(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 621 985 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
16.04.1997 Bulletin 1997/16

(21) Application number: **92905232.2**

(22) Date of filing: **14.01.1992**

(51) Int Cl.[6]: **H01R 13/631**, H01R 43/20

(86) International application number:
PCT/US92/00413

(87) International publication number:
WO 93/14537 (22.07.1993 Gazette 1993/18)

(54) **ASSEMBLY OF MINIATURE CONNECTOR SYSTEM**

MONTAGESYSTEM MIT MINIATURVERBINDERN

MONTAGE D'UN SYSTEME DE CONNEXION MINIATURE

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU MC NL SE

(43) Date of publication of application:
02.11.1994 Bulletin 1994/44

(73) Proprietor: **ITT INDUSTRIES, INC.**
Wilmington, Delaware 19801 (US)

(72) Inventor: **MOSQUERA, Rene, Augusto**
Laguna Niguel, CA 92677 (US)

(74) Representative: **Esser, Wolfgang et al**
c/o Deutsche ITT Industries GmbH
ITT Regional Patent Office-Europe
Hans-Bunte-Strasse 19
79108 Freiburg (DE)

(56) References cited:
EP-A- 0 060 644
US-A- 4 376 338
US-A- 4 619 495

- **IBM TECHNICAL DISCLOSURE BULLETTIN vol. 27, no. 12, May 1985, pages 7186 - 7187; 'Alignement tool/process for automated (robotic) assembly of components'**
- **IBM TECHNICAL DISCLOSURE BULLETTIN vol. 7, no. 6, November 1964, pages 523 - 524; AIH.BROUGHTON: 'Pin and socket insertion tool'**

EP 0 621 985 B1

Description

BACKGROUND OF THE INVENTION:

SCEM (small computer expendability module) is a type of architecture for small computers wherein various small modules, often in the form of small circuit boards or "tiles", can be stacked at any of several selective positions on a mother board. In one architecture a connector must lie within a circuit board area of about 76.2 *mm by 8.5 mm* (three inches by one third inch). The connector has 400 contacts arranged in six rows in a small area. As a result, the contact centers must be spaced apart along each row by about one millimeter, necessitating the use of very small contacts. A method for installing such large number of miniature contacts reliably and at low cost, would be of considerable value.

In the US-A-4 619 495 a connector for press-fit installation of contacts in a circuit board hole is disclosed. A tool is used for directly pressing on shoulders of the contacts extending either side-wise of the housing and/or over the top of an inner wall between rows of contacts within the housing, which requires additional space.

SUMMARY OF THE INVENTION

In accordance with the present invention, a method for installing large numbers of contacts of a connector in holes of a circuit board, and a combination of a connector assembly and a circuit board according to claim 7, constructed to facilitate such installation, are provided, enabling installation accurately and at low cost.

The method applies to a connector assembly on a circuit board, wherein said circuit board has a plurality of rows of holes and said connector assembly includes an upper housing with a base that has a plurality of rows of holes and a plurality of contacts with upper end portions for lying in said plurality of rows in said housing and a mount portion, with each mount portion constructed for interference fit into one of said circuit board holes, using contacts with said contact mount portions formed with a largely upward-facing shoulder, futher using an upper housing with a base formed with largely downwardly-facing lower surface regions around each of said contact receiving holes.

The method includes first, installing each said contact upper end portion into one of said housing holes so said upward-facing shoulder of said contact mount portion is spaced below the level of a corresponding one of said downwardly-facing lower surface regions to leave a space between them as seen in a side view, temporarily installing at least one push bar between a plurality of said upward-facing shoulders and said housing surface regions, so said push bar can engage both said upward-facing shoulders and said downward-facing surface regions; with said mount portions lying above and aligned with said circuit board holes, pressing down against said upper housing and transmitting force via said upper housing from said lower surface regions through said push bar to said upward-facing shoulders, to simultaneously press down said mount portions into said circuit board holes, finaly removing said push bar from between said contact shoulders and said housing lower surface regions.

Preferably, prior to inserting the lower tips of the contacts into the circuit board holes, an aligner is pressed sidewardly against each contact lower portion to deflect it into alignment with a corresponding circuit board hole. Each aligner is preferably in the form of a bar having a greater width than thickness. The aligner bar is initially installed with its width vertical, and thereafter the aligner bar is turned so its width is horizontal to deflect apart adjacent contact lower ends. The lower end portions of the contact, once projecting from the lower surface of the circuit board, can be installed in a lower housing which has a tapered deflector projecting from its upper surface to deflect the tips of the contact slightly sidewardly into holes of the lower housing.

The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded isometric view of a connector system for connecting modules of an expandable module system.

Fig. 2 is a partial isometric view of the system of Fig. 1, showing three circuit boards and associated connectors.

Fig. 3 is a sectional view of two connectors and two associated circuit boards of the system of Fig. 2, shown in a fully mated position.

Fig. 4 is a partial isometric view of one of the connector assemblies of Fig. 3, with modified end portions.

Fig. 5 is a partial sectional view of one of the connector systems of Fig. 3.

Fig. 6 is a view taken on the line 6 - 6 of Fig. 5.

Fig. 7 is a view taken on the line 7 - 7 of Fig. 5.

Fig. 8 is a partial plan view of one of the circuit boards of Fig. 3, shown prior to installation of connector housings and contacts therein.

Figs. 9A - 9H are sectional views of one of the connector assemblies of Fig. 3, showing various stages in the installation of the contacts in the circuit board and in the lower connector housing.

Fig. 10 is a sectional view of the lower housing of one of the connector assemblies of Fig. 3, shown prior to installation of contacts therein.

Fig. 11 is a view taken on the line 11 - 11 of Fig. 10.

Fig. 12 is an enlarged view of a portion of Fig. 11.

Fig. 13 is a view taken on the line 13 - 13 of Fig. 10.

Fig. 14 is an enlarged view of a portion of Fig. 13.

Fig. 15 is a simplified isometric view of apparatus used in the installation steps of Figs 9A - 9H.

Fig. 16 is a side elevation view of additional apparatus used in the installation steps shown in Fig. 9F.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 illustrates a connector system 10 for connecting various modules 12, 14, 16 to each other and to a module in the form of a mother board 18. This type of architecture has been designed for use with small computers to allow modules to expand the capability of the computer. Each module 12 - 16 includes a module connector assembly 22 - 26 for interconnecting the modules to each other and to a connector 20 on the mother board. Each of the middle module connectors 22, 24 includes upper and lower housings 30, 32 at opposite faces of the circuit board 34, and multiple contacts extending through the circuit board and into each of the housings 30, 32. Each of the end module connectors 20, 26 has a connector housing on only one side of the corresponding circuit board. Of course, terms such as "upper", "lower", "vertical", etc. are used only to aid in the description of the invention, and the system can be used in any orientation with respect to gravity.

Fig. 2 shows an arrangement which includes only the mother board 18 and two of the modules 12, 16. Fig. 3 illustrates an arrangement that includes only the two uppermost modules 14, 16 and their corresponding connector assemblies 24, 26. Any of the above arrangements and more complex ones can be used.

As shown in Fig. 3, the connector assembly 24 includes upper and lower connector housings 40, 42 lying respectively against upper and lower surfaces 44, 46 of the circuit board 34. A large number of contacts 50 are arranged in six rows 51 - 56. Each contact has an upper end portion 60 that lies primarily within the upper housing 40, a lower end portion 62 lying primarily within the lower housing 42 and a mount portion 64 lying within a hole 66 of the circuit board in interference fit, or press fit therein. The mount portion forms an upwardly-facing shoulder 78 which is used in installing the contact in the circuit board hole. As shown in Fig. 8, the holes 66 of the circuit board, which lie in the six rows 51 - 56, are staggered, in that one column 70 of holes includes holes in only three of the rows (rows 51, 53, and 55) while the next adjacent column of holes 72 includes holes only in each of the other three rows (rows 52, 54, and 56). For this reason, a sectional view of the connector assembly may show only portions of contacts in only three rows, with corresponding portions of contacts in the other three rows being hidden. Thus, in Fig. 5 which shows two contacts 50A, 50B, a simple sectional view that would show all of contact 50B would show only part of the other contact 50A.

As shown in Fig. 6, the upper end portion 60 includes a base-received part 70 that lies in interference fit with the walls of a hole 72 in the base 74 of the upper housing 40. The upper end portion 60 also includes a beam 76 which can engage a contact of another connector assembly. The upper end portion 60 also includes an unenclosed or bare part 80 which lies in the space 82 between the upper surface 44 of the circuit board and the lower surface portion 84 of the upper housing that lies immediately around the contact. The space 82 has a thickness Y which is much more than the average thickness A of each contact end portion. The contact also has a lower end portion 90 with a lower tip 92 lying within the lower housing 42 and a base-received portion 94 lying in interference fit with the walls of a hole 96 in the lower housing.

The interference fit between a contact mount portion 64 and a corresponding circuit board hole 66 is a high interference fit, in that this interference fit is the primary means for holding the contact in position, such as against upward and downward forces applied during mating and unmating from contacts of other connectors. In one connector that applicant has designed, the center-to-center spacing of contacts along each row was one millimeter. Each contact was constructed of sheet metal having a thickness of 0.15 mm (six thousandths inch) and a width B of 0.38 mm (fourteen thousandths inch). Yet, the insertion force required to push the mount portion 64 into the circuit board hole 66, (which was metal plated) was between 2.72 to 5.44 kg (six to twelve pounds). In order to push the mount portions of all four hundred contacts into their corresponding circuit board holes, a total force of between 1.1 to 2.2 metric tons (twenty four hundred pounds and forty eight hundred pounds) was required. It may be noted that a much lower force such as 0,453 kg (one pound) or less was required to insert the base-received portion 70 of each contact into a corresponding hole 72 of the connector housing.

A large number of contacts to be installed in a single row, are formed simultaneously from a sheet of metal, with the mount portions 64 of all contacts bent to a "C" shape as shown in Fig. 7, and with the upper and lower end portions bent as shown. Different positions of the contact end portions such as 60 with respect to the "C" shaped mount portion 64 can be utilized. Figs. 5 - 7 show a latest and preferred position. As shown in Fig. 7, the contact upper end portion 60 extends from one side 67 of the upwardly-facing shoulder 78, while the space immediately above the other side 68 of the shoulder is unobstructed. A bar portion of the width X lying over the shoulder, will pres down against about two-thirds of the cross-section of the mount portion 64.

With the row of contacts still part of a single sheet by virtue of connector parts (not shown) connecting them to a carrier strip of the sheet metal, the row of contacts are inserted into the row of holes 72 (Fig. 5) in the upper housing 40, this requiring only moderate force, and with each contact being individually accessible, at least from the bottom of the contact. After the rows of contacts have been installed in the upper housing 40, the contacts are severed from the carrier strip. The contacts are now to be installed in tight interference fit with

the circuit board holes.

Fig. 9A shows the connector assembly with the upper end portions 60 of the contacts installed in the upper housing 40, and with the contact lower end portions 62 extending down so their lower tips 100 lie at or slightly above the upper surface 44 of the circuit board 34. Although large downward forces are not required at this time, applicant inserts three push elements in the form of bars 102, 104, 106 through the space between the contact shoulder 78 and the lower surface regions 84 of the upper housing 40. Applicant prefers to orient the contacts so the upwardly-facing shoulders 78 of the contacts in two adjacent rows such as rows 51 and 52 can receive the same push bar 106 on them. This reduces the number of individual push bars and enables the contacts to position the push bars so they lie on the shoulders of both rows of contacts. However, it is possible to use a separate push bar for each row of contacts.

In order to assure that the tips 100 of all contacts will enter corresponding holes 66 of the circuit board, it is desirable that each tip 100 lie substantially on the axis 110 of the corresponding hole. Initially, the tips 100 are slightly spaced from the axis 110. Applicant installs elongated aligners or aligner bars 120 between the contacts in adjacent rows such as 51 and 52, slightly above the tips 100 of the contacts. Each aligner bar has a greater width W than its thickness T (Fig. 9B). Each of the aligner bars is rotatable about an axis 114 extending along the length of the aligner bar and parallel to the contact rows. The aligner bars are initially installed in the orientation shown in Fig. 9A with their widths vertical. As shown in Fig. 9B, the aligner bars are then rotated 90° so their widths are horizontal, and each aligner bar deflects a location 116 on the contact lower end portion 62 lying closer to the tip 100 than to the mount, so the tip lies aligned with the axis 110 of the cylindrical board hole.

As shown in Fig. 9C, a next step is to lower the upper housing 40 by a very small amount, so that the lower tips 100 of the contact actually lie within the board holes 66. Then, the aligner bars 120 are moved horizontally parallel to the lengths of the rows, to withdraw the aligner bars from between the contacts. Fig. 9D shows the apparatus with the aligner bars removed, but with the contact lower tips 100 lying within the board holes 66 so the contact tips will remain in the board holes. Fig. 9E shows a next step, which involves pushing down the upper housing 40 by a considerable amount (e.g. 12.7 mm (one-half inch)) until the contact mount portion lie substantially against the upper surface 44 of the circuit board, and ready to be inserted into the circuit board holes 66.

Fig. 9F shows a next step, where a large downward force F is applied to the upper surface 124 of the upper housing 40 to push down the upper housing 40. The housing 40 presses down the push bars 102 - l06 which press down the mount portions 64 into the contact holes 66.

As discussed above, a large downward force has to be applied to press fit each mount portion 64 into a circuit board hole 66. The upper housing 40 is preferably molded of a thermoplastic chosen to have a moderately high strength for a thermoplastic, but whose strength is low compared to that of common metals such as bronze or steel. If the entire downward force of perhaps 2.7 to 5.4 kg (six to twelve pounds) per contact had to be applied directly by the lower surface of the thermoplastic upper housing 40, then there could be high pressure on the lower surface of the thermoplastic upper housing 40 which might damage it and result in one or more of the contacts not being pressed reliably into a circuit board hole. Also, as shown in Fig. 5, it is desirable that the hole 72 in the housing base be considerably wider than the contact to enable a curved tip portion 130 to pass therethrough, which would result in only a small area of the housing pressing down against the shoulder 78 of the mount portion. There would even be danger that the C-shaped mount portion could be deformed into the housing hole 72. The use of the push bars such as 106, enables the use of a harder material, such as steel than the thermoplastic material of the housing. Also, the push bar 106 can lie over most of the shoulder 78, except for one side from which the upper contact portion 60 extends, to provide a large area of contact. The downward force applied to the push bars, is applied through the upper housing 40, by a large force F (Fig. 9F) applied against a large area of the housing upper surface 124. The upper housing 40 is pushed down far enough until spacer legs 132 at the bottom of the housing lie substantially against the upper surface 44 of the circuit board. The spacer legs 132 position the upper housing stably on the circuit board. The upper housing 40 can be held down to the circuit board solely by the contacts, although separate fasteners can be used.

After the contacts and upper housing 40 have been fully installed on the circuit board, a next step is to install the lower housing 42 on the contact lower end portions 62 and on the circuit board. The lower housing has a base 140 with base holes 142 which receive the contact lower end portions. However, the contact lower tips 100 are offset from the base holes 142. Applicant forms the lower housing 42 with tapered deflectors 144 extending upwardly from most of the housing upper surface 146 (the portion of the upper surface that lies between spacer legs 148 of the lower housing). As the lower housing 42 is moved upwardly, the contact tips engage inclined deflect surfaces 143 of tapered deflectors 144 and are deflected slightly to one side and into the base holes 142. Fig. 9G shows the connector assembly 24 with all parts thereof installed on the circuit board 34. The presser bars 106 are then removed by sliding them horizontally and parallel to the length of the contact rows, out of the space between the upper housing and the upper surface of the circuit board. Fig. 9H shows the connector assembly 24 with all installing apparatus removed.

Fig. 15 is a simplified view of one apparatus 150

which can be used to insert and remove the push bars 102 - 104, and to insert, turn, and remove the aligner bars 120. The apparatus includes a guide device 152 having three rectangular guideways 154 that can guide the push bars 102 - 106 to move them between the bottom of the upper housing and the shoulders of the contact mount portions. Each bar has a tapered forward end 156 to facilitate its insertion. The guide member also has three cylindrical guideways 160 that each receives one of the alignment bars 120. The rear end of each alignment bar is fixed to a cylindrical rod 162 that can slide and rotate within one of the cylindrical guideways 160. The guide device 152 can slide up and down a short distance on a base 164 which guides the guide device 152 in vertical movement. The base 164 has positioning devices 166 with pins 168 that can be received in corresponding holes 170 (Fig. 8) of the circuit board to accurately align the base 164 with the circuit board.

The upper housing 40 (Fig. 9A) with the upper contact end portions installed thereon, can be installed on the push bars 102 and alignment bars 120 by sliding the housing with contacts thereon horizontally over the bars. The aligner bars 120 are then turned to the position shown in Fig. 9B. Then the guide device 152 is moved downwardly a short distance such as several 0.025 mm (thousands inch), to the position shown in Fig. 9C, so the lower tips df the contacts enter the circuit board holes. The alignment bars 120 (Fig. 15) can then be turned, or can be left in their position, and then pulled rearwardly in the direction R out of the guide device 152. The guide device is then moved downwardly by a distance such as 12.7 mm (one-half inch), until the contacts and upper housing are at the position shown in Fig. 9E. If the guide device 152 is not to be used to apply large downward pressure to the upper housing, then the push bars 102 - 106 can be pushed further forward in the direction F, as by other bars 170 until the rear ends 172 of the push bar have been pushed forward of the guideways 154.

Fig. 16 shows a next step, wherein the upper housing 40 with contacts 50 installed therein, and with the push bars such as 106 still in place, is installed between the piston 180 and anvil 182 of a press 184 that can apply forces of up to a few tons. The circuit board lies on a support 186 which supports locations on the circuit board immediately beyond opposite sides of the six rows of contacts. A hard rubber plate 190 has been placed on the upper surface 124 of the connector housing 40 to assure that downward forces on the upper surface 124 are uniformly distributed thereon, the hard rubber plate 190 being softer than the more rigid material of the thermoplastic housing 40. The press is then operated to move down the piston 180 to press fit the contact mount portions 64 into the circuit board holes.

Thus, the invention provides a method for the installation of large numbers of miniature contacts in interference fit with a circuit board according to claim 1, and a combination of a connector assembly and a circuit board according to claim 7, constructed to facilitate such installation. The method includes using each contact mount portion with a largely upwardly-facing shoulder, and using an upper housing with a largely downwardly-facing surface region spaced above the shoulders. A push bar is installed between the contact shoulders and housing surface region so downward force on the top of the housing can be transmitted through the push bar to the shoulder of the mount portion to apply a large downward force to the mount portion that press fits it into a circuit board hole. The push bars can be installed in a direction parallel to the rows of contacts, and preferably with each push bar lying against shoulders of contacts lying in two adjacent rows. Preferably, the lower tips of the contacts can be pushed into accurate alignment with circuit board holes, by an aligner that presses against a contact location closer to the lower tip of the contact than to the mount portion. Each aligner can be in the form of a bar having a greater width than thickness, and which is installed with its width dimension vertical, and which is then turned so its width dimension is horizontal to deflect a pair of contact locations apart. A lower housing can be inserted onto the lower end portions of the contacts that project from the lower surface of the circuit board, by moving the lower housing upwardly with respect to the circuit board and upper housing contacts thereon. Preferably, the lower housing has an upper surface with tapered deflectors that deflect the tip of each contact sidewardly into one of the lower housing holes.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art.

Claims

1. A method for installing a connector assembly (24, 26) on a circuit board (34), wherein said circuit board has a plurality of rows (51-56) of holes (66) and said connector assembly includes an upper housing (40) with a base (74) that has a plurality of rows (51-56) of holes (72) and a plurality of contacts (50, 50A, 50B) with upper end portions (60) for lying in said plurality of rows (51-56) in said housing (40) and a mount portion (64), with each mount portion constructed for interference fit into one of said circuit board holes (66), characterized by:

   using contacts (50, 50A, 50B) with said contact mount portions (64) formed with a largely upward-facing shoulder (78), using an upper housing (40) with a base (74) formed with largely downwardly-facing lower surface regions (84) around each of said contact receiving holes (72);

   installing each said contact upper end portion

(60) into one of said housing holes (72) so said upward-facing shoulder (78) of said contact mount portion (64) is spaced below the level of a corresponding one of said downwardly-facing lower surface regions (84) to leave a space (82) between them as seen in a side view,

temporarily installing at least one push bar (102, 104, 106) between a plurality of said upward-facing shoulders (78) and said housing surface regions (84) so said push bar (102, 104, 106) can engage both said upward-facing shoulders and said downward-facing surface regions (84);

with said mount portions (64) lying above and aligned with said circuit board holes (66), pressing down against said upper housing (40) and transmitting force via said upper housing from said lower surface regions (84) through said push bar (102, 104, 106) to said upward-facing shoulders (78), to simultaneously press down said mount portions (64) into said circuit board holes (66);

removing said push bar (102, 104, 106) from between said contact shoulders and said housing lower surface regions.

2. The method described in claim 1 wherein:

said contacts are arranged so pairs of contacts (50A, 50B) in adjacent rows (51, 52) have adjacent shoulder sides (68) as view along the row, wherein the space (82) immediately above each of said adjacent shoulder sides (68) is *unobstructed* by said contact upper end portions (60);

said step of installing said push bar (102, 104, 106) includes installing it to lie on said adjacent shoulder sides (68) of each pair (50A, 50B) of a plurality of pairs of said contacts, and to lie between the upper end portion (60) of each said pair of contacts.

3. The method as claimed in at least one of claims 1 or 2 wherein:

said contacts are arranged in a predetermined number of rows (51 - 56), with each row including at least twice as many contacts in the row as said predetermined number of different rows;

said step of installing a push bar (102, 104, 106) includes moving it parallel to the lengths of said rows (51 - 56) with said push bar lying against the shoulder (78) of all contacts in at least one row of uniformly spaced contacts.

4. The method claimed in at least one of claims 1 to 3 wherein:

said housing has a plurality of spacer legs (132) extending to a level below said lower surface regions (84);

said contacts each have a lower end portion (62, 90) with a lower tip (100), with the sideward spacing between rows of tips (100) of undeflected contacts being different then the sideward spacing between rows (51, 52) of holes (66) in said circuit board;

each said circuit board hole has a vertical axis (110); *said method* including pressing an aligner (120) sidewardly against each of said contact lower end portions (62, 90), at a location closer to said lower tip (100) than to said mount portion (64), to deflect said lower tips sidewardly to a position centered on a corresponding circuit board hole axis (110);

with said aligner pressed against said contacts, moving down said housing (40) and contacts (50) and aligner (120) until said contact tips (100) have passed down at least partially into said circuit board holes (66), then removing said aligner, and then moving down said housing and contacts until said spacer legs (132) bear substantially against said circuit board.

5. The method claimed in at least one of claims 1 to 4 wherein each of said contact has an elongated lower end portion (62, 90) extending down from said mount portion (64) thereof, and including:

using a lower housing (42) with a plurality of contact-receiving holes (96, 142) that can each receive said lower end portion of one of said contacts, with said lower housing having an upper surface (146) and having a tapered deflector (144) extending above said upper surfaces (146) of said lower housing, and with each contact lower end portion having a lower tip (92, 100);

pressing said upper and lower housings (40, 42) towards each other until said contact lower tips engage said deflectors (144), and continuing to press said housings towards each other while said tips are deflected sidewardly by said deflector into one of said lower housing holes (96, 142), and then pressing said housings towards each other until they lie against opposite

surfaces of said circuit board (34).

6. The method claimed in at least one of claims 1 to 5 wherein:

said step of pressing down *said mount portions* (64) *into said circuit board holes (66),* includes laying a plate (190) of material that is more easily deformed than the material of said housing (40), on top (124) of said housing,

supporting said circuit board (34), and pressing the top of said plate towards said circuit board with a force of a *plurality of forty five kilograms (plurality of hundreds of pounds).*

7. The combination of a connector assembly (24, 26) *and* a circuit board (34) that has upper and lower faces (44, 46), wherein said circuit board has a plurality of rows (51-56) of holes (66), and said connector assembly includes an upper housing (40) with a base (74) and a plurality of rows (51 - 56) of contacts (50, 50A, 50B), each contact having an upper end portion (60) lying in said upper housing (40), a mount portion (64) lying in interference fit in one of said circuit board holes (66), and a lower portion (62, 90) projecting generally downwardly from said circuit board (34), characterized by:

said upper housing (40) base (74) has lower surface regions (84) lying around each of said contacts (50, 50A, 50B) and spaced *(82)* from the upper surface (44) of said circuit board (34), and said upper housing (40) having spacer legs (132) extending below the level of said lower surface regions (84) and bearing against said circuit board upper surface (44);

said mount portions (64) each having an upward-facing shoulder (78) *lying about even with the upper surface (44) of said circuit board (34)* and spaced below said lower surface regions (84), with said upper and lower end portions (60, 62, 90) and said mount portions (64) being integral;

the space between said lower surface regions (84) and the surface of said upward-facing shoulder (78) being large enough, so that along a row of said contacts (50, 50A, 50B) a push bar can be temporarily introduced between said upward-facing shoulders (78) and said housing lower surface regions (84), so that installation forces *necessary for pressing down mount portions (64) into said interference fit,* can be transmitted via said upper housing (40) through said push bar onto said upward-facing shoulders (78).

8. The combination described in claim 7 wherein:

each of said contact upper end portions (60) extends eccentrical upwardly from a first side (67) of the surface of said upward-facing shoulder (78) to leave most of the area immediately above an opposite second side (68) of said upwardly-facing shoulder unobstructed;

the contacts of first and second adjacent rows (51, 52) are oriented so said second sides (68) of said upward-facing shoulders lie closest to each other,

to enable a single push bar extending along said first and second adjacent rows (51, 52) to lie on the upward-facing shoulders (78) of contacts of both adjacent rows (51, 52) to simultaneously push down contacts of both rows.

9. The combination as claimed in at least one of claims 7 to 8 wherein:

said connector assembly includes a lower housing (42) that has a plurality of contact-receiving holes (96, 142) that each receives said lower end portion (62, 90) of one of said contacts;

said lower housing having an upper surface region (146) spaced below said circuit board lower surface (46) with said upper surface region forming a majority of the upper surface of said lower housing, with said housing having a deflector portion (144) extending upwardly from said upper surface region (146) beside each of said holes (96, 142) in said lower housing,

with each said deflector portion having a deflect surface (143) that extends downwardly and towards a corresponding hole, so when the lower tip (100) of a contact lower end portion *(62)* moves down, it can be deflected by said deflect surface into one of said holes.

10. The combination as claimed in 9 wherein:
said lower housing includes at least one elongated deflector (144) lying between two adjacent rows of contacts and projecting above most of the rest of said lower housing upper surface (146), said deflector having opposite sides that each form a plurality of deflector portions for one of said two rows of contact lower tips (100) .

11. The combination of a connector assembly (24, 26) on a circuit board (34), as claimed in at least one of claims 7 to 10, which further includes

at least one removable push bar (102, 104, 106) extending along at least a first of said rows of contacts (51 - 56) and lying closely between said upward-facing shoulders (78) and said housing lower surface (84) and

means (180, 182, 184, 190) for pressing against top (124) of said housing (40) and against the bottom of said circuit board (34), to push said mount portions (64) into said board holes (66) by forces of a plurality of forty five kilograms (plurality of hundreds of pounds) transmitted through said removable push bar (102, 104, 106).

12. The combination as claimed in claim 11 wherein each said contact (50) has a lower end (62, 90), and including:

at least one elongated aligner bar (120) having an axis (114) and extending between the lower ends (62, 90) of contacts of two adjacent rows of said contacts (51 - 56) ;

said aligner bar (120) having a greater width (W) than thickness (T) with said width being slightly greater than the distance between locations on said contacts lower ends (62, 90) when said lower ends are undeflected;

means for turning said aligner bar (120) about its axis (114) until bar locations at opposite sides of said width (W) can each press against said contacts locations to temporarily deflect said contact lower ends (62, 90) apart.

Patentansprüche

1. Ein Verfahren zum Einbau einer Steckverbinderbaugruppe (24, 26) auf einer Platine (34), wobei die Platine mehrere Reihen (51-56) von Löchern (66) hat und die Steckverbinderbaugruppe ein oberes Gehäuse (40) mit einem Unterteil (74) hat, das mehrere Reihen (51-56) von Löchern (72) und mehrere Kontakte (50, 50A, 50B) hat, mit Teilbereichen (60) am oberen Ende, die in den mehreren Reihen (51-56) des Gehäuses (40) liegen sollen, und einen Befestigungsbereich (64), wobei jeder Befestigungsbereich so konstruiert ist, daß er mit Preßpassung in ein Platinenloch (66) paßt, dadurch gekennzeichnet, daß

Kontakte (50, 50A, 50B) verwendet werden, deren Kontaktbefestigungsbereiche (64) mit einem großteils nach oben weisenden Vorsprung (74) ausgebildet sind, und wobei ein oberes Gehäuse (40) mit einem Unterteil (74) verwendet wird, das mit großteils nach unten weisenden unteren Flächenregionen (84) um jedes kontaktaufnehmende Loch (72) herum ausgebildet ist;

der obere Kontaktendbereich (60) in eines der Gehäuselöcher (72) eingebaut wird, so daß der nach oben weisende Vorsprung (78) des Kontaktbefestigungsbereiches (64) unterhalb der Höhe einer entsprechenden nach unten weisenden Oberflächenregion (84) mit einem Abstand versehen ist, so daß ein Abstand (82) resultiert, der in einer Seitenansicht dargestellt ist;

zeitweise zumindest ein Schiebestift (102, 104, 106) zwischen mehreren nach oben weisenden Vorsprüngen (78) und den Gehäuseoberflächenregionen (84) eingebaut wird, damit der Schiebestift (102, 104, 106) in die beiden nach oben weisenden Vorsprünge und die nach unten weisenden Oberflächenregionen (84) eingreifen kann;

wobei die Befestigungsbereiche (64) oberhalb der Platinenlöcher (66) und mit diesen in der Flucht liegen, nach unten gegen das obere Gehäuse (40) drücken und Kraft über das obere Gehäuse von den unteren Oberflächenregionen (84) durch den Schiebestift (102, 104, 106) auf die nach oben weisenden Vorsprünge (78) übertragen wird, um die Befestigungsbereiche (64) gleichzeitig nach unten in die Platinenlöcher (66) zu drükken;

der Schiebestift (102, 104, 106) zwischen den Kontaktvorsprüngen und den unteren Gehäuseoberflächenregionen entfernt wird.

2. Verfahren nach Anspruch 1,

wobei die Kontakte so angeordnet sind, daß Kontaktpaare (50A, 50B) in benachbarten Reihen (51, 52) benachbarte Vorsprungseiten (68) aus der Sicht entlang der Reihe haben, wobei der Zwischenraum (82) direkt oberhalb der benachbarten Vorsprungseiten (68) von den oberen Kontaktendbereichen (60) unbehindert ist;

wobei der Schritt des Einbaus des Schiebestiftes (102, 104, 106) auch seinen Einbau in der Weise beinhaltet, daß er auf den benachbarten Vorsprungseiten (68) jedes Paares (50A, 50B) von mehreren Kontaktpaaren liegt, und daß er zwischen dem oberen Endbereich (60) jedes Kontaktpaares liegt.

3. Verfahren nach mindestens einem der Ansprüche

1 oder 2,

wobei die Kontakte in einer vorher festgelegten Zahl von Reihen (51 - 56) angeordnet sind, wobei jede Reihe mindestens doppelt soviele Kontakte in der Reihe hat wie die genannte vorher festgelegte Zahl von Reihen;

wobei der Schritt des Einbaus eines Schiebestiftes (102, 104, 106) auch beinhaltet, daß er parallel zur Länge der Reihen (51 - 56) bewegt wird,

wobei der Schiebestift gegen den Vorsprung (78) aller Kontakte in zumindest einer Reihe mit gleichmäßig verteilten Kontakten liegt.

4. Verfahren nach mindestens einem der Ansprüche 1 bis 3,

wobei das Gehäuse mehrere Abstandsschenkel (132) hat, die sich auf eine Höhe erstrecken, die unterhalb der unteren Flächenregionen (84) liegen;

wobei die Kontakte jeweils einen unteren Endbereich (62, 90) mit einer unteren Spitze (100) haben, wobei der seitliche Abstand zwischen den Reihen der Spitzen (100) von ungebogenen Kontakten sich unterscheiden vom seitlichen Abstand zwischen den Reihen (51, 52) von Löchern (66) in der Platine;

wobei das Platinenloch eine vertikale Achse (110) hat, wobei das Verfahren das Pressen eines Ausrichters (120) seitwärts gegen jeden unteren Endbereich (62, 90) des Kontaktes an einer Stelle einschließt, die näher an der unteren Spitze (100) liegt als am Befestigungsbereich (64), um die unteren Spitzen seitwärts zu einer Stellung hin zu biegen, die zu einer entsprechende Platinenlochachse (110) zentriert ist;

wobei der Ausrichter gegen die Kontakte gedrückt ist, das nach unten Schieben des Gehäuses (40) und des Kontakts (50) und des Ausrichters (120), bis die Kontaktspitzen (100) mindestens teilweise sich in den Platinenlöchern (66) befinden, dann das Entfernen des Ausrichters und das nach unten Schieben des Gehäuses und der Kontakte, bis die Abstandsschenkel (132) zu einem wesentlichen Teil gegen die Platine drücken.

5. Verfahren nach mindestens einem der Ansprüche 1 bis 4,

wobei jeder Kontakt einen länglichen unteren Endbereich (62, 90) hat, der sich vom Befestigungsbereich (64) nach unten erstreckt, einschließlich der Verwendung eines unteren Gehäuses (42) mit mehreren kontaktaufnehmenden Löchern (96, 142), die jeweils den unteren Endbereich eines Kontaktes aufnehmen können, wobei das untere Gehäuse eine obere Fläche (146) und einen konisch zulaufenden Ablenker (144) hat, der oberhalb der oberen Flächen (146) des unteren Gehäuses verläuft, und wobei jeder untere Endbereich eines Kontaktes eine untere Spitze (92, 100) hat;

des Drücken des oberen und des unteren Gehäuses (40, 42) zueinander, bis die unteren Spitzen eines Kontaktes in die Ablenker (144) eingreifen, und das fortdauernde Drücken der Gehäuse zueinander, während die Spitzen vom Ablenker seitwärts in eines der unteren Gehäuselöcher (96, 142) gebogen werden, und dann das Drücken der Gehäuse zueinander, bis sie gegen die gegenüberliegenden Flächen der Platine (34) liegen.

6. Verfahren nach mindestens einem der Ansprüche 1 bis 5,

wobei der Schritt des Niederdrückens der Befestigungsbereiche (64) in die Platinenlöcher (66) auch das Einlegen einer Platte (190), die aus einem Material besteht, das einfacher zu verformen ist als das Material des Gehäuses (40), auf die Oberseite (124) des Gehäuses einschließt,

das Abstützen der Platine (34) und das Pressen auf die Oberseite der Platte gegen die Platine mit einer Kraft von mehreren 45 Kilogramm (mehrere 100 angelsächsische Pfund).

7. Die Kombination einer Steckverbinderbaugruppe (24, 26) und einer Platine (34), die obere und untere Flächen (44, 46) hat, wobei die Platine mehrere Reihen (51 - 56) von Löchern (66) hat, und die Steckverbinderbaugruppe ein oberes Gehäuse (40) mit einem Unterteil (74) und mehrere Reihen (51-56) von Kontakten (50, 50A, 50B) hat, wobei jeder Kontakt einen oberen Endbereich (60) hat, der im oberen Gehäuse (40) liegt sollen, jeder Befestigungsbereich (64) mit Preßpassung in einem Platinenloch (66) liegt und ein unterer Bereich (62, 90) sich im allgemeinen nach unten von der Platine (34) erstreckt, dadurch gekennzeichnet,

daß das Unterteil (74) des oberen Gehäuses (40) untere Flächenregionen (84) hat, die um jeden Kontakt (50, 50A, 50B) liegen und mit ei-

nem Zwischenraum (82) von der oberen Fläche (44) der Platine (34) versehen sind, und daß das obere Gehäuse Abstandsschenkel (132) besitzt, die sich unterhalb der Höhe der unteren Flächenregionen (84) erstrecken und gegen die obere Fläche (44) der Platine drücken;

daß die Befestigungsbereiche (64) jeweils einen nach oben weisenden Vorsprung (78) haben, der nahezu bündig mit der oberen Fläche (44) der Platine (34) ist und unterhalb den unteren Flächenregionen (84) mit einem Abstand versehen ist, wobei die oberen und unteren Endbereiche (60, 62, 90) und die Befestigungsbereiche (64) aus einem Stück sind;

daß der Zwischenraum zwischen den unteren Flächenregionen (84) und der Fläche des nach oben weisenden Vorsprungs (78) groß genug ist, daß entlang einer Reihe der Kontakte (50, 50A, 50B) ein Schiebestift zeitweise zwischen die nach oben weisenden Vorsprünge (78) und die unteren Flächenregionen (84) eingeführt werden kann, damit die für das Niederdrücken der Befestigungsbereiche (64) in die Preßpassung erforderlichen Einbaukräfte über das obere Gehäuse (40) und über den Schiebestift auf die nach oben weisenden Vorsprünge (78) übertragen werden können.

8. Die Kombination nach Anspruch 7,

wobei jeder obere Endbereich (60) sich exzentrisch nach oben von einer ersten Seite (67) der Fläche des nach oben weisenden Vorsprungs (78) erstreckt, um den größten Bereich direkt oberhalb einer gegenüberliegenden zweiten Seite (68) des nach oben weisenden Vorsprungs unbehindert zu lassen;

wobei die Kontakte der ersten und zweiten benachbarten Reihen (51, 52) so ausgerichtet sind, daß die zweiten Seiten (68) der nach oben weisenden Vorsprünge am nächsten zueinander liegen, um es einem einzelnen Schiebestift, der sich entlang der ersten und zweiten benachbarten Reihe (51, 52) erstreckt, zu ermöglichen auf den nach oben weisenden Vorsprüngen (78) der Kontakte beider benachbarten Reihen (51, 52) zu liegen, um die Kontakte beider Reihen gleichzeitig nach unten zu drücken.

9. Die Kombination nach mindestens einem der Ansprüche 7 bis 8,

wobei die Steckverbinderbaugruppe ein unteres Gehäuse (42) enthält, das mehrere kontaktaufnehmende Löcher (96, 142) hat, die jeweils den unteren Endbereich (62, 90) eines Kontaktes aufnehmen;

wobei das untere Gehäuse eine obere Flächenregion (146) hat, die unterhalb der unteren Fläche (46) der Platine mit einem Abstand versehen ist, wobei die obere Flächenregion den Großteil der oberen Fläche des unteren Gehäuses bildet, wobei das Gehäuse einen Ablenkbereich (144) hat, der sich von der oberen Flächenregion (146) neben jedem Loch (96, 142) im unteren Gehäuse nach oben erstreckt;

wobei jeder Ablenkbereich eine Ablenkfläche (143) hat, die sich nach unten und zu einem entsprechenden Loch hin erstreckt, so daß die untere Spitze (100) eines unteren Endbereiches (62) des Kontaktes während ihrer Abwärtsbewegung durch die Ablenkfläche in eines der Löcher gebogen werden kann.

10. Die Kombination nach Anspruch 9, wobei das untere Gehäuse mindestens einen länglichen Ablenker (144) enthält, der zwischen zwei benachbarten Kontaktreihen liegt und oberhalb dem überwiegenden Rest der oberen Fläche (146) des unteren Gehäuses herausragt, wobei der Ablenker gegenüberliegende Seiten hat, die jeweils mehrere Ablenkerbereiche für die unteren Spitzen (100) von einer der beiden unteren Kontaktreihen bilden.

11. Die Kombination aus einer Steckverbinderbaugruppe (24, 26) auf einer Platine (34) nach mindestens einem der Ansprüche 7 bis 10, die weiterhin einschließt:

mindestens ein abnehmbarer Schiebestift (102, 104, 106), der sich entlang mindestens einer ersten Reihe von Kontakten (51 - 56) erstreckt und nahe zwischen den nach oben weisenden Vorsprüngen (78) und der unteren Fläche (84) des Gehäuses liegt und

ein Element (180, 182, 184, 190) zum Pressen auf die Oberseite (124) des Gehäuses (40) gegen den Boden der Platine (34), um die Befestigungsbereiche (64) in die Platinenlöcher (66) mit einer Kraft von mehreren 45 Kilogramm (mehrere 100 angelsächsische Pfund) zu drükken, wobei diese Kraft über den abnehmbaren Schiebestift (102, 104, 106) übertragen wird.

12. Die Kombination nach Anspruch 11, wobei jeder Kontakt (50) ein unteres Ende (62, 90) hat,

und mindestens einen länglichen Ausrichtstift (120) enthält, der eine Achse (114) hat und sich

zwischen den unteren Enden (62, 90) der Kontakte von zwei benachbarten Reihen (51 - 56) der Kontakte erstreckt;

wobei der Ausrichtstift (120) eine größere Breite (W) als Stärke (T) hat, wobei die Breite leicht größer als die Strecke zwischen den Stellen auf den unteren Enden (62, 90) der Kontakte ist, wenn die unteren Enden nicht gebogen sind;

und ein Element zum Drehen des Ausrichtstiftes (120) um seine Achse (114) hat, bis die Stiftstellen an den gegenüberliegenden Seiten der Breite (W) jeweils gegen die Kontaktstellen drücken können, um die unteren Enden (62, 90) zeitweise auseinanderzubiegen.

Revendications

1. Procédé pour l'installation d'un ensemble de connecteur (24, 26) sur une carte à circuit imprimé (34), dans lequel ladite carte à circuit imprimé comporte une pluralités de rangées (51-56) de perçages (66) et dans lequel ledit ensemble de connecteur comporte un boîtier supérieur (40) avec une base munie d'une pluralité de rangées (51-56) de perçages (72) et une pluralité de contacts (50, 50A, 50B) comportant des portions d'extrémité supérieure (60) destinées à s'étendre dans ladite pluralité de rangées (51-56) dans ledit boîtier (40) et une portion de montage (64), chaque portion de portion de montage étant prévue pour être reçue avec serrage dans l'un des perçages (66) de la carte à circuit imprimé, caractérisé en ce que :

   on utilise des contacts (50, 50A, 50B) comportant desdites portions de montage (64) de contact qui sont formées avec un épaulement (78) sensiblement tourné vers le haut ;
   on utilise un boîtier supérieur (40) comportant une base munie de portions importantes de surface inférieure (84) sensiblement tournées vers le bas autour de chacun desdits perçages (72) destinés à recevoir un contact ;
   on installe chaque dite portion d'extrémité supérieure (60) du contact dans l'un desdits perçages (72) du boîtier de sorte que l'épaulement (78) tourné vers le haut de ladite portion de montage (64) du contact est décalé en-dessous du niveau d'une portion correspondante de surface inférieure (84) tournée vers le bas pour laisser subsister un espacement (82) entre eux lorsqu'on les regarde de côté ;
   on installe temporairement au moins une barre de poussée (102, 104, 106) entre une pluralité desdits épaulements (78) tournés vers le haut et lesdites portions de surface (84) du boîtier de sorte que la barre de poussée (102, 104, 106) peut coopérer à la fois avec les épaulements tournés vers le haut et avec les portions de surface (84) tournées vers le bas ;
   lesdites portions de montage (64) étant alignées au-dessus desdits perçages (66) de la carte à circuit imprimé, on applique un effort de poussée vers le bas sur le boîtier supérieur (40) et, en transmettant l'effort au travers dudit boîtier supérieur, par lesdites portions de surface inférieure (84) et au moyen des barres de poussée (102, 104, 106), en direction desdits épaulements (78) tournés vers le haut, on pousse simultanément vers le bas lesdites portions de montage (64) dans lesdits perçages (66) de la carte à circuit imprimé ; et
   on retire ladite barre de poussée (102, 104, 106) d'entre lesdits épaulements des contacts et lesdites surfaces inférieures du boîtier.

2. Procédé selon la revendication 1, caractérisé en ce que :

   lesdits contacts sont agencés de sorte que des barres de contact (50, 50A, 50B) dans des rangées adjacentes (51, 52) comportent des côtés d'épaulement (68) adjacents en vue selon la direction de la rangée, au niveau desquels l'espacement (82) immédiatement au-dessus de chacun des côtés d'épaulement (68) adjacents n'est pas obstrué par lesdites portions supérieures d'extrémité du contact ; et
   ladite étape d'installation de ladite barre de poussée (102, 104, 106) comporte l'installation de la barre au contact desdits côtés d'épaulement (68) adjacents de chaque paire (50, 50A, 50B) d'une pluralité de paires desdits contacts, la barre étant reçue entre les portions d'extrémité supérieure (60) de chaque paire de contacts.

3. Procédé selon l'une quelconque des revendications 1 ou 2, caractérisé en ce que ;

   lesdits contacts sont disposés en un nombre prédéterminé de rangées (51-56), chaque rangée comportant au moins deux fois plus de contacts dans la rangée que ledit nombre prédéterminé de rangées différentes ; et
   ladite étape d'installation de la barre de poussée (102, 104, 106) comporte l'étape consistant à la déplacer parallèlement à la longueur desdites rangées (51-56), ladite barre de poussée reposant contre l'épaulement de tous les contacts d'au moins une rangée de contacts uniformément espacés.

4. Procédé selon l'une quelconque des revendications

1 à 3, caractérisé en ce que :

ledit boîtier comporte une pluralité de jambes d'espacement (132) qui s'étendent à un niveau inférieur auxdites portions de surface inférieure (84) ;

lesdits contacts comportent chacun une portion d'extrémité inférieure (62, 90) avec une extrémité inférieure (100), l'espacement latéral entre les rangées d'extrémités (100) de contacts non fléchies étant différent de l'espacement latéral entre les rangées (51, 52) de perçages (66) dans ladite carte à circuit imprimé ;

chacun desdits perçages de la carte à circuit imprimé possède un axe vertical (110) ; ledit procédé comportant l'étape consistant à appliquer un dispositif d'alignement (120) latéralement contre chacune desdites portions d'extrémité inférieure (62, 90) des contacts, en un point plus proche de ladite extrémité inférieure (100) que de ladite portion de montage (64), pour fléchir lesdites extrémités inférieures latéralement vers une position centrée sur l'axe (110) d'un perçage correspondant de la carte à circuit imprimé ;

ledit dispositif d'alignement étant en appui contre lesdits contacts, on déplace vers le bas ledit boîtier (40), les contacts (50) et le dispositif d'alignement (120) jusqu'à ce que lesdites extrémités de contact (100) soient reçues au moins partiellement à l'intérieur desdits perçages (66) de la carte à circuit imprimé, en ce que l'on retire alors ledit dispositif d'alignement et en ce que l'on déplace vers le bas ledit boîtier et lesdits contacts jusqu'à ce que lesdites jambes d'espacement (132) portent sensiblement contre ladite carte à circuit imprimé.

5. Procédé selon l'une quelconque des revendications 1 à 4, dans lequel chacun desdits contacts comporte une portion d'extrémité inférieure (62, 90) allongée qui s'étend vers le bas depuis ladite portion de montage (64), et caractérisé en ce que :

on utilise un boîtier inférieur (42) avec une pluralité de perçages (96, 142) destinés à recevoir des contacts qui peuvent chacun recevoir ladite portion d'extrémité inférieure de l'un desdits contacts, ledit boîtier inférieur comportant une surface supérieure (146) et comportant un déflecteur chanfreiné (144) qui s'étend au-dessus de ladite surface supérieure (146) dudit boîtier inférieur, et chaque portion d'extrémité inférieure des contacts comportant une extrémité inférieure (92, 100) ;

l'on pousse les boîtiers supérieur et inférieur (40, 42) en direction l'un de l'autre jusqu'à ce que lesdites extrémités inférieures des contacts coopèrent avec lesdits déflecteurs (144), en ce que l'on continue de pousser lesdits boîtiers en direction l'un de l'autre tandis que lesdites extrémités sont fléchies latéralement par ledit déflecteur dans l'un desdits perçages (96, 142) du boîtier inférieur, et en ce que l'on pousse alors les boîtiers l'un vers l'autre jusqu'à ce qu'ils reposent contre les surfaces opposées de la carte à circuit imprimé (34).

6. Procédé selon l'une quelconque des revendications 1 à 5, caractérisé en ce que ladite étape consistant à pousser vers le bas lesdites portions de montage (64) dans lesdits perçages (66) de la carte à circuit imprimé comporte l'étape consistant à agencer au-dessus dudit boîtier une plaque (190) d'un matériau qui est plus aisément déformé que le matériau dudit boîtier (40),

en ce qu'on maintient ladite carte à circuit imprimé (34), et en ce qu'on pousse le dessus de ladite plaque en direction de ladite carte à circuit imprimé avec une force de plusieurs fois 45 kg (plusieurs centaines de livres).

7. Combinaison d'un ensemble de connecteur (24, 26) et d'une carte à circuit imprimé (34) qui comporte des surfaces supérieure et inférieure (44, 46), dans laquelle ladite carte à circuit imprimé comporte une pluralité de rangées (51-56) de perçages (66), et ledit ensemble de connecteur comporte un boîtier supérieur (40) avec une base et une pluralité de rangées (51-56) de contacts (50, 50A, 50B), chaque contact comportant une portion d'extrémité supérieure (60) qui s'étend dans ledit boîtier supérieur (40), une portion de montage (64) qui est reçue avec serrage dans l'un desdits perçages (66) de la carte à circuit imprimé, et une portion inférieure (62, 90) qui s'étend généralement vers le bas depuis ladite carte à circuit imprimé (34), caractérisée en ce que :

ladite base (74) du boîtier supérieur (40) comporte des portions de surface inférieure (84) qui s'étendent autour de chacun desdits contacts (50, 50A, 50B) et qui sont décalées de la surface supérieure (44) de ladite carte à circuit imprimé (34), et ledit boîtier supérieur (40) comporte des jambes d'espacement (132) qui s'étendent en-dessous du niveau desdites portions de surface inférieure (84) et portent contre ladite surface supérieure (44) de la carte à circuit imprimé ;

lesdites portions de montage (64) comportent chacune un épaulement (78) tourné vers le haut qui est sensiblement au même niveau que la surface supérieure (44) de ladite carte à circuit imprimé (34) et qui est décalé en-dessous desdites portions d'extrémité inférieure (84),

lesdites portions d'extrémité supérieure et inférieure (60, 62, 90) et lesdites portions de montage (64) étant d'une seule pièce ; et
l'espace entre lesdites portions de surface inférieure (84) et la surface dudit épaulement (78) tourné vers le haut est suffisamment important pour que le long d'une rangée des contacts (50, 50A, 50B) une barre de poussée puisse être introduite temporairement entre lesdits épaulements (78) tournés vers le haut et lesdites portions de surface inférieure (84) du boîtier, de sorte que les forces d'installation nécessaires pour monter avec serrage les portions de montage (64) puissent être transmises par l'intermédiaire dudit boîtier (40) et de ladite barre de poussée sur lesdits épaulements tournés vers le haut (78).

8. Combinaison selon la revendication 7, caractérisée en ce que :

chacune desdites portions d'extrémité supérieure (60) des contacts s'étend vers le haut depuis un premier côté (67) excentré de la surface dudit épaulement tourné vers le haut (78) pour laisser non obstruée la plupart de la surface qui est immédiatement au-dessus d'un second côté opposé (68) dudit épaulement tourné vers le haut ;
les contacts des première et deuxième rangées adjacentes (51, 52) sont orientés de sorte que les seconds côtés (68) desdits épaulements tournés vers le haut soient agencés au plus près l'un de l'autre pour permettre à une barre de poussée unique s'étendant le long desdites première et deuxième rangées adjacentes (51, 52) de s'appuyer sur les épaulements (78) tournés vers le haut des contacts des deux rangées adjacentes (51, 52) pour pousser simultanément vers le bas les contacts des deux rangées.

9. Combinaison selon l'une quelconque des revendications 7 ou 8, caractérisée en ce que :

ledit ensemble de connecteur comporte un boîtier inférieur (42) qui est muni de perçages (96, 142) destinés à recevoir les contacts qui reçoivent chacun la portion d'extrémité inférieure (62, 90) de l'un desdits contacts ;
le boîtier inférieur comporte une portion de surface supérieure (146) agencée en-dessous de ladite surface inférieure (46) de ladite carte à circuit imprimé, ladite portion de surface supérieure formant la majeure partie de la surface supérieure dudit boîtier inférieur, ledit boîtier inférieur comportant des déflecteurs (144) qui s'étendent vers le haut depuis ladite portion de surface supérieure (146) à côté de chacun desdits perçages (96, 142) du boîtier inférieur ; et
chaque déflecteur comporte une surface de déflexion (143) qui s'étend vers le bas et en direction d'un perçage correspondant, de sorte que lorsque l'extrémité inférieure (100) d'une portion d'extrémité inférieure (62) d'un contact est déplacée vers le bas, elle puisse être défléchie par la surface de déflexion vers l'intérieur de l'un desdits perçages.

10. Combinaison selon la revendication 9, caractérisée en ce que :

ledit boîtier inférieur comporte au moins un déflecteur allongé (144) qui s'étend entre deux rangées adjacentes de contact et qui s'étend au-dessus de la plupart du reste de ladite surface supérieure (146) du boîtier inférieur, ledit déflecteur comportant des côtés opposés qui forment chacun une pluralité de portions de déflexion pour l'une des deux rangées d'extrémité inférieure (100) de contact.

11. Combinaison d'un ensemble de connecteur (24, 26) sur une carte à circuit imprimé (34) selon l'une quelconque des revendications 7 à 10, caractérisée en ce qu'elle comporte de plus :

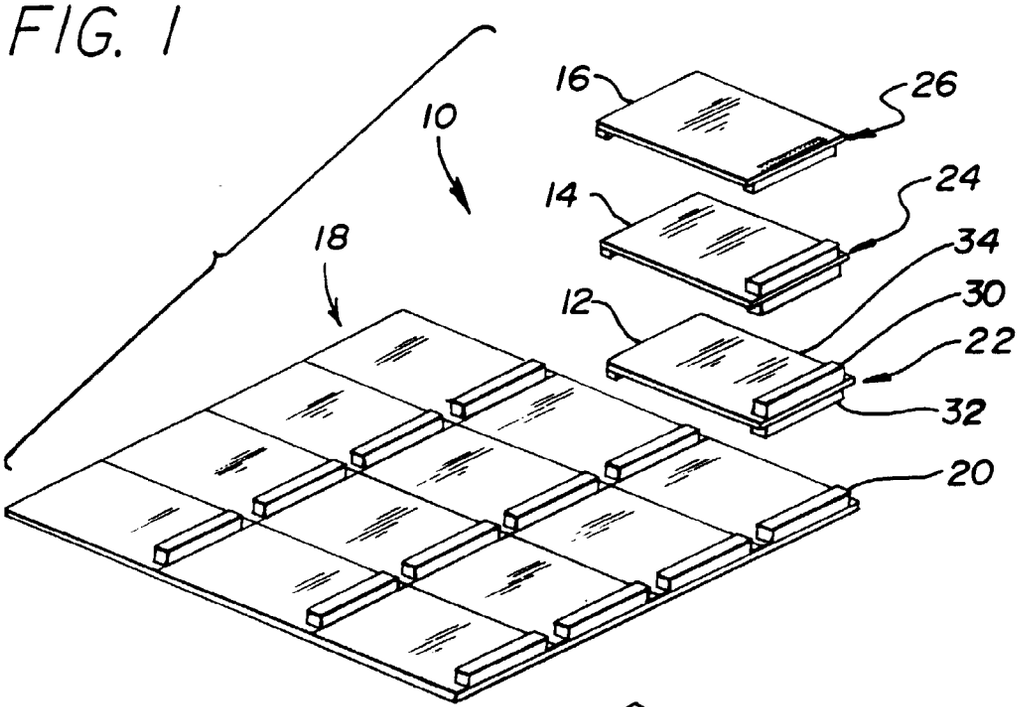
au moins une barre de poussée amovible (102, 104, 106) s'étend le long d'au moins une première desdites rangées de contacts (51-56) et s'étend entre lesdits épaulements (78) tournés vers le haut et ladite surface inférieure (84) du boîtier ; et
des moyens (180, 182, 184, 190) pour pousser contre le dessus (124) dudit boîtier (40) et contre le dessous de la carte à circuit imprimé (34) pour pousser lesdites portions de montage (64) à l'intérieur desdits perçages (66) de la carte en utilisant des forces de plusieurs fois 45 kg (plusieurs centaines de livres) transmises par ladite barre de poussée amovible (102, 104, 106).

12. Combinaison selon la revendication 11, caractérisé en ce que chaque contact (50) comporte une extrémité inférieure (62, 90), et comportant :

au moins une barre d'alignement allongée (120) d'axe (114) s'étend entre les extrémités inférieures (62, 90) des contacts de deux rangées adjacentes desdits contacts (51-56) ;
ladite barre d'alignement (120) comporte une largeur (W) supérieure à son épaisseur (T), ladite largeur étant légèrement supérieure à la distance entre des points desdites extrémités inférieures (62, 90) des contacts lorsque les extrémités inférieures sont non fléchies ;

des moyens pour tourner ladite barre d'alignement (120) autour de son axe (114) jusqu'à ce que des points de la barre opposés dans le sens de la largeur (W) arrivent en appui contre lesdites points des contacts pour écarter temporairement lesdites extrémités inférieures (64, 90) des contacts.

FIG. 1



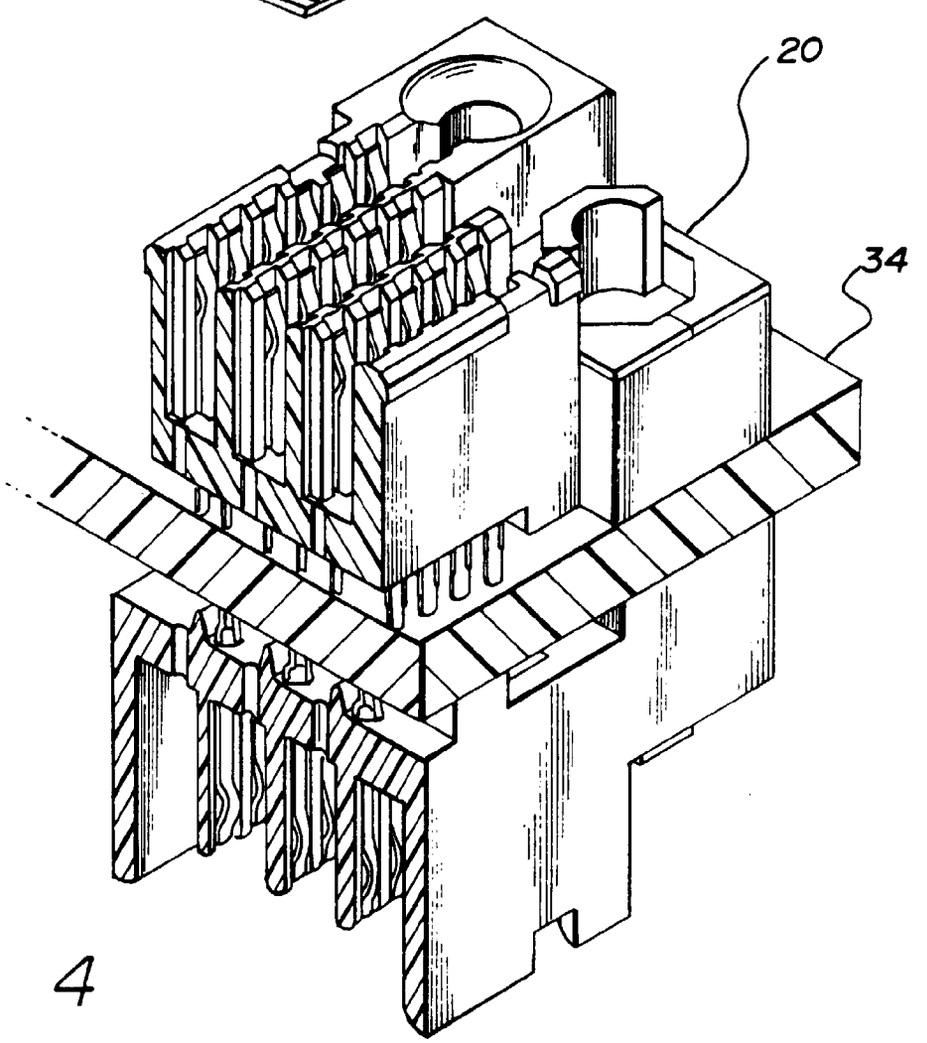


FIG. 4

FIG. 2

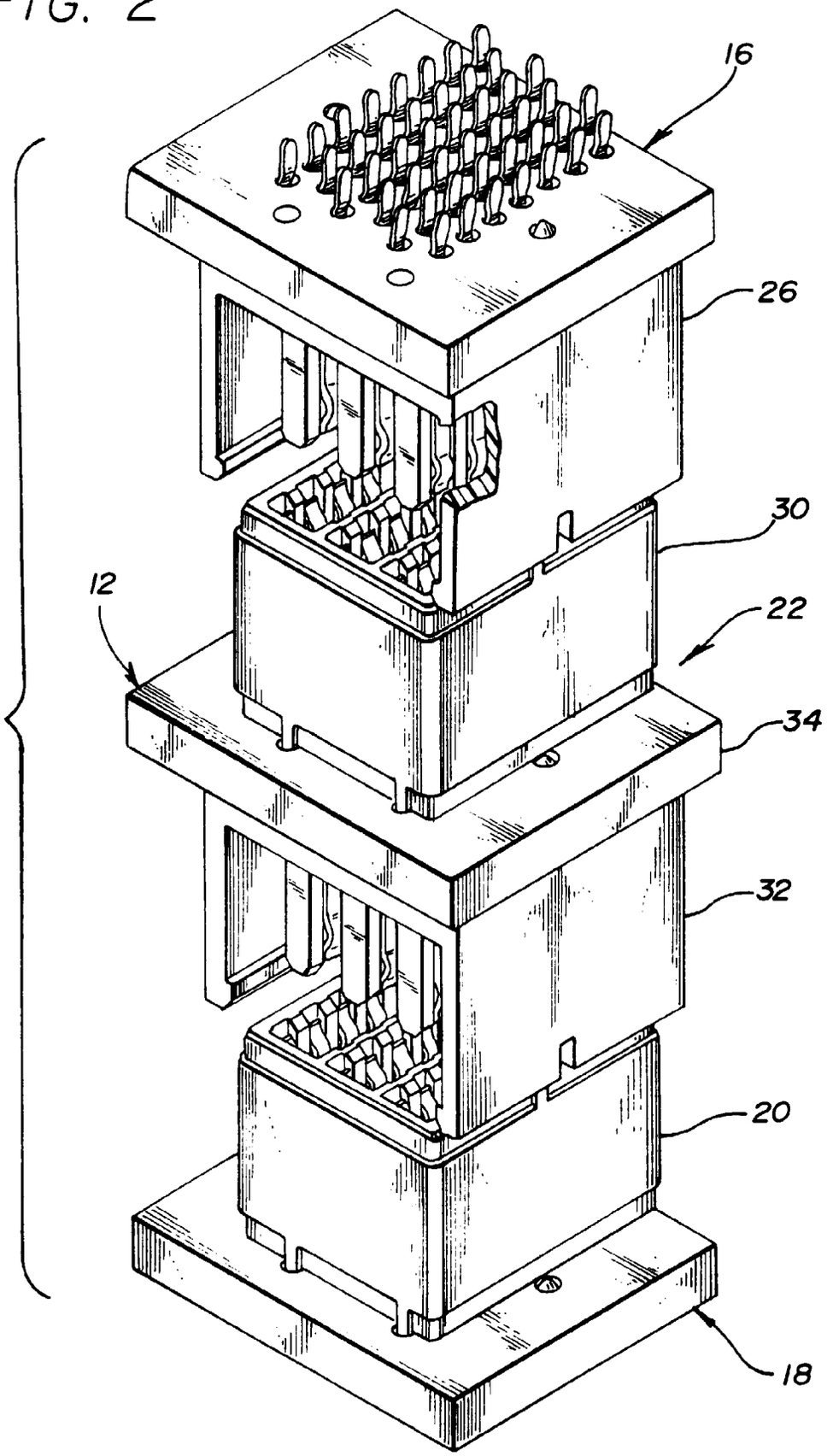
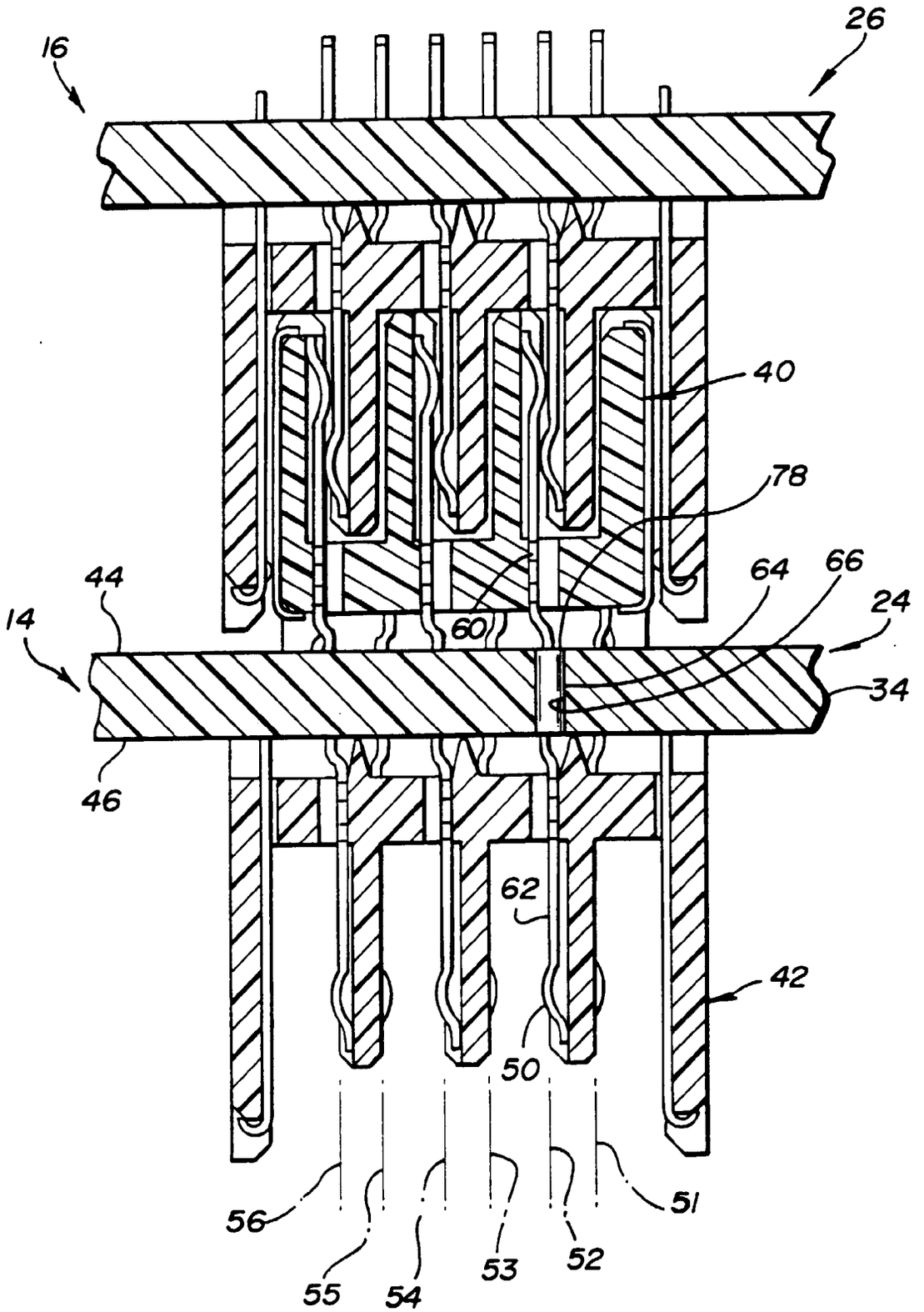


FIG. 3



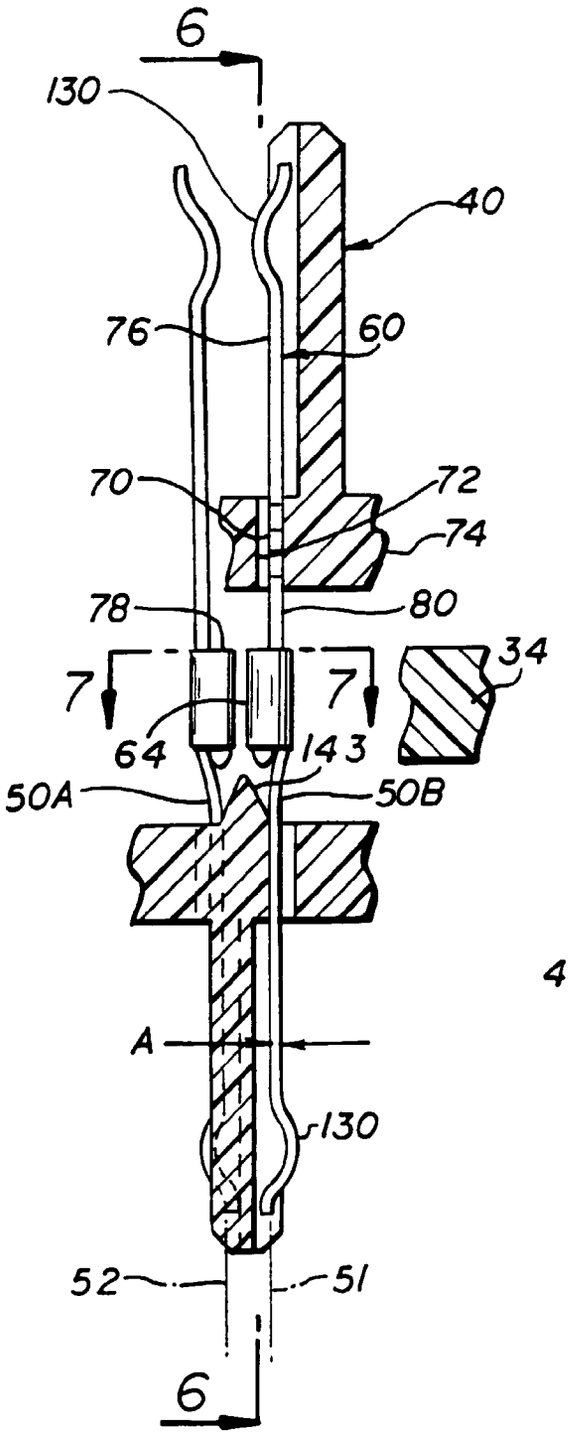
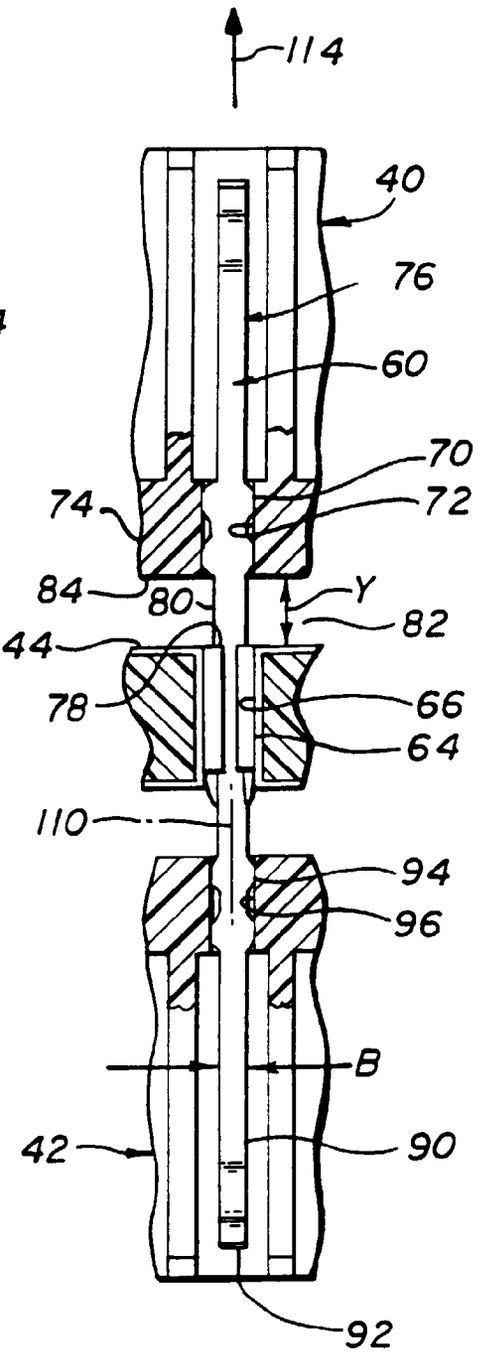

6
130
40
76
60
70
72
74
78
80
34
7
7
64
143
50A
50B
A
130
52
51
6

FIG. 5

FIG. 6


114
40
76
60
70
72
74
84
80
Y
82
44
78
66
64
110
94
96
B
42
90
92

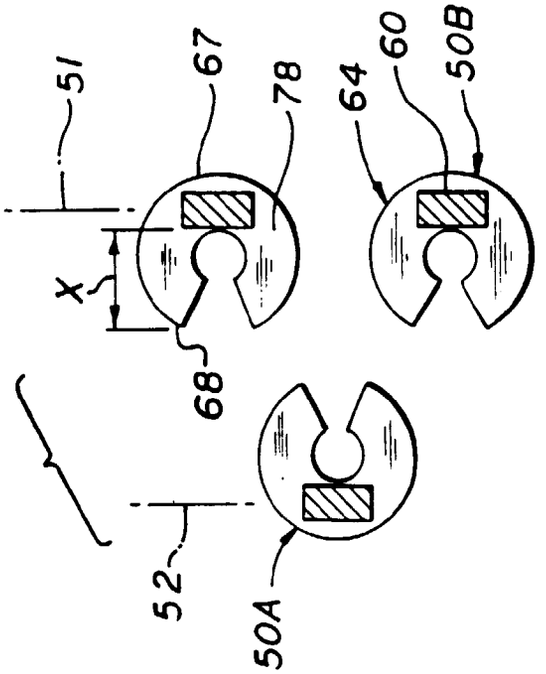


FIG. 7

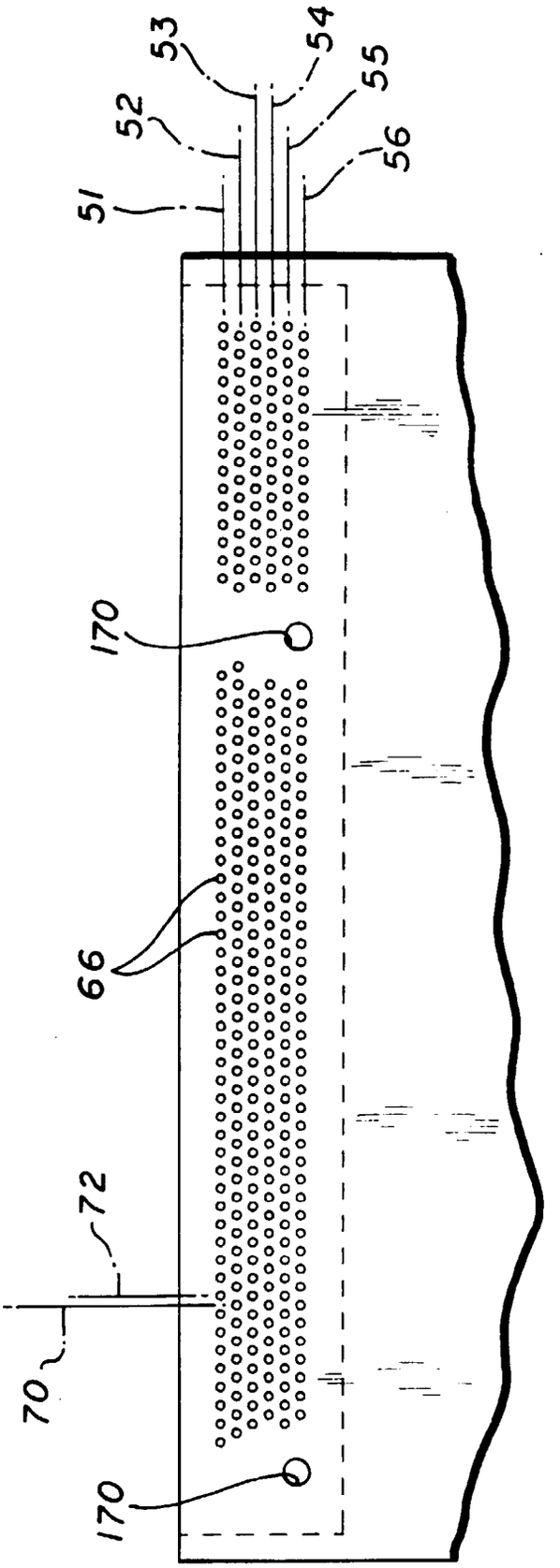


FIG. 8

FIG. 9B

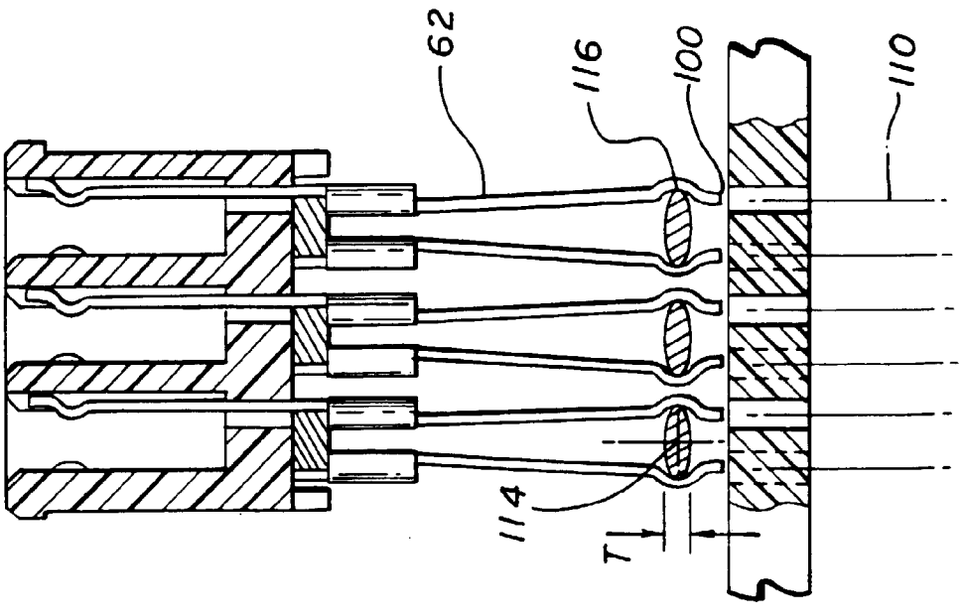
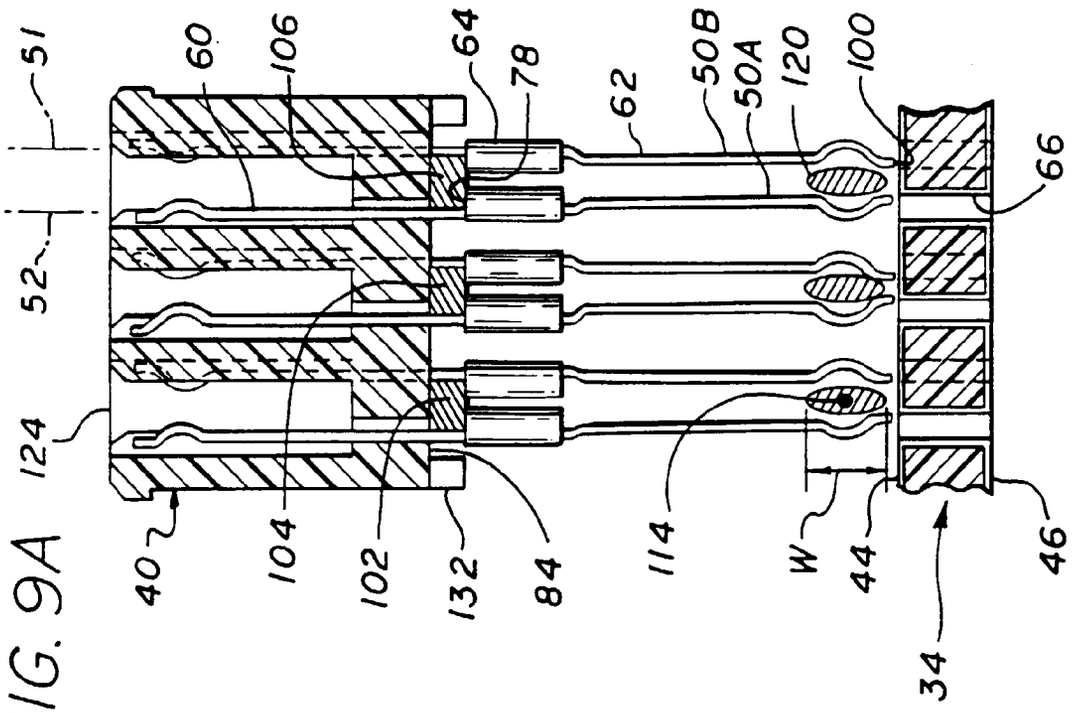

62
116
100
110
114
T

FIG. 9A


51
52
124
60
106
64
78
62
50B
50A
120
100
66
40
104
102
132
84
114
W
44
46
34

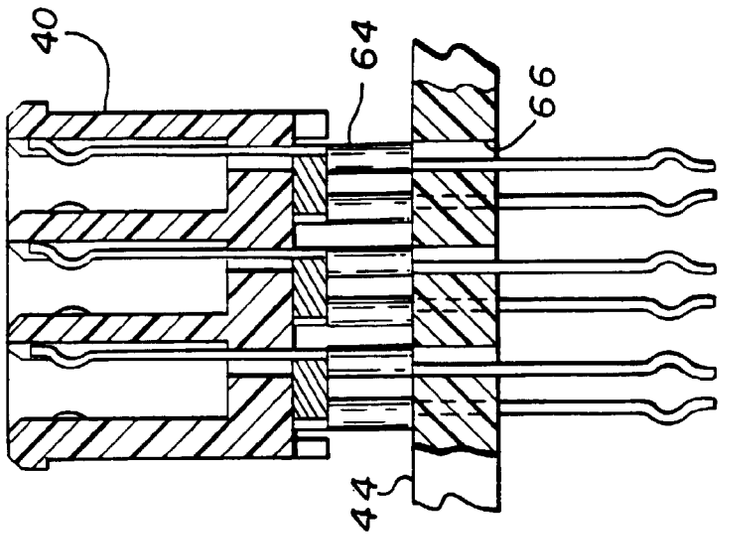


FIG. 9E

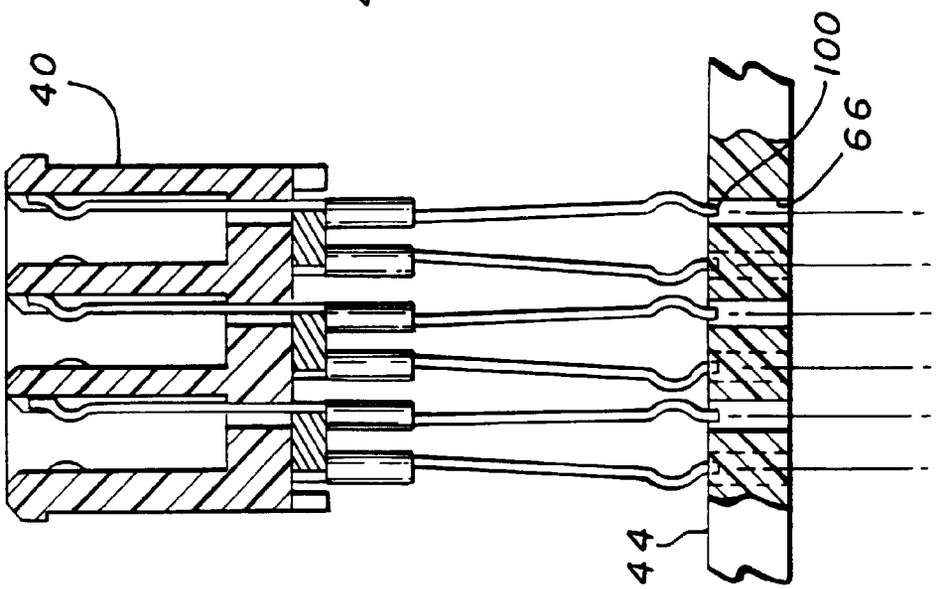


FIG. 9D

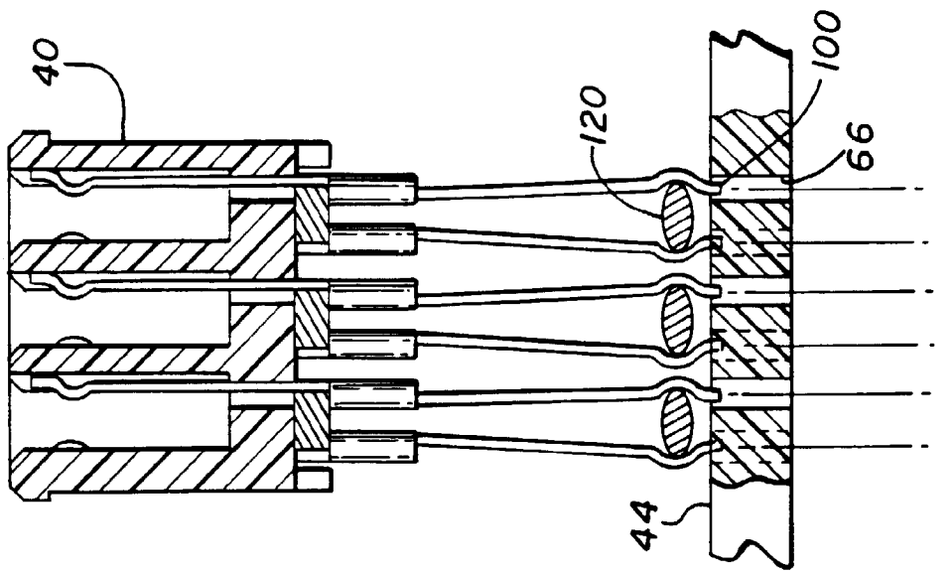
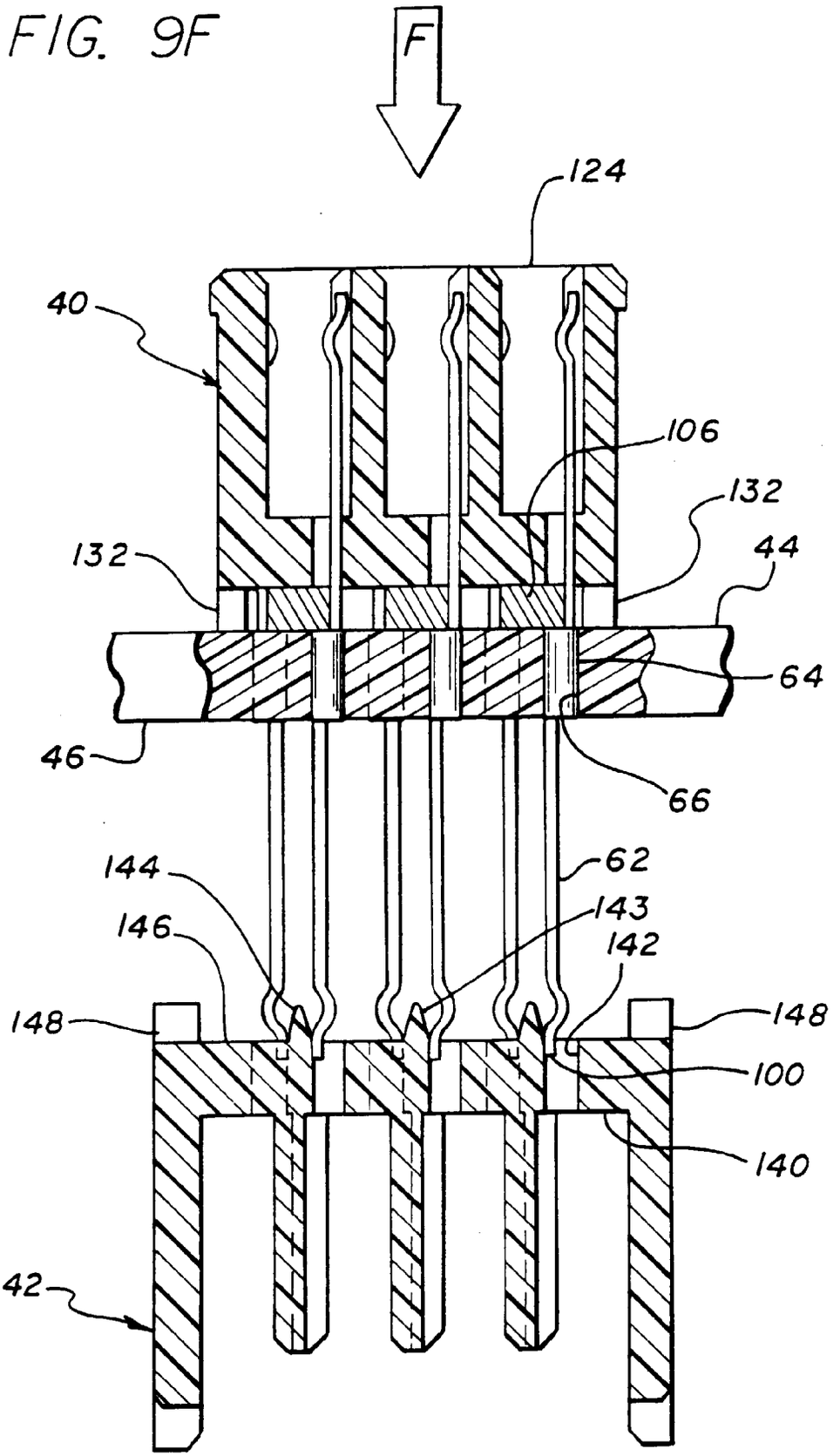


FIG. 9C

FIG. 9F


F
124
40
106
132
132
44
64
46
66
144
62
146
143
142
148
148
100
140
42

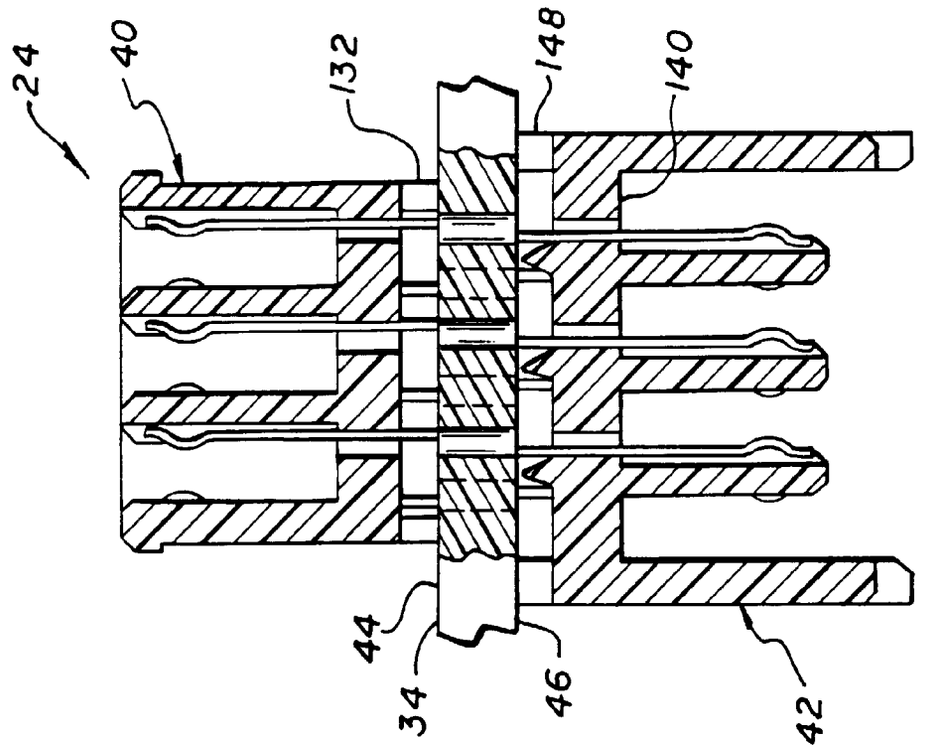


FIG. 9H

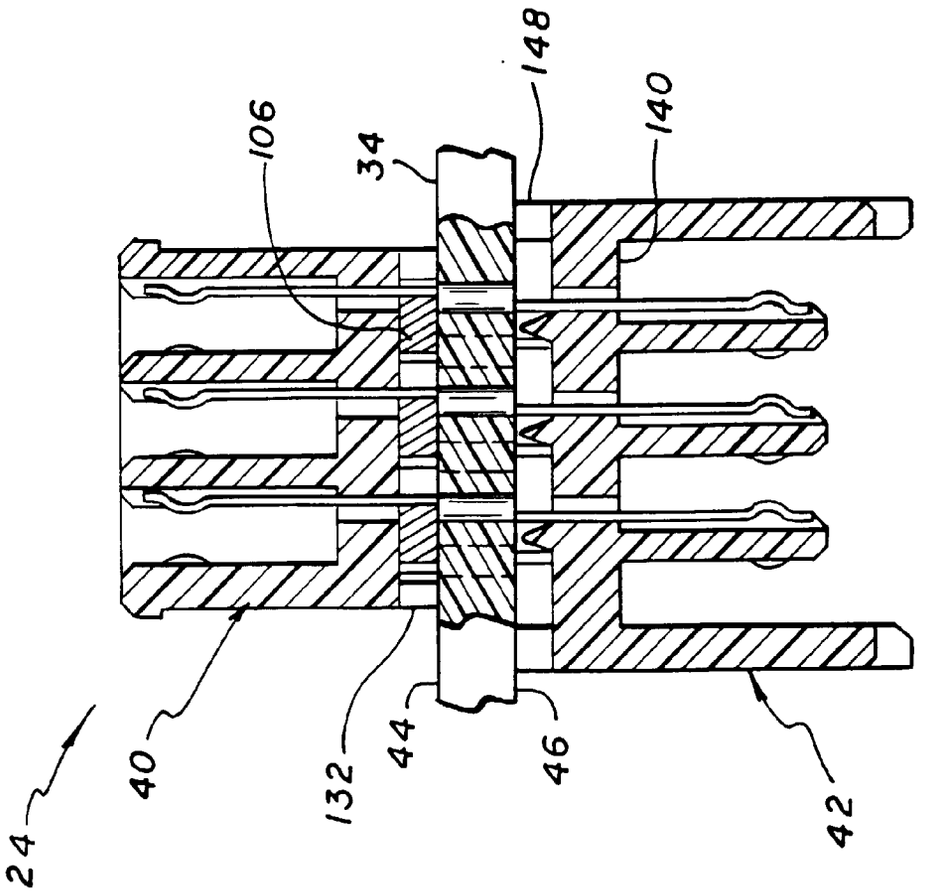


FIG. 9G

FIG. 10

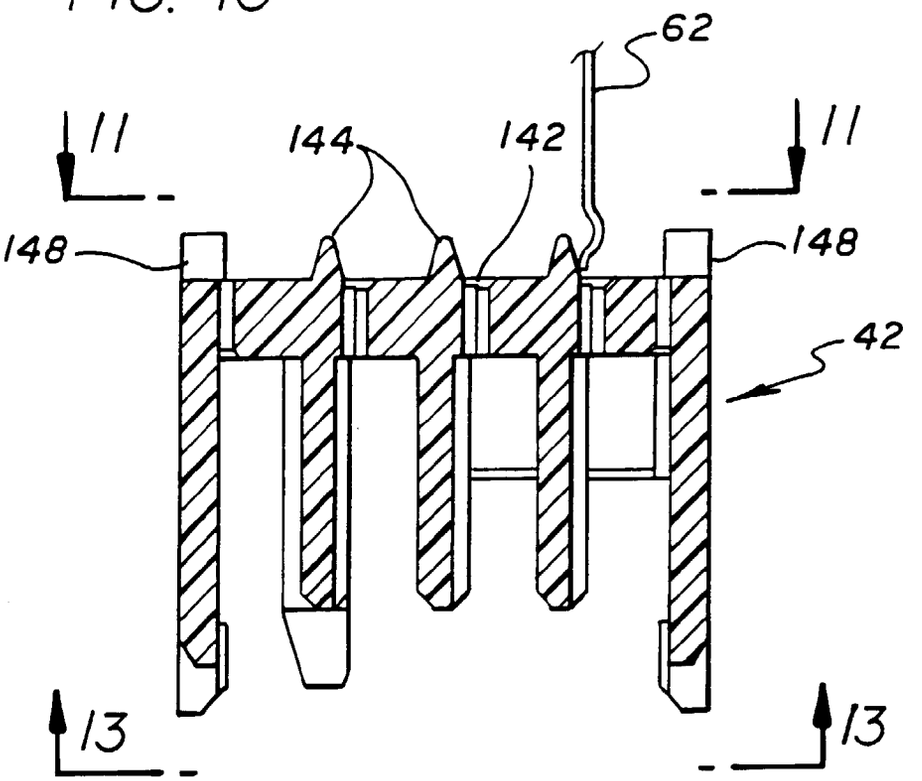


FIG. 11

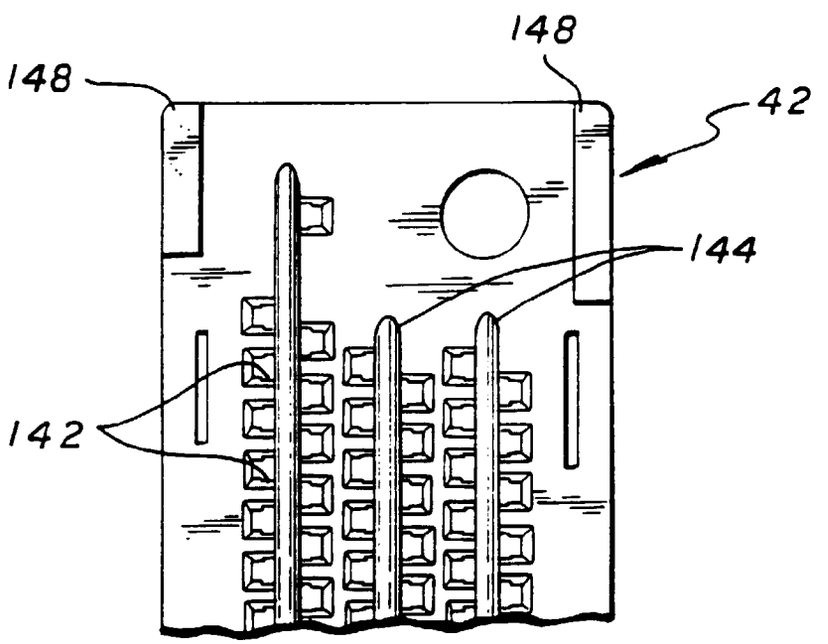
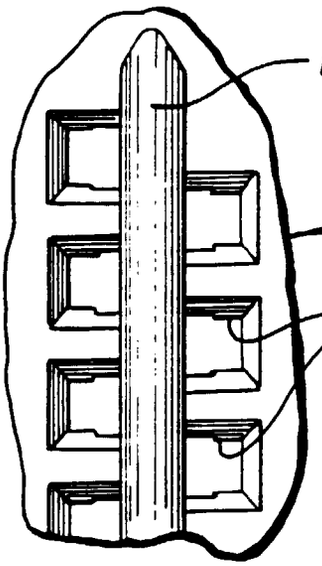


FIG. 12



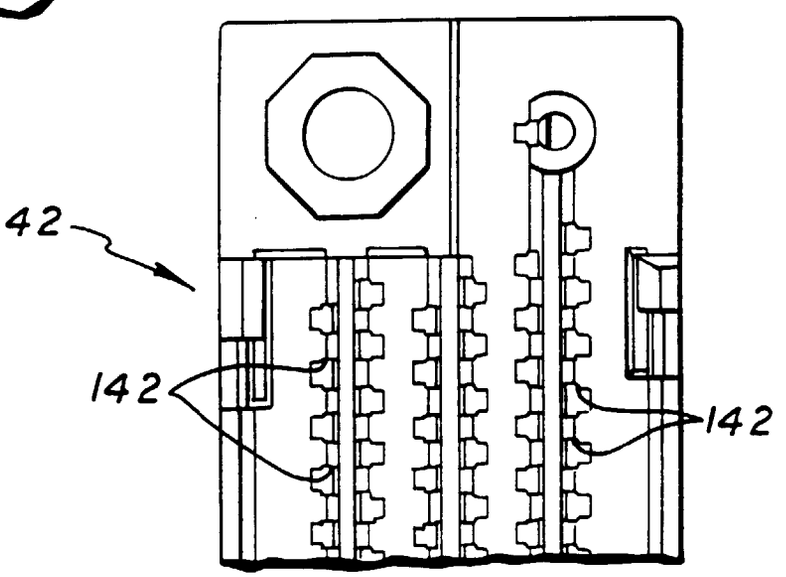


FIG. 13

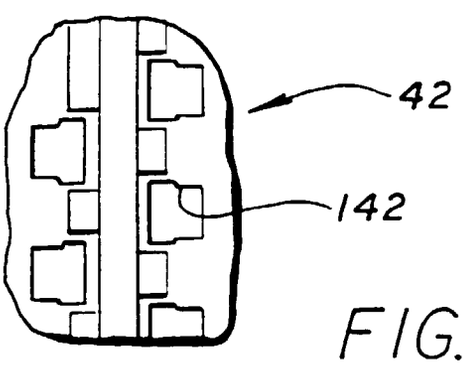


FIG. 14

FIG. 15

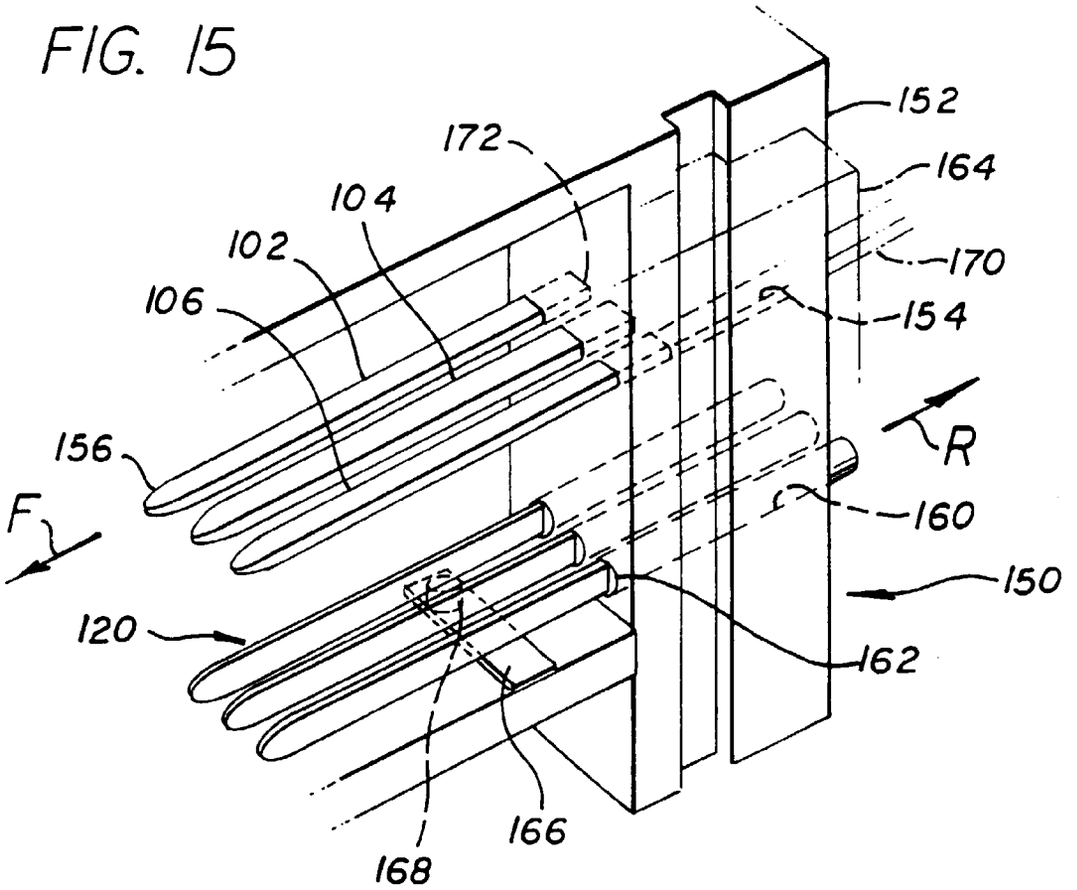
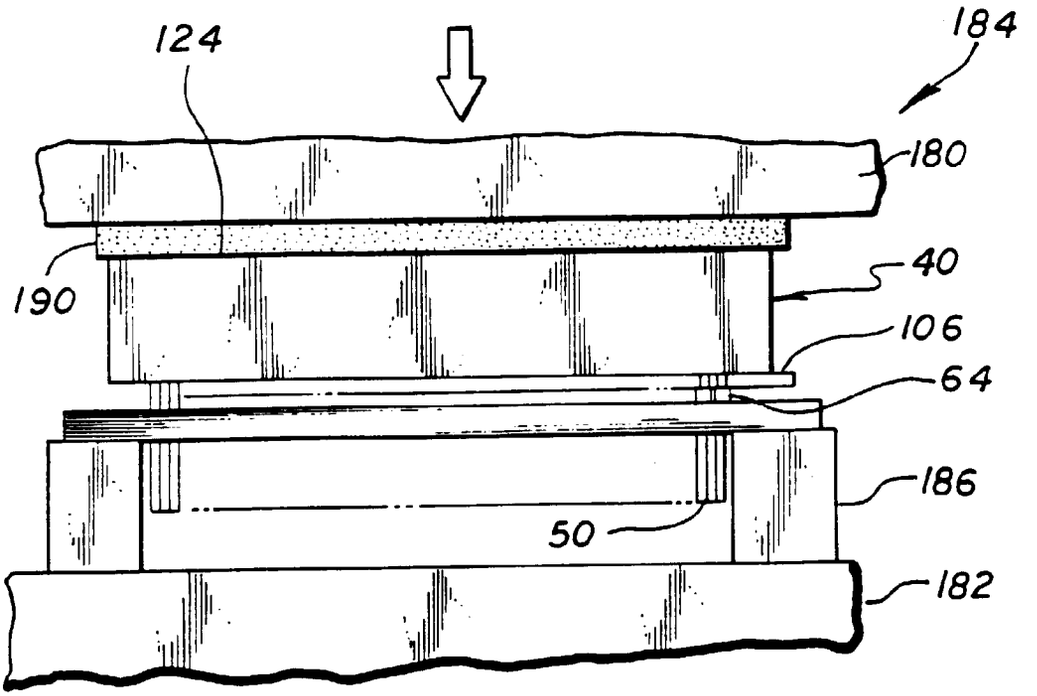

152
172
164
104
102
170
106
154
R
156
F
160
150
120
162
166
168

FIG. 16


124
184
180
190
40
106
64
186
50
182