(12) UK Patent Application (19) GB (11) 2 091 036 A

(21) Application No 8200520
(22) Date of filing 8 Jan 1982
(30) Priority data
(31) 81/00929
(32) 13 Jan 1981
(33) United Kingdom (GB)
(43) Application published 21 Jul 1982
(51) INT CL³ H01L 23/32
(52) Domestic classification H1K 4C11 4C5M 5M2 MA RL
(56) Documents cited GB 2028584A
(58) Field of search H1K
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(54) Integrated circuit carrier assembly

(57) A carrier assembly for an integrated circuit including a carrier unit (1) in which a flatpack (3) with a heat sink (4) is mounted, and a protector unit (2) in which the carrier unit is mounted. The protector unit (2) provides a surround to the carrier unit which protects the leads (5) of the flatpack (3). To mount the flatpack to a printed circuit board, it is merely necessary to remove the protector unit and then to attach the leads (5) to conductors on the printed circuit board. In another embodiment the guide grooves (6) may comprise two spaced apart walls on each side of the frame, capable of accommodating a flatpack with connection leads having widened portions facilitating the application of test probes.

A faulty flatpack can be removed from a printed circuit board by severing the leads (5) on the inner side of the carrier unit (1) and soldering the (shortened) leads of a replacement flatpack to the original leads.

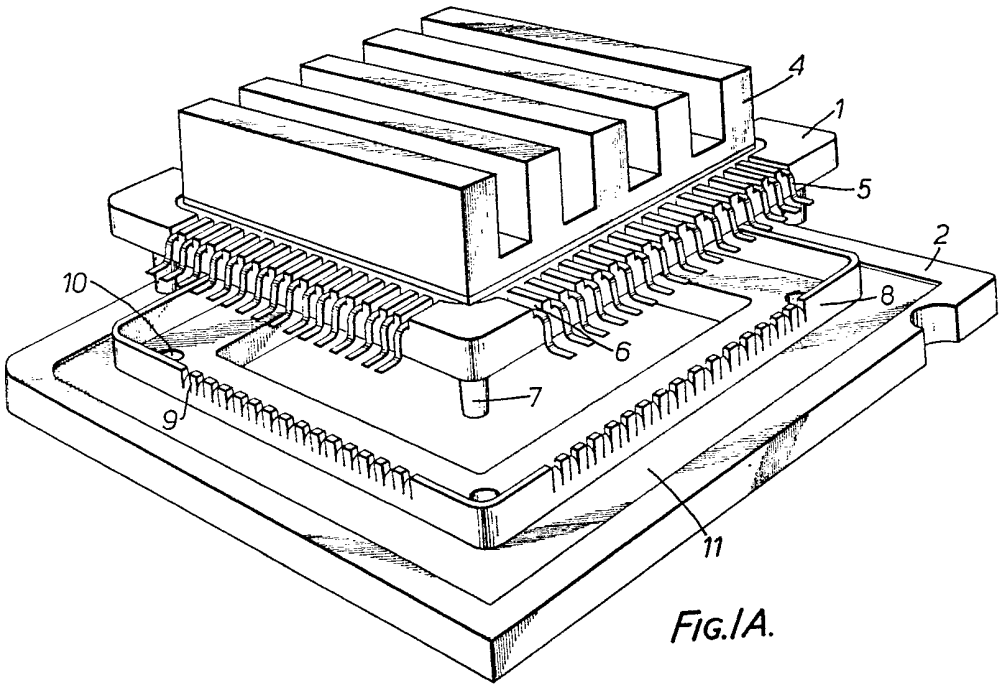

FIG.1A.

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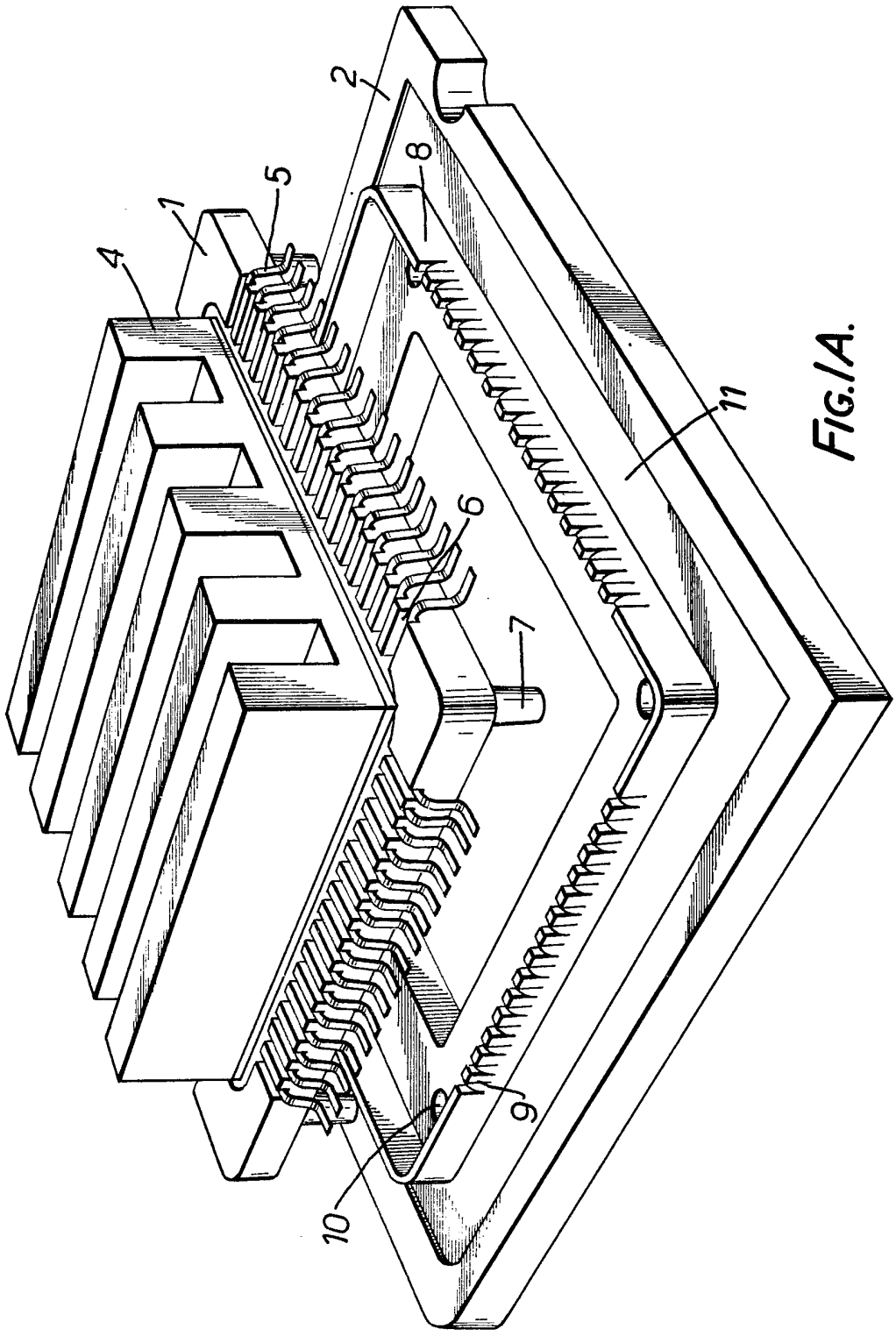

FIG.1A.

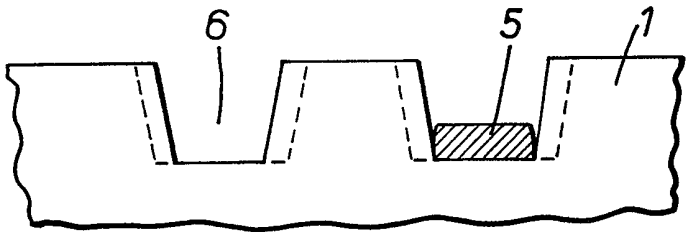

FIG. 1B.

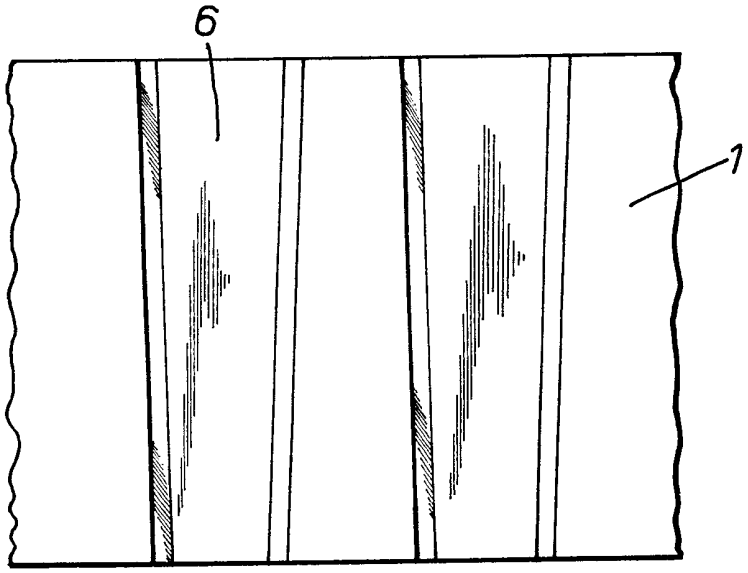

FIG. 1C.

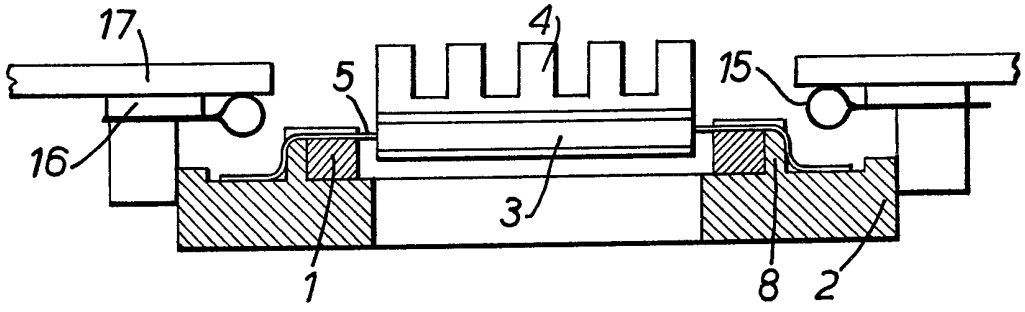

FIG. 3.

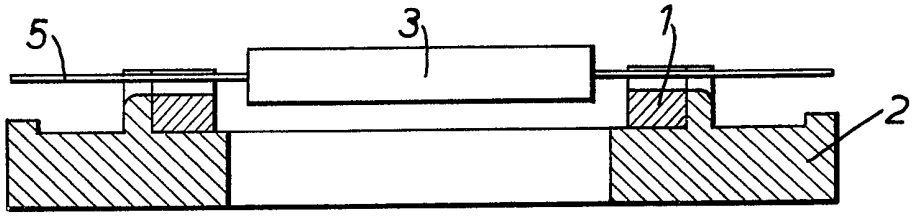

FIG. 2A.

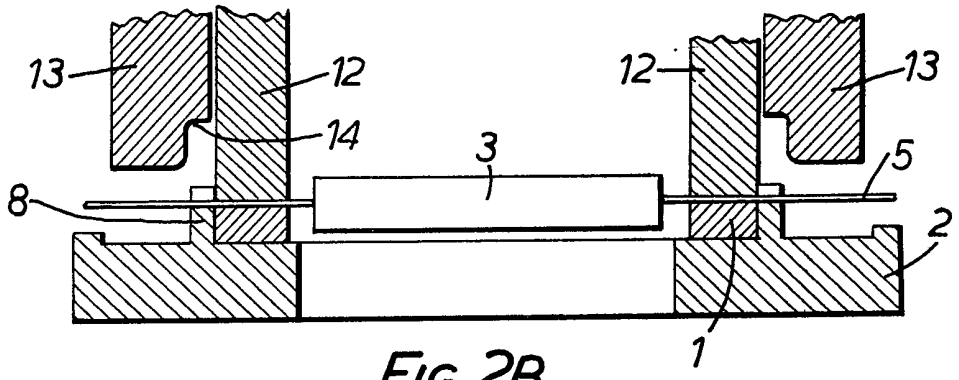

FIG. 2B.

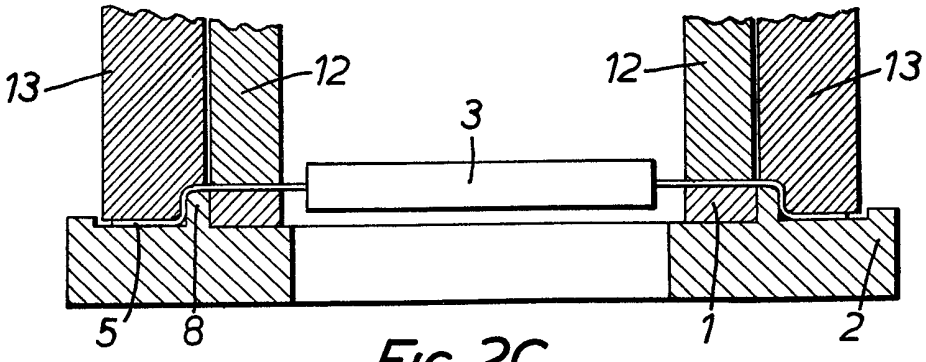

FIG. 2C.

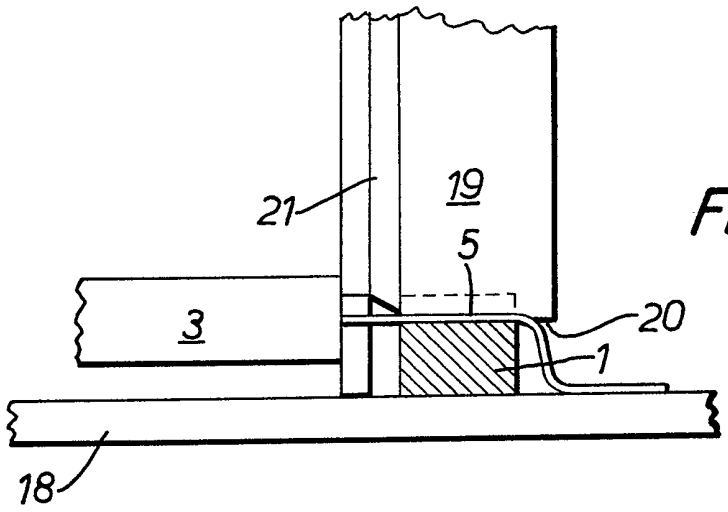

FIG. 4A.

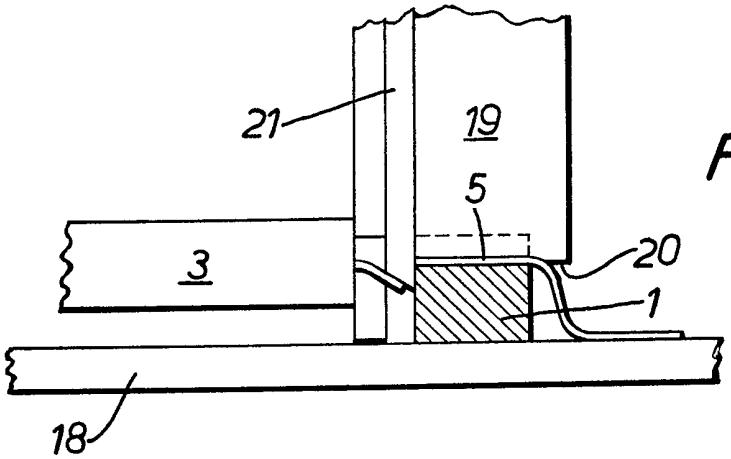

FIG. 4B.

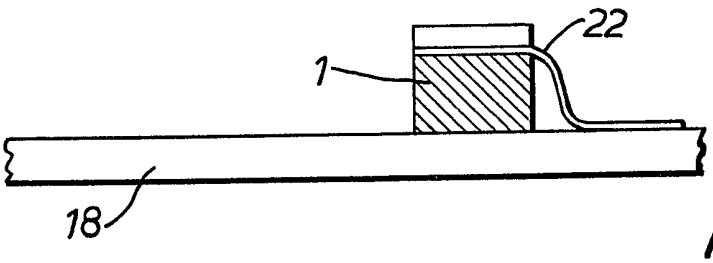

FIG. 4C.

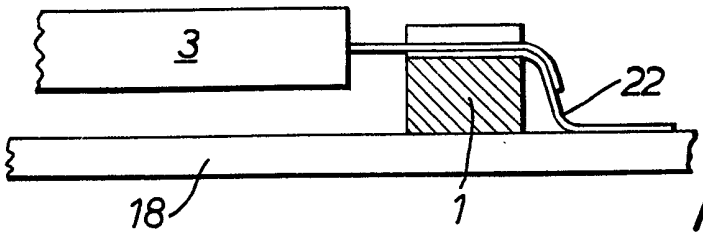

FIG. 4D.

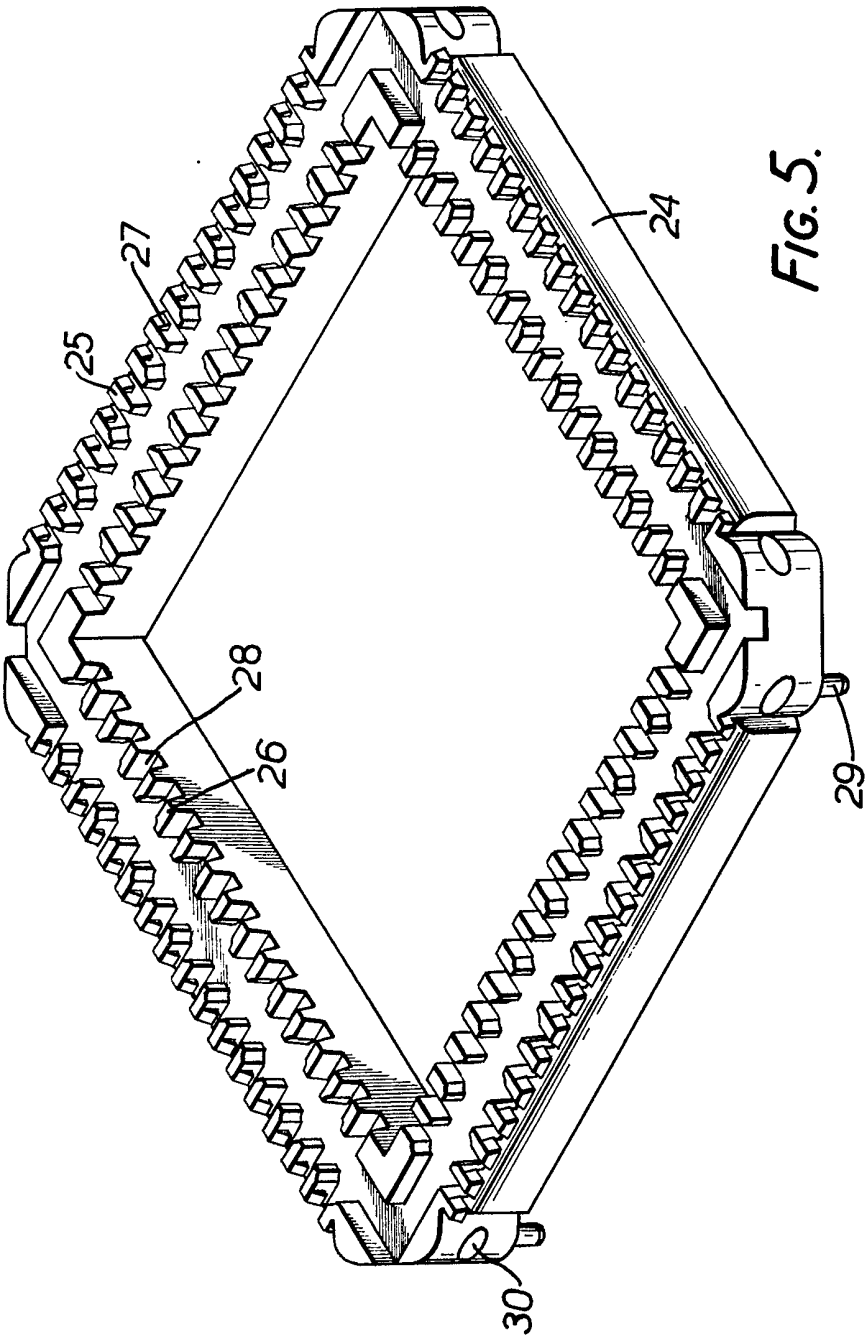

FIG. 5.

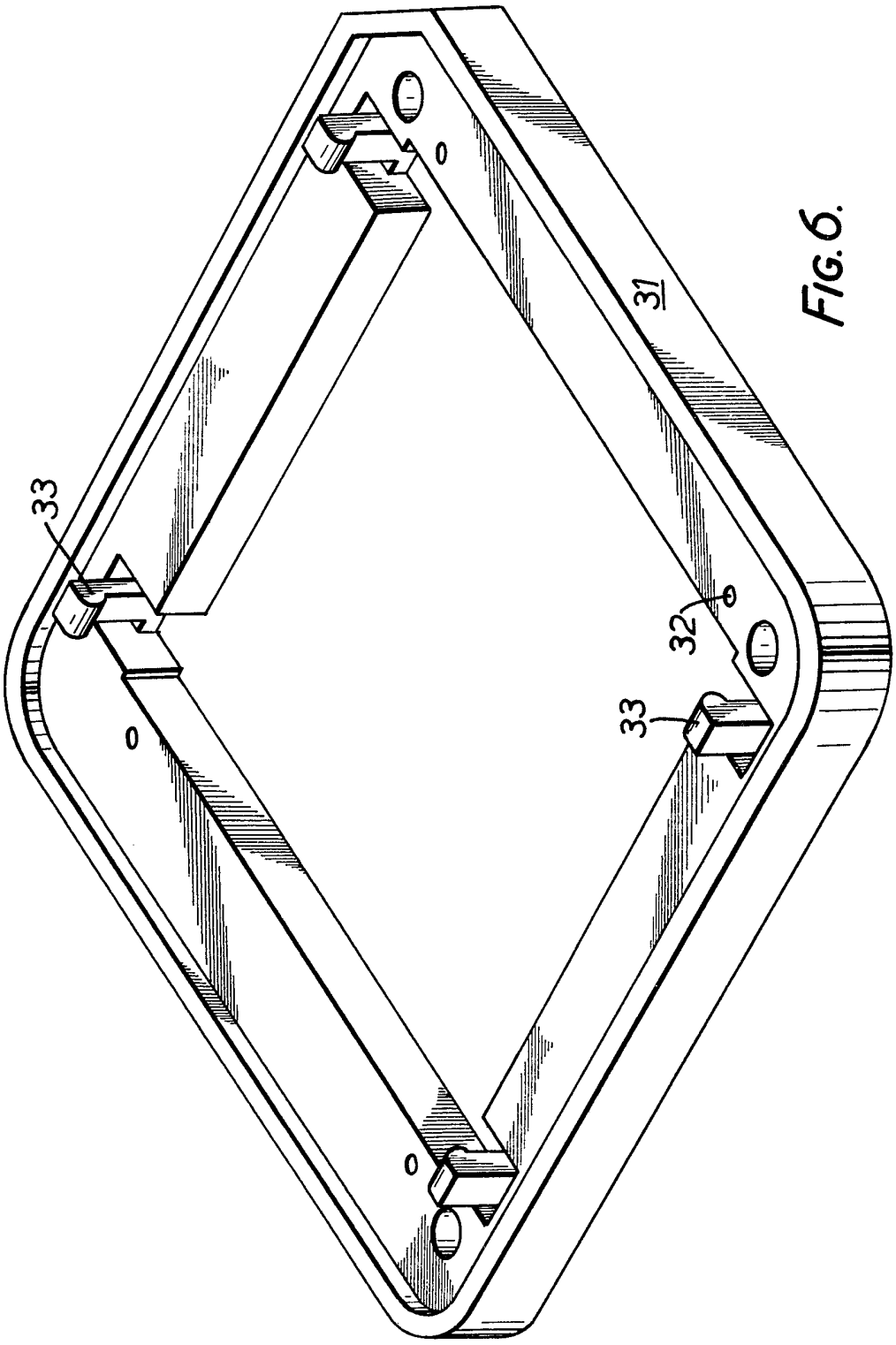

FIG. 6.

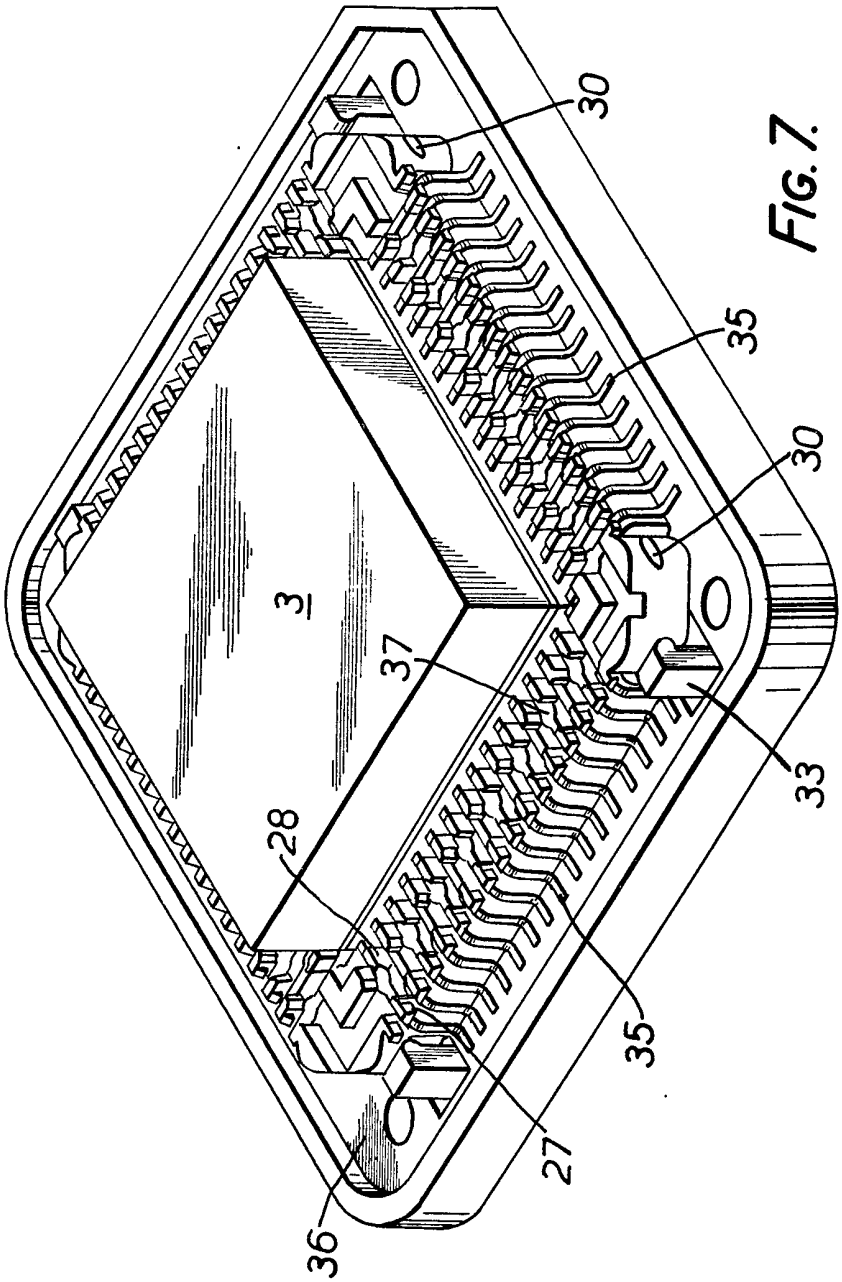

FIG. 7.

SPECIFICATION

Improvements in or relating to a carrier assembly for an integrated circuit

The present invention relates to a carrier assembly for an integrated circuit.

In particular the invention relates to a carrier assembly for a form of integrated circuit known as a flatpack. Such a flatpack conventionally comprises a main body, usually rectangular in shape, and has a number of connection leads extending from its sides.

It has previously been proposed to provide carriers for flatpacks which are constructed in such manner as to fully enclose the connection leads. Such carriers require to be separated from the flatpacks to allow access to the connection leads before they are mounted on a circuit assembly such as, for example, a printed circuit board.

According to the present invention a carrier assembly for an integrated circuit includes a first part shaped to accommodate the integrated circuit and having a plurality of insulating guides each arranged to accommodate a connection lead of the integrated circuit with a portion of each connection lead extending beyond the first part; and a second part engaging the first part and effective to protect said extending portions of all the connection leads during handling and storage, the second part being removable to expose said portions of the connection leads thereby allowing the integrated circuit together with the first part to be incorporated in a circuit assembly.

A carrier assembly for an integrated circuit embodying the present invention will now be described, by way of example, with reference to the accompanying drawings, in which;

Figure 1A is a perspective part-exploded view of a flatpack and two-part carrier assembly,

Figure 1B is a sectional view of a detail of the carrier assembly,

Figure 1C is a plan view of the detail of Figure 1B,

Figures 2A to 2D illustrate schematically the mounting of the flatpack into its carrier assembly,

Figure 3 is a schematic sectional view of an arrangement for testing a flatpack assembly,

Figures 4A to 4D illustrate schematically the steps involved in the replacement of a flatpack,

Figure 5 is a perspective view of a modified form of two-part carrier assembly and flatpack,

Figure 6 is a perspective view of one part of the modified form of carrier assembly, and

Figure 7 is a perspective view of the other part of the modified form of carrier assembly.

Referring to Figure 1A of the drawings, a two-part carrier assembly for a flatpack integrated circuit structure comprises a carrier unit 1 and a lead protector unit 2.

The carrier unit 1 is in the form of a rectangular frame dimensioned to accommodate the body portion 3 of a flatpack integrated circuit structure. The body portion 3 has mounted thereon a heatsink 4. (The body portion 3 is hidden from view by the heatsink 4 in Figure 1A). Sixteen connection leads 5 extend from each of the four sides of the body portion 3. Parallel guide grooves 6 are provided in the carrier unit 1, sixteen in each side of the frame. The guide grooves 6 are positioned to receive the connection leads 5 of the flatpack integrated circuit structure. The grooves are tapered, i.e. their sides converge both from top to bottom and from end to end, as shown in Figures 1B and 1C, to accommodate positional tolerances of the connection leads 5. Dowel pins 7 are provided, one at each corner of the carrier unit 1. It will be noted that the connection leads 5 extend beyond the edges of the carrier unit 1.

The lead protector unit 2 is also in the form of a rectangular frame, but is larger than the carrier unit 1. An upstanding wall 8 on the upper surface of the lead protector unit 2 encloses an area dimensioned such that the carrier unit 1 is a clearance fit therein. Slots 9 in the wall 8 are formed as shown, sixteen in each side of the wall, and correspond with the grooves 6 in the carrier unit 1. Location holes 10 are provided in the unit 2 for co-operation with the dowel pins 7. A shallow recess 11 extends around the outer periphery of the wall 8.

The carrier unit 1 is engageable with the lead protector unit 2 simply by inserting the carrier unit into the area enclosed by the wall 8, the dowel pins 7 entering into the corresponding location holes 10. The connection leads 5 of the flatpack lie in the slots 9 in the wall 8 and extend downwards outside the wall, to rest in the shallow recess 11.

Referring now to figures 2A to 2C, a method of mounting a flatpack into the two-part carrier assembly will now be described.

Flatpack integrated circuit structures are conventionally supplied with a frame (not shown) linking the outer ends of the connection leads 5. Such a frame is formed integrally with the connection leads and, by supporting the leads, facilitates the manufacture of the circuit structure. Before mounting the flatpack, therefore it is necessary to remove the lead support frame. This operation can conveniently be carried out using a press operated cropping device, for example.

The carrier unit 1 is mounted on the lead protector unit 2, the dowel pins 7 engaging the holes 10, and the flatpack is placed on the carrier unit 1 as shown in Figure 2A. The flatpack is positioned so that its connection leads 5 are aligned with the grooves 6 of the carrier unit 1 and the slots 9 in the wall 8 of the lead protector unit 2. The two parts 1 and 2 of the carrier assembly together with the flatpack are then placed on the bed of a press (not shown).

A tool comprising two movable parts 12 and 13 (shown in Figures 2B and 2C) is arranged to be operated in two stages by the press. During such operation part 12 of the tool moves first to engage the connection leads 5 and urges them into the bottom of their respective grooves 6, as shown in Figure 2B. This is followed by movement of part 13 of the tool which is effective to form those

parts of the leads 5 extending outside the wall 8, as shown in Figure 2C, so that their ends lie on the surface of the recess 11 of the lead protector unit 2. During the movement of part 13 of the tool, part 12 remains in its operated position to firmly clamp the leads 5 in the grooves 6 thus preventing damage to the flatpack. It will be appreciated that the operative end of the part 12 must be profiled to provide projections which correspond with the grooves 6 in the carrier unit 1 enabling the tool to enter the grooves 6 and to push down and clamp the connection leads 5. It is also necessary to similarly profile the tool part 13 in the region indicated at 14 in order that the tool part 13 enters the slots 9 in the lead protector unit 2.

After this operation the flatpack is retained in the carrier unit by frictional contact of the leads 5 with the grooves 6.

At this stage the heat sink 4 is secured to the exposed upper surface of the body 3 of the flatpack as shown in Figure 1A.

It will be appreciated that the assembly formed so far provides protection against damage for the connection leads 5 during subsequent storage and handling operations.

When it is required to mount the flatpack on a printed circuit board the lead protector unit 2 is disengaged from the remainder of the assembly to expose the connection leads 5. It will be noted that the surface of the recess 11 lies in the same plane as would the surface of a printed circuit board, when the flatpack and carrier unit 1 are mounted thereon. Thus, the ends of the leads 5 are correctly positioned for attachment to conductors on the surface of the printed circuit board.

Removal of the lead protector unit 2 can be readily accomplished with the aid of an ejection device (not shown). Such a device may include projections which are engageable with dowel pins 7 through the location holes 10. Following such removal the carrier unit 1 may be mounted on a printed circuit board, the dowel pins 7 now engaging corresponding holes in the printed circuit board to locate the carrier unit 1 thereon.

It will be appreciated that the construction of the lead protector unit 2 is such that when it is in position on the carrier unit 1, the ends of the connection leads 5 are exposed thus allowing the application of contact probes to test the flatpack.

An arrangement for carrying out such testing is shown in Figure 3. The arrangement includes conductive test probes 15, corresponding one with each of the connection leads 5, and carried in a flexible elastomeric strip 16. The test probes 15 are connected to test equipment (not shown) and a movable member 17 is operable to urge the test probes 15 into electrical contact with the connection leads 5.

The construction of the carrier unit 1 of the present invention facilitates the removal of a faulty flatpack from the printed circuit board upon which it is mounted. It will be noted that there is clearance between the edges of the body 3 of the flatpack and the carrier unit 1. This clearance enables a cutter blade to be passed therebetween to sever the connection leads 5.

Figures 4A and 4B show the carrier unit 1 and flatpack mounted on a printed circuit board 18 together with a device for severing the connection leads 5. The device includes a body portion 19 having a clamping surface 20 which is profiled to provide projections corresponding to the grooves 6 in the carrier 1. The clamping surface 20 is effective to clamp the connection leads 5 on one of the four sides of the flatpack firmly against the bottoms of the grooves 6. On the body portion 19 is mounted a cutter blade 21 which is movable towards the printed circuit board 18 to sever the connection leads 5 as shown in Figure 4B. The leads 5 on all four sides of the flatpack are severed in turn allowing the flatpack to be removed from the carrier unit 2 (Figure 4C) leaving in the grooves 6 the severed ends 22 of the connection leads 5 soldered to the printed circuit board 18.

A replacement flatpack may now be inserted into the carrier unit 1, the connection leads 5 of the replacement flatpack overlying the severed portions 22 of the connection leads of the original flatpack as shown in figure 4D. The connection leads 5 of the replacement flatpack are then soldered to the severed portions 22 by, for example, a reflow process. The connection leads 5 of the replacement flatpack are required to be shortened before insertion as shown in Figure 4D.

If it is desired to carry out further tests on the removed flatpack the severing operation leaves a sufficient length of the connection leads remaining on the flatpack to enable contact to be made thereto with a test probe.

A further form of two-part carrier assembly is shown in Figures 5, 6 and 7. The carrier unit 24 (Figure 5) of this assembly is in the form of a rectangular frame as before. However, instead of the guide grooves for the connection leads extending right across the top surface of each side of the frame, in this case two spaced apart walls 25 and 26 are provided on each of the four sides of the frame. Grooves 27 in the walls 25 are aligned with grooves 28 in the walls 26. The edges of the facing ends of each pair of aligned grooves 27 and 28 are chamfered and all the grooves 27 and 28 are tapered so that they are wider at their mouths to accommodate positional tolerances of the connection leads. Dowel pins 28 are provided at the corners on the underside of the carrier unit 24 and depressions 30 are provided on its sides adjacent the corners.

The lead protector unit 31 of the further form of the device is shown in Figure 6. Location holes 32 are provided for co-operation with the dowel pins 29 when the carrier unit 24 is engaged with the protector unit 31. Resiliently mounted latches 33 are provided, one at each corner, to engage the depressions 30 in the carrier unit 24 to retain the lead protector unit 31 and the carrier unit 24 in engagement.

The carrier unit 24 carrying a flatpack 34 and in engagement with the lead protector unit 31, is shown in Figure 7. It will be seen that the

connection leads 35 are accommodated in the grooves 27 and 28 and, as in the previously described form of the device, extend beyond the edge of the carrier unit and rest in a recess 36 as before.

The flatpack 34 shown in Figure 7 is of a type in which alternate connection leads have widened portions 37 therein. These widened portions are commonly called "bellies" and are situated between the two walls 25 and 26. They provide regions of increased area on the connection leads thereby facilitating the application of test probes, for example.

It will be appreciated that, although four resiliently mounted latches 33 are employed in the described second embodiment, it would be possible to employ fewer of such latches, for example, two or even one.

In the two embodiments of the invention described the flatpack is supported in the frame solely by its connection leads which are accommodated in the grooves of the carrier unit. It will be realised that, if desired, further support could be provided for the flatpack by way of projections attached to the carrier unit and engaging the body portion of the flatpack, for example.

CLAIMS

1. A carrier assembly for an integrated circuit including;

a first part shaped to accommodate the integrated circuit and having a plurality of insulating guides each arranged to accommodate a connection lead of the integrated circuit with a portion of each connection lead extending beyond the first part; and

a second part engaging the first part and effective to protect said extending portions of all the connection leads during handling and storage, the second part being removable to expose said portions of the connection leads thereby allowing the integrated circuit together with the first part to be incorporated in a circuit assembly.

2. A carrier assembly as claimed in Claim 1, in which said second part includes a flat surface area with which said first part engages and a further surface area in the same plane on which the ends of said connection leads are supported.

3. A carrier assembly as claimed in Claim 2, in which said first part is in the form of a frame surrounding the integrated circuit and having an inner and an outer edge, and in which said guides are provided by grooves, extending between the inner and outer edges, in which the connection leads lie.

4. A carrier assembly as claimed in Claim 3, in which the sides of each groove converge towards the bottom of the groove and also converge towards that end of the groove at the outer edge of the frame.

5. A carrier assembly as claimed in Claim 4, including an upstanding wall on said flat surface of the second part enclosing an area for receiving said first part, and location holes in one of said parts co-operating with corresponding dowel pins in the other of said parts.

6. A carrier assembly as claimed in Claim 5, in which said upstanding wall includes slots aligned with said grooves for receiving said connection leads.

7. A carrier assembly as claimed in Claim 2, in which said first part is in the form of a frame surrounding the integrated circuit and in which said guides are provided by pairs of aligned grooves in which the connection leads lie, the grooves of each pair being positioned respectively one in each of two spaced apart walls extending around the frame.

8. A carrier assembly as claimed in Claim 7, in which the sides of each groove converge towards the bottom of the groove, and in which edges of facing ends of each pair of aligned grooves are chamfered.

9. A carrier assembly as claimed in Claim 8, including location holes in one of said parts co-operating with corresponding dowel pins in the other of said parts, and at least one resiliently mounted latch on one of said parts engaging the other of said parts to hold the parts together.

10. A carrier assembly for an integrated circuit constructed as hereinbefore described with reference to the accompanying drawing.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1982. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.