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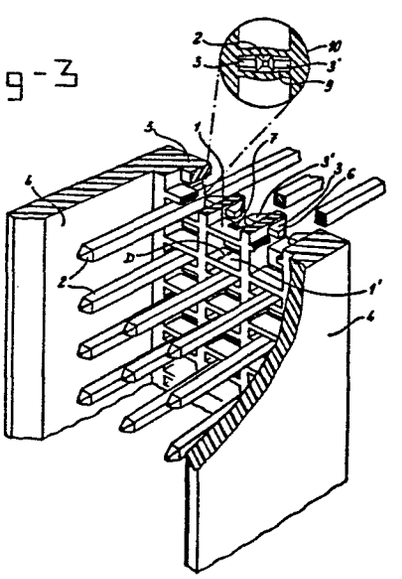
(54) Connector housing.

(57) A connector housing (4) of rectangular box shape having a bottom part (5) and walls, for accepting an array of electrical terminal pins (2) which, arranged in a predetermined pattern, pass through corresponding apertures (9) in said bottom part, whereby the one and/or other protruding ends of said terminal pins permit further electrical connection, such as to a printed circuit board, whereby each aperture has a substantially rectangular cross-section, on two opposite sides of which spring elements (1,1') are provided, the mutual spacing and arrangement of said spring elements in relation to terminal pin cross-section being such that, when inserted, a press-fit locking of the terminal pins is obtained.

Fig-3



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Connector housing.

The invention relates to a connector housing of rectangular box shape having a bottom part and walls, for accepting an array of electrical terminal pins which, arranged in a predetermined pattern, pass through corresponding apertures in said bottom part, whereby the one and/or protruding ends of said terminal pins permit further electrical connection, such as to a printed circuit board. Such a connector housing is known from European patent application 81,200080,0.

Such connector housings or shrouds find frequent application in the electrical and electronic industry. Here, in particular, an array of terminal pins according to a predetermined pattern make electrical connection to and from electrical or electronic circuits, for example a printed circuit board. In such applications the terminal pins with one end are inserted into or through corresponding holes in the printed circuit board; the subsequent connection being effected by either soldering or press-fitting. In case said terminal pins protrude at the other side of the printed circuit board, they can be readily used for further electrical connection. In many cases such terminal pins have a rectangular cross-section which will permit wire-wrapping for connection to wires.

The above mentioned European patent application describes a connector housing or shroud which is utilized to lock and position an array of terminal pins in a pre-determined pattern.

In practice in such connector assemblies problems are encountered with respect to relative positional mismatch due to associated tolerances. Said tolerances in receiving an array of terminal pins in corresponding apertures in a shroud greatly influence the rigidity and reliability of the connection of said pins and the life time of the connector assembly. Clearance in the locking of terminal pins in the housing adversely affects the connection. The terminal pin may get loose with respect to the electrical circuit e.g. printed circuit board, which unfavourably affects the engaging forces.

It is an object of the invention to provide means for improving the entry and subsequent locking of terminal pins in

the housing. The above mentioned problems associated with relative position mismatch of an array of terminal pins, which are possibly connected with an electrical circuit, are obviated.

The set objective, in accordance with the invention, is achieved in a connector housing of the type mentioned in the preamble such that each aperture in the housing is provided with spring elements in at least two opposite sides. The mutual spacing and arrangement of said spring elements in relation to terminal pin cross section are such that, once inserted, a press-fit locking of the terminal pins is obtained. This implementation according to the invention permits such a housing to be press-fitted as an integral unit over an array of terminal pins. Prior to this operation, however, said terminal pins may be press-fit or joined by soldering to an electrical or electronic circuit, such as a printed circuit board. Subsequently, when said housing is located over the terminal pin array, each pin is individually gripped by the corresponding recess in the housing and held in position. In the specification recess stands for aperture and its spring elements.

As individual terminal pins are press-fit and locked in position by individual pairs of spring elements, the following advantages are obtained:

- reduction of position mismatch between an array of terminal pins, and corresponding recesses in the housing;
- reduction of problems associated with excentricity of recess axis with respect to the outer diameter of recess;
- compensation of skew of individual terminal pins; and
- compensation of problems due to tolerance of recess location with respect to the housing periphery.

These above mentioned compensation features inherent to the invention permit considerable freedom in connector tolerances.

Furthermore, since a large number of terminal pins are simultaneously press-fitted and locked in the housing, associated forces during engagement are not local. Rather these forces are evenly distributed over the bottom of the housing and also over corresponding area on connected circuit, such as

a printed circuit board. This reduces the likelihood of rupture in a localized area of individual connection of press-fit terminal pins.

A further advantageous embodiment of the housing having a rectangular box shape with bottom part and walls, whereby the aperture pattern is located in the bottom part, is characterized in that each aperture is rectangular in cross section having spring elements on its two opposite sides. The other two opposite sides may have cams protruding towards the center of the aperture, which cams further facilitate terminal pin insertion.

In another advantageous embodiment the spring elements are formed by two opposite walls of each individual aperture, which walls are of thin construction.

In a further advantageous embodiment, each spring element is arc-like in shape, whereby its apex is towards the center of the aperture. Also, each spring element can be substantially V-shaped with its concave open end directed towards the center of the aperture. Also, each spring element can be of oblong shape being arranged in each aperture mutually parallel or crossed and at an angle to the bottom of the housing; whereby each spring element can at one end be lightly hinged to the wall of the aperture, its other end being free.

Advantageously, the spring elements are integral with the housing and therefor, both are made of the same plastic material.

The invention will be explained on the basis of various embodiments with reference to the drawings, in which identical parts in the figures have the same reference numbers, and in which:

figure 1 shows an example of a housing representative of the state of the art;

figures 2a/2d show views of a recess and of the receipt of a terminal pin in this recess in a housing according to the invention;

figure 3 shows a perspective view of a housing according to the invention, whereby a cut-away area permits a view of inserted terminal pins;

figure 4 shows a perspective view of the housing shown in figure 3 and an array of terminal pins mounted on a printed circuit board;

figures 5a/5d show bottom views of various embodiments of the spring elements according to the invention;

figure 6 shows a side view of one terminal pin having a local broadening of cross-section diameter to provide better locking by the spring elements;

figures 7a/7a show side views of a connector assembly having two housings located on either side of a printed circuit board, firstly in figure 7a according to the state of the art and secondly in figure 7b according to the invention; and

figure 8 shows a perspective view of a further housing according to the invention, which is already provided with terminal pins.

Figure 1 shows a cross section of a part of a connector housing of the state of the art, in which connector housing the terminal pins 2 are inserted through the corresponding recesses 9 of the bottom part 5 of the housing 4. Such housings or shrouds are in wide use in order to lock and position arrays of terminal pins which are already mounted to electrical or electronic circuits, such as printed circuit boards. It is very important that such a housing is locked to the terminal pins in a closely fitting manner to eliminate problems associated with relative position tolerances of the terminal pins.

The figures 2a/2d show some examples of a recess and of the press-fit locking of a terminal pin in this recess located

in the bottom part of a plastic housing or shroud.

Figure 2a shows a simple version of one recess located in the bottom of a housing. Its two relatively thin sidewalls form two spring elements which are integral with the plastic material of the housing. The thickness of these elements is T. These spring elements 1, 1' extend over the length of the aperture 9 and parallel to the surface of the bottom. The spacing X between the walls 1, 1' is slightly smaller than the lateral size of the terminal pin 2 to be inserted, as shown in figure 2b. Here a terminal pin 2 having a square cross section is inserted into the recess. During this insertion the two plastic spring elements must deflect to receive and lock the terminal pin. The resulting lateral forces, working in opposite directions from the spring elements on the pin, cooperate with the corresponding contact area of this pin due to which the pin is locked in the corresponding recess.

Figure 2c shows a further variant in which in each recess two opposing cams 3 and 3' are mounted. Again these cams are integral with the plastic material surrounding the aperture. The function of these cams is to contribute to a proper centering of the terminal pin as is shown in figure 2d. Here an individual terminal pin having rectangular cross section, is received and locked by two opposing forces exercised by the spring elements. The opposed cams 3 and 3' facilitate the central positioning of the terminal pin in the recess. Both the spring elements and the cams can be advantageously provided with lead-in entry surfaces to ensure an easier insertion of the pin.

Figure 3 gives a view of a housing, a part of which is cut open in order to illustrate the insertion apertures 9 and the terminal pins 2 accepted in these apertures. One of the apertures and its surrounding wall is shown in more detail as a segment 10. The housing specifications are equivalent to those mentioned in DIN 41612, The rectangular housing consists in essence of two standing side walls 4 and a bottom part 5. This bottom part has three rows of 32 apertures 9 provided in a raster pattern. Each aperture 9 is provided on two longitudinal walls

with the spring elements 1 and 1', and on the two transverse walls with the two opposing cams 3 and 3'. The cams 3 and 3' are located at the entry zone of the recess near the bottom of the housing. The cams have lead-in faces 7. Only a single moulding or stamping operation is required to form the total housing including all apertures, corresponding spring elements and cams.

For application in a further connector system reference is made to figure 4. An array of pins 2 is press-fitted to a printed circuit board 8. Such pins can also be soldered to the printed circuit board. The housing is provided with a raster of corresponding apertures having plastic spring elements and cams. The housing can be press-fitted integrally over the array of pins. In this way each terminal pin is first mounted to the printed circuit board and subsequently press-fitted into the housing. As the individual pins are locked between the individual pairs of spring elements and cams, this arrangement can compensate for mismatch due to relative position tolerances in an array of pins. This mismatch can be caused by position tolerance of the recesses, excentricity of recess axis with respect to outer diameter of recess, skew of individual terminal pins and also tolerances in position of recess axis with respect to the housing periphery. By the use of present invention associated connector tolerances are more easily accomodated and compensated.

Furthermore, since many terminal pins are simultaneously press-fitted by the connector housing, engagement forces are distributed more evenly over the total bottom surface of the housing and also over corresponding area on the printed circuit board. This reduces the likelihood of rupture in a localized area of an individual connection of a press-fitted pin with a printed circuit board.

Although the housing according to the invention can be used to advantage in accordance with specifications of those of DIN 41612, it can also be used for connectors of other types. For example, in these cases the terminal contacts may have a tail which can cooperate with suitable plastic spring elements in order to obtain a press-fit locking after insertion.

The spring elements can also be implemented in a form other than the rectangular shape along the wall. Figures 5a/5d show various further embodiments of spring elements.

Figures 5a and 5b show an example of a substantially arc-like embodiment of the spring elements. These can be implemented both separate from the wall and integral with the wall. Although not shown, cams can be provided which have substantially the same arc-like form. Figure 5c shows spring elements which have substantially a V-form. In this embodiment, instead of a terminal pin having a rectangular cross section, a terminal pin having a round cross section can advantageously be inserted and locked.

In the above examples the spring elements are parallel to the bottom surface of the housing. They can, however, also be positioned at an angle to the bottom surface of the housing. Also, the spring elements can be parallel or crossed with respect to each other and simultaneously at an angle to the bottom. Figure 5d shows an example of two parallel spring elements at an angle to the longer end of the bottom surface. It is obvious that an increased length of spring elements, which are mutually parallel or crossed, can be used to influence the forces occurring during insertion of the terminal pin and to obtain a better compensation of position tolerances.

Furthermore, the invention is not restricted to the case in which the spring elements extend over the total width of the apertures. Each spring element can be slightly hinged at one end and integral with the material of the housing, while the other end is left free. Also the spring element can be mounted with both ends to the wall of the aperture, while the central part of one or both spring elements is able to displace slightly under influence of the inserted terminal pin.

It is obvious that varying the depth D (figure 3) and the thickness T (figure 2a) of the individual spring elements, and the spacing X (figure 2a) of the apertures are important factors in the total press-fitting of the housing. This is essential as relatively large holes in a printed circuit board entail a low retention force to the corresponding terminal pin.

Also, when housing lockking force between an individual recess and terminal pin is high, this terminal pin may be pushed out of the associated printed circuit board. The press-fit force can be maintained within specified limits by controlling the thickness and depth of the spring element in addition to its form as shown in figures 5a/5d.

Figure 6 shows again a further variant in which the size of the cross section of the aperture in the housing and the form of the spring elements are adapted to the size of a thickening incorporated in the diameter of the terminal pin 2. In an embodiment of a defined connector this can consist of two adjacent protrusions 12 on the terminal pin 2 (figure 6) such that when being locked in the housing the sharp edges of the spring elements (1, 1') get fastened in the notch between the two protrusions 12. In a further embodiment the terminal pin, either individually or besides the two protrusions of figure 6, can comprise a single protrusion for locking this pin in a printed circuit board. In the latter case only one protrusion is required.

Besides possible problems as to position tolerances of the terminal pins, the individual terminal pins can also have tolerances in length and in position of the point with respect to the printed circuit board as a result of certain adjustments of the operation machines during the process of mounting the pins into a printed circuit board.

The above mentioned European patent application 81,200080,0 describes the use of a spacing element to position and lock two housings on both sides of a printed circuit board, as shown in figure 7a. The apertures 9 in the housings 4 are smooth due to which this embodiment needs a separate spacing element 11 to position the two housings 4 with respect to the printed circuit board 8 in a manner not shown in this figure.

In the embodiment according to the invention shown in figure 7b, the points of the array of terminal pins press-fit in the printed circuit board can be fixed accurately at a correct distance from the bottom of the first housing 4".

Subsequently the second housing 4' can be positioned at the other side of the printed circuit board in press-fit engagement with the array of projecting pins. If required, a distance between the bottom of the housing 4' and the printed circuit board can be maintained. It is obvious that the present housing in figure 7b of the invention constitutes an improvement over the known arrangement according to figure 7a. The need for the known spacing element 11, as indicated in figure 7a, is now eliminated.

In again a further embodiment of the connector the array of terminal pins can be mounted initially in a first housing. Subsequently this assembly can be placed as an integral unit over an array of corresponding holes in a printed circuit board. The pins are fixed either by press-fitting or by soldering. Finally, the second housing can be press-fit over the terminal pins protruding at the other side of the printed circuit board.

It is obvious that the invention is not restricted to the illustrated embodiments, but that modifications and additions are possible without exceeding the scope of the invention. E.g. individual connectors provided with an array of terminal pins can be press-fit with the tail ends of the pins in a housing according to the invention. These tails of different cross sections protrude beyond the bottom of the housing.

Thus, figure 8 shows an example of a housing in which the array of pins is already taken up in the bottom of the housing, indicated on the left part of figure 8, such that the press fitting section present on each pin as a local thickening, protrudes beyond the housing on the left side. Subsequently, the housing with the protruding tail ends of the pins, is placed in the corresponding holes of a printed circuit board (not shown) on the left of said housing, and is pressed onto this printed circuit board. During this pressing operation, the pins can conform to the pattern of the holes of the printed circuit board. Although all pins protruding to the left are provided with a thickening, this thickening, for convenience's sake, is shown only on the first pin of a row. Thus, in this embodiment as male connector, a press-fit locking of the pins

in the plastic spring elements of the housing together with a press-fit locking of the metal pins in the printed circuit board is obtained.

There is also the possibility to implement the housing as female connector, as shown on the right of figure 8. This entails that this housing comprises pins or contact springs press-fit therein. Further, straight tail parts protrude on the right of the housing. Each of these tails may again have a press-fit section which permit fixation to an additional printed circuit board (not shown) at the right of the housing. This female connector thus accomodates a press-fit locking of the pins or contact springs in the plastic spring elements in the housing and a also press-fit locking of the metal tails in the printed circuit board.

The male and female connector part, each of which is possibly provided with a printed circuit board, can then be interconnected. The pins projecting on the right of the male connector part may also have the form of a contact spring, which contact springs can then be introduced into the corresponding recesses in the female connector part.

CLAIMS.

1. A connector housing of rectangular box shape having a bottom part and walls, for accepting an array of electrical terminal pins which, arranged in a predetermined pattern, pass through corresponding apertures in said bottom part, whereby the one and/or other protruding ends of said terminal pins permit further electrical connection, such as to a printed circuit board, characterized in that each aperture has a substantially rectangular cross-section, on two opposite sides of which spring elements are provided, the mutual spacing and arrangement of said spring elements in relation to terminal pin cross-section being such that, when inserted, a press-fit locking of the terminal pins is obtained.

2. A connector housing according to claim 1, characterized in that the apertures each at the other two opposite sides are provided with cams protruding towards the center of the aperture, which cams failitate terminal pin insertion.

3. A connector housing according to claim 1 or 2, characterized in that the spring elements are formed by two opposite walls of each aperture, which walls are of thin construction.

4. A connector housing according to one of the claims 1-3, characterized in that each spring element has at least partly an arc-like shape, its apex being directed towards the center of the aperture.

5. A connector housing according to one of the claims 1-3, characterized in that each spring element has a substantially V-shape, its open side being directed towards the center of the aperture.

6. A connector housing according to one of the claims 1-3, characterized in that each spring element has an oblong shape being arranged in each aperture mutually parallel or crossed at an angle with respect to the bottom of the housing.

7. A connector housing according to claim 6, characterized in that the spring elements are lightly hinged to the wall of the aperture.

8. A connector housing according to one of the preceding claims, in which the housing is made of plastic, characterized in that the spring elements, being integral with this housing, are also made of

plastic.

9. A connector housing according to one of the preceding claims in which the terminal pins are made of metal, characterized in that the terminal pins are provided additionally with two adjacent protrusions, between which the edges of the spring elements get fastened.

10. A connector housing according to one of the preceding claims, characterized in that the terminal pins are provided additionally with a single protrusion on its tail protruding from the housing to obtain a press-fit locking in a printed circuit board.

Fig-1

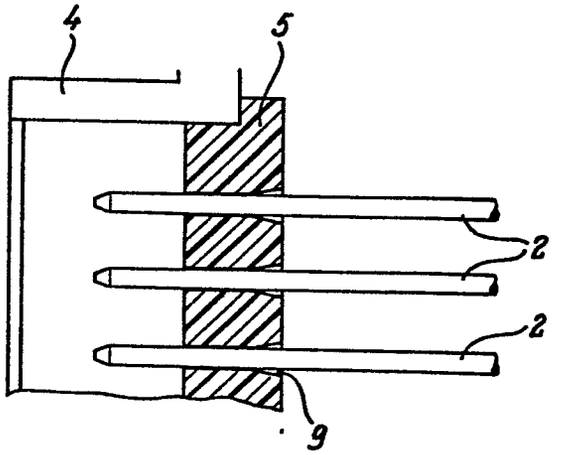

Fig-2

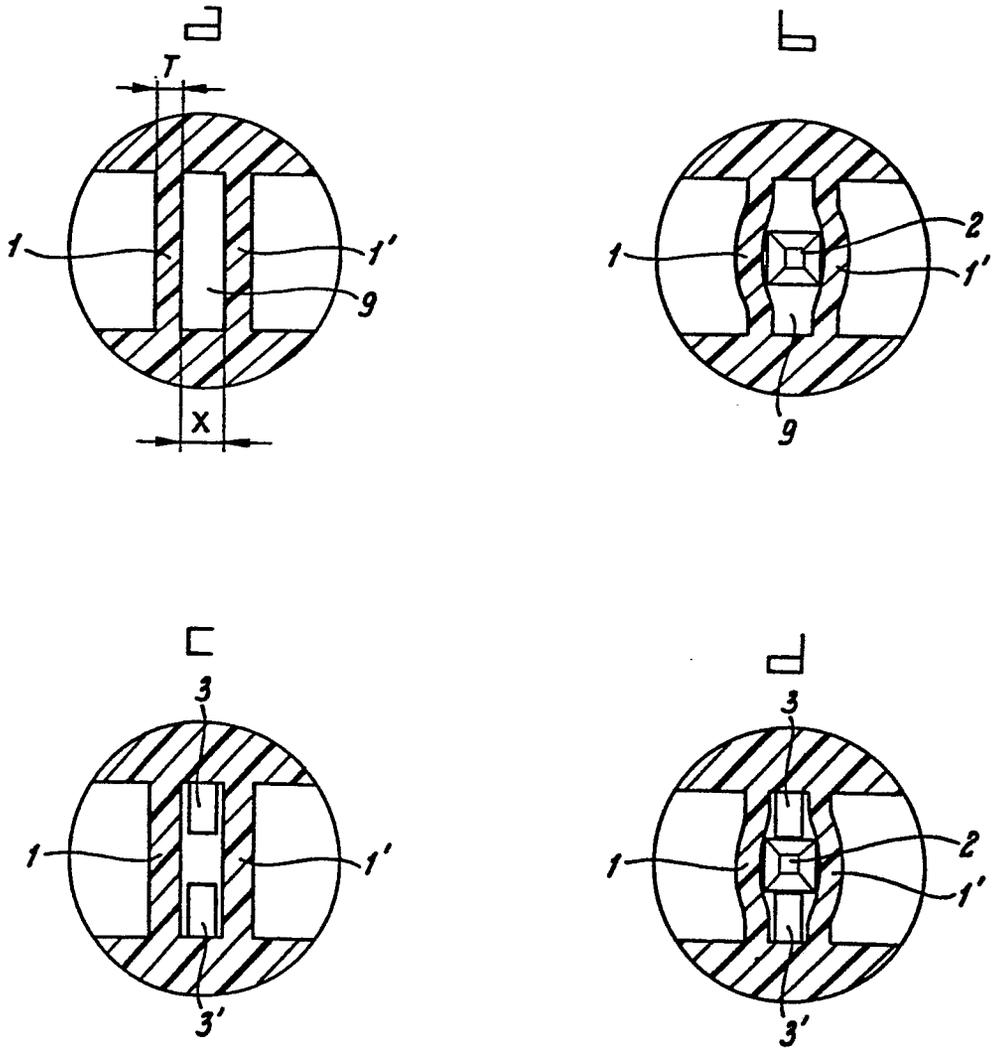

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Fig-3

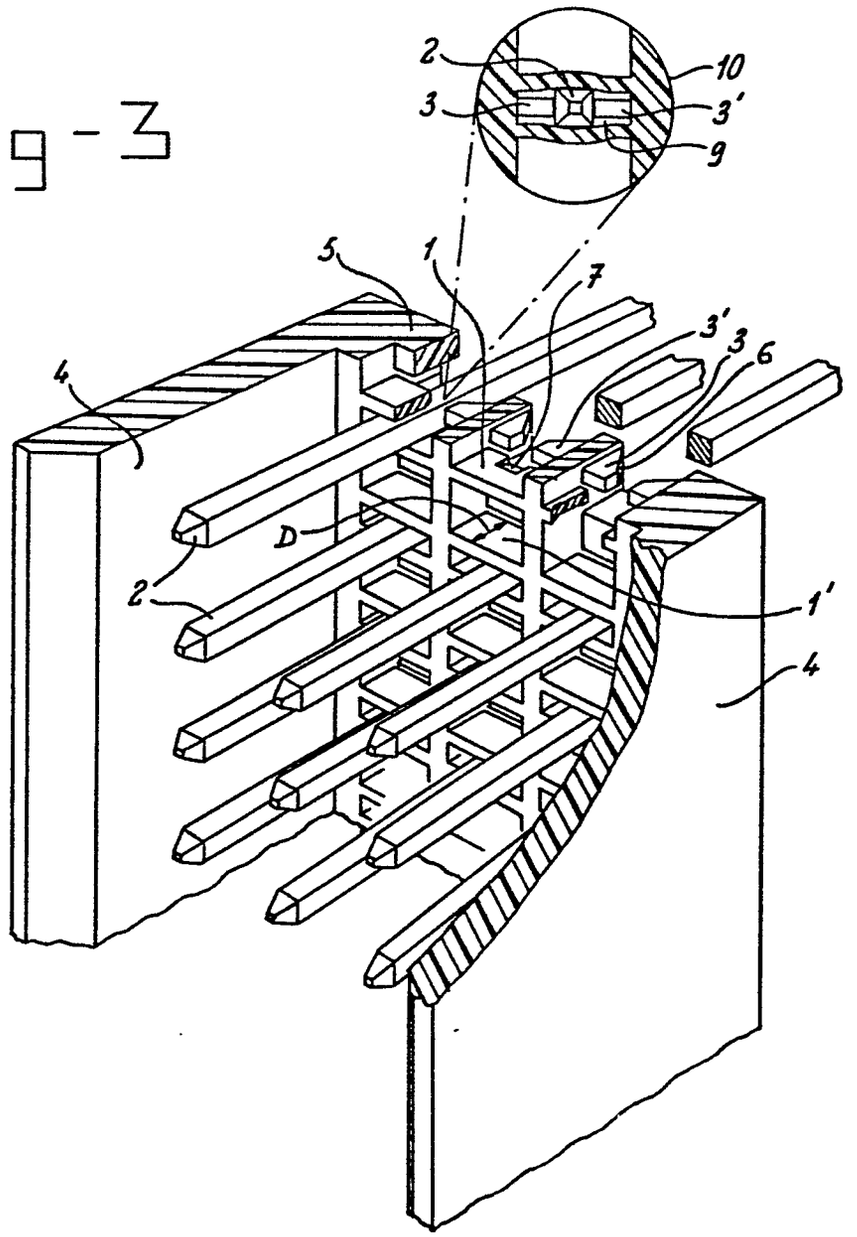


Fig-6

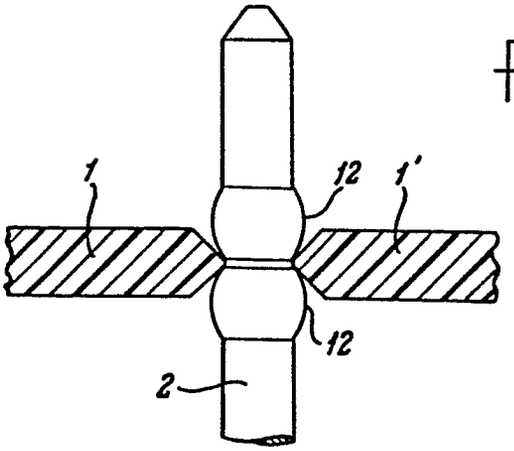


Fig-4

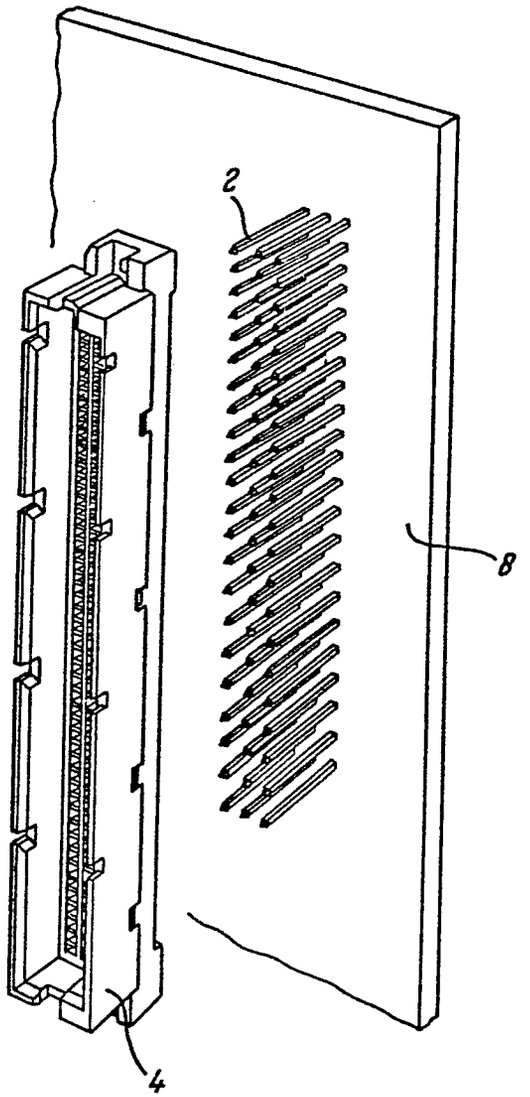


Fig-5

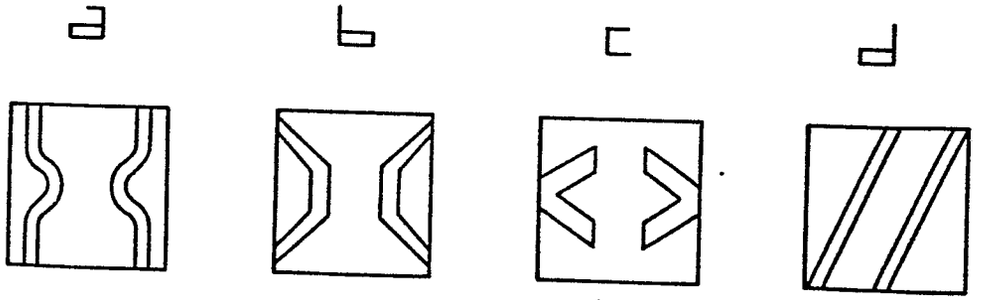


Fig-7a

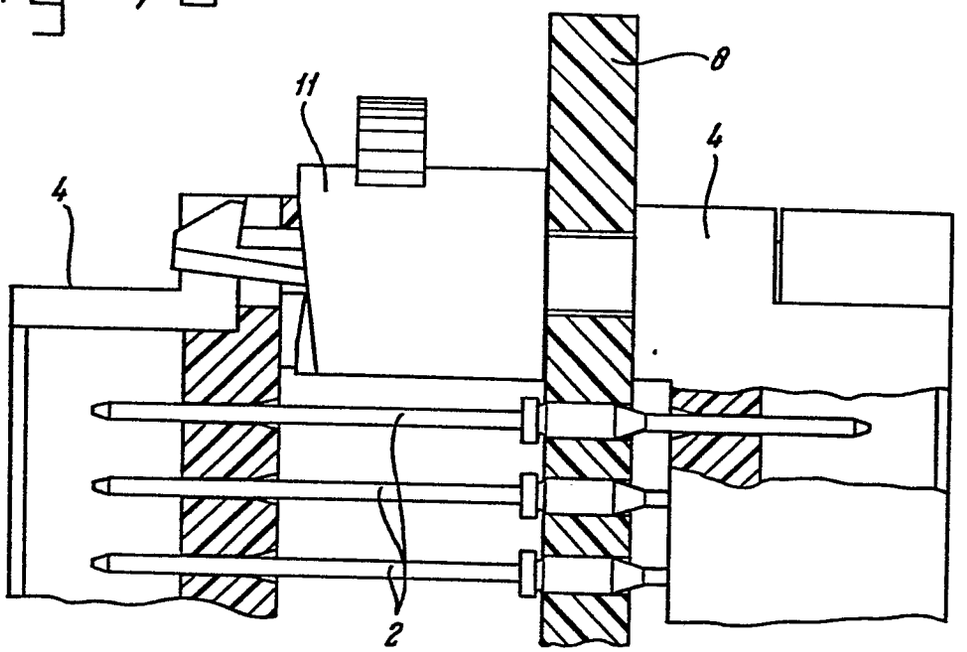
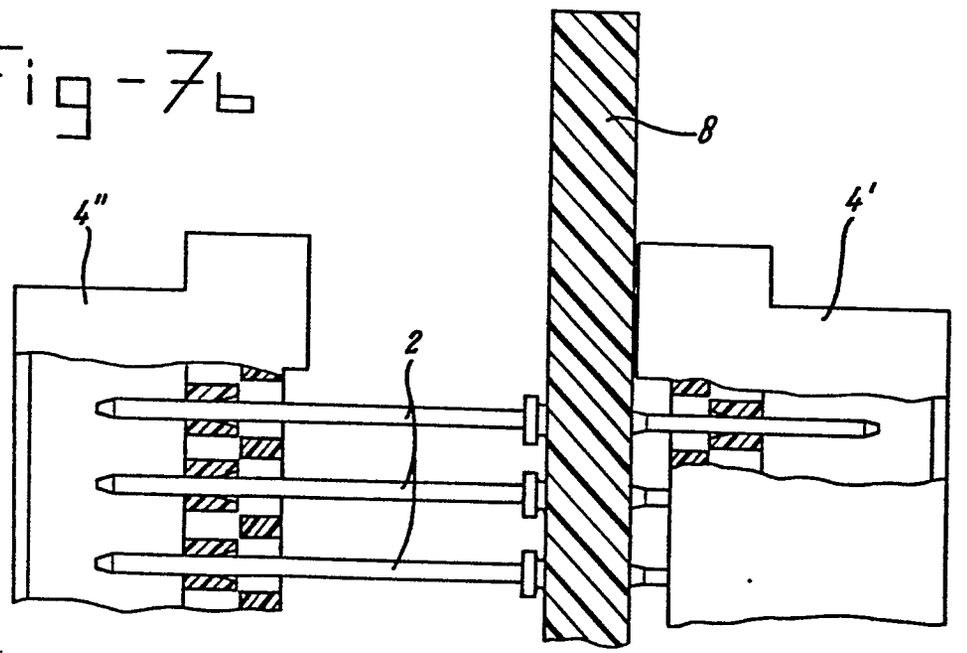


Fig-7b



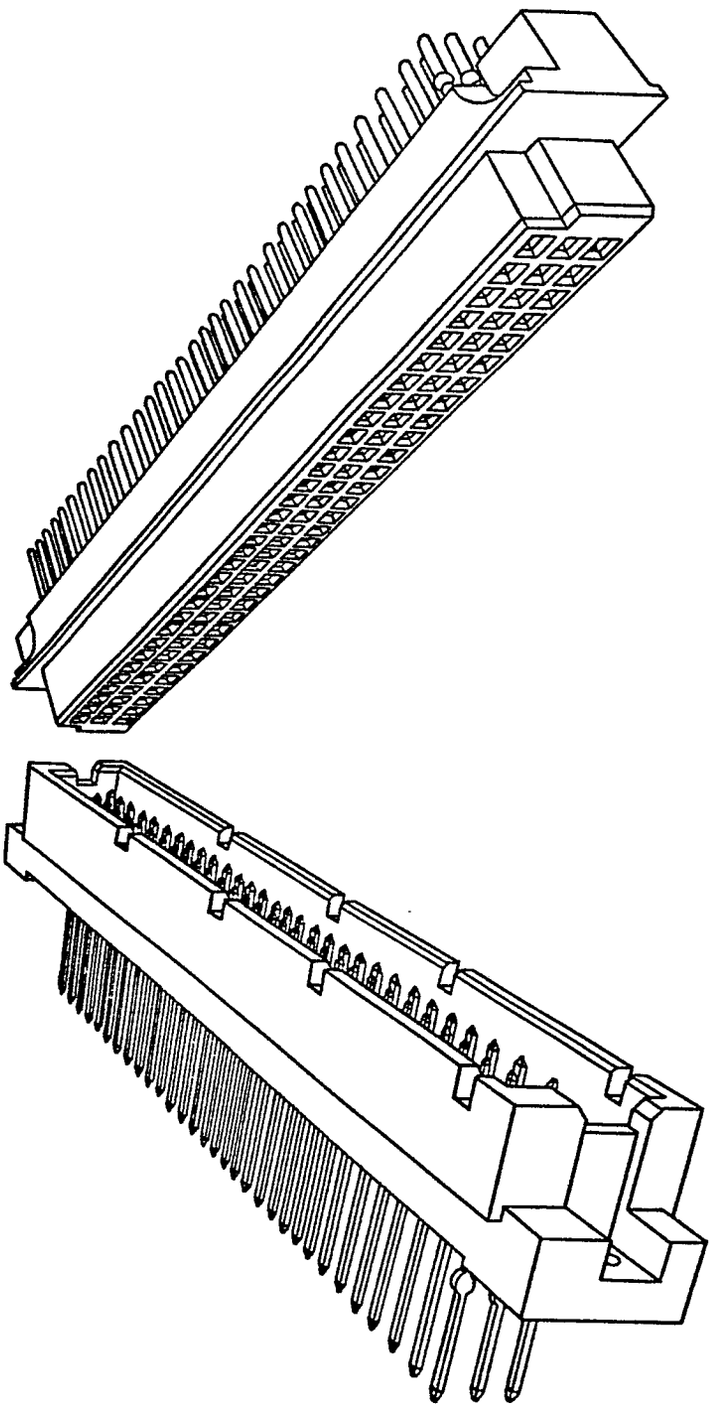


Fig 5

European Patent Office

EUROPEAN SEARCH REPORT

0079665
Application number

EP 82 20 1465

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	GB-A- 927 954 (PLESSEY) *Page 3, lines 37-42,62-70, line 110 - page 3, lines 3-28; figures*	1,2,8, 9	H 01 R 13/422
Y	US-A-3 938 874 (BENDIX) *Column 5, lines 1-43; figures*	1,7-9	
A	US-A-4 187 272 (BENDIX) *Abstract; figures*	1,2,8	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

H 01 R 13
H 01 R 43

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22-02-1983	RAMBOER P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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