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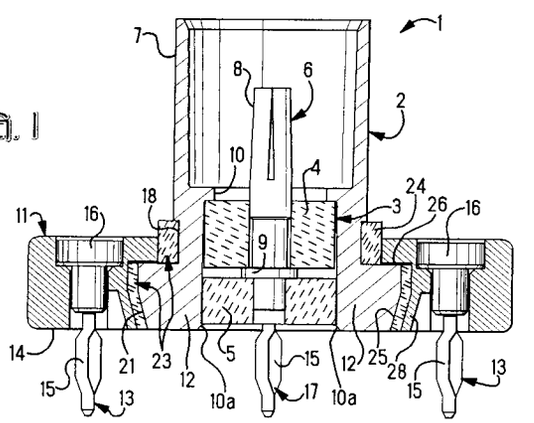
(54) Vertical mount connector.

(57) An electrical connector (1) comprises: a conductive contact 6 connected to a circuit board mounting terminal (17), an insulative body (3) surrounding the contact (6), a conductive shell (2) surrounding the insulative body (3), a base 11 surrounding the shell (2), and conductive circuit board mounting posts (13) on the base (11), the shell (2) being insulated from the base (11), and an electrical capacitor comprised of a dielectric element (26) being disposed between the shell (2) and the base (11).

FIG. 1



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The invention relates to a connector that is vertically mounted to a circuit board and incorporates an electrical filter.

A known connector described in U.S. Patent 4,684,200 comprises, a conductive shell surrounding an insulative body, a conductive contact surrounded by the insulative body, a mounting terminal on the contact, a base surrounding the shell, and mounting posts projecting from the base. A mating portion of the shell projects from the base. The mating portion is for mated coupling with an electrical connector that is terminated to an electrical cable. The terminal and the mounting posts connect to a circuit board. The mounting posts connect the base of the connector to a conductive ground path of the circuit board. One of the drawbacks of the known connector is that radio frequency interference, RFI, can induce a voltage in a signal contact of the connector.

A connector described in U.S. Patent 5,062,811 comprises, a conductive shell, capacitor elements against the shell, and a conductive clip engaging the capacitor elements and extending to mounting posts projecting from a housing surrounding the shell. Voltages induced by RFI are transmitted through the capacitor elements to a ground path of a circuit board to which the mounting posts are connected. It is desirable to shorten the conductive path between the capacitor elements and the ground path of the circuit board, thereby to reduce the electrical resistance in the circuit path, and to reduce the transmission time of the induced voltages to the circuit board.

The invention is directed to an electrical connector constructed with an electrical capacitor suppressing RFI that could be transmitted from a signal contact of the connector to a circuit board. The capacitor is constructed with insulation material such as a dielectric element between a base of the connector and a conductive shell adapted with a mating portion for mating connection to another electrical connector. Voltages induced in the shell by RFI are transmitted through the capacitor to a ground plane or ground path on the circuit board to which the base is mounted.

According to the invention, a dielectric element is between the shell and a base of the connector.

According to an embodiment of the invention, an electrical connector comprises, a conductive contact connected to a mounting terminal, an insulative body surrounding the contact, a conductive shell surrounding the insulative body, a base surrounding the shell, a mating portion of the shell projecting from the base, conductive mounting posts on the base, and a dielectric element between the shell and the base.

The invention is also directed to an electrical connector constructed with a conductive shell and capacitor elements to transmit voltages induced by RFI to a ground path of a circuit board. The capacitor elements are mounted on a top surface of a conductive mounting platform having the top surface facing the shell, and an opposite, second surface facing a circuit board and having circuit board mounting terminals on the second surface, whereby the conductive path between the capacitor elements and the terminals extends from one surface to the second surface through a thickness of the platform. Voltages induced in the shell by RFI are transmitted through the capacitor elements and their mounting platform to the terminals of the mounting platform adapted for engaging a ground path of a circuit board.

According to another embodiment of the invention, an electrical connector comprises, a conductive contact connected to a mounting terminal, an insulative body surrounding the contact, a conductive shell surrounding the insulative body, electrical capacitor elements in contact with the shell mounted on one surface of a conductive mounting platform, the one surface facing the shell, and an opposite second surface of the platform facing a circuit board and having projecting circuit board mounting terminals, whereby a conductive path from the capacitor elements extends from the one surface to the opposite surface through a thickness of the platform to the terminals.

Embodiments of the present invention will now be described by way of example with reference to the accopanying drawings in which:

Figure 1 is an elevational view in section of a connector comprising, a dielectric element between a shell and a base;

Figure 2 is an enlarged fragmentary sectional view of a portion of the connector shown in Figure 1;

Figure 3 is a perspective view of the connector shown in Figure 1 with parts separated from one another;

Figure 4 is a perspective view of the connector shown in Figure 3 with the parts assembled;

Figure 5 is a perspective view of the connector shown in Figure 4;

Figure 6 is an elevational view in section of an alternative connector;

Figure 7 is a bottom plan view of a conductive platform of the connector shown in Figure 6;

Figure 8 is an elevational view of the platform shown in Figure 7;

Figure 9 is a perspective view of the platform shown in Figure 7 with an insulator; and

Figure 10 is a bottom plan view of the structure shown in Figure 9 mounted in the connector shown in Figure 6.

With reference to Figure 1, a coaxial electrical connector 1 includes a hollow conductive shell 2

surrounding an insulative body 3, comprised of a first cylindrical portion 4 and a second cylindrical portion 5 surrounding a conductive electrical contact 6 concentric within the shell 2. The axis of the connector 1 is the concentric axis of the shell 2 and the contact 6. A top mating end 7 of the shell 2 provides a coupling for mated connection with another, complementary connector, not shown. An electrical receptacle portion 8 of the contact 6 is for mated connection with the complementary connector, not shown. The contact 6 has a radial flange 9 against which the portions 4, 5 of the insulative body 3 are seated. The shell 2 has an internal lip 10 against which the portion 4 seats to prevent movement of the insulative body 3 relative to the shell 2. A corner edge of the shell is indented inward radially at various points to provide protrusions 10a overlapping the portion 5 to prevent movement of the insulative body 3.

A broad base 11 surrounds a bottom 12 of the shell 2. The base 11 is conductive. Conductive circuit board mounting posts 13 extend beyond a mounting surface 14 of the base 11 and are adapted with compliant portions 15 to be connected to a circuit board, not shown. The posts 13 are connected to the base 11 with enlarged heads 16. Other fasteners 13' (Figs. 3-5) mechanically mount the base 11 to the circuit board, not shown. A conductive, circuit board mounting, electrical terminal 17 of the contact 6 has a compliant portion 15 and extends beyond the mounting surface 14 to be connected to a circuit board, not shown. Further details of the connector 1 are described in U.S. Patent 4,684,200.

With reference to Figure 2, the bottom 12 of the shell 2 has a stepped exterior having an annular groove 18 recessed in the exterior, an enlarged diameter portion 19 defining an exterior, circular flange 20 next to the groove 18, and a tapered, frustoconical end 21. The base 11 has a stepped interior passage 22 surrounding the stepped exterior of the shell 2. Insulative material 23 in the form of a first ring 24 which can be constructed of two segments butted together, and retained in the groove 18, Figure 3. The second ring 25 is a separate cylindrical part assembled around and on the bottom 12, or is a part that is molded directly around and on the bottom 12. A semiconductive capacitor element 26 comprising a relatively thin washer of material, such as barium titinate, surrounds the shell 2 and is placed against the flange 20. The base 11 is passed over the shell, Figure 3, until the element 26 registers against an interior transverse surface 27 of the shell that extends transverse to the axis of the coaxial connector 1. An electrical capacitor is established by intimate contact of the element 26 between the shell 2 and the base 11. If a voltage across the shell 2 is induced by RFI, the voltage across the element 26 will be transmitted through the base 11, through the posts 13 and into a ground plane of a circuit board, not shown, to which the posts 13 are connected, thereby advantageously protecting the contact 6 from RFI.

To insure intimate contact, the base 11 has a thin rim 28 that is radially inwardly formed toward the frustoconical portion 21 of the shell 2 to assume a frustoconical shape. The ring 25 is also deformed radially to conform to the shape of the portion 21. A clearance surrounds the rim 28 to permit receipt of a forming tool, not shown, against the rim 28. The rim 28 is deformed radially and in a direction axially, due to the frustoconical shape. The rim 28 when deformed axially will urge the shell 2 axially against the element 26, and will urge both of them axially toward the transverse surface 27, clamping the element 26 between the shell 2 and the base 11 and establishing the intimate contact. The element 26 is in a relatively small space or clearance between the shell 2 and the base 11. To insure that the shell 2 is insulated from the base 11, the insulative material of the insulative material 23 fills relatively large, radial spaces or clearances between the shell 2 and the base 11. The insulative material 23 encloses the element 26.

With reference to Figure 6, a coaxial electric connector 1' includes a hollow conductive shell 2' surrounding an insulative body 3', comprised of a first cylindrical portion 4' and a second cylindrical portion 5' surrounding a conductive electrical contact 6' concentric within the shell 2'. The axis of the connector 1' is the concentric axis of the shell 2' and the contact 6'. A top mating end 7' of the shell 2' provides a coupling for mated connection with another, complementary connector, not shown. An electrical receptacle portion 8' of the contact 6' is for mated connection with the complementary connector, not shown. The contact 6' has a radial flange 9' against which the portions 4', 5' of the insulative body 3' are seated. The shell 2' has an internal lip 10' against which the portion 4' seats to prevent movement of the insulative body 3' relative to the shell 2'. A corner edge of the shell 2' is indented inwardly radially at various points to provide protrusions 10'a (Fig. 10) overlapping the portion 5' to prevent movement of the insulative body 3'.

A broad base 11', Figure 10, surrounds a bottom 12' of the shell 2'. The base 11' is conductive and is a unitary part of the shell 2'. Conductive, circuit board mounting fasteners or posts 13'a extend beyond a mounting surface 14' of the base 11' and are adapted with compliant portions 15' to be connected to a circuit board, not shown. The posts 13'a are connected to the base 11'. Other fasteners 13'b mechanically mount the base 11' to

the circuit board, not shown. A conductive circuit board mounting, electrical terminal 17' of the contact 6' has a compliant portion 15' and extends beyond the mounting surface 14' to be connected to a circuit board, not shown. Further details of the connector 1' are described in U.S. Patent 4,684,200.

With reference to Figures 6 and 10, the base 11' has a stepped interior passage 22' surrounding the exterior of the shell 2' at the bottom 12'. A second insulative body 23' in the form of a ring, Figure 4, is passed over the bottom 12' of the shell 2' and is retained in the passageway 22' of the base 11'. Corner edges of the base 11' are indented inwardly radially at various points to provide protrusions 23'a overlapping the insulative body 23' to prevent movement of the insulative body 23'.

Electrical circuit elements such as capacitor elements 26' are placed in passages 29 through the ring 23'. The capacitor elements 26' are surrounded by the ring 23', which is supported, Figure 6, on a mounting surface 30 of a conductive platform 31.

As shown in Figures 7, 8 and 10, the platform 31 comprises stamped and formed metal having an inner opening 32 through its thickness. A set of first conductive resilient spring fingers 33 carry the mounting surface 30, and comprise cantilever beams formed in the thickness of the platform 31 and bent to project into the passages 29 to engage and urge the capacitor elements 26 axially of the connector 1', Figure 6, and into engagement with the base 11' of the shell 2'. Circuit board engaging electrical terminals 34 comprise a second set of conductive spring fingers as cantilever beams formed in the thickness of the platform 31 and bent to project outwardly. The terminals 34 carry a circuit board facing surface 35 of the platform 31, and project in the same direction from the base 11' as the posts and fasteners 13'a and 13'b which project for connection to a circuit board, not shown. Each of the terminals 34 project for resilient engaged connection to a conductive path, not shown, comprising a ground plane of the circuit board.

If a voltage across the shell 2' is induced by RFI, the voltage will be transmitted through the capacitor elements 26', through the thickness of the platform 31 that is defined between the surfaces 30 and 35, and to a ground plane of a circuit board, not shown, to which the terminals 34 are connected.

The platform 31 is attached to the insulative body 23'. The insulative body 23' includes unitary posts 36 projecting from recesses 37, and extending through openings 38 through the thickness of the platform 31. The openings 38 are surrounded by recesses 39 stamped as offset areas of the platform 31. Ends of the posts 36 that extend through the openings 38 are enlarged by the application of heat and pressure to form enlarged heads 40, Figures 6 and 10, that overlap the openings 38 and retain the platform 31 on the insulative body 23'. The heads 40 are recessed from the bottom surface of the platform 31. The insulative body 23' insulates the platform 31 from contact with the base 11'.

The present embodiments have the advantage that a capacitor element is placed between facing surfaces of an outer metal shell and a metal mounting platform. Another advantage is that the capacitor elements are positoned in a cavity of the outer metal shell and are biased in engagement with the metal shell by means of metal spring members.

Claims

1. An electrical connector (1,1') comprising a conductive contact (6,6') connected to a circuit board mounting terminal (17,17'), an insulative body (3,3') surrounding the contact (6,6'), a conductive shell (2,2') surrounding the insulative body (3,3'), a base (11,11') surrounding the shell (2,2'), and conductive circuit board mounting posts (13,13',13'a,13'b) on the base (11,11'), characterized in that an electrical capacitor element (26,26') is positioned between the shell (2,2') and the base (11,11').

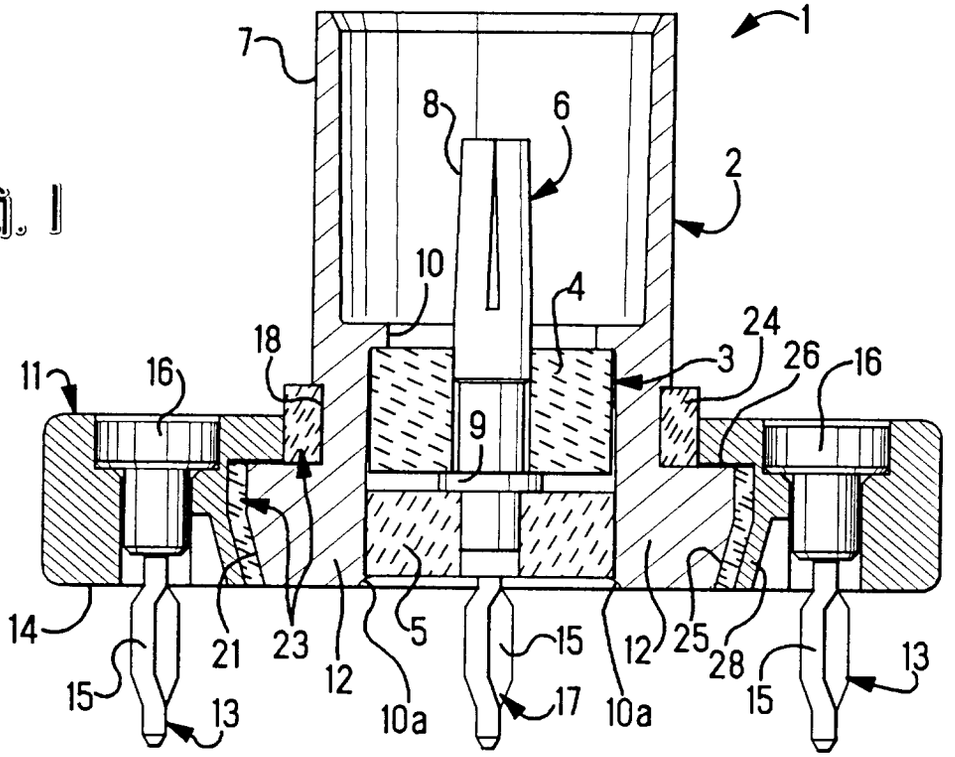
2. An electrical connector (1) as claimed in claim 1, characterized in that insulative material (23) is positioned between said shell (2) and said base (11) with the capacitor element (26) in the form of a ring disposed in electrical engagement with said shell (2) and said base (11) between members (24,25) of said insulative material (23).

3. An electrical connector (1) as claimed in claim 2, characterized in that said members (24,25) are ring members disposed between said shell (2) and said base (11).

4. An electrical connector (1') as claimed in claim 1, characterized in that an insulative body (23') is retained in a passageway (22') of said base (11') and said insulative body (23') includes a passage (29) in which said capacitor element (26') is disposed, with an inner end of said capacitor element (26') engaging said base (11'), and a metal platform (31) extending along said insulative body (23') and said base (11') and including an electrical terminal (34) extending into said passage (29) and engaging an outer end of said capacitor element (26').

5. An electrical connector (1') as claimed in claim 4, characterized said metal platform (31) includes a spring fingers (33) extending outwardly from said platform (31).

FIG. 1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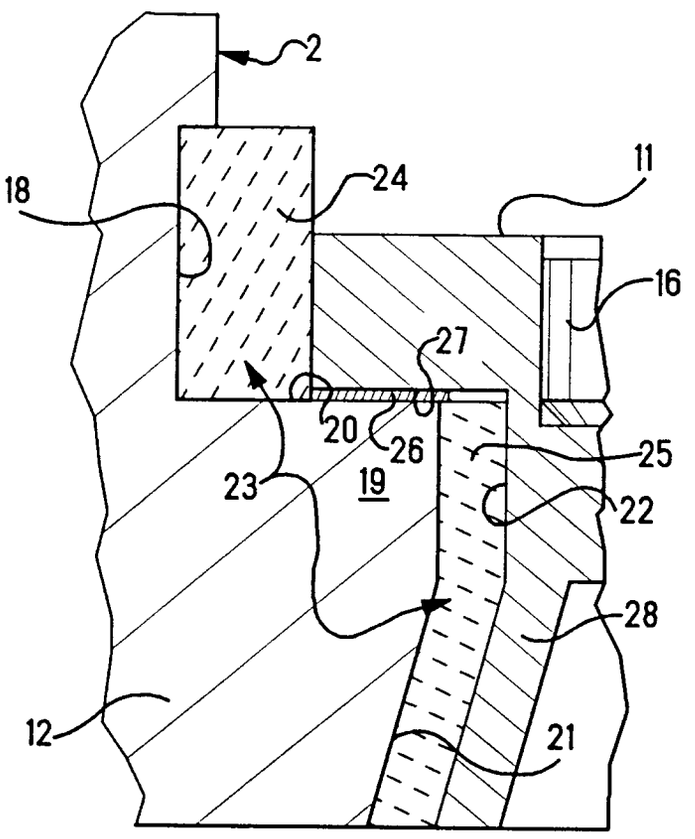
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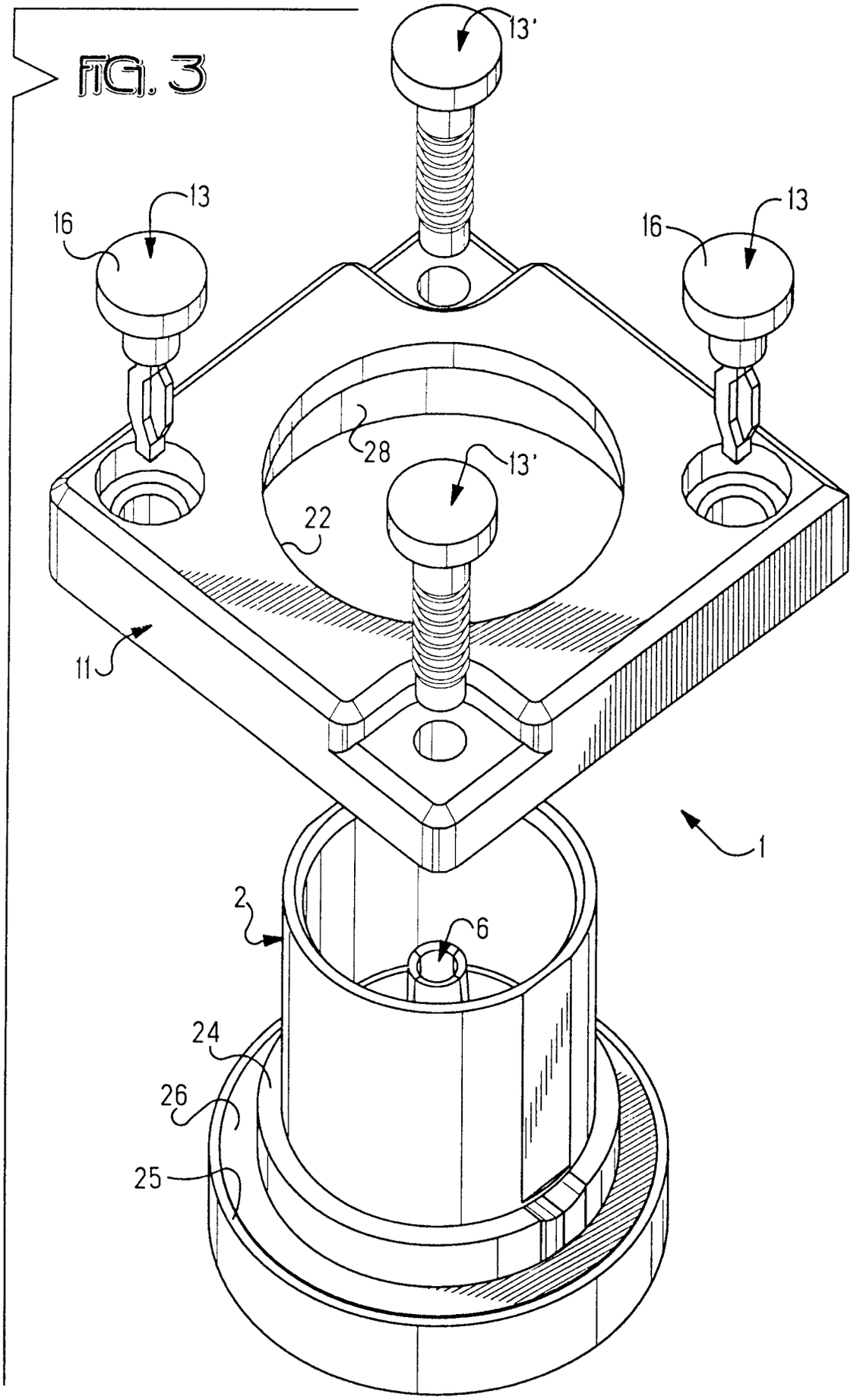
FIG. 2

FIG. 3



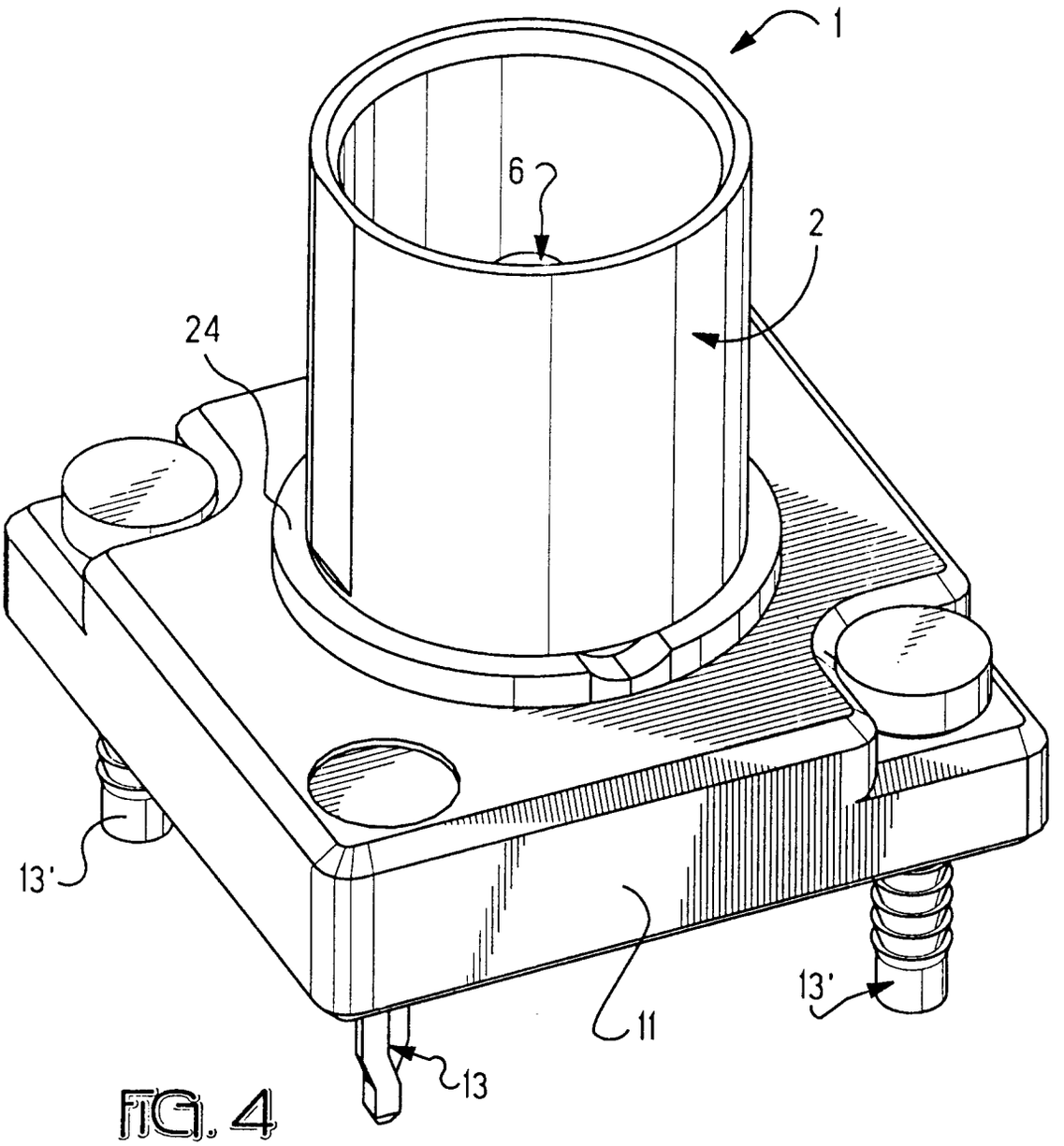


FIG. 4

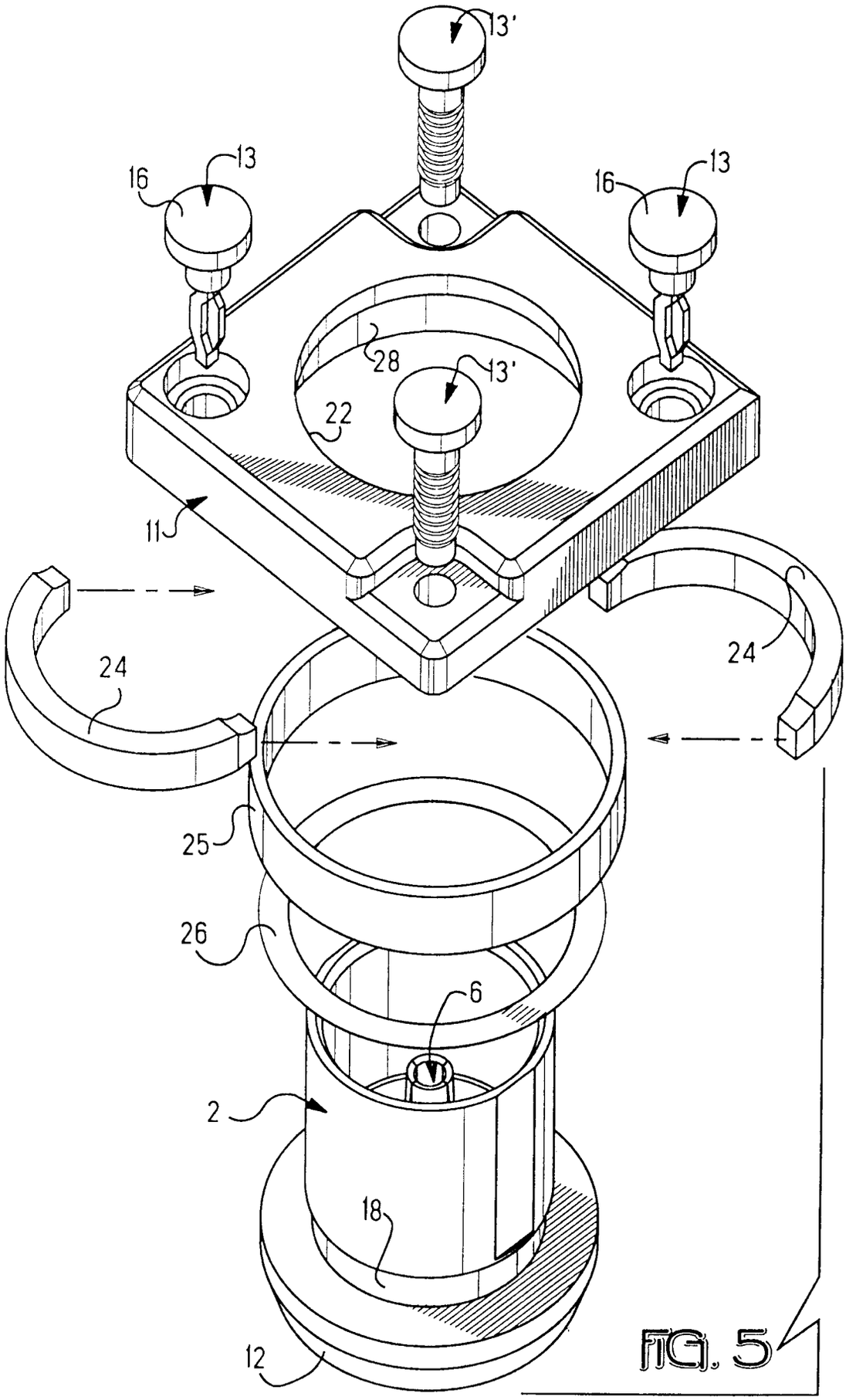


FIG. 5

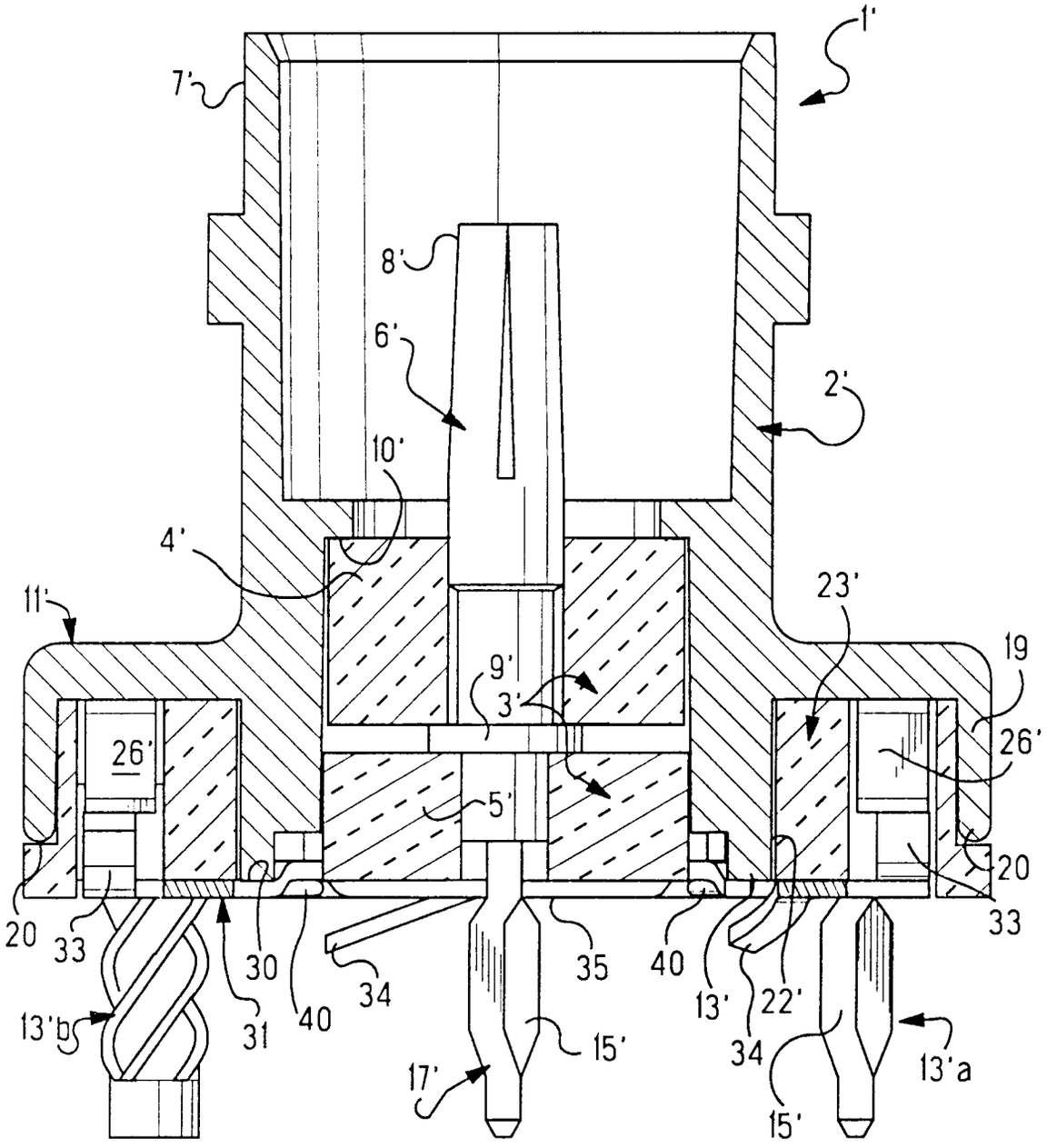

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FIG. 6

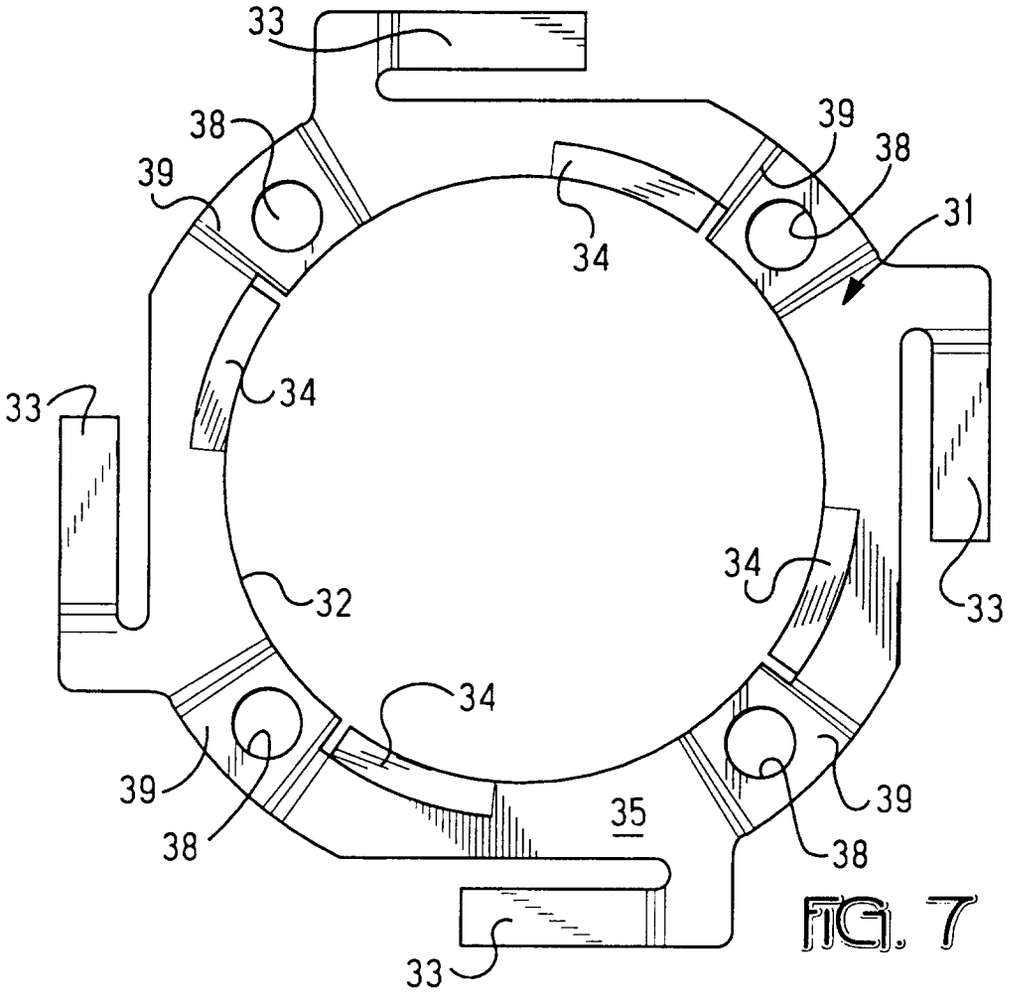
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FIG. 7

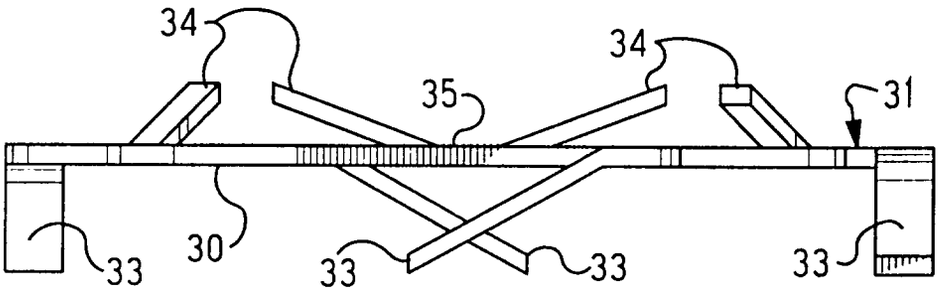
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FIG. 8

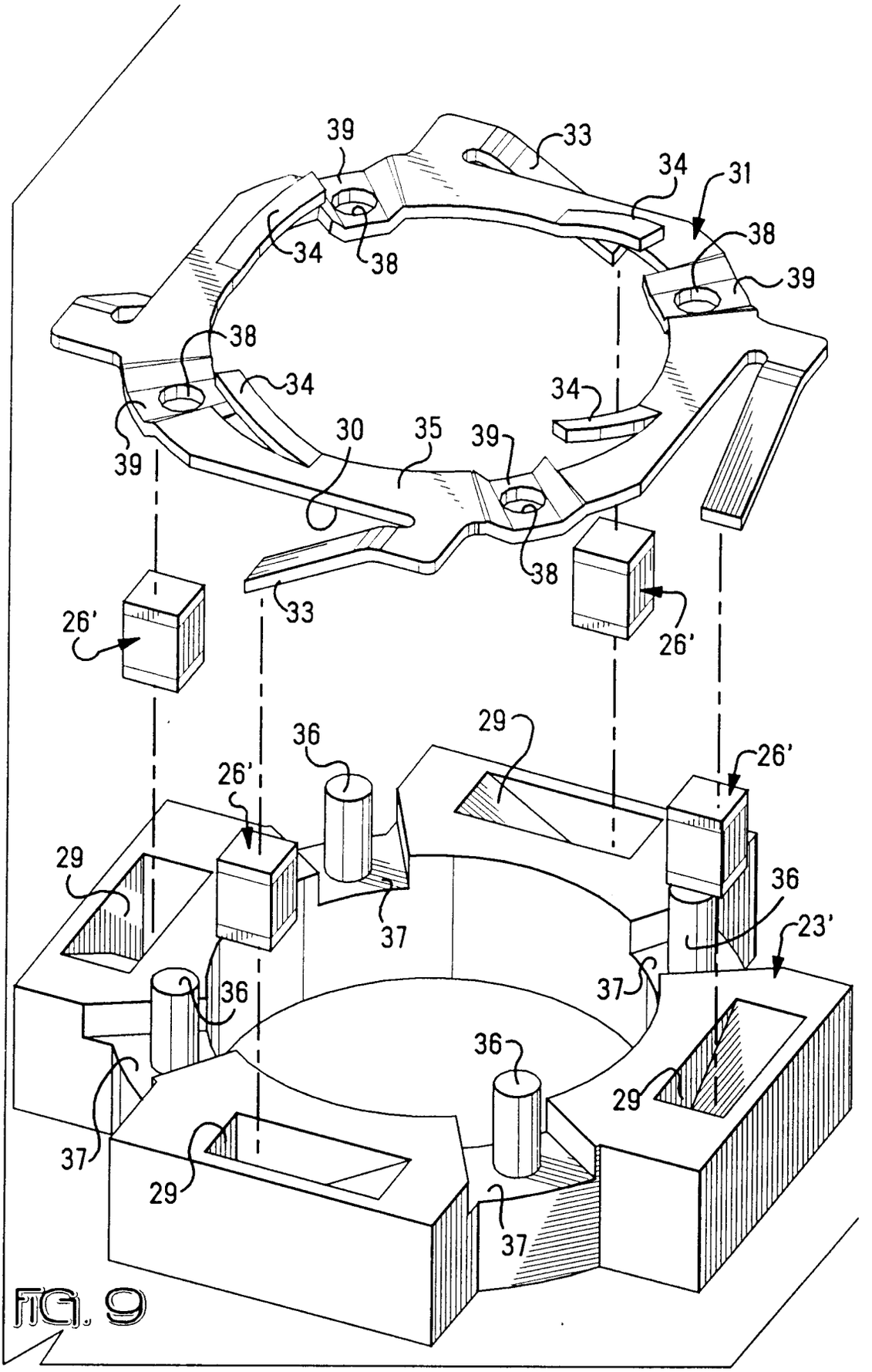
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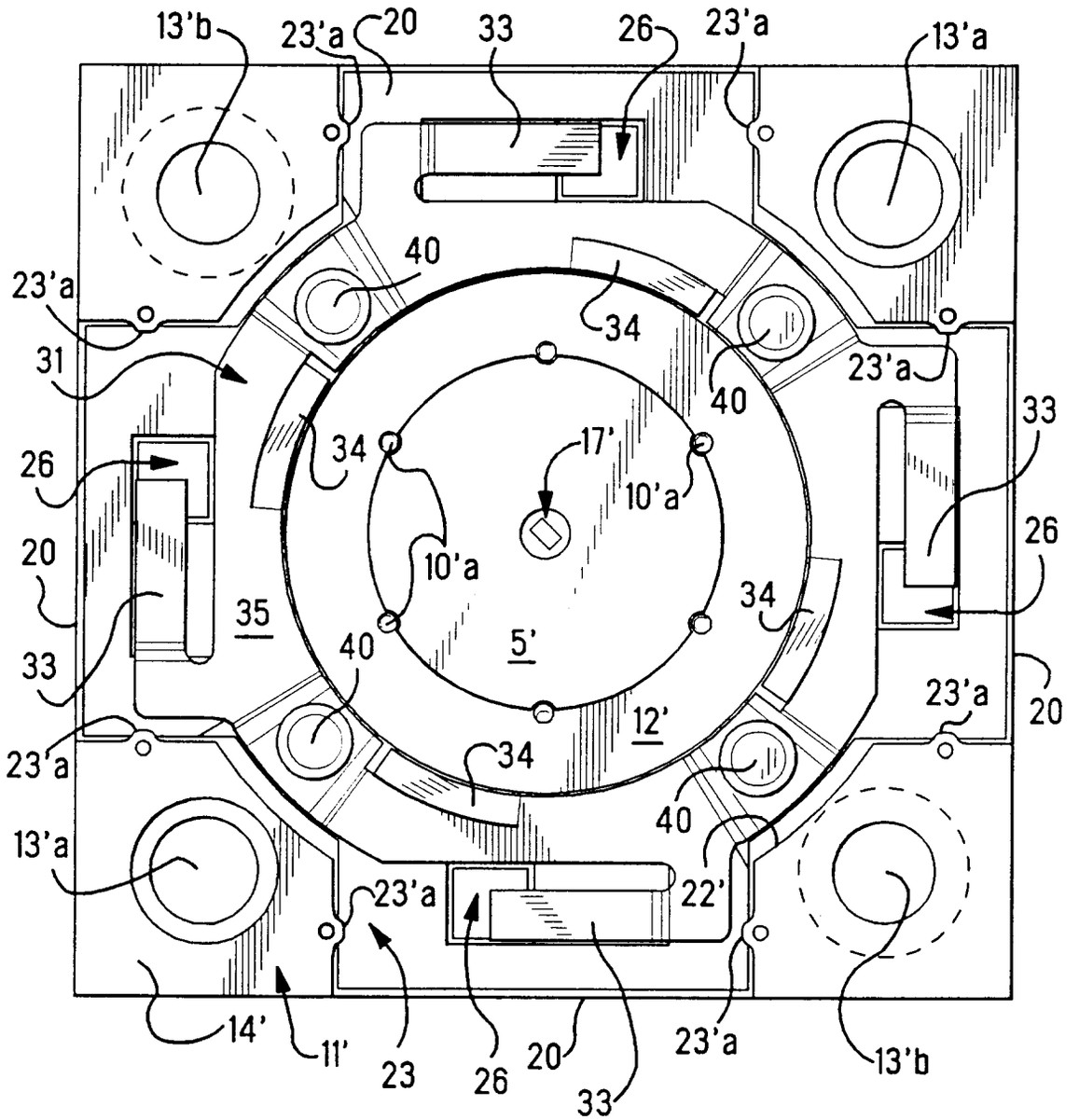
FIG. 9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23'a
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FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 30 2963

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.5)
D,Y	US-A-4 684 200 (CAPP) * column 2, line 12 - column 3, line 52; figure 2 *	1-5	H01R17/12 H01R13/66
D,Y	US-A-4 934 960 (CAPP ET AL.) * column 3, line 13 - column 4, line 43; figure 2 *	1-5	
A	US-A-4 772 221 (KOZLOF) * column 3, line 54 - column 4, line 19; figure 2 *	1,4	
D,A	US-A-5 062 811 (HACKMAN) * column 3, line 26 - line 35; figure 4 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 AUGUST 1993	KOHLER J.W.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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