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Lynch

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[54] **PRESS FITTED TERMINAL POST**

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[73] Assignee: **AMP Incorporated,** Harrisburg, Pa.

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[52] **U.S. Cl.** ..... **339/221 R**

[51] **Int. Cl.²** **H01R 9/08**

[58] **Field of Search** ..... 339/221 R, 221 M, 220 R, 339/217 R, 217 S, 252 R, 252 S, 252 P, 253 R, 176 R, 176 M, 176 MP, 17 R, 17 C, 17 LC, 17 M

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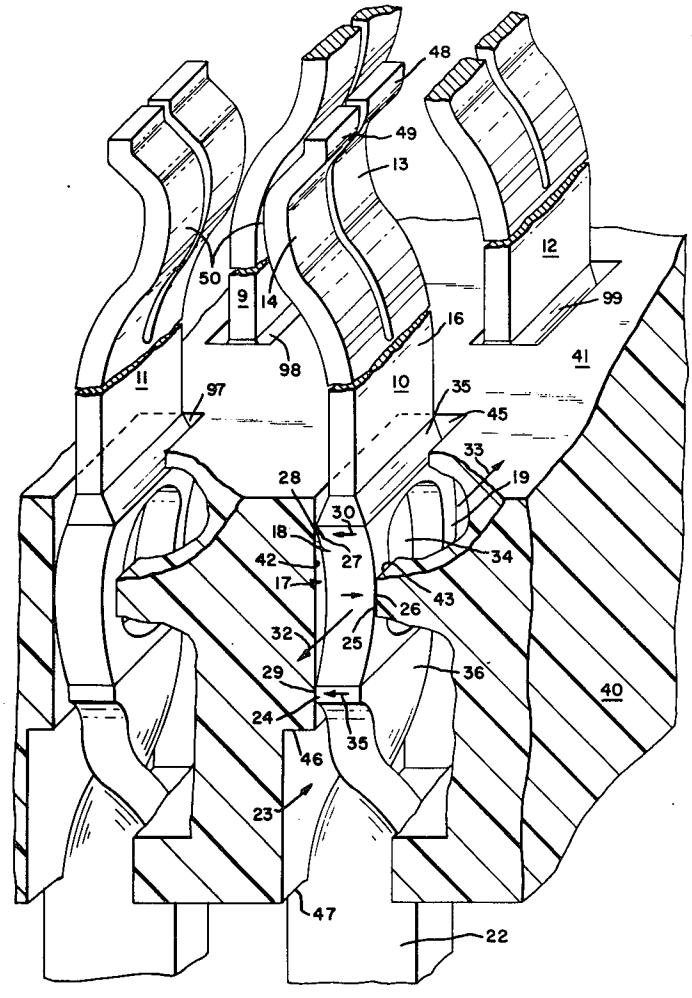
Assistant Examiner—James W. Davie
Attorney, Agent, or Firm—William J. Keating, Esq.; Donald W. Phillion, Esq.

[57] **ABSTRACT**

In a terminal, an engaging portion for engaging the walls of an aperture formed in a housing or a printed circuit board, in which the aperture is substantially rectangular in cross-sectional area configuration. The engaging portion comprises a pair of curved, substantially parallel beams extending longitudinally through the aperture. The two beams are curved in the same direction with the two ends of the concave sides of the beams pressing against one major wall of the aperture and the center portion of the convex side of the beam pressing against the other major wall of the aperture. Further, the two beams are bowed outwardly from each other with their side edges pressing against the side walls of the aperture, thereby producing an overall force-fit effect in which the aperture engaging portion of the terminal exerts force in all four directions against the sidewalls of the aperture and is rigidly secured therein.

9 Claims, 6 Drawing Figures



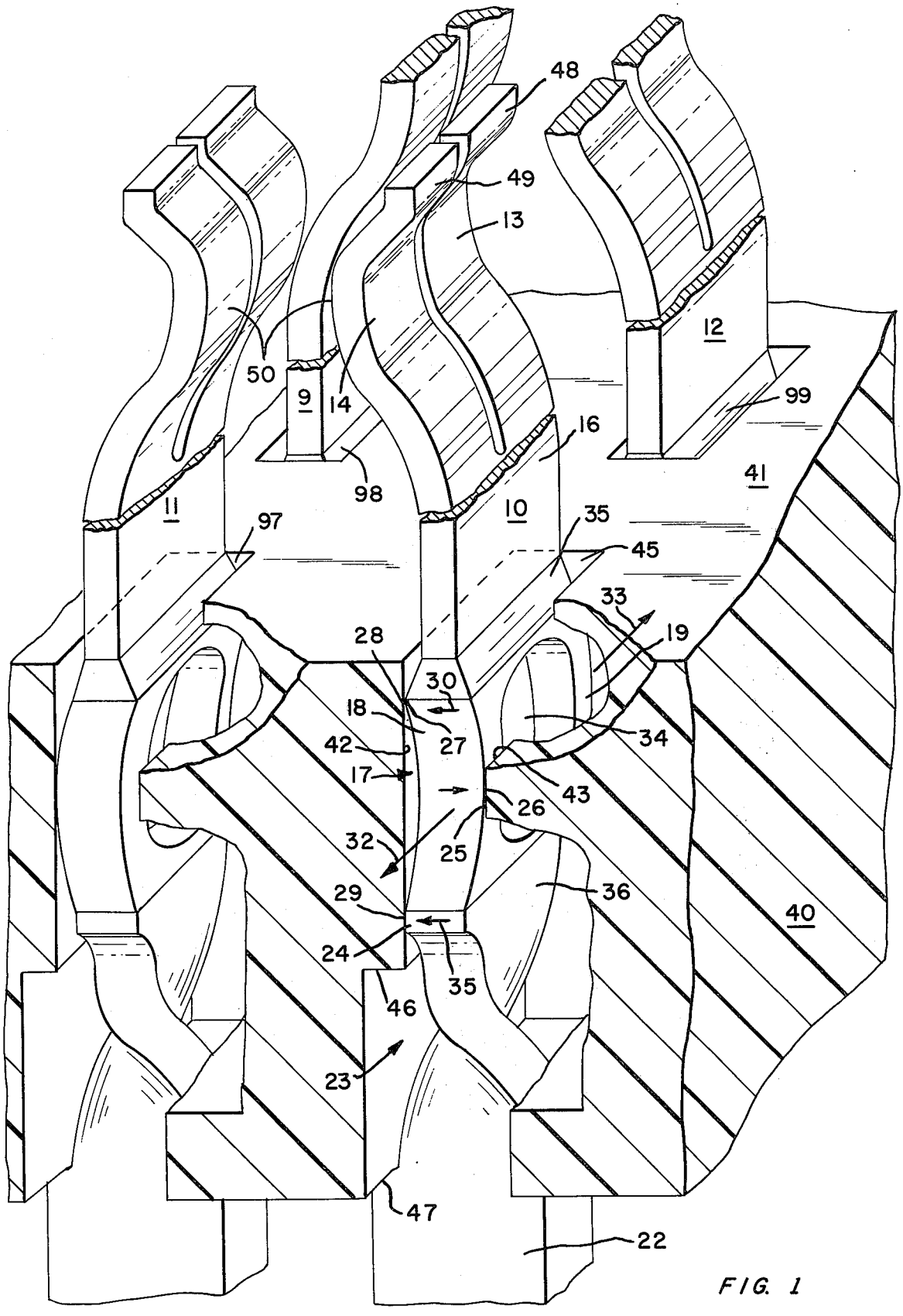

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FIG. 1

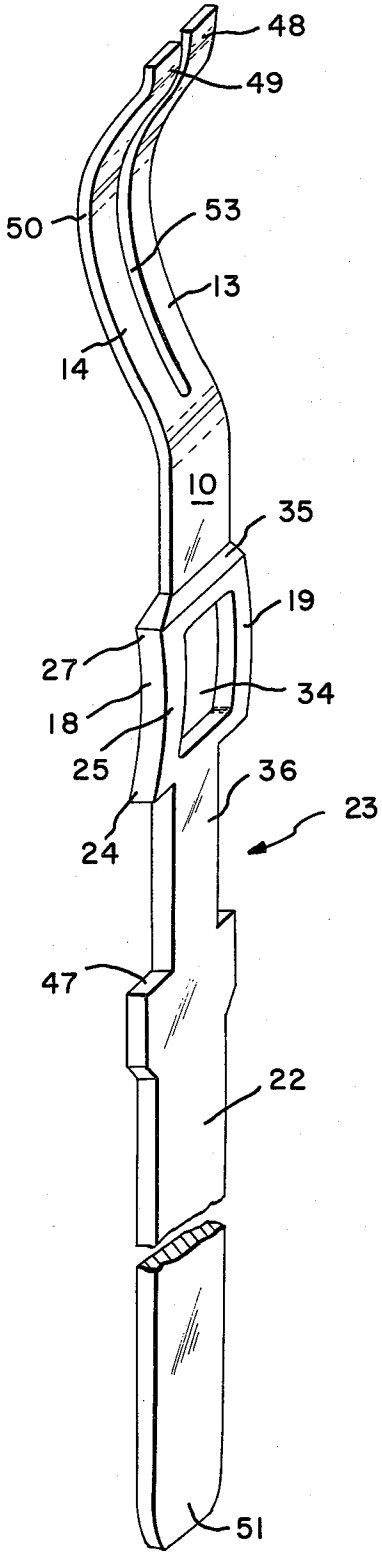
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FIG. 2

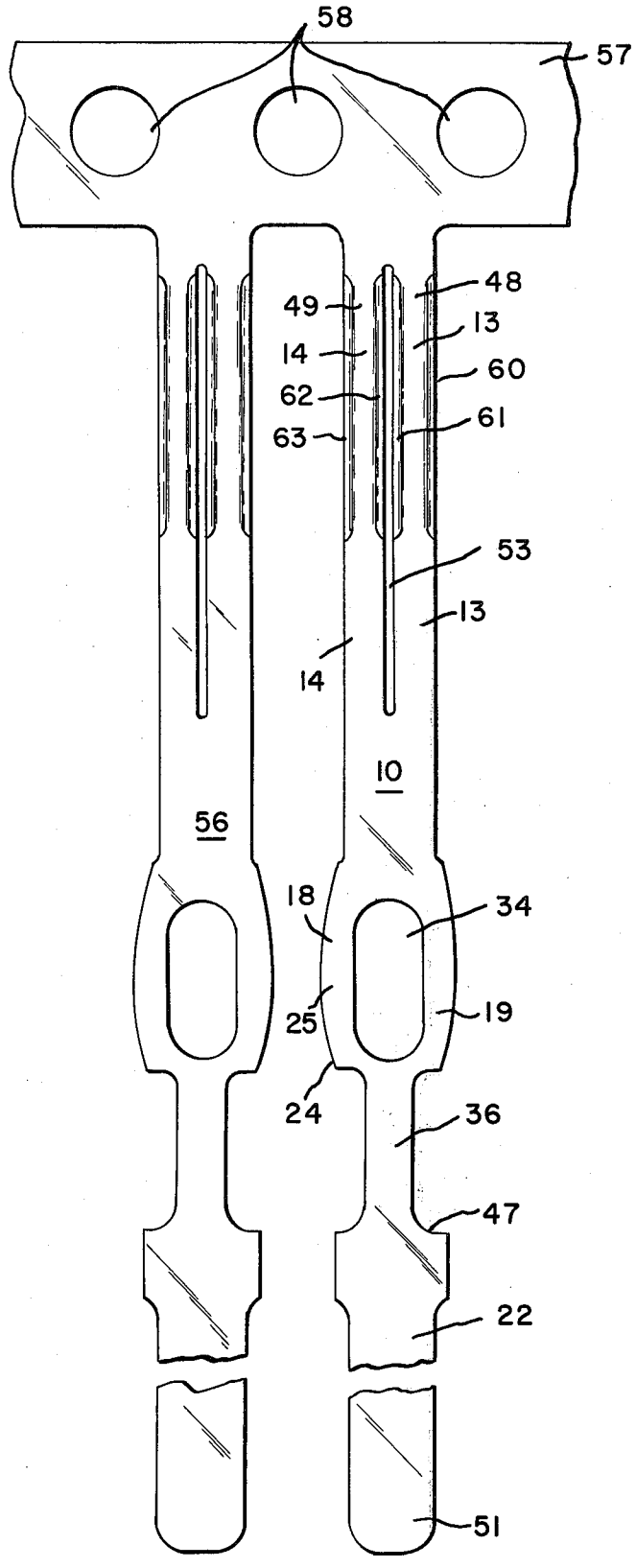
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FIG. 3

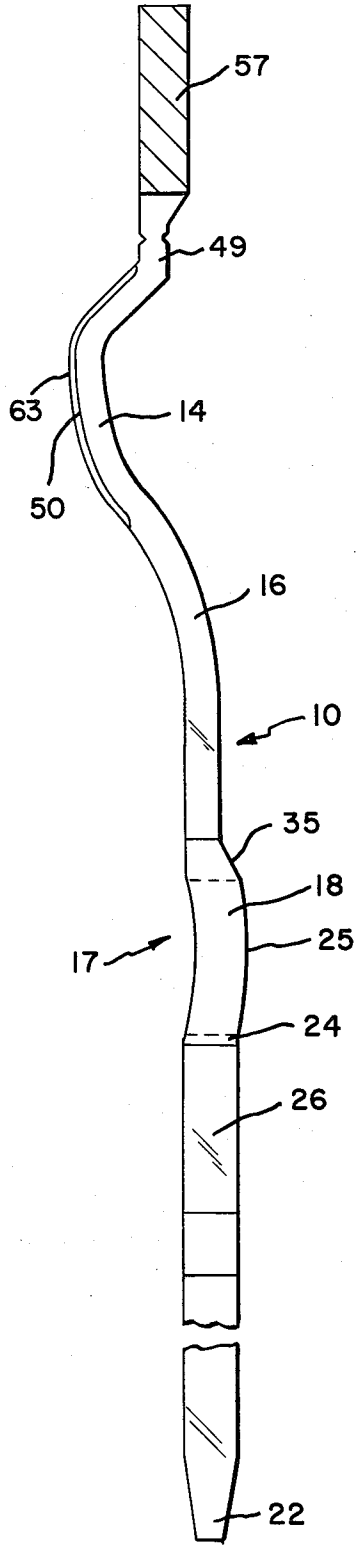

FIG. 4

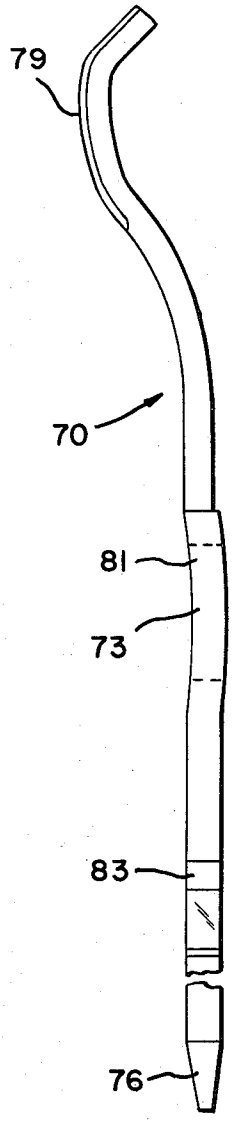

FIG. 6

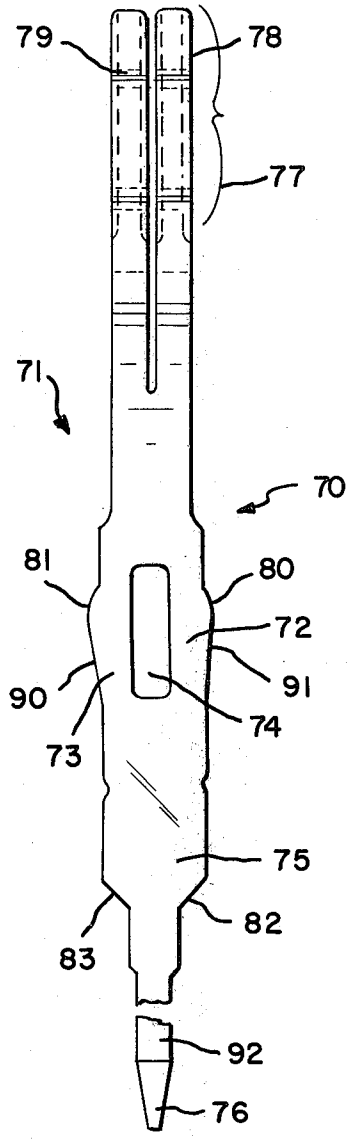

FIG. 5

PRESS FITTED TERMINAL POST

BACKGROUND OF THE INVENTION

This invention relates generally to terminals which are mountable in apertures in housings or circuit boards and more particularly it relates to that portion of the terminal which engages the walls of apertures formed therefor in housings or circuit boards.

It is common practice today to force fit terminals, such as terminal posts, in apertures in housings or printed circuit boards. Such force fitted terminals have portions which are designed to effect such a friction fit or force fit against the walls forming the aperture in the housing or circuit board.

Even in those cases where the terminal is to be soldered to conductive pads formed on the surface of the printed circuit board, it is highly desirable to provide a circuit board engaging means on said terminal which has entry and withdrawal forces within predetermined limits and which will hold a terminal rigidly therein with a minimum of wobble or misalignment until soldering can be effected.

The foregoing characteristics of uniform entry and withdrawal forces of said terminals becomes particularly important when a plurality of terminals are inserted in a circuit board simultaneously as, for example, in a comb form wherein a plurality of such terminals are secured to a common carrier strip and are inserted through a row of holes formed therefor in a printed circuit board by some appropriate insertion apparatus or machinery. When the terminals are to be soldered, the carrier strip is sometimes broken off after the insertion of terminals, and before soldering occurs. In such cases, if one of the terminals fits too loosely in its hold, it can easily become misaligned or, in certain extreme cases, can slip out of the hole.

In other cases, where terminals fit too tightly within holes, enough pressure can build up in the printed circuit board housing or break the plastic housing or printed circuit board.

In some applications terminal posts are inserted through holes in a printed circuit board on a piece-by-piece basis by means of computer controlled insertion equipment. As in the case of gang insertion of terminals, all terminals do not have exactly the same dimensions, nor do all holes in a circuit board have the same dimensions. Thus, in piece-by-piece insertion if a terminal is too loose, misalignment or even non-retention of the terminal can occur. If a terminal fits too tightly, the hole wall can be damaged. Such damage is particularly likely to occur when the hole is plated-through. The tight fitting terminal can crumble the plated-through metal resulting in poor electrical connection.

In other instances it is desirable to insert a terminal post in a connector housing or a printed circuit board and then, for some reason, to remove the terminal and then reinsert it, either in the same hole or in another hole. If the first hole in which the terminal was inserted was too small or the hole engaging portion of the terminal too large, the said hole engaging portion can become deformed and will not properly engage the wall of the next hole in which it is inserted.

BRIEF STATEMENT OF THE INVENTION

In accordance with a primary object of the invention there is provided a aperture wall engaging portion which will provide a spring-like force upon the sides of the wall in all directions, in a plane perpendicular to the axis of the hole in which the terminal is inserted.

A second aim of the invention is an aperture wall engaging portion having a pair of substantially parallel curved spring members each of which has its two ends on its concave side pressing against one major wall surface of a hole, having a rectangularly-shaped cross section, in a given direction, and the middle portion of the convex side forced against the opposite major wall of the hole in the opposite direction, and each of which is curved outwardly from each other to provide forces against the walls of the hole at right angles to said first directional forces.

A third primary object of the invention is to provide a terminal having a portion thereof which engages the walls of a hole of rectangularly-shaped cross section formed in a printed circuit board or other housing, and in which said aperture engaging portion consists of a pair of substantially parallel and curved resilient beam members, with the ends of each of the beams applying force at their ends against one wall of the aperture in opposition to the force applied to the other side of the aperture by the convex center of the beam, and in which said beams are bowed outwardly with respect to each other to provide additional forces on the walls of the holes in directions substantially 90° from the direction of said first forces.

A fourth aim of the invention is to provide a terminal post having a circuit board aperture engaging portion constructed to grip the walls of a circuit board aperture comprising a pair of parallel curved spring-like beam members each of which independently exerts force against the major sides of the aperture which has a rectangularly-shaped cross section, and also against the minor sides of the aperture.

A fifth purpose of the invention is to provide a terminal having a supporting body engaging portion which is spring-like in nature and which will adapt to fit within rectangularly-shaped holes in said supporting body over a range of sizes of said rectangular holes and within the spring-like characteristics of said engaging portion.

A further aim of the invention is to provide a terminal post having a supporting body engaging portion which has a spring-like characteristic and which will fit into a substantially large range of rectangular hole sizes because of such spring-like characteristics, with the insertion and withdrawal force of said terminal remaining within predetermined permissible limits.

A still further aim of the invention is a terminal having a supporting body engaging means which has a spring-like characteristic, thereby enabling said supporting body engaging means to fit a large range of cross-sectional areas of holes without permanently distorting the supporting body engaging portion of said terminal post.

A still further aim of the invention is the improvement of force fit type terminals, and particularly terminal posts, in general.

In accordance with the invention there is provided a portion of a terminal (usually a terminal having a terminal post thereon), which is constructed to engage by force fit or friction fit the walls of an aperture formed in a housing or a printed circuit board. The aperture wall engaging portion of said terminal comprises a pair of curved, spring-like beam members which are substantially parallel with each other and also with the longitudinal axis of the aperture. The aperture preferably

has a rectangularly-shaped cross-sectional area or it can have a cross-sectional area in the shape of a Maltese cross. On their concave side, the two parallel spring beam-like members have their ends pressed against one wall, herein defined as a major wall surface of the aperture, and on their convex side the two beams have their center portion pressed against the opposite major surface wall of the aperture. The two spring-like beams are also curved in directions away from each other so as to present convex surfaces to the two sidewall surfaces of the aperture. Thus, each of the two curved beam members are positioned under pressure in the aperture with forces exerted thereby against each of the opposite major surfaces and also against each of the sidewalls. The net result is that spring-like forces are exerted by the aperture wall engaging portion of the terminal in all four directions against the aperture walls in a plane substantially normal to the longitudinal axis of the aperture.

In accordance with a feature of the invention the two spring-like beams function substantially independently of each other to minimize distortion of the terminal when it is fitted into an aperture in which the forces between the two spring-like members and the aperture walls are not the same because of variations in dimensions both of the aperture and also of the beams.

In accordance with another feature of the invention, because the two spring-like beams are separated by a predetermined distance and function substantially independently of each other, said beams function to compensate for different sizes in the aperture in the housing or printed circuit board. Thus, within limits, if a hole is too small, the beams will be forced towards each other and tend to straighten out to accommodate said smaller hole, but will tend to stay within their elastic limits so that if withdrawn from said hole, will spring back to a shape essentially the same as their original shape. On the other hand, within limits, if a hole is too large, because of the two curved configuration beams, the said beams will span the distance between the two major walls of the aperture and also the distance between said beams and said aperture walls.

Obviously, there is a limit to the range of sizes of apertures into which the terminals can be inserted successfully. However, such range is larger than obtainable with most terminals currently available on the market.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other objects and features of the invention will be more fully understood from the following detailed description thereof when read in conjunction with the drawings in which:

FIG. **1** is a broken away, perspective view of four terminals mounted in a housing or circuit board;

FIG. **2** is a perspective view of a single terminal;

FIG. **3** is a plan view of a pair of terminals of the type shown in FIG. **2** and attached to a common carrier;

FIG. **4** is a side view of one of the terminals of FIG. **3**;

FIG. **5** is a plan view of another form of the terminal; and

FIG. **6** is a side view of the structure of FIG. **5.**

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. **1** there is shown a partially broken away perspective view of four terminals **9, 10, 11** and **12** each inserted through separate apertures **98, 35, 97** and **99** of retaining body **40,** which can be a connector housing or a printed circuit board, and in particular shows the structure of that portion of the terminal which engages the walls of the aperture through which it is inserted.

Since all four terminals have similar structure, a description of only one of said terminals, namely terminal **10** and the circuit board engaging portion thereof will be described in detail.

The terminal **10** has an upper portion **16** extending above the upper surface **41** of the board **40** and a lower portion **22** extending below the printed circuit board **40.** The lower portion **22** can be a terminal post, for example, and the upper portion **16** can be one of the pair of mating terminals adapted to receive a male pin (not shown) thereinbetween.

The center portion **17** of the terminal **10** is that portion which is designed to grip the walls of the aperture **35.** Said center portion **17,** which is also identified herein as a housing or aperture wall engaging portion, is comprised of two leg portions **18** and **19** which are formed of a spring-like material such as a brass alloy, and which are generally parallel with each other and separated by a distance determined by the size of the hole **34** thereinbetween. The existence of said hole **34** defines the two spring-like beams **18** and **19** on either side thereof.

The hole **34** is not necessarily of any particular configuration. It can be round, oval, rectangular or square in shape. The important function of the aperture or hole **34** is to define two beams, such as beams **18** and **19,** on either side thereof.

The two spring-like elements **18** and **19** are curved in a manner and to a degree, with respect to the size of the rectangularly-shaped hole **35,** as shown in FIG. **1.** More specifically, the dimensions of the beams **18** and **19,** the amount of curvature therein, and the size of the hole **35** are such that the ends **27** and **24** of the convex portion of beam **18,** for example, exerts a force against the major wall **42** of the aperture **35,** as indicated by the arrows **30** and **31.**

The middle portion **25** of the other side of the curved beam **18** applies a force against the other major surface **26** of aperture **35** in the direction indicated by arrow **27.**

In a similar manner the ends of the curved beam **19** exert forces against the major surface **42** of aperture **35** and the midpoint of the convex other side thereof exerts a force against the major surface **26** of aperture **35.**

While it cannot be seen clearly in FIG. **1** the two beams **18** and **19** are also curved outwardly from each other in the directions of arrows **32** and **33** respectively. Thus, the outer side edges of beams **18** and **19** exert forces against opposite sides of the aperture **35.** For example, the outer side of beam **19** exerts the force **33** on sidewall **45** of aperture **35.**

The portion **22** of terminal **10** has been twisted in the general area **23** so as to be at right angles to the portion **36** of terminal **10.** Such twisted portion is not a part of the invention per se. It simply shows one means for further securing the terminal in a circuit board and preventing unauthorized withdrawal of said terminal as well as adding some structural strength to the mechanical joining of terminal **10** and board **40.** It is to be noted that aperture **35** is widened at the shoulder **46** in the circuit board or housing **40.** This enlarged width of aperture **35** facilitates the twisting of the portion **22** of terminal **10.** Another shoulder **47** is formed on the portion **22** of terminal **10** and abuts against the lower sur-

face of the housing or printed circuit board **40.**

Referring now to FIG. **2** there is shown a perspective view of a single terminal of the general type shown in FIG. **1,** but without the presence of a housing and without the bottom portion **22** being twisted at right angles to the portion **36.** All the portions of the terminal of FIG. **2** are identified by the same reference characters which identify corresponding portions of the terminal of FIG. **1.** In addition it can be seen that the lower portion **22** terminates in a spade-like configuration which can be received by a pair of leaf terminals or a female receptacle. The tip **51** can be of a shape other than the spade shape shown in FIG. **2.** For example, it can be a frustum of conical or pyramidal configuration.

If desired, the upper end of the terminal of FIG. **2** can be bifurcated by slot **53** to form two contact elements **13** and **14,** which terminate in tabs **48** and **49.** The contact of FIG. **2** can be used in facing pairs, as shown by contacts **10** and **11** of FIG. **1,** with the contact surfaces **50** facing each other and with the tab-like portions **48** and **49** being held back in a pre-stressed condition by some appropriate shoulder or tab means formed on the retaining housing member. Thus, the pair of contacts, such as contact **10,** can receive a male contact therebetween, with the surfaces **50** making contact with said male contact, between the contacts **10** and **11** of FIG. **1** for example.

It is to be understood that the particular configuration of the upper part of the terminal is not a part of the invention per se.

Referring now to FIG. **3** there is shown a plan view of two of the contacts of the type shown in FIGS. **1** and **2** on a carrier strip **57.** These two contacts are identified by reference characters **10** and **56,** with contact **10** representing the same contact **10** as shown in FIG. **2.**

The remaining portions of the contact **10** of FIG. **3** are identified by reference characters corresponding to the reference characters identifying corresponding portions of the contact **10** of FIGS. **1** and **2.** In addition, however, in FIG. **3,** the carrier strip **57** and sprocket holes **58** are also shown. Further, in FIG. **3,** embossed portions **60** and **61** are shown in bifurcated contact portion **48** and bifurcated and embossed portions **62** and **63** are shown on the bifurcated contact leg **49.**

Referring now to FIG. **4** there is shown a side view of the terminal **10** of FIG. **3** with corresponding portions thereof being identified by the same reference characters as in FIG. **3.** In FIG. **4** the curvature of the vertical housing engaging portion **17** can be easily seen.

It will be observed in FIG. **4** that the width of the beam, such as beam **18,** is greater than the thickness of the upper portion **16** of the terminal, that is the portion **16** above the surface of the housing or printed circuit board in which the terminal is inserted, as shown in FIG. **1** for example. No difference in thickness between the upper portion **16** and the beams of the housing engaging portions **17** is not absolutely necessary. It is employed only in those cases where greater strength and greater spring force is required in the beams than is required in the upper portion **16** of the contact.

Referring now to FIG. **5** there is shown another form of the invention. In FIG. **5** the two spring-like members **73** and **72** which fit into printed circuit board aperture have tapered outer edges **90** and **91,** rather than the convex arrangement of the structure of FIGS. **1, 2** and **3.** The tapered edges **90** and **91** form an overall wedge-shaped structure which is inserted into an aperture in a printed circuit board or housing and is, in fact wedged, against the walls of said aperture to secure the terminal **70** therein.

The portion **75** of the terminal **70** has no narrow portion comparable to the narrow portion **36** of the structure of FIG. **3.** The reason for the absence of such narrowed portion in the area **75** of the structure of FIG. **5** is due to the fact that the post **92** of the terminal of FIG. **5** is not designed to be twisted at right angles with respect to the remainder of terminal **70,** as is the post of FIG. **3.**

The upper portions of the two terminals **70** of FIG. **5** can be bifurcated, if desired. Specifically, in contact **70,** the upper portion is bifurcated to form two legs **79** and **78** which have a curved profile as shown in the side view of FIG. **6.**

It is to be understood that the forms of the invention shown and described herein are but preferred embodiments thereof and that various changes can be made in the details thereof without departing from the spirit or scope of the invention.

I claim:

1. In a terminal constructed to be frictionally secured in a securing body within an aperture defined by walls to have a rectangular cross-sectional area, and having an upper terminal portion, and a lower terminal portion, an aperture wall-engaging portion connecting said upper portion to said lower portion and positioned within said aperture, and comprising:

first and second substantially parallel beam members spaced apart and each secured at its two ends to said first and second terminal portions of said terminal;

said first and second beams each being bowed in a first direction towards a first wall of said aperture an amount to place said beams in a spring compression force between the two opposing walls of said aperture including said first wall; and

said first and second beams further being bowed outwardly in opposite directions from one another by an amount to exert a spring compression force between the two remaining walls of said aperture.

2. An engaging portion as in claim **1** in which said securing body comprises a substrate; and

in which said terminal comprises a post having dimensions which will enable insertion thereof through said aperture.

3. An engaging portion as in claim **1** in which said securing body comprises a connector housing composed of an insulative material; and

in which said terminal comprises a post having dimensions which will enable insertion thereof through said aperture.

4. In a terminal constructed to be press fitted within an aperture in a terminal retaining body, with said aperture being defined by two parallel major surfaces and two parallel minor surfaces substantially perpendicular to said major surfaces, an engaging portion for frictionally engaging the walls of said terminal retaining body comprising:

first and second beam-like elements separated by an aperture formed through said engaging portion;

said first and second beam-like elements being substantially parallel to each other and each being curved in the same direction to present a convex surface towards said first major surface and a concave surface towards said second major surface;

said first and second beam-like elements being further curved in directions away from each other to

each present a convex surface towards opposite minor surfaces of said aperture; and

said engaging portion being of a size to have said first and second beam-like elements under compressive force between the major surfaces of said aperture and to be under compressive force between the minor surfaces of said aperture.

5. An engaging portion as in claim **4** in which said terminal retaining body comprises a substrate; and

in which said terminal comprises a post having dimensions which will enable insertion thereof through said aperture.

6. An engaging portion as in claim **4** in which said terminal retaining body comprises a connector housing composed of an insulative material; and

in which said terminal comprises a post having dimensions which will enable insertion thereof through said aperture.

7. In a terminal an engaging portion positioned between the ends of said terminal and constructed to frictionally engage the walls of an aperture in a retaining body, said apertures having two facing major wall surfaces and two facing minor wall surfaces joining together the ends of said facing major wall surfaces and comprising:

first and second beam-like elements connected between the two end sections of said terminal and extending side-by-side longitudinally through said aperture;

said first and second beams each being bowed to have first convex surfaces which are adjacent a common major wall surface and second convex surfaces which are adjacent opposite minor wall surfaces of said aperture;

said engaging portion having overall dimensions in the direction normal to said major wall surface greater than the distance between said major wall surfaces and in the direction normal to said minor wall surfaces greater than the distance between said minor wall surfaces to exert a force against said major wall surfaces and said minor wall surfaces of said aperture when inserted therein.

8. An engaging portion as in claim **7** in which said terminal retaining body comprises a substrate; and

in which said terminal comprises a post having dimensions which will enable insertion thereof through said aperture.

9. An engaging portion as in claim **7** in which said terminal retaining body comprises a connector housing composed of an insulative material; and

in which said terminal comprises a post having dimensions which will enable insertion thereof through said aperture.

* * * * *