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

(11) Publication number: **0 251 518**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87305029.8**

(51) Int. Cl.4: **H01R 13/436**

(22) Date of filing: **08.06.87**

(30) Priority: **21.06.86 GB 8615183**

(43) Date of publication of application:
07.01.88 Bulletin 88/01

(84) Designated Contracting States:
DE ES FR GB SE

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(54) Electrical connectors.

(57) An electrical connector comprising a moulded sythetic resin body (11), a plurality of parallel terminal receiving passages (15) in the body, said passages (15) being open at one face of the body (11) to permit insertion of respective terminals (16), and having abutment surfaces to limit movement of the terminals (16) in the passages (15) in the insertion direction, each of said passages (15) having a shoulder (19) intermediate the ends thereof for engagement by a locking latch (17) of the terminal (16) to resist withdrawal of the terminal (16), and each passage (15) being open at an opposite face of the body (11) to provide access to the terminals (16) whereby mating terminals can be introduced into said terminals (16) of the connector in use, the body (11) further being provided with a plurality of locking bar passages (21) extending into the body (11) parallel to said terminal receiving passages (15), each locking bar passage (21) being positioned adjacent a respective terminal receiving passage (15) and the connector further including a plurality of locking bars (124) for insertion into respective locking bar passages (21), the body (11) defining, between each terminal receiving passage (15) and its respective locking bar passage (21), a deflectable arm (22) which can be deflected from a rest position, by introduction of a locking bar (124) into the respective locking bar passage (21), to an operative position in which the arm (22) projects into the respective terminal receiving passage (15) to lie in the path of withdrawl of the respective terminal (16), each arm (22) and the respective locking bar (124) being so arranged that as the locking bar (124) approaches its fully inserted position the co-action between the arm (22) and the locking bar (124) takes place at a point along the length of the arm (22) spaced from the free end of the arm so that in the event that the terminal (16) of the respective terminal receiving passage (15) is not fully inserted into the passage (15) and is thus engaged by the arm (22) during its deflection then the arm (22) is caused to flex in a region spaced from its free end and the free end surface (23) of the arm (22) remains in a position wherein it can be abutted by a stop surface (126) on the respective locking bar (124) to prevent full insertion of the locking bar (124).

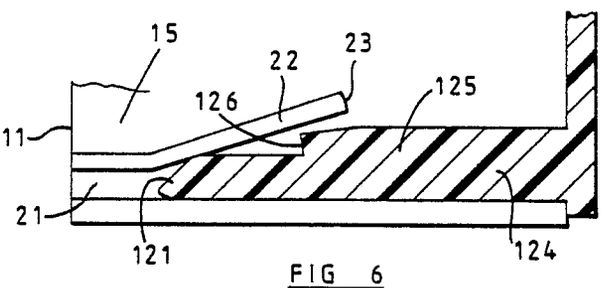

FIG 6

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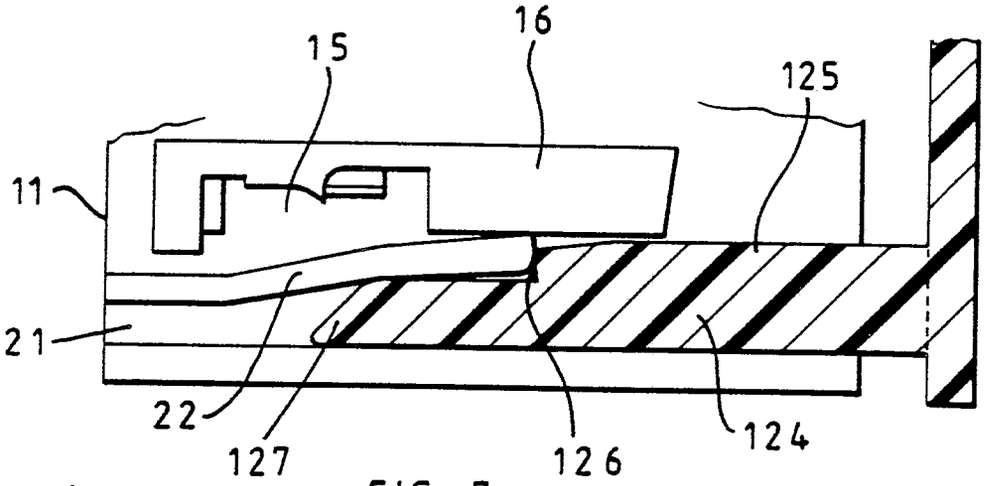

FIG 7

ELECTRICAL CONNECTORS

This invention relates to electrical connectors, particularly but not exclusively for making electrical connection to devices such as electro-magnetic relays or the like wherein connection is to be made to a plurality of parallel blade terminals extending from one face of the device.

In our co-pending European Patent Application number 84301315.2 (published as 0121324) the disclosure of which is imported herein by this reference, there is disclosed inter-alia an electrical connector the body of which contains a plurality of parallel terminal receiving passages and parallel locking bar receiving passages, terminals received in their respective passages being held against withdrawal from their passages by respective lances or the like on the terminals which engage shoulders in their respective passages and by parts of the passage wall defining respective arms which are deflected to engage behind the correctly positioned terminals by locking bars introduced into the locking bar passages. The locking bars are carried as integral components projecting from a common plate and the intention is that in the event that one or more terminal is not fully inserted into its respective passage then the or each terminal will obstruct the deflection of the respective arm so preventing full insertion of the respective locking bar. Since all of the locking bars are carried by a common plate, then should even one of the locking bars be prevented from reaching its fully inserted position then the plate will not be correctly engaged to the body of the connector and will provide a clear visual indication of the fact that one of the terminals at least is not properly inserted. As described in application 84301315.2 the operative end regions of the locking bars are wedge-shaped to facilitate deflection of the respective arms. In normal useage this system works extremely well, but it has been found that occasionally an unskilled operator, finding resistance to insertion of the locking bars as a result of failure to fully insert one or more terminals, will not recognise that a terminal is not properly in place, and will apply excessive force to drive the locking bars home. It has been found that such applications of excessive force can distort the arm associated with the terminal which is not fully inserted into its respective passage and/or the terminal itself, sufficiently to permit the locking bar to be fully inserted, so that subsequently the connector has the appearance of one in which all of the terminals have been fully inserted. It is an object of the present invention to provide an electrical connector wherein this disadvantage is minimised.

In accordance with the present invention there is provided an electrical connector comprising a moulded synthetic resin body, a plurality of parallel terminal receiving passages in the body, said passages being open at one face of the body to permit insertion of respective terminals, and having abutment surfaces to limit movement of the terminals in the passages in the insertion direction, each of said passages having a shoulder intermediate the ends thereof for engagement by a locking latch of the terminal to resist withdrawal of the terminal, and each passage being open at an opposite face of the body to provide access to the terminals whereby mating terminals can be introduced into said terminals of the connector in use, the body further being provided with a plurality of locking bar passages extending into the body parallel to said terminal receiving passages, each locking bar passage being positioned adjacent a respective terminal receiving passage and the connector further including a plurality of locking bars for insertion into respective locking bar passages, the body defining, between each terminal receiving passage and its respective locking bar passage, a deflectable arm which can be deflected from a rest position, by introduction of a locking bar into the respective locking bar passage, to an operative position in which the arm projects into the respective terminal receiving passage to lie in the path of withdrawl of the respective terminal, each arm and the respective locking bar being so arranged that as the locking bar approaches its fully inserted position the co-action between the arm and the locking bar takes place at a point along the length of the arm spaced from the free end of the arm so that in the event that the terminal of the respective terminal receiving passage is not fully inserted into the passage and is thus engaged by the arm during its deflection then the arm is caused to flex in a region spaced from its free end and the free end surface of the arm remains in a position wherein it can be abutted by a stop surface on the respective locking bar to prevent full insertion of the locking bar.

Preferably the locking bars are carried by a common locking plate which, when the bars are fully inserted in the body, engages said opposite face of the body, said plate having apertures therein to provide access to said terminal receiving passages.

Desirably said locking bars are integral with said plate.

In the accompanying drawings

Figures I and 2 are taken from our co-pending European Patent Application 84301315.2 and show respectively an end view of connector body and a sectional view of the connector body and its associated locking plate and locking bars,

Figure 3 is an enlarged diagrammatic representation of one of the terminal receiving passages of the body of a connector in accordance with one example of the present invention, showing the associated terminal and locking bar,

Figure 4 is a view similar to Figure 3 but illustrating the terminal and locking bar in their normally operative positions,

Figure 5 is a view similar to Figure 4 showing the parts in the positions which they occupy if a terminal has not been fully inserted into the respective passage, and

Figures 6 and 7 are views similar to Figures 4 and 5 respectively of a modification.

Referring to the drawings, the electrical connector is basically very similar to the connector disclosed in our European Patent Application 84301315.2 and in view of the full description given in the specification of application 84301315.2 only a general description of the basic construction will be given herein.

The connector body 11 is a generally cubic synthetic resin moulding and has associated therewith a moulded synthetic resin locking member 12. Extending through the body 11 between upper and lower faces 13, 14 thereof, is a plurality of terminal receiving passages 15. The passages 15 are of two different sizes, adapted to receive different sizes of terminal 16, each of the terminals 16 being a flat socket terminal of the kind known as a LUCAR (Registered Trade Mark). The terminals 16 are inserted into their respective passages 15 from the ends of the passages 15 open at the lower face 14 of the body. Each terminal 16 includes an integral resilient lance 17 which is deflected by ramp 18 on the wall of the respective passage 15 as the terminal is inserted. When the terminal 16 reaches its fully inserted position within its respective passage 15 the lance 17 can restore towards its original position to engage behind a shoulder 19 on the wall of the passage thus resisting withdrawal of the terminal 16 from the passage.

Associated with each terminal receiving passage 15 is a respective locking bar receiving passage 21. The locking bar passages 21 extend into the body 11 from the face 13, and extend parallel to the terminal receiving passages 15. A region of the wall of the body 11 which separates each terminal receiving passage 15 from its respective locking bar receiving passage 21 is shaped, at a point part way along the length of the passage 15, to define a resilient arm 22 extending in the direction of the length of the passages 15, 21, and having its free end surface 23 presented towards the upper face 13 of the body 11.

In the absence of a locking bar in a passage 21 the arm 22 occupies a rest position as shown in Figure 2 wherein the arm does not extend into the passage 15, and thus does not impede introduction of a terminal 16 into the passage. Insertion of a locking bar 24 into a respective passage 21 results in the locking bar 24 deflecting the arm 22 so that it projects into the associated passage 15. The arrangement is such that if the terminal 16 is fully inserted within its respective passage 15 then the free end surface 23 of the arm 22 will, in the deflected position of the arm 22, lie behind the socket portion of the terminal 16 and thus will obstruct withdrawal of the terminal 16 from the passage 15. Assuming therefore that the lance 17 of the terminal has for some reason failed to latch behind the shoulder 19 of the passage then after introduction of the locking bar the arm 22 will prevent withdrawal of the terminal. Figure 2 illustrates the locking bar arrangement described in our co-pending European Patent Application 84301315.2, from which it can be seen that the locking bars 24 have inclined ramp surfaces 25 at their free ends for deflecting the respective arms 22.

In the event that a terminal 16 is not fully inserted into its passage 15 when an attempt is made to insert the locking bar 24, then initial deflection of the arm 22 will cause the arm 22 to abut the side of the terminal, and further insertion movement of the locking bar will thus be resisted. It is intended that this resistance to further insertion of the locking bar shall provide an indication to an operator that a terminal is not fully inserted into its respective passage 15. However, it has been found that some unskilled operators, not recognizing that the resistance to further insertion of a locking bar 24 is an indication of misalignment of an associated terminal, may apply additional, and excessive insertion force to the locking bar 24. As is apparent from Figure 2 the ramp surfaces 25 provide the locking bars with a wedge-shaped configuration and thus after an arm 22 has been deflected sufficiently far to engage the misaligned terminal 16 then any additional insertion force applied to the locking bar is transmitted by the wedge-shaped end region primarily to the free end region of the arm 22, and through the arm 22 to the associated terminal 16. Excessive application of insertion force has been found in some cases to result in sufficient distortion of the free end region of an arm 22 and/or the associated terminal 16, to permit the locking bar 24 to be inserted "fully home" in its respective passage. Thereafter of corse there is no visual indication (as would otherwise arise from the

locking bar not being "fully home") that a terminal is not fully inserted into its respective passage 15, and thus the visual appearance of the connector is that of a correctly assembled connector.

The foregoing description is of the known arrangement disclosed in our co-pending European Patent Application 84301315.2. Turning now to Figures 3, 4 and 5 it will be recognized that the locking bars 124 differ from the locking bars 24 of Figure 2. Each locking bar 124 is provided on its face presented to the respective passage 15 in use, with an integral longitudinal extending rib 125 terminating short of the free end of the locking bar 124 in a stop surface 126 extending transverse to the length of the locking bar 124. Moreover, the operative end region 127 of each locking bar 124, that is to say the region which coacts with the arm 22 in use, has a maximum thickness restricted to a value such that it will deflect the free end region of its respective arm 22 only sufficiently far to lightly engage a terminal 16 which has not been fully inserted into its respective passage 15. Notwithstanding this maximum thickness of the operative end region 127 of each bar 124 it will be understood that in the event that a terminal is fully inserted into a respective passage 15 then as the respective locking bar 124 reaches its fully inserted position sufficient deflection of the arm 22 will have occurred to cause the end surface 23 to lie behind the socket region of the respective terminal 16.

In order to understand the operation more fully consideration should be given to Figures 4 and 5. Looking firstly at Figure 4 it can be seen that a terminal 16 has been fully inserted into its respective passage 15 and the locking bar 124 has been fully inserted into its respective passage 21. Notwithstanding the restricted thickness of the operative end region 127 of the locking bar 124 full deflection of the arm 22 has occurred since the operative region 127 of the locking bar coacts with the arm 22 adjacent its root, rather than adjacent its free end surface 23. Obviously, the closer the region 127 approaches the root of the arm 22 then the greater will be the deflection at the free end of the arm. In particular it will be noted that the arm 22 is deflected sufficiently far for the stop surface 126 of the bar 124 to slide past the end surface 23 of the arm 22.

Consider now the condition illustrated in Figure 5 where the terminal 16 was not fully inserted into its passage 15. During initial insertion of the locking bar 124 its operative region 127 coacted with the free end region of the arm 22 and deflected the free end region to engage lightly against the side of the terminal 16. Further insertion movement of the bar 124 did not apply additional force to the arm 22 at its free end region but instead applied force progressively further down the arm 22 towards its root. This additional insertion movement of the bar 124 is accommodated by flexure of the arm 22 between its root and its free end without applying any significant additional force laterally at the free end of the arm. Thus there is no tendency to distortion of the free end region of the arm 22 and/or the terminal 16, and the free end surface 23 of the arm remains in a position where it can be abutted by the stop surface 126 of the bar 124. Immediately such abutment occurs then further insertion movement of the bar 124 is prevented. Clearly the abutment of the surface 126 with the surface 23 is a face to face abutment in a plane at right angles to the insertion direction of the bar 124. The positioning of the stop surface 126 and the free end 23 of the arm 22 is such that when abutment occurs the bar 124 is someway short of its fully inserted position and thus a visual indication is given that the terminal 16 is not fully inserted in the passage 15. The abutment of the surface 126 with the surface 23 can of course accept considerable insertion force loading on the bar 123, and thus, short of total destruction of the connector, the bar 124 will not reach its fully inserted position and even an unskilled operator will recognise that there has been some failure to assemble the connector correctly.

The operative end region 127 of each bar 124 is tapered so as to present an inclined face to the respective arm 22 in order both to facilitate insertion of the bar into its passage 21 and to facilitate initial deflection of the respective arm 22 during insertion.

Extending part way along the rib 125 of each bar 124 is a further rib 128 of increased height. Each rib 128 terminates short of the surface 126 and is provided in order to prevent insertion of the bar 124 in the event that the respective terminal 16 has been inserted back to front. Each terminal has a flat face from which the lance 17 projects and an opposite face defined by a pair of parallel rolled over portions. The rolled over portions should be presented towards the side of the passage 15 containing the arm 22 in which case the rib 128 can pass between the rolled over portions of the terminal during insertion of the bar 124. However if the terminal 16 has been inserted into its passage 15 with the flat face presented to the arm 22 then subsequently, during insertion of the bar, the end of the rib 128 will abut the terminal 16 so preventing further insertion of the bar and giving an indication to the operator that the terminal is incorrectly positioned.

As with the connector illustrated and described in our co-pending European Patent Application 84301315.2 the locking bars 124 extend parallel to one another and are integral with a common locking plate to form the locking member 12 the plate

having apertures therein to provide access, for mating terminals, to the terminals I6 in the passages I5. When all of the locking bars I24 are "fully home" in their respective passages 2I then the undersurface of the plate of the locking member I2 engages the upper face I3 of the body II. If any one of the associated terminals has not been fully introduced into its respective passage I5 then the plate of the locking member I2 cannot be brought into facial contact with the end face I3 of the body.

In the modification illustrated in Figures 6 and 7 the shape of the locking bars I24 has been simplified although the operation thereof in relation to the respective arms 22 is unchanged. The further rib I28 of Figures 3 to 5 has been dispensed with, its function in ensuring correct orientation of the respective terminal being performed by appropriate shaping of the wall of the terminal receiving passage.

Claims

I. An electrical connector comprising a moulded sythetic resin body (II), a plurality of parallel terminal receiving passages (I5) in the body, said passages (I5) being open at one face of the body (II) to permit insertion of respective terminals (I6), and having abutment surfaces to limit movement of the terminals (I6) in the passages (I5) in the insertion direction, each of said passages (I5) having a shoulder (I9) intermediate the ends thereof for engagement by a locking latch (I7) of the terminal (I6) to resist withdrawal of the terminal (I6), and each passage (I5) being open at an opposite face of the body (II) to provide access to the terminals (I6) whereby mating terminals can be introduced into said terminals (I6) of the connector in use, the body (II) further being provided with a plurality of locking bar passages (2I) extending into the body (II) parallel to said terminal receiving passages (I5), each locking bar passage (2I) being positioned adjacent a respective terminal receiving passage (I5) and the connector further including a plurality of locking bars (I24) for insertion into respective locking bar passages (2I), the body (II) defining, between each terminal receiving passage (I5) and its respective locking bar passage (2I), a deflectable arm (22) which can be deflected from a rest position, by introduction of a locking bar (I24) into the respective locking bar passage (2I), to an operative position in which the arm (22) projects into the respective terminal receiving passage (I5) to lie in the path of withdrawl of the respective terminal (I6), the connector being characterized in that each arm (22) and the respective locking bar (I24) are so arranged that as the locking bar (I24) approaches its fully inserted position the co-action between the arm (22) and the locking bar (I24) takes place at a point along the length of the arm (22) spaced from the free end of the arm so that in the event that the terminal (I6) of the respective terminal receiving passage (I5) is not fully inserted into the passage (I5) and is thus engaged by the arm (22) during its deflection then the arm (22) is caused to flex in a region spaced from its free end and the free end surface (23) of the arm (22) remains in a position wherein it can be abutted by a stop surface (I26) on the respective locking bar (I24) to prevent full insertion of the locking bar (I24).

2. An electrical connector as claimed in claim I characterized in that the locking bars (I24) are carried by a common locking plate which, when the bars (I24) are fully inserted in the body, engages said opposite face of the body (II), said plate having apertures therein to provide access to said terminal receiving passages (I5).

3. An electrical connector as claimed in claim 2, characterized in that said locking bars (I24) are integral with said locking plate.

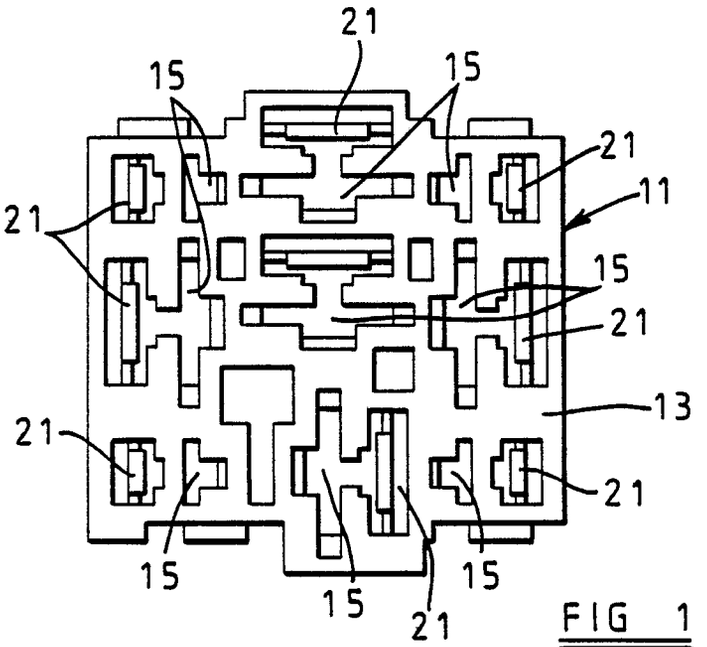
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FIG 1

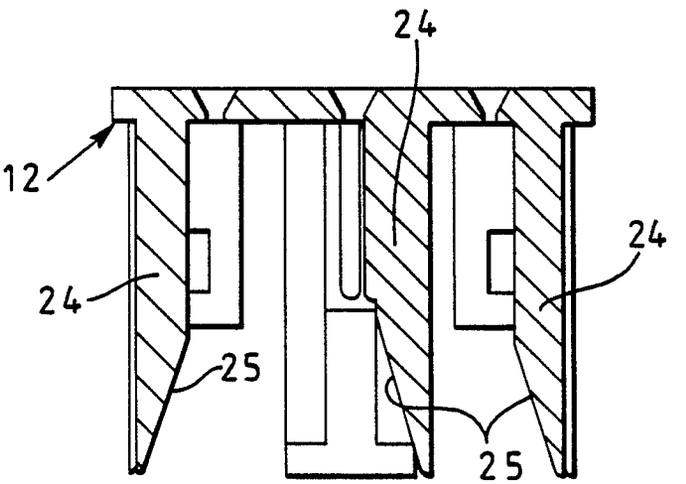
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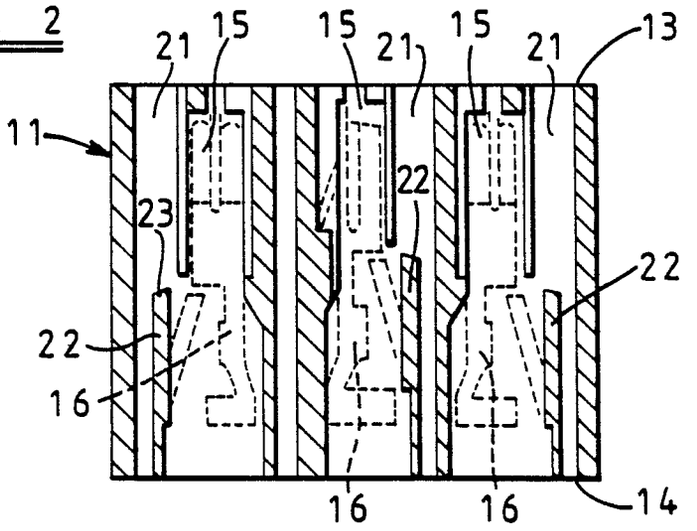
FIG 2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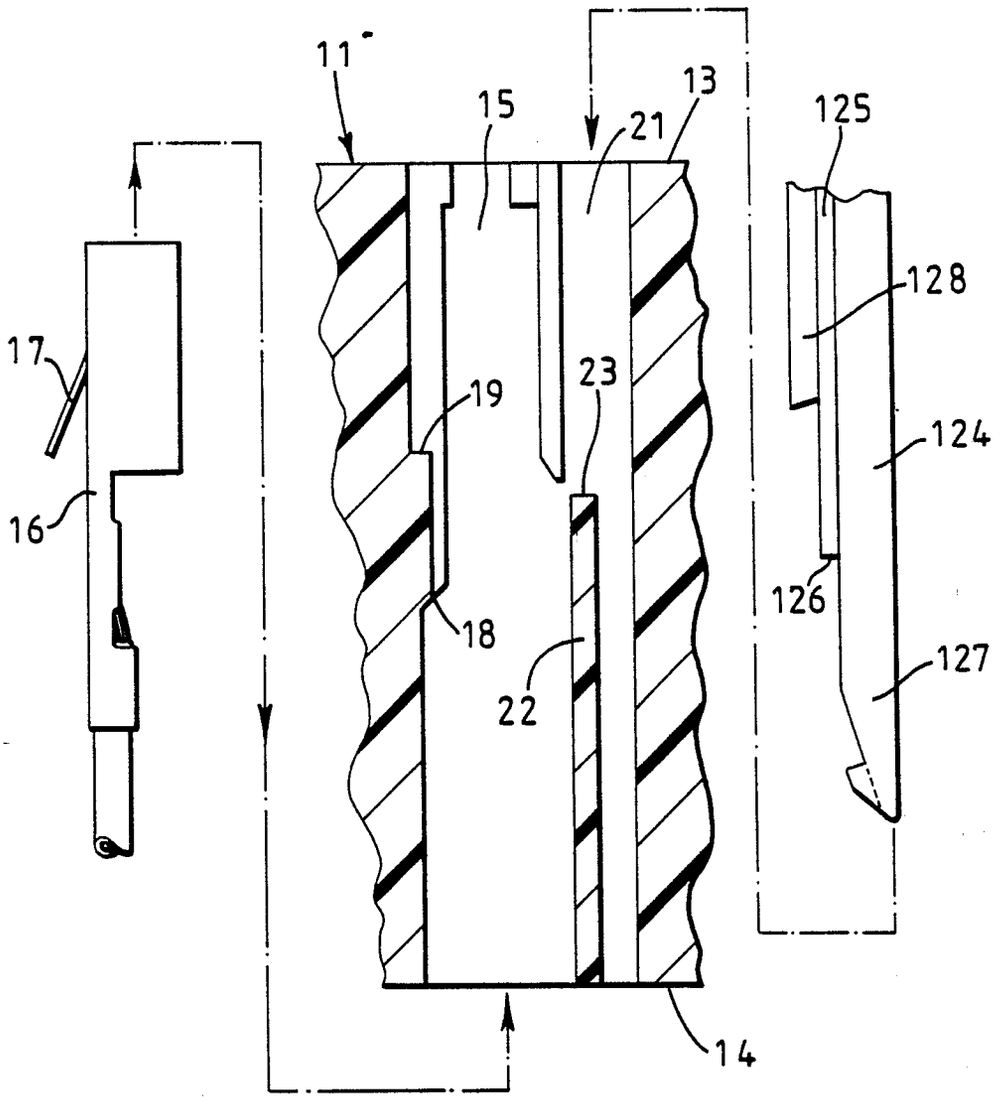

FIG 3

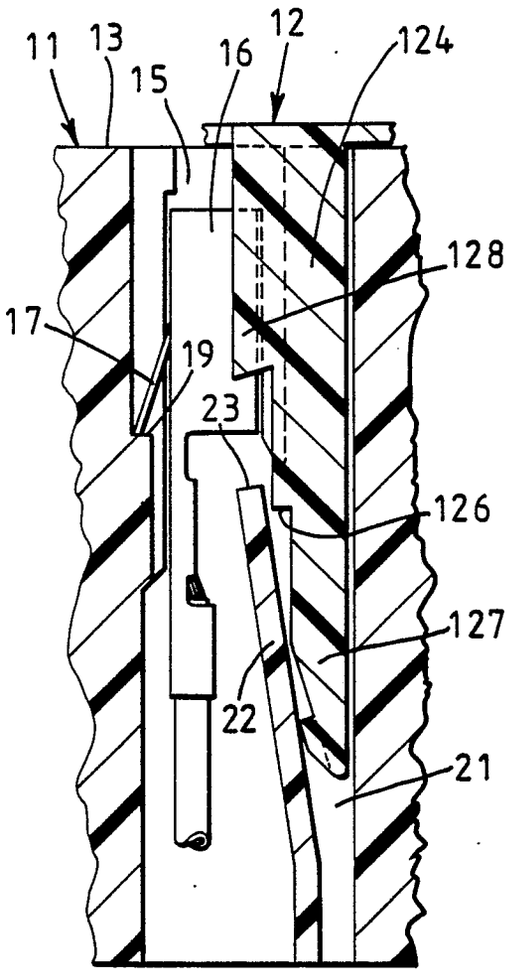
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FIG 4

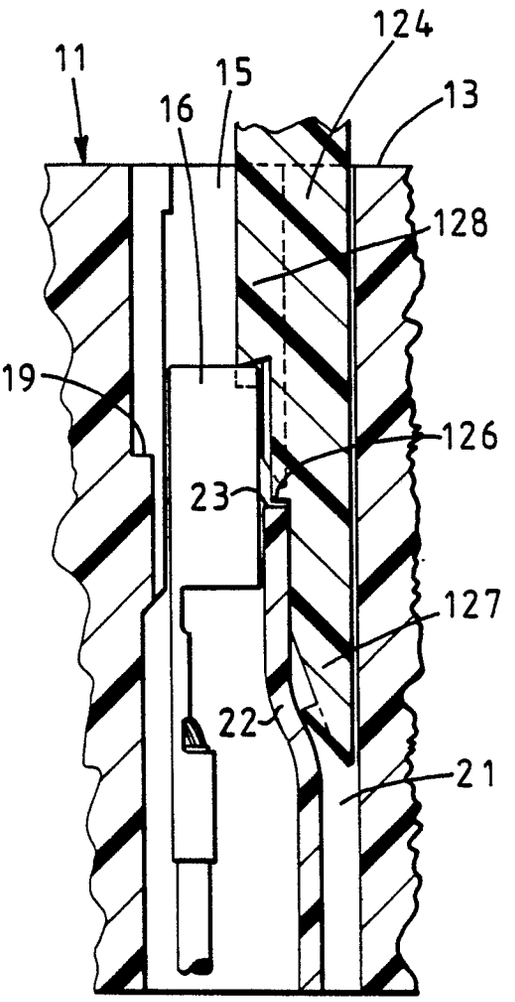
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FIG 5

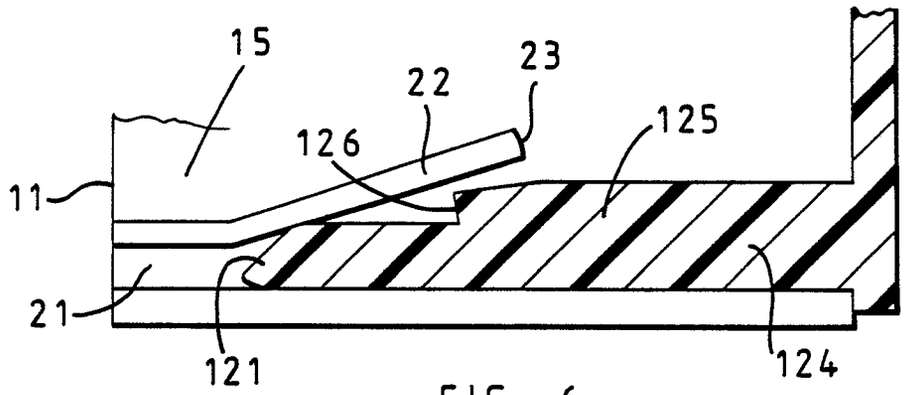

FIG 6

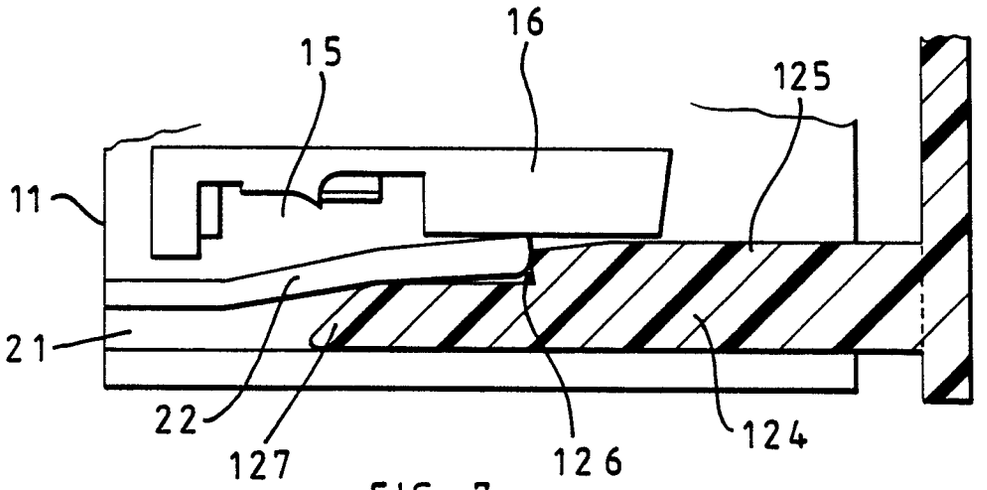

FIG 7