United States Patent [19]

Gluntz

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[45] **Sept. 3, 1974**

[54] **ELECTRICAL CONNECTORS**

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

[22] Filed: **Feb. 7, 1972**

[21] Appl. No.: **223,996**

Related U.S. Application Data

[60] Division of Ser. No. 4,662, Jan. 20, 1970, Pat. No. 3,659,243, which is a continuation-in-part of Ser. No. 869,079, Oct. 24, 1969, abandoned.

[52] **U.S. Cl.** ..... **29/630 D,** 29/628, 29/630 R

[51] **Int. Cl.** **H01r 9/00**

[58] **Field of Search** ..... 29/628, 629, 630 R, 630 A, 29/630 B, 630 D

[56] **References Cited**

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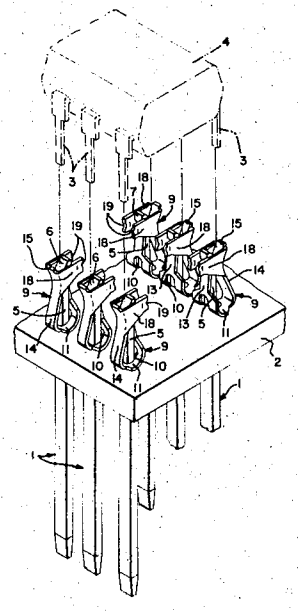
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Primary Examiner—Charles W. Lanham
Assistant Examiner—James R. Duzan
Attorney, Agent, or Firm—Gerald K. Kita

[57] **ABSTRACT**

An electrical connector of the receptacle type comprises a mounting panel having electrical posts secured therein at spaced locations. Spring members disposed on sections of the posts extending outwardly from one surface of the panel. Means provided by the sections of the posts and the spring members securing the spring members on the sections. Legs of the spring members biased against contact surfaces of the post sections to define receptacle means and outer ends of the post sections and legs being chamfered to define lead-in means to facilitate movement of contact members with the receptacle means. Maintaining means provided by the spring members for maintaining other legs of the spring members in secured engagement with the post sections and to guide movement of the first-mentioned legs relative to the post sections.

4 Claims, 22 Drawing Figures



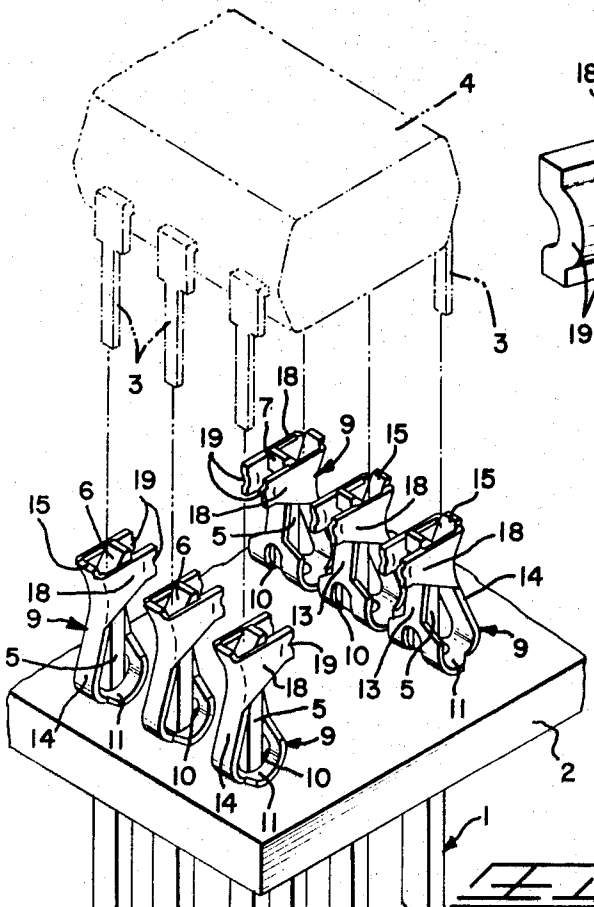


FIG. 1

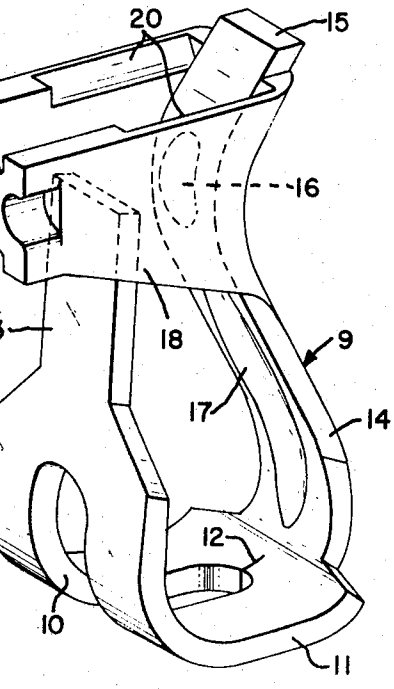


FIG. 3

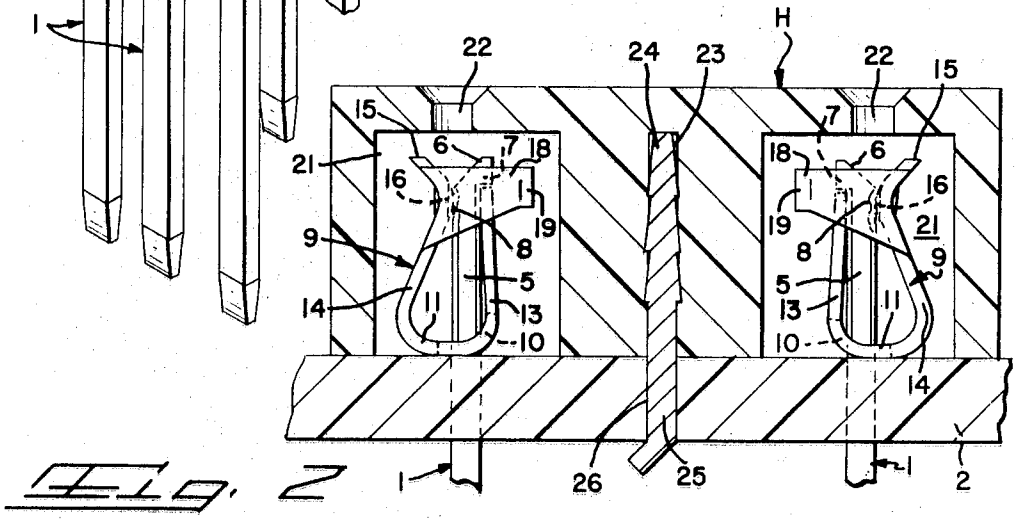


FIG. 2

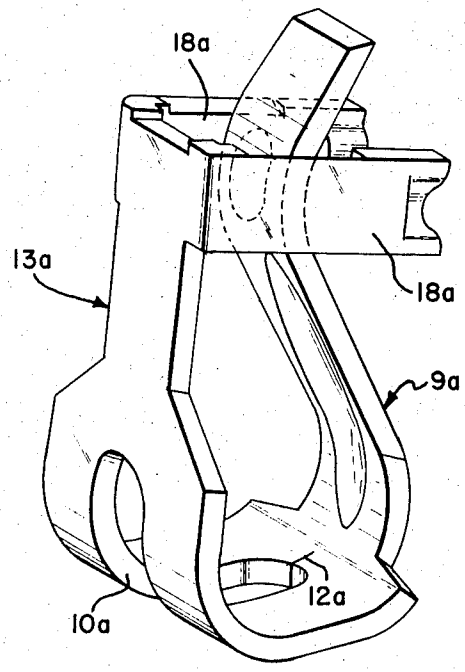


Fig. 4

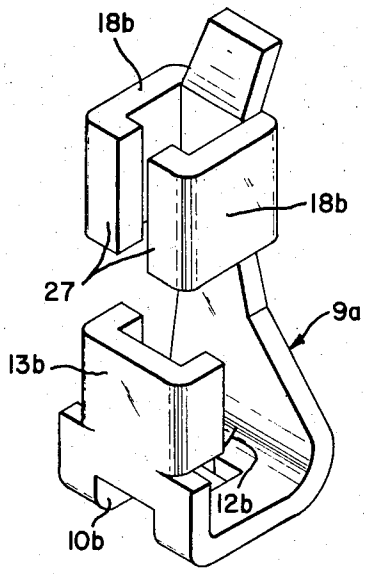


Fig. 5

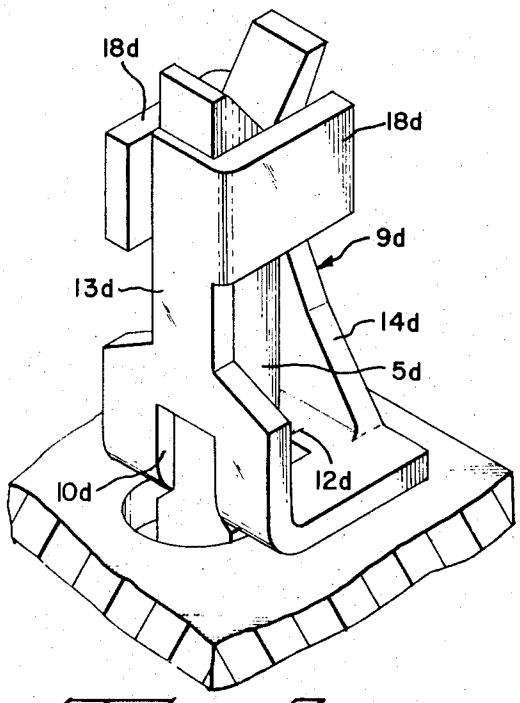


Fig. 7

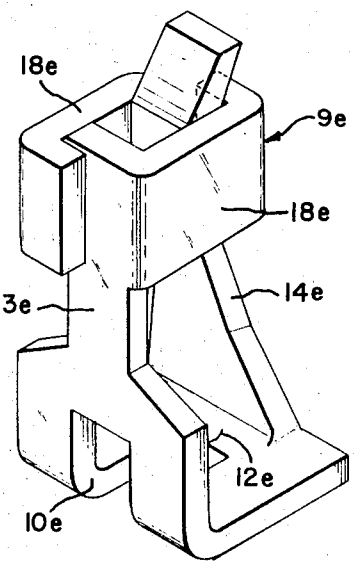


Fig. 8

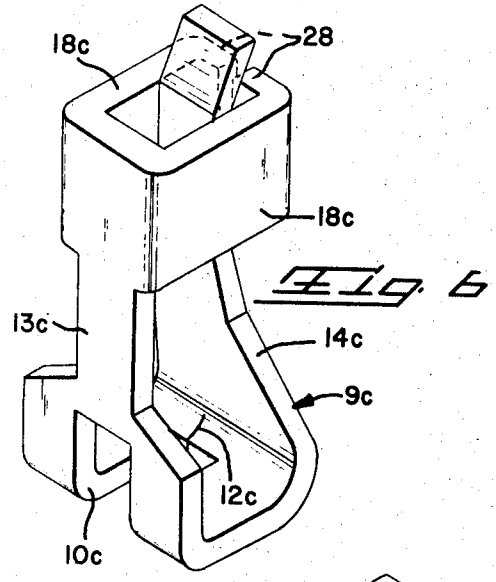


Fig. 6

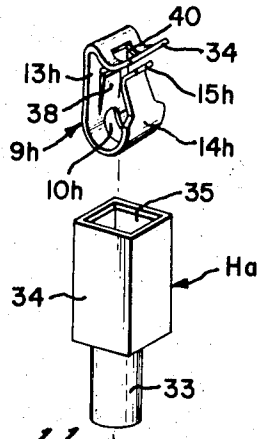


Fig. 11

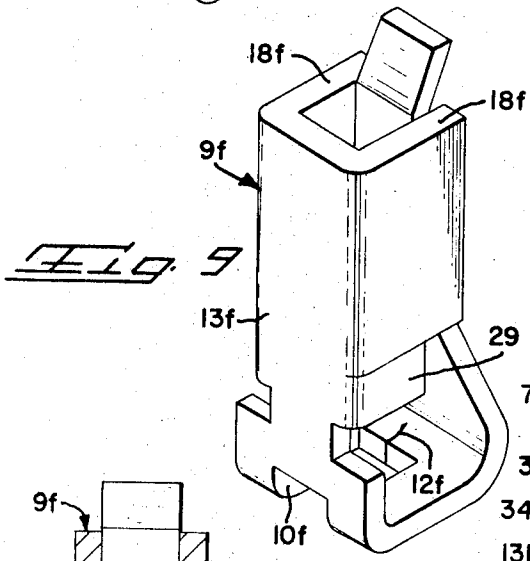
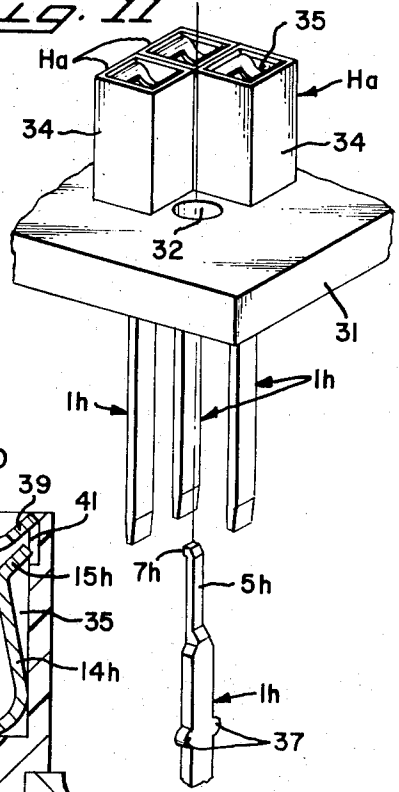


Fig. 9



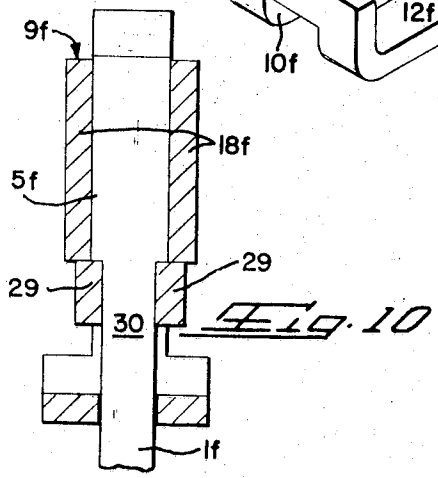


Fig. 10

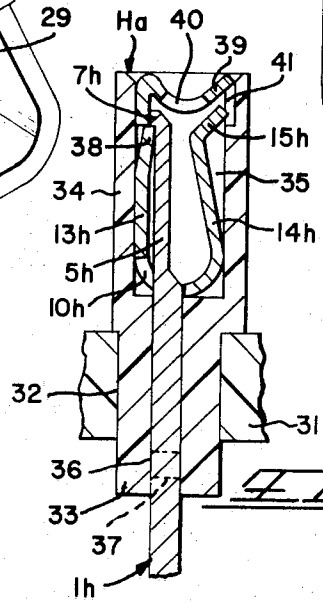


Fig. 12

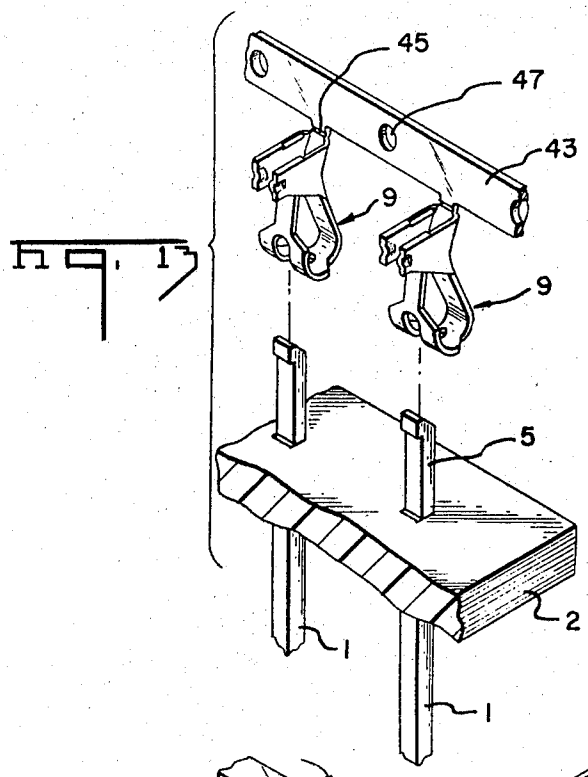


Fig. 13

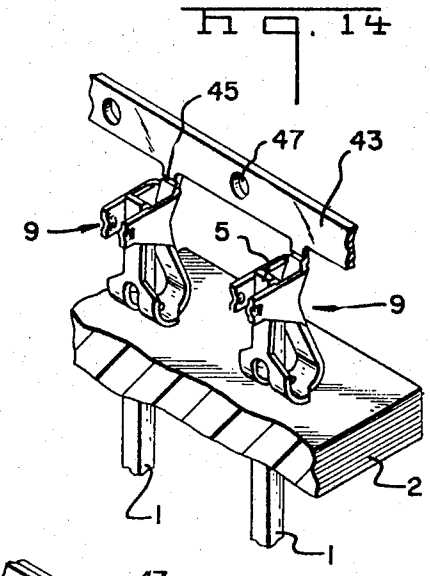


Fig. 14

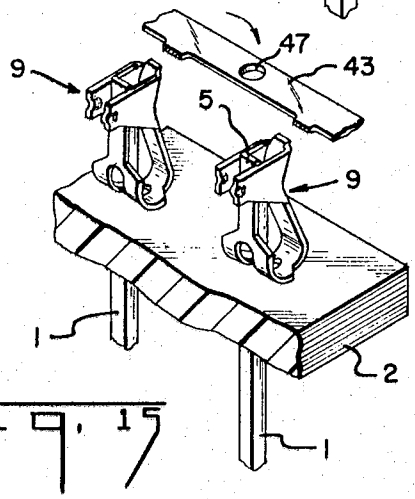


Fig. 15

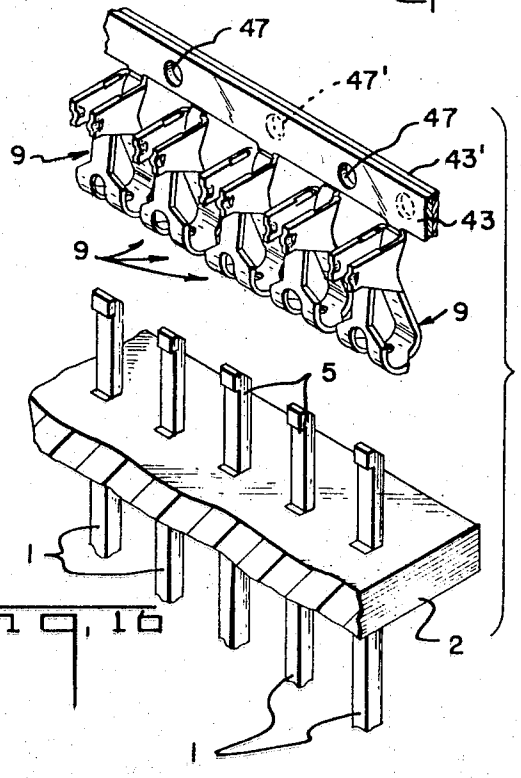


Fig. 16

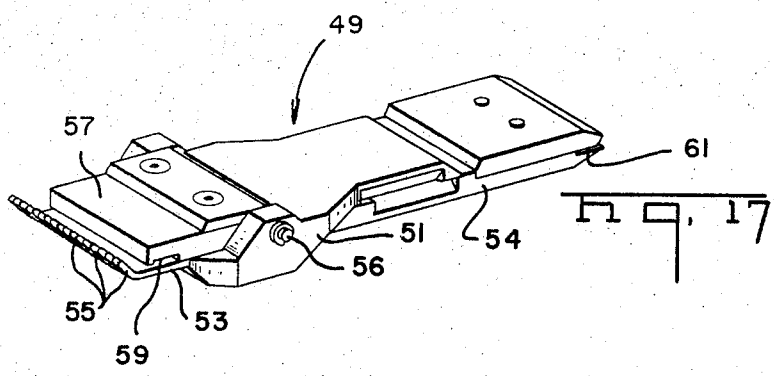


Fig. 17

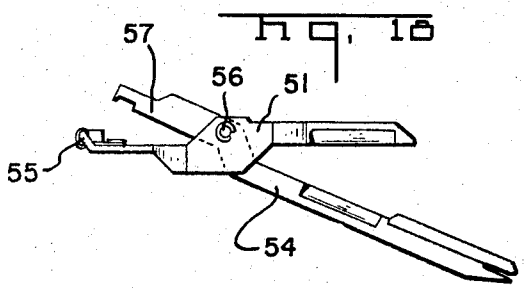


Fig. 18

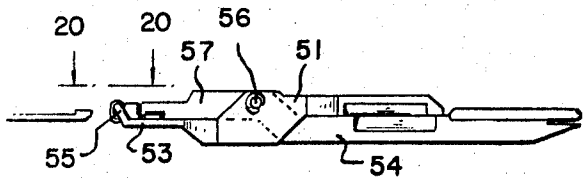


Fig. 19

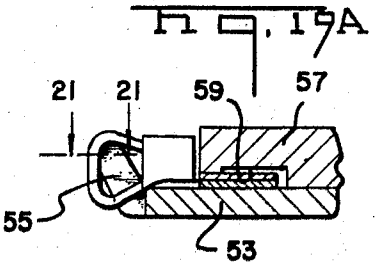


Fig. 19A

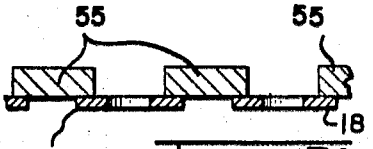


Fig. 21

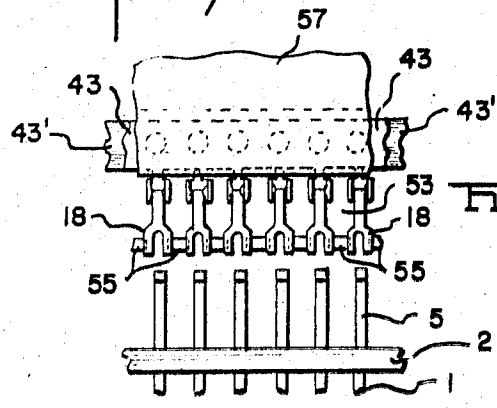


Fig. 20

ELECTRICAL CONNECTORS

This application is a divisional application of application Ser. No. 4,662, filed Jan. 21, 1970, and now U.S. Pat. No. 3,659,243, which is a continuation-in-part of application Ser. No. 869,079, filed Oct. 24, 1969 and now abandoned.

This invention relates to electrical connectors and more particularly to electrical connectors for making electrical connection with leads of a microelectronic circuit member.

In the field of microelectronic circuitry such as, for example, integrated circuits and large scale integrated circuits, leads extending outwardly therefrom have to be connected with other circuitry to formulate a complete circuit arrangement. In view of the smallness of this microelectronic circuitry, connection of the leads thereof to other circuitry has been a problem, and solving of the connection problem for these circuits has been of significant importance since the effective use of these circuits is paramount in present and future electronic circuit capabilities for without proper connection of microelectronic circuitry, improper operation thereof will result.

An object of the present invention is to provide electrical receptacle means insulatingly spaced in parallel rows on a mounting panel for electrical connection with leads of microelectronic circuit means.

Another object is the provision of electrical receptacle means for leads of microelectronic circuit means which include posts secured in a mounting panel and having sections extending outwardly from one surface of the mounting panel on which spring means is mounted.

A further object is to provide chamfered areas on the post sections and the spring means defining lead-in means for leading leads of the microelectronic circuit means into the receptacle means.

An additional object is the provision of wing means on the spring means to maintain movable sections of the spring means in alignment with the post sections.

Still a further object is to provide means on the spring means for preventing rotation or movement around the post sections.

A still additional object is the provision of housing means housing the receptacle means individually or in numbers.

Still another object is to provide other sections of the posts defining conductor-engaging sections for having connected therewith conductors in a point-to-point wiring scheme.

A further object of the invention is to provide an improved method of assembling electrical connecting devices to terminal posts and means for accomplishing such assembling methods.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each

as may be best suited to the conditions of a particular use.

In the drawings:

FIG. 1 is a part perspective view of an electrical connector with part of a microelectronic circuit means exploded therefrom in phantom;

FIG. 2 is a cross-sectional view of an electrical connector of FIG. 1 with housing means in position thereon;

FIG. 3 is a perspective view of spring means which is one of the elements of the receptacle means;

FIG. 4 is an alternative embodiment of a spring means;

FIG. 5 is another embodiment of the spring means;

FIG. 6 is a perspective view of a further embodiment of the spring means in position of a springreceiving section of a post means;

FIG. 7 is a perspective view of still another embodiment of the spring means;

FIG. 8 is a perspective view of still a further embodiment of the spring means;

FIG. 9 is a perspective view of an additional embodiment of the spring means;

FIG. 10 is a cross-sectional view of FIG. 9 with the spring means in position on a spring-receiving section of a post means;

FIG. 11 is an exploded and perspective view of still another embodiment of the electrical connector and individual housing means therefor; and

FIG. 12 is a cross-sectional view through the electrical connector and housing of FIG. 11.

FIGS. 13 and 14 are fragmentary perspective views illustrating the manner in which connectors in accordance with the invention can be mounted on terminal posts.

FIG. 15 is a view illustrating the manner in which the carrier strip is removed from a plurality of connectors after they have been assembled to the terminal posts of a panel board.

FIG. 16 is a view similar to FIG. 13 but illustrating the manner in which connectors in accordance with the invention can be assembled to a printed circuit board on closely spaced centers.

FIG. 17 is a perspective view of a hand tool for assembling closely spaced connectors, as shown in FIG. 16, to the terminal posts of a printed circuit board.

FIG. 18 is a side view of the tool of FIG. 17.

FIG. 19 is a side view of the tool showing the jaws in their closed conditions with a strip of terminals gripped between the jaws.

FIG. 19A is an enlarged sideview of the lefthand end of the tool as shown in FIG. 19.

FIG. 20 is a fragmentary frontal view of the jaw portions of the tool of FIG. 17.

FIG. 21 is a view taken along the lines 21—21 of FIG. 19A.

Turning now to FIGS. 1 through 3, metallic posts 1 are force fitted into openings within dielectric mounting panel 2 in rows and spaced from each other corresponding to the spaced leads 3 of microelectronic circuit means 4 defining an integrated circuit IC, a medium scale integrated circuit MSI or a large scale integrated circuit LSI.

Posts 1 have spring-receiving sections 5 which are provided with beveled surfaces 6 and projections 7. A

corrugated area 8 is provided on the inner surface of spring-receiving section 5.

Spring means 9 is stamped and formed from a suitable metal having desirable spring characteristics and it includes an oblong opening 10 having a width to enable the spring means to be inserted onto spring-receiving sections 5 therethrough until bight 11 is disposed adjacent the upper surface of panel 2. The width of opening 10 is slightly smaller than the width of section 5 so that opposing surfaces of opening 10 snugly engage opposite sides of section 5. In order to facilitate the movement of spring means 9 onto section 5, a slit 12 is provided in bight 11 to permit opening 10 to be opened further if opening 10 is not wide enough or section 5 is too wide so that no deformation to opening 10 is done when spring means 9 is mounted on section 5. Slit 12 therefore provides an anti-overstress means and allows for manufacturing tolerances.

Spring means 9 includes a stationary member 13 and a movable member 14. Stationary member 13 has its free end disposed in alignment with projection 7 and movable member 14 is springably engaged with section 5 along corrugated area 8 to thereby maintain stationary member 13 in engagement with section 5 and the free end in alignment with projection 7 and this action secures the spring means 9 in position on section 5. Outer end 15 of movable member 14 has an arcuate configuration and it extends angularly away from beveled surface 6 of section 5 so that beveled surface 6 and outer end 15 provide an entrance to the receptacle defined by section 5 and spring means 9 to receive a lead 3 of microelectronic circuit means 4 therein and the configuration of this entrance facilitates the guiding of leads 3 into the receptacles.

An inwardly-directed dimple 16 is provided in end 15 opposite corrugated area 8 and dimple 16 and corrugated area 8 define irregular contact-engaging surfaces for electrical engagement with leads 3 to enhance the electrical engagement therebetween. An elongated depression 17 is formed in movable member 14 to strengthen it and provide the desirable spring characteristics thereto. Wings 18 extend outwardly from movable member 14 and along corresponding sides of spring-receiving section 5 to maintain the contact-engaging area of movable member 14 in alignment with the contact-engaging area of section 5 during the relative movement therebetween. Arcuate depressions 19 are disposed in wings 18 and they can engage stationary member 13 and projection 7 to limit the movement of movable member 14 relative to section 5 thereby providing an anti-overstress means to prevent overstressing movable member 14. Beveled areas 20 are provided in the inside surfaces of wings 18 to assist in guiding leads 3 into the receptacle means. The wings may be tapered from an outer to inner direction thereby replacing beveled areas 20 to assist in the guiding of the leads into the receptacle means.

After metallic posts 1 have been secured in mounting panel 2 in accordance with a predetermined array, spring means 9 are mounted on spring-receiving sections 5 thereby forming electrical receptacle means to electrically receive leads 3 of microelectronic circuit means 4. Posts 1 can have a configuration suitable for being connected to circuit paths on panel 2 by conventional flow-soldering techniques or they can have the necessary configurations for having connected thereto point-to-point wiring via conventional connection-making means.

FIGS. 13–15 illustrate a preferred method of assembling connectors in accordance with the invention to the contact engaging areas 5 of the terminal posts mounted in the panel 2. The connectors 9 are manufactured in the form of a continuous ladder strip comprising a carrier strip 43 having connectors 9 integral therewith and extending laterally therefrom at spaced-apart intervals. Conventional pilot holes 47 are provided in the ladder strip for feeding the strip through the die as is common practice in the stamping and forming art. It should be mentioned that the spacing between adjacent connectors 9 of the strip shown in FIG. 13 will be precisely predetermined as will the spacing between adjacent pilot holes. Die stamping of electrical connecting devices is a precise and exacting art and extremely close tolerances are commonly held on the parts as a matter of routine in order to ensure consistently high quality and performance.

In accordance with the assembling method of the instant invention, the sections 45 of the connecting devices 9, by means of which they are joined to the carrier strip, are scored or otherwise weakened so that the individual connectors can be broken from the carrier strip 43. The scoring can take the form of a notch extending parallel to the edge of the carrier strip and having a depth sufficient to permit the carrier strip to be cleanly broken from the connectors. When it is desired to assemble a group of connectors 9 to the upper post sections 5 of the terminal posts, a length of terminal strip is cut having a number of connectors thereon which is equal to the number of posts to which connectors are to be assembled. It will be understood that the posts 5 are located in the panel board on centers equal to the spacing between adjacent connectors 9 of the terminal strip. The strip is simply moved downwardly as illustrated in FIGS. 13 and 14 until the post portions 5 extend through the connectors. Since the connectors are accurately located on the strip, and since the posts are accurately located in the panel board, the terminals can easily be aligned with the terminal posts as indicated. After the connectors have been assembled to the posts, the carrier strip 43 is simply bent laterally until the connecting sections between the terminals or connectors in the carrier strip fractures as shown in FIG. 15.

FIG. 16 shows a modification which permits the assembly of connecting devices 9 to terminal posts which are located on closely spaced centers, the spacing between adjacent posts in FIG. 16 being one-half the spacing between the posts shown in FIG. 13. Where the spacing is as in FIG. 16, two strips of terminals 43, 43′ are positioned against each other with the connecting devices interdigitated and with the carrier strips against each other. The assembly procedure is as described above; the two strips of terminals are simply moved downwardly until the connecting devices are assembled to the terminal posts and the carrier strips 43, 43′ are then broken away from the connecting devices.

The assembly operations shown in FIGS. 13–16 can be carried out manually although it is desirable to use a tool or applicator for this operation. FIG. 17 shows a simple hand tool particularly designed to assemble the connecting devices extending from two terminal strips to closely spaced terminal posts as shown in FIG. 16. This tool 49 has crossed handles 51, 53 which are

pivoted together by a pin **55.** The forward portions of the handles **53, 57** are flat and platelike, the forward portion **53** of the handle **51** extending beyond the portion **57** of the other handle and having obliquely upwardly directed teeth **55** on its end. These teeth are spaced apart by a distance equal to one-half of the spacing between adjacent connectors **9** of the terminal strip and the gaps between adjacent teeth have a width which is substantially equal to, and slightly greater than, the distance between the external surfaces of the wings **18** of the connecting devices **9.** By virtue of these dimensions, two superimposed strips can be positioned on the surface of the jaw portions **53** with the wing portions of the connectors held between adjacent teeth **55.** The connectors will then be spaced apart by a distance substantially equal to the spacing between adjacent posts on the panel **2.** The jaw **57** has a channel **59** on its underside, which is wider than the carrier strip **43.** The jaws do not grip the strips tightly when the handles are closed so that both strips **43, 43'** can move laterally by a slight amount to permit the terminals to align themselves precisely with the posts while they are being assembled to the posts.

In order to facilitate the removal of the carrier strips from the connectors which have been assembled to the terminal post, the end of the handle **53** is provided with a slot **61,** the width of which is equal to twice the thickness of an individual carrier strip **43.** The carrier strips can then be removed by merely locating the strips in this slot and swinging the tool through a slight arc to affect fracture of the carrier strips at the weakened sections **45.**

It will be apparent that the assembly method described above and shown in FIGS. **13–20** can be carried out with an automatic or semiautomatic insertion apparatus where large numbers of connecting devices must be applied to printed circuit boards having terminal posts located therein at regularly spaced intervals.

The receptacle means, as illustrated in FIG. **1,** can be completely open or they can be covered by a dielectric housing H as illustrated in FIG. **2** which is provided with cavities **21** in which the electrical receptacle means are located. Openings **22** having beveled entrances are provided in housing H and they are in alignment with the respective receptacle means so that the leads of the microelectronic circuit means extend therethrough for electrical engagement with the receptacle means. Holes **23** are disposed in housing H between cavities **21** and they have secured therein barbed securing members **24** which have sections **25** extending through apertures **26** in panel **2** and the free ends thereof are bent to secure housing H in position on panel **2.**

Wings **18** can be engaged by a projection means (not shown) on the microelectronic circuit means to move the movable members **14** of the spring means **9** away from the close sections **5** in a simultaneous manner while the leads **3** are being inserted into the receptacle means, and after the leads are disposed in the receptacles, the projection means move free of wings **18** and movable members **14** move into engagement with leads **3.** This arrangement provides a zero-insertion force approach which can be advantageous when a large number of leads are to be connected.

FIGS. **4** through **10** illustrate various embodiments of the spring means. In FIG. **4,** wings **18***a* are located on stationary member **13***a*. Stationary member **13***b* in FIG. **5** is U-shaped so that the legs thereof extend along the sides of section **5** and they can, in fact, be bent into tight engagement with section **5** while wings **18***b* are located on movable member **14***b* and they have inwardly directed free ends **27** which extend along section **5** below projection **7.** The embodiment of FIG. **6** is similar in construction to that of FIG. **5** except that wings **18***c* extend outwardly from stationary member **13***c* and they have inwardly-directed free ends **28** extending toward one another behind movable member **14***c*. In FIG. **7,** one wing **18***d* extends outwardly from stationary member **13***b* along the side of section **5***d* and movable member **14***d* while the other wing **18***d* extends outwardly from movable member **14***d* along another side of section **5***d* and along stationary member **13***d*. The spring means **9** *e* of FIG. **8** is similar in construction to that of FIG. **7** except that the free ends of wings **18***e* are bent inwardly and disposed in spaced relationship back of stationary member **13***e* and movable member **14***e*. Wings **18***f* extend outwardly from stationary member **13***f* in FIG. **9** and parts **29** of wings **13***f* have been sheared therefrom and they are clenched onto section **5***f* of post **1***f* in an undercut area **30** thereof.

Openings **10** and **10***a* through **10***f* of the spring means **9** and **9***a* through **9***f* are dimensioned so that the sides of these openings in engagement with section **5** of the post properly engage the sides of the post section to prevent any rotation of the spring means on the post sections and, of course, slits **12** and **12***a* through **12***f* prevent the openings **10** and **10***a* through **10***f* from being deformed. In the case of the embodiment of FIGS. **5** and **9,** the legs of the U-shaped stationary member **13***b* and parts **29** can be clenched onto sides of the post sections thereby increasing the resistance against rotation of the spring means on the post sections.

FIGS. **11** and **12** illustrate a mounting panel **31** having apertures **32** extending therethrough and into which round sections **33** of dielectric housing H*a* are disposed. Square or rectangular sections **34** of housings H*a* abut against adjacent housings when mounted on panel **31** to prevent any rotation therebetween. Cavity **35** is located in each section **34** and it is in communication with a rectangular opening **36** extending through round section **33.** A post **1***h* is provided with arcuate projections **37** and post **1***h* is inserted into opening **36** while housing H*a* is held against panel **31** until section **5***h* is properly positioned in cavity **35** and arcuate projections **37** are seated in a portion of round section **33** below panel **31** causing this portion to be expanded in size thereby securing housing H*a* in position on the panel. Spring means **9***h* is pushed into cavity **35** with spring-receiving section **5***h* extending through oblong opening **10***h* until spring lance **38,** which has been struck inwardly from stationary member **13***h*, is seated under projection **7***h* thereby securing spring means **9***h* in position. The outer end of stationary member **13***h* is provided with a V-shaped extension **39** having an opening **40** therein in alignment with the contact-engaging areas between section **5***h* and outer end **15***h* of movable member **14***h* so that the leads of the microelectronic circuit means can be readily guided thereinto via V-shaped extension **39** and opposing sides of housing H*a*. A channel **41** is disposed in the internal surface of the side of housing H*a* adjacent movable member **14***h* to allow outer end **15***h* to move thereinto and to provide antioverstress means to prevent deformation of mov-

able member **14***h*. Movable member **14***h* is placed under stress by virtue of the inner end thereof being in engagement with the sidewall of cavity **35** when spring means **9***h* is inserted into cavity **35** so that movable member **14***h* properly engages the leads of the microelectronic circuit means when inserted therein.

As can be discerned from the foregoing there has been disclosed different types of electrical receptacle means for connection with leads of microelectronic circuit means which are unhoused or housed and the spring means can be replaced if they are damaged.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

I claim:

1. A method whereby a plurality of electrical terminals are mounted in spaced relationship to a printed circuit board, comprising the steps of:

mounting fixedly in spaced relationship a plurality of elongated electrically conducting post-type electrical contacts in said printed circuit board.

providing a plurality of electrical terminals in spaced relationship along a length of a common carrier strip,

assembling said plurality of electrical terminals substantially simultaneously to said post-type electrical contacts while yet provided on said length of said common carrier strip, and

separating said length of said common carrier strip from said electrical terminals, leaving each electrical terminal mounted to a corresponding post-type electrical contact and resulting in said plurality of electrical terminals mounted in spaced relationship to said printed circuit board.

2. The method as recited in claim **1,** wherein said plurality of electrical terminals are frangibly attached to said length of said common carrier strip, and the step of separating said length of said common carrier strip from said plurality of electrical terminals includes frangibly removing said length of said common carrier strip from said electrical terminals after said electrical terminals are assembled to said post-type electrical contacts.

3. The method as recited in claim **2,** wherein said electrical terminals are each scored with a notch extending parallel to said length of said common carrier strip, and the step of separating said length of said common carrier strip from said plurality of terminals includes the step of: deflecting said length of said common carrier strip to sever the same generally simultaneously from all of said terminals along the extent of the notch portions provided in said electrical terminals.

4. The method as recited in claim **1,** wherein said step of assembling said plurality of electrical terminals to said post-type electrical terminals further includes the step of: receiving said post-type electrical contacts within receptacle-type portions of said electrical terminals, and further including the step of: latching said receptacle-type portions of said electrical contacts to corresponding post-type contacts prior to separating said length of said common carrier strip for said electrical terminals.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,832,770 Dated September 3, 1974

Inventor(s) GLENN HARLAN GLUNTZ

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, claim 4, line 32, "for" should be - - from - - .

Signed and sealed this 19th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents