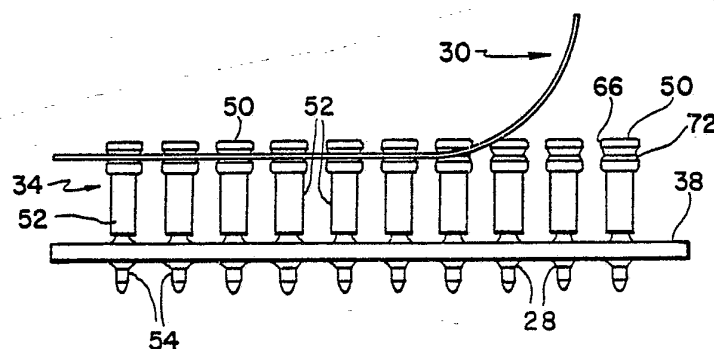




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification<sup>3</sup> : <b>B23P 17/00; B65D 73/02</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 84/ 03653</b> (43) International Publication Date: 27 September 1984 (27.09.84)</p>
<p>(21) International Application Number: PCT/US84/00163 (22) International Filing Date: 6 February 1984 (06.02.84) (31) Priority Application Number: 477,622 (32) Priority Date: 22 March 1983 (22.03.83) (33) Priority Country: US  (71) Applicant: ADVANCED INTERCONNECTIONS, INC. [US/US]; 5 Division Street, Warwick, RI 02818 (US). (72) Inventor: MURPHY, James, V. ; 28 Ladderlook Road, Warwick, RI 02886 (US). (74) Agent: DOHERTY, Robert, J.; 11 Linden Road, Barrington, RI 02806 (US).  (81) Designated States: CH (European patent), DE (European patent), FR (European patent), GB (European patent), JP.</p>		<p><b>Published</b> <i>With international search report.</i></p>

(54) Title: IMPROVED SOCKET TERMINAL POSITIONING METHOD AND CONSTRUCTION



## (57) Abstract

An improved method and construction for positioning a plurality of socket terminals (34) on an electrical circuit board (22) in a predetermined configuration prior to the solder connection thereto. A sheet of electrically insulative, flexible, resinous plastic material (30, 30a) is provided with a plurality of holes (32, 32a) in an array conforming to the desired positioning of the sockets on the circuit boards. The socket terminals are provided with an enlarged generally cylindrical head (50) including an intermediate groove (68) such that the heads extend into the holes (32, 32a) and are adapted for frictional snap engagement with the sheet (30, 30a). The sheet with the array of sockets temporarily held thereby is positioned on the circuit board which is then conventionally soldered so as to electrically and mechanically fix the sockets to the boards. Thereafter, the sheet may be removed. The enlarged head (50) of the circuit terminal is provided with leading edge sheet contacting surface (66) to enable the terminals to be push positioned into the holes without injuring the sheet.

***FOR THE PURPOSES OF INFORMATION ONLY***

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	KR	Republic of Korea
AU	Australia	LI	Liechtenstein
BE	Belgium	LK	Sri Lanka
BG	Bulgaria	LU	Luxembourg
BR	Brazil	MC	Monaco
CF	Central African Republic	MG	Madagascar
CG	Congo	MR	Mauritania
CH	Switzerland	MW	Malawi
CM	Cameroon	NL	Netherlands
DE	Germany, Federal Republic of	NO	Norway
DK	Denmark	RO	Romania
FI	Finland	SD	Sudan
FR	France	SE	Sweden
GA	Gabon	SN	Senegal
GB	United Kingdom	SU	Soviet Union
HU	Hungary	TD	Chad
JP	Japan	TG	Togo
KP	Democratic People's Republic of Korea	US	United States of America

DescriptionImproved Socket Terminal Positioning  
Method and ConstructionTechnical Field

5           This invention deals with an improved construc-  
tion and method of positioning a plurality of socket  
terminals on an electrical circuit board such as a  
printed circuit board having a plurality of openings  
into which the pin portions of the socket terminals  
10 can be hand assembled upon the circuit board in the  
desired position, such involves undue time consumption;  
and, accordingly, it is generally accepted practice to  
utilize socket terminal carrier assemblies for group  
insertion into the printed circuit board.

15 Background Art

Such carrier assemblies are conventionally in  
the form of an aluminum plate having a plurality of  
downwardly extending thin fingers for entrance into  
the open sleeve portion of the socket terminals such  
20 that the terminals are held thereby and inserted into  
the PC board as a group in the desired array. Such  
system has found wide acceptance for socket terminals  
destined for single in-line and dual in-line posi-  
tioning on circuit boards but are not particularly  
25 adapted with the recently introduced more complex  
pin grid arrays associated with electronic circuitry,  
i.e., integrated circuits. Thus it would be unwieldy  
to produce a conventional aluminum carrier having  
downwardly extending fingers in the desired number  
30 and geometric configuration necessary to group insert  
the number of socket terminals associated with such  
integrated circuit pin grid arrays. Accordingly, it  
would be desirable to be able to simply and effec-  
tively group position socket terminals in both simple  
35 and complex pin arrays by the same means.



-2-

Another problem associated with the use of presently utilized conventional socket terminal carrier assemblies such as the above-described aluminum plates is that there is both considerable tooling cost and  
5 lead time required to produce such carriers. Accordingly, a further desirable feature would be the provision of a means by which both lead time and tooling cost could be substantially reduced.

10 Still another problem associated with the use of aluminum carriers as above-described is that the slender fingers which are inserted into the lead socket can sometimes undesirably alter the electrical  
15 conductive properties of the sleeve portion of such sockets as by scratching or otherwise damaging the internal surface thereof. Such sleeves are very often provided with a very thin gold plate for contact of  
20 the pins of the active electrical or electronic circuit element and, accordingly, can be fragile and unnecessary contact therewith should be avoided. Also as when such aluminum carriers are carelessly removed,  
25 it is possible to actually pull out the contact sleeve of one or more sockets thus rendering the device useless. Accordingly, a further object of the present invention is the provision of a system and means whereby internal portions of the lead sockets are not  
30 contacted during the group insertion thereof into the printed circuit board.

It is also important that inspection of the soldered connections, particularly the connections  
30 between the upper portion of the printed board and the downwardly extending lead socket pin, not be obscured or otherwise hindered from proper inspection.



-3-

Disclosure of Invention

The above objectives as well as other objectives as will hereinafter be more apparent are achieved in the present invention by the provision of a construction for temporarily positioning a plurality of socket terminals on an electrical circuit board in a predetermined configuration prior to solder connection thereto, comprising a sheet of relatively thin, flexible, electrically insulative, resinous plastic material having a plurality of holes extending there-through, said holes arranged in a planar configuration about said sheet to correspond with said predetermined positioning of said socket terminals in said circuit board, a plurality of socket terminals each having a pin adapted for insertion into an opening in said board at their lower end and an enlarged generally cylindrical head at their upper end, said enlarged head having upper and lower sections defined by an inwardly extending perimetral groove intermediate the height thereof and of a lateral extent less said upper and lower sections, said holes of a perimetral extent less than said head sections but generally corresponding to or slightly greater than that of said groove, said terminals adapted for positioning upon said sheet with the heads thereof extending through said holes and the sheet extending into said grooves and therein the leading edge of at least one of said upper and lower head sections is provided with a longitudinally oriented, sheet contacting surface to enable said terminals to be push positioned into said grooves.



-4-

Brief Description of Drawings

The details of the invention will be described in connection with the accompanying drawings, in which Fig. 1 is a perspective view of a conventional aluminum lead socket carrier; Fig. 2 is an elevational view partially in section showing the manner in which the carrier shown in Fig. 1 may be utilized to position lead sockets on a printed socket board; Fig. 3 is a perspective view showing one form of the carrier sheet utilized in the present invention; Fig. 3A is a perspective view similar to Fig. 3 showing another form (a pin grid array) of the carrier of the present invention; Fig. 4 is a side elevational view of either of the carrier forms shown in Figs. 3 or 3a; Fig. 5 is an elevational view similar to Fig. 2 but showing the manner in which the carrier sheet of the present invention may be utilized; Fig. 5A is an elevational view similar to Fig. 5 but showing an alternate constructional form of socket which may be positioned on a PC board by the carrier sheet of the present invention; Fig. 6 is an elevational view similar to Fig. 5 but showing the manner in which the active circuit component, i.e., a pin grid array of an integrated circuit, is assembled to the circuit board/lead socket carrier assembly; Fig. 7 is an enlarged sectional view showing the manner in which an individual lead socket pin is held by the carrier of the present invention; Fig. 7A is an enlarged partial sectional view showing an alternate manner by which the carrier may hold an individual lead socket pin; Fig. 8 is a modified form in which the carrier of the present invention may take; and Fig. 9 is an elevational view partially in section showing the manner in which the carrier form shown in Fig. 8 is utilized.



Best Mode for Carrying Out the Invention

Referring to the drawings and particularly Figs. 1 and 2 thereof, the conventional prior art manner of positioning lead sockets onto a printed circuit board prior to the soldering thereto is depicted. Therein  
5 an aluminum carrier 10 having a generally planar body 12 with downwardly extending flanges 14 is shown. Such configuration is known as dual in-line. The carrier also is formed in a single line configuration  
10 as well. The flanges terminate in a plurality of thin fingers 16 which are adapted to extend internally and engage a contact sleeve 18 of a lead socket 20. The construction of such lead socket 20 may be as described in U. S. Patent No. 4,236,776, the dis-  
15 closure of which is herewith incorporated into the present specification by specific reference thereto. In addition, the aluminum carrier may be that described in Augat, Inc.'s catalog, Page No. DS28, copyright 1973, and a copy of which is attached to  
20 the specification and incorporated therein by specific reference thereto.

With the various lead sockets 20 carried by the fingers 16, the assembly as a group is positioned upon a printed circuit board 22 such that the down-  
25 wardly extending terminal pin portions 24 of the sockets 20 extend into openings 26 in the printed circuit board. Such configuration is standard and shown not only by the above referred to Augat catalog page but also in U. S. Patent No. 4,175,810, the  
30 disclosure of which is hereby incorporated into the present specification by specific reference thereto. Thereafter, the resultant assembly is wave soldered by conventional techniques so as to result in a solder fillet 28 bridging the openings 26 and both elec-  
35 trically and preferably mechanically attaching the



-6-

plurality of lead sockets 20 to the printed circuit board 22 in the desired array. After inspecting the solder connections, the holder 10 is removed and, accordingly, the receiving sleeve contact portions of the lead sockets 20 available to receive an active electrical or electronic circuit in the intended manner.

As previously explained in the objects of the invention, such procedure is satisfactory for a single or a dual in-line configuration but does not lend itself to the more complex group lead socket configurations which are required for pin grid arrays such as required by active integrated circuit components. Accordingly and by reference to the remaining portions of the drawings, the carrier element 30 of the present invention may take the form of a dual in-line configuration such as shown in Fig. 3 of a more complex configuration suitable for an I.C. circuit pin grid array such as shown in Fig. 3a. Accordingly, the configuration shown in Fig. 3a involves the use of a far greater number of holes 32 disposed therethrough and adapted for the receipt of a lead socket 34 as will hereinafter be more fully brought out.

A preferred material for the carrier sheet 30 is .01 inch thick Mylar approximately 2.1 inches in length and 1.8 inches in width although any appropriate size, thickness, and material may be utilized so long as it exhibits the necessary flexibility, heat resistance at soldering temperatures, and electrical insulative properties. It is also preferable that the material be a resinous plastic for ease in forming, at least translucent and preferably clear such that the solder connections ultimately made in utilizing this sheet may be inspected with





-7-

ease and printable such that instructions, directions,  
and the like may be applied to the upper surface  
thereof. Such sheet 30 is provided with a number of  
holes 32, preferably circular in configuration and  
5 each generally of the same diameter.

Such holes 32 are formed by conventional punching  
or drilling techniques and, accordingly, the use of  
such sheet in the intended manner as will hereinafter  
be brought out lends itself to short run or one-of-a-  
10 kind projects wherein it would not be generally  
economical to produce hard tooling that would other-  
wise be necessary for the construction of conventional  
aluminum carrier 10 such as depicted in Figs. 1 and  
2 of the drawings. In addition to the socket posi-  
15 tioning holes 32, a number of other holes 36 of vary-  
ing diameter and position may be provided so as to  
orient the carrier sheet 30 when loaded with the  
appropriate number of lead sockets 34 over a printed  
circuit board in the intended manner. The sheet  
20 shown in Fig. 3a is provided with any desired number  
of preferably distant spaced holes, i.e., 100 (ten  
to a side) or 196 (fourteen to a side); although any  
number as appropriate for use with pin grid arrays  
or conventional dual in-line configurations or  
25 single in-line configurations may be utilized.

It should also be pointed out that the carrier  
sheet 30 may be of more extensive planar dimension  
so as to enable, for example, an entire circuit board  
to be group inserted. That is, the sheet may be  
30 appropriately configured with holes and thus be loaded  
with the lead sockets from any practical number of  
individual arrays, be they single in-line, dual in-  
line, complex pin grid arrays, or combinations thereof.

The resultant sheet 30 is generally bottom  
35 supported in any desired manner as by a suitable jig



-8-

and thereafter by conventional equipment or by hand and the appropriate number of lead sockets 34 snapped into place. Thereafter, the resultant carrier and socket assemblies such as shown in Fig. 4 is utilized to group position the sockets 34 into position on a printed circuit board 38 with the terminal pins 40 thereof extending through openings (not shown) in the circuit board 38. Thereafter, the resultant assembly shown in Fig. 5 is soldered such that the pins 40 and, accordingly, the sockets 34 are at least electrically and preferably mechanically as well attached to the printed circuit board 38. Any conventional soldering technique may be utilized so long as the temperature at which it is carried out is not detrimental to the material from which the carrier sheet 30 is made. Generally a wave soldering process which does not adversely effect Mylar is the preferred manner. In those cases where a different soldering technique is desired, e.g., vapor phase soldering, then a carrier sheet material with a higher temperature resistance may be utilized. Kapton, made by Dupont is a suitable material for use in vapor phase soldering.

Referring to Fig. 5A, it should be made clear that the carrier sheet can be advantageously used to group position sockets of varying constructions. For example, sockets 20a which are not pin inserted into openings in a circuit board but which are positioned above or in contact with the circuit board. An appropriate way to orient such sockets is by providing blank sockets 20b which may be glued to the board surface to orient the array. Suitable contact glues are commercially available for this purpose. Also orientation sockets with pins may be utilized in addition to or in combination with the above-described mounting technique.



-9-

After inspection of the solder fillets such as solder fillets similar to those shown in Fig. 2, which is facilitated by the observation ease brought out by the preferably clear or at least translucent nature of the carrier sheet 30, the sheet 30 may be removed. Thereafter, the pin grid array of an active electrical or electronic circuit is plugged into the resultant assembly in the intended manner. It is not completely necessary to remove the carrier sheet since such is not conductive and is otherwise generally harmless to the resultant structure. It is, however, normal that the sheet be progressively torn or peeled away from the enlarged headed portions of the sockets 34 after soldering and inspection.

Turning now to Figs. 7 and 7A of the drawings, the particular configuration of the sockets 34 of the present invention will be described. Such sockets may internally conform to those conventional sockets described in the previous description of the prior art and differ primarily therefrom in the construction and inclusion of a generally cylindrical enlarged head 50. The external part of the pin 34 includes a body portion 52, the enlarged terminal upper head portion 50, and a lower terminal pin portion 54. The interior portion of the socket 34 includes an upper open end 56 into which pins (58) from a pin grid array 50 or other electrical or electronic unit may downwardly extend into contact with a pre-positioned sleeve 62.

Such socket 34 as well as the sleeve may be formed from any appropriate material although it is common that the major portions of such be brass and that the sleeve 62 be provided with a gold coating to improve electrical contact. The leading lower surface 64 of the enlarged head 50 is provided with a



-10-

generally longitudinally oriented sheet contacting surface 66 as in the form of the chamfer depicted. Preferably the upper leading edge 67 is also provided with such chamfered surface 66. It should be brought out that the chamfered surface 66 depicted may be otherwise configured such as in the form of a curve or the like so long as the intended purpose of gradually imparting frictional contact with those portions of the sheet defining the holes 32 is brought about. Thus in those cases where the sheet 32 is bottom supported and the pins inserted from the top, the sheet will come in initial contact with the lower chamfer 66 and in those cases where the top of the sheet supported and the pins inserted from below, then the sheet will contact the upper surface 66.

An inwarding extending groove 68 is positioned intermediate the enlarged head 50 and is generally of V-shaped configuration brought about by the convergence of an upper inwardly, downwardly extending wall 70 and a lower, inwardly, upwardly extending wall 72. The diameter of the openings 32 terminate in a circumferential edge surface 74. As shown in Fig. 7, the movement of the lower head section 76 towards and into the opening 32 will cause a slight downward extension or bending of the edge 72, i.e., a sort of slight wiping action such that the peripheral portions of the sheet 30 surrounding the hole 32 will be downwardly directed into contact with the lower wall 72 within the groove 68. Conversely, if the socket 34 is inserted in the opposite direction, the slight deformation of the sheet surrounding the openings 32 will be in the opposite direction and the terminal edge 74 thereof will abut the upper slanted wall surface 70.



-11-

Alternatively and as shown in Fig. 7A, the dimensions of the groove 68 and the openings 32 may be such that a lesser deflection is caused such that the terminal edge 74 merely extends into the groove 68. The important aspect is that the relative dimensions are such that the socket head 50 is securely grasped by the sheet 30 in the various holes 32 thereof such that they cannot easily dislodge therefrom during normal handling of the carrier and socket subassembly prior to insertion on the PC board. It is also possible to utilize groove and hole configurations which are non-circular so long as they are appropriately matched to facilitate the necessary firm connection between the two. It is, accordingly, anticipated that some useful functions such as rotational orientation of a socket in a particular manner with respect to the carrier sheet 30 and, accordingly, ultimately with respect to the circuit board can be achieved by the use of triangular, square, oblong, rectangular, etc. openings.

Turning now to Figs. 8 and 9 of the invention, a modified form of the carrier 30a is shown wherein the sides thereof include downwardly extending flanges 82 of a length such that the terminal surface or edges 84 thereof contact the upper surface of the PC board in such a manner as to hold the pin portions of the sockets slightly above the upper surface of the PC board so as to promote desirable solder filleting therebetween.



-12-

Claims

1. A construction for temporarily positioning a plurality of socket terminals on an electrical circuit board in a predetermined configuration prior to solder connection thereto, comprising a sheet of relatively thin, flexible, electrically insulative, resinous plastic material having a plurality of holes extending therethrough, said holes arranged in a planar configuration about said sheet to correspond with said predetermined positioning of said socket terminals in said circuit board, a plurality of socket terminals each having a pin adapted for insertion into an opening in said board at their lower end and an enlarged generally cylindrical head at their upper end, said enlarged head having upper and lower sections defined by an inwardly extending perimetral groove intermediate the height thereof and of a lateral extent less said upper and lower sections, said holes of a perimetral extent less than said head sections but generally corresponding to or slightly greater than that of said groove, said terminals adapted for positioning upon said sheet with the heads thereof extending through said holes and the sheet extending into said grooves and wherein the leading edge of at least one of said upper and lower head sections is provided with a longitudinally oriented, sheet contacting surface to enable said terminals to be pushed positioned into said grooves.
2. The invention of claim 1 wherein the geometric configuration of said holes corresponds with that of said grooves.
3. The invention of claim 2, said holes being circular.



-13-

4. The invention of claim 1, said head section sheet contacting surface being a circumferential chamfer.
5. The invention of claim 4, said chamfered surface provided on the lower portion of said lower head section.
6. The invention of claim 4, said chamfered surface provided on the upper portion of said upper head section.
7. The invention of claim 4, said chamfered surface provided on both the lower portion of said lower head section and the upper portion of said upper head section.
8. The invention of claim 1, said head section sheet contacting surface being provided on the leading edges of both said upper and lower head sections.
9. The invention of claim 1, said groove being of substantially V-shaped configuration.
10. The invention of claim 1, said sheet including downwardly extending edge flanges having terminal edge surfaces adapted to contact the upper surface of said circuit board so as to hold portions of said socket terminal pins above said board during soldering of said pins thereto.
11. The invention of claim 1, said sheet being substantially clear Mylar.
12. The method of group positioning a plurality of socket terminals on an electrical circuit board in a predetermined configuration prior to solder connections thereto, comprising forming a plurality of holes in a sheet of relatively thin, flexible, electrically insulative, resinous plastic material in an array at least including said predetermined configuration, each of said socket terminals having a head of enlarged, generally cylindrical configuration and having an

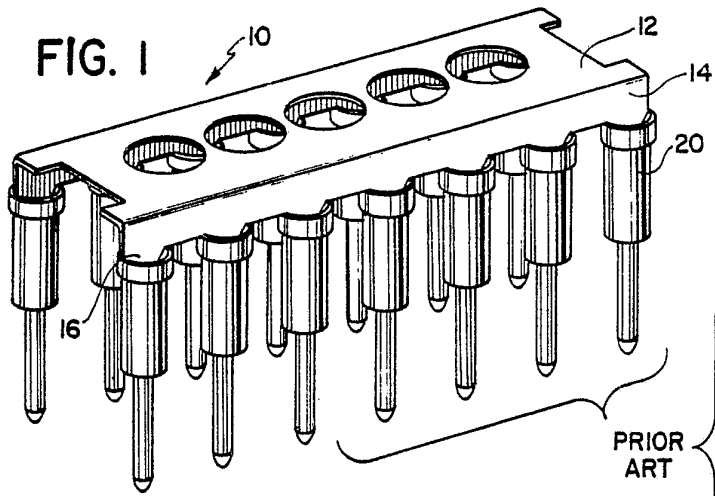


-14-

- 5 inwardly extending perimetral groove intermediate  
the height thereof so as to define upper and lower  
sections of said head, said holes of a perimetral  
extent less than said head sections but generally  
10 corresponding to or slightly smaller than said  
intermediate groove, the leading edge of at least  
one of said head sections provided with a longi-  
tudinally oriented sheet contacting surface,  
supporting one surface of said sheet and there-  
15 after inserting the heads of a plurality of socket  
terminals from the opposite surface of said sheet  
into said holes in said predetermined configuration  
such that said longitudinally oriented surface  
initially contacts peripheral edge portions of  
said sheet defining said holes so as to slightly  
deform said edge portions in the direction of  
head insertion until said sheet edge portions snap  
into said groove.
13. The method of claim 12 wherein said sockets are  
20 inserted into said holes head first.
14. The method of claim 12 wherein said sockets are  
inserted into said holes head last.







PRIOR ART

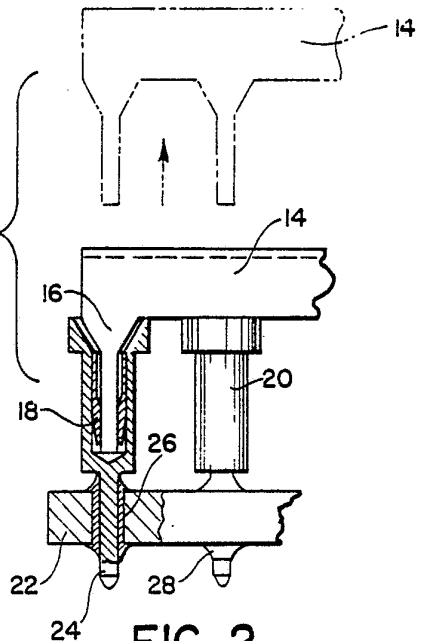


FIG. 2

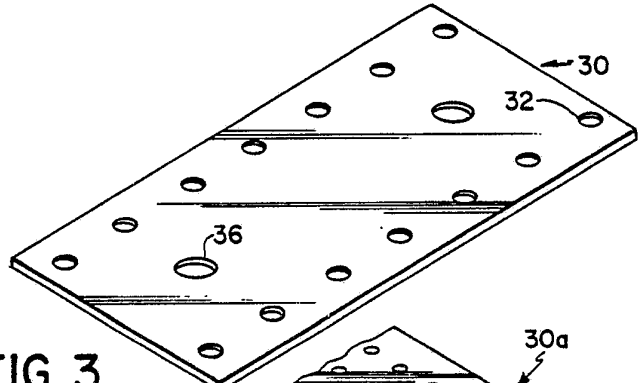


FIG. 3

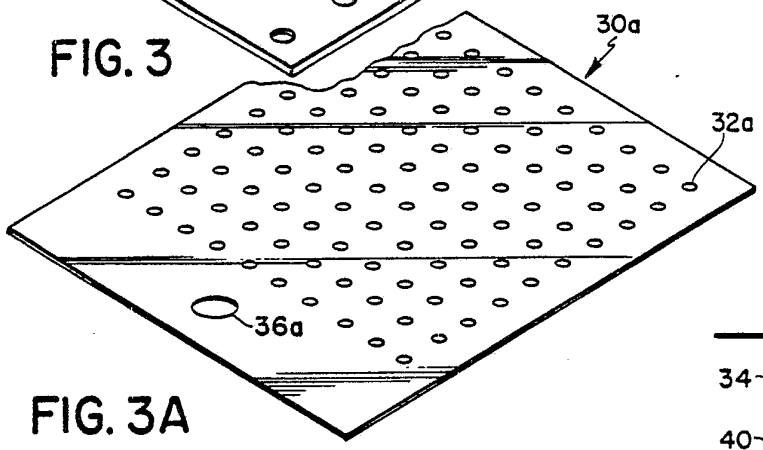


FIG. 3A

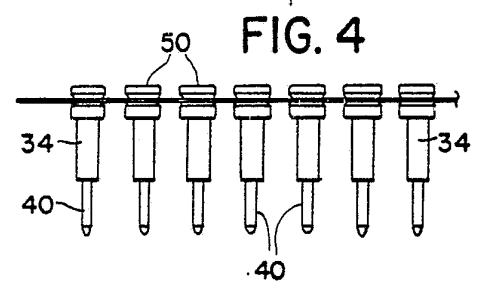


FIG. 4

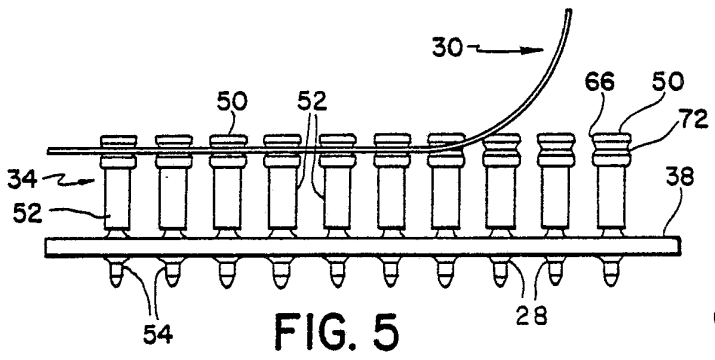


FIG. 5

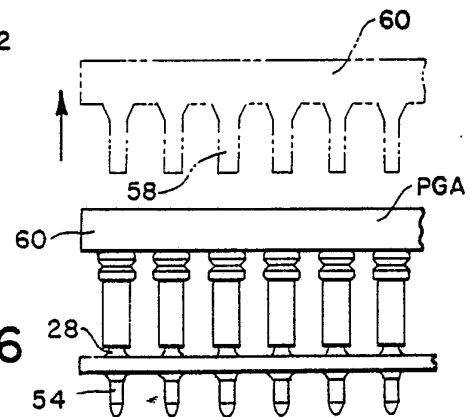


FIG. 6



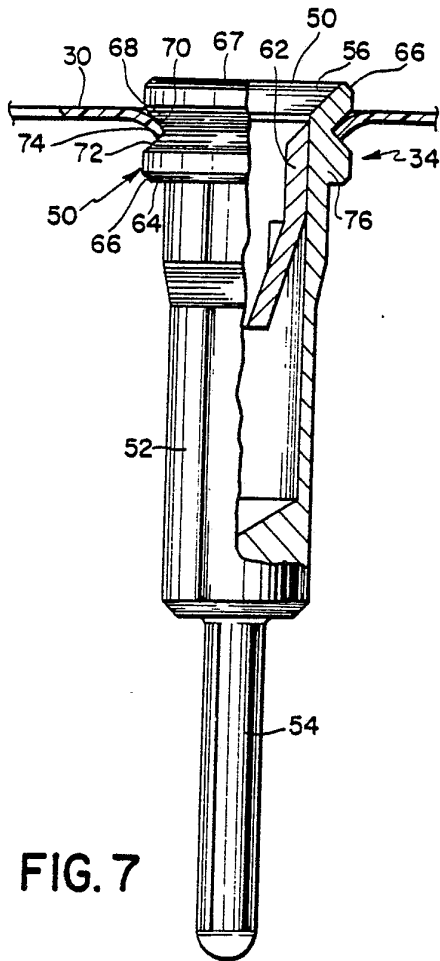


FIG. 7

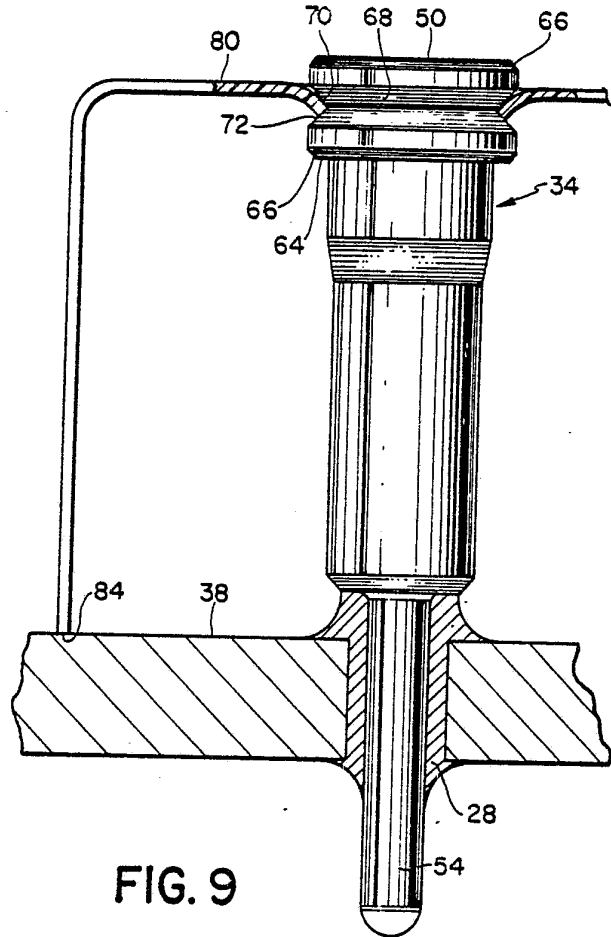


FIG. 9

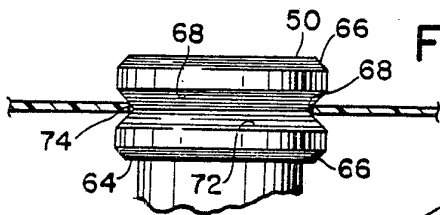


FIG. 7A

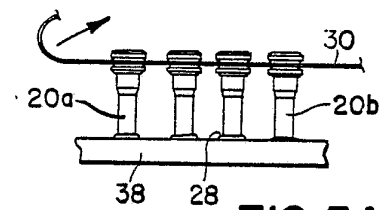


FIG. 5A

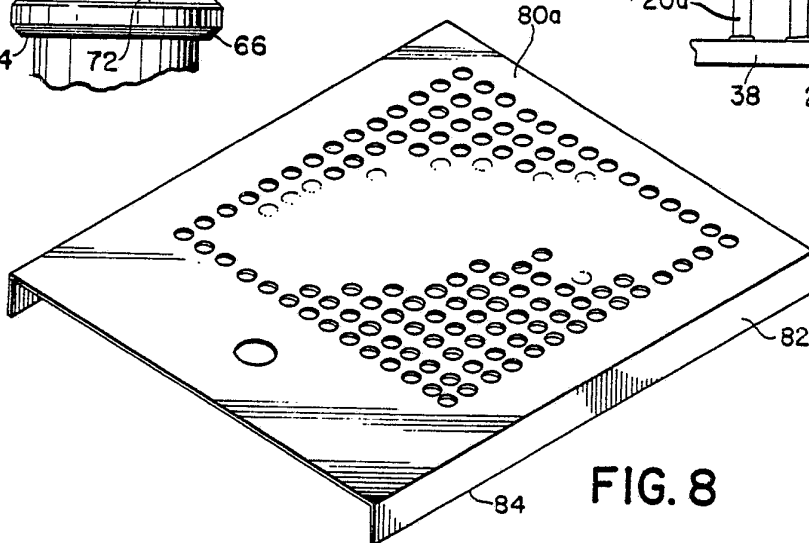


FIG. 8



# INTERNATIONAL SEARCH REPORT

International Application No PCT/US84/00163

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>3</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC U.S.C.L. 206/329; 29/423; 206/328, 347, 443; 269/43, 287; 29/837 INT. CL B23P 17/00, B65D 73/02		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
US	206/328, 329, 443, 347 269/43, 287 29/837, 839, 840, 423	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category *	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
A	US, A, 3,027,004 (Gluck) 27 March 1962	
A	US, A, 3,388,465 (Johnston) 18 June 1968	
A	US, A, 3,097,360 (Carlson, Jr., et al) 16 July 1963	
A	US, A, 3,545,606 (Bennett, et al) 08 December 1970	
A	US, A, 3,892,313 (Lange) 01 July 1975	
A	US, A, 4,099,615 (Lemke, et al) 11 July 1978	
A, P	US, A, 4,414,741 (Holt) 15 November 1983	
<p>* Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>2</sup>	Date of Mailing of this International Search Report <sup>2</sup>	
23 March 84	18 APR 1984	
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>20</sup>	
ISA/US	Allan N. Shoap <i>Allan N. Shoap</i>	