap.

THIS SHEET HAS BEEN
REPLACED

In the first conventional method, it is difficult to properly configure the claw of a jig or the like. Further, it is difficult to perform adjustments of the hooking of the claw. In addition, because of limited space, it is difficult to design the structure so as to prevent plastic deformation of the spring. Further, in the second conventional method, if the connectable plate has a sharp edge as in the case of a liquid crystal glass plate, both the connecting portions of the clip connector and the connectable plate may be damaged.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide a clip connector that reliably comes into contact with the connectable plate.

Another object of this invention is to provide a clip connector such that when it is connected to the connectable plate there is no damage caused to either the connectable plate or to itself.

In accordance with this invention, there is provided a clip connector, which includes a housing, a plurality of contacts mounted on the housing, and a connectable plate, the connectable plate being connected to each of the contacts; wherein a clip holds together the connectable plate and the housing, which has an inclined portion and a uniform thickness portion; and wherein the opening width of the clip is larger than the thickness of the connectable plate but smaller than the sum of the thickness of the connectable plate and the thickness of the uniform

This Sheet Has Been Replaced



thickness portion.

Further, in accordance with this invention, there is provided a clip connector which includes a housing, a plurality of contacts mounted on the housing, and a connectable plate, the connectable plate being connected to each of the contacts; wherein the spacing of a resilient forked portion of each contact is slightly larger than the thickness of the connectable plate in a direction perpendicular to the direction in which the connectable plate is inserted into each contact in a state in which the connectable plate is inclined with respect to the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a front view of a clip connector according to a first embodiment of this invention;

Fig. 1B is a rear elevational view of the clip connector according to the first embodiment of this invention;

Fig. 1C is an enlarged sectional view taken along the line A-A of Fig. 1B;

Fig. 1D is a side view of the clip connector according to the first embodiment of this invention;

Fig. 2 is a sectional view showing a state in which the clip of the clip connector of the first embodiment of this invention has not yet been mounted to the connectable plate and the housing;

Fig. 3 is a sectional view showing a state of beginning to mount the clip of the clip connector of the first embodiment of this invention to the connectable plate



and the housing;

Fig. 4 is a sectional view showing a state of mounting the clip of the clip connector of the first embodiment of this invention to the connectable plate and the housing;

Fig. 5 is a sectional view showing a state in which the clip of the clip connector of the first embodiment of this invention has been mounted to the connectable plate and the housing;

Fig. 6 is a sectional view of a clip connector according to a second embodiment of this invention, showing the relationship between the thickness of a connectable plate and a changeable interval of contacts in a state in which the connectable plate is not fitted in the clip connector;

Fig. 7 is a sectional view of the clip connector according to the second embodiment of this invention, showing the spacing of the resilient forked portion of the contacts in a direction perpendicular to the direction in which the connectable plate is inserted into the contacts;

Fig. 8 is a sectional view showing a state in which the clip connector according to the second embodiment of this invention has had the connectable plate fitted in it, with the clip not yet being used;

Fig. 9 is a sectional view showing a state in which the clip connector of the second embodiment of this invention has had the connectable plate fitted in it, with the clip being used;

Fig. 10A is a front view of the clip connector according to the second embodiment of this invention;

Fig. 10B is a rear elevational view of the clip connector according to the second embodiment of this invention;

Fig. 10C is an enlarged sectional view taken along the line A-A of Fig. 10B; and

Fig. 10D is a side view of the clip connector according to the second embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Clip connectors according to two embodiments of this invention will be described.

Referring first to Figs. 1A to 5, a first embodiment of this invention will now be described.

Figs. 1A to 1D are drawings showing a clip connector according to this first embodiment. To explain the construction more specifically, a plurality of contacts 3 are mounted in a row on a housing 1. A clip 4, having a U-shaped cross-sectional configuration is mounted on either side of the plurality of contacts 3. The clips 4 are detachable with respect to the housing 1 of the clip connector and are employed to support the clip connector with a connectable plate 2, such as a liquid crystal glass plate, which is described below. The housing 1 has an inclined portion 1a and a horizontal portion (uniform thickness portion) 1b for enabling the clips 4 to be easily mounted.

Figs. 2 to 5 show how a clip 4 is mounted to the housing 1 of the clip connector and the connectable plate 2. Referring to Fig. 2, the gap between a connector-housing-side end portion 4b of the clip 4 and an end portion to face the upper surface of the connectable plate 4c constitutes a clip opening 4a. The opening width 4e of the clip opening 4a is larger than the thickness of the connectable plate 2b, but smaller than the sum of the thickness of the connectable plate 2b and the thickness of the portion of the housing 1 to which the clip 4 is mounted (the diagonally shaded portion). An insulating coating portion 4d (indicated by marks x) is provided on the portion of the clip 4 which will be in contact with the connectable plate 2 and the peripheral portion.

When the clip 4 is moved from the position shown in Fig. 2 in the direction of the arrow shown in Fig. 3, the clip 4 can be mounted to the connectable plate 2 with zero insertion force without touching a sharp edge 2a of the connectable plate 2, and no force is applied to the spring of the clip 4 in the process.

When the clip 4 is moved further in the direction of the arrow shown in Fig. 3, the insulating coating portion 4d comes into contact with the surface of the connectable plate 2, as shown in Fig. 4, as a result of a reaction force. In this case, the reaction force is applied to the connector-housing-side end portion 4b from the inclined portion 1a of the housing 1 in the direction of the arrow.

When the clip 4 is moved still further in the direction of the arrow shown in Fig. 4, as shown in Fig. 5, the connector-housing-side end portion 4b comes into contact with the horizontal portion 1b of the housing 1. In this state, the clip 4 holds together the connectable plate 2 and the housing 1. Further, the connectable plate 2 is in contact with a plurality of contacts 3. In this case, the surface pattern of the connectable plate 2 is not damaged, since the clip 4 has the insulating coating portion 4d.

Next, referring to Figs. 6 to 10D, a second embodiment of this invention will be described.

Fig. 6 is a sectional view of a clip connector according to the second embodiment of this invention, showing the relationship between the thickness of a connectable plate L_3 and a changeable interval L_1 of contacts 14 when the connectable plate, such as a liquid crystal glass plate, is not fitted in ($L_1 < L_3$). A plurality of contacts 14 are mounted in a row on a housing 13.

Fig. 7 is a sectional view of the clip connector according to the second embodiment of this invention. The spacing L_2 of a resilient forked portion of the contacts 14 is larger by α than the thickness of the connectable plate L_3 , so that the connectable plate can be inserted into the contact 14 with zero insertion force from a direction inclined by θ with respect to the housing 13.

In the state shown in Fig. 7, the connectable plate 16, such as a liquid crystal glass plate, is inserted into

the resilient forked portion of the contacts 14 with zero insertion force from the direction inclined by θ with respect to the housing 13.

Then, the connectable plate 16 is rotated counterclockwise about a point a of the contacts 14 to the horizontal position shown in Fig. 8. Then, a desired contact force is obtained between the contact point c positioned somewhat outside the point a of the contacts 14 and the connectable plate 16. As a result, the connectable plate 16 and the contacts 14 can be connected without any damage caused to the patterns, etc., on the connectable plate or to the contacts 14 of the connector.

In the state shown in Fig. 8, however, when the external force which biases the connectable plate 16 in the counterclockwise direction is cancelled, the connectable plate 16 is caused to rotate clockwise because of the spring force of the contacts 14. To prevent such clockwise rotation of the connectable plate 16, a clip 15, as shown in Fig. 9, is employed. The cross-sectional configuration of the clip 15 is U-shaped. The connector is fixed to the connectable plate 16 by means of holding the housing 13 of the connector together with the connectable plate 16. Thus, the connector holds the connectable plate 16 in a desired fitted-in state.

Figs. 10A to 10D are drawings showing the clip connector according to the second embodiment. To explain the construction more specifically, the connectable plate 16 and the contacts 14 of the clip connector are connected

at a connecting portion 11. The thickness of the connectable plate 16 is somewhat smaller than the narrow spacing between a point a positioned near the gate of the contacts 14 and a point b so that the connectable plate 16 can be inserted into the resilient forked portion of the contact 14 with zero insertion force from the direction inclined by θ with respect to the housing 13. This clip connector and the associated connectors fit in together at a fit-in portion 12. A plurality of contacts 14 are mounted in a row on the housing 13. A clip 15 is arranged at either end of the plurality of contacts 14. The clip 15 is detachable with respect to the housing 13. The clip 15 is employed in order to support the clip connector in the position shown in Fig. 9 with respect to the connectable plate 16.

Instead of the clip 15 described above, a clip having another construction may be employed so that the connectable plate 16 may be engaged with the housing 13 in parallel thereto.

As is apparent from the above description, this invention provides the following advantages:

1. The clip connector can be connected to the connectable plate without any damage being caused to the connectable plate or to the clip connector. Thus, this clip connector is useful for the connection of a connectable plate such as a liquid crystal glass plate or a liquid crystal film plate, in which the surfaces are liable to be damaged and on which there is a sharp edge.

THIS SHEET HAS BEEN
REPLACED

10

2. By using the clip, the clip connector can be easily connected to the connectable plate.

This Sheet Has Been Replaced





THIS SHEET HAS BEEN
REPLACED

WHAT IS CLAIMED IS:

1. A clip connector comprising a housing, a plurality of contacts mounted on said housing, and a connectable plate, said connectable plate being connected to each of said plurality of contacts, wherein a clip holds together said connectable plate and said housing having an inclined portion and a uniform thickness portion, and wherein the opening width of said clip is larger than the thickness of said connectable plate but smaller than the sum of the thickness of said connectable plate and the thickness of said uniform thickness portion.

2. A clip connector comprising a housing, a plurality of contacts mounted on said housing, and a connectable plate, said connectable plate being connected to each of said plurality of contacts, the spacing of a resilient forked portion of each of said plurality of contacts is slightly larger than the thickness of said connectable plate in a direction perpendicular to the direction in which said connectable plate is inserted into each of said plurality of contacts in a state in which it is inclined with respect to said housing.

3. A clip connector as claimed in claim 1 or 2, further comprising an insulating coating portion provided in the portion of said clip which is in contact with said connectable plate.

4. A clip connector as claimed in claim 1 or 2, wherein said connectable plate comprises a liquid crystal





THIS SHEET HAS BEEN
REPLACED

plate.

5. A clip connector as claimed in claim 1 or 2, wherein said connectable plate is fixed to said housing in parallel thereto by means of said clip.

6. A clip connector as claimed in claim 5, wherein the cross-sectional configuration of said clip is U-shaped, and wherein said clip holds together said connectable plate and said housing.

7. A clip connector as claimed in claim 5, wherein said clip is detachable with respect to said housing.

This Sheet Has Been Replaced



ABSTRACT OF THE DISCLOSURE

CLIP CONNECTOR

A connectable plate (2) is mounted on an upper surface of a horizontal portion (the uniform thickness portion) (1b) of a housing (1). A plurality of contacts (3) mounted on the housing come into contact with a pattern of the connectable plate. A clip (4) has a U-shaped cross-sectional configuration. A spacing of a resilient forked portion of the contacts (an opening width) is larger than the thickness of the connectable plate but smaller than the sum of the thickness of the connectable plate and the thickness of the uniform thickness portion. When the clip is mounted to the connectable plate and the housing, an insulating coating portion (4d) of the clip slides onto the upper surface of the connectable plate, and a connector-housing-side end portion (4b) of the clip presses against an inclined portion (1a) of the housing. Thus, the opening width of the clip becomes larger, so that the connector-housing-side end portion slides smoothly onto the lower surface of the uniform thickness portion. As a result, the clip holds the connectable plate and the housing, and does not cause damage to either the connectable plate or to the clip connector.

FIG. 1

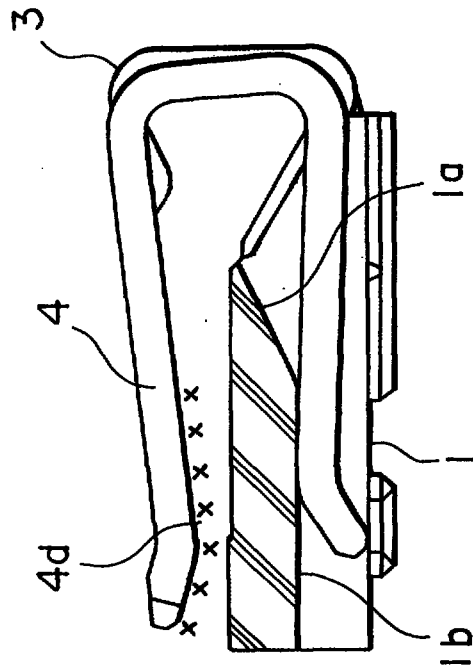


FIG. 1C

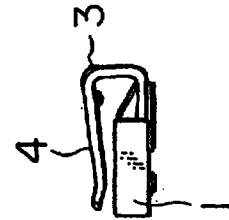


FIG. 1D

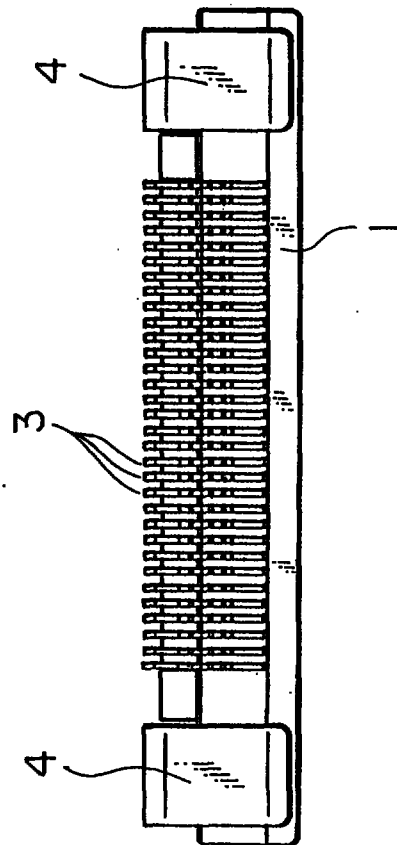


FIG. 1A

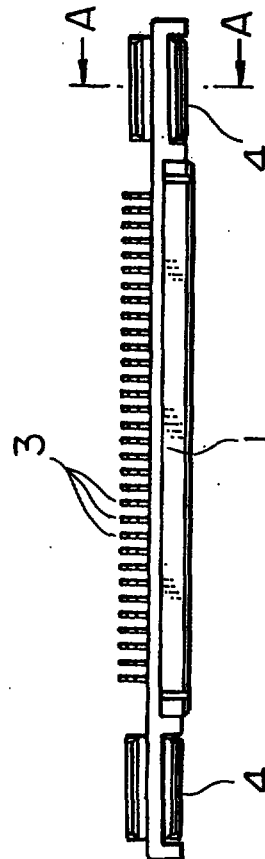


FIG. 1B

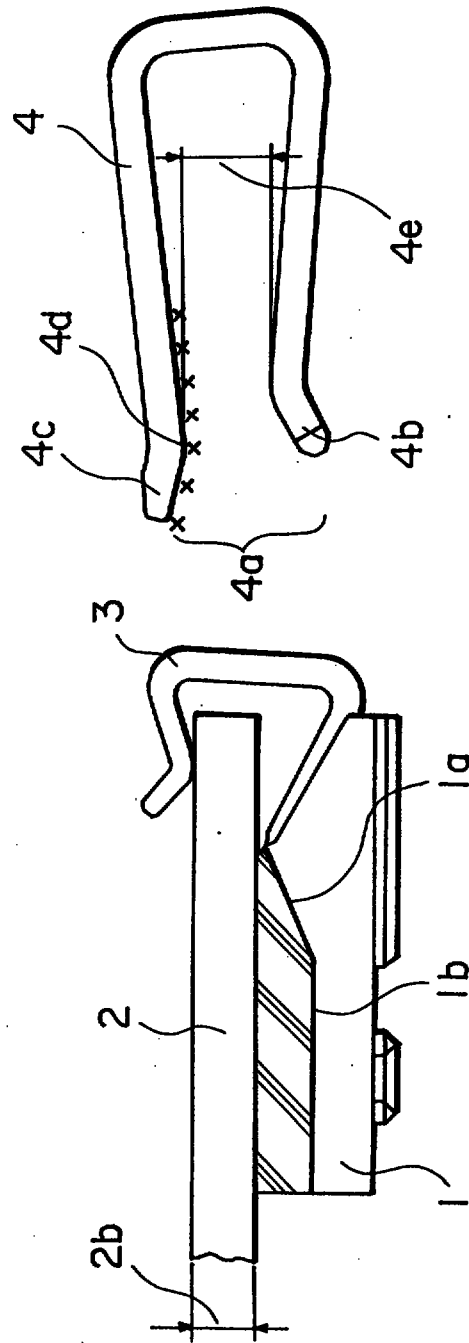
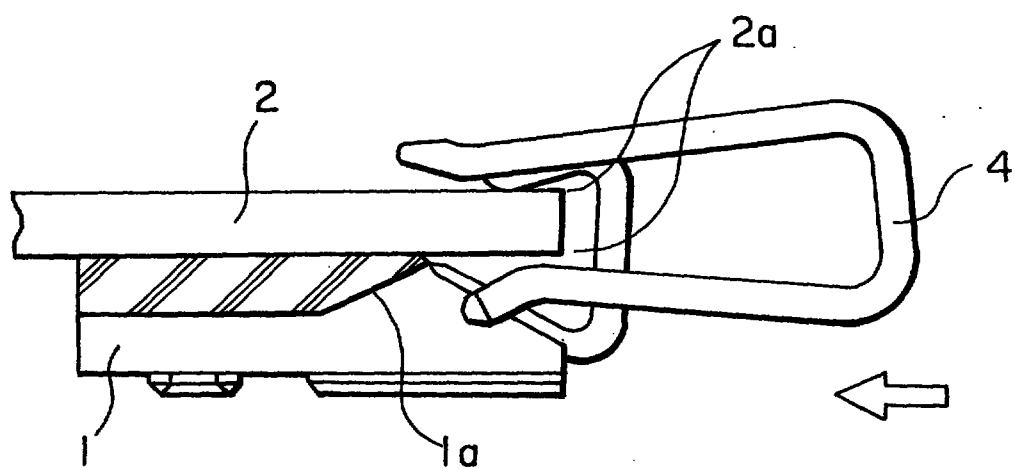


FIG. 2

**FIG. 3**

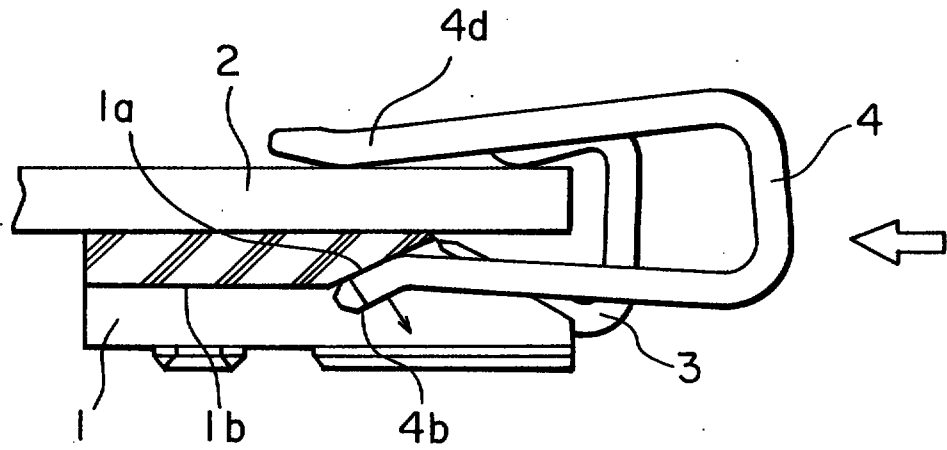


FIG. 4

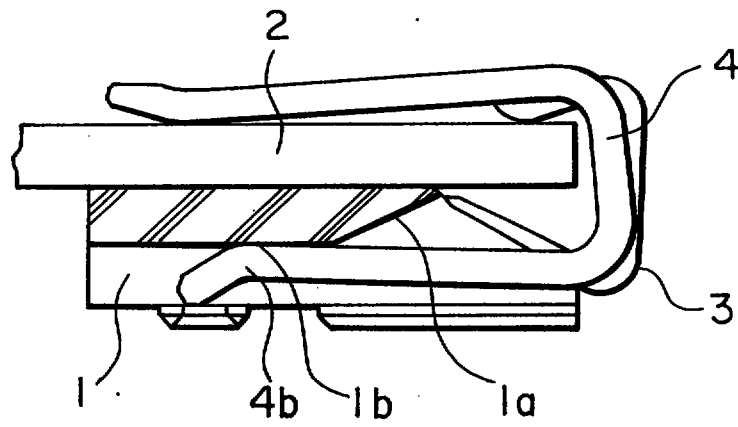


FIG. 5

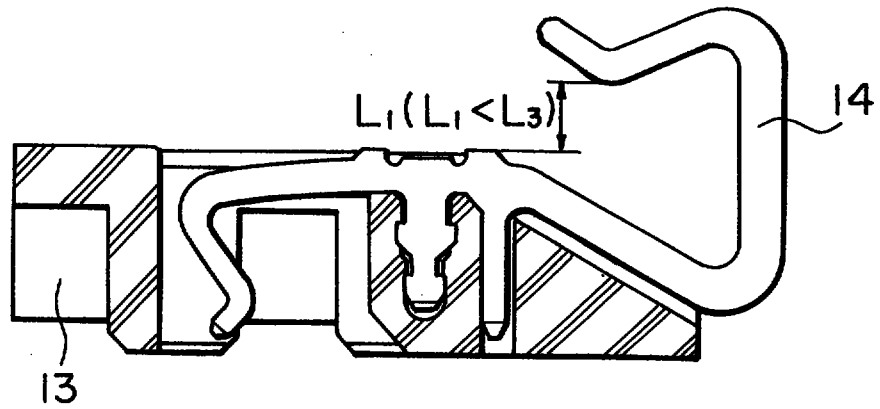


FIG. 6

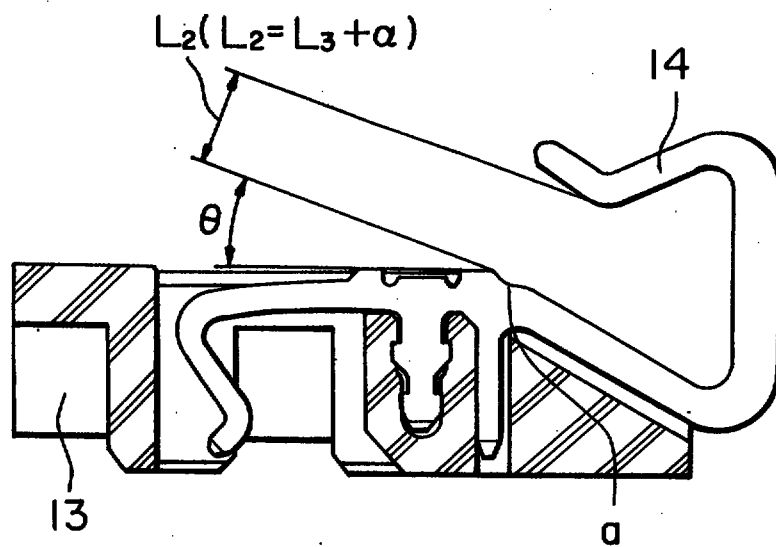


FIG. 7

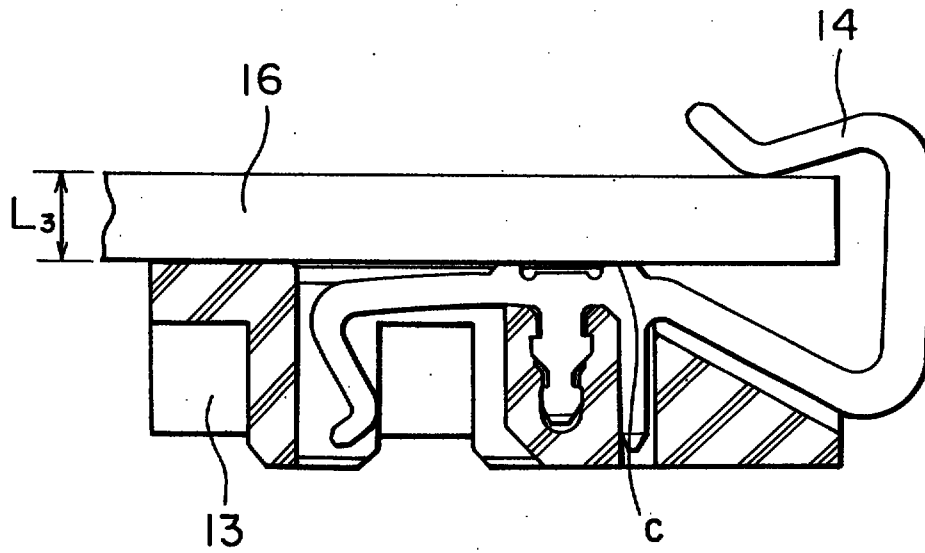


FIG. 8

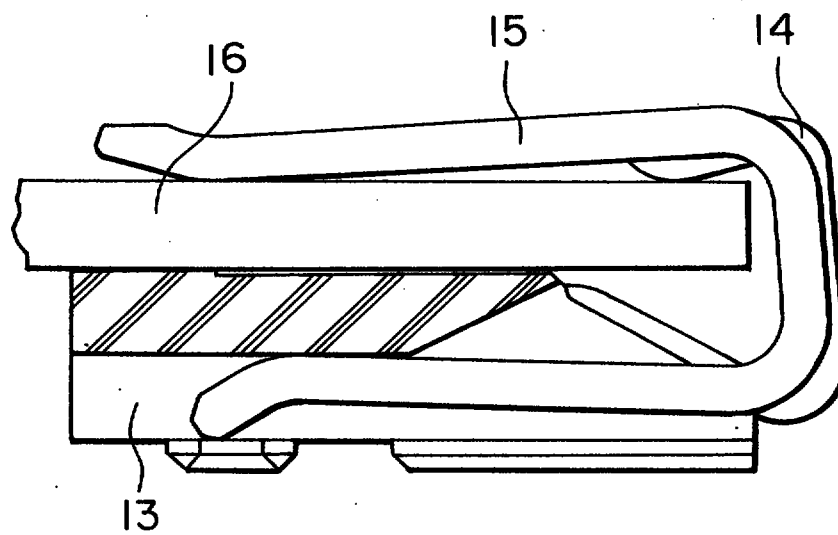


FIG. 9

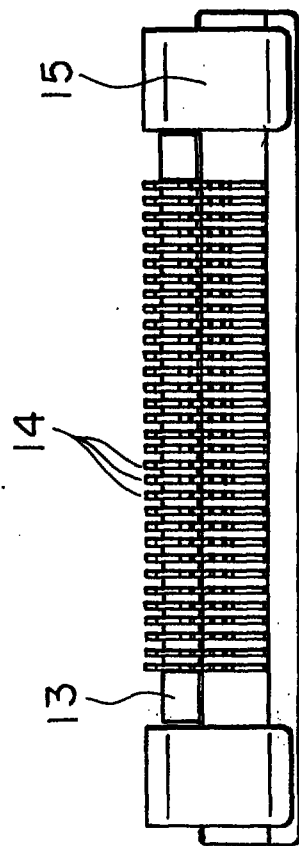


FIG. 10A

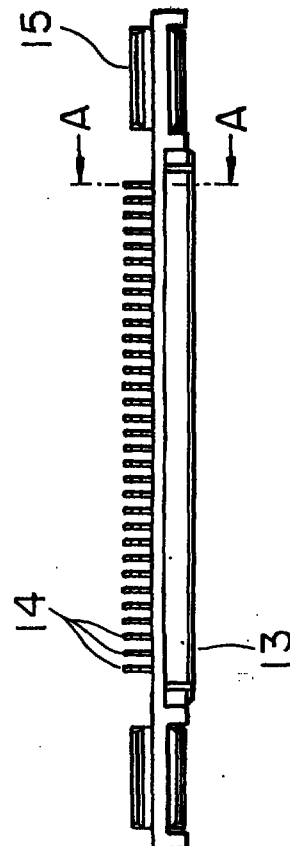


FIG. 10B

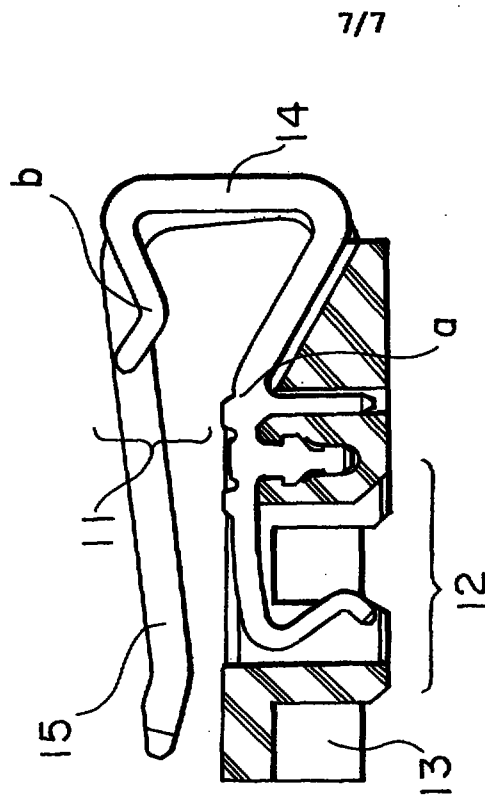


FIG. 10C

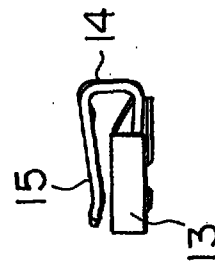
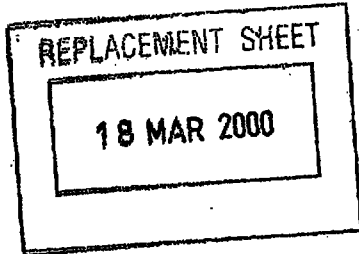


FIG. 10D



Substitute sheet - 17 March 2000

THIS SHEET HAS BEEN
REPLACED

- 2 -

In the first conventional method, it is difficult to properly configure the claw of a jig or the like. Further, it is difficult to perform adjustments of the hooking of the claw. In addition, because of limited space, it is difficult to design the structure so as to prevent plastic deformation of the spring. Further, in the second conventional method, if the connectable plate has a sharp edge as in the case of a liquid crystal glass plate, both the connecting portions of the clip connector and the connectable plate may be damaged.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided a connector comprising:

- a connector housing;
- 10 a plurality of contacts mounted on said connector housing;
- a connectable plate electrically connectable to said plurality of contacts;
- a clip connectable with said connector housing and said connectable plate for holding said connectable plate in contact with said connector housing;
- wherein said connector housing includes an inclined portion and a uniform thickness
- 15 portion, and wherein an opening width of said clip is larger than a thickness of said connectable plate but smaller than the sum of the thickness of said connectable plate and a thickness of said uniform thickness portion.

In accordance with the present invention there is also provided a connector

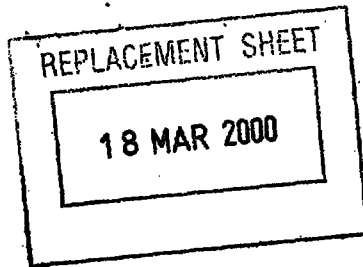
20 comprising:

- a connector housing;
- a plurality of contacts mounted on said connector housing;
- a connectable plate electrically connectable to said plurality of contacts;
- a clip connectable with said connector housing and said connectable plate for holding
- 25 said connectable plate in contact with said connector housing;

wherein a spacing of a resilient U-shaped portion of each of said plurality of contacts is shaped to allow said connectable plate to be inserted into said U-shaped portions of said plurality of contacts in an inclined state with respect to said connector housing.

This Sheet Has Been Replaced





Substitute sheet - 17 March 2000

THIS SHEET HAS BEEN
REPLACED

- 3 -

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a front view of a clip connector according to a first embodiment of this invention;

- 5 Fig. 1B is a rear elevational view of the clip connector according to the first embodiment of this invention;

Fig. 1C is an enlarged sectional view taken along the line A-A of Fig. 1B.

Fig. 1D is a side view of the clip connector according to the first embodiment of this invention;

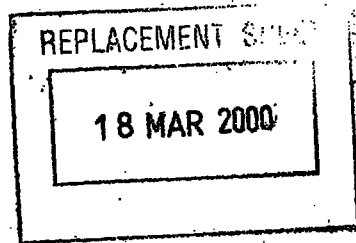
- 10 Fig. 2 is a sectional view showing a state in which the clip of the clip connector of the first embodiment of this invention has not yet been mounted to the connectable plate and the housing;

Fig. 3 is a sectional view showing a state of beginning to mount the clip of the clip connector of the first embodiment of this invention to the connectable plate

15

This Sheet Has Been Replaced





Substitute sheet - 17 March 2000

10

2. By using the clip, the clip connector can be easily connected to the connectable plate.

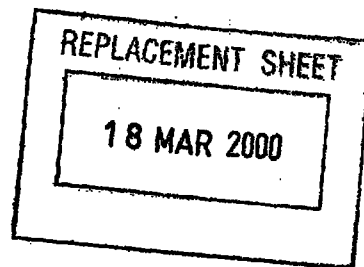
Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.



THIS SHEET HAS BEEN
REPLACED

Substitute sheet - 17 March 2000

- 11 -



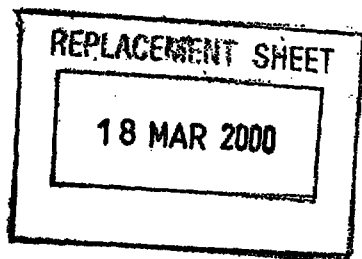
WHAT IS CLAIMED IS:

1. A connector comprising:
a connector housing;
5 a plurality of contacts mounted on said connector housing;
a connectable plate electrically connectable to said plurality of contacts;
a clip connectable with said connector housing and said connectable plate for holding
said connectable plate in contact with said connector housing;
wherein said connector housing includes an inclined portion and a uniform thickness
10 portion, and wherein an opening width of said clip is larger than a thickness of said
connectable plate but smaller than the sum of the thickness of said connectable plate and a
thickness of said uniform thickness portion.
2. A connector comprising:
15 a connector housing;
a plurality of contacts mounted on said connector housing;
a connectable plate electrically connectable to said plurality of contacts;
a clip connectable with said connector housing and said connectable plate for holding
said connectable plate in contact with said connector housing;
20 wherein a spacing of a resilient U-shaped portion of each of said plurality of contacts
is shaped to allow said connectable plate to be inserted into said U-shaped portions of said
plurality of contacts in an inclined state with respect to said connector housing.
3. A connector as claimed in claim 1 or 2, further comprising an insulating coating
25 portion provided in a portion of said clip which, when connected to said connector housing
and said connectable plate, is in contact with said connectable plate.
4. A connector as claimed in claim 1 or 2, wherein said connectable plate comprises a
liquid crystal plate.

30

This Sheet Has Been Replaced





Substitute sheet - 17 March 2000

- 12 -

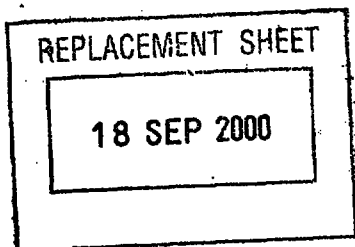


5. A connector as claimed in claim 1 or 2, wherein said connectable plate is fixed to said housing substantially in parallel thereto by means of said clip.
6. A connector as claimed in claim 5, wherein the cross-sectional configuration of said clip is U-shaped.
7. A connector as claimed in claim 5, wherein said clip is detachable with respect to said connector housing.

10

This Sheet Has Been Replaced





9803077-8
170515

Substitute sheet - 15 September 2000

- 2 -

In the first conventional method, it is difficult to properly configure the claw of a jig or the like. Further, it is difficult to perform adjustments of the hooking of the claw. In addition, because of limited space, it is difficult to design the structure so as to prevent plastic deformation of the spring. Further, in the second conventional method, if the connectable plate has a sharp edge as in the case of a liquid crystal glass plate, both the connecting portions of the clip connector and the connectable plate may be damaged.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided a connector comprising:

a connector housing;

a plurality of contacts mounted on said connector housing;

a connectable plate electrically connectable to said plurality of contacts; and

a clip connectable with said connector housing and said connectable plate for holding said connectable plate in contact with said connector housing;

wherein said connector housing includes an inclined portion and a uniform thickness portion, and wherein an opening width of said clip is larger than a thickness of said connectable plate but smaller than the sum of the thickness of said connectable plate and a thickness of said uniform thickness portion such that said clip can be mounted on said connectable plate, without touching a sharp edge thereof, by initially placing said clip in contact with said inclined portion and by effecting further movement of said clip so as to contact said uniform thickness portion.

In accordance with the present invention there is also provided a connector comprising:

a connector housing;

a plurality of contacts mounted on said connector housing;

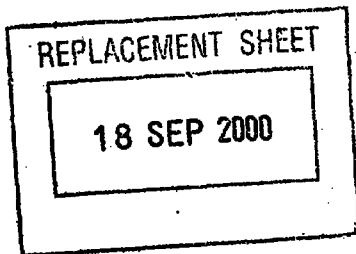
a connectable plate electrically connectable to said plurality of contacts; and

a clip connectable with said connector housing and said connectable plate for holding said connectable plate in contact with said connector housing;

wherein a spacing of a resilient U-shaped portion of each of said plurality of contacts is shaped to allow said connectable plate to be inserted into said U-shaped portions of said plurality of contacts in an inclined state with respect to said connector housing; and

wherein said connector housing includes an inclined portion and a uniform thickness portion, and wherein an opening width of said clip is larger than a thickness of said connectable

9803077-8
18/9/00



Substitute sheet – 15 September 2000

- 3 -

plate but smaller than the sum of the thickness of said connectable plate and a thickness of said uniform thickness portion such that said clip can be mounted on said connectable plate, without touching a sharp edge thereof, by initially placing said clip in contact with said inclined portion and by effecting further movement of said clip so as to contact said uniform thickness portion.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a front view of a clip connector according to a first embodiment of this invention;

Fig. 1B is a rear elevational view of the clip connector according to the first embodiment of this invention;

Fig. 1C is an enlarged sectional view taken along the line A-A of Fig. 1B.

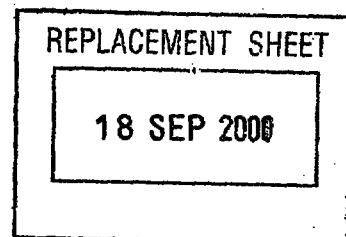
Fig. 1D is a side view of the clip connector according to the first embodiment of this invention;

Fig. 2 is a sectional view showing a state in which the clip of the clip connector of the first embodiment of this invention has not yet been mounted to the connectable plate and the housing;

Fig. 3 is a sectional view showing a state of beginning to mount the clip of the clip connector of the first embodiment of this invention to the connectable plate



WHAT IS CLAIMED IS:



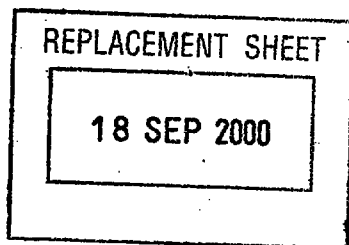
1. A connector comprising:
a connector housing;
a plurality of contacts mounted on said connector housing;
a connectable plate electrically connectable to said plurality of contacts; and
a clip connectable with said connector housing and said connectable plate for holding said connectable plate in contact with said connector housing;

wherein said connector housing includes an inclined portion and a uniform thickness portion, and wherein an opening width of said clip is larger than a thickness of said connectable plate but smaller than the sum of the thickness of said connectable plate and a thickness of said uniform thickness portion such that said clip can be mounted on said connectable plate, without touching a sharp edge thereof, by initially placing said clip in contact with said inclined portion and by effecting further movement of said clip so as to contact said uniform thickness portion.

2. A connector comprising:
a connector housing;
a plurality of contacts mounted on said connector housing;
a connectable plate electrically connectable to said plurality of contacts; and
a clip connectable with said connector housing and said connectable plate for holding said connectable plate in contact with said connector housing;

wherein a spacing of a resilient U-shaped portion of each of said plurality of contacts is shaped to allow said connectable plate to be inserted into said U-shaped portions of said plurality of contacts in an inclined state with respect to said connector housing; and

wherein said connector housing includes an inclined portion and a uniform thickness portion, and wherein an opening width of said clip is larger than a thickness of said connectable plate but smaller than the sum of the thickness of said connectable plate and a thickness of said uniform thickness portion such that said clip can be mounted on said connectable plate, without touching a sharp edge thereof, by initially placing said clip in contact with said inclined portion and by effecting further movement of said clip so as to contact said uniform thickness portion.



Substitute sheet – 15 September 2000

- 12 -

3. A connector as claimed in claim 1 or 2, further comprising an insulating coating portion provided in a portion of said clip which, when connected to said connector housing and said connectable plate, is in contact with said connectable plate.
4. A connector as claimed in claim 1 or 2, wherein said connectable plate comprises a liquid crystal plate.
5. A connector as claimed in claim 1 or 2, wherein said connectable plate is fixed to said housing substantially in parallel thereto by means of said clip.
6. A connector as claimed in claim 5, wherein the cross-sectional configuration of said clip is U-shaped.
7. A connector as claimed in claim 5, wherein said clip is detachable with respect to said connector housing.