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(11)

EP 0 726 616 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.08.1996 Bulletin 1996/33

(51) Int. Cl.⁶: **H01R 13/627**

(21) Application number: **96101809.0**

(22) Date of filing: **08.02.1996**

(84) Designated Contracting States:
DE ES FR GB IT PT

(30) Priority: **09.02.1995 IT VI950022**

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(54) A pin coupling for the connection of co-axial cables

(57) The invention discloses a pin coupling (1) for the connection of co-axial cables (6, 7) which comprises: a male terminal (2) and a female terminal (3) each of which is connected with one of said co-axial cables. Said male terminal (2) presents an opening (22) provided with a lateral surface (122) having a profile converging inside the male terminal (2) itself, suited to

lodge the connector (5) of said female terminal (3). The angle of inclination (222) of said lateral surface (122), in combination connection between said terminals (2, 3), should at least one of said terminals be released before the locking to its corresponding terminal occurs.

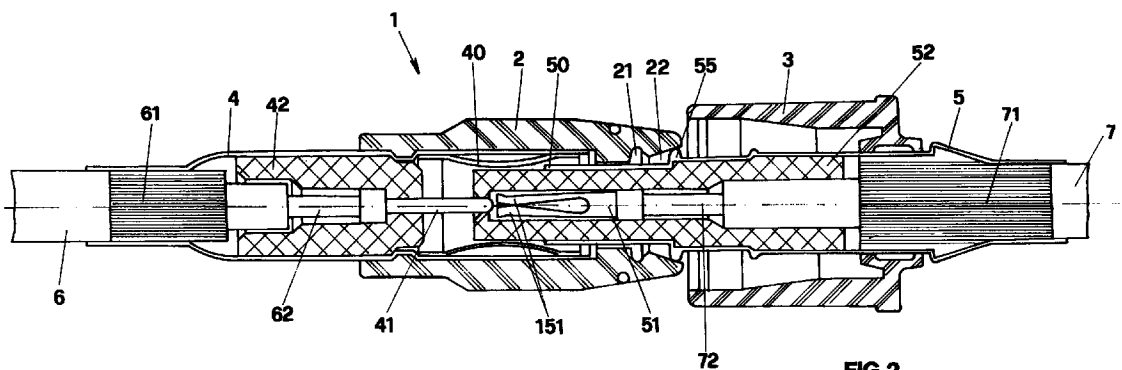


FIG.2

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Description

The invention concerns a pin coupling for realizing the electric connection between two co-axial cables.

It is a known fact that the connection between two co-axial cables is done by means of special kinds of pin couplings, essentially consisting of two terminals, one being a male terminal and the other a female terminal, which are mechanically connected with each other by connecting means. Said terminals are internally provided with conductive elements which are suited to ensure the electrical continuity between the extremities of said co-axial cables.

Patent DE 40 15 092 is known. It describes a pin coupling which comprises a male terminal and a female terminal matching one another by means of a projecting part present in the male terminal, which matches a corresponding notch present in the female terminal. The connection between the two terminals and, consequently, between the co-axial cables connected to each of them, takes place in two phases. First the male terminal is connected with and locked to the female terminal. Then, through an axial translation movement, the female terminal is tightened to the male terminal by snap tightening of the previously described notch on the projecting part.

With the purpose of overcoming the inconvenience of having to perform the connection with two different actions, the same inventor of the present invention has disclosed a pin coupling for the connection between two co-axial cables, which is the object of the Italian application No. VI93A000197, wherein the connection between the terminals occurs by mutually pushing the terminals in only one direction.

Said pin coupling also presents characteristics of watertightness, so that it is suited for use in the open air, said characteristics are absolutely necessary when it is used for connecting co-axial cables of car radio antennas, which have to operate while being exposed to humid environments or even in presence of water.

However, all the described pin couplings present the inconvenience that the male and female terminals are linked together, even when the operator does not sufficiently force them one against the other so as to engage the locking elements with which they are complete. In fact, if by mistake, the user inserts the male terminal into the female terminal, but without exerting a force sufficient to permit the snap tightening of the connecting means, the friction generated between the inner elements of the coupling realizes, even if precariously, both the mechanical continuity between the terminals and the electrical continuity between the co-axial cables connected to them. In such a situation, little vibrations or sudden movements are sufficient to cause the terminals to come apart from one another, thus interrupting the electrical continuity between the co-axial cables.

It is easy to understand that such a possibility is one of those common events which are not usually taken into consideration as possible causes of malfunction,

and which sometimes engage the maintenance engineers in long searches for locating a failure which, in reality, does not exist inconvenience.

In particular, one purpose of the invention is to realize a pin coupling for the connection of co-axial cables, wherein the mechanical continuity between the male and female terminals composing said pin coupling is ensured only by realizing the mutual interference between the locking elements belonging to said terminals.

Another purpose is for the pin coupling according to the invention to realize the electrical continuity between the co-axial cables connected to the terminals, only when there is the mechanical continuity between the terminals themselves.

Not the least purpose is for the coupling according to the invention to be provided with suitable means to reject the connection between said terminals, in case these are not stably locked with one another by means of the interference of the locking means with which they are complete.

The described purposes are achieved by a pin coupling for the connection between co-axial cables which, in accordance with the main claim comprises:

- a male terminal lodging inside a first connector and a first contact element, said connector and said contact element being both conductors, insulated from each other and connected with a first co-axial cable;
- a female terminal lodging inside a second connector and a second contact element, said connector and said contact element being both conductors, insulated from each other and connected with a second co-axial cable, said connectors and said contact elements being suited to match one another in order to realize the electrical continuity between said co-axial cables, whenever said female terminal receives said male terminal;
- one or more projecting parts obtained in said second connector, suited to be inserted by a snapping action into one or more corresponding recesses obtained in said male terminal, whenever said second connector is inserted into an opening made in said male terminal, the lateral surface of which presents a profile converging toward said recesses, and against which said one or more projecting parts contrast, and is characterized in that the angle of inclination of said lateral surface, in combination with the elasticity of said male terminal, realizes an axial pushing component acting against said one or more projecting parts and going against the coupling direction of said terminals, the intensity of which is stronger than the axial resisting component developed by the friction of said one or more projecting parts against said lateral surface, and is such so as to cause the mutual repulsion between said terminals, should at least one of said terminals

be released before said one or more projecting parts is lodged in said one or more recesses.

Advantageously, the impossibility for said terminals to remain joined together if the connecting elements with which they are provided are not locked with one another, is a guarantee for the user against the possibility of accidental disconnections of the terminals. Consequently, when the user is searching for failures, he has the further advantage of being able to exclude the possibility that the cause of said failures may be attributed to caused by accidental disconnections of the terminals

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter.

However, it should be understood that the detailed description and specific example, while indicating a preferred embodiment of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description and from the drawings, wherein:

- Fig. 1 is the exploded axonometric representation of the pin coupling according to the invention;
- Fig. 2 shows a cross-section of the pin coupling according to the invention while the male and female terminals are being reciprocally coupled with one another;
- Fig. 3 shows the pin coupling of Fig. 2 with the male and female terminals coupled with one another;
- Fig. 4 shows a detail of the pin coupling according to the invention at the beginning of the coupling process of the terminals with one another;
- Fig. 5 shows the detail of Fig. 4 at the end of the coupling process of the terminals.
- Fig. 6 shows the detail of Fig. 5 once the terminals have been coupled with one another.

The pin coupling according to the invention is represented in Fig. 1, wherein it is indicated as a whole with 1 and wherein it can be observed that it comprises a male terminal 2 and a female terminal 3 suited to receive said male terminal 2, both of them being made of an insulating material and having a co-axial cable 6 and 7 respectively, connected with them.

In particular, in Fig. 2 it can be observed that inside said male terminal 2 there is a part of a first connector 4 which is connected to braid 61 of a first co-axial cable 6, the central core 62 of which is connected with a first contact element 41 belonging to an insulating body 42 arranged inside said first connector 4.

In a similar way, inside said female terminal 3 there is a part of a second connector 5 which is connected to braid 71 of a second co-axial cable 7, the central core 72 of which is connected with a second contact element 51 belonging to an insulating body 52 arranged inside said second connector 5. It can also be observed that said second contact element 51 is provided with elastic

jaws 151 suited to receive by pressure said first contact element 41. In a similar way, said first connector 4 is provided with depressions 40 suited to receive by pressure, the extremity 50 of said second connector 5, in order to realize the electrical continuity between said co-axial cables 6 and 7, whenever said terminals 2 and 3 are connected with one another.

In order to stably connect said terminals 2 and 3 with one another, said male terminal 2 is provided with an annular recess 21, while said second connector 5 presents an annular projection 55, wherein said annular projection 55 inserts itself into said annular recess 21, whenever said second connector 5 is inserted into an opening 22 obtained in said male terminal 2. It can be observed in greater detail in the Figs. 4, 5 and 6, that the shape of a truncated-cone along which said annular projection 55 slides, whenever said second connector 5 is inserted into said opening 22.

When the second connector 5 is axially pushed inside said male terminal 2 following direction 56, it is necessary for the annular projection 55 to go beyond the area having a minimum diameter 322 of the opening 22, so as to obtain a stable connection between said male terminal and said female terminal.

In fact, the male terminal 2 presents a total elasticity which results from the sum of an intrinsic elasticity, due to the elasticity of the material it is made of, and an elasticity caused by the presence of both the slits 25, visible in Fig. 1, and the elastic circular ring 26 arranged around it.

When said second connector 5 is pushed inside said male terminal 2 following direction 56, the male terminal 2 and the elastic element 26 are expanded and, because of their deformation, they collect elastic power.

Should the pushing action stop before the annular projection 55 has gone beyond the point of minimum diameter 322, the elastic recovery of the male terminal 2 is discharged on the annular projection 55, thus producing an axial pushing component 622 which follows the direction opposite to the coupling direction 56 of the terminals, its value depending on the elastic coefficients of the material the male terminal 2 and the elastic ring 26 are made of, and on the number and shape of the slits 25, in combination with the value of the angle of inclination 222 of the lateral surface 122. Such elastic coefficients and such an angle of inclination 222 must be properly chosen, so that the axial pushing component 622 can always present a higher value in relation to the horizontal component 522 opposite to it, which is caused by the friction between the lateral surface 122 and the annular projection 55 and which depends, as it is known, on both the characteristics of the materials reciprocally in contact with one another and which compose said annular projection 55 and said male terminal 2, and on the conditions of their surfaces.

As has already been said, if the constructive values are chosen so, that said axial pushing component 622 is always higher in relation to the axial resisting component 522 caused by the friction, and if the annular pro-

jection 55 does not go beyond the area having a minimum diameter 322, the male terminal 2 repels the coupling of the second connector 5 and, therefore, it does not realize the mechanical connection with the female connector 3.

Consequently, the electrical continuity between the co-axial cables 6 and 7 is not obtained either. In order to avoid the intervention of other friction forces which may prevent the mutual repulsion of the terminals if the locking fails to occur, the extremity 50 of the second connector 5 is made in such a way that its length 150, in relation to said annular projection 55, as can be observed in Fig. 5, is only brought into contact with the depressions 40 of the first connector 4 when the annular projection 55 is just about to be inserted into the recess 21. Moreover, this fact ensures that the electrical continuity between the co-axial cables occurs only in the Fig-
ures it can be observed that the area having a minimum diameter 322 is joined to the annular recess 21 by means of a slanted joining surface 922, having an inclination diverging from the annular recess 21 itself, beginning from the area having a minimum diameter 322. As can be observed in Fig. 5, the presence of such a slanted joining surface 922 helps the coupling of the annular projection 55 with the recess 21, since the elastic recovery of the male terminal 2 produces, in the point of contact 822 between the slanted joining surface 922 and the annular projection 55, a horizontal force 722 which favours the coupling.

On the basis of what has been described, it is understood that the pin coupling according to the invention achieves all the proposed purposes.

It has been seen, in fact, that between the co-axial cables of the pin coupling, no electrical continuity is produced if the terminals composing the pin itself are not stably locked with one another through the mutual interference of the locking elements with which they are provided.

It has also been seen that the pin coupling according to the invention realizes the reciprocal repulsion of the terminals should the locking elements with which they are provided, not be reciprocally and stably connected with one another.

With advantage for the user, this fact excludes the possibility of common failures caused by accidental disconnections of the terminals, because of faulty couplings.

A different embodiment of the pin coupling according to the invention can foresee for the opening area having the shape of a convergent truncated-cone to present a curved lateral surface rather than a flat one.

Different embodiments are also possible, wherein the male terminal and the female terminal present shapes differing from the one represented in the Fig-
ures. In the same way, the connectors, the annular recesses and the annular projections which compose the reciprocal locking elements between the elements composing the pin may also be shaped differently.

However, said modifications and other possible ones must all fall within the spirit and scope of the present invention.

5 Claims

1. A pin coupling (1) for the connection between co-axial cables (6, 7) comprising:

- a male terminal (2) lodging inside a first connector (4) and a first contact element (41), said connector (4) and said contact element (41) being both conductors, insulated from each other and connected with a first co-axial cable (6);
- a female terminal (3) lodging inside a second connector (5) and a second contact element (51), said connector (5) and said contact element (51) being both conductors, insulated from each other and connected with a second co-axial cable (7), said connectors (4, 5) and said contact elements (41, 51) being suited to match one another in order to realize the electrical continuity between said co-axial cables (6, 7), whenever said female terminal (3) receives said male terminal (2);
- one or more projecting parts (55) obtained in said second one or more corresponding recesses (21) obtained in said male terminal (2), whenever said second connector (5) is inserted into an opening (22) made in said male terminal (2), the lateral surface (122) of which presents a profile converging toward said recesses (21), and against which said one or more projecting parts (55) contrast, and is characterized in that the angle of inclination (222) of said lateral surface (122), in combination with the elasticity of said male terminal (2), realizes an axial pushing component (622) acting against said one or more projecting parts (55) and going against the coupling direction (56) of said terminals (2, 3), the intensity of which is stronger than the axial resisting component (522) developed by the friction of said one or more projecting parts (55) against said lateral surface (122), and is such so as to cause the mutual repulsion between said terminals (2, 3), should at least one of said terminals be released before said one or more projecting parts (55) is lodged in said one or more recesses (21).

2. A pin coupling according to claim 1, characterized in that said lateral surface (122) of said opening (22) presents an area having a minimum diameter (322) joining said one or more recesses (21) by means of a joining surface (922), having an inclination diverging from said recesses (21), beginning from said area having a minimum diameter (322).

3. A pin coupling according to claim 1, characterized in that said one or more recesses consist of an annular recess (21) obtained in said male terminal (2) and suited to lodge said one or more projecting parts obtained in said second connector (5) which consist of one or more annular projections (55). 5
4. A pin coupling according to claim 1, characterized in that said lateral surface (122) is a flat surface. 10
5. A pin coupling according to claim 1, characterized in that said lateral surface (122) is a curved surface.
6. A pin coupling according to claim 1, characterized in that said second contact element (51) is provided with elastic jaws (151) suited to lodge by pressure said first contact element (41). 15
7. A pin coupling according to claim 1, characterized in that said first connector (4) is provided with projections (40) suited to lodge by pressure the extremity (50) of said second connector (5), said extremity (50) presenting such a length (150) in relation to said one or more projecting parts (55), so as to match said depressions (40) only when said one or more projecting parts (55) are just about to match said one or more recesses (21). 20 25

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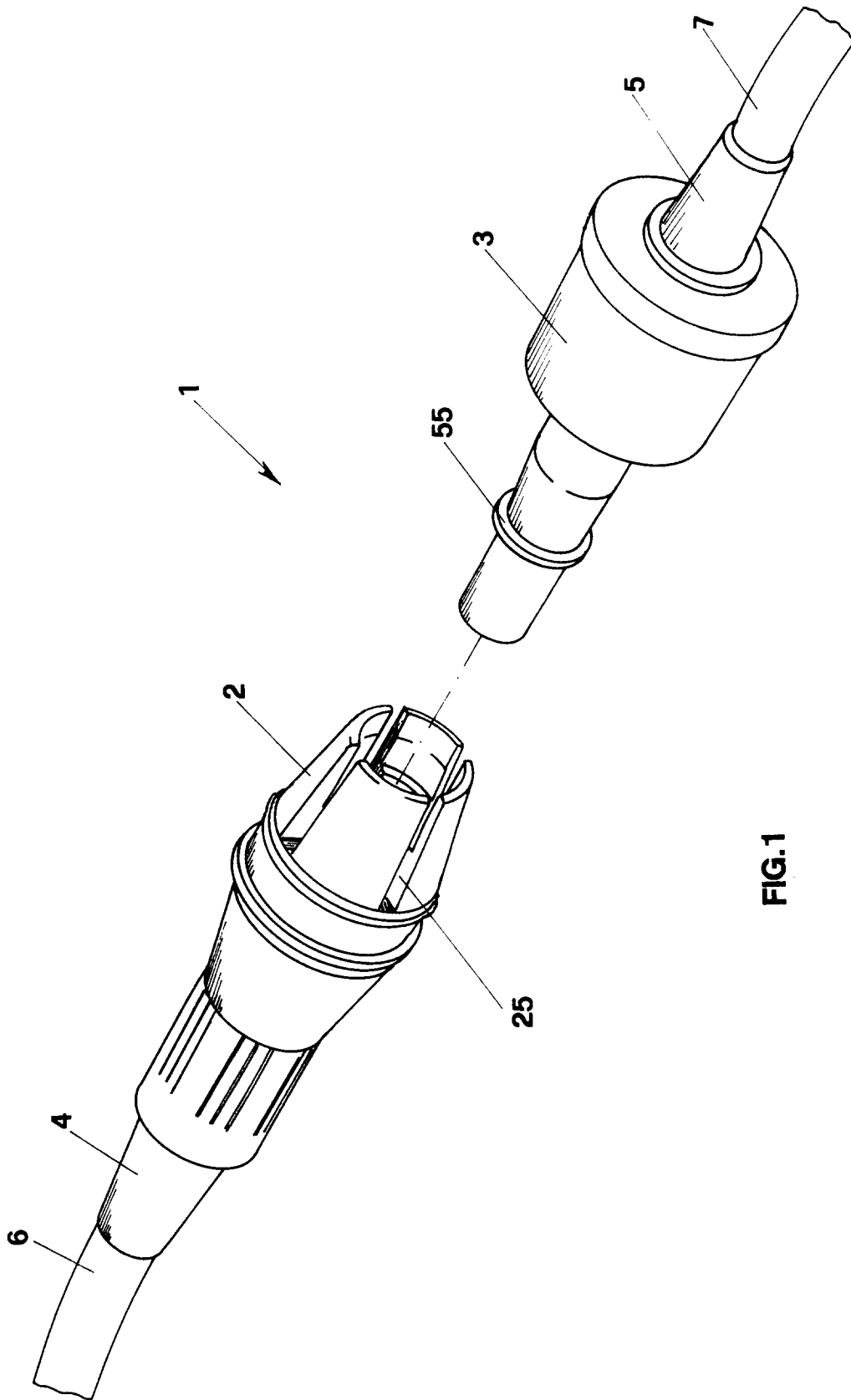
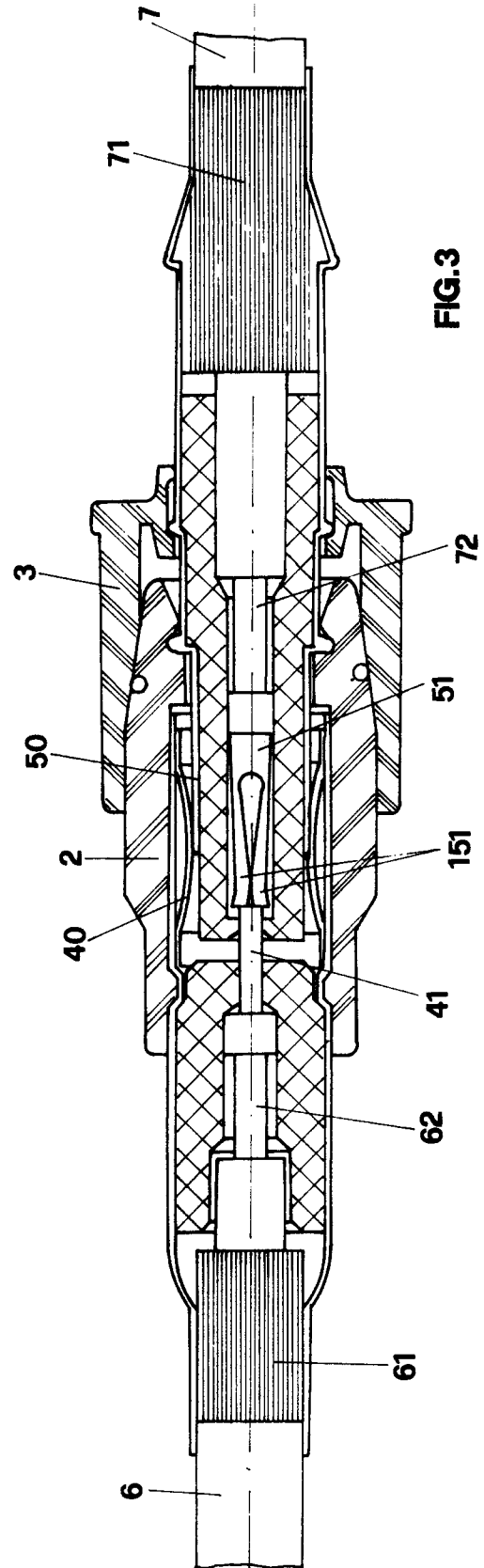
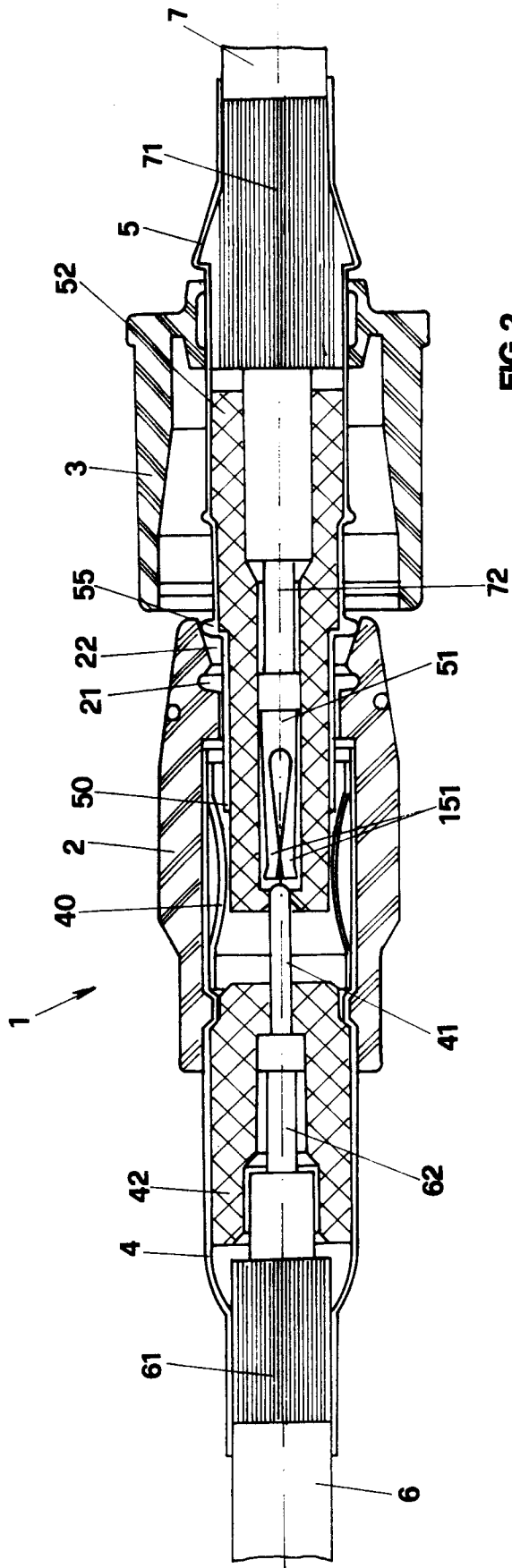


FIG.1



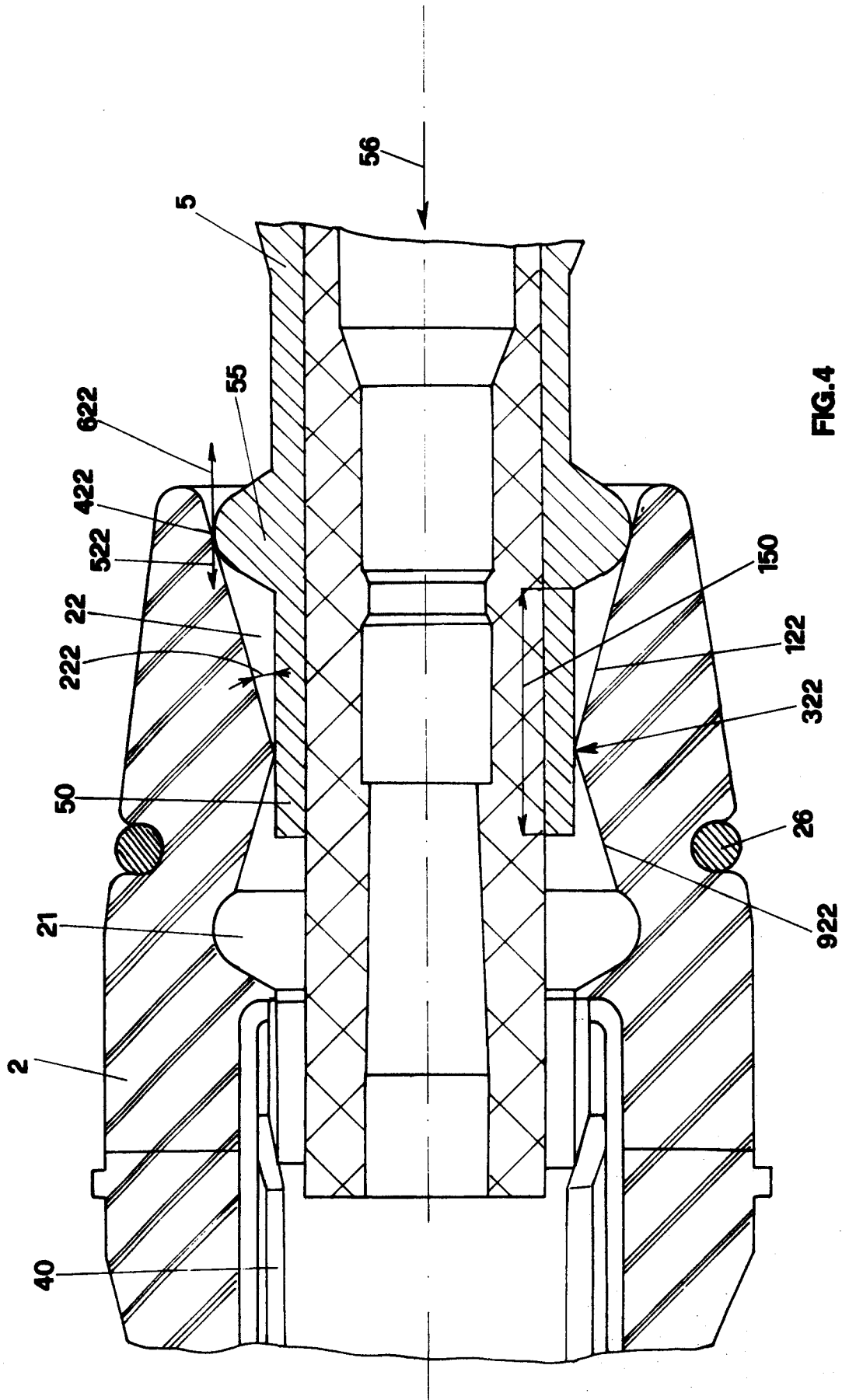


FIG. 4

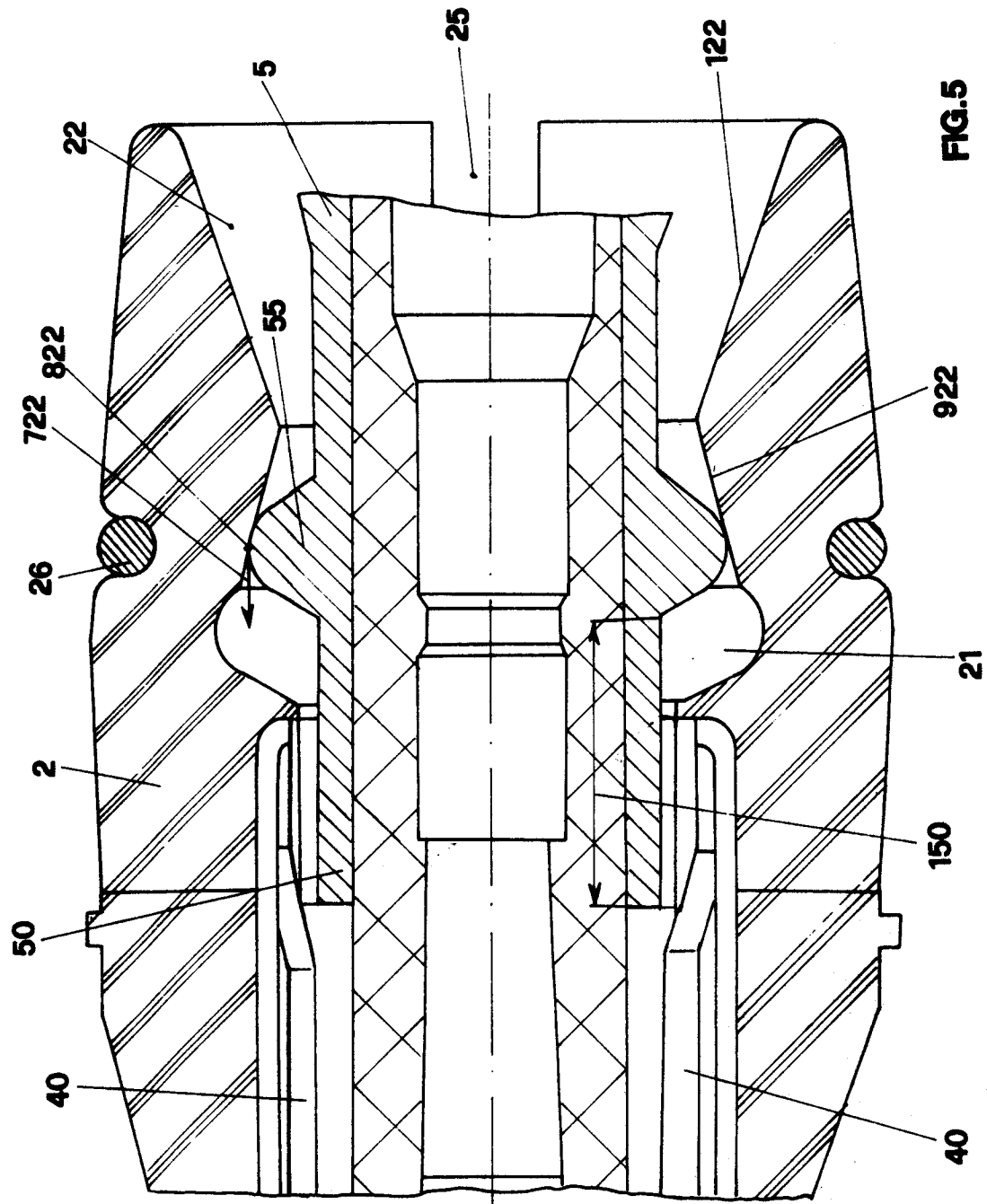


FIG. 5

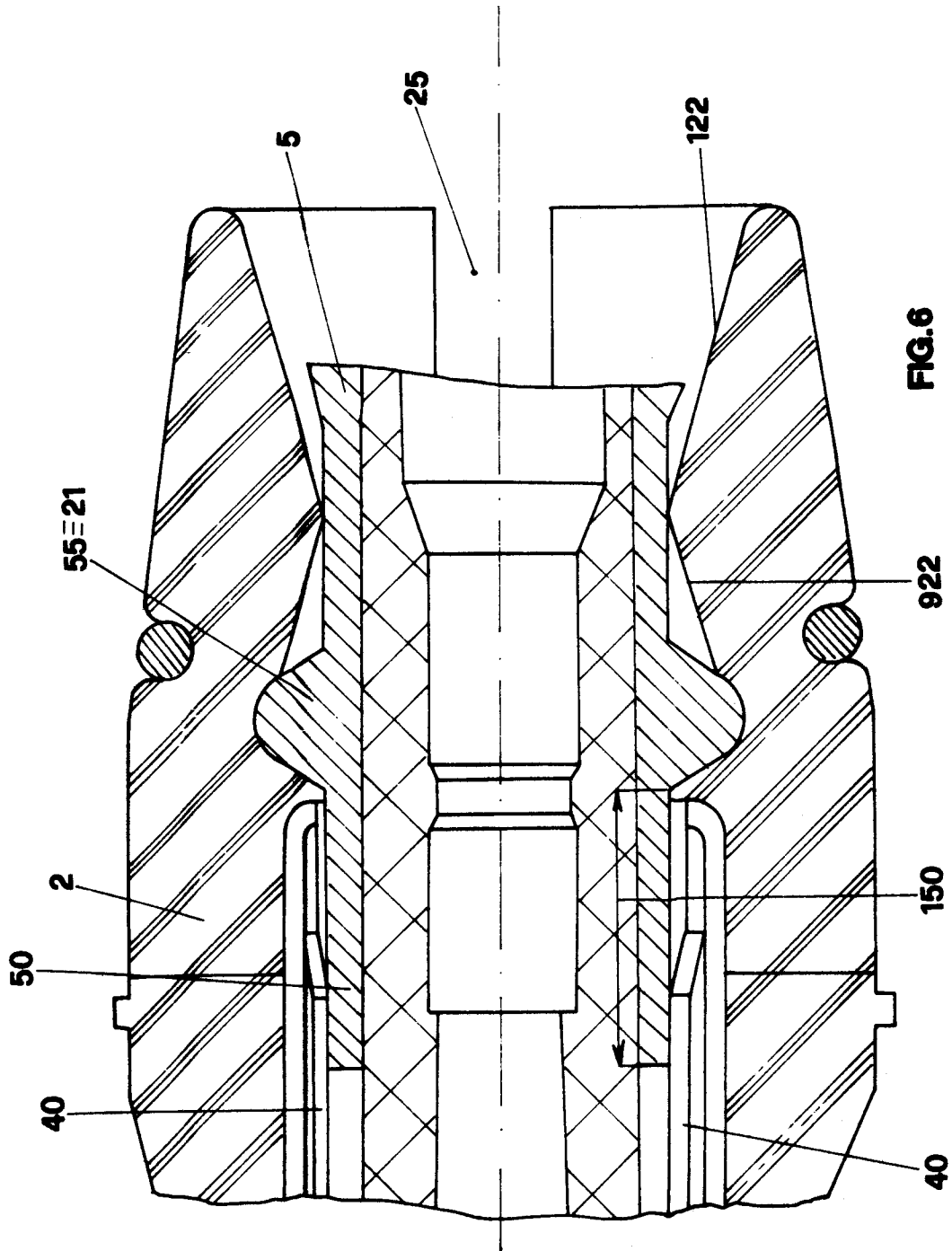


FIG.6