

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electrical connectors affixed to printed circuit boards and, more particularly, to a connector comprising a retainer having a plurality of pins mounted therein, the pins being stiff and extending outwardly from the retainer and having portions for insertion through respective holes of a printed circuit board.

2. Description of Related Art

Since the advent of the printed circuit board, electrical components have generally been affixed to the board by soldering the component leads to the printed electrical pattern. Often times the component leads extend through the board's holes and must be soldered in this position.

One of the problems encountered in such operations is maintaining the components in the desired position or orientation during assembly and soldering. Various attempts have been made to solve this problem. In earlier times when discrete electrical components such as capacitors and resistors were commonly affixed in large number to printed circuit boards, various lead locking arrangements were suggested. For example, in US-A-2,754,486 the two relatively soft lead wires of a resistor were crimped in a configuration so when inserted, the leads temporarily lock in the substantially larger board holes by hooking around the bottom edge of the board holes to thereby hold the resistor in place while soldering. This document also discloses that the outer portions of the leads can be provided with a crimp projecting laterally toward the other lead and pressing against one side of the board hole, said outer portions being held at an inclination to each other by the engagement of said crimps against the sides of said holes, to thereby hold said resistor in position until the projecting ends of said leads can be soldered. Similar approaches were proposed for capacitors in US-A-3,162,721, US-A-3,056,939, US-A-3,239,720 and US-A-3,747,045. Where such discrete components have been packaged together, similar techniques have been tried. US-A-3,524,108 for example, discloses a board mounted modular circuit component comprising a hard dielectric ceramic material supporting a number of active and passive components with multiple, self-locking leads bent into a configuration so as to provide cam surfaces for contacting the printed circuit board holes.

Retention during soldering is particularly important in connection with the more recent multi-termi-

nal connectors. Where such connectors have flat, thin leads, which can be readily crimped as in the discrete components of the past, the retention is not a serious problem. This is because the easily crimped flat, thin leads usually have a large offset permitting adequate room to pass through the board holes. The crimped portion passes completely through holes and locks to the other end of the holes. To provide adequate retention, the thickness of the board and location are critical.

In the case of electrical connector headers, lead locking arrangements of the prior art are not easily applied. Such headers include numerous male terminal pins surrounded by various plastics. The male pins are typically square metal posts approximately 1 mm (0.025 inches) square and are very stiff. Because of the size and stiffness of such square male pins, headers are soldered to printed circuit boards utilizing various hold-down devices to retain the header in place during the soldering operation. Such devices include mechanical fasteners such as bolts and screws. Weighted plates are also used. These are placed atop the headers and removed after the soldering process. Although such methods work, they are expensive because they are labor intensive.

Within the last few years, methods of attachment which are an integral part of the header have been sought. What has been tried typically involves employing a single male pin in the header which will interfere with one printed circuit board hole. The male pin used is commonly one of the commercially available compliant-type pins. Such pins, however, usually require high insertion forces on the order of 178N (40 pounds). Also they are useful for one insertion only.

The move to robotic insertion has lead to a need for a header that can be mechanically placed on a printed circuit board and automatically retained through subsequent board handling and soldering operations. Robotic loaders typically have an upper limit on insertion forces (for example, about 67N (15 pounds)) to protect the circuit board in case of a misplaced or damaged component. As this load limit is reached, the insertion head of the robotic loader retracts to provide this safety feature. Consequently, retention features must have relatively low insertion forces to be used with robotic loaders.

STATEMENT OF INVENTION

The present invention seeks to provide a solution for retaining an electrical connector in the correct position during soldering and other handling operations. According to the invention an electrical connector or header comprising a retainer plastics material having a plurality of terminal pins mounted

therein, the pins being relatively thick and stiff and extending from the retainer and having end portions for insertion through respective holes of a printed circuit board; wherein the pins include at least one pair of pins having at the insertion portion of each pin an offset in the form of a crimp with the insertion portions of the rest of the pins being straight; the crimp of one pin of said one pair of pins extends in a direction opposite to the crimp of the other pin of the pair, each crimp being so shaped that on insertion into the holes of the printed circuit board each crimped pin only contacts the printed circuit board by its shaped crimped portion within its respective hole only on one side of said hole and thereby exerts a relatively high normal force against said printed circuit board only at said one side of the hole which is opposite to the corresponding normal force exerted by the other crimped pin of the pair in an opposing insertion hole to thereby act as retention means for retaining the connector in a position for soldering, whereby when the pins are all inserted in the holes in the printed circuit board and positioned for soldering, the connector is retained in position for soldering solely by the normal forces exerted by the crimped pins.

The crimp or deformation is not dependent upon the thickness of the printed circuit board because retention depends upon the complementary normal forces of the pair of crimped pins against two opposing printed circuit board holes. The complementary action of each pin of the pair against the corresponding surface of the hole provides retention, no matter whether the board is relatively thin or thick. Also, the thick pins allow for very little room for offset without creating very high insertion forces.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a first embodiment of the present invention illustrating a pair of crimped retaining pins in a double row vertical header.

FIG. 1A is a top view of FIG. 1.

FIG. 1B is a sectional view taken along the line B-B of FIG. 1A, after insertion in a printed circuit board.

FIGS. 2, 2A and 2B are respectively similar views of a second embodiment of the present invention illustrating a pair of crimped retaining pins in a triple row vertical header.

FIGS. 3, 3A, 3B and 3C are also respectively similar views of a third embodiment of the present invention illustrating two pairs of crimped retaining pins in a single row vertical header.

FIGS. 4, 4A, and 4B are also respectively similar views of two pairs of crimped pins in a

single row, right angle header.

FIGS. 5, 5A and 5B are also respectively similar views of a pair of crimped retaining pins in a double row, right angle header.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a first embodiment of the present invention wherein a double row vertical header 10 is shown. The header comprises two rows of square male terminal pins 12. Such male terminal pins are an industry standard 1 mm (0.025 inches) square.

The pins are held in a plastic retainer or wafer 14. In FIG. 1, a pair of adjoining pins, 12A and 12B, have been crimped as shown at their terminal or insertion end. In the embodiment shown, the deformation is such that the crimped portions of pins 12A and 12B extend toward each other. The retention feature of the present invention will work equally well if the crimped portions both extend away from each other. What is important is that each crimped portion of the pair cooperates against corresponding surfaces in the printed circuit board holes, as explained below. Buttons 16 are provided on the wafer 14 to provide an offset between wafer and printed circuit board after insertion of the header 10. This allows for adequate cleaning after the soldering operation.

FIG. 1B illustrates the retention action of the pair of crimped pins 12A and 12B after the header 10 is inserted into a printed circuit board 18. The crimped end of the pins are shown within the holes of the board. It should be noted that retention can be achieved by contact of the crimped portion of each lead with only one side of its hole at points identified as 19A and 19B, respectively. The normal forces exerted against hole surfaces 19A and 19B by the crimped portion of pins 12A and 12B is sufficiently high to provide the necessary retention during the soldering operation.

Since only one surface of each hole is necessary for retention, the thickness of the printed circuit board is not as critical as where retention due to a terminal or lead deformation requires contact with opposite sides of the same to circuit board hole. Thus the present invention operates equally well in very thin and very thick printed circuit boards. What is important is that at least a pair of complementary pins be similarly crimped so that normal forces of the crimped portion of each act cooperatively against the corresponding surface of each respective printed circuit board hole.

FIGS. 2, 2A and 2B illustrate a second embodiment of the present invention where like parts are identified by the same reference number. This second embodiment shows a triple row vertical header

20 differing from header 10 essentially only in that it contains three instead of two rows of pins 12. A single pair of crimped terminals 12A and 12B is utilized here also, one from the first and third rows. They are separated by a regular pin 12. The retention action in the printed circuit board 18 is otherwise identical as shown in FIG. 2B.

FIGS. 3, 3A and 3B illustrate a third embodiment of the present invention. The header 30 in the embodiment comprises but a single row of pins held in a plastic wafer 34 similar to 14 of the prior embodiments.

Since only a single row is used, the retaining pins with crimped ends must be in the same row. In the embodiment of FIG. 3, two pairs of pins are crimped in alternating directions. One pair of oppositely crimped pins, however, will also provide adequate retention. Pairs 32A and 32B cooperate with one another as do pairs 32C and 32D in a manner similar to the single pair of crimped pins in the first two embodiments to provide retention of the header in the printed circuit board. Thus, as shown in FIG. 3B, complementary crimped terminals 32A (shown in solid) and 32B (shown in phantom) have their crimped portion exerting normal forces against opposite surfaces of their respective printed circuit board holes, thereby achieving the same retention action as in the prior embodiments. Likewise, the same is true for crimped terminals 32C (solid) and 32C (phantom) shown in FIG. 3D.

FIGS. 4, 4A and 4B illustrate a fourth embodiment of the present invention. The header 40 is also a single row header but the terminal pins 42 are bent at right angles at one end. This is because header 40 is designed to be inserted into printed circuit board 48 at right angles as shown in FIG. 4C. As before, the pins 42 are held by a plastic wafer 44. Header 40 also has two pairs of pins crimped alternatively as in the header of FIG. 3. The crimps are at the right angle portion of the pins for obvious reasons. Thus, as in the case of the embodiment of FIG. 3, pairs 42A and 42B and pairs 42C and 42D of crimped terminals cooperate to retain the header in the printed circuit board 48. FIG. 4B illustrates the previously explained cooperative retaining action between crimped pin 42B (solid) and 42A (phantom). The same occurs in the case of pins 42C and 42D. Again, adequate retention can be obtained with a single pair of crimped pins.

FIGS. 5, 5A and 5B illustrate a fifth embodiment of the present invention. The header 50 is a double row, right angle header, meaning that it comprises a double row of pins 52 held by a wafer 54 where all the pins are set at right angles for insertion into a printed circuit board. A pair of pins 52A and 52B are crimped in the manner previously described. Thus, when the header 50 is inserted

into the printed circuit board 58, crimped terminals cooperate as did crimped pins 12A and 12B in the embodiment of FIG. 1 to retain header 50 in the proper position during soldering.

Claims

1. An electrical connector or header (10, 20, 30, 40, 50) comprising:-
 - a retainer (14, 34, 44, 54) of plastics material having a plurality of terminal pins (12, 32, 42, 52) mounted therein,
 - the pins (12, 32, 42, 52) being relatively thick and stiff and extending from the retainer (14) and having end portions for insertion through respective holes of a printed circuit board (18); wherein
 - the pins include at least one pair of pins (12A, 12B; 32A - 32D; 42A - 42D; 52A, 52B) having at the insertion portion of each pin an offset in the form of a crimp with the insertion portions of the rest of the pins being straight;
 - the crimp of one pin of said one pair of pins extends in a direction opposite to the crimp of the other pin of the pair, each crimp being so shaped that on insertion into the holes of the printed circuit board each crimped pin only contacts the printed circuit board by its shaped crimped portion within its respective hole only on one side of said hole and thereby exerts a relatively high normal force against said printed circuit board only at said one side of the hole which is opposite to the corresponding normal force exerted by the other crimped pin of the pair in an opposing insertion hole to thereby act as retention means for retaining the connector in a position for soldering, whereby when the pins are all inserted in the holes in the printed circuit board and positioned for soldering, the connector is retained in position for soldering solely by the normal forces exerted by the crimped pins.
2. An electrical connector according to claim 1 wherein said terminal pins have square cross-sections.
3. An electrical connector according to claim 1 or claim 2 wherein the crimps of said pair of pins extend toward each other.
4. An electrical connector according to claim 1 or claim 2 wherein the crimps of said pair of pins extend away from each other.
5. An electrical connector according to any one of claims 1 to 4 wherein there are two rows of



20 differing from header 10 essentially only in that it contains three instead of two rows of pins 12. A single pair of crimped terminals 12A and 12B is utilized here also, one from the first and third rows. They are separated by a regular pin 12. The retention action in the printed circuit board 18 is otherwise identical as shown in FIG. 2B.

FIGS. 3, 3A and 3B illustrate a third embodiment of the present invention. The header 30 in the embodiment comprises but a single row of pins held in a plastic wafer 34 similar to 14 of the prior embodiments.

Since only a single row is used, the retaining pins with crimped ends must be in the same row. In the embodiment of FIG. 3, two pairs of pins are crimped in alternating directions. One pair of oppositely crimped pins, however, will also provide adequate retention. Pairs 32A and 32B cooperate with one another as do pairs 32C and 32D in a manner similar to the single pair of crimped pins in the first two embodiments to provide retention of the header in the printed circuit board. Thus, as shown in FIG. 3B, complementary crimped terminals 32A (shown in solid) and 32B (shown in phantom) have their crimped portion exerting normal forces against opposite surfaces of their respective printed circuit board holes, thereby achieving the same retention action as in the prior embodiments. Likewise, the same is true for crimped terminals 32C (solid) and 32C (phantom) shown in FIG. 3D.

FIGS. 4, 4A and 4B illustrate a fourth embodiment of the present invention. The header 40 is also a single row header but the terminal pins 42 are bent at right angles at one end. This is because header 40 is designed to be inserted into printed circuit board 48 at right angles as shown in FIG. 4C. As before, the pins 42 are held by a plastic wafer 44. Header 40 also has two pairs of pins crimped alternatively as in the header of FIG. 3. The crimps are at the right angle portion of the pins for obvious reasons. Thus, as in the case of the embodiment of FIG. 3, pairs 42A and 42B and pairs 42C and 42D of crimped terminals cooperate to retain the header in the printed circuit board 48. FIG. 4B illustrates the previously explained cooperative retaining action between crimped pin 42B (solid) and 42A (phantom). The same occurs in the case of pins 42C and 42D. Again, adequate retention can be obtained with a single pair of crimped pins.

FIGS. 5, 5A and 5B illustrate a fifth embodiment of the present invention. The headers 50 is a double row, right angle header, meaning that it comprises a double row of pins 52 held by a wafer 54 where all the pins are set at right angles for insertion into a printed circuit board. A pair of pins 52A and 52B are crimped in the manner previously described. Thus, when the header 50 is inserted

into the printed circuit board 58, crimped terminals cooperate as did crimped pins 12A and 12B in the embodiment of FIG. 1 to retain header 50 in the proper position during soldering.

Claims

1. An electrical connector or header (10, 20, 30, 40, 50) comprising:-
 - a retainer (14, 34, 44, 54) of plastics material having a plurality of terminal pins (12, 32, 42, 52) mounted therein,
 - the pins (12, 32, 42, 52) being relatively thick and stiff and extending from the retainer (14) and having end portions for insertion through respective holes of a printed circuit board (18); wherein
 - the pins include at least one pair of pins (12A, 12B; 32A - 32D; 42A - 42D; 52A, 52B) having at the insertion portion of each pin an offset in the form of a crimp with the insertion portions of the rest of the pins being straight;
 - the crimp of one pin of said one pair of pins extends in a direction opposite to the crimp of the other pin of the pair, each crimp being so shaped that on insertion into the holes of the printed circuit board each crimped pin only contacts the printed circuit board by its shaped crimped portion within its respective hole only on one side of said hole and thereby exerts a relatively high normal force against said printed circuit board only at said one side of the hole which is opposite to the corresponding normal force exerted by the other crimped pin of the pair in an opposing insertion hole to thereby act as retention means for retaining the connector in a position for soldering, whereby when the pins are all inserted in the holes in the printed circuit board and positioned for soldering, the connector is retained in position for soldering solely by the normal forces exerted by the crimped pins.
2. An electrical connector according to claim 1 wherein said terminal pins have square cross-sections.
3. An electrical connector according to claim 1 or claim 2 wherein the crimps of said pair of pins extend toward each other.
4. An electrical connector according to claim 1 or claim 2 wherein the crimps of said pair of pins extend away from each other.
5. An electrical connector according to any one of claims 1 to 4 wherein there are two rows of



pins, each row containing one each of said pair of crimped pins.

6. An electrical connector according to claim 5 wherein the insertion end of all the pins are formed at right angles to the remainder of said pins, the crimp of each pin of said pair being located at said right angle insertion end. 5
7. An electrical connector according to any one of claims 1 to 4 wherein there are three rows of pins, two of said rows containing one each of said pairs of crimped pins. 10
8. An electrical connector according to any one of claims 1 to 4 wherein there is a single row of pins and said pair of crimped pins is located in said single row. 15
9. An electrical connector according to claim 8 wherein the insertion end of all the pins of the header are formed at right angles to the remainder of the pins, the crimp of each pin of said pair being located at said right angle insertion end. 20
10. An electrical connector according to claim 8 or claim 9 and further comprising a second pair of crimped pins, both pins of each pair being positioned adjacent one another in the row. 25
11. An electrical connector according to any one of the preceding claims wherein the rest of the plurality of pins extend through respective holes in the printed circuit board and are not required to be in contact with the printed circuit board until soldered thereto. 30

Patentansprüche

1. Elektrischer Verbinder oder -gehäuse (10, 20, 30, 40, 50), welcher aufweist:
einen Halter (14, 34, 44, 54) aus Kunststoffmaterial, welcher eine Mehrzahl von Anschlußstiften (12, 32, 42, 52) hat, welche darin angebracht sind,
die Stifte (12, 32, 42, 52) relativ dick und steif sind und sich von dem Halter (14) aus wegerstrecken und Endabschnitte zum Einführen in zugeordnete Öffnungen einer gedruckten Schaltungsplatte (18) haben, bei dem
die Stifte wenigstens umfassen
ein Paar von Stiften (12A, 12B; 32A-32D; 42A-42D; 52A-52B), welche an dem Einführungsabschnitt jedes Stiftes eine Versetzung in Form einer Biegung haben, wobei die Einführungsabschnitte des restlichen Teils der Stifte geradlinig ausgebildet sind; 35

die Biegung eines Stifts des einen Paares von Stiften in einer Richtung entgegen der Biegung des anderen Stifts des Paares gerichtet ist, jede Biegung derart ausgebildet ist, daß beim Einführen in die Öffnungen der gedruckten Schaltungsplatte jeder gebogene Stift nur die gedruckte Schaltungsplatte mit dem hinsichtlich der Formgebung gebogenen Abschnitt in der zugeordneten Öffnung nur auf einer Seite der Öffnung kontaktiert und hierdurch eine relativ hohe Normalkraft gegen die gedruckte Schaltungsplatte nur auf dieser einen Seite der Öffnung ausübt, welche entgegengesetzt zu der entsprechenden Normalkraft ist, die von dem anderen gebogenen Stift des Paares in einer gegenüberliegenden Einführungsöffnung ausgeübt wird, um hierdurch als eine Halteinrichtung zu wirken, welche den Verbinder in einer Position zum Löten hält, wodurch dann, wenn die Stifte alle in die Öffnungen der gedruckten Schaltungsplatte eingesetzt und zum Löten positioniert sind, der Verbinder in der Position zum Löten lediglich durch die von den gebogenen Stiften aufgebrauchten Normalkräften gehalten wird.

2. Elektrischer Verbinder nach Anspruch 1, bei dem die Anschlußstifte quadratische Querschnitte haben.
3. Elektrischer Verbinder nach Anspruch 1 oder 2, bei dem die Biegungen des Paares von Stiften aufeinander zu gerichtet sind.
4. Elektrischer Verbinder nach Anspruch 1 oder 2, bei dem die Biegungen des Paares von Stiften voneinander wegweisen.
5. Elektrischer Verbinder nach einem der Ansprüche 1-4, bei dem zwei Reihen von Stiften vorgesehen sind, und jede Reihe jeweils ein Paar von gebogenen Stiften enthält.
6. Elektrischer Verbinder nach Anspruch 5, bei dem das Einführungsende aller Stifte rechtwinklig zu dem restlichen Teil der Stifte ausgebildet ist, wobei die Biegung des jeweiligen Stiftes des Paares an dem rechtwinklig abgeboenen Einführungsende liegt.
7. Elektrischer Verbinder nach einem der Ansprüche 1-4, bei dem drei Reihen von Stiften vorgesehen sind, wobei zwei der Reihen jeweils das Paar von gebogenen Stiften enthalten.
8. Elektrischer Verbinder nach einem der Ansprüche 1-4, bei dem eine einzige Reihe von Stiften vorgesehen ist, und das Paar von geboge-



nen Stiften in dieser einzigen Reihe liegt.

9. Elektrischer Verbinder nach Anspruch 8, bei dem das Einführungsende aller Stifte des Gehäuses rechtwinklig zu dem restlichen Teil der Stifte ausgebildet ist und bei dem die Biegung jedes Stifts des Paares an dem rechtwinklig abgebogenen Einführungsende liegt.

10. Elektrischer Verbinder nach Anspruch 8 oder 9, welcher ferner ein zweites Paar von gebogenen Stiften aufweist, wobei beide Stifte jedes Paares in der Reihe einander benachbart angeordnet sind.

11. Elektrischer Verbinder nach einem der vorangehenden Ansprüche, bei dem die restlichen der Mehrzahl von Stiften durch zugeordnete Öffnungen in der gedruckten Schaltungsplatte gehen und es nicht erforderlich ist, daß diese in Kontakt mit der gedruckten Schaltungsplatte sind, bis diese an dieser angelötet werden.

Revendications

1. Un connecteur électrique ou embase (10, 20, 30, 40, 50) comprenant:

- un support (14, 34, 44, 54) en matière plastique dans lequel sont montées une pluralité de broches de connexion (12, 32, 42, 52),
- les broches (12, 32, 42, 52) étant relativement épaisses et rigides et s'étendant du support (14), et comportant des parties d'extrémité pour insertion à travers des trous respectifs d'une carte à circuit imprimé (18);

dans lequel:

au moins une paire (12A, 12B; 32A-32D; 42A-42D; 52A, 52B) des broches comporte, à la partie d'insertion de chaque broche, un décalage en forme de sertissage, les parties d'insertion des autres broches étant rectilignes;

le sertissage de l'une des broches de ladite paire de broches s'étend dans une direction opposée au sertissage de l'autre broche de la paire, chaque sertissage étant d'une telle forme que, suite à son insertion dans les trous de la carte à circuit imprimé, chaque broche sertie ne contacte la carte à circuit imprimé au moyen de sa partie conformée sertie à l'intérieur du trou respectif, que sur l'une des faces dudit trou en exerçant ainsi une force normale relativement élevée contre ladite carte à circuit imprimé, uniquement à ladite face du trou qui est opposée à la force normale correspondante exercée par l'autre broche sertie de la paire, située dans un trou d'insertion opposé, pour

agir ainsi comme moyen de maintien pour retenir le connecteur en position pour la soudure, de sorte que, quand toutes les broches sont insérées dans les trous de la carte à circuit imprimé et sont positionnées pour leur soudure, le connecteur soit maintenu en position de soudure uniquement par les forces normales exercées par les broches serties.

2. Un connecteur électrique selon la revendication 1, dans lequel lesdites broches de connexion ont une section transversale de forme carrée.

3. Un connecteur électrique selon la revendication 1 ou 2, dans lequel les sertissages de ladite paire de broches s'étendent l'un vers l'autre.

4. Un connecteur électrique selon la revendication 1 ou 2, dans lequel les sertissages de ladite paire de broches s'étendent dans des sens opposés l'un par rapport à l'autre.

5. Un connecteur électrique selon l'une quelconque des revendications 1 à 4, dans lequel le connecteur comporte deux rangées de broches, chaque rangée comprenant l'une des broches serties de ladite paire.

6. Un connecteur électrique selon la revendication 5, dans lequel l'extrémité d'insertion de toutes les broches est formée à angle droit par rapport au reste desdites broches, le sertissage de chaque broche de ladite paire étant situé à ladite extrémité d'insertion repliée à angle droit.

7. Un connecteur électrique selon l'une quelconque des revendications 1 à 4, dans lequel le connecteur comporte trois rangées de broches, deux desdites rangées comporte une chacune desdites paires de broches.

8. Un connecteur électrique selon l'une quelconque des revendications 1 à 4, comprenant une rangée unique de broches, ladite paire de broches serties étant située dans ladite rangée unique.

9. Un connecteur électrique selon la revendication 8, dans lequel l'extrémité d'insertion de toutes les broches de l'embase est formée à angle droit par rapport au reste de la broche, le sertissage de chaque broche de ladite paire étant situé sur ladite extrémité d'insertion repliée à angle droit.



10. Un connecteur électrique selon la revendication 8 ou la revendication 9 et comprenant en outre une deuxième paire de broches serties, les deux broches de chaque paire étant positionnées l'une adjacente à l'autre dans la rangée.

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11. Un connecteur électrique selon l'une quelconque des revendications précédentes, dans lequel le reste de la pluralité de broches s'étend à travers des trous respectifs de la carte à circuit imprimé, leur contact avec la carte à circuit imprimé n'étant pas nécessaire jusqu'au moment de leur soudure sur ladite carte.

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