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(54) **Apparatus with a floating container for a cabel**

(57) The present invention concerns an apparatus with a floating tank 2 for take-up of cable 1, and a drive arrangement 6. The inner tank 2 is designed as a floating body, with a floor 5 and sides. Further is the inner tank 2 placed inside an outer tank 4, so that an interstice is created between the inner tank 2 and the outer tank 4 for filling of fluid. A minimum of one support for support of the inner tank 2 inside the outer tank 4 permits rotation of the inner tank 2 relative to the outer tank 4. The drive arrangement 6 will turn the inner tank 2.

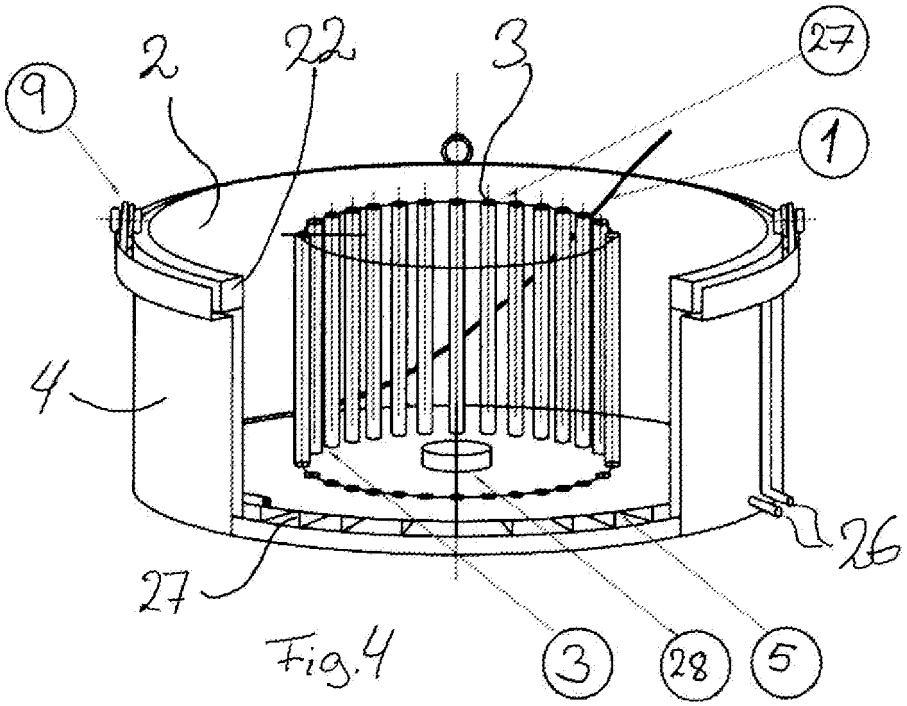

Fig.4

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Description

[0001] The present invention concerns an apparatus for loading and unloading cables.

[0002] The apparatus is primarily intended used for coiling cables onboard a floating vessel. However, the apparatus can also be utilised by manufacturers and developers offshore for oil and gas fields and in coastal areas for coiling power and signal cables and other applications for coiling.

[0003] The apparatus is primarily intended placed on a barge for the use of coiling multifunctional cables or umbilicals. The cable will then be paid out from a turntable onshore and stored onboard the barge until the vessel used for installing the cable takes it onboard. The place for such storage may be close to the manufacturer or close to the field of installation. When the last is the case, the installation vessel may have a shorter work period.

[0004] Devices in common use on vessels today are made with heavy foundations and with wheels for supporting the load, and this requires extra heavy reinforcements of the hull structure compared to other loads. Further to this such designs need large and expensive bearings for supporting the load of the cable, and comparatively powerful motors for coiling the cable.

[0005] With the present invention this is solved by utilising the principle of buoyancy in fluid to make the tank with the cable free to rotate.

[0006] The apparatus involves primarily a cylindrical tank with a vertical centre axis and a floor or base that withstands the load from the water and the cable loaded. The tank with the cable rotates inside another tank that is slightly larger, and so that the rotating motion is permitted without contact between the two tanks.

[0007] The outer tank may be part of the vessels hull structure or may be placed on the floor without causing significant reinforcements of the hull. The last is relevant when utilising ordinary barges.

[0008] The rotating tank may have a flat floor. The upper part of this tank may be a strong ring construction. This ring may take loads that are in addition to buoyancy and that takes up loads giving stability to keep the tank in position and a force may be applied to the ring for rotating the tank. These loads may be transferred with wheels mounted on the outside tank.

[0009] All bearings and drive units may be arranged so that they can be replaced during operation. The number of units for stabilisation and rotation may be with a redundancy that allows the removal of a unit during operation for maintenance. The fluid between the tanks may be tap water with additives acting to prevent corrosion and marine growth. The tank with the cable may be dimensioned for lifting with full load of cable and may for example be placed onshore or on another vessel if this is suitable for the purpose.

[0010] Another advantage with such handling on a barge is that capacities on turntables onshore are made free. Production of cables for which the device is made, may last several months and quite often the loadout is made several weeks after the cable is finished manufactured and tested.

[0011] Compared to other known devices for coiling of cable on a vessel the apparatus according to the invention may be significantly smaller. For the purpose of storage and transport an arrangement with multiple devices on the same barge may be favourable. The load capacity for one single unit may for example be 1500 tonnes. Outer diameter for a small tank with the cable may then be 18 meter and the diameter inside the cable bundle 9 meter, and respectively 25 meter and 15 meter for a larger one. These dimensions agree well with the restrictions on bending of typical cable constructions and also to barges with typical dimensions for use in harbours.

[0012] The present invention concerns an apparatus with a floating tank for take-up of cable. The tank is designed as a floating body with floor and sides. This tank is placed inside another tank so that there is a room between these for filling of fluid.

[0013] At least one support unit supports the floating tank, and is adapted to allow the rotation of the inner tank relative to the outer one. A drive unit is provided for rotating the floating tank.

[0014] The inner tank and the outer one may be cylindrical or multi-edged.

[0015] The inner tank with an outside diameter and the outer tank with an inside diameter will make an interstice sufficiently large so that the tanks do not contact when the interstice is fluid filled, and also small so that the construction is compact and does not need large amounts of fluid. Typical difference in diameters may be 0,05 to 0,5 meter. The difference in diameter is large enough to avoid large shear forces in the fluid during rotation, and large enough to use normal tolerances in the construction. The interstice shall be dimensioned to avoid seizing of the tanks during installation and removal. It will also be an advantage to have a small volume of fluid in respect to weight and pump capacity when controlling the buoyancy during loading and unloading. During sailing the fluid is drained or pumped to a storage tank in a sealed off system, and the inner tank will then rest against elements that secure the inner tank.

[0016] The at least one such support unit may be a rotating bearing in the centre for pivotal attachment of the floating tank in the outer tank.

[0017] The at least one such support unit may comprise roller units along the tank rim. These rollers may be suspended in the outer tank and act onto a rim on the inner tank facing the load caused by the buoyancy. These rollers may have a flange and the rim may be a rail such that the guidance can be compared with a wheel on a railway.

[0018] The drive unit may include a minimum of one motor unit for rotation of the rollers for the inner tank.

[0019] The drive unit may include a motor unit with pinion in contact with a toothed ring along the rim of the inner tank.

[0020] The drive unit may include a motor unit mechanically connected to the centre of the inner tank.

[0021] The inner and the outer tanks may include an enlargement in the upper part mainly horizontally in extent.

[0022] The roller units may act upon the horizontal surface on the inner tank.

[0023] The apparatus may further include fastening elements for fastening the inner tank relative to the outer tank as seafastening.

[0024] The apparatus may further include a pump and a control system for regulating the fluid level in the interstice between the tanks.

[0025] The at least one support unit may be placed in the upper part of the outer tank and may include rollers for supporting of the inner tank in rotation. After completed filling or unloading cable from the inner tank, this will be lowered and at the same time engage against supports in the floor.

[0026] An inside limitation for the support of the cable may be placed in the floor centre area of the inner tank. This limitation may be suitable poles, a curved body or otherwise and may have the form of a drum, hub or reel for coiling of cable. The inside limitation may be replaceable in order to be adapted to the cable weight and minimum bend radius. The total weight of the cable must not exceed the maximum weight the device allows. Maximum weight depends on the buoyancy of the tank, and in some cases permitted bearing loads or roller loads.

[0027] The apparatus can be used for loading and unloading of a cable as described above, to a vessel for transport of cable.

[0028] The expression "cable" in this description is meant to cover all forms of meterware, for example umbilicals, hoses, electric power cables, coiled tubing, wire etc.

[0029] Short description of the enclosed figures:

Figure 1 is an overhead view of a barge with an apparatus according to the invention;

Figure 2 is a sectioned side view of the barge with an apparatus according to the invention as shown in figure 1;

Figure 3 is a sectioned side view of an apparatus according to the invention in a larger scale;

Figure 4 is a sectioned view of an alternative embodiment of the invention;

Figure 5 is a perspective view of an inner tank according to the invention; and

Figure 6 is a perspective view of an outer tank according to the invention.

[0030] Detailed description of designs according to the invention with reference to the enclosed figures:

From figure 1 it appears a top view of a barge 18 with an apparatus according to the invention. A cable is coiled around an inside limitation in a circular tank 2. The inner, circular tank 2 is positioned in an outer tank 4. The outer tank 4 is prepared for filling of fluid so that the inner tank 2 is given a buoyancy. Eight rollers, barrels or wheels 9 are shown suspended in respect to the outer tank 4. A stiffened upper rim 22 on the inner tank 2 rests against the rollers 9 and is guided by a flange on the rollers 9. One or several of the rollers 9 may be powered by a suitable motor for the rotation of the inner tank 2 in respect to the outer tank 4. The cable 1 is shown running through a feeder and guidance arrangement for the positioning of the cable correctly inside the inner tank 2.

From figure 2 it appears arrangements according to the invention in a cross section, seen from the side, placed on a barge 18. As it appears from figure 2, an outer tank 4 is placed on the outside of the circular tank 2 with a stiffened upper rim 22. Inside limitation 3 is mounted on the floor 5 in the circular tank 2. The sides run upwards from the floor. The circular tank 2 is watertight so that it will float in fluid, but have an open topside for running cable 1 in and out.

From figure 2 it is also shown that there are webs 7 between the circular tank 2 and the outer tank 4. The webs run in a direction perpendicular to the axis of gyration for the inner tank 2, and may be placed as a restrictor to the flow of fluid upwards or downwards between the circular tank 2 and the outer tank 4.

From figure 3 it appears a cross section of another design of the device according to the invention, in greater detail, where the inner tank 2 upper rim 22 is designed so the rim 22 is pressed downwards against the rollers 9 as opposed to the inner tank 2 being pressed upwards against the rollers. From figure 3 it appears that the circular tank 2 with a stiffened upper rim 22, an inner limiter 3 and a floor 5 in greater detail. The cable 1 is shown coiled around the inner limiter 3. The circular tank 2 upper stiffened rim 22 comprises a mainly horizontal area 13. The rollers 9 with a flange are placed along the horizontal area 13 to support the inner tank 2 and in order to keep this in correct position. One or several of the rollers 9 may also be connected to a suitable drive unit, for example an hydraulic motor, for rotating the circular tank 2 around an axis of rotation O. Horizontal webs 7 are placed inside the outer tank 4 for directing the fluid between the circular tank 2 and the outer tank 4, particularly to restrict fluid from flowing upwards between the walls in the tanks when the inner tank 2 turns around its axis O.

[0031] The fluid between the inner tank 2 and the outer tank 4 may as typical be water with different additives to restrict growth of marine organisms, freezing, corrosion etc.

[0032] Figures 4, 5 and 6 show the apparatus in greater detail.

[0033] Figure 4 shows the circular tank 2 placed inside the outer tank 4. An inner limiter 3 is made with poles with braces 27 in between the poles, placed on a reinforced floor or deck 5. The poles function as an inner limit for a cargo hold room where the cable shall be placed. In the centre of the tank it is placed a bearing 28 for maintaining the inner tank 2 position inside the outer tank 4. The upper rim of the inner tank is stiffened with a ring 22. The ring 22 is in contact against rollers 9, supported from the outer tank 4. Piping 26 for supply or drainage of fluid to the outer tank 4 is shown in the side of the tank. One of the pipes may be positioned near the floor of the outer tank 4 for drainage, and the other pipe may be placed in the upper part of the outer tank in order to avoid overfilling. Braces 27 are shown on the inner tank 2 floor 5 for stiffening. These may also contribute to keep of the inner tank 2 in steady position when the device shall be transported, and the fluid is drained out. The pipes 26 may be a part of a closed circuit with storage tank and a pump for the fluid used. The level of filling fluid may be regulated using suitable valves and pumps controlled by units made for the purpose. Parameters for regulating the valves and the pump are for example the position of the inner tank 2, the level of fluid in the interstice between the inner tank 2 and outer tank 4, mass of cable 1 in the inner tank 2. A bearing 28 may be placed in the centre of the floor 5 for guidance of the inner tank 2 relative to the outer tank 4. The bearing 28 may be a substitute or - or a supplement to the rollers 9.

[0034] Figure 5 shows the inner tank 2 with the upper rim 22 for stiffening and the inner limiter 3.

[0035] Figure 6 shows the outer tank 4 for accommodating the inner tank 2 and fluid. The outer tank 4 has an upper part 29 that is widened to make room for the stiffened rim 22 on the inner tank 2.

Claims

1. An apparatus with a floating inner tank (2) for take-up of cable (1) and a drive system (6),
characterized by:

the inner tank (2) is made as a floating body, with a floor (5) and sides, and by placing the inner tank (2) in an outer tank (4), so that an interstice is formed between the inner tank (2) and the outer tank (4) for filling of fluid into the interstice;
at least one support unit for support of the inner tank (2) inside the outer tank (4), permitting rotation of the inner tank (2) in relation to the outer tank (4); and
a drive system (6) adapted to rotate the inner tank (2) in relation to the outer tank (4).

2. The apparatus according to claim 1, where the inner tank (2) and the outer tank (4) are cylindrical or with multiple edges.

3. The apparatus according to claim 1, where the inner tank (2) has a first outside diameter and the outer tank (4) has a second inside diameter, so that the interstice between the inner tank (2) and the outer tank (4) is sufficiently large to avoid contact when the interstice is filled with fluid, and sufficiently small so that the structure is compact and does not need large volumes of fluid.

4. The apparatus according to claim 1, where support unit includes an in the inner tank (2) and the outer tank (4) centrally located bearing (8) for pivotal attachment of the inner tank (2) inside the outer tank (4).

5. The apparatus according to claim 1, where the support unit includes rolling units (9) along the circumference of the inner tank (2).

6. The apparatus according to claim 5, where the drive unit (6) includes at least one motor (10) for powering the roller units (9) and for rotation of the inner tank (2) relative to the outer tank (4).

7. The apparatus according to claim 1, where the drive system includes a motor unit (6) with a pinion and rack gear along the circumference of the inner tank (2).

8. The apparatus according to claim 1, where the drive unit (6) includes a motor unit with mechanical transmission in connection with the centre of the inner tank (2).

9. The apparatus according to claim 5, where the outer tank (4) and the inner tank (2) includes an upper enlargement with a mainly horizontal portion (21) on the outer tank (4) and a horizontal portion on the inner tank (2).

10. The apparatus according to claim 9, where the rolling units (9) runs on the mainly horizontal portions (13, 21) between the outer tank (4) and the inner tank (2).

11. The apparatus according to claim 1, further including fastening elements for securing of load in the inner tank (2) relative to the outer tank (4).

12. The apparatus according to claim 1, further including a pump and a system for regulation of the level of

fluid in the interstice between the outer tank (4) and the inner tank (2).

13. The apparatus according to claim 1, further including an inside limited (3) for supporting the cable, placed on the floor (5) in the inner tank (2) centre area.

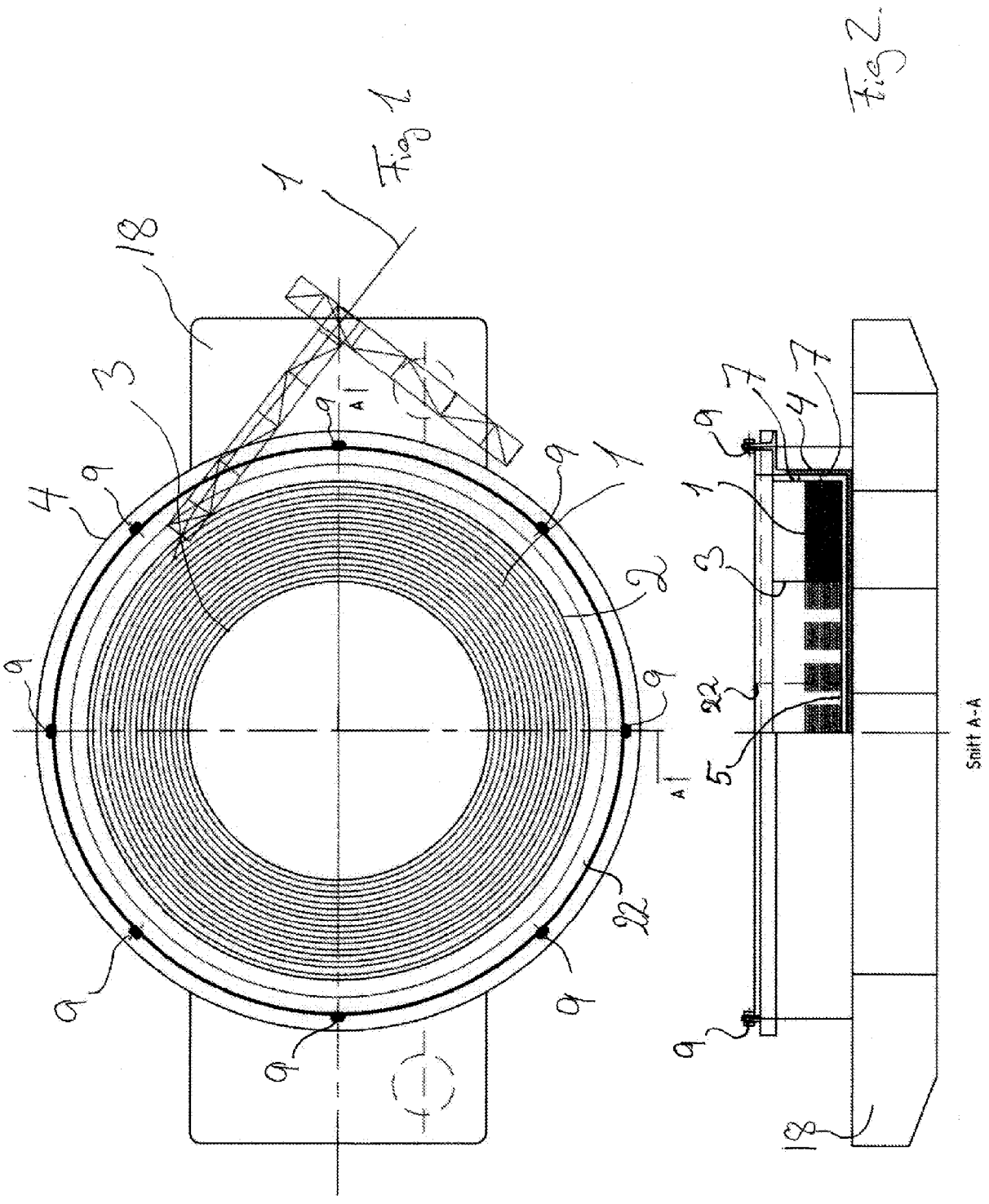
Fig 1
Fig 2
Schnitt A-A

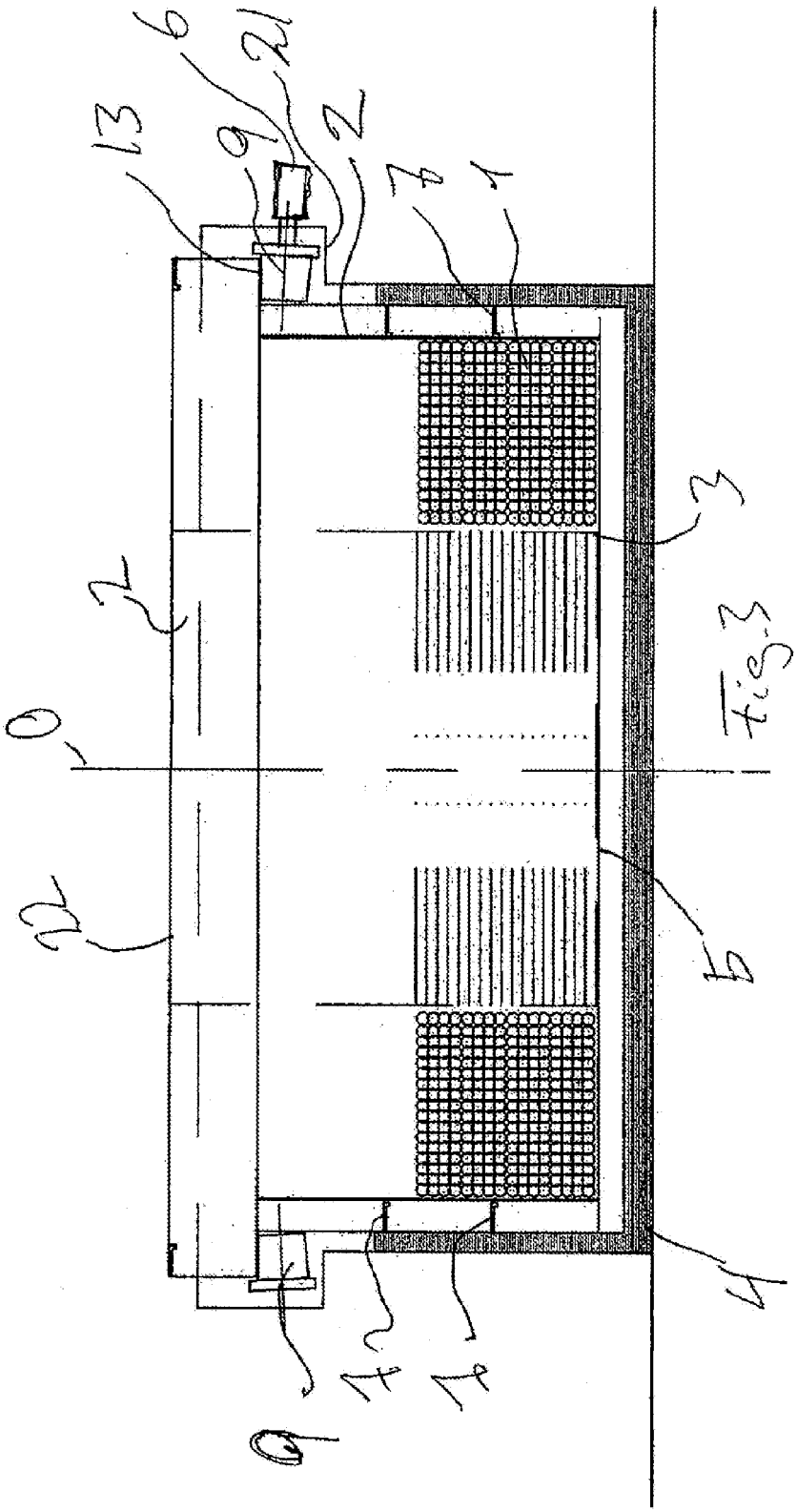

Fig. 3

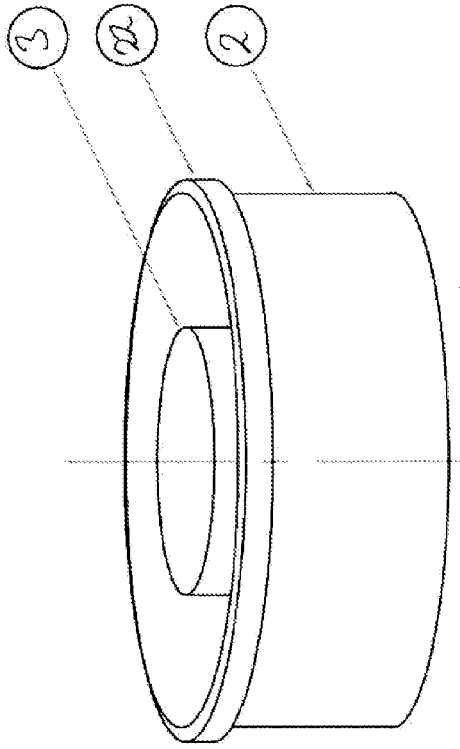

Fig.5

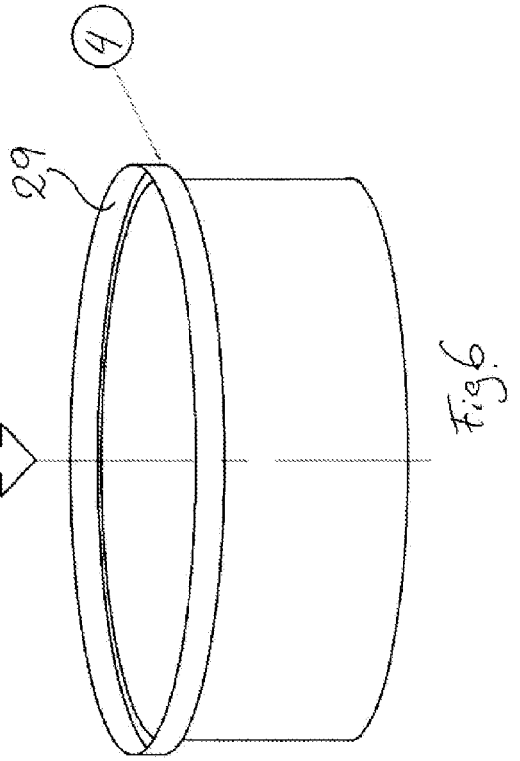

Fig.6

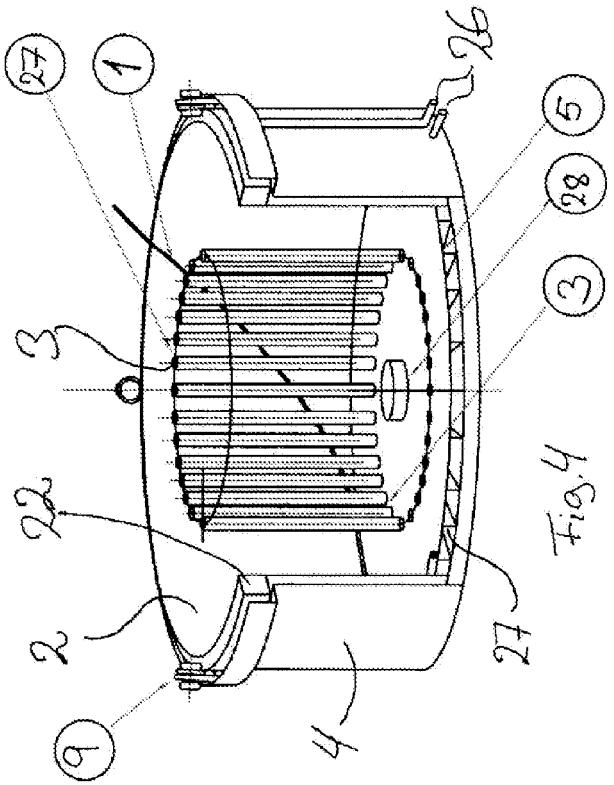

Fig.4