

A CONNECTOR

TECHNICAL FIELD

The present invention relates to the art of connectors and, particularly to an electrical connector adapted for mounting on a printed circuit board.

5 BACKGROUND

Printed circuit board (PCB) connectors are known in the electronics industry. They provide a connectable interface between the PCB and another connector device. They also may provide an interface between the PCB on which the connector is mounted and a second PCB. In whatever application, the primary
10 board-mounted connector includes some form of board mounting means for holding or locking the connector to its PCB.

One form of mounting means typically used in the electronics industry is to provide separate board locks between the connector and the PCB. These separate board locks may be of metal material or in the form of plastic clips, may
15 be mounted on or otherwise secured to the connector housing, and can add considerably to the costs of manufacturing the connector. U.S. Pat. No. 6,796,835 discloses an electrical connector that has a housing, a number of terminals retained in the housing and a pair of board locks secured on the housing.

A cost-effective mounting means is to have mounting posts molded
20 integrally with the housing of the connector. The mounting posts may then be inserted into mounting holes in the PCB. Such mounting posts have taken a wide variety of configurations. U.S. Pat. No. 5,366,389 discloses a connector that has a plastic housing with pegs that project through round holes in a circuit board to hold the connector in place. U.S. Pat. No. 5,334,048 discloses an electrical
25 connector which has a retention device to maintain the connector in position on a panel.

A dilemma when designing the mounting posts typically occurs between providing high retention forces with respect to the PCB and requiring low insertion forces when mounting the connector on the PCB. Other design considerations of the mounting posts include resistance to breakage during shipment and assembly and the proper alignment of the posts to the mounting holes in the PCB during mounting of the connector on the PCB. The design of the mounting posts usually focus on balancing all of these factors.

It is known to provide a mounting post with a substantially C-shaped cross section, with or without latching hooks or barbs for latching to an opposite side of the printed circuit board. Such C-shaped mounting posts provide a high degree of reliability because of their low breakage experience. However, such C-shaped mounting posts often require far greater insertion forces than are desired or are required for particular specifications.

Another design is to provide mounting posts with a bifurcated configuration which defines two generally parallel legs separated by a slot. One leg may be more rigid than the second leg which includes a board latch or hook. In other words, the first leg provides rigidity and the second leg provides the necessary locking or latching flexibility. One problem associated with the bifurcated leg type of mounting post is that the flexible leg often becomes caught on extraneous objects, particularly during shipping and handling, resulting in a high degree of breakage or damage to the post under those conditions. U.S. Pat. No. 6,257,926, U.S. Pat. No. 5,980,314, and U.S. Pat. No. 5,697,812 disclose connectors with different mounting post designs.

The present invention is directed to solving the above problems by providing an improved structure as a mounting post for mounting a connector of the character described to a PCB.

SUMMARY

It would be desirable to provide a connector with an improved structure as a mounting post for mounting the connector to a printed circuit board.

In accordance with one embodiment of the present invention, there is
5 provided a connector, comprising:

a housing having at least one end wall and a board-mounting face
contiguous to the end wall of the housing;

at least one mounting post extending from the board-mounting face of the
housing; and

10 at least one restrainer extending from the end wall of the housing
proximate the mounting post.

In accordance with another embodiment of the present invention, there is
provided an electrical connector configured to be mounted on a printed circuit
board comprising:

15 a housing having at least one end wall and a board-mounting face
contiguous to the end wall of the housing;

a plurality of contacts assembled within the housing with one portion of
the contacts in the housing and another portion of the contacts extending beyond
the board-mounting face;

20 at least one mounting post extending from the board-mounting face of the
housing; and

at least one restrainer extending from the end wall of the housing
proximate the mounting post.

BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary form of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a perspective view looking towards a board-mounting face of
5 a connector having mounting posts according to a prior art;

Figure 2 is a perspective view of an exemplary connector of the present invention placed in line with the mounting holes in a printed circuit board (PCB) prior to insertion;

Figure 3 shows a cross-sectional view of the exemplary connector of
10 Figure 2 placed in line with the mounting holes in a printed circuit board (PCB) prior to insertion;

Figure 4A shows a perspective view of an exemplary connector with an alternative socket mating face;

Figure 4B shows a perspective view of an exemplary connector with a
15 header mating face;

Figure 4C shows a cross-sectional view of the exemplary connector of Figure 4B;

Figure 5 shows a close-up view of a mounting post of the exemplary connector of Figure 2;

Figures 6A, 6B and 6C illustrate the various stages of inserting the
20 mounting posts of Figure 5 through the mounting holes and securing the connector to the PCB;

Figure 6D illustrates how the mounting posts of Figure 5 may be disengaged from the PCB so that the connector may be removed; and

Figure 7A and **7B** illustrate how the mounting post of Figure 5 is restrained by a restrainer to prevent the accidental disengagement of the
5 connector from the PCB.

While the above-identified drawing figures set forth several embodiments of the invention, other embodiments are also contemplated, as noted in the discussion. In all cases, this disclosure presents the invention by way of representation and not limitation. It should be understood that numerous other
10 modifications and embodiments can be devised by those skilled in the art, which fall within the scope and spirit of the principles of the invention. The figures may not be drawn to scale. Like reference numbers have been used throughout the figures to denote like parts.

DETAILED DESCRIPTION

Referring to Figure 1, a connector **10** is shown to include a pair of mounting posts **12** according to a prior art. The connector **10** includes a housing **14** molded of dielectric material such as plastic or the like. The housing **14** with a plurality of stiffening ribs **16** on the outside, defines a mating face **18** and a board-mounting face **20**. A plurality of slots **22** that extend through the board-mounting face **20** and are a remnant of the manufacturing of the connector **10**. A pair of standoffs **24** are molded integrally with the housing **14** and project beyond the board-mounting face **20** for engaging a printed circuit board (PCB) and spacing the housing **14** from the PCB. Lastly, a plurality of contacts **26** are mounted within the housing **14** and extend beyond the board-mounting face **20**. The contacts **26** are longer than the standoffs **24** for insertion into appropriate holes in the PCB for electrical connection to circuit traces on the PCB and/or in the holes by soldering, for example.

The mounting post **12** of the connector **10** in Figure 1 is of a bifurcated configuration to define a locking leg **28** and a backing leg **30** with a post slot **31** extending longitudinally therebetween. The locking leg **28** includes an outwardly projecting hook **32** for latching engagement with a side of the PCB opposite an insertion side of the PCB. An outer surface **34** of the locking leg **28** is tapered between a distal end **36** of the locking leg **28** and the projecting hook **32** to facilitate inserting the bifurcated mounting post **12** into an appropriate mounting hole in the PCB. The outer surface of the backing leg **30** may also be tapered to facilitate insertion of the mounting post **12** into the hole.

In operation of mounting posts **12**, as the mounting posts **12** are inserted into their respective mounting holes in the PCB, each locking leg **28** is biased inwardly toward the respective backing leg **30** until the projecting hook **32** of the locking leg **28** clears the opposite side of the PCB, whereupon the locking leg **28** will snap back outwardly to lock the connector **10** to the PCB. Often, the locking

leg **28** is more resilient than the backing leg **30** so that the locking leg **28** is more flexible. As mentioned earlier, there is a tendency that the locking leg **28** may be caught on extraneous objects during shipping or handling resulting in the locking leg **28** being deformed or broken.

5 Referring to Figures 2 and 3, an exemplary connector **100** in accordance with the present invention comprises an insulative housing **14**, a pair of side walls **140**, a pair of end walls **142**, a mating face **18**, a board-mounting face **20** contiguous to end walls **142**, at least one mounting post **200** extending from the board-mounting face **20** of the housing **14** and at least one restrainer **184**
10 extending from the end wall **142** of the housing **14**.

 In one embodiment of the present invention, at the mating face **18** of the housing **14**, there is a mating slot **180** with a plurality of terminal passageways **182** formed in inner walls of the mating slot **180** extending from mating face **18** to the board-mounting face **20**. A plurality of contacts **26** are assembled within
15 the housing **14** with a portion of the contacts **26** in the terminal passageways **182** and another portion of the contacts **26** extending beyond the board-mounting face **20** for insertion into a plurality of contact holes **320** at an insertion face **302** of a printed circuit board (PCB) **300** for electrical connection to circuit traces on the PCB **300** and/or in the contact holes **320** by soldering, for example. The mating
20 slot **180** provides a mating interface for components such as, but not limited to, devices with a card edge header, secondary PCBs, etc. to be mounted on the PCB **300**.

 In one embodiment of the present invention, with reference to Figure 4A, the mating face **18** of the connector **100** may be a socket with a plurality of holes
25 leading to the terminal passageways **182** in the housing **14**. In this case, the component that will mate with connector **100** may be a device with a header with corresponding contact terminals which will then be inserted into the holes on the mating face **18**.

In one embodiment, with reference to Figures 4B and 4C, a connector **100** may be a header connector with a portion of the contacts **26** extending beyond the mating face **18** and thus, providing a header interface for mating with a device having a socket connector.

5 With reference to Figure 5, in one embodiment of the present invention, the mounting post **200** comprises a rigid portion **210** extending from the housing **14** at the board-mounting face **20**, a flexible portion **220** and a bridging portion **230** connecting the rigid portion **210** to the flexible portion **220** and having a first bridging point **231** and a second bridging point **232** forming a general “U” shape.

10 The mounting post **200** further comprises a first locking device **222** and a second locking device **224** extending outwards from the flexible portion **220**. The first locking device **222** fixes the distance between the board-mounting face **20** of the connector **100** and the insertion face **302** of the PCB **300** and therefore, ensuring that there is a spacing between the connector **100** and the PCB **300**. The distance

15 between the first locking device **222** and the second locking device **224** may be modified to accommodate the thickness of the PCB **300** which the connector **100** is to be mounted on or the desired spacing between the connector **100** and the PCB **300**.

20 A first surface **242** of the flexible portion **220** on a side opposite to the first locking device **222** is tapered from a distal end **240** of the flexible portion **220** to increase the flexing angle of the flexible portion **220** as it flexes during the insertion of the mounting post **200** into the mounting hole **310** in the PCB **300**. A second surface **244** of the flexible portion **220** on the side of the second locking device **224** between the second locking device **224** and the second bridging point

25 **232** is tapered to reduce the amount of insertion force to be exerted during the insertion of the mounting post **200** into the mounting hole **310** in the PCB **300**.

In one embodiment of the present invention, with reference to Figure 3, the connector **100** has a first mounting post **201** and a second mounting post **202**.

The first mounting post **201** and the second mounting post **202** may be configured in a similar fashion so that there is no restriction on the orientation in which the connector **100** may be mounted on the PCB **300** since both mounting post **201** and mounting post **202** may be interchangeably inserted into any of the appropriate mounting holes **311**, **312** on the PCB **300**. In another embodiment of the present invention, the first mounting post **201** and the second mounting post **202** are configured differently and therefore, the connector **100** may be mounted on the PCB **300** in only one orientation because the first mounting post **201** may only be inserted into a first mounting hole **311** in the PCB **300** and the second
10 **202** may only be inserted into a second mounting hole **312** in the PCB **300**.

Referring to Figures 6A, 6B and 6C, before inserting the connector **100** into the PCB **300**, the mounting posts **200** are first aligned to the mounting holes **310** on the PCB **300**. In one embodiment of the present invention, the mounting posts **200** are tapered at the two bridging points **231**, **232** and so, a part of the bridging portion **230** rests inside the mounting hole **310** prior to application of an insertion force. The depth in which the mounting post **200** sinks into the mounting hole **310** is determined by a number of factors including, the angle at which the bridging portions **231**, **232** are tapered, the dimension of the bridging portion **230** with respect to the mounting hole **310** and the location of the second
15 locking device **224**. Preferably, the above factors are chosen such that the mounting posts **200** can hold the connector **100** in a stable position on the PCB **300** at the insertion face **302** of the PCB **300** before insertion.

As the connector **100** is pushed into the PCB **300** in a direction illustrated by arrow D, the flexible portion **220** of each mounting post **200** near the distal end **240** is biased inwardly toward the respective end wall **142** until the first surface **242** of the flexible portion **220** nears or comes in contact with the end wall **142**. A further application of insertion force on the connector **100** in the direction illustrated by arrow D will cause the second locking device **224** to be cleared through the PCB **300** to an engagement side **304** of the PCB **300**,
25

whereupon the flexible portion **220** of the mounting post **200** near the distal end **240** will snap back outwardly to lock the connector **100** to the PCB **300**.

The flexible portion **220** is made more resilient than the rigid portion **210** to minimise the amount of insertion force needed to be placed on the connector **100** to cause the second locking device **224** to move from the insertion face **302** to the engagement face **304** of the PCB **300**. The difference in flexibility between the rigid portion **210** and the flexible portion **220** may be achieved in a number of ways including, but not limited to, the use of different material for the two portions during manufacturing and having different physical dimensions for the two portions.

In one embodiment of the present invention, there is a restrainer **184** near to each mounting post **200**. The restrainer **184** may include, but is not limited to, a bracket extending from a first edge **144** of the end wall **142** to a second edge **146** of the end wall **142**. The restrainer may extend at least a portion of the way around the flexible portion **220**, for example by not extending completely from the first edge **144** to the second edge **146**, or by comprising two sections, each of which extend part way from an edge of the end wall **142** towards the middle of the end wall **142**. Alternatively, the restrainer may extend completely from the first edge **144** to the second edge **146**, forming an enclosure around at least a portion of flexible portion **220**. A restrainer of such configuration will be able to minimise the likelihood of the flexible portion **220** being caught on extraneous objects during shipping or handling resulting in the flexible portion **220** being deformed or broken.

Referring to Figure 6D, to disengage the connector **100** from the PCB **300**, a side force illustrated by the arrow **S** is applied to the flexible portions **220** of both mounting posts **200** at the part near the second locking devices **224**. As the second locking devices **224** move away from the edges of the mounting holes **310** on the side of the engagement face **304**, the flexible portions **220** near the

distal ends **240** are biased inwardly toward the end walls **142** of the connector **100**, thus allowing the connector **100** to be pulled out of the PCB **300** by providing an upward force illustrated by the arrow U.

Referring to Figures 7A and 7B, it is possible that an upward force
5 illustrated by the arrow U may accidentally be provided to the connector **100**
without the side force illustrated by the arrow S. In such an event, the flexible
portions **220** near the distal ends **240** will be biased outwards away from the end
walls **142** of the connector **100**. Having a restrainer **184** around the mounting
post **200** will prevent unnecessary stress being exerted on the flexible portion **220**
10 by restricting the amount which the flexible portion **220** near the distal end **240**
can move away from the end wall **142** of the connector **100**.

The foregoing description of the preferred embodiment of the invention
has been presented for purposes of illustration and description. It is not intended
to be exhaustive or to limit the invention to the precise forms disclosed, since
15 many modifications or variations thereof are possible in light of the above
teaching. All such modifications and variations are within the scope of the
invention. The embodiments described herein were chosen and described in order
to best explain the principles of the invention and its practical application,
thereby to enable others skilled in the art to utilise the invention in various
20 embodiments and with various modifications as are suited to the particular use
contemplated thereof. It is intended that the scope of the invention be defined by
the claims appended hereto, when interpreted in accordance with the full breadth
to which they are legally and equitably suited.

CLAIMS

1. An electrical connector comprising:
 - a housing having at least one end wall and a board-mounting face contiguous to the end wall of the housing;
 - 5 at least one mounting post extending from the board-mounting face of the housing; and
 - at least one restrainer extending from the end wall of the housing proximate the mounting post.
2. The electrical connector as claimed in claim 1 wherein the mounting
10 post further comprises one rigid portion extending from the board-mounting face of the housing, one flexible portion parallel to the rigid portion and one bridging portion connecting the rigid portion to the flexible portion wherein the rigid portion connects to the bridging portion at a first bridging point and the flexible portion connects to the
15 bridging portion at a second bridging point.
3. The electrical connector of claim 2 wherein the rigid portion, bridging portion, and flexible portion form a general U shape with the bridging portion forming the base of the U shape and being furthest from the board-mounting surface.
- 20 4. The electrical connector as claimed in any one of claims 1 to 3 wherein the mounting post further comprises a first locking device and a second locking device extending from the flexible portion.
5. The electrical connector as claimed in claim 4 wherein the flexible
25 portion has a first side on which the first and second locking devices are located, an opposite second side, and a distal end; wherein the first

locking device is between the distal end and the second locking device and the second locking device is between the first locking device and the second bridging point; and wherein an area of the second side opposite the first locking device is tapered to the distal end of the flexible portion and an area of the first side of the flexible portion is tapered from the second locking device to the second bridging point.

6. The electrical connector as claimed in any one of claims 1 to 5 wherein the restrainer further comprises a bracket extending from a first edge of the end wall to a second edge of the end wall.
7. The electrical connector of claim 6 wherein the restrainer extends at least a portion of the way around the first locking device of the flexible portion.
8. The electrical connector of claim 6 wherein the restrainer forms an enclosure around the first locking device of the flexible portion.
9. An electrical connector configured to be mounted on a printed circuit board comprising:
 - a housing having at least one end wall and a board-mounting face contiguous to the end wall of the housing;
 - a plurality of contacts assembled within the housing with one portion of the contacts in the housing and another portion of the contacts extending beyond the board-mounting face;
 - at least one mounting post extending from the board-mounting face of the housing; and
 - at least one restrainer extending from the end wall of the housing proximate the mounting post.

10. The electrical connector as claimed in claim 9 wherein the housing further comprises a mating face and a mating slot with a plurality of terminal passageways extending from the mating face to the board-mounting face.
- 5 11. The electrical connector as claimed in claim 9 wherein the housing further comprises a mating face and a plurality of holes on the mating face leading to a plurality of terminal passageways extending from the mating face to the board-mounting face.
12. The electrical connector as claimed in claim 9 wherein the housing
10 further comprises a mating face and a portion of the contacts extend beyond the mating face.
13. The electrical connector as claimed in any one of claims 9 to 12 wherein the mounting post further comprises one rigid portion
15 extending from the board-mounting face of the housing, one flexible portion parallel to the rigid portion and one bridging portion connecting the rigid portion to the flexible portion wherein the rigid portion connects to the bridging portion at a first bridging point and the flexible portion connects to the bridging portion at a second bridging point.
14. The electrical connector of claim 13 wherein the rigid portion, bridging
20 portion, and flexible portion form a general U shape with the bridging portion forming the base of the U shape and being furthest from the board-mounting surface.
15. The electrical connector as claimed in any one of claims 9 to 14
25 wherein the mounting post further comprises a first locking device and a second locking device extending from the flexible portion.

16. The electrical connector as claimed in claim 15 wherein the flexible portion has a first side on which the first and second locking devices are located, an opposite second side, and a distal end; wherein the first locking device is between the distal end and the second locking device and the second locking device is between the first locking device and the second bridging point; and wherein an area of the second side opposite the first locking device is tapered to the distal end of the flexible portion and an area of the first side of the flexible portion is tapered from the second locking device to the second bridging point.
- 10 17. The electrical connector as claimed in any one of claims 9 to 16 wherein the restrainer further comprises a bracket extending from a first edge of the end wall to a second edge of the end wall.
- 15 18. The electrical connector of claim 17 wherein the restrainer extends at least a portion of the way around the first locking device of the flexible portion.
19. The electrical connector of claim 17 wherein the restrainer forms an enclosure around the first locking device of the flexible portion.