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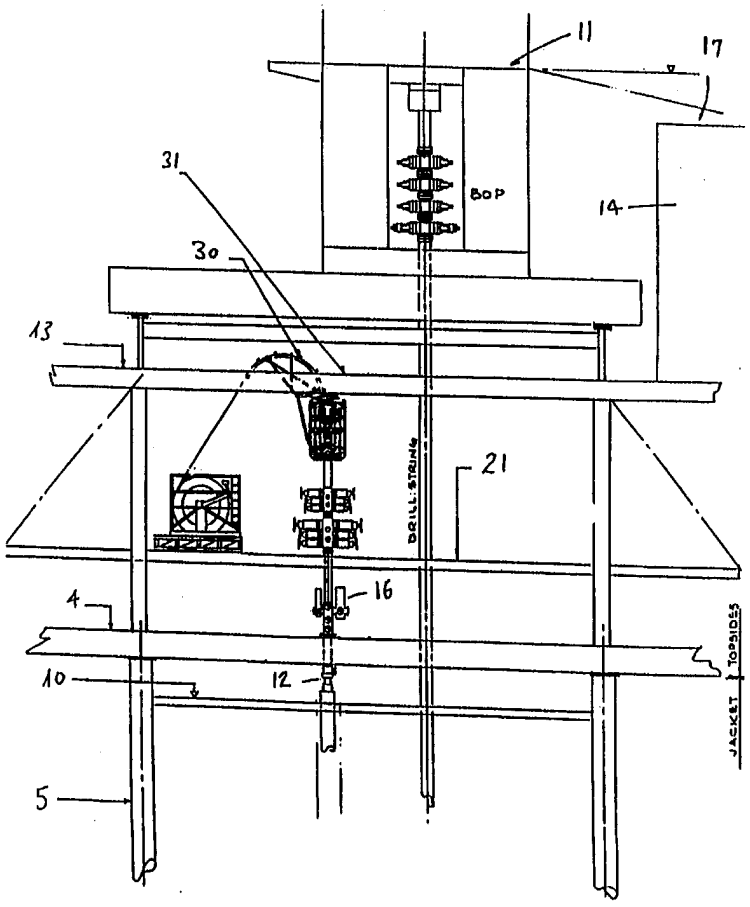
(54) Title: OFF–SHORE OIL OR GAS PRODUCTION UNIT

(57) Abstract

The invention relates to an off–shore oil or gas unit (1) for the production of oil or gas for providing access to at least one well head conductor or riser (14), the unit having an upper topside (8) part and a lower base or jacket (2) part which are constructed as separate parts and transported to the well side as separate parts and assembled together at the well site, the upper topside part (8) comprising a main platform (4) and a drilling platform (13) arranged above the main platform and said top–side part (8) also comprising a work–over deck (21) arranged above the Christmas trees (16) for the operation and location of coiled tubing (30), or other work–over related equipment, and the jacket part (2) comprising a plurality of generally vertical jacket legs (5) connected together by a plurality of horizontal jacket members (6), the unit also comprises an in–jacket platform (10) provided below the first main platform (4) and arranged within the jacket (2). The in–jacket platform (10) comprises the tie–backs (12) for the conductor or risers (14) and access to the shut–down valves, as well as a means fixed connections to the caissons (20) avoiding the time consuming caisson connection during assembly of the unit at the well head location.



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Off-shore Oil or Gas Production Unit

The invention relates to an off-shore oil production unit. Such units are used to extract oil or gas or oil and gas from reservoirs located beneath the sea or ocean bed. The units typically comprise a supporting jacket which comprises a plurality of jacket legs which are supported up from the sea bed and provide the support for a production platform on which the well head of the riser conductors of the well are located. The jacket also provides the support for the remaining structure of the unit, the so-called top-side structure.

The units are used to carry out the initial drilling of the well and also production from the well and also for so-called "workover operations" which are subsequent operations requiring access to the well during the production life of the well, for example, to improve production rates.

Such workover operations require access to the well for a number of reasons, for example to take further measurements of the reservoir by introducing logging devices, for servicing or installation of electric submersible pumps to enhance production rates or for many other reasons. In recent years such workover operations have been increasingly carried out using coiled or continuous reel tubing. The fact that it is a continuous single tube provides several advantages when entering a live oil or gas well which could have anything up to 7,000 psi well head pressure. This means the well does not have to be killed, (i.e. a heavy fluid does not have to be pumped down the production tubing to control the oil or gas producing zone by the effect of its greater hydrostatic pressure). Continuous

tubing has the advantage of also being able to pass through the tubing through which the oil and/or gas is being produced, without disturbing the tubing in place.

Since its introduction, the uses and applications for coiled tubing have grown immensely, and now, rather than just being used to circulate various fluids in a well bore, it is not uncommon for coiled tubing to be used for conveying various hydraulically powered tools and more recently electrically powered tools such as electric submersible pumps into the well. In order to keep the drilling programme as short as possible simultaneous drilling and intervention (into adjacent wells) is required. It is also necessary to increase the height of the drilling platform above the well head area to allow concurrent drilling and coiled tubing operations. The standard height requirement for coiled tubing equipment between the top of the Christmas trees in the well head area to the underside of the floor of the drilling deck above is typically 18 metres. This also applies to the removal and maintenance of down hole pumps where space is required to "rack-up" drill pipe, wire-lining and other such operations which can utilise the additional height.

Thus the drilling module is required to be at a level which is much higher than previously, making access to the pipe rack much more difficult and dangerous due to the height difference. Also, access for operators to the drilling platform is also more difficult as the distance required to reach the drilling level from the well head area is much greater. This height difference also incurs the risk of heavy objects falling from a height which is a danger to workers working below.

An object of the present invention is to provide an off-shore oil or gas production unit which overcomes the above disadvantages and is able to support the increased top side burden.

It is also an object of the present invention to provide easier access between the pipe rack and the drilling level for the handling of drill pipe and other equipment.

It is also an objective of the invention to provide easier access for personnel between the well area and the drilling level.

It is also an objective of the invention to provide a simpler installation of the topsides onto the jacket of the platform and to provide for easier drainage of spent materials to the jacket caissons.

According to the invention there is provided an off-shore oil or gas unit for the production of oil or gas from an off-shore location said unit providing access to at least one well head conductor or riser, which transfers the oil and /or gas from the reservoir to the well head, each having a well control system or Christmas tree arrangement including shut down valves and at least one conductor tie-back arranged below the well control system for securing the conductors to the unit, the unit having an upper topside part and a lower base or jacket part, the said lower jacket part projecting above the level of the sea and supporting at its upper end the upper topside part, the said upper topside part comprising a main platform and a drilling platform arranged above the main platform said topside part also comprising a workover equipment deck and a skid beam support for the operation and location of coiled tubing equipment, the base comprising a plurality of generally vertical jacket legs connected together by a plurality of horizontal jacket members, characterised in that the unit also comprises in the lower jacket part an in-jacket platform provided below the first main platform and arranged within the jacket.

The in-jacket platform preferably comprises the tie-backs for the conductor risers. The shut-down valves are also preferably located on the in-jacket platform. The so-called Christmas tree arrangements of each well head may also be arranged on the in-jacket platform.

The in-jacket platform preferably comprises a plated surface in the immediate surrounding area of each of the well heads to avoid spillage into the sea and a grating surface in areas away from the well heads.

Preferably the main platform comprises a drilling equipment storage platform, or driller's pipe-rack arranged alongside the drilling platform to enable easy transfer of equipment between the drilling platform and the equipment storage platform. Preferably the oil or gas unit also comprises a weather deck with a mud module arranged thereon. Preferably the equipment platform is arranged on the mud module.

The caissons are connected directly to the in-jacket platform and the tops of the caissons are therefore located lower than the first main platform when it is in the installed position. Drains from the main platform level to the jacket caissons are therefore provided having a positive downward slope.

The invention will now be described in further detail with reference to the following drawings in which:

Fig. 1 is a side cross section of a conventional oil or gas unit;

Fig. 2 is a side cross section of a more recent prior art oil or gas unit for operating coiled tubing;

Fig. 3 is a side cross section of an oil or gas unit according to the invention,

Fig. 4 is an open perspective enlarged view of the general arrangement of the off-shore oil or gas production unit of Fig. 3,

Fig. 5 is an enlarged section of the unit of fig. 3 showing a typical simultaneous drilling and coiled tubing operation utilising the in-jacket deck, and

Fig. 6 is a further enlarged view showing the connection of the in-jacket deck to the caissons.

Referring to fig. 1 a typical oil or gas unit or platform 1 is shown comprising supporting legs 5 and cross bracing members 3 which together form the base or jacket 2 which is supported on the sea bed.

The normal sea level is shown as level A. At the top of the base or jacket 2 is the first main platform 4 which is located at a level which at the highest level of the sea over a 100 hundred year period. This is known as the 100 year sea level line. At this first main platform the conductor tie-backs 12 and the well control Christmas tress 16 are located and access is provided to these from this main platform or deck 4. On this main deck 4 there is also located a process area 7 and a utility area 9. Immediately above the main deck 4 is a second platform 13 known as the weather platform which comprises a drilling equipment support 14 in an area known as the mud module. Living quarters 15 extend upwardly from the main deck 4 and continue upwardly through the weather deck 13. Above the weather deck 13 is the drill floor 11 on which the required pipe lengths are manipulated for insertion into the desired well. The drill floor 11 usually

comprises skid rails for the lateral transfer to position the desired tubing in-line with the required conductor. Along side the drill floor a storage level for new and used pipe in lengths is provided on the top of the mud module as is often referred to as the driller's pipe-rack 17. A central vertical derrick 18 is arranged above the drill floor. The required pipes are easily manipulated from the pipe rack 17 to the drill floor 11 through a so-called Vee door 19 in the central derrick construction. This conventional structure provides the desired access to the well heads and the ease of manipulation of the drill pipes.

Referring now to fig. 2 an oil or gas production unit 1 is shown which is similar to that in figure 1 but in which the drill floor 11 has been raised higher above the well head area to permit the concurrent drilling and coiled tubing operations which are now advantageous to maximise the production from the reservoir. Such larger distances are, for example, required to enable the coiled tubing equipment to function satisfactorily when connected to the well head. The standard requirement for coiled tubing is that there should be 18 metres clear working height above the top of the Christmas tree well control system 16. As can be seen from the fig. 3 the drill floor is now significantly higher than the pipe-rack located on top of the mud module. This distance between the pipe-rack 17 and the drill floor 11 is shown as D in the fig. 2. This makes the handling of pipe-work and casing through the Vee door 19 to the drill floor 11 much more difficult and dangerous. In addition there is a much greater distance for operators to travel to reach the drilling floor from the main platform which makes operations more time-consuming and tiring. A deck 20 is provided above the Christmas trees for the location of coiled tubing, wire-lining and down-hole pump maintenance etc.. Additional bracing is also located below the drilling deck to provide support for these structures (not shown).

Referring to figs. 3 and 4 there is shown an off-shore oil or gas unit 1 according to an embodiment of the invention. The unit 1 has a base 2 which projects above the level of the sea and supports at its upper end a first platform 4, the base comprising a plurality of generally vertical jacket legs 5 connected together by a plurality of horizontal jacket members 6 to form a so-called jacket. This is similar to the jacket constructions described previously and are commonly used for oil or gas production units. The base similarly provides support for the top-side structure 8 which itself supports the work- over equipment and other supporting equipment as well as any accommodation decks, helicopter pads etc.

Referring again to fig. 3 and 4 the unit 1 also comprises a fourth access platform 10 provided below the first platform 4 and arranged within the jacket 2 and connected thereto. This fourth platform provides a dry location which is still above the normal 100 year wave height and provides access for the conductor tie backs. This allows the Christmas trees 16 to be effectively lowered down from the topside 8 and the level of the main platform 4 above. In fact the main platform 4 is essentially elevated to provide the additional deck below it which is still at the 100 year wave line. The well heads 12 of the production conductor risers 14 are thus located on the fourth access platform 10 as are the caissons 20 and the shut-down valves which enables a safe location for and convenient access to them to be provided which is below the main production platform.

The fourth access platform is located inside the jacket in this embodiment is shown a part of the jacket and may be fabricated as part of the jacket. Alternatively the fourth access floor or in-jacket deck may be fabricated separately and installed inside the jacket when the jacket is in the desired position.

This elevation of the main platform 4 relative to the conductors and associated flow control equipment decreases the vertical distance between the main platform 4 and the drill deck 11. The weather deck 13 is correspondingly raised to the same extent as the main platform 4 in order to have the same space available for the process area 7 and the utility area 9 and the mud module 14 that is provided on the weather deck 13. The driller's pipe-rack 17 is also correspondingly raised the same distance above the 100 year wave line. The height of the drill deck is however maintained at the required height above the top of the flow control Christmas trees. Thus the distance D1 between the level of the pipe-rack 17 and the drill deck 11 is correspondingly reduced by the amount by which the main platform 4 is raised above the 100 year wave line which is itself the height of the additional fourth access deck 10. This raising of the main platform and the corresponding modules such as the living quarters, helicopter pad, process area, utility area and mud module would not normally be considered a desirable step due to the raising of the centre of gravity of the overall construction. However the inventor has found that there are surprising advantages in terms of the safe handling of the equipment required at and to and from the drill floor which results in a saving of weight to compensate the raised centre of gravity.

The workover deck 21 is provided above the Christmas trees to allow the location and use of coiled tubing, wire-lining, removal and maintenance of down-hole pumps etc.. Equipment may be handled by overhead gantry cranes, air film transporters or trolleys as required. Sufficient external lay-down areas are provided to transfer the required equipment in and out.

The fourth platform 10 comprises a plated surface in the immediate surrounding area of each of the well heads 12 with drain gulleys to avoid local spillage to the sea and a grating surface in areas distant from the well heads.

A number of caissons are normally connected to the topside for example for sea water inlet and/or for the outlet of water sewage and drilling fluids and cuttings. In this embodiment the caissons are connected directly to the fourth platform 10 which is provided as part of the jacket. Thus when the main platform and the remaining 'topsides' are fitted on the jacket during installation of the platform 1 the required connections to the jacket caissons can be made by connecting pipes leading down from the main platform because the tops of the caissons are located lower than the first platform 4. Thus no welding or pulling of the caissons is therefore required to connect the jacket to the top side structure as would be required for conventional production unit constructions and the installation procedure is therefore simplified. This also allows a positive slope to be utilised between the lowest level of the main platform and the top of the drain caissons, thus leading to improved flow of sewerage and spent drilling fluids etc.

Referring to fig. 5 an enlarged view of the unit of the embodiment of the invention is shown showing the simultaneous drilling and coiled tubing operations utilising the in-jacket deck. The in-jacket deck 10 is located within the jacket 2 and is positioned immediately below the main deck 4 and permits access to the tie backs and safety shut-off valves. The work-over deck is arranged above the main deck on which the work-over and coiled tubing equipment is located and operated. A typical coiled tubing set-up 30 is shown located on the work-over deck 13. The weather deck is located above the work-over deck and comprises an area 31 above the work-over area on the work-over deck which is free from steel-work or other structures to permit the vertical extension of the coiled tubing set-up 30.

Referring now to fig. 6 an enlarged view is shown of the details of the support for the caissons to the in-jacket deck. Conventionally, caissons are normally attached

to the topsides after the topsides have been located on top of the jacket at the desired well site location. This may be done by pulling the caissons up from the jacket after installation of the topsides offshore and welding a support to the main deck. Alternatively, an extension piece is welded to the caisson to bring it to the main deck level. Both of these methods add significantly to the installation time and therefor delay the time at which the unit can be used for drilling and production. By means of the invention however the caisson are provided already fixed to the in-jacket deck and no additional installation is required after the unit is located at the well cite.

Referring to fig. 6, the conventional method of attaching the caisson to the main deck 4 of the topsides is shown by a dotted line. The caisson connections 41 according to an embodiment of the invention are shown in full lines as are the caissons 20 and the in-jacket 10 to which they are attached at the time of fabrication on-shore. Support for the caisson is also provided by an in-jacket guide 42 which is linked to the jacket frame.

It will be appreciated that the above is a description of a non-limiting exemplary preferred embodiment of the invention and the invention may encompass other embodiments included in the appended claims.

CLAIMS

1. An off-shore oil or gas unit for the production of oil or gas from an off-shore location said unit providing access to at least one well head conductor or riser, which transfers the oil and /or gas from the reservoir to the well head, each having a well control system or Christmas tree arrangement including shut down valves and at least one conductor tie-back arranged below the well control system, the unit having an upper topside part and a lower base or jacket part which are constructed as separate parts and transported to the well site as separate parts and assembled together at the well site, the said lower jacket part, in the assembled state projecting above the level of the sea and supporting at its upper end the upper top-side part, the upper topside part comprising a main platform and a drilling platform arranged above the main platform and said top-side part also comprising a work-over deck arranged above the Christmas trees for the operation and location of coiled tubing, or other work-over related equipment, the jacket part comprising a plurality of generally vertical jacket legs connected together by a plurality of horizontal jacket members, characterised in that the unit also comprises a in-jacket platform provided below the first main platform and arranged within the jacket.

2. An off-shore oil or gas unit according to claim 1, characterised in that the in-jacket platform comprises the tie-backs for the conductor risers.

3. An off-shore oil or gas unit according to claim 1, characterised in that the in-jacket platform provides access to the shut-down valves.

4. An off-shore oil or gas unit according to claim 1, characterised in that the in-jacket platform is provided at the level of the Christmas tree flow control arrangements and provides access to the Christmas tree flow control arrangements of each well head.

5. An off-shore oil or gas unit according to claim 1, characterised in that the in-jacket platform comprises a plated surface in the immediate surrounding area of each of the well heads and a grating surface in areas distant from the well heads.

6. An off-shore oil or gas unit according to claim 1, characterised in that the main platform comprises an equipment storage platform arranged alongside the drilling platform to enable easy transfer of equipment between the drilling platform and the equipment storage platform.

7. An off-shore oil or gas unit according to claim 1, characterised in that the oil or gas unit comprises a weather deck with a mud module arranged thereon.

8. An off-shore oil or gas unit according to claim 6 and claim 7, characterised in that the equipment platform is arranged on the mud module.

9. An off-shore oil or gas unit according to claim 1, characterised in that the caissons are connected directly to the in-jacket platform.

10. An off-shore oil or gas unit according to claim 9, characterised in that the tops of the caissons are located lower than the first main platform when it is in the installed position.

11. An off-shore oil or gas unit according to claim 10, characterised in that the drains from the main platform level to the jacket caissons are provided having a positive slope.

12. An off-shore oil or gas unit according to claim 1, characterised in that the topside part comprises an additional deck on which the work-over equipment, such as coiled tubing, wire-line, and down-hole pump maintenance equipment, may be located and operated.

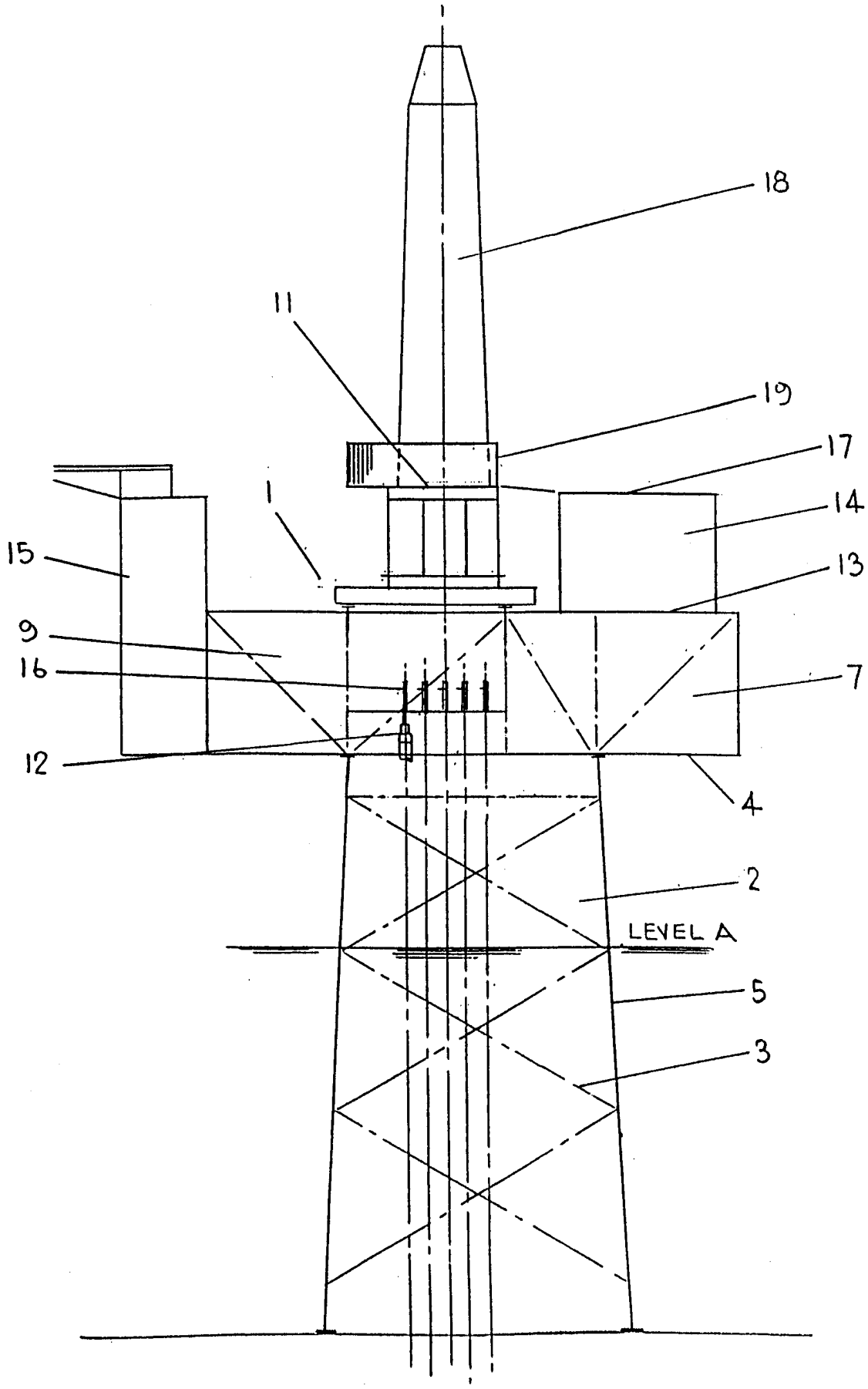

FIGURE 1

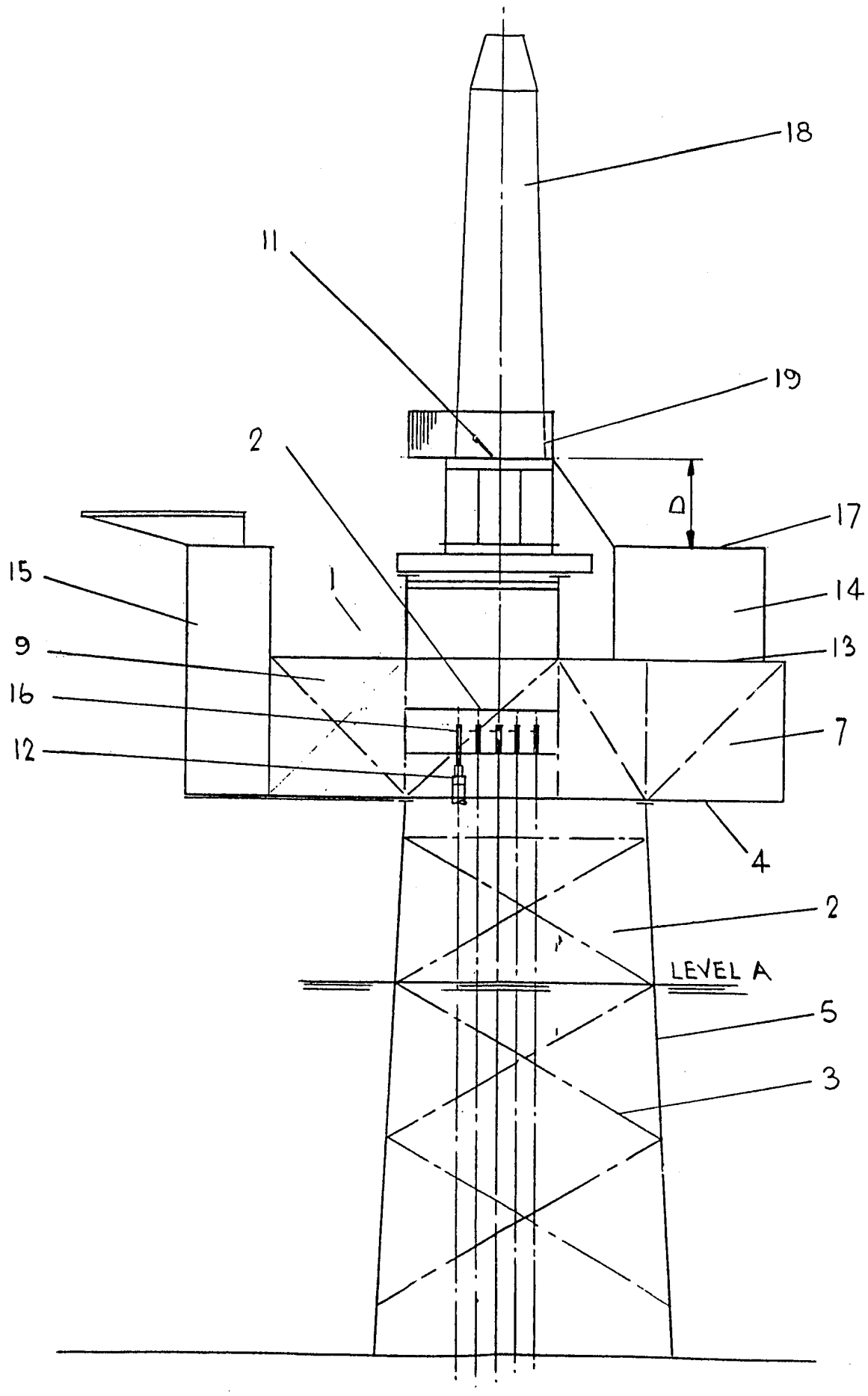

FIGURE 2

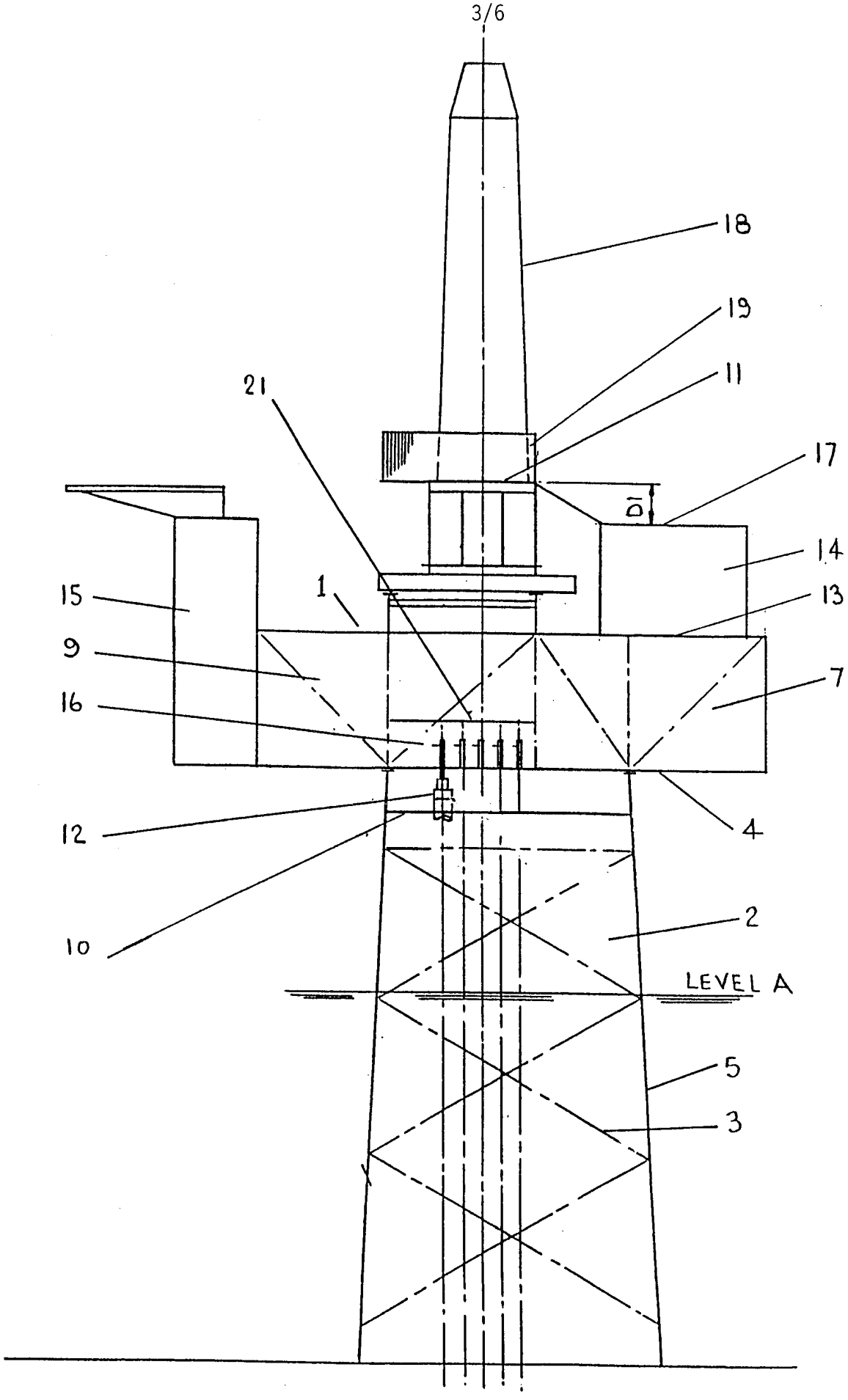

FIGURE 3

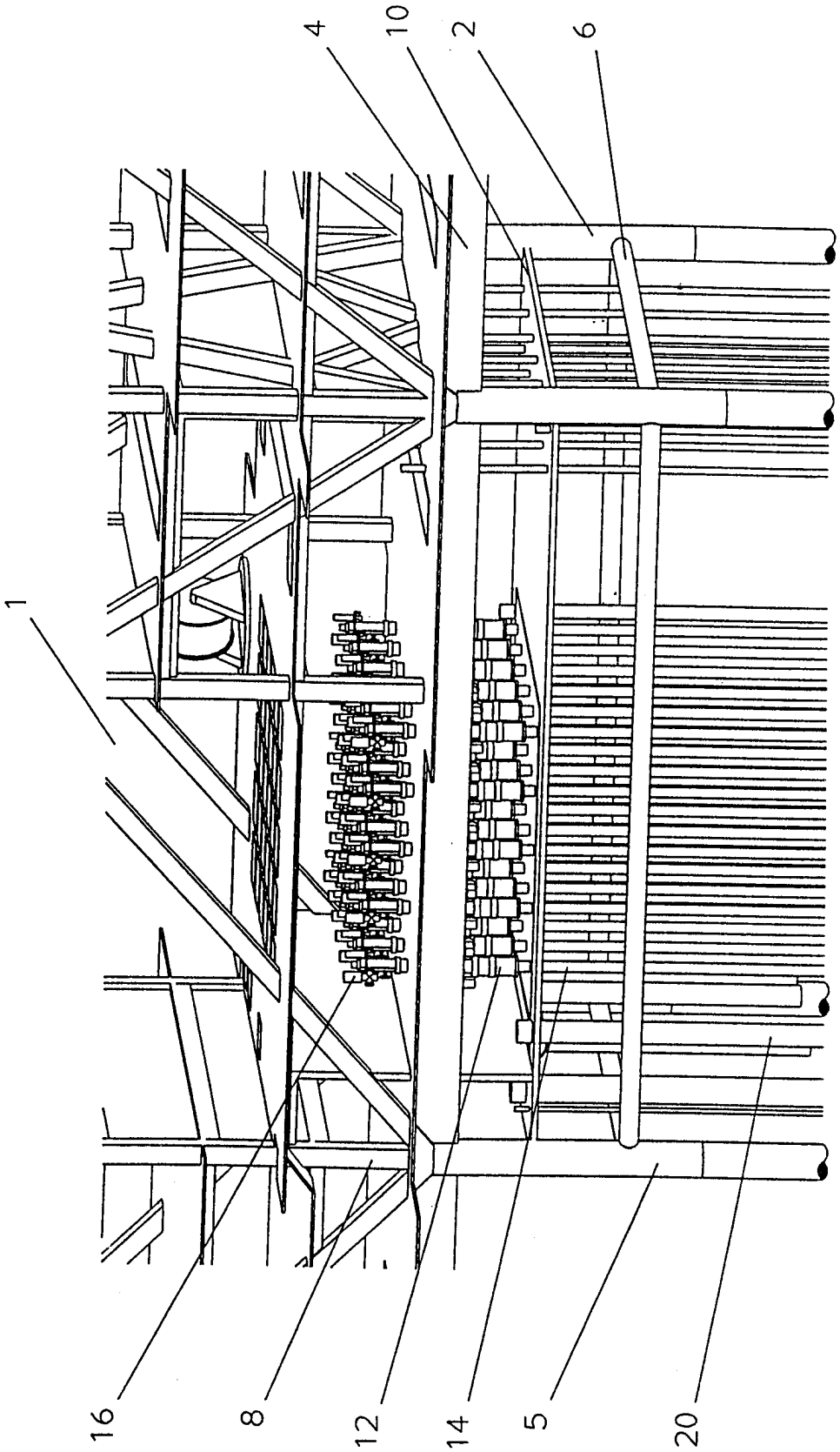

figure 4

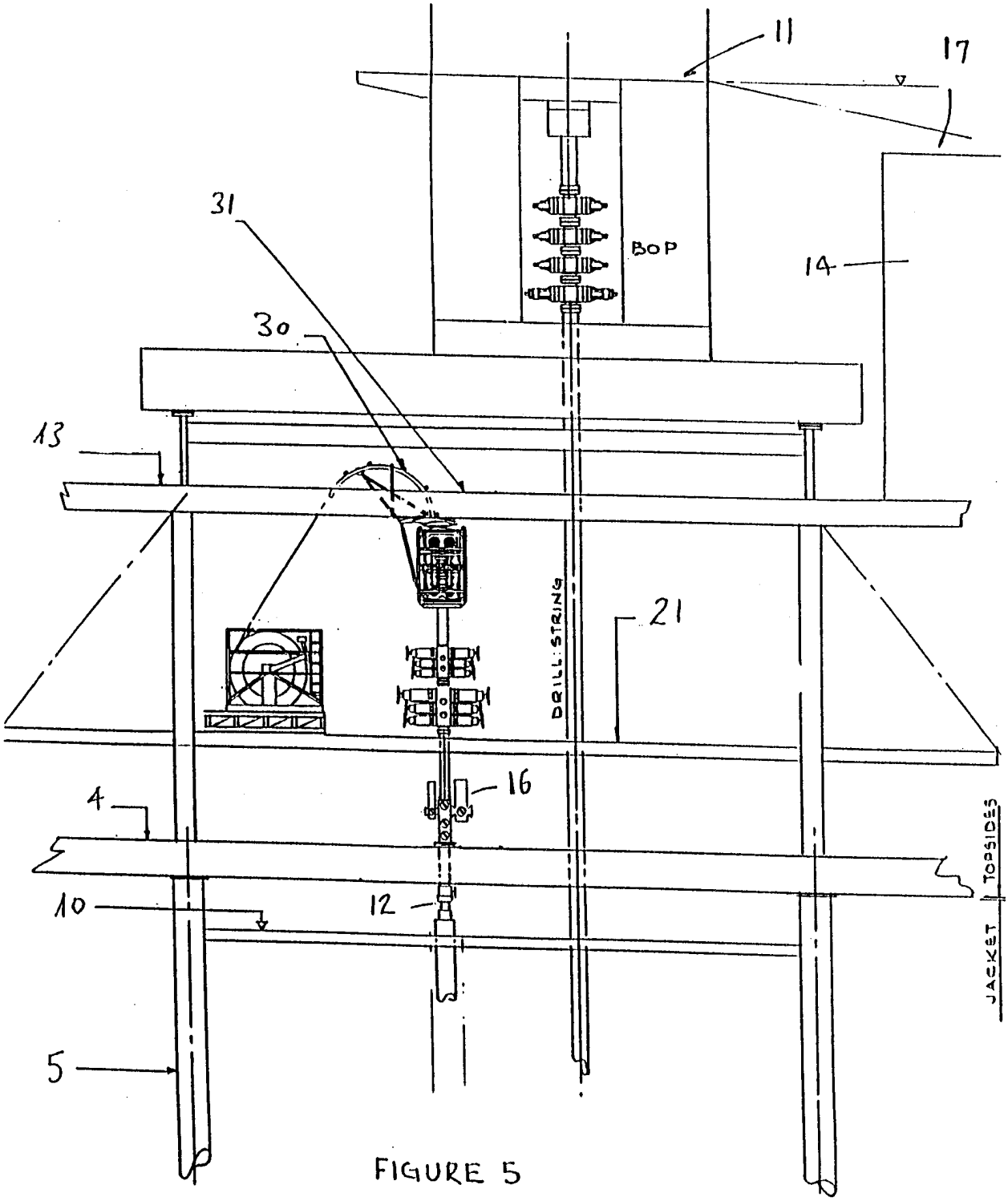
11
17
31
BOP
14
30
13
DRILL STRING
21
16
4
10
12
JACKET
TOPSIDES
5

FIGURE 5

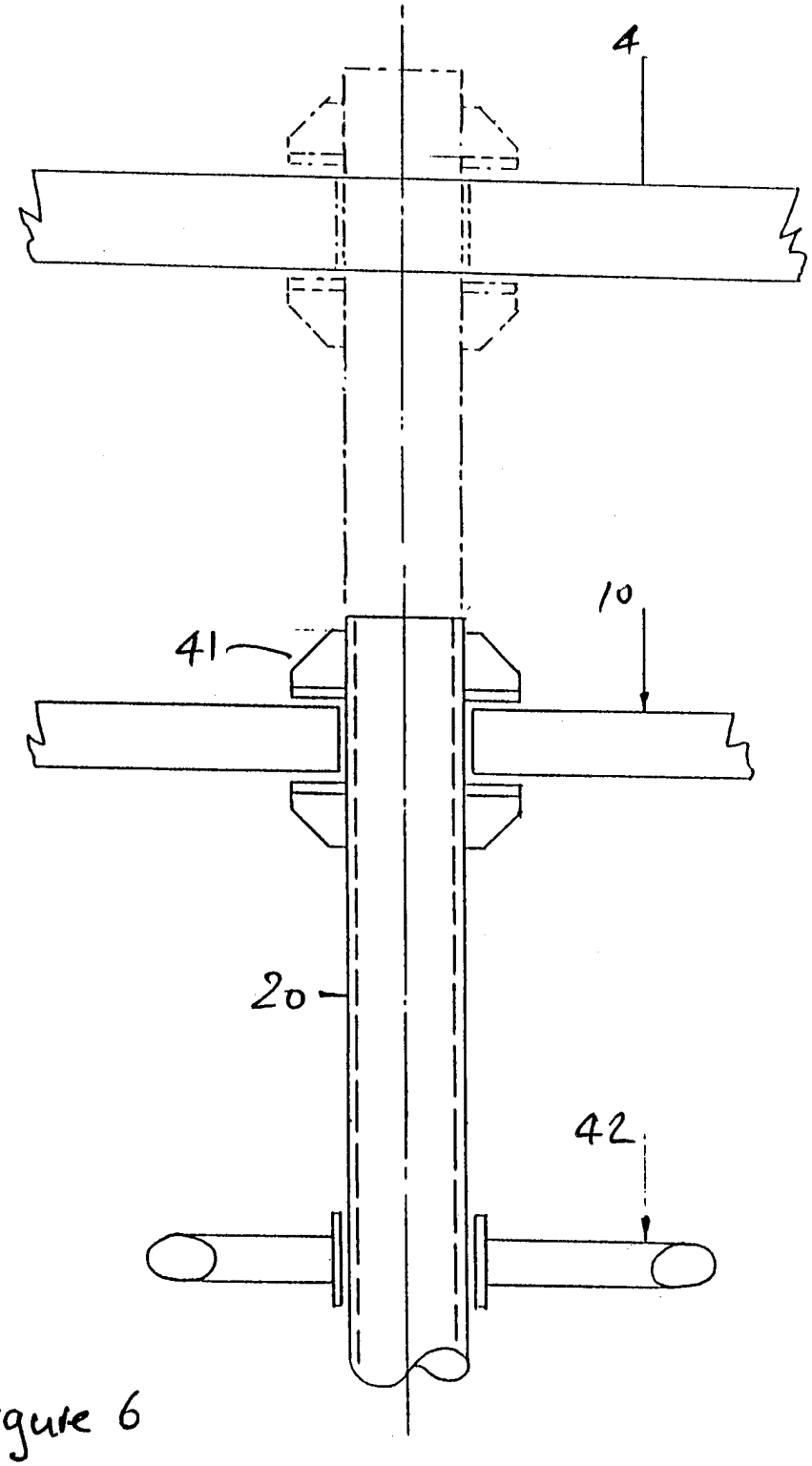

Figure 6

INTERNATIONAL SEARCH REPORT

In. ational Application No
PCT/IB 97/01150

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E21B15/02 E21B43/01 E21B19/22

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)
IPC 6 E21B

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 315 473 A (F.R. HAUBER) 25 April 1967 see the whole document	1
A	US 5 547 314 A (AMES THOMAS J) 20 August 1996 see abstract	1
A	WO 96 28633 A (BAKER HUGHES INC) 19 September 1996 see abstract	1
A	FR 2 035 241 A (EXXON RESEARCH ENGINEERING CO) 18 December 1970 see figure 4	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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1

Date of the actual completion of the international search	Date of mailing of the international search report
10 December 1997	05/01/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Fonseca Fernandez, H

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INTERNATIONAL SEARCH REPORT

In. .ational Application No
PCT/IB 97/01150

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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Information on patent family members

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