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(54) Low profile modular phone jack and method of making same

(57) A modular phone jack (10) includes an outer dielectric housing (12) having a plug-receiving opening (26) formed in a forward mating end (28) of the housing. An inner dielectric insert (14) is positionable in the housing. A plurality of elongated terminals (16) are fixed to the dielectric insert. Each terminal includes a contact portion (16b) at one end extending diagonally into the plug-receiving opening and a tail portion (16c) at the opposite end extending from the housing. A comb structure (22a) secures the tail portions to the housing at predetermined spaced locations. A method of fabricating the modular phone jack (10) according to the above structure is contemplated.

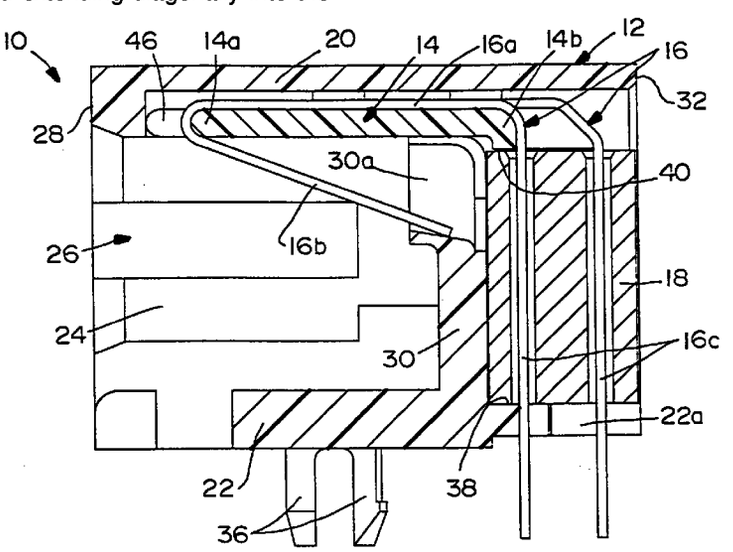

FIG.2

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Description

Field of the Invention

This invention generally relates to the art of electrical connectors and, particularly, to a low profile modular phone jack, along with a method of fabricating the modular phone jack.

Background of the Invention

Electrical connectors commonly called modular phone receptacles or jacks have been known in the art for many years. Although connectors of this type were originally designed for the telecommunications industry, and in particular for telephones, they have found wide acceptance in other areas. For example, modular jacks are commonly used as input/output (I/O) interface connectors for computers to communicate with each other and with a variety of peripheral equipment.

Modular jacks are used extensively as an interface between a standard modular plug and a printed circuit board. The modular jacks generally include a dielectric housing having a plug-receiving socket or opening therein. A plurality of stamped, metallic elongated terminals are mounted in the housing for engaging contacts of the corresponding plug. Typically, each terminal includes a contact portion at one end extending diagonally into the socket or opening, a tail portion at the other end extending from the housing and an intermediate portion between the contact portion and the tail portion.

Modular phone jacks may be formed either as a one-piece housing structure or as a two-piece assembly. In the one-piece structure, a one-piece or unitary dielectric housing has channels adapted to locate and hold the stamped metallic terminals. In the two-piece assembly, the terminals are mounted on a dielectric insert as a subassembly, and this subassembly is positioned in the housing. Typically, the terminals are at least partially formed or bent prior to positioning the subassembly into the housing. The finally assembled modular phone jack then can be mounted on a printed circuit board with the tail portions of the terminals inserted into precisely spaced holes in the printed circuit board.

One of the problems in the use of modular phone jacks as described above involves maintaining the tail portions of the terminals at the same precise location and spacing as the holes in the printed circuit board. This problem is particularly prevalent in two-piece assemblies where the terminals are preassembled on the insert prior to positioning the subassembly of the insert and the terminals into the jack housing. It is fairly easy to precisely locate the tail portions in a one-piece molded jack housing. However, in the two-piece assembly, the various preassembly steps, including bending and forming of the tail portions, handling and inserting the subassembly into the housing, tend to cause the tail portions to become misaligned. This problem is further complicated when filter elements are positioned about the tail portions of the terminals.

The present invention is directed to these problems by providing a unique system for maintaining proper spacing or alignment of the terminal tail portions in a modular phone jack particularly of the two-piece design.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved modular phone jack of the character described, along with a method of fabricating the modular phone jack.

In the exemplary embodiment of the invention, the jack includes an outer dielectric housing having a plug-receiving opening formed in a forward mating end of the housing. An inner dielectric insert is positionable in the housing. A plurality of elongated terminals are fixed to the insert. Each terminal includes a contact portion at one end extending diagonally into the plug-receiving opening and a tail portion at the opposite end extending from the housing. Generally, means are provided for securing the tail portions to the housing at predetermined spaced locations.

More particularly, the terminals have intermediate portions between the contact portions and the tail portions. The intermediate portions are fixed to the dielectric insert. After this subassembly is positioned in the jack housing, the tail portions are secured to a comb structure of the housing to maintain the tail portions at precise, predetermined spaced locations.

As disclosed herein, the insert is generally planar and includes a forward end from which the contact portions of the terminal extend and a rearward end from which the tail portions of the terminals extend. A filter element is positioned about the tail portions of the terminals. In final assembly, the filter elements are sandwiched between first shoulder means on the housing and second shoulder means on the insert.

The invention also contemplates a method of fabricating a modular jack, including the steps of providing an outer dielectric housing with a plug-receiving opening in a forward mating end of the housing. The plurality of terminals are fixed to an inner dielectric insert to form a subassembly. The subassembly then is positioned in the housing with the contact portions of the terminals extending diagonally into the plug-receiving opening and with the tail portions of the terminals extending from the housing. After positioning the subassembly in the housing, the tail portions of the terminals are secured to the housing at their predetermined spaced locations.

The method may include the step of mounting a filter element about the tail portions of the terminals prior to positioning the subassembly into the housing. During assembly, the filter elements are sandwiched between opposing shoulder means on the insert and the hous-

ing.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIGURE 1 is a perspective view of a modular phone jack incorporating the concepts of the invention;
FIGURE 2 is a vertical, front-to-rear section through the phone jack;
FIGURE 3 is a front elevational view of the jack;
FIGURE 4 is a bottom plan view of the jack;
FIGURE 5 is a vertical, front-to-rear section through the jack housing;
FIGURE 6 is a bottom plan view of the housing;
FIGURE 7 is a horizontal section taken generally along line 7-7 of Figure 6; and
FIGURE 8 is a top plan view of the dielectric insert with the terminals staked thereto, and prior to forming the terminals;
FIGURE 9 is a front-to-rear section through the dielectric insert with the terminals staked thereto prior to forming the terminals;
FIGURE 10 is a front elevational view of the dielectric insert with the terminals staked thereto after forming the terminals; and
FIGURE 11 is a front-to-rear section through the dielectric insert with the terminals staked thereto after forming the terminals.

Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail, and first to Figures 1-4, the invention is incorporated in a modular phone jack, generally designated 10. Generally, the jack is a two-piece assembly including an outer dielectric housing, generally designated 12, and an inner dielectric insert, generally designated 14. A plurality of elongated terminals, generally designated 16, are mounted in the housing. A filter in the form of a ferrite block 18 (Fig. 2) is positioned over portions of the terminals.

More particularly, referring to Figures 5-7 in conjunction with Figures 1-4, outer dielectric housing 12 of modular phone jack 10 is of a conventional box-like configuration including a top wall 20, a bottom wall 22 and a pair of side walls 24, all combining to define a plug-receiving socket or opening, generally designated 26. The socket is open at a forward mating end 28 of the housing. The rear of the socket is closed by an internal partition 30 spaced inwardly or forwardly of a rear end 32 of the housing. The top of partition 30 includes a comb-like structure 30a. The rear of bottom wall 22 also includes a comb-like structure 22a. A pair of mounting posts 36 are integrally molded with and project downwardly from the housing. The posts are mounted into locating holes in the printed circuit board to precisely locate the housing on the board, particularly relative to the terminal tail holes in the board.

As best seen in Figure 2, each terminal 16 includes an intermediate portion 16a between a contact portion 16b and a tail portion 16c. The contact portion of each terminal extends at one end of the intermediate portion diagonally into plug-receiving opening 26. The tail portions 16c of the terminals are bent generally perpendicular to intermediate portions 16a at the opposite ends thereof downwardly and out of housing 12 for insertion into holes in the printed circuit board. It can be seen in Figure 2 that tail portions 16c of the terminals are formed so that alternating ones of the terminals are in two different rows as is typical in the art. Lastly, Figure 2 shows ferrite filter block 18 sandwiched between a first shoulder 38 defined by comb structure 22a of the housing and a second shoulder 40 defined by insert 14.

Figure 8 shows dielectric insert 14 and terminals 16 in the process of being joined to form a subassembly for insertion into jack housing 12. More particularly, the dielectric insert is formed as a generally planar, molded plastic component having a plurality of upstanding staggered locating projections 42. Terminals 16 are mounted on top of insert 14 and include oval-shaped pilot holes 44 which are staggered with respect to one another in the alternating terminals. Locating projections 42 are adapted to be received within pilot holes 44 to precisely position terminals 16 on the top of insert 14. After positioning the terminals, locating projections 42 are cold staked to rigidly fix the terminals to the insert.

After terminals 16 are fixed to dielectric insert 14 as shown in Figure 8, the terminals then are formed as shown best in Figure 2. In other words, contact portions 16b of the terminals are bent downwardly about a front edge 14a of the insert until the contact portions extend diagonally rearwardly beneath the insert. Tail portions 16c are bent downwardly generally at right angles to intermediate portions 16a behind a rear edge 14b of the insert. Before the subassembly of insert 14 and formed terminals 16 is positioned within housing 12, ferrite filter block 18 is positioned onto tail portions 16c of the terminals as seen in Figure 2. The inside of side walls 24 of the housing are provided with grooves 46 (see Figs. 2 and 5) for receiving the side edges of insert 14 when the subassembly of the insert and the terminals are mounted in the housing through the rear end 32 of the housing.

The method of fabricating modular phone jack 10

can fairly be derived from the above description of the structural combination thereof. Nevertheless, the method can be summarized as follows:

providing outer dielectric housing 12 with plug-receiving opening 16 in forward mating end 28 of the housing;
fixing terminals 16 to dielectric insert 14 to form the subassembly of Figure 8;
forming the terminals with contact portions 16b and tail portions 16c as shown in Figure 2;
positioning this subassembly in housing 12 with contact portions 16b extending diagonally into plug-receiving opening 26 and with tail portions 16c extending from the housing; and
securing tail portions 16c of terminals 16 to comb structure 22a at the rear of bottom wall 22 of the housing.

If filter element 18 is employed, the method includes the step of mounting the filter element about tail portions 16c of the terminals prior to positioning the subassembly of the insert and the terminals into the housing. During assembly, filter element 18 becomes sandwiched between opposing shoulders 38 and 40 of the housing and the dielectric insert, respectively.

As the subassembly of dielectric insert 14 and terminals 16 is positioned into housing 12, the tail portions enter comb structure 22a at the rear of bottom wall 22 to precisely position the tail portions at predetermined spaced locations corresponding to their respective holes in the printed circuit board. In order to assure precise positioning of the tail portions, the tail portions can be cold staked to the bottoms or bases of the slots in the comb structure. Contact portions 16b are separated by comb structure 30a.

The structural combination of the invention takes the advantages afforded by a one-piece jack structure as well as a two-piece assembly without creating any substantial disadvantages. In particular, it is known that a one-piece jack housing can best locate the tail portions of the terminals relative to their respective holes in the printed circuit board. This can be understood because mounting posts 36 precisely locate the housing on the board and the housing, in turn, precisely locates the tail portions of the terminals. However, a one-piece housing structure has considerable disadvantages in assembling conductors 16 and/or filter elements inside the one-piece structure.

On the other hand, a two-piece assembly including a dielectric insert, such as insert 14, considerably simplifies the assembly processes of a modular phone jack. Unfortunately, the two-piece assembly suffers from the disadvantages of the tail portions of the terminals becoming misaligned during manufacture and handling.

The present invention takes advantage of the positive attributes of both types of designs. The invention uses the two-piece structure to provide a subassembly which is very easy to assemble within the jack housing, including the terminals and the filter block, if desired. The structure of the invention then relies on the housing (i.e. comb structure 22a) to precisely align and space the terminal tail portions for insertion into their respective holes in the printed circuit board.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

Claims

1. A modular phone jack (10), comprising:

   an outer dielectric housing (12) having a plug-receiving opening (26) formed in a forward mating end (28) of the housing;
   an inner dielectric insert (14) positionable in the housing;
   a plurality of elongated terminals (16) fixed to the dielectric insert (14), each terminal including a contact portion (16b) at one end extending diagonally into the plug-receiving opening (26) and a tail portion (16c) at the opposite end extending from the housing (12); and
   means (22a) for securing the tail portions (16c) to the housing (12) at predetermined spaced locations.

2. The modular phone jack of claim 1 wherein said terminals (16) have intermediate portions (16a) between said contact portions (16b) and said tail portions (16c), the intermediate portions being fixed to the dielectric insert (14).

3. The modular phone jack of claim 1 wherein said dielectric insert (14) is generally planar and includes a forward end (14a) from which the contact portions (16b) of the terminals (16) extend and a rearward end (14b) from which the tail portions (16c) of the terminals extend.

4. The modular phone jack of claim 1, including a filter element (18) about the tail portions (16c) of the terminals.

5. The modular phone jack of claim 4 wherein said filter element (18) is sandwiched between first shoulder (38) means on the housing (12) and second shoulder means (40) on the dielectric insert (14).

6. The modular phone jack of claim 1 wherein said housing (12) includes a comb structure (22a) forming said means for securing the tail portions (16c) of

the terminals to the housing.

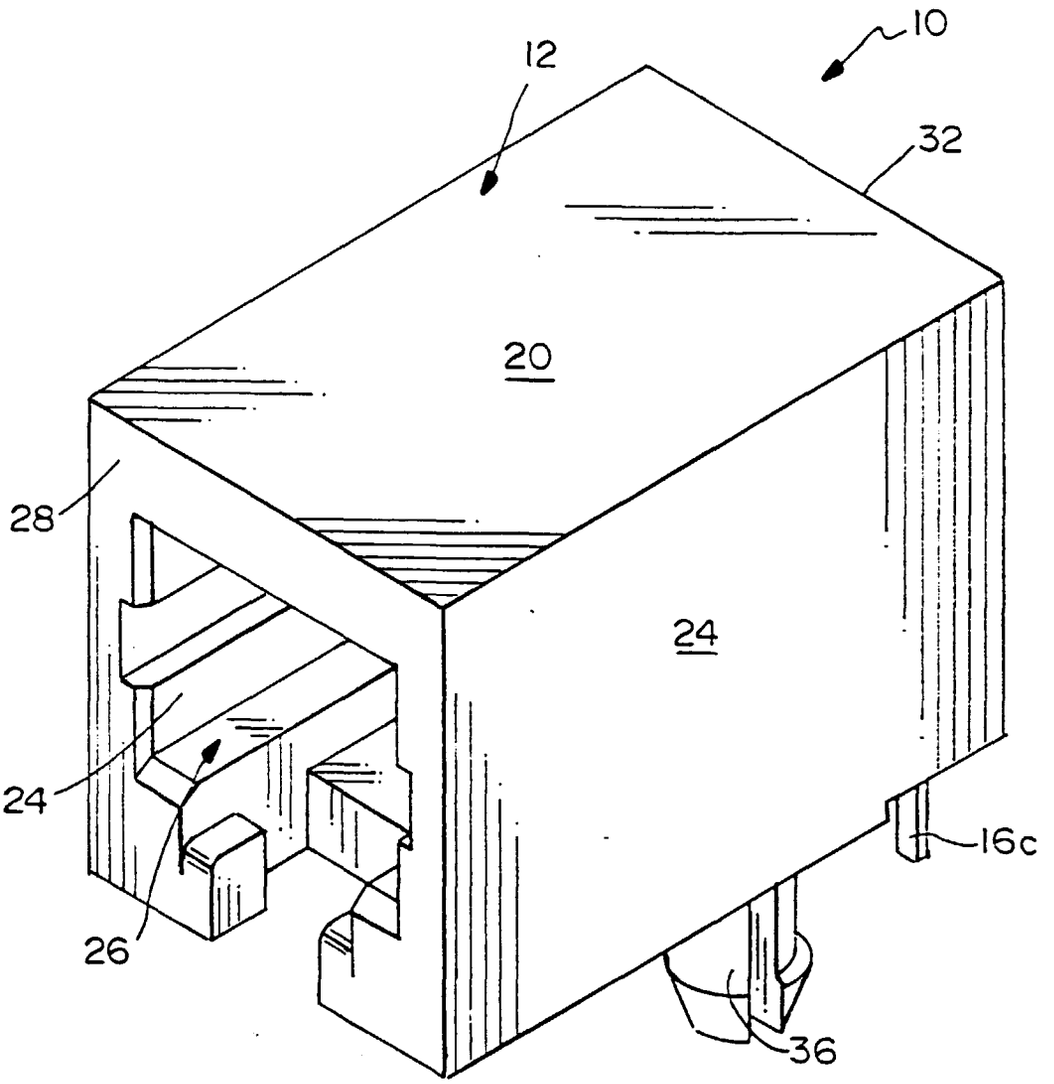

FIG.1

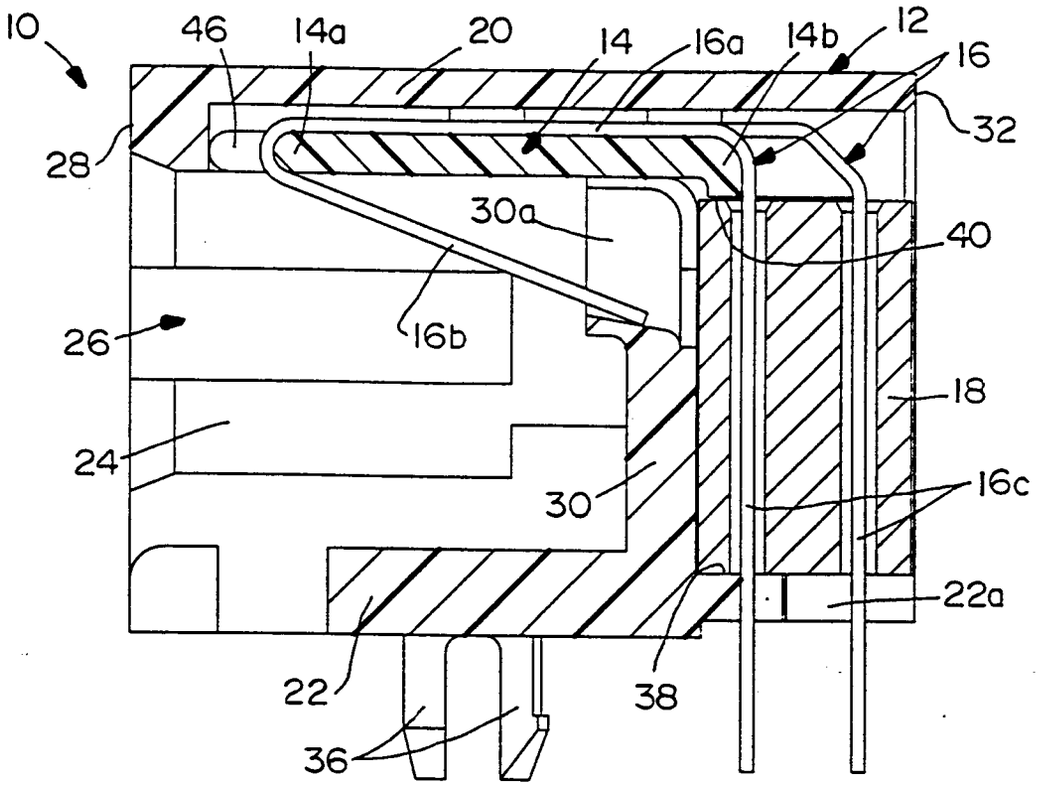
10
46
14a
20
14
16a
14b
12
16
32
28
30a
40
26
16b
18
24
30
16c
22a
22
38
36

FIG.2

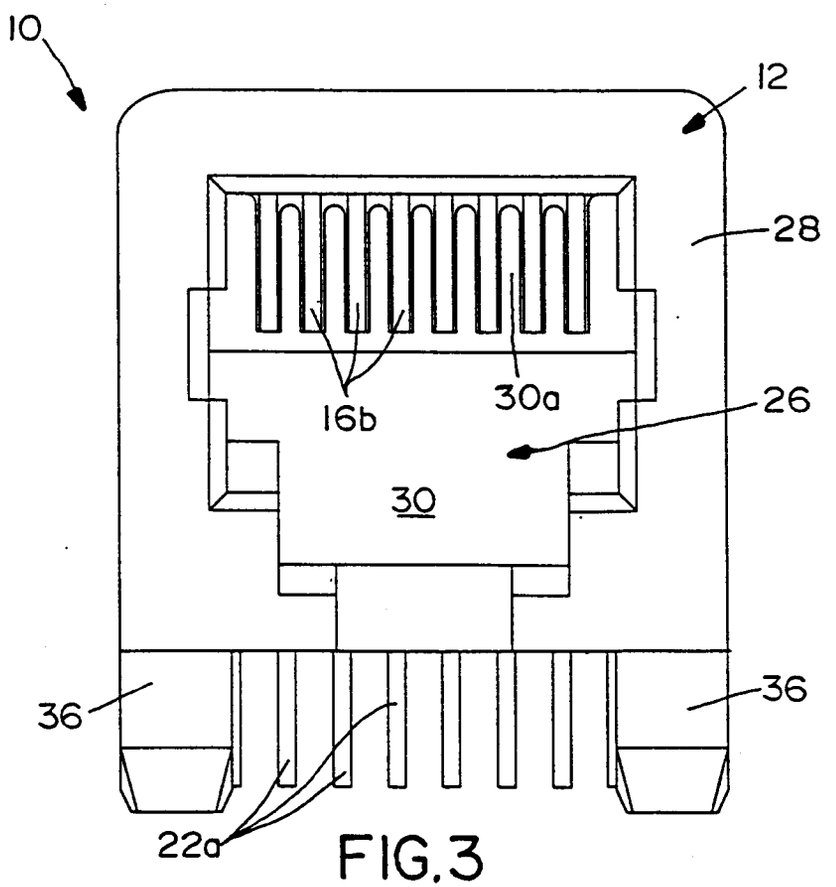
10
12
28
16b
30a
26
30
36
36
22a

FIG.3

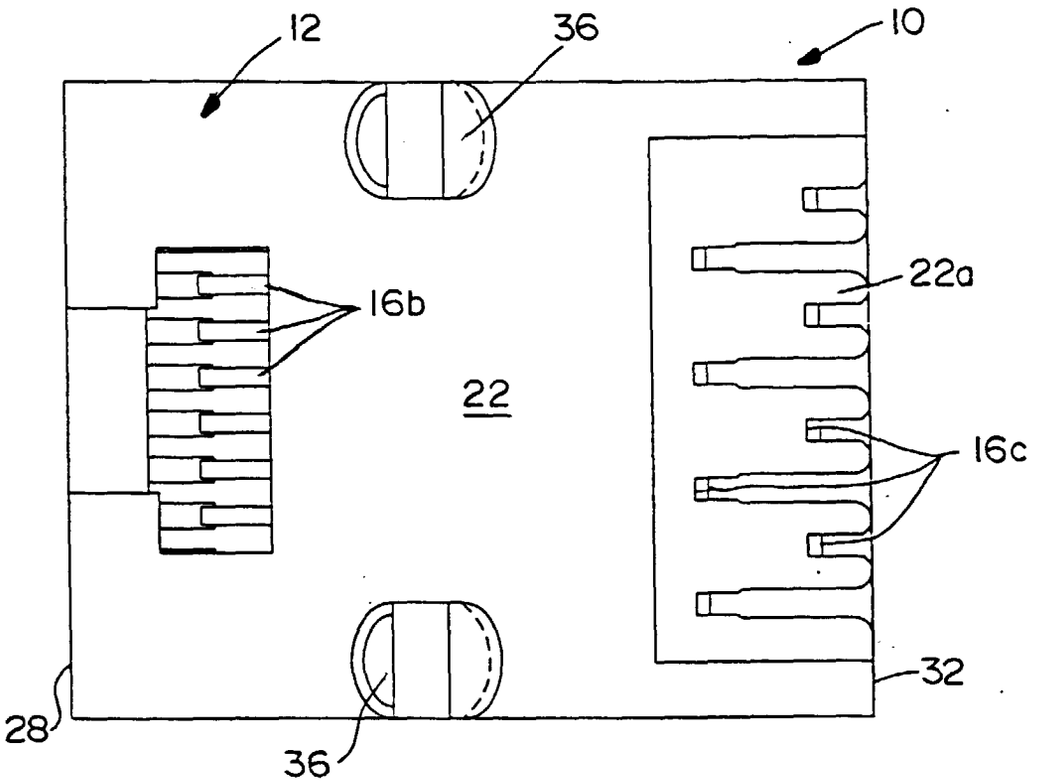
12
36
10
16b
22
22a
16c
32
28
36

FIG.4

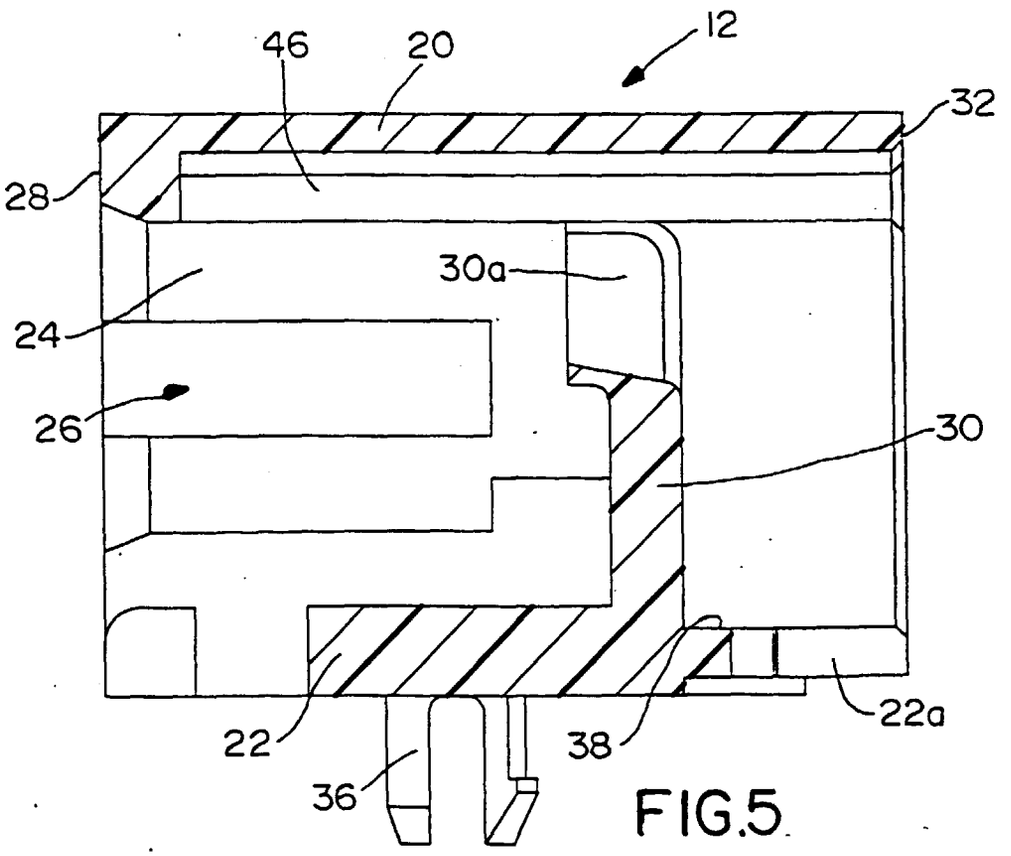
46
20
12
32
28
30a
24
26
30
22
38
22a
36

FIG.5

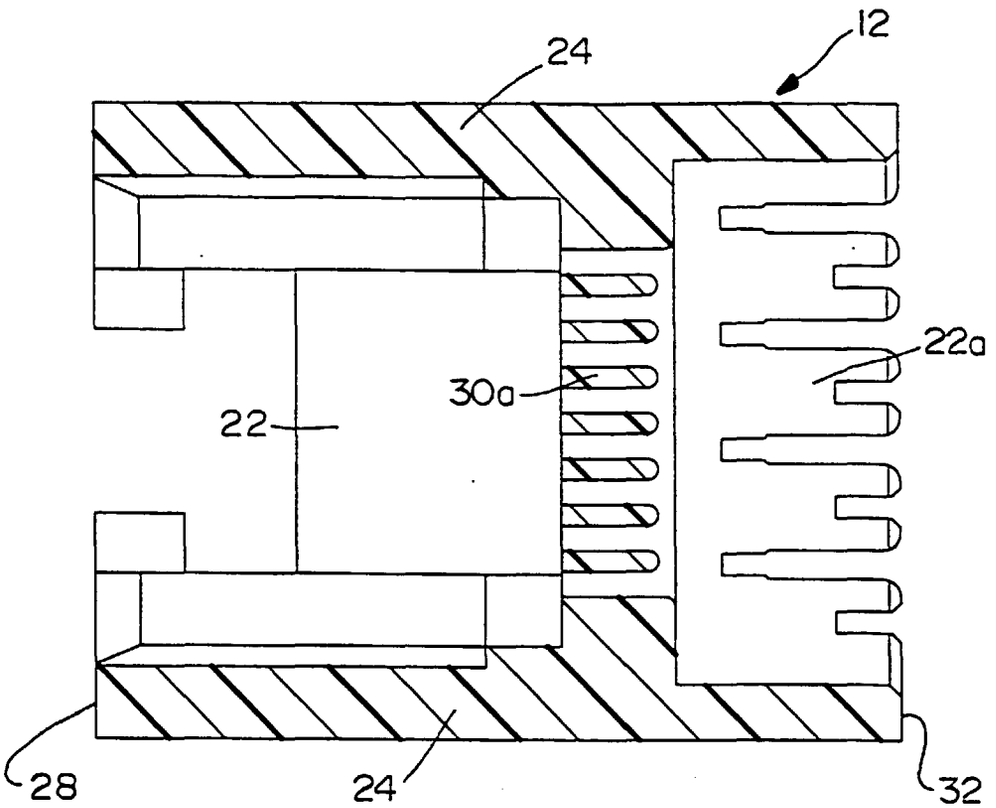

FIG.7

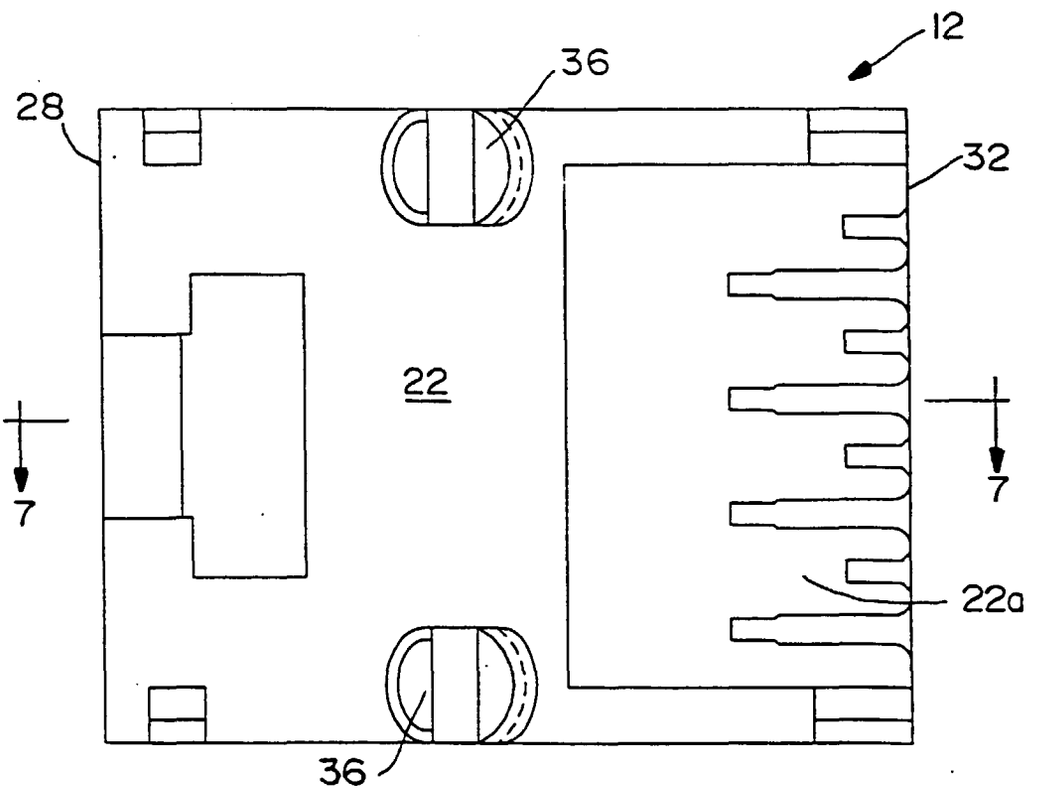

FIG.6

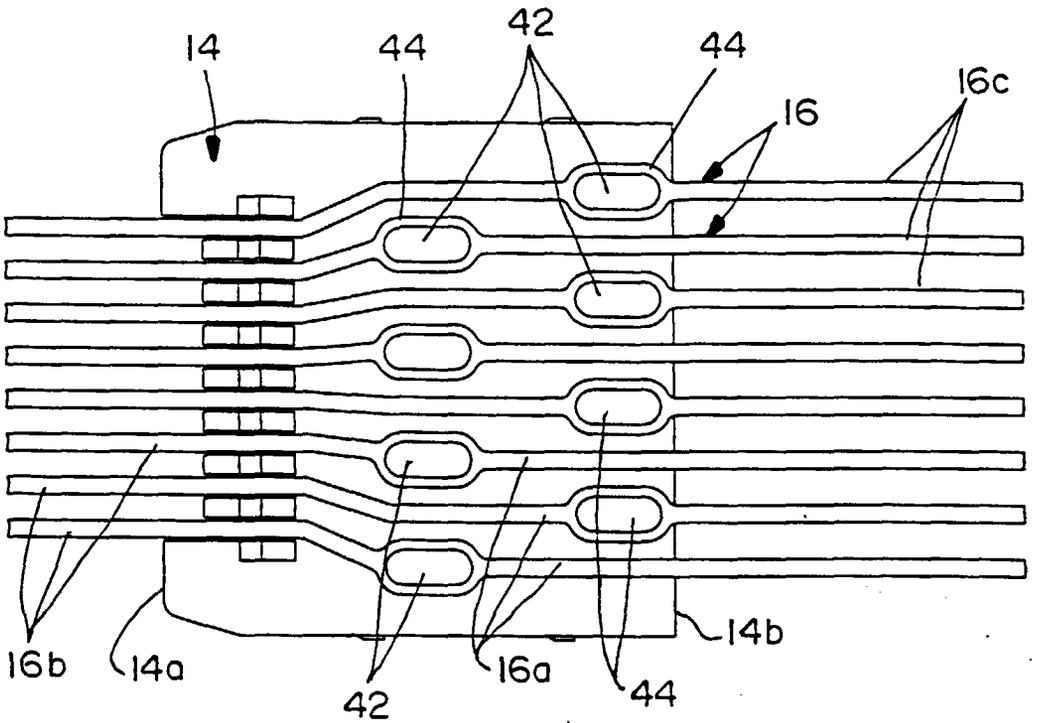
14
44
42
44
16c
16
16b
14a
42
16a
44
14b

FIG.8

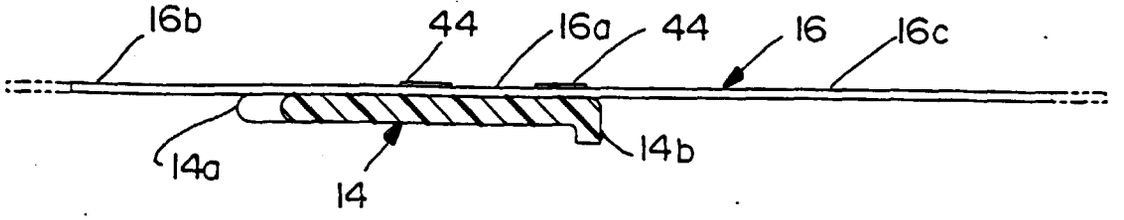
16b
44
16a
44
16
16c
14a
14
14b

FIG.9

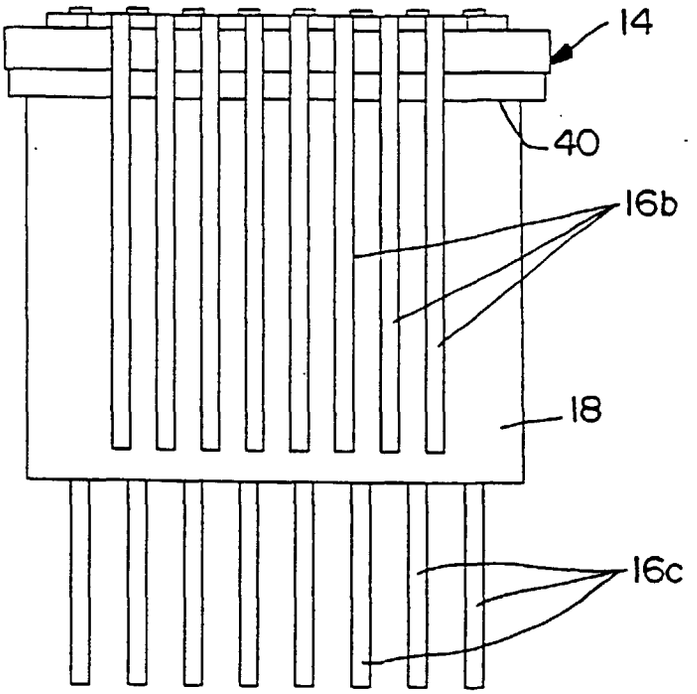

FIG.10

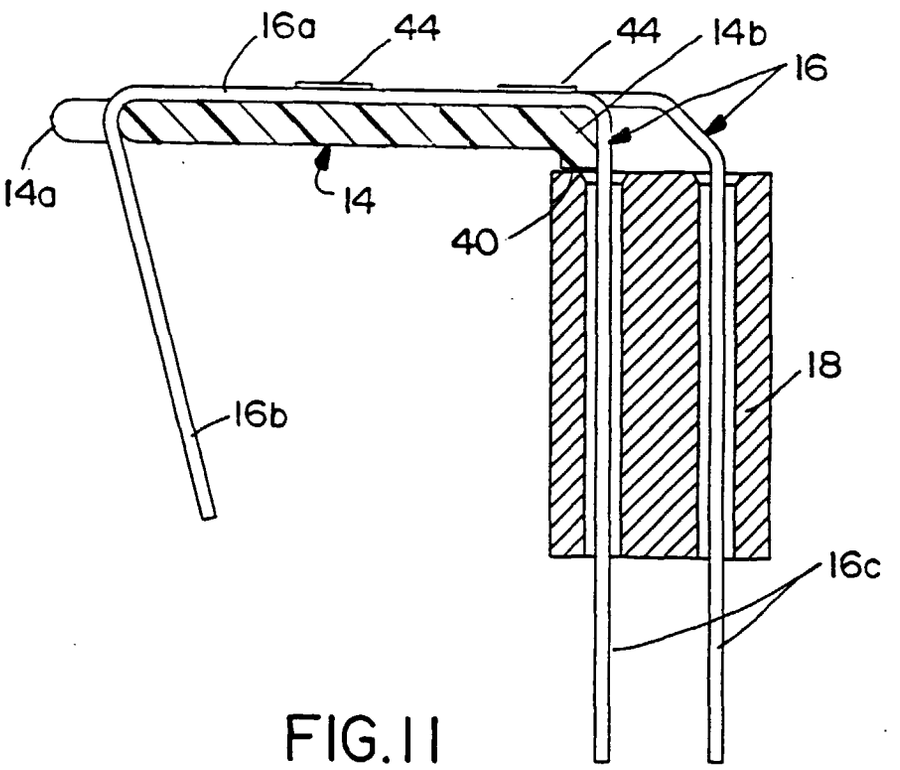

FIG.11