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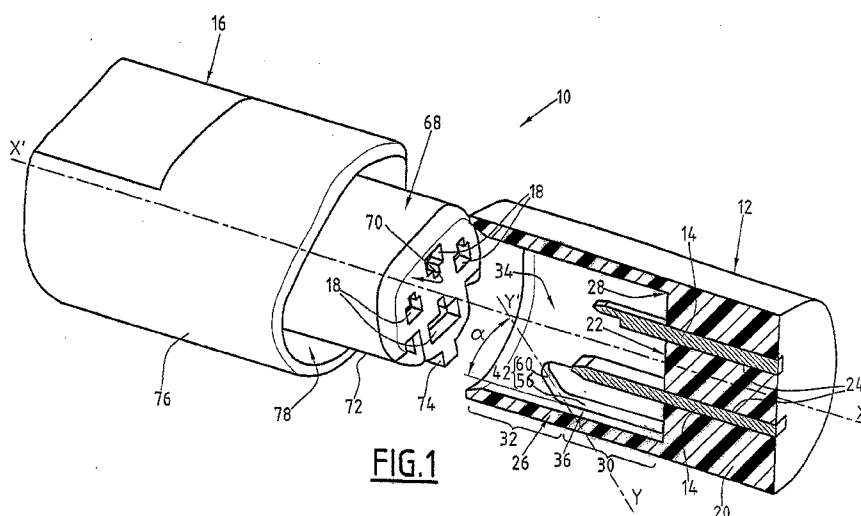
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(54) Title: ELECTRICAL CONNECTOR



(57) Abstract: The electrical connector (10) comprises first element (12) carrying electrical contacts (14), second element (16) defining receiving chambers (18), a guide system (34, 72) for guiding the elements (12, 16) with respect to each other along the mating direction. One of the two elements (12; 16) comprises a first flank side (42), which comprises an oblique portion (60) extending along an oblique direction with respect to the mating direction, and the other element comprises an aligning portion (74) so that, when the two elements (12, 16) are guided one with respect to the other by the guide system (34, 72) along the mating direction, from an unaligned position of the contacts (14) with the receiving chambers (18), the aligning portion (74) of the other element (16) cooperates with the first flank side (42) which makes the other element (16) rotate, with respect to the one element (12), around the XX' axis, up until an aligned position.

Electrical connector

The present invention relates to electrical connectors, in particular electrical connectors used in the automotive industry to connect spark plugs.

Recent spark plugs include sensors, for example to detect the pressure inside the cylinder. Such a spark plug therefore comprises an electrical contact for the spark current, and one or several other electrical contacts for the sensors.

A typical engine comprises four spark plugs, each fixed in a different angular orientation around their axis. However, the spark plugs are not easily accessible, and it is very difficult to determine the orientation, so that the operator must blind connect the spark plugs.

The invention aims at simplifying the connection of electrical connectors.

Accordingly it is proposed an electrical connector according to claim 1. Other features of the invention are presented in the dependent claims.

These and other features of the invention will be more readily understood from the following detailed description of various preferred embodiments of the invention. The description refers to the accompanying drawings, in which:

FIG. 1 is a three dimensional view of an electrical connector according to a first embodiment of the invention;

FIG. 2 is a top view of a part of the electrical connector of FIG. 1;

FIG. 3 and 4, are three dimensional view of the electrical connector of FIG. 1 in the process of being mated;

FIG. 5 is a three dimensional view of an electrical connector according to a second embodiment of the invention;

FIG. 6 is a cross section view of the electrical connector of FIG. 5;

FIG. 7 is a transparent view of a skirt of the electrical connector of FIG. 5; and

FIG. 8 is an unfolded view of the element of the skirt of FIG. 7.

Turning to FIG. 1, a first electrical connector 10 according to a first embodiment of the invention comprises a first element 12 carrying electrical contacts 14, and a second element 16 defining receiving chambers 18 for receiving the electrical contacts 14 along a mating direction, defined by an axis XX'.

In the following description, spatial terms such as "longitudinal", "transversal", "front", "rear" will refer to the XX' axis, orientated, from rear to front, from the first element 12 towards the second element 16.

The first element 12 constitutes a connecting part of a spark plug for a car engine. The first element 12 comprises a first body 20 having a body front face 22 facing the second element 16. The first body 20 has advantageously a substantially cylindrical shape around the XX' axis.

Longitudinal passages 24 are made through the first body 20. Each electrical contact 14 is received and fixed in a corresponding passage 24, such that the electrical contact 14 projects frontward with respect to the body front face 22.

The first element 12 further comprises a first skirt 26 for protecting the electrical contacts 14. The first skirt 26 projects frontward from a periphery 28 of the front face 22. The first skirt 26 comprises a rear portion 30 wrapped around the electrical contacts 14, and a front portion 32 projecting frontward beyond the electrical contacts 14, with respect to the X-X' axis. The first skirt 26 has advantageously a substantially cylindrical shape around the XX' axis, so as to prolong frontward the body 20. The first skirt 26 comprises an inner surface 34 that is substantially cylindrical around the XX' axis.

Turning to FIG. 2, the first element 12 comprises two ribs 36, 38, which extend on the inner surface 34.

The ribs 36, 38 are symmetrical to each other with respect to a plan P including the XX' axis.

Each rib 36, 38 comprises a flank side 42, 44, such that the flank sides 42, 44 are orientated towards the P plan. The flank sides 42, 44 elevate from the inner surface 34. The flank sides 42, 44 define between them a channel 46, along the inner surface 34.

Each flank side 42, 44 comprises a longitudinal portion 56, 58 and an oblique portion 60, 62, defining respectively a funnel portion 64 of the channel 46, and a longitudinal portion 66 of the channel 46.

The funnel portion 64 of the channel 46 is defined by the oblique portions 60, 62 of the flank sides 42, 44 and has the shape of a funnel with a frontward opening 67 towards the other element 16.

The longitudinal portion 56, 58 of the flank side 42, 44 extends frontward along the XX' axis from the front face 22 of the body 20. The longitudinal portion 56, 58 of the flank side 42, 44 goes from the front face 22, past the electrical contacts 14 along the XX' axis.

The oblique portion 60, 62 of the flank side 42, 44 prolongs frontward the longitudinal portion 56, 58, while going away from the P plan. More precisely, the oblique portion 60, 62 extends along an oblique direction, defined by an axis YY', with respect to the XX' axis. The YY' axis defines, with respect to the XX' axis, an acute angle α that is opened frontward. The oblique portion 60, 62 starts off beyond the end of the electrical contacts 14.

The second element 16 comprises a second body 68 comprising a rear face 70 facing the first element 12. Receiving chambers 18 open to the rear face 70. The second body 68 has a substantially cylindrical shape around the XX' axis. The second body 68 comprises an outer surface 72 which is substantially cylindrical around the axis XX'.

The second body 68 comprises an aligning rib 74 that projects from the outer surface 72 of the second body 68, and extends parallel to the XX' axis. The aligning rib 74 extends frontward up to the rear face 70.

The second element 16 comprises a second skirt 76 wrapped around the second body 68, at a distance from the outer surface 72 of the second body 68, such that the first skirt 26 of the first element 12 is able to be introduced between the outer surface 72 of the second body 68 and an inner surface 78 of the second skirt 76.

Preferably, the electrical connector 10 comprises a locking system (not shown) intended to prevent unmating of the two elements 12, 16 along the XX' axis.

During mating of the two elements 12, 16, the second body 68 is introduced into the first skirt 26. The outer surface 72 of the second body 68 and the inner surface 34 of the first skirt 26 interact together, so as to form a guide system for guiding the two elements 12, 16 with respect to each other along the XX' axis. The guide system also prevents displacements of the elements with respect to each other, transverse to the XX' axis, while allowing rotation of one element with respect to the other around the XX' axis.

During the mating process, the aligning rib 74 enters the channel 46.

Depending on the angular orientation around the XX' axis of the elements 12, 16 with respect to each other, the elements 12, 16 may be in an unaligned position in which each contact 14 is not aligned with a respective receiving chamber 18.

In this case, when the elements 12, 16 are guided by the guide system, the aligning rib 74 progresses in the funnel portion 64 of the channel 46 toward the front face 22 of the first body 20, while cooperating with the flank sides 36, 38, which makes the second element 16 rotating, with respect to the first element 12, around the XX' axis.

When the aligning rib 74 arrives in the longitudinal portion 66 of the channel 46, the two elements 12, 16 are in a position in which each electrical contact 14 is aligned with a respective receiving chamber 18.

While the rib 74 progresses in the longitudinal portion 66 of the channel 46, the electrical contacts 14 are introduced in the respective chambers 18.

The longitudinal portions of the flank sides are facing each other, at a distance corresponding to the size of the aligning rib 74 in the corresponding direction transverse to the XX'

axis. The interaction of the aligning rib 74 and the longitudinal portions 56, 58 of the flank side 42, 44 thus prevents the rotation between the two elements 12, 16 around the XX' axis that could damage the electrical contacts 14.

When the electrical contacts 14 are received in the respective receiving chambers 18, the locking system (not shown) locks the two elements 12, 16.

The invention thus permits to mate the two elements 12, 16, even when the two elements 12, 16 are introduced in each other with an angular mismatch.

Turning to FIG. 5 to 8, a second connector 110 according to second embodiment of the invention is illustrated.

The second connector 110 is substantially similar to the first connector 10. Consequently, elements that have been already described will not be described again. These elements will have, in FIG. 5 to 8, a numeral reference corresponding to their numeral reference in the first embodiment, augmented by 100. New elements will have numeral references starting from 200.

In the second embodiment, the second skirt 176 comprises a plateau 200 elevating from the inner surface 178, while the first skirt 126 comprises an aligning pin 202 on an outer surface 204 of the first skirt 126 extending along a direction perpendicular to the XX' axis. It is thus the inverse configuration than for the first electrical connector 10. Outer surface 204 has a substantially cylindrical shape around the XX' axis.

The plateau 200 comprises two flank sides 206, 208 elevating from the inner surface 178 of the second skirt 176.

The flank sides 206, 208 define between them a channel 210, along the inner surface 178. The flank sides 206, 208 comprise a first flank side 206 that extends parallel to the XX' axis on the whole length of the channel 210, and a second flank side 208.

The second flank side 208 comprises a longitudinal portion 212 that extends from the front face 122 along the XX' axis. The longitudinal portion 212 faces the first flank side 206, at a distance corresponding to the size of the pin 202.

The second flank side 208 further comprises an oblique portion 214 that prolongs the longitudinal portion 212 toward the first element 112. The oblique portion 214 extends on the inner surface 178 in a helicoidally manner around the XX' axis.

The channel 210 comprises a funnel portion 218, comprising the oblique portion 214, and a longitudinal portion 220 corresponding to the longitudinal portion 212. The funnel portion 218 has an enlarged opening 222 towards the first element 112.

At the opening 222, the second flank side 208 joins the first flank side 206 so as to form a peak 224 of the plateau 200. The opening 222 of the channel 216 thus extends all around the XX' axis.

The process of mating the two elements 112, 116 is identical to the first electrical connector 110, except that, because the opening 222 of the channel 216 extends all around the XX' axis, any angular mismatch can be compensated.

The angle α has to be large enough so that the oblique portion 60, 62, 214 is not too long, but not too large so that the force required for mating the two elements 12,16 remains in an accepted range. Preferably, the angle α ranges from 15° to 45°.

CLAIMS

1. An electrical connector (10 ; 110) comprising:

a first element (12 ; 112) carrying electrical contacts (14),

a second element (16 ; 116) defining receiving chambers (18 ; 118) for receiving the electrical contacts (14) along a mating direction defined with an axis XX',

a guide system (34, 72 ; 134, 172) for guiding the elements (12, 16 ; 112, 116) with respect to each other along the mating direction, in order to bring the electrical contacts (14) to the receiving chambers (18 ; 118), and for preventing displacements of the elements (12, 16 ; 112, 116) with respect to each other, transversal to the mating direction,

wherein the guide system (34, 72 ; 134, 172) allows the rotation around the XX' axis of the elements (12, 16 ; 112, 116), with respect to each other,

wherein one of the two elements (12 ; 116) comprises a first flank side (42 ; 208), which comprises an oblique portion (60 ; 214) extending along an oblique direction with respect to the mating direction and the other element comprises an aligning portion (74 ; 202), so that, when the two elements (12, 16 ; 112, 116) are guided one with respect to the other by the guide system (34, 72 ; 134, 172) along the mating direction, from an unaligned position in which each contact (14) is not aligned with a respective receiving chamber (18 ; 118), the aligning portion (74 ; 202) of the other element (16 ; 112) cooperates with the first flank side (42 ; 208) which makes the other element (16 ; 112) rotate, with respect to the one element (12 ; 116), around the XX' axis, up until an aligned position in which each contact (14) is aligned with a respective receiving chamber (18 ; 118).

2. The electrical connector (10 ; 110) of claim 1, wherein the element (12 ; 116) comprising the first flank side comprises:

a second flank side (44 ; 206), and

a channel (46 ; 210) defined between the first flank side (42 ; 208) and the second flank side (46 ; 210),

wherein the channel (46 ; 210) comprises the funnel portion (64 ; 218) comprising the oblique portion (60 ; 214) of the first flank side (42 ; 208), and

wherein the funnel portion (64 ; 218) has an enlarged opening (67 ; 222) towards the other element (16 ; 112).

3. The electrical connector (10) of claim 1 or 2, wherein the aligning portion (74) is a rib extending along the mating direction.

4. The electrical connector (110) of claim 1 or 2, wherein the aligning portion (202) is a pin extending perpendicular to the mating direction.

5. The electrical connector (10) of any one of claims 2 to 4,

wherein the element (12) comprising the first flank side also comprises two ribs (36, 38), symmetrical with respect to each other relative to a plan P including the XX' axis, and

wherein the first and second flank sides (42, 44) are the sides of the ribs (36, 38) facing the plan P.

6. The electrical connector (110) any one of claims 2 to 4,

wherein the one element (116) comprises a plateau (200), and

wherein the first and second flank sides (206, 208) are sides of the plateau (200).

7. The electrical connector (110) of claim 6, wherein the first and second flank sides (206, 208) join each other towards the other element (112), so that the opening (222) extends all around the XX' axis.

8. The electrical connector (10; 110) of any one of claims 4 to 5,

wherein the first flank side (42 ; 208) comprises a longitudinal portion (56 ; 212) extending along the XX' axis,

wherein the second flank side (44 ; 206) comprises a longitudinal portion (56, 58 ; 206A, 212) extending along the XX' axis,

wherein the channel (46 ; 210) comprises a longitudinal portion (66 ; 220) defined between the longitudinal portions (56, 58 ; 206A, 212) of the flank sides (42, 44 ; 206, 208), and is located, along the XX' axis, opposite the opening (67 ; 222) with respect to the oblique portion (64 ; 218),

wherein the longitudinal portions (56, 58 ; 206A, 212) of the flank sides (42, 44 ; 206, 208) are facing each other, at a distance corresponding to the size of the aligning portion (74 ; 202) transverse to the XX' axis, in order to prevent movement of the aligning portion (74 ; 202) transverse to the XX' axis, and

wherein the longitudinal portion (66 ; 220) of the channel (46 ; 210) is located around the XX' axis such that, when the aligning portion (74 ; 202) is in the longitudinal portion (66 ; 220), the elements (12, 16 ; 112, 116) are in the aligned position.

9. The electrical connector (10; 110) of any one of claims 1 to 8,

wherein the first element (12 ; 112) comprises a first skirt (26 ; 126), the first skirt (26 ; 126) being wrapped around the XX' axis, and

wherein the second element (16 ; 116) comprises a body (68 ; 168) able to be introduced into the first skirt (26 ; 126).

10. The electrical connector (10 ; 110) of claim 9,

wherein the second element (16 ; 116) comprises a second skirt (76 ; 176), the second skirt (76 ; 176) being wrapped around the XX' axis, and

wherein the first skirt (26 ; 126) is able to be introduced between the body (68 ; 168) of the second element (16 ; 116) and the second skirt (76 ; 176).

11. The electrical connector (10) of claim 9,

wherein the first skirt (26) comprises an inner surface (34), and

wherein the first flank side (42) elevates from the inner surface (34).

12. The electrical connector (110) of claim 10,

wherein the second skirt (126) comprises an inner surface (178), and

wherein the first flank side (208) elevates from the inner surface (178).

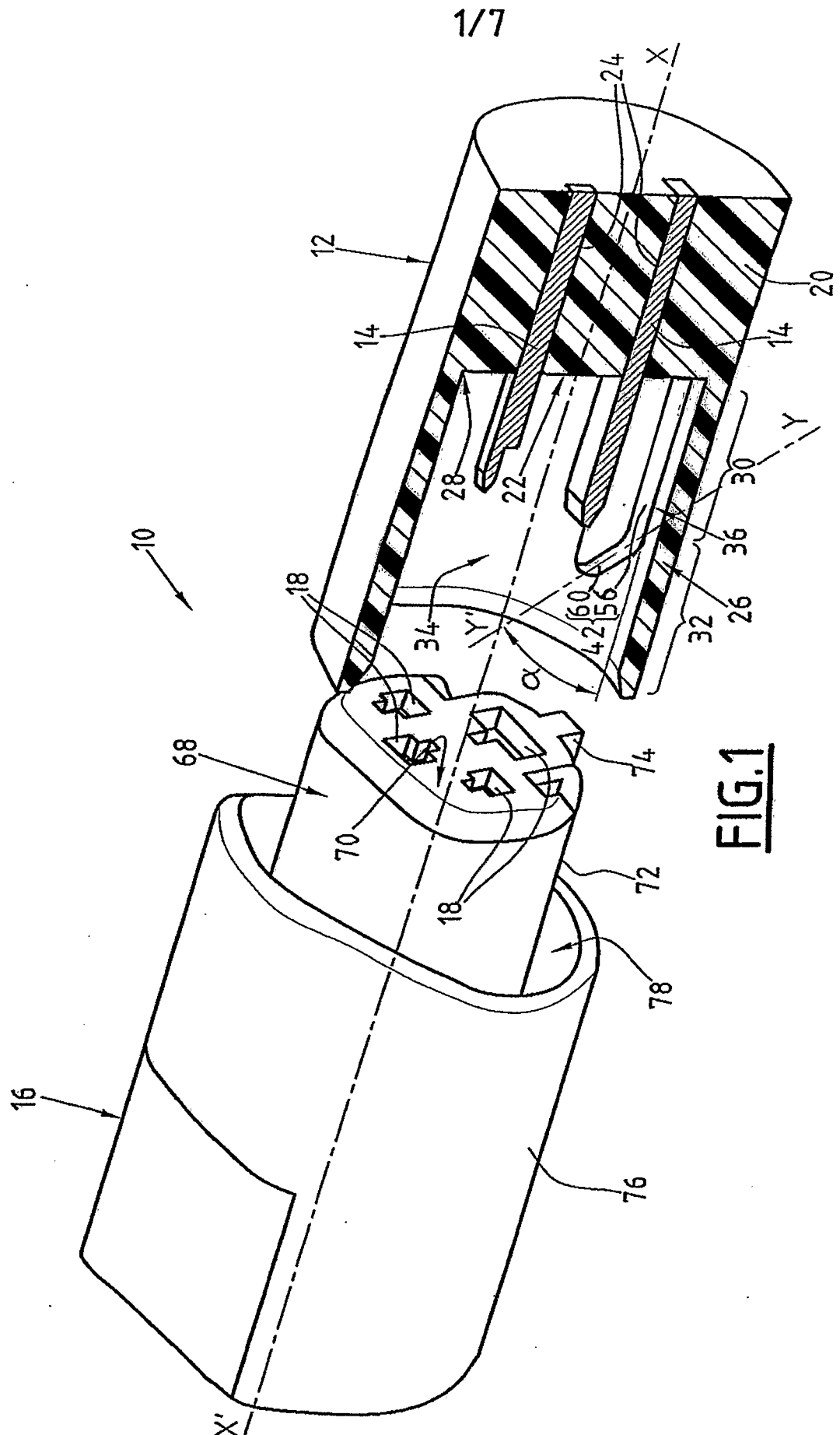
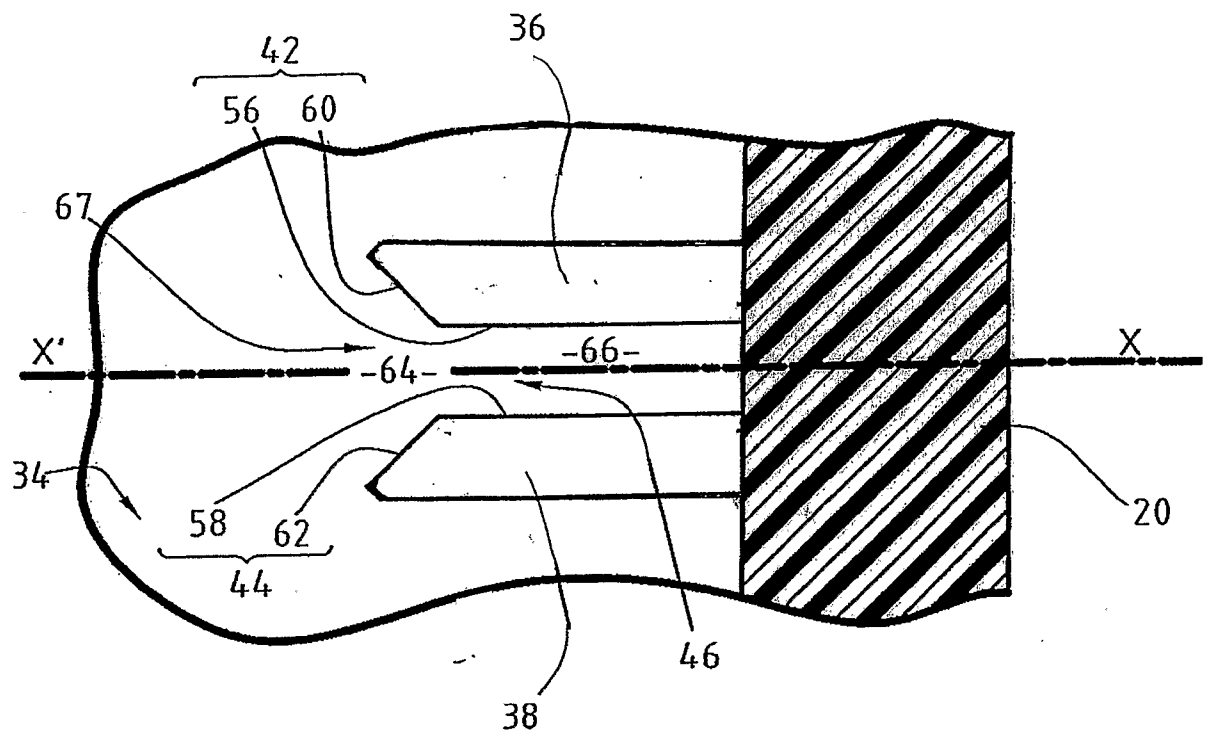


FIG. 1

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FIG. 2

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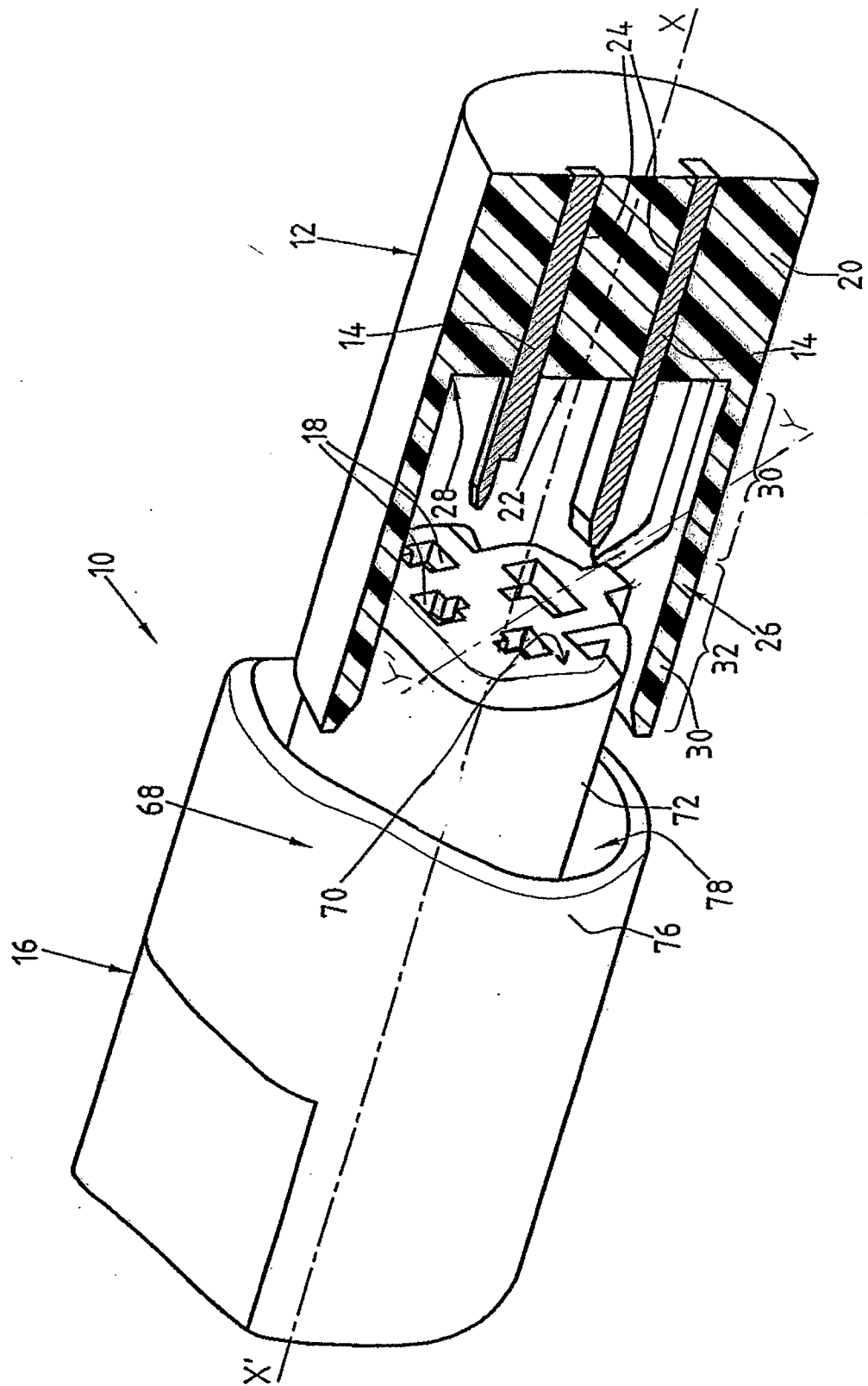


FIG. 3

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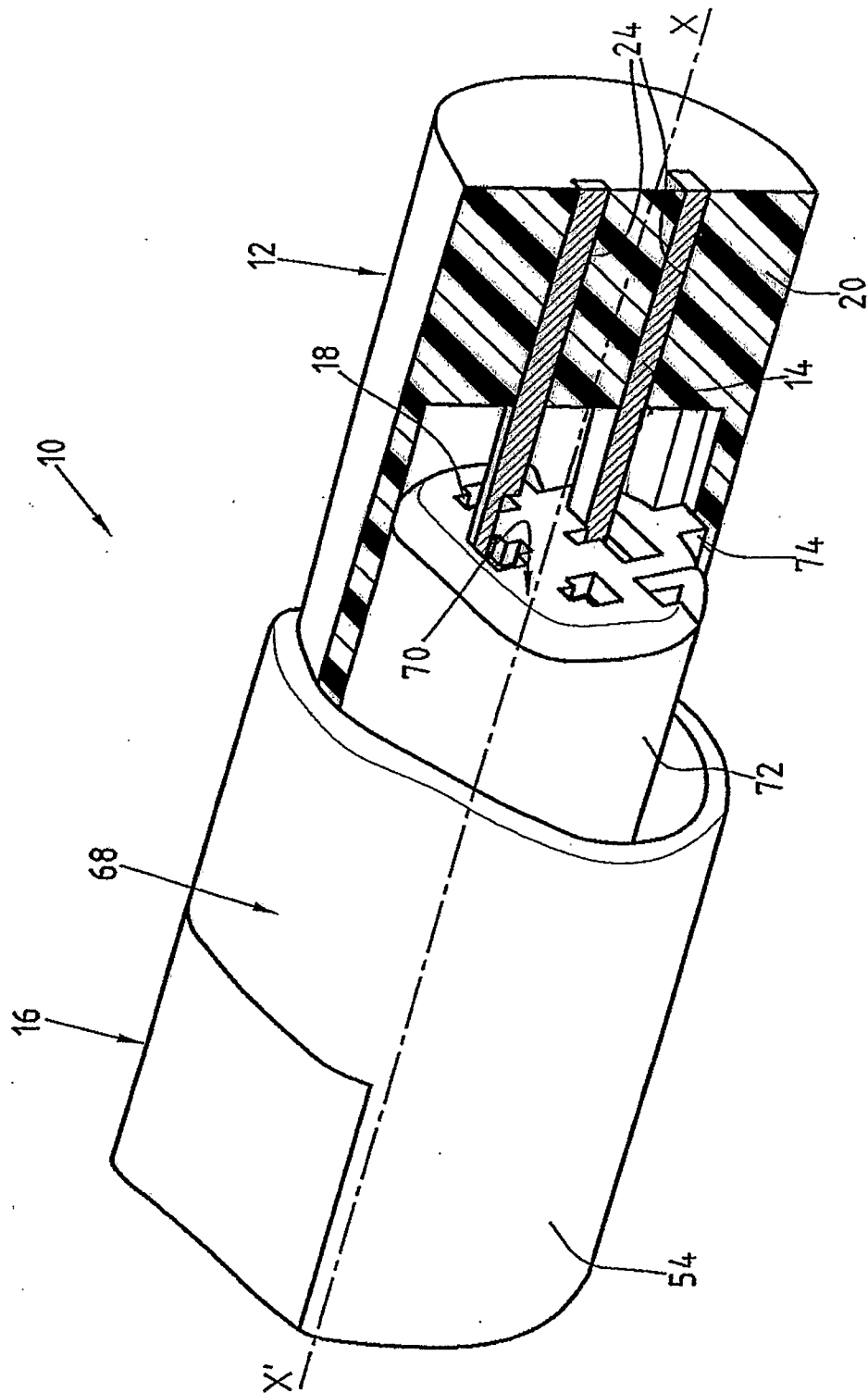
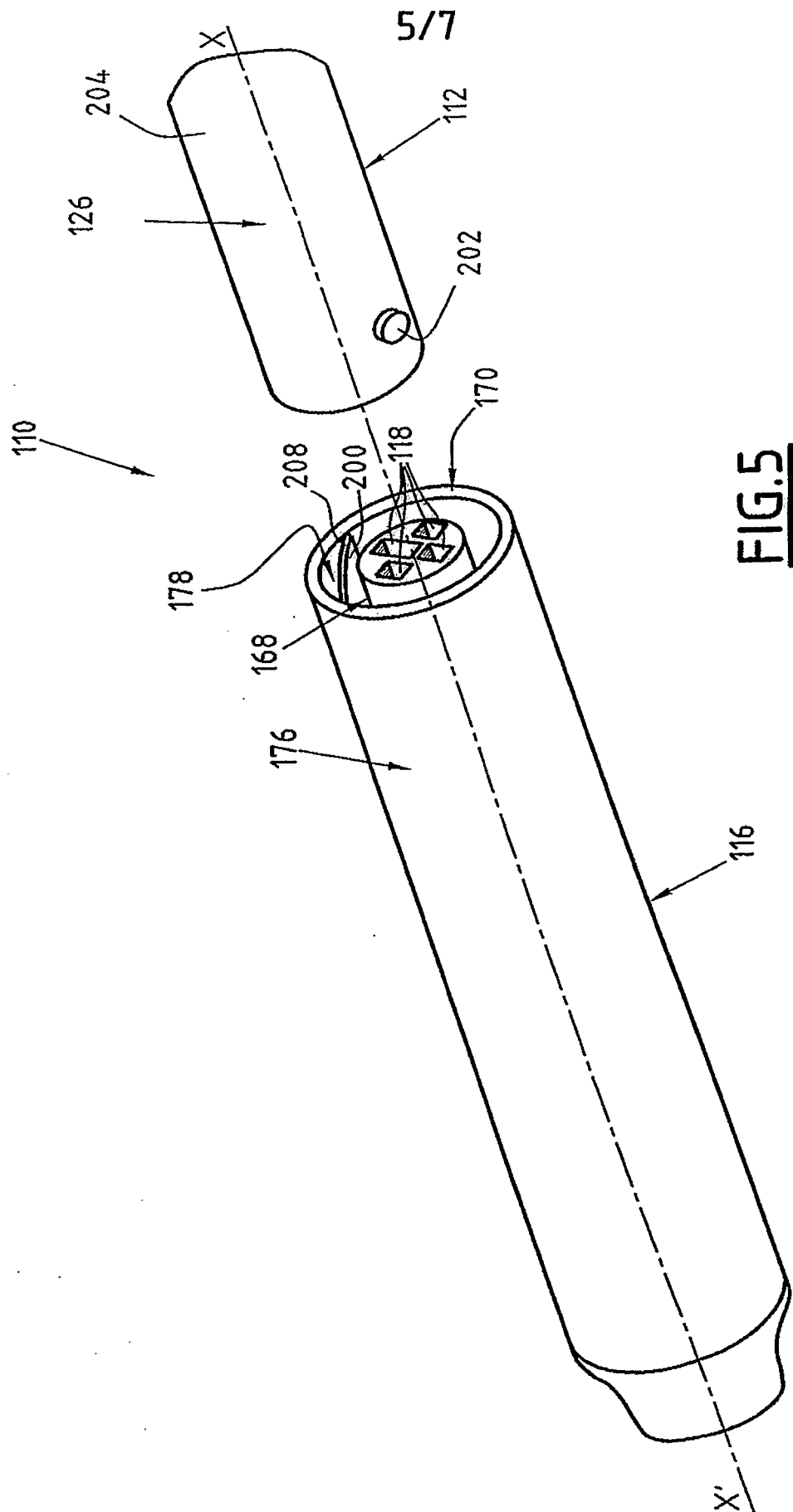
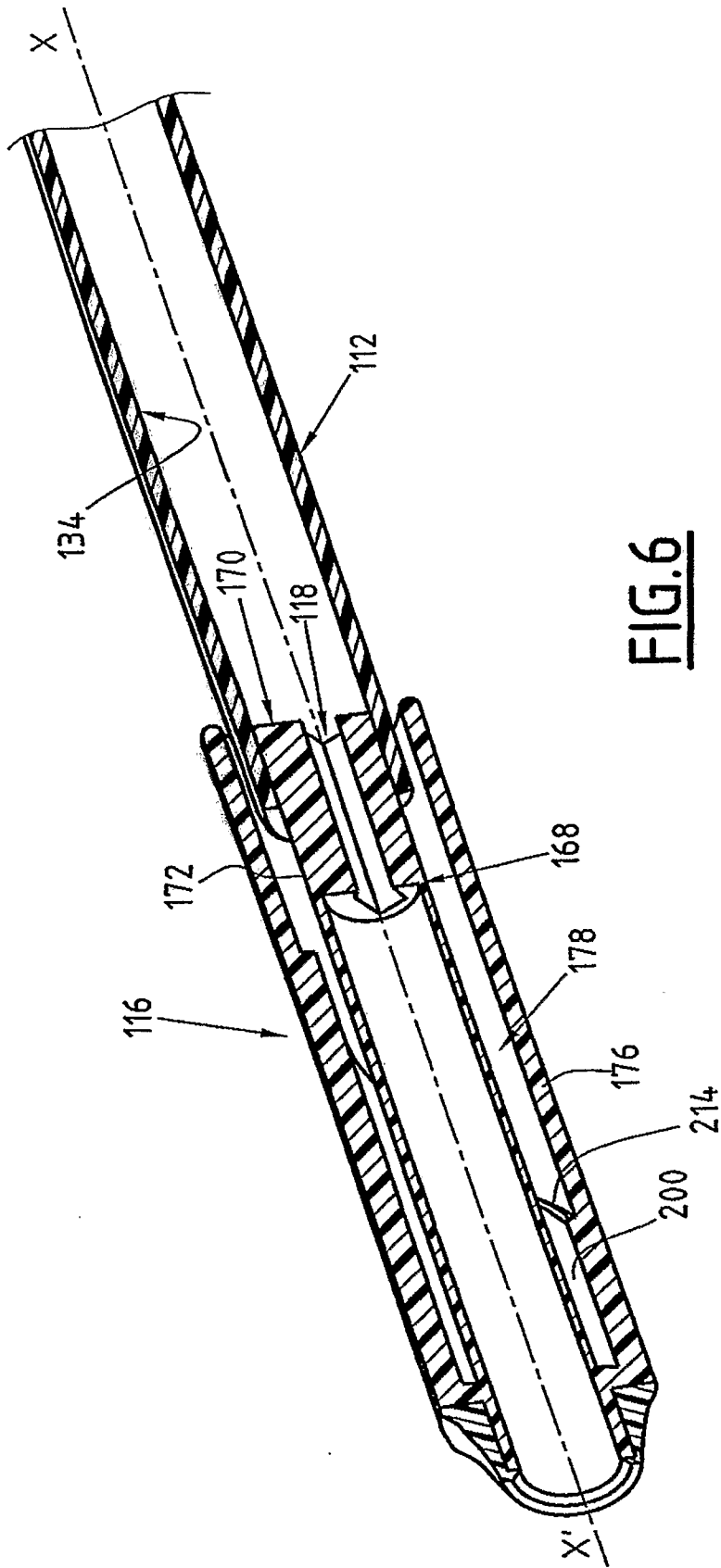


FIG. 4





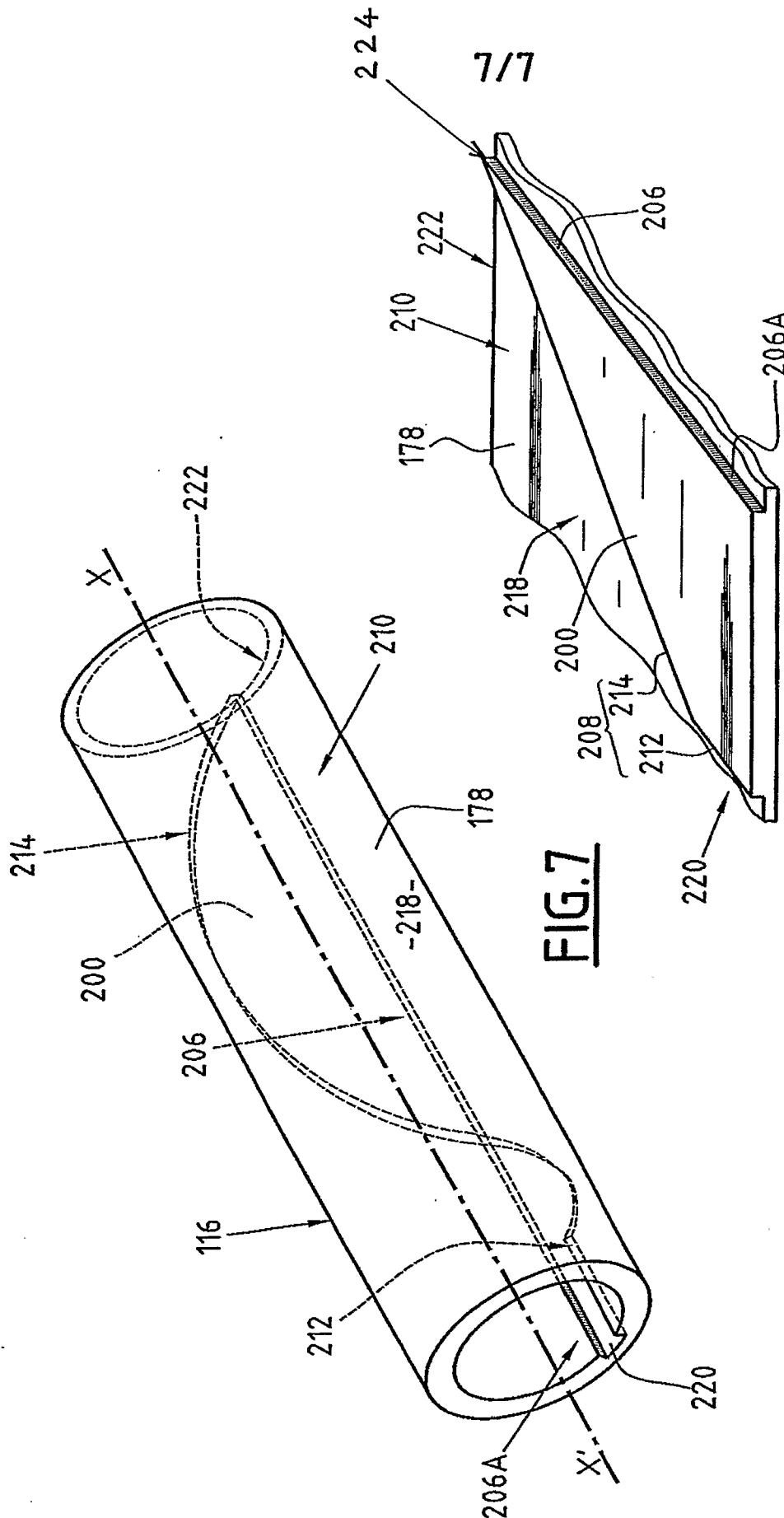


FIG. 7

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2008/002430

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01R13/631

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 26 46 093 A1 (HIRSCHMANN RADIOTECHNIK) 27 April 1978 (1978-04-27) the whole document -----	1,2,4-7, 9-12

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

5 June 2009

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16/06/2009

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2646093	A1	27-04-1978	NONE