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(72) Inventeur/Inventor:
SYVERTSEN, KARE, NO

(73) Propriétaire/Owner:
SEVAN MARINE ASA, NO

(74) Agent: EMERY JAMIESON LLP

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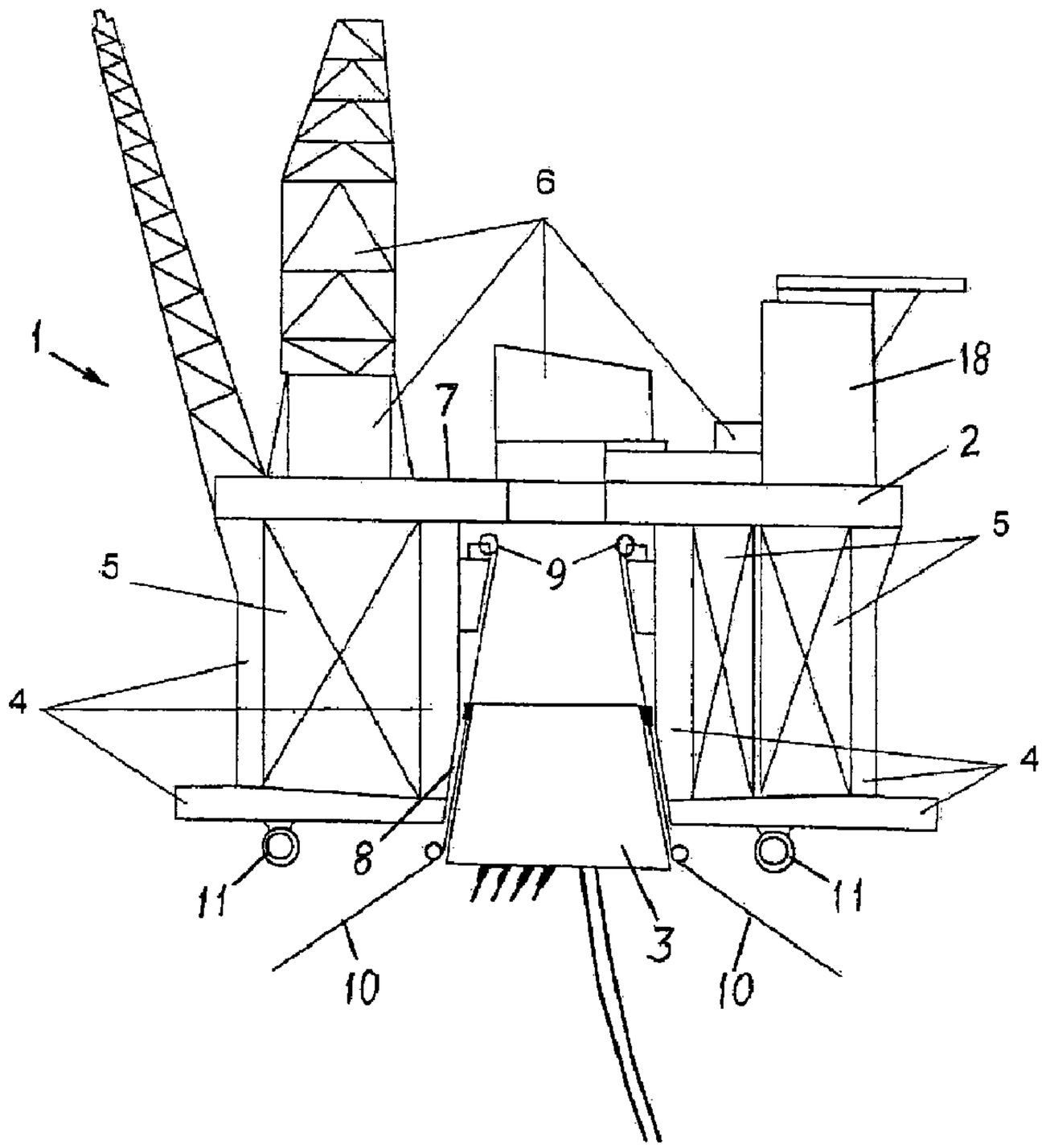
(54) Title: FLOATING PLATFORM FOR OPERATION IN REGIONS EXPOSED TO EXTREME WEATHER CONDITIONS



(57) Abrégé/Abstract:
A floating platform for drilling after or production of hydrocarbons comprises a semi-submersible main platform (2) carrying process and/or drilling equipment at its upper surface (7), and which is designed as a vertical, essentially flatbottomed cylinder. The main

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(57) Abrégé(suite)/Abstract(continued):
platform (2) is provided with a central vertical shaft (8) which at its lower end is adapted for reception and releasable locking of an anchoring buoy (3) carrying fastening equipment for anchoring lines (10) and for risers (14, 15) and umbilicals.

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(71) Applicant *(for all designated States except US)*: **SEVAN MARINE ASA** [NO/NO]; Kittelsbuktveien 5, N-4836 Arendal (NO).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **SYVERTSEN, Kåre** [NO/NO]; Dønnestadvn. 37B, N-4657 Tveit (NO).

(74) Agent: **TANDBERGS PATENTKONTOR AS**; Boks 7085, N-0306 Oslo (NO).

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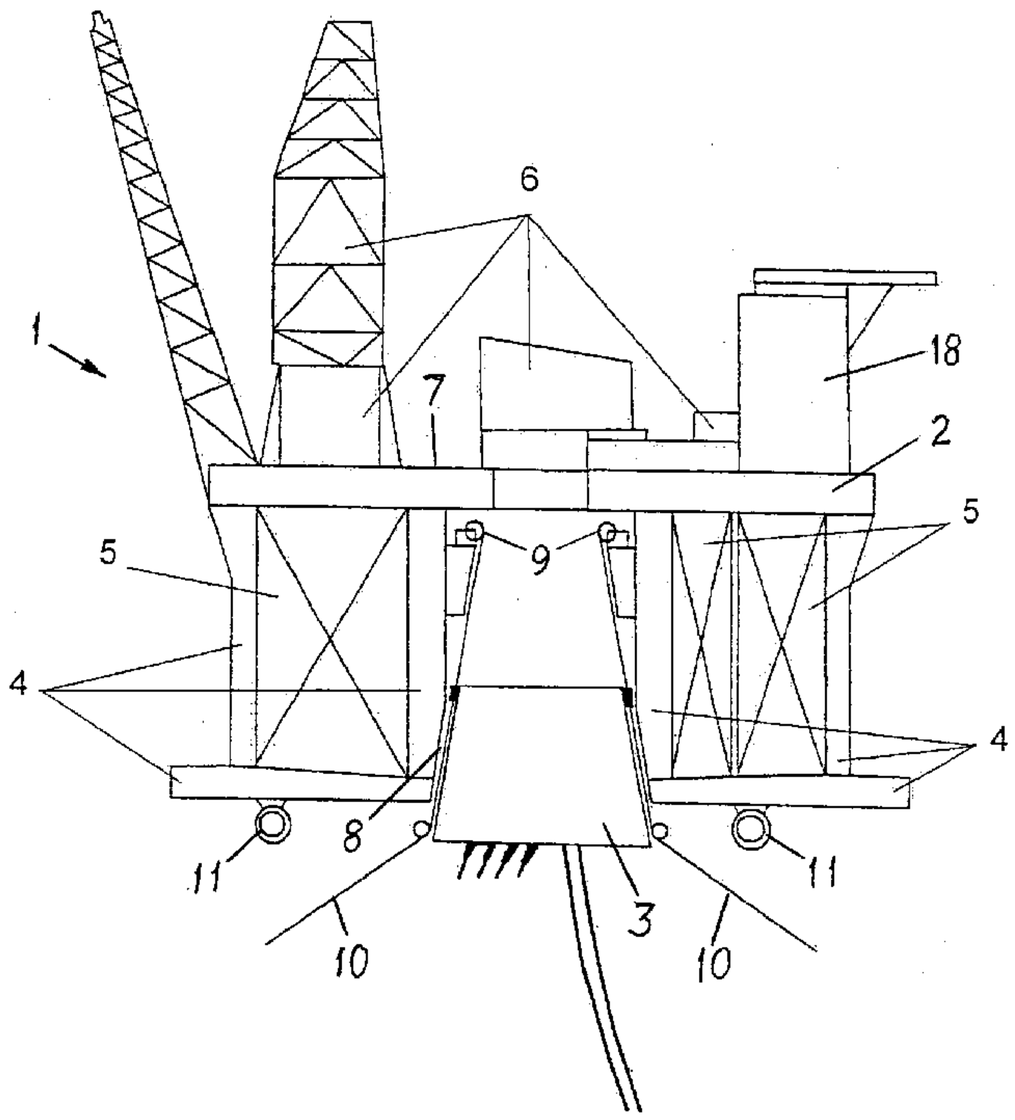


Figur 1

(57) Abstract: A floating platform for drilling after or production of hydrocarbons comprises a semi-submersible main platform (2) carrying process and/or drilling equipment at its upper surface (7), and which is designed as a vertical, essentially flatbottomed cylinder. The main platform (2) is provided with a central vertical shaft (8) which at its lower end is adapted for reception and releasable locking of an anchoring buoy (3) carrying fastening equipment for anchoring lines (10) and for risers (14, 15) and umbilicals.

Floating platform for operation in regions exposed to extreme weather conditions

The invention relates to a floating platform for drilling after or production of hydrocarbons offshore, comprising a semi-submersible main platform carrying process and/or drilling equipment at its upper surface, and which is designed as a vertical, essentially flat-bottomed cylinder.

A platform designed as stated above is known from Norwegian patent No. 319 971. By designing the platform with a cylindrical platform body, there is obtained a substantial reduction of pitching and rolling movements. Further, such a platform has large carrying capacity with respect to production or drilling equipment, and a large storage capacity for oil, fuel and the like. The platform will be direction - independent with respect to environmental influence, and therefore may be anchored by means of a simple fixed anchoring system. Further, risers can be connected directly to a receiving system on the platform, without any need for swivel transference or the like.

For operation in arctic regions where there is a danger for icebergs, it is a requirement that a floating platform must have the possibility for disconnection of both anchoring system and risers. When operating in regions where extreme weather occurs with low frequency, for example in regions exposed to hurricanes, it may be of great advantage to be able to disconnect a floating unit, as this will be able to reduce the requirements to an anchoring system considerably.

The drawbacks of a conventional disconnection with production of hydrocarbons where anchoring lines and risers are disconnected individually, are loss of time and breaks in deliveries. In addition, equipment which is to be able to be disconnected is more expensive in order to be able to take into account a possible leakage together with picking-up from the sea. A disconnection and a subsequent connection of anchoring lines and/or risers may involve several weeks of stoppage in the production of a production unit. The connection generally will require that a tender vessel is engaged for picking-up of anchoring lines and risers. The connecting operation therefore will be sensitive to the weather conditions.

The object of the present invention is to provide a platform for use in regions exposed to extreme weather or where drifting ice and icebergs occur.

The above-mentioned object is achieved with a platform of the introductorily stated type which, according to the invention, is characterised in that the main platform is provided with a central, vertical shaft which at its lower end is adapted for reception in releasable locking of an anchoring buoy carrying fastening equipment for anchoring lines and for risers and umbilicals.

The invention will be further described below in connection with exemplary embodiments with reference to the drawings, wherein

Fig. 1 shows the main platform and the anchoring buoy connected together;

Fig. 2 shows how the anchoring buoy is raised to the main platform by chain winches;

Fig. 3 shows a first embodiment of the anchoring buoy with flexible risers connected thereto;

Fig. 4 shows a second embodiment of the anchoring buoy with steel risers connected thereto;

Fig. 5 shows a top view of a set-up of anchoring lines connected to the anchoring buoy;

Fig. 6 shows the anchoring buoy lowered to a free-floating position after disconnection; and

Fig. 7 shows pick-up lines extending from the anchoring buoy and floating on the water surface.

As shown in Figs. 1 and 2, the illustrated embodiment of a platform structure 1 according to the invention comprises a main platform 2 and an anchoring unit consisting of a submerged anchoring buoy 3. The main platform 2 is designed as a vertical, essentially flat-bottomed cylinder body, in a corresponding manner as in the introductorily mentioned patent specification. The platform may have a circular or a polygonal cross-section.

As distinct from the previously known platform, the cylinder body in this case is provided with a central, vertical shaft 8 which at its lower end is adapted for reception and releasable locking of the anchoring buoy 3. The platform has double walls and possibly a double bottom that are used as ballast tanks 4. These are divided into a sufficient number of tanks to make sure that damage stability and the like is taken care of. Inside of the ballast tanks there are arranged loading tanks 5 for storage of hydrocarbons. Under a living quarter 18 on the main deck 7 there will be engine rooms and different tanks, a cofferdam etc. Equipment for the production of oil and gas, drilling equipment and different auxiliary systems are placed as modules 6 on the main deck.

As appears from Figs. 1 and 2, winches 9 are arranged in the upper part of the shaft 8, for pulling-in of the anchoring buoy 3 from a submerged position and up to the connecting position in the shaft 8. The anchoring buoy has an at least partly conical shape, for reception in a corresponding conical portion in the lower part of the shaft. When the buoy 3 is in the correct position, it will be securely locked by a mechanical locking means (not shown). The winches 9 will also be used for connection, pre-stressing and after-tensioning of the anchoring lines (anchor chains) 10 for the platform. On the main platform there are also installed coupling manifolds for the

transfer of well stream, and for oil and gas export. Transfer hoses will be installed between the coupling manifold and riser fastenings 20 located on the anchoring buoy.

The main platform 2 may be a passive unit which has no propulsion machinery of its own, and which has to be towed by a tender vessel to and from the position for connection, or if it has to be moved away from the current location. The main platform 2 may also be equipped with propellers (thrusters) 11 which will give the main platform the possibility to transfer itself without any assistance from a tender vessel. It may transfer itself to avoid bad weather or icebergs, and it may sail back for own machine and couple itself to the anchoring buoy 3.

The anchoring buoy 3 is a large buoyancy tank. The buoyancy tank is divided into a suitable number of cells in order to ensure that a damage does not have dramatic consequences. At the outer edge of the buoy there are placed fairleads 12 for fastening of the anchor chains 10. The anchor chains 10 extend from the fairleads and up to chain locks 13 at the top the buoy. The chain locks will carry all forces from the anchor chains 10, both when the buoy floats freely and when it is connected to the main platform 2. Risers and umbilicals 14, 15 will be connected to the buoy. If flexible risers 14 are used at "normal" water depths, there will be arranged I- or J-tubes extending through the buoy hull from the bottom to the top. The risers 14 may then be pulled in and locked fixedly at the upper edge of the buoy. Here there will be placed safety valves and the like together with coupling flenses 20 for connection of transfer hoses etc. At the bottom of the I- or J-tube there may be arranged either a bellmouth or a locking means for fastening of bend stiffeners. If steel catenary risers (SCR) 15 are used, an opening 25 will be arranged in the center of the buoy (see Fig. 4) where there is arranged a deck for suspension of the risers. The risers then will hang in a flexible joint fastened in this deck. Safety valves, coupling flanges etc. will be placed above the deck. With this arrangement the steel risers will hang freely towards the sea bed. A similar suspension may also be used for freely hanging flexible risers 14. The flexible joint at the top then will not be required.

When installing the platform structure 1, the main platform 2 and the anchoring buoy 3 will be interconnected by a mechanical locking means. Pulling-in/adjustment of anchoring lines 10 and tensioning of lines will be as on a "conventional" unit. After pulling-in of the anchoring lines 10 they will be locked by the chain locks 13 located at the top of the anchoring buoy 3. After locking of the anchoring lines/anchor chains 10, the chain length which has been pulled on board will be placed in chain lockers 16 at the top of the anchoring buoy. At the end of some of the chains there will be mounted a pick-up line 17. The number of pick-up lines 17 depends on how the anchoring lines 10 are arranged. For the arrangement shown in Fig. 5, three pick-up lines 17 will be used, i.e. one from each group of anchoring lines 10. The pick-up lines 17 may be arranged so that they are picked up by a remotely

operated vehicle (ROV) in that lines 17 with a buoyancy element are released by a hydroacoustic signal, whereafter the lines can be picked up at the water surface, or at least one line 23 may be equipped with a floating element 22 so that it lies on the surface and can be picked up.

Pulling-in and connection of risers, umbilicals, etc. will also be carried out with the anchoring buoy 3 connected. After locking of risers 14, 15, connection hoses and cables between the top of risers/cables and the manifold arrangement on the main platform 2 can be mounted in place. After connection of anchoring lines 10 and risers 14, 15 the platform structure 1 is ready for operation.

As mentioned above, the anchoring buoy 3 in the connected position is locked to the main platform 2 by a mechanical locking means. Before a disconnection can be carried out, all connection hoses and cables between the main platform 2 and the anchoring buoy 3 must be disconnected. When this has been carried out, the anchoring buoy can be disconnected by opening the mechanical locking means. The anchoring buoy is ballasted so that it finds a position of equilibrium at a pre-determined depth D below the water surface 24. The anchoring buoy 3 will now float in a position wherein it will only to a small extent be subjected to loads from waves. In addition, the risk for collision with vessels and possible icebergs will be reduced to a minimum.

When connecting the anchoring buoy 3, the main platform 2 will be brought to the correct position above the buoy, either unaided or by assistance from a tender vessel. A remotely operated vehicle (ROV) picks up pick-up lines 17 which are brought up inside the shaft 8 in the main platform 2. The pick-up lines 17 are connected to the chain winches 9 which are used to pull up the ends of the anchor chains 10 located in the chain lockers 16 at the top of the anchoring buoy 3, and the chains are placed on the chain winches. The pull-in is carried out in that the chain winches 9 pull in the anchoring buoy 3 with all risers, umbilicals, cables, etc. connected to and extending down to the sea bed. When the anchoring buoy 3 is in the correct position, it is locked by the mechanical locking means. Coupling hoses, cables, etc. from the main platform 2 is connected to the anchoring buoy 3 and the production can be restarted.

Alternatively, the pick-up lines 17 will have floating buoys 21, 22 which can be released for instance by a hydroacoustic signal or which lie on the water surface and can be picked up in a conventional manner. If an arrangement with a floating pick-up line 23 is used, a line must be arranged from the shaft 8 and outwards to the side of the platform 2. The floating line 23 is then picked up from the side of the main platform 2 and is connected to said line. The buoyancy elements 21, 22 are disconnected and the interconnected lines are again dropped into the sea. The pick-up lines 17 can now be pulled up through the shaft 8 and connected to the chain winches 9. Further pulling-up and connection will be as with the use of an ROV.

When the platform structure is to be equipped with an installation for drilling after oil, such an installation requires a vertical opening through the main platform (a moon-pool) if the installation is to be placed on the deck 7 of the platform. It will then be most suitable to use a part of a loading tank 5 as a moon-pool. When using an "internal" moon-pool, drilling risers and the like will be protected against ice and the like in exposed regions. Possible oil leakages in the moon-pool will also in a simple manner be able to be intercepted and removed.

Alternatively, the drilling installation may be placed on a cantilever platform (not shown) at the side of the main platform 2. In case of drilling operations the anchoring lines may be adjusted in order to maintain a correct position of the platform when the weather load varies. If the platform is equipped with thrusters 11 these may be used in addition in order to maintain a best possible position while drilling.

When connecting and disconnecting the anchoring buoy 3, the drilling installation will not be involved. Drilling risers etc. will be connected after that the anchoring buoy is in the locked position. When disconnecting the anchoring buoy, drilling risers with associated valves etc. will be disconnected from the bottom and preferably raised and stored prior to disconnection.

Claims

1. A floating platform for drilling after or production of hydrocarbons offshore, the floating platform comprising:

a semi-submersible main platform carrying process and/or drilling equipment at its upper surface, and which is designed as a vertical, essentially flat- bottomed cylinder;

an anchoring unit comprised of an anchoring buoy carrying fastening equipment for anchoring lines and for risers and umbilicals and wherein the main platform is provided with a central vertical shaft which at its lower end has a shape that corresponds with a shape of at least a part of the anchoring buoy, allowing the anchoring buoy to be at least partly received in the shaft; and

releasable locking means for connecting and disconnecting the anchoring buoy with the main platform, wherein the anchoring buoy is securely and releasably connected to the main platform by the locking means when the anchoring buoy is in a connecting position in the shaft and wherein the anchoring buoy is disconnected from the main platform when the locking means are released.

2. The floating platform according to claim 1, wherein the anchoring buoy has an at least partly conical shape, for reception in a corresponding conical portion at the lower part of the shaft in the main platform.

3. The floating platform according to claim 1 or 2, wherein the anchoring buoy is provided with chain stoppers and fairleads placed along an outer periphery of the buoy.

4. The floating platform according to any one of claims 1 to 3, wherein the anchoring buoy has an arrangement for fastening of flexible risers or steel risers in a central opening in the buoy.

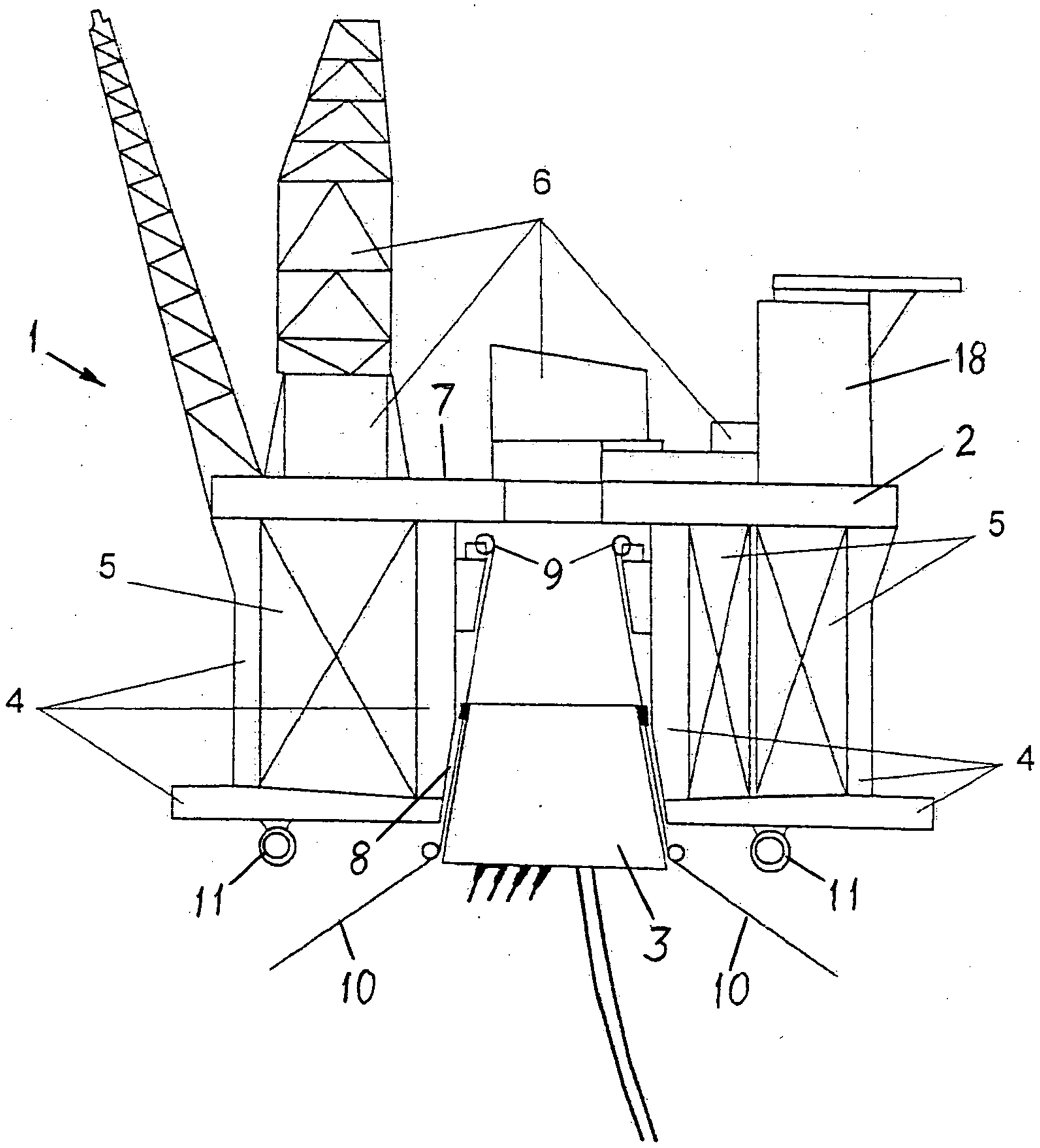
5. The floating platform according to any one of claims 1 to 4, wherein the anchoring buoy is divided into ballast tanks which can be partly filled with ballast to give the buoy a suitable depth in the water after disconnection.

6. The floating platform according to any one of claims 1 to 5, wherein the anchoring buoy is equipped with a line arrangement making it possible to connect the end of anchor chains to pull-in winches on the main platform.

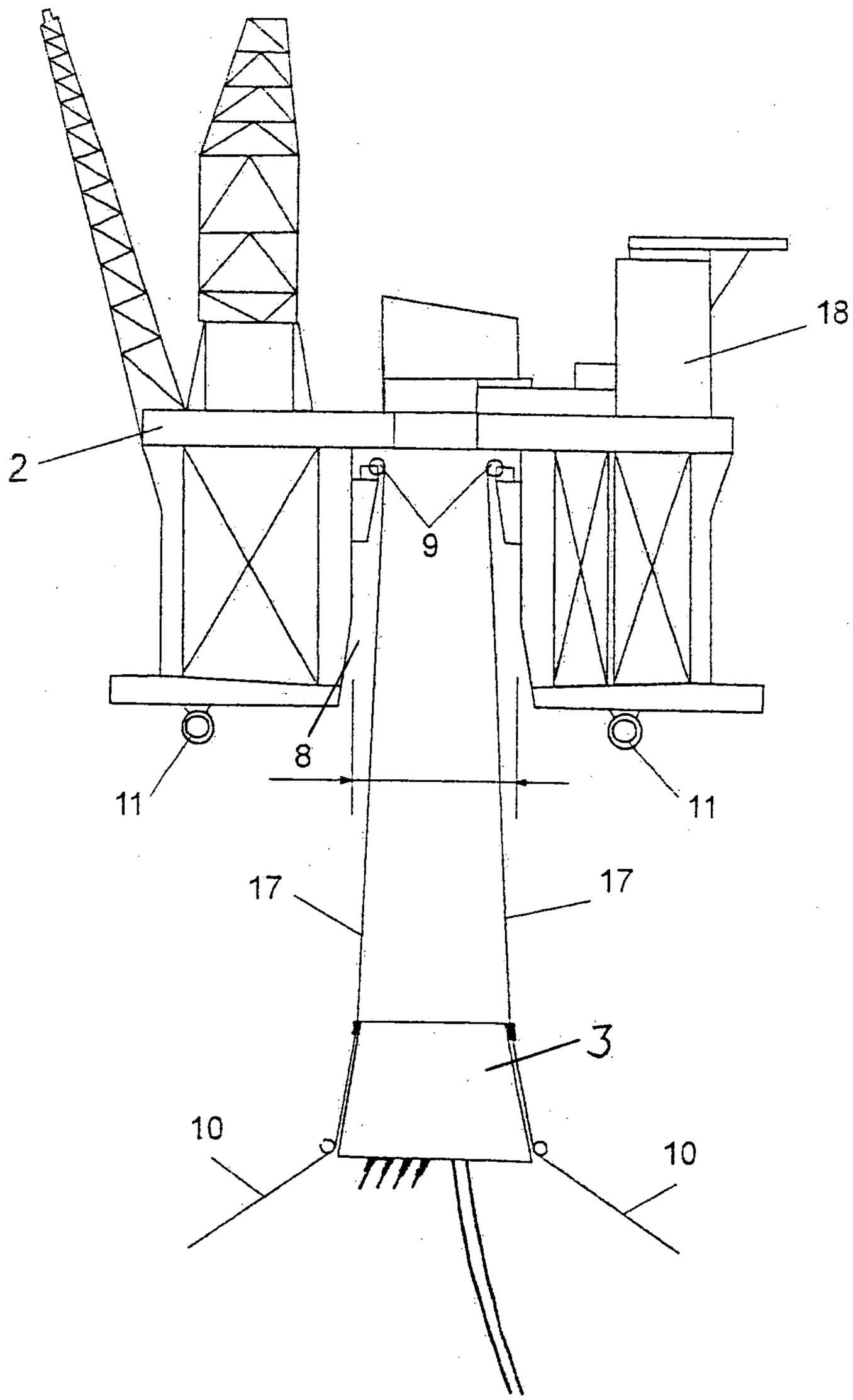
7. The floating platform according to any one of claims 1 to 6, wherein the anchoring buoy can be pulled into the shaft in the main platform by use of the winches used for pulling-in and tensioning of the anchor chains.

8. The floating platform according to any one of claims 1 to 7, wherein the main platform has a vertical opening in the platform hull for execution of drilling operations or other well interventions.

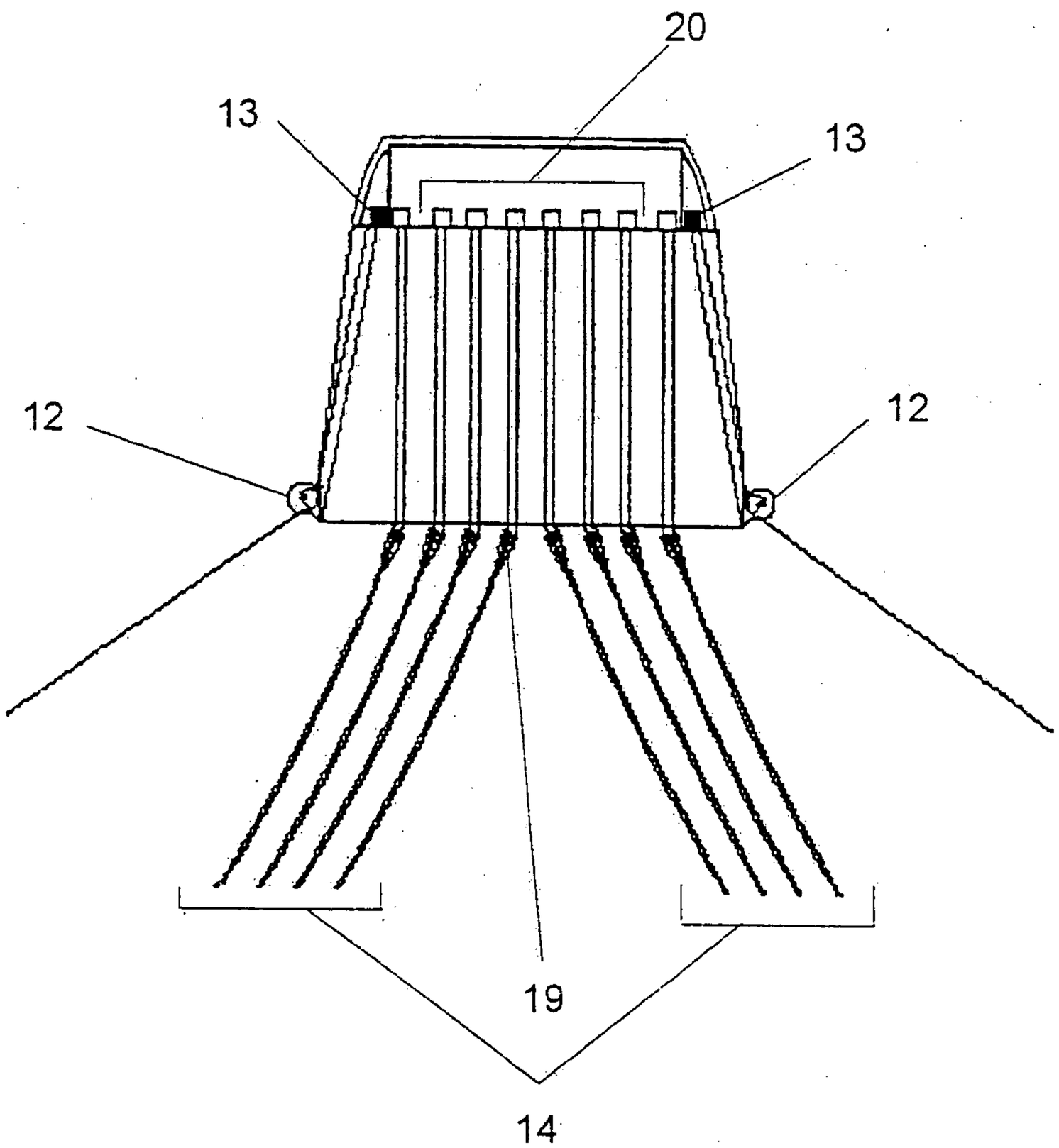
9. The floating platform according to claim 1, wherein the main platform has a cantilever platform for the support of equipment for carrying out drilling operations or other well interventions.



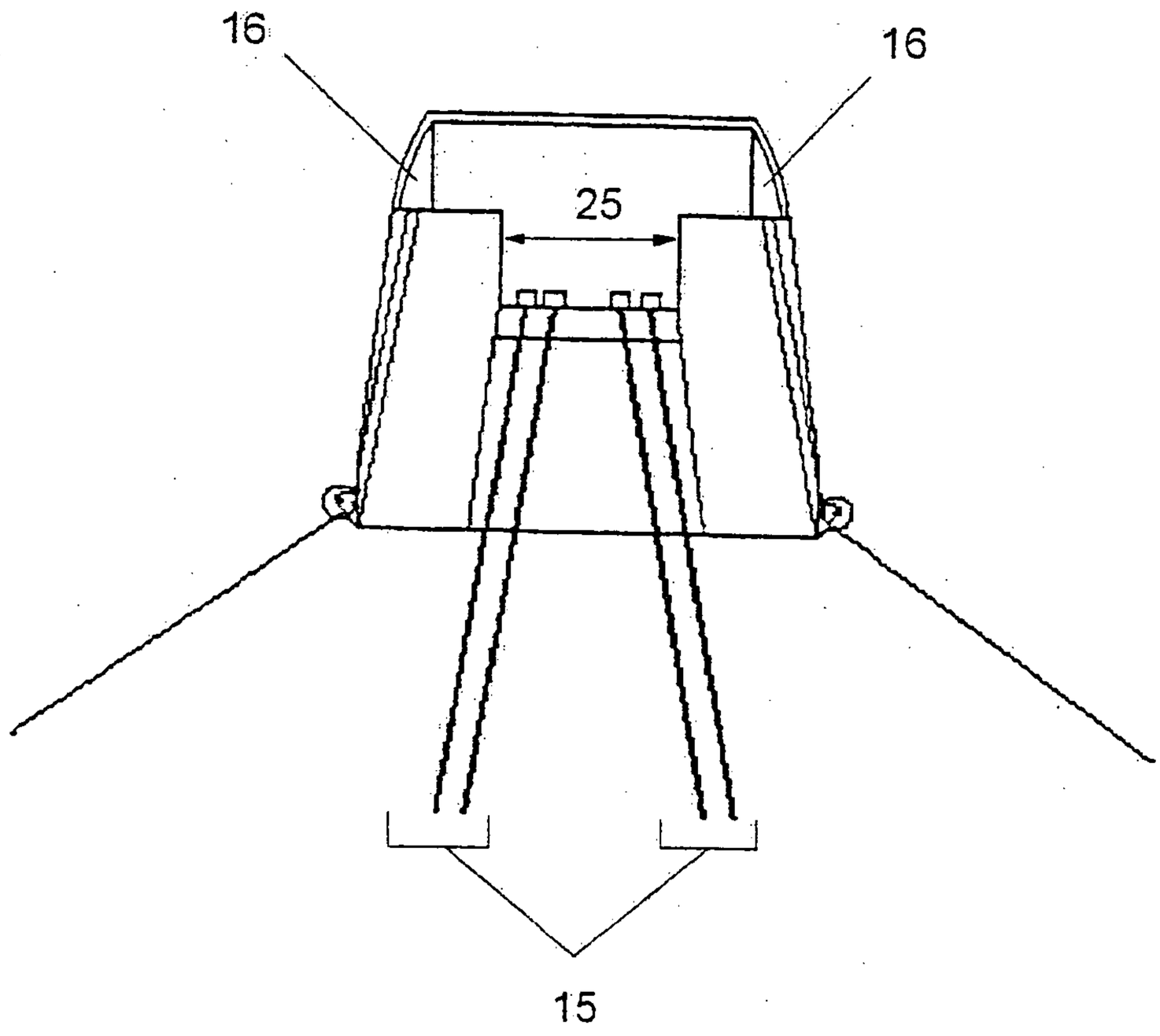
Figur 1



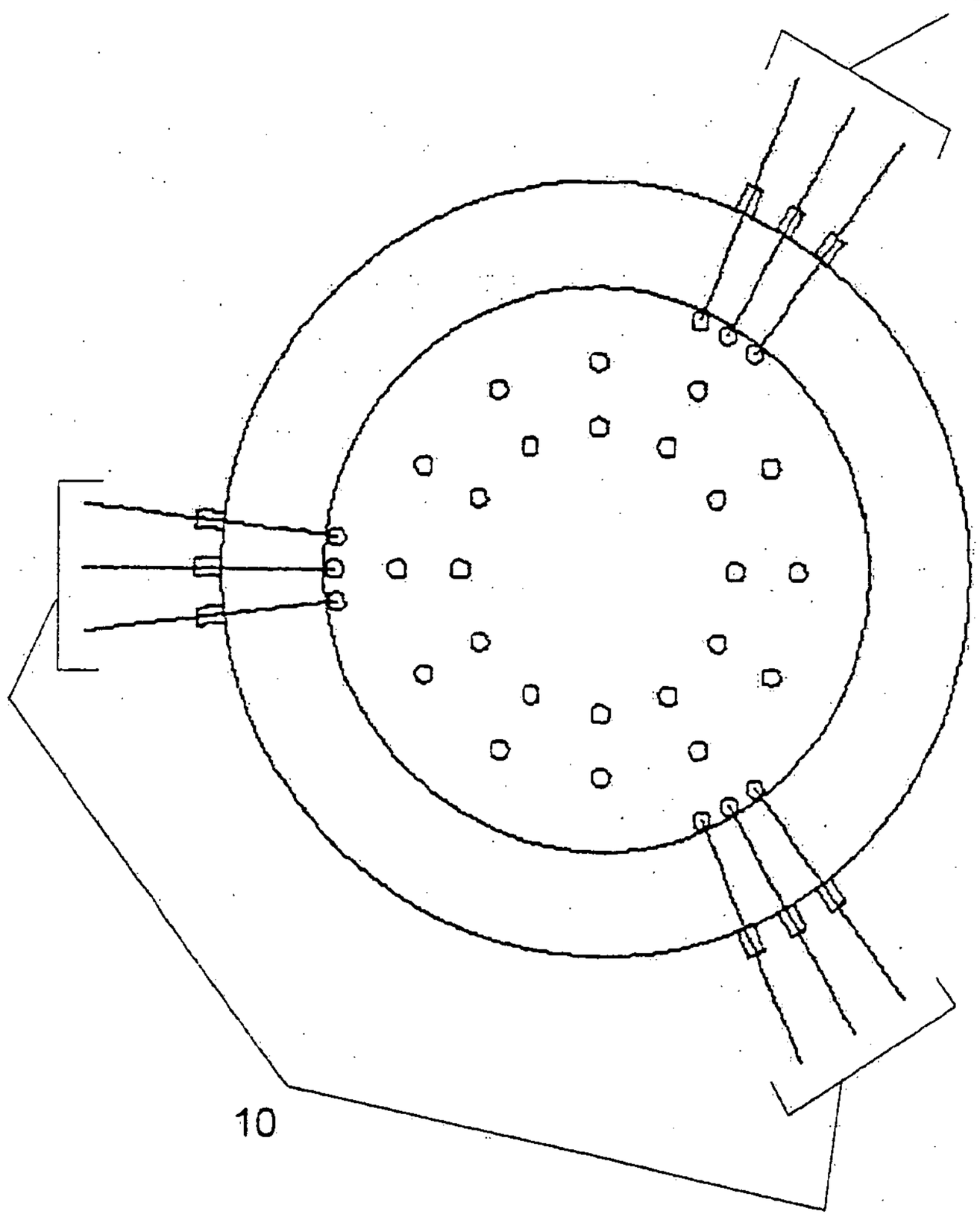
Figur 2



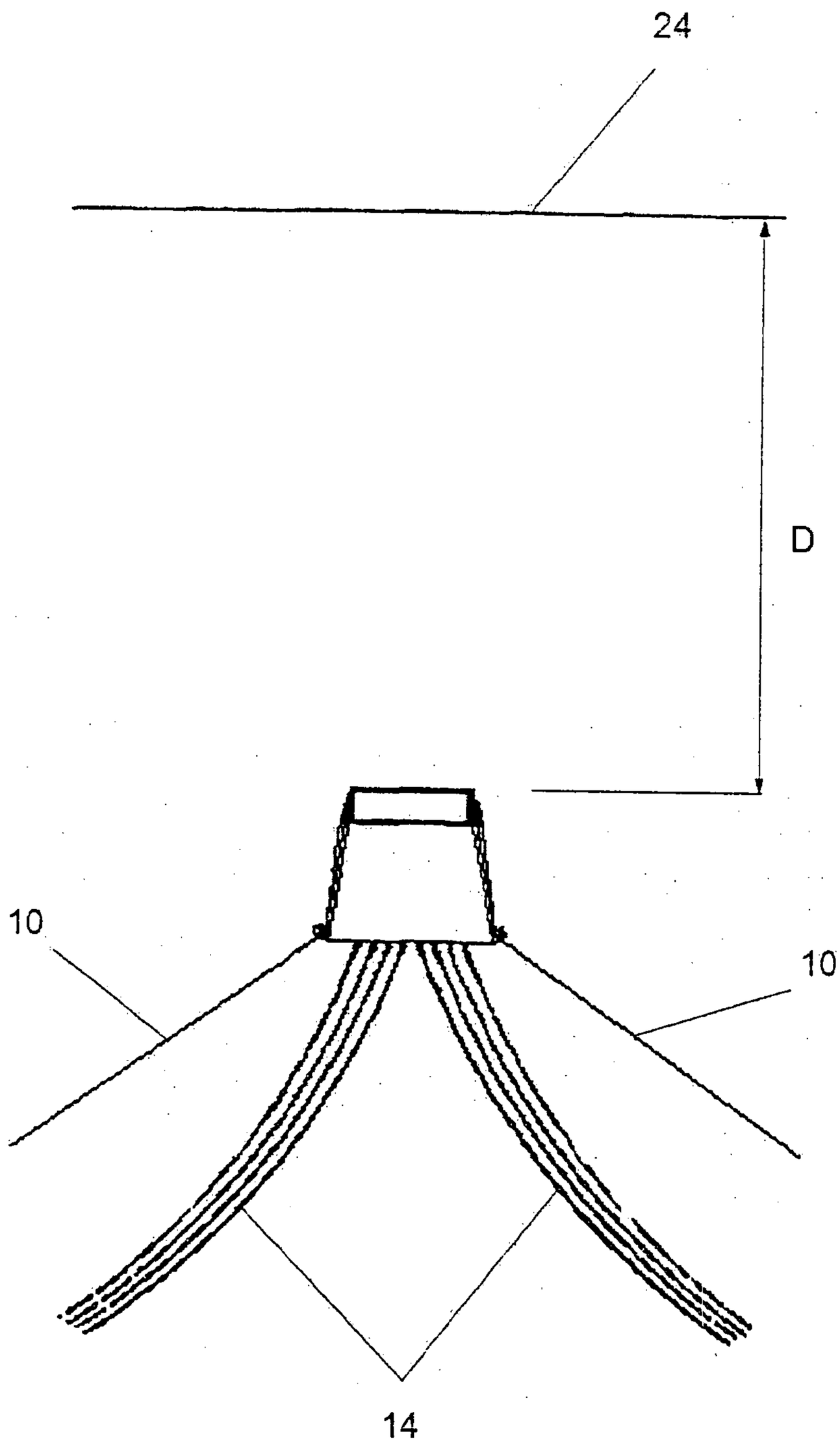
Figur 3



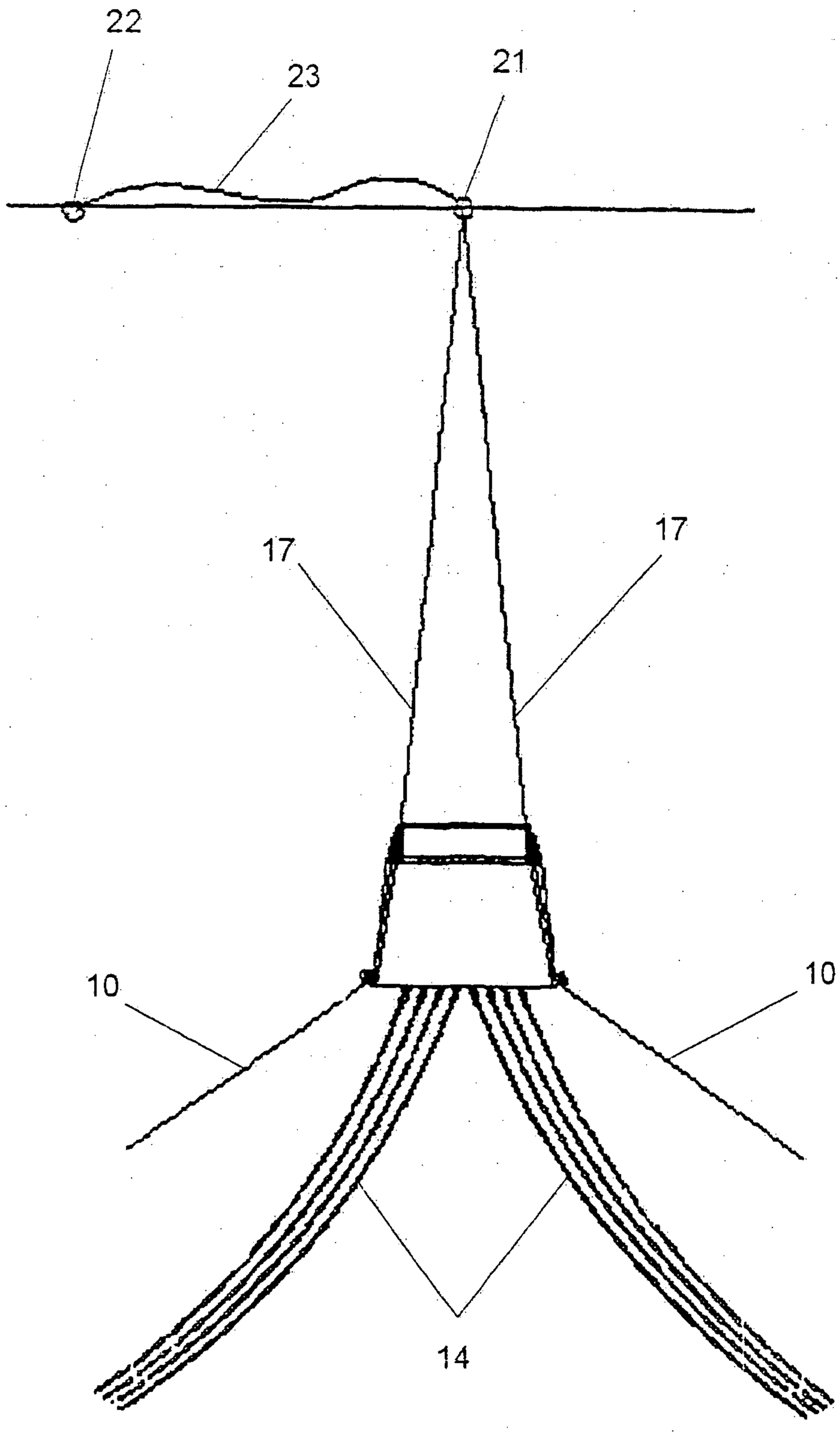
Figur 4



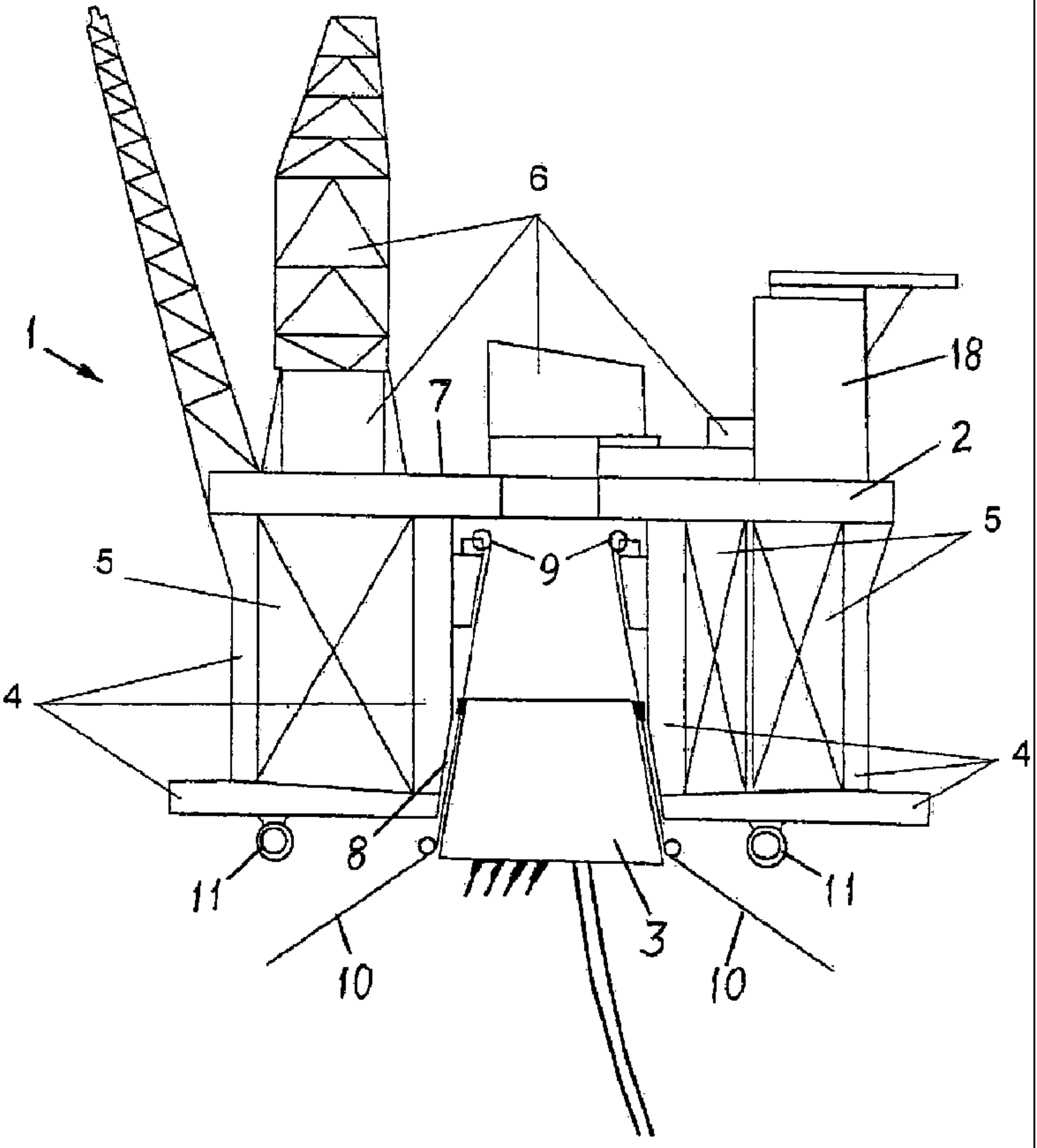
Figur 5



Figur 6



Figur 7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