

SPECIFICATIONMOUNTING OF ELECTRICAL CONNECTORSBackground of the Invention

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The present invention relates generally to a jig for mounting a plurality of electrical connectors to be used for connecting a pair of printed circuit boards.

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Conventionally, electrical connections between a first printed circuit board (motherboard) and another printed circuit board (daughterboard) may be established through the use of electrical connectors. In the past, one receptacle or female connector has been mounted on one printed circuit board, and an electrical plug or male connector is mounted on the other printed circuit board. By mating and connecting the female connector receptacle and the plug male connector with each other, electrical communication between the respective printed circuit boards is established. However, in the recent years, the number of required terminals or circuits is increasing due to the desire for down-sizing, reduction of weight of the electronic equipment and for higher performance.

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Accordingly, it now has become necessary on frequent occasions to mount a plurality of electrical connectors on each of the printed circuit boards.

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When a plurality of electrical connectors are to be mounted on the surface of one of the printed circuit boards, it is important to be able to precisely position the respective connectors which are to be mounted to the same circuit board relative to each other. If they are not precisely positioned, the subsequent engagement between the electrical female connector receptacles and the electrical plug male connectors becomes difficult. Moreover, the

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solder tails of the respective connectors and the circuits on the circuit boards to which they are to be soldered might be misaligned to the extent that could result in the failure to complete circuits which should have been completed.

5 Various methods have been employed in the past to avoid such problems. One such prior method for positioning of the connectors is by setting a guide block which is designed to accommodate the connectors therein on the printed circuit board as is disclosed in Japanese Unexamined
10 Patent Publication (Kokai) No. Heisei 5-47443. Another method connects two connectors by means of a bridge for fixing the relative portions of the connectors as is disclosed in 0.5 mm Pitch Multi-Pole Board-to-Board Connector, Electronics Mounting Technology, Vol. 10, No. 10,
15 pp. 72-73.

 Another known method is to restrict the relative positions of a plurality of connectors by employing a jig having cavities to externally engage with the connectors is disclosed in Japanese Unexamined Patent Publication No. 5-
20 135835.

 Among the prior art set forth above, the methods employing the guide block or the bridge have a problem of consuming spacial volume on the circuit board that might otherwise have a functional use because the guide block or
25 the bridge is mounted on the printed circuit board together with the connectors. On the other hand, in the case of the aforementioned method employing the jig, because a part of the jig is located outside of the connector, a space to accommodate the extending part of the jig must be provided
30 during the mounting of the connector on the printed circuit board. Therefore, similar to the former case, this method still causes the waste and loss of what otherwise could be functional volume or space on the circuit board.



Summary of the Invention

In view of the aforementioned problems, it is an object of the present invention to provide a jig for mounting a connector which can mount a plurality of connectors on a printed circuit board with high positioning accuracy and without sacrificing functional volume or space.

In one principal aspect of the invention a plurality of electrical connectors are positioned for mounting on a printed circuit board by providing a jig having a perimeter and at least four posts spaced from each other and positioned adjacent the perimeter of the jig. One of the connectors is positioned over two of the spaced posts so that the two spaced posts extend into at least one cavity in one of the connectors and engage the cavity to position and hold the connector on the jig and substantially at the perimeter of the jig. Another of the connectors is positioned over the other two spaced posts so that the other two spaced posts extend into at least one cavity of that connector and engage the cavity to position and hold the last mentioned connector on the jig, substantially at the perimeter of the jig and in a fixed predetermined relationship to the first connector. Once the connectors are mounted to the printed circuit board, the jig and posts are removed from the connectors.

In another principal aspect of the invention, the posts frictionally engage the cavity of the connectors.

In still another principal aspect of the invention, the posts deform to frictionally engage the cavity.

In still another principal aspect of the invention, the jig includes at least two sets of posts. Each of the sets of posts includes two pair of posts with each pair and each post in each said set being spaced from



each other. Each set of posts and each post in each set is also positioned to coincide and conform to the cavity of a connector, and the one of the connectors is positioned over one of the sets of posts, and the other of the connectors is positioned over the other of the sets of posts.

In still another principal aspect of the invention, each of the posts in the last mentioned pairs of posts is deformable both in the direction of the other posts of the pair and the other pair of posts in the set.

In still another principal aspect of the invention, the aforementioned fixed predetermined relationship between the connectors may be in side by side relationship.

In still another principal aspect of the invention, at least one additional connector may be positioned on the jig in end to end relationship to at least one of the aforementioned connectors.

In still another principal aspect of the invention, the connectors have a cavity within the connector and each of the pair of posts is spaced from each other by a distance substantially equal to the length of the cavity of one of the connectors and one post of each pair is spaced from the other post of each pair by a distance substantially equal to the width of the cavity.

In still another principal aspect of the invention, the aforementioned connectors have a perimeter, and the posts are positioned within the maximum dimensions of the perimeters of the connectors when the connectors are positioned on the posts.

These and other objects, features and advantages of the present invention will be more clearly understood through a consideration of the following detailed description.



Brief Description of the Drawings

The present invention will be understood more fully from the detailed description given herebelow and from the accompanying drawings of the preferred embodiment of the invention which are for explanation and understanding of the invention only and not limiting thereof, and in which:

FIG. 1 is a perspective view of a first embodiment of a connector mounting jig constructed according to the principles of the present invention;

FIG. 2 is a perspective view of the first embodiment of the connector mounting jig in use to position a plurality of connectors for mounting to a circuit board;

FIG. 3 is a perspective view of a connector to be mounted by the first embodiment of connector mounting jig, and in which the connector is illustrated in an upright condition;

FIG. 4 is a perspective view of the connector substantially as shown in FIG. 3 to be mounted by the first embodiment of the connector mounting jig, but in which the connector is in the upside down condition;

FIG. 5 is a perspective view of a second embodiment of the connector mounting jig constructed according to the principles of the invention; and

FIG. 6 is a perspective view of the second embodiment of the connector mounting jig in use to position a plurality of connectors for mounting to a circuit board.



Description of the Preferred Embodiments

The present invention will be discussed hereinafter in detail in terms of the preferred embodiments and with reference to the accompanying drawings.

5 A first embodiment of a connector mounting jig 1 according to the present invention is shown in FIG. 1. The connector mounting jig 1 has a base member 2 of generally polygonal shape, and more preferably of rectangular shape as seen in FIG. 1. The base member 2 is generally formed of
10 shorter transversely extending pieces 2a and longer longitudinally extending side pieces 2b. Two pairs of posts 3 preferably extend upwardly from the upper (as shown in the drawings) surface at each end of the longer pieces 2b and at each corner of the base member 2 adjacent its perimeter to
15 define two sets of pairs of posts 3A and 3B, as shown in FIG. 1, one set for each connector. The base member 2 and the posts 3 are preferably formed integrally with each other and of the same synthetic resin material. Through openings 4 also are preferably formed at given intervals as shown in
20 FIG. 1 in the longer pieces 2b. Accordingly, if the frame of the base member 2 is formed of hollow construction, and the through openings 4 are formed through the longer pieces 2b, the base member 2 can be made light in weight. In addition, the openings reduce the shrinkage of the
25 plastic base member which could affect the position of posts 3.

Each set of pairs of posts 3A and 3B is adapted to correspond with each of two connector components 5A and 5B, respectively, as shown in FIG. 2. Each connector 5 is
30 illustrated in FIGS. 3 and 4. The posts 3 at the opposite ends of one longer piece 2b are adapted to be inserted in and engaged with a cavity in each connector component, such as internal cavity 7, and the posts are preferably formed



and shaped to mate with mating surfaces in each connector such as mating surfaces 6, as viewed in FIG. 3. As shown in FIG. 1, two pair of posts, one at each end of a longer piece 2b of the base member 2 are preferably provided and each of the two sets 3A and 3B are engaged with each of the connectors 5A and 5B, respectively.

In order to insert the two pairs of posts 3 of a set of posts 3A or 3B into the receptacle cavity 7 while establishing frictional engagement with the peripheral surface of the receptacle cavity, and to release the posts from the receptacle cavity 7, each post 3 is preferably deformable both in the longitudinal direction of the longer piece 2b and in the direction perpendicular thereto, i.e., in the transverse direction perpendicular to the longitudinal direction of the connector 5. Each of the posts 3 is also preferably chamfered at their tips at 3a and 3b as shown in FIG. 1 to facilitate insertion of the posts 3 into the receptacle cavity 7.

FIG. 2 illustrates a condition where two connector components 5A and 5B are to be mounted on the printed circuit board by means of the first embodiment of the connector mounting jig 1 according to the invention. Each of two pairs of posts 3 at the respective opposite ends of the longer piece 2b of the base member 2, i.e., a set of posts 3A or 3B, are inserted into and engaged with the receptacle cavity 7 of the corresponding connector component 5. By maintaining this condition, two connector components 5A and 5B mounted on both longer pieces 2b of the base member 2 can be maintained at a fixed positional relationship in both the longitudinal and lateral directions. Therefore, by soldering the two connector components 5A and 5B on the printed circuit board while maintaining fixed positional relationship between the two



connector components 5A and 5B, the relative positions of the two connector components on the printed circuit board 2 can be fixed with certainty and accuracy by the posts 3 of the connector mounting jig 1. As a result, two connector components 5A and 5B can be mounted on the printed circuit board with high precision.

While the connector component 5 shown in FIGS. 2-4 of the drawings is provided with the solder tails 8 adapted to be mounted on the surface of the printed circuit board by way of soldering, the connector mounting jig 1 according to the present invention is equally effective for mounting connectors of the type having solder tails that pass through holes formed in the printed circuit board.

After completion of mounting of the connector components 5A and 5B onto the printed circuit board, the connector mounting jig 1 is simply removed by removing and releasing the posts 3 from the receptacle cavities 7 by pulling the jig 1 away from connector components 5A and 5B. Accordingly, after the connector components 5A and 5B are mounted, the connector mounting jig 1 is no longer necessary and may be completely removed from the connector-printed circuit board assembly. Therefore, waste or loss of what otherwise might be functional space or volume is eliminated. Furthermore, during mounting, no part of the connector mounting jig 1 extends beyond the extreme circumferential surfaces of the connector components 5, again avoiding the sacrifice or waste of mounting space or volume on the printed circuit board that might otherwise have a functional use. The distance between two pairs of the posts 3 at the same ends of the longer pieces 2b, i.e., two pairs of posts of the respective sets 3A or 3B, at all times corresponds to the desired distance between the respective connector components 5A and 5B. Therefore, either where the two



connector components 5A and 5B are to be arranged as close as possible to each other or where the two connector components 5A and 5B are to be arranged at some predetermined distance, either spacing can be accurately maintained by the transverse distance between the two sets 3A and 3B of pairs of respective posts.

A second embodiment of connector mounting jig 11 according to the present invention is shown in FIGS. 5 and 6. In this embodiment two base members 2 of the first embodiment are connected in tandem fashion so that four connector components 5A, 5B, 5C and 5D (either receptacle or plug connector components), as seen in FIG. 6, may be mounted simultaneously on a printed circuit board. The base member 12 of this embodiment is provided with eight pairs of posts 13 at respective corners, and also at the intermediate position to form four sets of posts 13A, 13B, 13C and 13D, as seen in FIG. 5. Similar to the first embodiment, the base member 12 and the posts 13 are preferably formed integrally with each other and of the same synthetic resin material.

In FIG. 6 the connector mounting jig 11 is shown in use. As seen in FIG. 6, four connector components 5A-5D are arranged in two parallel strings. Similar to the first embodiment, the positional relationship between the connector components 5A-5D can be fixed and maintained with accuracy and certainty. Therefore, the four connector components 5A-5D can be accurately mounted on a printed circuit board with precise positional relationship relative to each other. As in the first embodiment, the pairs of posts 13 are respectively inserted in and engaged into the respective corners of the connector components 5, and can be released therefrom after completion of mounting of the connectors 5A-5D onto the printed circuit board. By



releasing the posts 13 from engagement with receptacle cavities 7 of the connector components, the connector mounting jig 11 can be removed.

5 It will be understood that while the two
embodiments described herein are discussed in terms of
mounting two or four connector components, the number of the
connector components is not limited to the specific number
described, but can be of any desired number, such as three,
10 five, six, etc. In any case, the number of post sets to be
provided on the base member may simply be adapted to the
desired number of the connector components to be mounted.
Additionally, it will be understood that although the
embodiments discussed herein are illustrated using
15 receptacle connector components which receive the mounting
posts 3, 13 within an internal cavity within the sidewalls
of the connector components, the posts may be received
within similar internal cavities of male or plug connector
components as well as external cavities of the connector
20 component sidewalls. Moreover, it will also be understood
that although some of the connector components 5 are shown
in FIG. 6 in end to end relationship, they may also be
arranged in side by side relationship, and while some are
shown in side by side relationship in FIG. 2, they may also
be arranged in end to end relationship.

25 It will also be understood that the preferred
embodiments of the present invention which have been
described are merely illustrative of the principles of the
present invention. Modifications may be made by those
skilled in the art without departing from the true spirit
30 and scope of the invention.





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CLAIMS:

1. A connector mounting jig (1) for
simultaneously positioning a plurality of electrical
connector components (5A, 5B), in a predetermined
5 arrangement for subsequent mounting on a printed circuit
board, comprising:

a base member (2) having an upper surface and a
perimeter;

10 at least two sets of resilient posts (3A, 3B)
extending upward from said upper surface of said base
member (2) adjacent its perimeter, one (3A) of said sets of
posts being positioned in a predetermined relationship to
the other set (3B) of posts on said base member (2), and
each of said sets of posts (3A, 3B) comprising at least two
15 pair of resilient posts (3) with each of said pair of posts
and each post being spaced from each other, each pair of
posts being positioned to define a receptacle for receiving
and retaining a portion of one of said connector components,
so that each of said sets of posts (3A, 3B) may receive one
20 of said connector components and firmly position and support
the respective connector components (5A, 5B) on said base
member (2) in said predetermined arrangement.

25 2. The connector mounting jig of claim 1, wherein
said base member (2) is formed of a synthetic resin, and
said posts (3) and said base are formed integrally with each
other.

30 3. The connector mounting jig of claim 2, wherein
each said connector component has at least one cavity (7)
within a body portion thereof and said posts are received in
said cavity.





4. The connector mounting jig of claim 1, wherein said base member (2) is of a polygonal frame-shaped configuration.

5 5. The connector mounting jig of claim 4, wherein said configuration is rectangular.

10 6. The connector mounting jig of claim 1, wherein said posts (3) are arranged for supporting at least two of said connectors in a fixed positional side by side relationship to each other.

15 7. The connector mounting jig of claim 6, wherein said posts (3) are also arranged for supporting at least two additional connector components in fixed positional end to end relationship to said side by side connectors.

20 8. The connector mounting jig of claim 1, wherein said posts (3) are arranged for supporting at least two of said connectors in fixed positional end to end relationship to each other.

25 9. The connector mounting jig of claim 1, wherein each post (3) is deformable in the directions of both the other pair of posts on the set and the other post in each pair.

30 10. The connector mounting jig of claim 1, wherein said base member (2) comprises:
a frame having elongate frame components oriented in a given direction for arranging and positioning said connector components relative to each other, at least some of said frame components having openings therein for lightening the jig.





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11. The connector mounting jig of claim 1,
wherein said connector components (5A, 5B) each include a
cavity (7) having a length and width within the connector
component, and each of said pair of posts (3A, 3B) in a set
5 is spaced from each other by a distance substantially equal
to the length of the cavity (7) of one of said connector
components, and one post of each said pair is spaced from
the other post of each said pair by a distance substantially
equal to the width of said cavity (7).

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12. The connector mounting jig of claim 1,
wherein the connector components (5A, 5B) have a perimeter
having maximum dimensions, and said posts (3) are positioned
relative to each other to be within the maximum dimensions
15 of the perimeter of the connector components when the
connector components are positioned on the posts.

13. A method of positioning a plurality of
electrical connectors for mounting on a printed circuit
20 board, comprising:

providing a jig (1) having a perimeter and having
at least four resilient posts (3) spaced from each other and
positioned adjacent the perimeter of the jig;

25 positioning one of the connectors (5A, 5B) on two
of the spaced posts (3) so that the two spaced posts deflect
and engage one of the connectors to position and hold the
connector (5A, 5B) on the jig (1) and substantially at the
perimeter of the jig (1); and

30 positioning another of the connectors (5A, 5B) on
the other two spaced posts (3) so that the other two spaced
posts deflect and engage a second of the connectors to
position and hold the second connector on the jig (1),
substantially at the perimeter of the jig (1) and in a fixed





predetermined relationship to said one connector;
mounting said connectors (5A, 5B) to the printed
circuit board; and
removing the jig (1) and posts (3) from the
5 connectors after the connectors (5A, 5B) have been mounted
to a circuit board.

10 14. The method of claim 13, wherein said posts
(3) frictionally engage a cavity (7) of the connectors.

15 15. The method of claim 14, wherein said posts
deform to frictionally engage the cavity (7).

16. The method of claim 13, wherein the jig (1)
15 includes at least two sets of posts (3), each of said sets
of posts (3) comprising two pair of posts (3) with each pair
and each post in each said set being spaced from each other,
each set of posts (3) and each post in each set being
positioned to define a cavity for receiving a connector (5A,
20 5B), wherein said one of said connectors is positioned over
one of said sets of posts, and said another connector (5A,
5B) is positioned over the other of said sets of posts (3).

25 17. The method of claim 13, wherein said fixed
predetermined relationship between the connectors is in side
by side relationship.

30 18. The method of claim 19, including positioning
at least one additional connector on the jig (1) in end to
end relationship to at least one of the aforementioned
connectors (5A, 5B).





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19. The method of claim 12, wherein the connectors (5A, 5B) have a perimeter having maximum dimensions, and the connectors are positioned on the posts (3) so that the posts (3) are within the maximum dimensions of the perimeter of the connectors (5A, 5B).

20. A combination comprising:
a plurality of electrical connectors (5A, 5B),
each of the connectors (5A, 5B) having a plastic body
portion and a plurality of spaced apart conductive
terminals; and
a connector mounting jig (1) including:
a base member (2) having an upper surface and a
perimeter; and
at least two sets of posts (3A, 3B) extending
upward from said upper surface of said base member (2)
adjacent its perimeter, one (3A) of said sets of posts being
positioned in a predetermined relationship to the other (3B)
set of posts, and each of said sets of posts (3A, 3B)
comprising at least two pair of posts (3) with each of said
pair of posts and each post being spaced from each other,
each set of posts (3) and each post in each set being
positioned to define a receptacle for receiving a portion of
said body portion of one connector (5A, 5B), so that each of
said sets of posts respective portions of said connectors
and firmly position and support the respective connectors on
said base member in a predetermined relationship to each
other.

21. The combination of claim 20, wherein said
base member (2) is formed of a synthetic resin, and said
posts (3) and said base member (2) are formed integrally
with each other.





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22. The connector of claim 20, wherein said base member (2) is rectangular.

5 23. The combination of claim 20, wherein said posts (3) support at least two of said connectors (5A, 5B) in a fixed positional side-by-side relationship to each other.

10 24. The combination of claim 23, wherein said posts (3) support at least two of said connectors (5A, 5B) in fixed positional end to end relationship to said side-by-side connectors.

15 25. The combination of claim 20, wherein said posts (3) support at least two of said connectors (5A, 5B) in fixed positional end to end relationship to each other.

20 26. The combination of claim 20, wherein the connectors (5A, 5B) have a perimeter having maximum dimensions, and said posts are positioned within the maximum dimensions of the perimeter of the connectors (5A, 5B).

