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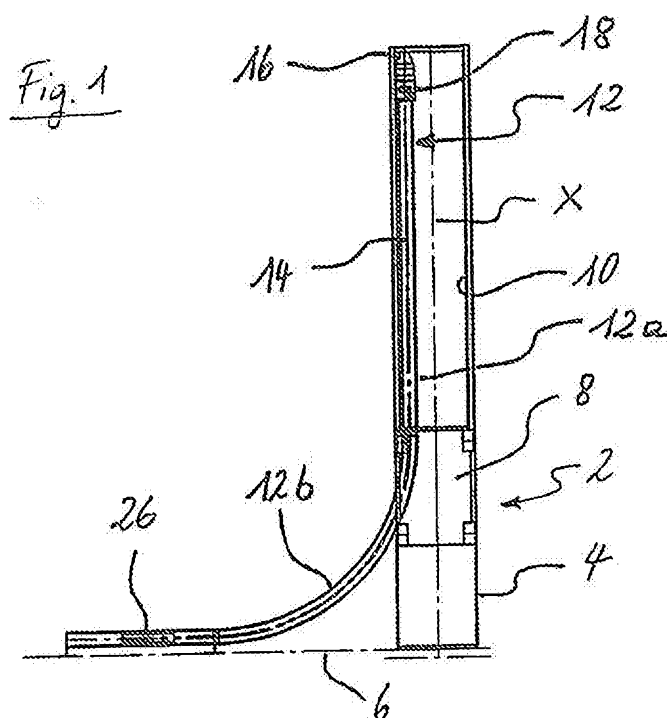
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[Fortsetzung auf der nächsten Seite]

(54) Title: ANTENNA DEVICE FOR A SUBMARINE

(54) Bezeichnung : ANTENNENVORRICHTUNG FÜR EIN UNTERSEEBOOT



(57) Abstract: An antenna device for a submarine has an extending unit (2) comprising an extendible mast (10). Furthermore, the antenna device is equipped with at least one HF antenna (14), which is guided in said mast (10) and can be extended out of said mast (10), is formed in one piece and, when the extending unit (2) is in a retracted state, is arranged inside said mast (10) and inside a spatially curved guide, which is adjoined thereto on the submarine side.

(57) Zusammenfassung: Eine Antennenvorrichtung für ein Unterseeboot weist ein Ausfahrgerät (2) mit einem ausfahrbaren Mast (10) auf. Darüber hinaus ist die Antennenvorrichtung mit mindestens einer in dem Mast (10) geführten und aus dem Mast (10) ausfahrbaren HF-Antenne (14) ausgestattet, welche einteilig ausgebildet ist und im eingefahrenen Zustand des Ausfahrgeräts (2) innerhalb des Mastes (10) und innerhalb einer sich bootseitig daran anschließenden raumgekrümmten Führung angeordnet ist.



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Description

The invention relates to an antenna device for a submarine.

Military submarines are usually provided with various antenna devices. Such antenna devices which are arranged outside the pressure hull of the submarine within its tower form the starting point of the invention. These antenna devices comprise at least one, as the case may be however also several antennae which permit a telecommunication during travel at periscope depth and for this can be extended so far out of the tower of the submarine, that they project out of the water.

Amongst others, HF antennae which are used for communication in the short-wave range belong to the applied antennae. These HF antennae as a rule are designed in a comparatively slim manner for ensuring a good efficiency, wherein their length is usually more than 7 m. With submarines whose tower is less than 7 m high, such antenna devices which have a telescopically designed HF antenna are applied, in order to be able to accommodate the antenna device completely in the tower of the submarine when not in use. The telescopic design however is relatively cumbersome, since an electrically conductive connection of the individual telescopic parts of the HF-antenna must be ensured in the extended condition, where it is simultaneously to be ensured that this connection is protected from sea water, since sea water could otherwise upset the signal transmission.

Against this background, it is the object of the invention, to provide an antenna device for a submarine, with which at least one HF antenna mounted in the tower of the submarine can be extended out of the tower of the submarine, wherein the antenna device with improved transmitting and receiving characteristics of the HF antenna is to have a simpler construction compared to the antenna devices of this type known until now.

This object is achieved by an antenna device with the features specified in claim 1. Advantageous further developments of this antenna device are to be deduced from the dependent claims, the subsequent description as well as the drawing. Hereby, the features specified in the dependent claims in each case per se, but also in a suitable combination with one another can further form the solution according to claim 1 and according to the invention.

The antenna device according to the invention for a submarine, in a manner known per se is envisaged for arrangement in the tower of a submarine. It comprises an extension device with an extendible mast. The mounting of the extension device in the tower is preferably effected on a foundation which is arranged on the outer side of the pressure hull of the submarine. The antenna

device is moreover provided with at least one HF antenna which is guided in the mast and can be extended out of the mast, for communication in the shortwave range.

The basic concept of the invention is to design the HF antenna in a single-part manner and in the retracted condition of the extension apparatus to arrange it within the mast and within a spatially arcuate guide which connects thereto on the submarine side. I.e. the antenna according to the invention, below the mast comprises a guide device, in which a section of the HF antenna which is guided therein, given an extension apparatus retracted into the tower, is guided in a bent manner in the direction obliquely and/or transversely to the extension device of the extension apparatus, whereas the remaining part of the HF antenna is designed in a straight manner in the extension direction of the extension apparatus and in the extension direction of the HF antenna. The HF antenna is arranged completely outside the spatially arcuate guide and assumes a shape which is aligned in a straight manner over its complete length, as soon as the extension apparatus is completely extended, but however at least when the HF antenna extends out of the mast. For this, the HF antenna at least in the section which is guided in the guide given a retracted extension apparatus, then however over its entire length is preferably designed in a flexible manner, i.e. in a resiliently yielding manner, transverse to its longitudinal extension. The provision of the spatially arcuate guide, with the antenna device according to the invention permits the use of a HF rod antenna which is simple with regard to its construction and whose length can be significantly greater than the tower height of the submarine due to the arcuate (bent) arrangement in the guide and which therefore has very good transmitting and receiving characteristics.

The HF antenna of the antenna device according to the invention is preferably coupled in movement to the mast with an extension or retraction movement of the extension apparatus and can be extended out of the mast and retracted into the mast, with the help of an individual drive. Accordingly, the HF antenna for example is coupled to the mast by way of a suitable fixation in the mast, in a manner such that when the mast is extended or retracted by the extension apparatus, e.g. by way of a piston-cylinder arrangement, it is extended or retracted in the same manner. The HF antenna can be extended out of the mast into its transmitting and/or receiving position above the water line by way of a drive which is assigned to it and which is preferably arranged in the mast, preferably when the mast is completely extended by the extension apparatus, and can subsequently be retracted back into the mast.

According to a further advantageous design of the antenna device according to the invention, the HF antenna can be guided in an enveloping body (casing), wherein one end of the enveloping body is fixed on the extendible end of the mast. Preferably, a tube or a flexible tubing serves as an enveloping body. The enveloping body is co-moved with the mast given an extension and retraction movement of the mast, as a result of the fixation of the enveloping body

on the extendible end of the mast. The enveloping body serves for guiding the HF antenna but also for its external protection. For this reason, the enveloping body is preferably designed so long that it can completely accommodate the HF antenna in a mounting/stowage position, i.e. with a retracted extension apparatus. The enveloping body is accordingly designed just as long as the HF antenna. In this case, a section of the enveloping body which is at the rear in the extension direction of the mast is usefully arranged with the HF antenna arranged therein, in the spatially arcuate (curved) guide of the antenna device according to the invention, or itself forms this spatially arcuate guide for the HF antenna, wherein the section of the enveloping body which is at the rear in the extension direction of the mast is bent obliquely or transversely to the extension direction of the mast.

Advantageously, for forming a spatially arcuately designed guide, an end of the enveloping body which is at the rear in the extension direction of the mast can be displaceably arranged on a guide rail which is arranged on the submarine side which is to say on the part of the submarine, and this guide rail extends from a position laterally of a middle axis of an enveloping body section arranged in the mast in a projection perpendicularly to this middle axis in the direction of the middle axis. A section of the enveloping body which is adjacent to the rear end of the enveloping body is designed in a bendable manner and bent, relative to the extension direction of the extension apparatus and of the mast, with this design, and this, given an extended extension apparatus permits a space-saving stowage of a long HF antenna in the tower of a submarine. The enveloping body which is preferably fixed in the mast is co-guided with the extension of the mast, wherein the rear end of the enveloping body which is displaceably arranged in the guide rail arranged on the submarine side displaces in the direction of the middle axis of the enveloping body section located in the mast, by which means the bent section of the enveloping body reduces in size.

In an alternative advantageous design, an end section of the enveloping body which is at the rear in the extension direction of the extension apparatus can be rolled up on a round guide device, with which it can be the case of a rotatable roller for example, which likewise permits a space-saving stowage of the HF antenna led in the enveloping body.

According to a further advantageous further development of the antenna device according to the invention, the enveloping body can be designed in a telescopic manner. This has the effect that the enveloping body lengthens when it is extended with the mast by the extension apparatus, so that an end of the enveloping body which is at the rear in the extension direction of the mast does not need to be displaceably arranged in a guide rail, but can be fixed on the submarine side in a position laterally of the middle axis of the enveloping body section arranged in the mast.

Preferably, a drive assigned to the HF antenna is provided, with which the HF antenna can be extended out of the mast and retracted again into the mast. Such a drive is preferably arranged on an end of the enveloping body which is at the front in the extension direction of the extension apparatus, given the use of an enveloping body for the HF antenna.

A roller drive can advantageously be used as a drive for extending and retracting the HF antenna. A roller drive is to be understood as a drive which comprises at least two rollers, between which the HF antenna is guided whilst forming a friction fit with the rollers, wherein at least one of the rollers is coupled in movement to a motoric drive, and the HF antenna is extended out of the mast or is retracted into this, with a rotation of the roller coupled in movement to the motoric drive, depending on the rotation direction of the roller.

Alternatively to a roller drive, a hydraulic or pneumatic drive can be provided for extending and retracting the HF antenna. Thus a design is possible, with which the enveloping body forms a cylinder of a piston-cylinder arrangement, and a piston guided in the enveloping body is preferably arranged at an end of the HF antenna which is at the rear in the extension direction of the HF antenna. Hereby, a section of the enveloping body usefully designed in a pressure-tight manner and which is located behind the piston in the extension direction of the HF antenna is subjected to a pressure medium for extending the HF antenna. With regard to the pressure medium, with a hydraulic drive it is typically the case of a hydraulic fluid and with a pneumatic drive, it is typically the case of air. The retraction of the HF antenna into the enveloping body permits a pressure impingement of a section of the enveloping body which is located in front of the piston in the extension direction of the HF antenna.

The HF antenna is preferably designed of a fibre-reinforced plastic with an electrically conductive core. Thus the HF antenna is advantageously formed by an electrical lead which is encased by fibre-reinforced plastic at the outside. Glass-fibre reinforced plastic is preferably provided hereby as a fibre-reinforced plastic, and this on the one hand gives the HF antenna an adequate robustness, in order to withstand wave impact, currents and any wind load, but on the other hand permits the necessary bending ability of the antenna device. The antenna rod can be provided with a suitable cross-sectional contour for this.

According to a further advantageous design of the antenna device according to the invention, an insulator is formed on the end of the enveloping body which is at the front in the extension direction of the extension apparatus, said insulator having a contact which is conductively connected to a transmitting and/or receiving device. The transmitting and/or receiving device which is not part of the antenna device according to the invention, is usefully arranged in the inside of the pressure hull of the submarine, so that a lead which is connected to

the contact of the insulator is led in a suitable pressure-tight manner through the pressure hull of the submarine.

An electrical contact is preferably formed on an end of the antenna which is at the rear in the extension direction, in combination with a contact conductively connected to an transmitting and/or receiving device and formed on the insulator, wherein the first mentioned contact contacts the contact formed on the insulator in the extended condition of the HF antenna. I.e. the HF antenna can thus only be put into operation when it is completely extended out of the enveloping body and the contact which is formed on it, with regard to which it can be the case of a sliding contact, contacts the contact formed on the insulator side.

The invention is hereinafter explained in more detail by way of an embodiment example represented in the drawings. In the drawings are shown in:

- Fig. 1 in a schematically simplified basic sketch, an antenna device for a submarine with an extendible mast and with an extendible HF antenna, with a retracted mast and retracted HF antenna,
- Fig. 2 the antenna device according to Fig. 1, with an extended mast and retracted HF antenna,
- Fig. 3 the antenna device according to Fig. 1, with an extended mast and an extended HF antenna and
- Fig. 4 a detail A of Fig. 3 which is represented in an enlarged manner.

The antenna device for a submarine and which is represented in the Figures 1 - 3 comprises an extension apparatus 2, whose base body 4, with which it is the case of an open hollow body, is fastened on a foundation 6 arranged on the outer side of a submarine in the region of the tower. The base body 4 extends essentially up to an upper end of the tower of the submarine which is not represented. A guide part 8 is arranged in the base body 4 and this guide part is movable in the base body 4 in the direction of a longitudinal axis X of the extension apparatus 2 up to the end of the base body 4 which is away from the foundation 6 and vice versa, by way of a piston-cylinder arrangement which is arranged in the base body 4 and is not represented in the drawing for the purpose of a better overview.

A mast 10 of the antenna device is arranged on an upper side of the guide part 8 which is away from the foundation 6. The mast 10 designed in a hollow manner is designed in an open manner at its end which is away from the guide part 8 and is dimensioned such that when the

guide part 8 is located in its retraction position in the base body 4, it is just about completely received by the base body 4, thus does not project out of the base body 4 (Fig. 1).

A tube 12 is fastened in the inside of the mast 10, in the region of the end of the mast 10 which is away from the guide part 8. The tube 12 forms an enveloping body for a HF antenna 14 displaceably guided in the tube 12. The tube 12 comprises two consecutive sections 12a and 12b. The section 12a of the tube 12 is designed in a straight manner and extends parallel to the longitudinal axis X of the extension apparatus 2. The section 12a is moreover designed in a telescopic manner in the direction of its longitudinal extension. The section 12b connecting on the end of the section 12a which faces the foundation 6 is designed in a bent manner transversely to the longitudinal section of the section 12a and is led out of the base body 4 of the extension apparatus 2, between the guide part 8 and the foundation 6, wherein the free end of the section 12b is fixed on the foundation 6 in a manner distanced to the extension apparatus 2 in the direction transverse to the longitudinal axis X of the extension apparatus 2. The section 12b forms a spatially arcuate guide device for the HF antenna 14 arranged in the tube 12, and this device permits the use of a particularly long HF antenna 14 designed in a single part manner, in the represented antenna device.

With regard to the HF antenna 14, it is the case of a rod antenna which is formed by a CFK rod with an electrically conductive core. The HF antenna 14 is extendible out of the tube 12, on an insulator 16 which is arranged on the end of the tube 12 which is arranged in the mast. A drive 18 is provided for extending and retracting the HF antenna 14 and this drive is arranged behind the insulator 16 with respect to the extension direction of the HF antenna 14. With regard to the drive 18 it is the case of a roller drive which comprises two rollers 20 and 22 which are arranged next to one another and between which the HF antenna 14 is led through whilst forming a friction fit with the rollers 20 and 22. The rollers 20 and 22 are driven by a motor 24 for moving the HF antenna 14.

The manner of functioning of the antenna device represented in the drawings is as follows:

Fig. 1 shows the antenna device when not in operation. The antenna device is then completely arranged in the tower of a submarine which is not represented. Hereby, the mast 10 is retracted completely in the base body 4 of the extension apparatus 2. The section 12a of the tube 12 is not telescoped. The HF antenna 14 retracted completely in the tube then extends in a space-saving manner up to into the bent section 12b of the tube 12.

If the antenna device is to be put into operation, as is shown firstly in Fig. 2, the mast 10 is then firstly extended out of the base body 4 of the extension apparatus 2. Hereby, the section

12a of the tube 12 telescopes in the extension direction of the mast 10, so that the length of the section 12a increases in the extension direction of the mast 10. The HF antenna 14 which is fixed between the rollers 20 and 22 of the drive 18 is driven or caught by the enlarging section 12 of the tube 12 when telescoping the section 12a, and this results in the fact that an end section 26 of the HF antenna 14 which was previously arranged in the bent section 12b and is at the rear with respect to the extension direction of the HF antenna 14, is moved out of the section 12b of the tube 12, so that the HF antenna 14 is located completely in the straight section 12a of the tube.

The HF antenna 14, after the mast 10 is extended completely out of the base body 4 of the extension apparatus 2, by way of starting operation of the drive 18 is extended so far out of the tube 12 until an electric contact which is arranged on the end section 26 of the HF antenna 14 and which is not shown in the drawing contacts a likewise non-represented electrical contact which is arranged on the insulator 16 and which is conductively connected to a transmitting and/or receiving device in the inside of the submarine. The HF antenna 14 is only ready for transmitting and receiving in this condition (Fig. 3).

After use of the HF antenna 14, this is firstly retracted back into the tube 12 and the mast 10 together with the guide part 8 is retracted into the base body 4 of the extension apparatus 2. The antenna device is now again located completely within the tower of the submarine.

List of reference numerals

2	extension apparatus
4	base body
6	foundation
8	guide part
10	mast
12	tube
12a, 12b	section
14	HF antenna
16	insulator
18	drive
20	roller
22	roller
24	motor
25	end section
A	detail
X	longitudinal axis

Claims

1. An antenna device for a submarine, with an extension apparatus (2) which comprises an extendible mast (10) and with at least one HF antenna (14) which is guided in the mast (10), is extendible out of the mast (10), is designed in a single-part manner and in the retracted condition of the extension apparatus (2) is arranged within the mast (10) and within a spatially arcuate guide connecting thereto on the submarine side.
2. An antenna device according to claim 1, with which the HF antenna (14), with an extension or retraction movement of the extension apparatus (2), is coupled in movement to the mast (10) and can be extended out of the mast (10) and retracted into the mast (10), with the help of its own drive (18).
3. An antenna device according to one of the preceding claims, with which the HF antenna (14) is guided in an enveloping body, wherein one end of the enveloping body is fixed on the extendible end of the mast (10).
4. An antenna device according to claim 3, with which the enveloping body at least in a part region is designed in a flexible manner transverse to its longitudinal extension.
5. An antenna device according to one of the claims 3 or 4, with which an end of the enveloping body which is at the rear in the extension direction of the mast (10) is displaceably arranged on a guide rail which is arranged on the submarine side and which extends from a position laterally of a middle axis of a enveloping body section arranged in the mast (10), in the direction of this middle axis.
6. An antenna device according to one of the claims 3 or 4, with which an end section of the enveloping body which is at the rear in the extension direction of the extension apparatus (2) can be rolled up on a round guide.
7. An antenna device according to claim 3, with which the enveloping body is designed in a telescopic manner.
8. An antenna device according to one of the claims 3 – 7, with which the drive (18) for the HF antenna (14) is arranged on an end of the enveloping body which is at the front in the extension direction of the extension apparatus (2).
9. An antenna device according to claim 8, with which the drive (18) is a roller drive.

10. An antenna device according to claim 8, with which the drive is a hydraulic or pneumatic drive.
11. An antenna device according to one of the preceding claims, with which the HF antenna (14) is designed of a fibre-reinforced plastic with an electrically conductive core.
12. An antenna device according to one of the claims 3 - 10, with which an insulator (16) is formed on the end of the enveloping body which is at the front in the extension direction of the extension apparatus (2), said insulator having a contact which is conductively connected to a transmitting and/or receiving device.
13. An antenna device according to claim 12, with which an electrical contact is formed on an end of the HF antenna (14) which is at the rear in the extension direction, said contact in the extended condition of the HF antenna (14) contacting the contact formed on the insulator (16).

Fig. 1

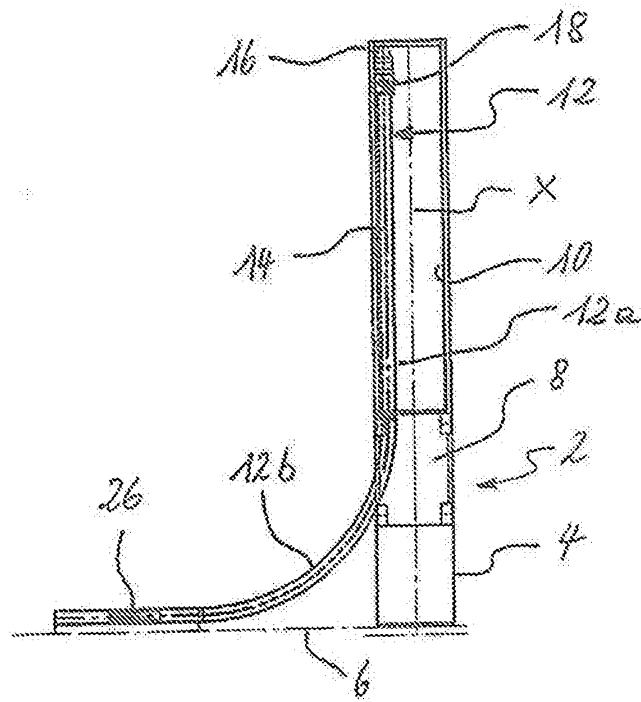


Fig. 2

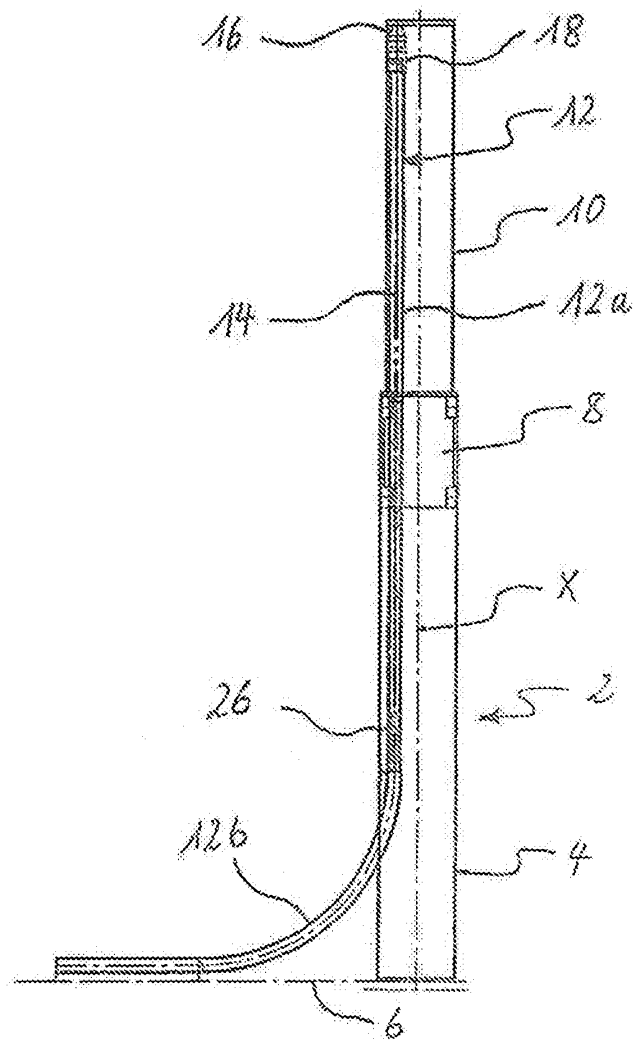
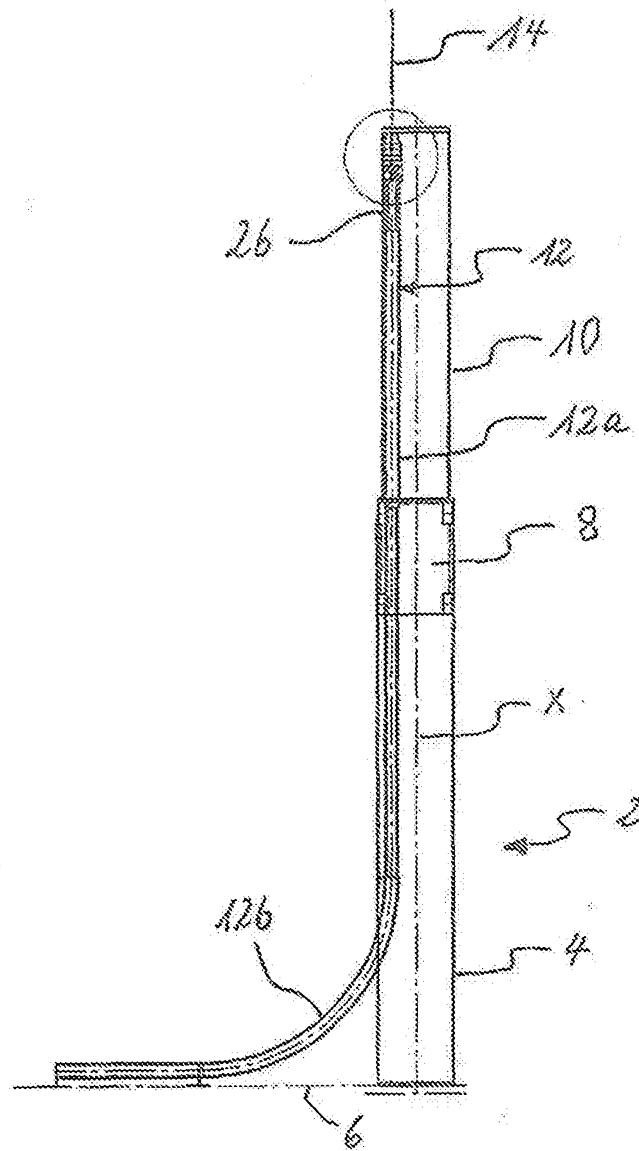


Fig. 3Fig. 4