

- [54] **CONNECTOR ASSEMBLY HAVING POSITIVE RETENTION MEANS**
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[57] **ABSTRACT**

The connector assembly of the invention basically includes three parts plus the connector itself. A lower plate and an upper plate are secured together to secure the connector therebetween. The connector is arranged to receive printed circuit contacts on the connector contact side and a cable on the connector terminal side. A third piece of the assembly is pivotally mounted between the upper and lower plates, which third piece includes retention plugs at one end and a depression point at the other end thereof. Depressing the depression point raises the plugs so as to either enable the insertion or removal of a circuit board having contacts to mate with the connector contacts. The circuit board includes retention holes for receiving the retention plugs so that there is a positive engagement of the plugs with the holes thereby securing the circuit board with the connector. Securing of the upper plate to the lower plate insures this positive connection retention.

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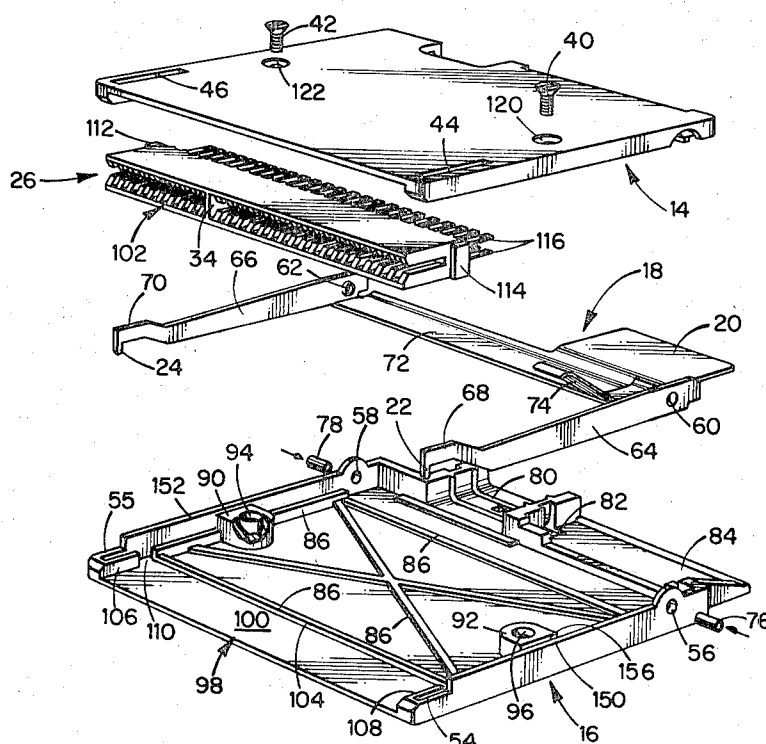
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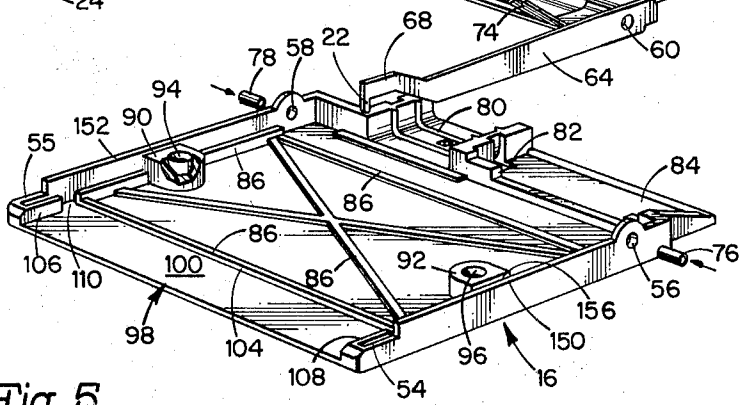
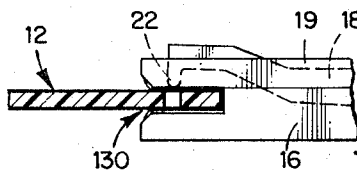
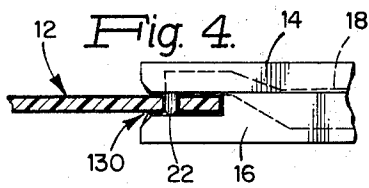
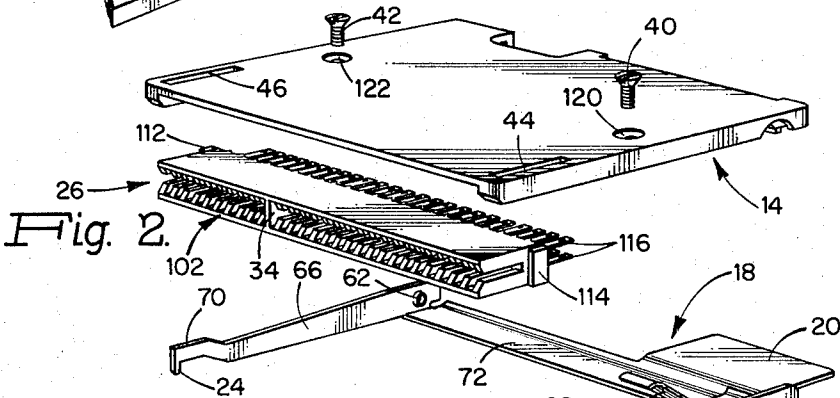
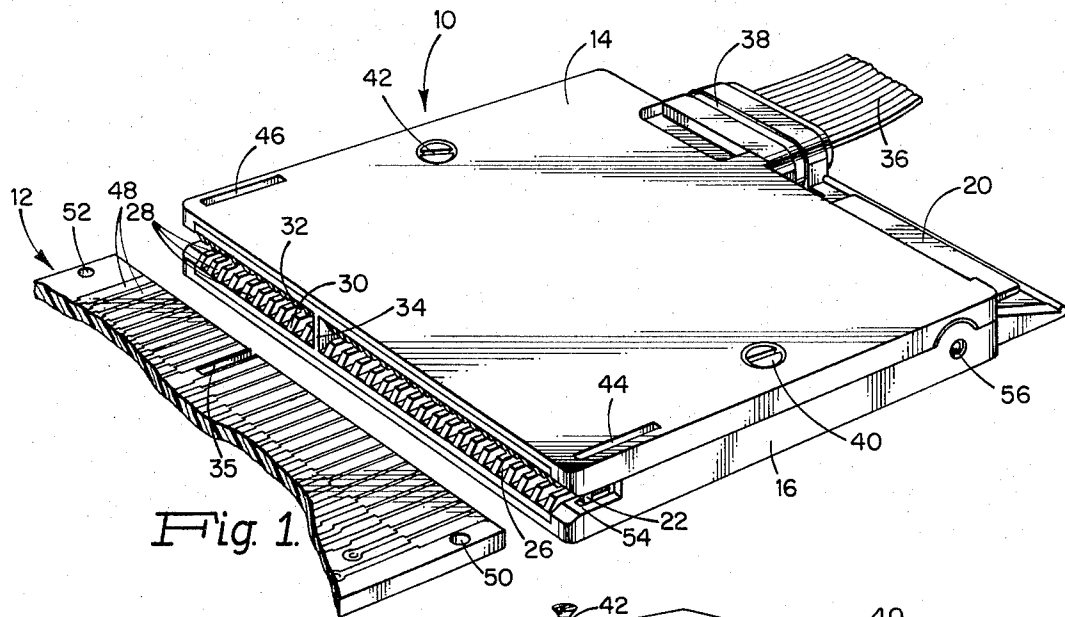
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18 Claims, 5 Drawing Figures





CONNECTOR ASSEMBLY HAVING POSITIVE RETENTION MEANS

BACKGROUND OF THE INVENTION

The apparatus of the present invention generally relates to connector assemblies and more particularly to connector assemblies having positive retention devices.

In order to connect a printed circuit board with a connector, the connector must have a high retention force and therefore a high insertion force, in order to insure that the circuit board and the connector remain connected during the operation of the respective system associated therewith. Lower insertion force connectors and therefore low retention force type connectors may be utilized if there is further means for retaining the connection therebetween. Such retaining means have included various clamps and spring assemblies which usually added to the overall volume and size of the assembly and which do not lend themselves to quick and easy removal of the connector from the circuit board. Some of such retention devices also require the use of special tools for removal thereof. Further, such retention devices do not allow a compact design wherein the connector assemblies may be stacked one upon the other and wherein the connector assemblies may be placed side by side with substantially no loss of contact space on the circuit board. Further, some of such retention devices have been found in addition to their complexity to not positively secure the connector assembly to the circuit board.

It is accordingly a primary object of the invention to provide an improved connector assembly for mating with a circuit board.

It is a further object of the invention to provide such a connector assembly which may be utilized with either high or low insertion force connectors and which provides positive retention means which enables positive locking of the connector assembly to the printed circuit board while maintaining a small volume of the overall connector assembly and further while providing easy means for inserting or removing the circuit board with the connector assembly.

SUMMARY OF THE INVENTION

The above and other objects of the invention are attained by providing a connector assembly for use with a printed circuit board having a plurality of printed circuit contacts and at least one retention hole. The assembly includes a lower plate and an upper plate, a retention device and a spring plus the associated connector. The lower plate includes a slot or opening at one end for receiving a cable, and also includes a position at the other end for retaining the connector. Pivot points at either side near the one end of the lower plate are also provided. The retention device is pivotably mounted with the pivot points and includes a depression point extending beyond the one end of the lower plate and at least one retention plug near the other end of the lower plate for engaging at least one retention hole in the printed circuit board. The upper plate is secured to the lower plate. Both the plates partially enclose the spring, the retention device, the received cable and the connector. The spring enables the retention plug in a normal position for positively engaging the retention hole except when the depression point is depressed.

BRIEF DESCRIPTION OF THE DRAWINGS

The manner in which the apparatus of the present invention is constructed and its mode of operation will best be understood in light of the following detailed description, together with the accompanying drawings in which:

FIG. 1 is a perspective view of the connector assembly of the present invention;

FIG. 2 is an exploded view of the connector assembly of the present invention;

FIG. 3 is a crosssectional view of the connector assembly of the present invention;

FIG. 4 is a crosssectional view of the connector assembly with a circuit board inserted and secured therein in the normal position; and

FIG. 5 is a crosssectional view of the connector assembly of the invention with a circuit board inserted therein but not secured.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, the connector assembly 10 is shown ready to receive a printed circuit board 12. The connector assembly 10 includes a top or upper plate 14, a bottom or lower plate 16 and a retention device 18 which is best seen with reference to FIG. 2. In FIG. 1, the retention device 18 includes a depression extension or point 20 and a first retention plug 22 and a second retention plug 24 best seen in FIG. 2. Also included in assembly 10 is a commercially available edge card connector 26 which includes a plurality of contacts 28 which are included in a first row 30 and a second row 32. The purpose of the two rows is to allow contact with the printed circuit board on both sides of such board. The connector 26 may also include a keying device 34 which mates with key slot 35 on board 12.

FIG. 1 also illustrates a cable 36 which may be either a flat conductor cable or an array of round wires or a combination thereof. The cable may be secured to the lower plate 16 by means of a suitable wrap 38. The upper plate 14 is secured to the lower plate 16 by means of screws 40 and 42. The upper plate 14 also includes slots 44 and 46 as shall be discussed with reference to FIGS. 2 and 3 in order to decrease the overall height of the connector assembly by enabling the retention device 18 to go into such slots 44 and 46 when the depression point 20 is depressed.

The printed circuit board 12 includes contacts 48 which may be included on both sides of the printed circuit board 12 in order to provide independent electrical mating with contacts 28 in rows 30 and 32 of connector 36. Circuit board 12 also includes retention holes 50 and 52 for engagement with retention plugs 22 and 24 respectively.

The retention device 18 is shown in its normal position in FIG. 1. Thus, the retention plugs 22 and 24 extend respectively down to the surfaces 54 and 55 of lower plate 16. In this position, which is the normal position, the circuit board 12 cannot be inserted into the connector assembly. Further, if the circuit board is already in the connector assembly, the circuit board cannot be removed therefrom when the retention device is in the normal position. It is only when the depression point 20 is depressed that the retention device pivots about points 56 and 58 such that the retention plugs 22

and 24 are raised up from the surfaces 54 and 55 of the lower plate 16 in order to enable the insertion or removal of the circuit board 12. The depression point 20 is designed in order to enable one's thumb to provide the force to raise such retention plugs 22 and 24. When the force is removed, the plugs again are sprung to their normal position as will subsequently be discussed such that the circuit board now inserted is positively locked within the assembly 10.

Now referring to FIG. 2, there is illustrated an exploded view of the connector assembly of the present invention which more particularly shows the retention device 18. The retention device 18 includes the depression point 20, the pivot holes 60 and 62, arms 64 and 66, upper arms 68 and 70 as well as a support 72 extending between arms 64 and 66 in the vicinity of holes 60 and 62. The depression point 20, the arms 64, 66, 68, 70 and plugs 22 and 24 along with support 72 may be shaped from one piece of metal. In addition, the retention device 18 includes a spring 74 which is attached, such as by welding, to the support 72. As can be seen, the spring 74 is placed on the support 72 at a position away from the position that the cable 36 is received. This is done in order to allow proper routing of the wires in the cable with the connector terminal. It should be understood that spring 74 may have been positioned anywhere on support 72 and in fact more than one spring may have been used.

The retention device 18 is mounted to lower plate 16 by means of C-springs 76 and 78 which are inserted into holes 60 and 62 of retention device 18 after retention device 18 has been placed within lower plate 16 such that the holes 56 and 58 in the lower plate 16 hold the retention device 18 in place. Also shown in the lower plate is a slot or opening 80 which is designed in order to enable the cable to be inserted and connected with the terminals 116 of connector 26. On the outside of the opening 80, are holes 82 and another hole not visible on the far side of the opening 80 to facilitate the use of wrap 38 to secure the cable 36 in place.

The lower plate also includes a shelf 84 which is conveniently used to facilitate the supplying of force or pressure at the depression point 20 such that a thumb is placed on the top side of depression point 20 and a finger is placed on the lower side of shelf 84 in order to easily enable the pressing of the depression point 20 towards shelf 84 and thereby pivot the retention device 18 so that the retention plugs 22 and 24 are raised from their normal positions. The lower plate as well as the upper plate are preferably molded in plastic and include ribs 86 for reinforcement thereof. The lower plate 16 also includes thread mounts 90 and 92 which are threaded in order to receive the screws 42 and 40. The mounts 90 and 92 may for additional strength include threaded metal bushings 94 and 96 in order to minimize the possibility of shearing the screw threads. The forward end 98 of the lower plate 16 includes a surface 100 upon which the lower part 102 of connector 26 lies. In order to retain the connector 26 on such surface in the position indicated on shelf 100 between front end 98 and the front portion 104 of rib 86 there is included a projection 106 and 108 on the lower plate and similarly on the upper plate, which projections form as may be best seen for projection 106, a slot 110 which receives projection surface 112 of connector 26. With the upper plate 14 removed, the connector 26 now lying on surface 100, may not be moved in the

plane of the lower plate 16, but may be raised therefrom so long as the printed circuit board 12 and wrap 38 have been removed. When the upper plate 14 is secured to the lower plate 16, the connector 26 is secured between both plates without additional screws or pins, etc. and therefore minimizes the complexity of the connector assembly of the present invention.

As previously indicated, the connector 26 includes contacts 28 in two rows 30 and 32. On the opposite side of connector 26, there are included terminals 116 also arranged in two rows. Each of the terminals 116 are extensions of and electrically and physically connected with their respective contacts 28. The terminals 116 may have soldered thereto the wires of cable 36. The terminals 116 may in the alternative be connected to an intermediate board between such terminals and the wires of cable 36 in order to provide further versatility in the connector assembly of the present invention.

With the upper plate 14 removed from the connector assembly of the present invention, the connector 26 along with the connections thereto from cable 36 may be physically removed from the lower plate 16 without the need for unfastening anything except possibly the wrap 38 if included. Further, with the upper plate 14 removed, the retention device 18 is in its normal position because of its weight however, there is no spring tension thereon forcing and/or securing the retention device 18 to hold the plugs 22 and 24 in their normal positions. When the retention plugs are in their normal position, the arm 66 of device 18 lies between surface 152 of lower plate 16 and thread mount 90 and arm 64 lies between mount 92 and surface 150 in the area 156.

It is only when upper plate 14 is secured to lower plate 16 by inserting screws 40 and 42 through holes 120 and 122 in upper plate 14 and into threaded inserts 96 and 94 that the spring 74 is depressed or stressed and causes spring tension to be exerted on retention device 18 so that the plugs 22 and 24 are secured in their normal position. This feature can best be seen with reference to FIG. 3.

FIG. 3 illustrates the circuit board 12 with holes 50 and 52 ready to be inserted into the opening 130 between upper plate 14 and lower plate 16. Retention device 18 is shown by the dotted lines, and one retention plug 22 is shown, retention plug 24 being directly behind plug 22. A portion of the lower side of upper plate 14 is shown by numerical indication 140. Spring 74 of retention device 18 is also shown being depressed by the lower side 140 of upper plate 14, so as to cause the plug 22 to be forced downward into the normal position by pivoting retention device 18 about pivot points 56 and 58 such that plugs 22 and 24 prevent both the insertion or removal of the circuit board 12 depending upon the position of the board 12.

Thus, by a simple spring attached to the support 72 of retention device 18 and the securing by means of screws 40 and 42 of the upper plate 14 to the lower plate 16, the plugs 22 and 24 are positively secured in a normal position thereby allowing the use of a low insertion force connector while positively engaging the connector assembly with a circuit board having retention holes. This thus prevents the removal of the connector of the contacts 48 and 28 by accident or otherwise during the operation of the equipment associated with such connector assembly except when depression point 20 is depressed. Further, it can be seen that such connector assembly of the present invention is simple

in construction and utilizes basically only three parts plus the connector 26. Further, it can be seen that such connector assembly is compact in design and that the distance between the bottom of the lower plate 16 and the top of the upper plate 14 is minimal since the connector 26 firstly does not have to be secured in place by additional mechanical means in the assembly 10 and second because the slots 44 and 46 are included in the upper plate such that the upper arms 68 and 70 protrude therein when depression point 20 is depressed.

Now with reference to FIG. 4, the opening 130 between the upper plate 14 and the lower plate 16 is shown with the circuit board 12 inserted therein and the retention plugs 22 and 24 are shown in their normal position such that the retention plugs extend within and/or through the retention holes 50 and 52 in the circuit board (depending upon design choice) in order to prevent the removal of the circuit board 12 from the connector assembly 10 of the present invention.

FIG. 5 illustrates the circuit board 12 also inserted into the opening 130, however, with the retention device 18 being raised by means of depressing the depression point 20 such that the retention plugs 22 and 24 are not in the normal position thereby enabling insertion or removal of the circuit board 12.

Having described the invention, what is claimed as new and novel and for which it is desired to secure Letters Patent is:

We claim:

1. A connector assembly for use with a printed circuit board having a plurality of printed circuit contacts and at least one retention hole, said assembly comprising:

A. a lower plate comprising

1. slot means at one end of said lower plate for receiving a cable having a plurality of wires,
2. connector retention means at the other end of said lower plate for receiving a connector having a plurality of contacts for mating with said printed circuit contacts, and
3. pivot means on either side of said lower plate near said one end of said lower plate;

B. further retention means pivotably mounted with said pivot means of said lower plate, said further retention means made from one piece of material and having depression means extending beyond said one end of said lower plate and at least one retention plug for engaging said at least one retention hole on said printed circuit board.

C. an upper plate secured to said lower plate, both said plates partially enclosing said further retention means, said received cable and said connector; and

D. means, securely attached to said further retention means and enclosed between said upper and lower plates, for enabling said at least one plug means in a normal position for engaging said at least one retention hole when said upper and lower plates are secured together, except when said depression means is depressed.

2. An assembly as in claim 1 wherein said means for enabling includes a spring coupled at one end with said further retention means for holding said at least one plug means in said normal position.

3. An assembly as in claim 2 wherein said spring is contiguous at its other end to said upper plate such that said spring is stressed to securely provide said normal position when said upper plate is secured to said lower plate.

4. An assembly as in claim 3 further comprising a second retention plug for engaging with another retention hole in said circuit board, said retention plugs located adjacent to either side and near said one end of said lower plate.

5. An assembly as in claim 4 wherein said retention plugs are located on opposite sides of said connector retention means.

6. An assembly as in claim 3 further comprising first means in said upper plate for locking said connector between said connector retention means and said upper plate when said upper plate is secured to said lower plate.

7. A connector assembly for use with a circuit board having a plurality of electrical contacts and two retention holes, said assembly comprising:

A. a connector;

B. a lower plate having means for retaining said connector at one end thereof and pivot points located on either side of said lower plate near the other end thereof;

C. retention means pivotably mounted at said pivot points, said retention means including two retention plugs for engaging said two retention holes when each of said plugs are in a normal position in order to secure said circuit board with said connector, said two retention plugs located on opposite sides and near said one end of said lower plate;

D. spring means, secured to said retention means, for securing each of said retention plugs in said normal position; and

E. an upper plate secured to said lower plate, both said plates partially enclosing said retention means, said spring means and said connector such that said plugs are forced in said normal position when said upper and lower plates are secured together.

8. An assembly as in claim 7 wherein said spring means is secured at one end to said retention means and wherein the other end of said spring means engages with and is coupled to provide spring tension with said upper plate when said upper plate is secured to said lower plate.

9. An assembly as in claim 8 wherein said retention means further comprises depression means extending beyond the other end of said lower plate, said depression means being operative to release said retention plugs from said normal position when said depression means is depressed.

10. An assembly as in claim 9 further comprising:

A. slot means located at said other end of said lower plate for receiving a cable having a plurality of wires;

B. said connector includes one side having terminal means for independent circuit engagement with said contacts on both sides of said circuit board and another side having terminals for connection with said wires; and wherein

C. said means for retaining is disposed such that said connector and said wires of said cable may be lifted out of said lower plate when said upper plate is removed.

11. An assembly as in claim 9 wherein said retention means includes a support extending between opposite sides and near said other end of said lower plate, said depression means attached to said support outwardly from said assembly, said retention means further including two arms adjacent opposite sides of said lower

plate and extending from said support toward said one end of said lower plate, and said retention means further including means for connecting one of said retention plugs to each of said arms.

12. An assembly as in claim 11 further comprising means for attaching said spring means to said support and wherein said depression means, said arms, said plugs and said support are made from one piece of metal.

13. An assembly as in claim 11 wherein said upper plate further comprises slot means disposed on opposite sides of said upper plate near the end thereof in proximity with said one end of said lower plate, and wherein said slot means are further disposed to accept a portion of the respective ones of said arms when said depression means is depressed, whereby the overall height of said assembly is reduced.

14. A connector assembly for use with a printed circuit board having a plurality of printed circuit contacts and at least one retention hole, said assembly comprising:

- A. a lower plate comprising
 - 1. slot means at one end of said lower plate for receiving a cable having a plurality of wires,
 - 2. connector retention means at the other end of said lower plate for receiving a connector having a plurality of contacts for mating with said printed circuit contacts, and
 - 3. pivot means on either side of said lower plate near said one end of said lower plate;
- B. retention means pivotably mounted with said pivot means of said lower plate, said retention means having depression means extending beyond said one end of said lower plate and at least one retention plug for engaging said at least one retention hole on said printed circuit board;
- C. an upper plate secured to said lower plate, both said plates partially enclosing said retention means, said received cable and said connector;
- D. means for enabling said at least one plug means in a normal position for engaging said at least one retention hole except when said depression means is depressed, wherein said means for enabling includes a spring coupled at one end with said retention means for holding said at least one plug means in said normal position, and wherein said spring is contiguous at its other end to said upper plate such that said spring is stressed to securely provide said normal position when said upper plate is secured to said lower plate.

15. An assembly as in claim 14 wherein said upper plate further comprises slot means disposed on said upper plate near the end thereof in proximity with said one end of said lower plate, and wherein said slot means is further disposed to accept a portion of said retention plug when said depression means is depressed, whereby the overall height of said assembly is reduced.

16. A connector assembly for use with a printed circuit board having a plurality of printed circuit contacts and at least one retention hole, said assembly comprising:

- A. a lower plate comprising
 - 1. slot means at one end of said lower plate for receiving a cable having a plurality of wires,
 - 2. connector retention means at the other end of said lower plate for receiving a connector having

a plurality of contacts for mating with said printed circuit contacts, and

- 3. pivot means on either side of said lower plate near said one end of said lower plate;
 - B. retention means pivotably mounted with said pivot means of said lower plate, said retention means having depression means extending beyond said one end of said lower plate and at least one retention plug for engaging said at least one retention hole on said printed circuit board;
 - C. an upper plate secured to said lower plate, both said plates partially enclosing said retention means, said received cable and said connector;
 - D. means for enabling said at least one plug means in a normal position for engaging said at least one retention hole except when said depression means is depressed; and wherein
 - E. said upper plate further comprises slot means disposed on said upper plate near the end thereof in proximity with said one end of said lower plate, and wherein said slot means is further disposed to accept a portion of said retention plug when said depression means is depressed, whereby the overall height of said assembly is reduced.
17. A connector assembly for use with a circuit board having a plurality of electrical contacts and two retention holes, said assembly comprising:
- A. a connector;
 - B. a lower plate having means for retaining said connector at one end thereof and pivot points located on either side of said lower plate near the other end thereof;
 - C. retention means pivotably mounted at said pivot points, said retention means including two retention plugs for engaging said two retention holes when each of said plugs are in a normal position in order to secure said circuit board with said connector, said two retention plugs located on opposite sides and near said one end of said lower plate;
 - D. spring means for securing each of said retention plugs in said normal position;
 - E. an upper plate secured to said lower plate, both said plates partially enclosing said retention means and said connector; and wherein
 - F. said upper plate further comprises slot means disposed on opposite sides of said upper plate near the end thereof in proximity with said one end of said lower plate, and wherein said slot means are further disposed to accept a portion of the respective ones of said retention plugs when said depression means is depressed, whereby the overall height of said assembly is reduced.
18. A connector assembly for use with a circuit board having a plurality of electrical contacts and two retention holes, said assembly comprising:
- A. a connector;
 - B. a lower plate having means for retaining said connector at one end thereof and pivot points located on either side of said lower plate near the other end thereof;
 - C. retention means pivotably mounted at said pivot points, said retention means including two retention plugs for engaging said two retention holes when each of said plugs are in a normal position in order to secure said circuit board with said connector, said two retention plugs located on opposite sides and near said one end of said lower plate;

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D. spring means for securing each of said retention plugs in said normal position;

E. an upper plate secured to said lower plate, both said plates partially enclosing said retention means and said connector; and wherein

F. said retention means further comprises depression means extending beyond the other end of said lower plate, said depression means being operative to release said retention plugs from said normal position when said depression means is depressed, said retention means further including two arms adjacent opposite sides of said lower plate and extending from said support toward said one end of

said lower plate, and said retention means further including means for connecting one of said retention plugs to each of said arms; and wherein

G. said upper plate further comprises slot means disposed on opposite sides of said upper plate near the end thereof in proximity with said one end of said lower plate, and wherein said slot means are further disposed to accept a portion of the respective ones of said arms when said depression means is depressed, whereby the overall height of said assembly is reduced.

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