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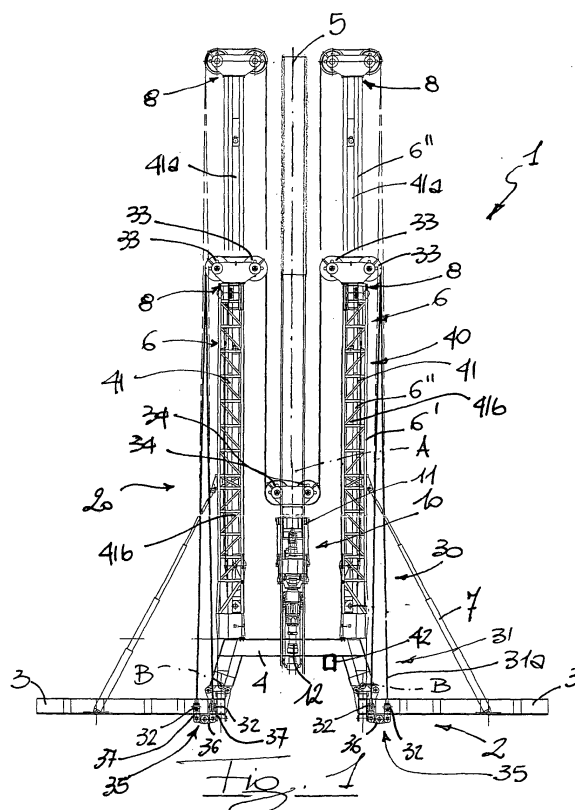
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(54) **Drilling unit**

(57) Drilling unit (1) provided with a top drive (10) which is mobile along a drilling axis (A) in order to move drilling rods, with two telescopic drilling masts (6) which are arranged facing each other, a cable device (30) and a hydraulic device (40) which co-operate with each other to move the top drive (10) along a support guide (5) which is parallel to the axis (A) and is arranged in an intermediate position in relation to the two drilling masts (6) for supporting and sliding the top drive (10) along the axis (A); a hydraulic actuator (41) for each drilling mast (6) being suitable for modifying a longitudinal length of the relative drilling mast (6) itself, and a control station (42) being suitable for controlling the actuation of each hydraulic actuator (41) either in contemporary or independent fashion.



Description

[0001] The present invention refers to a drilling unit.

[0002] In general, drilling units of a well known kind comprise a drilling mast; a top drive which is supported in sliding fashion by the mast itself in order to move the drilling rods; and a movement group for the top drive.

[0003] In drilling units of the kind which have been described above, the drilling mast is a telescopic mast which is defined by a fixed trellis and a sliding trellis which is inside the fixed trellis, and the movement group comprises a cable device which is provided with at least a pair of hanging sheaves which are arranged at the head of the sliding trellis, and a hydraulic device which is suitable for modifying the length of the telescopic mast in order to move the top drive along the telescopic mast itself.

[0004] Drilling units of the above-described kind have always been advantageously used because they are practical to move and to install even in places which are rather impractical, but the increasingly pressing operating demands which have been imposed in the drilling sector in general, and in the sector of drilling for oil in particular, have lead to a progressive increase in the power which is required of these units in terms of reaching their structural and functional limits. It has in fact been noted that in order to increase the developed power which is available to the movement group it would be necessary to construct a telescopic mast of such dimensions that would not only thwart the above-mentioned characteristics of agility, but would also render extremely difficult the use of the hydraulic devices which are currently available on the market to the detriment, in addition, of production costs.

[0005] The aim of the present invention is to produce a drilling unit which, while maintaining characteristics of agility in terms of positioning, will also be able to support levels of operating power which are greater than current ones, and which will not involve high levels of costs in terms of production, planning or engineering.

[0006] According to the present invention a drilling unit will be produced comprising a top drive which is mobile along a drilling axis in order to move drilling rods, and a movement group of the top drive comprising, in its turn, a cable device and a hydraulic device which co-operates with the cable device in order to move the top drive along the drilling axis; the unit comprising two drilling masts which are arranged facing and parallel to each other and a support guide which is arranged side by side and in an intermediate position in relation to the two drilling masts in order to support and slide the top drive along the drilling axis; the hydraulic device being provided with a hydraulic actuator for each drilling mast which is suitable for modifying a longitudinal length of the drilling mast itself, and with a control station for the actuation of the hydraulic actuator either in contemporary or independent fashion.

[0007] The present invention will now be described with reference to the attached drawings, which illustrate a non-limiting form of embodiment of the present inven-

tion, in which:

- FIGURE 1 illustrates a lateral elevation of a preferred form of embodiment of the drilling unit according to the present invention; and
- FIGURE 2 illustrates from above, with some parts removed for reasons of clarity, the unit which is shown in FIGURE 1.

[0008] With reference to the attached drawings, the number 1 indicates in its entirety a drilling unit for the drilling of oil wells.

[0009] The unit 1 comprises a support structure 2 which is defined, in the form of embodiment which is described, by two lateral bases 3 which may be positioned on substructures or others and by a central frame 4, which is connected to both the bases 3, and which is raised in relation to the bases 3 themselves.

[0010] In addition, the unit 1 comprises a support guide 5 which is positioned on the central frame parallel and frontally to a drilling axis A, and two drilling masts 6, which are arranged opposite the axis A and the guide 5, and which rise from the frame 4 parallel to the guide 5 itself. Each drilling mast 6 is a telescopic mast which is defined by a fixed trellis 6' which is hinged to the base 3 in order to rotate around a respective axis B which is transverse to the axis A under the action of a jack 7 which is interposed between the trellis 6' itself and the relative lateral base 3, and by a trellis 6" which is inserted in longitudinally sliding fashion inside the trellis 6' itself, and which is provided with an upper head 8.

[0011] In FIGURE 1, the drilling masts 6 are shown in their closed operating condition, in which the length of each mast 6 is substantially equal to the length of the relative trellis 6', as well as in a possible elongated operating condition, in which the length of each mast 6 is substantially equal to the sum of the length of the relative trellis 6' plus the length of the relative trellis 6". In the case in which the masts 6 are completely elongated, the overall length of each of these will be substantially equal to the length of the guide 5 measured from the starting point of the frame 4.

[0012] Finally, the unit 1 comprises a top drive 10 which is supported in sliding fashion by the guide 5 by means of interposing a trolley 11 in order to move the drilling rods along the axis A, and a movement group 20 of the top drive 10 which comprises, in its turn, a cable device 30 and a hydraulic device 40 which co-operates with the device 30 in order to move the top drive 10 along the axis A.

[0013] The trolley 11 is coupled to the guide 5 in order to slide along the guide 5 itself parallel to the axis A, and the top drive 10 comprises a rod moving sleeve 12, which is arranged co-axial to the axis A and is connected to the trolley 11 in order to slide along the axis A itself. The top drive 10 is suitable for being moved along the guide 5 starting from its own lower dead point which corresponds to the closed operating condition of both the two masts

6, as far as its own upper dead point which corresponds to the elongated operating condition of both the masts 6.

[0014] The cable device 30 comprises four pulls of cable 31a, which are each fixed, at their own opposite ends, to respective dead ends 32, and, for each pull 31, four pairs of hanging sheaves 33 which are arranged in pairs on the head 8 of each mast 6, and a pair of hanging sheaves 34 which are mounted on the trolley.

[0015] The hanging sheaves 33 and 34 are all loose pulleys which are suitable for rotating around respective rotation axes which are parallel to each other, and, in particular, the two hanging sheaves 33 of each pair on each head 8 are arranged facing the hanging sheaves 33 of the other three pairs of the same head 8, and, equally, the two hanging sheaves 34 of each pair on the trolley 11 are arranged facing the hanging sheaves 34 of the other three pairs which are supported by the trolley 11 itself in such a way as to arrange the four pulls 31 parallel to each other and in the same dynamic conditions.

[0016] The device 30 comprises, in addition, two balancing systems 35, each of which is arranged in correspondence with a respective side of each base 3, and comprises an equaliser 36 which is hinged to the base 3 in order to rotate around an own axis which is parallel to the axis B, and two gripping elements 37, which are each connected to an end 32 in such a way that an end 32 of a pull 31 is opposed on the equaliser 36 to an end 32 of the immediately adjacent pull 31.

[0017] In other words, the cable 31a of each pull 31 is engaged by a relative element 37, and extends upwards along the relative mast 6 in order to wind around a pair of hanging sheaves 33 and return downwards to wind, this time, around a pair of hanging sheaves 34; then return upwards along the other mast 6 in order to wind around the other pair of hanging sheaves 33 and descend along the same mast 6 to be engaged by the other element 37.

[0018] The hydraulic device 40 comprises two hydraulic cylinders 41, each of which presents an engine power which is equal to the engine power of the other cylinder 41, and is interposed between a relative fixed trellis 6' and the corresponding mobile trellis 6'' in order to modify the length of the relative telescopic mast 6 in such a way as to move the top drive 10 along the support guide 5.

[0019] Each cylinder 41 extends inside the trellises 6' and 6'', and presents a respective rod which is connected at the top to the relative head 8, and at the bottom is inserted inside a casing 41b which is, instead, integral with the trellis 6'. In addition, each cylinder 41 is connected to a control station 42, which is part of the device 40, and which is suitable for controlling the activation of the two cylinders 41 either in contemporary fashion or independently of each other. In the form of embodiment which is herein described and in the attached drawings, the control station 42 has been generalised and schematised for reasons of simplicity, being a control station which is normally used in hydraulic circuits for controlling relative components.

[0020] In use, starting from the closed operative position, the activation of each cylinder 41 determines the elongation along the axis A of the relative mast 6, or rather the upward movement of the relative hanging sheave 33. As the length of the cables 31a of each pull 31 is fixed, and the cables 31a are blocked at both their ends in correspondence with the balancing systems 35, the elongation of the two masts 6 determines the raising of the top drive 10 along the guide 3 with the advantage that, in the case that the activation of the two cylinders 41 is not contemporary, the power which is delivered by each cylinder 41 in order to raise the top drive 10 is, in proportion, equal to half of the power which can be delivered by the cylinders 41 in the case that they function in contemporary fashion.

[0021] Consequently, it is obvious that the presence of the two cylinders 41 and the layout of the unit 1 which has been described above enables the supply of an overall power which is double that which may be supplied by each mast 6 on an individual basis without the need to double the dimensions of the mast 6 itself.

[0022] In addition, the unit 1 which has been described above may equally function in the case of damage to or failure of one of the two cylinders 41, permitting, however, the continuation of the drilling operations and the repair of the damage or failure.

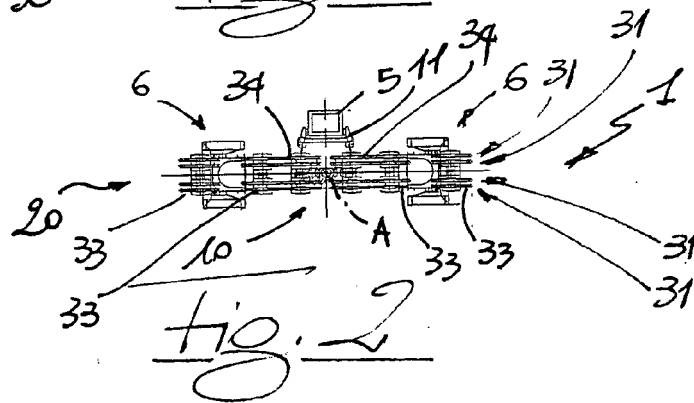
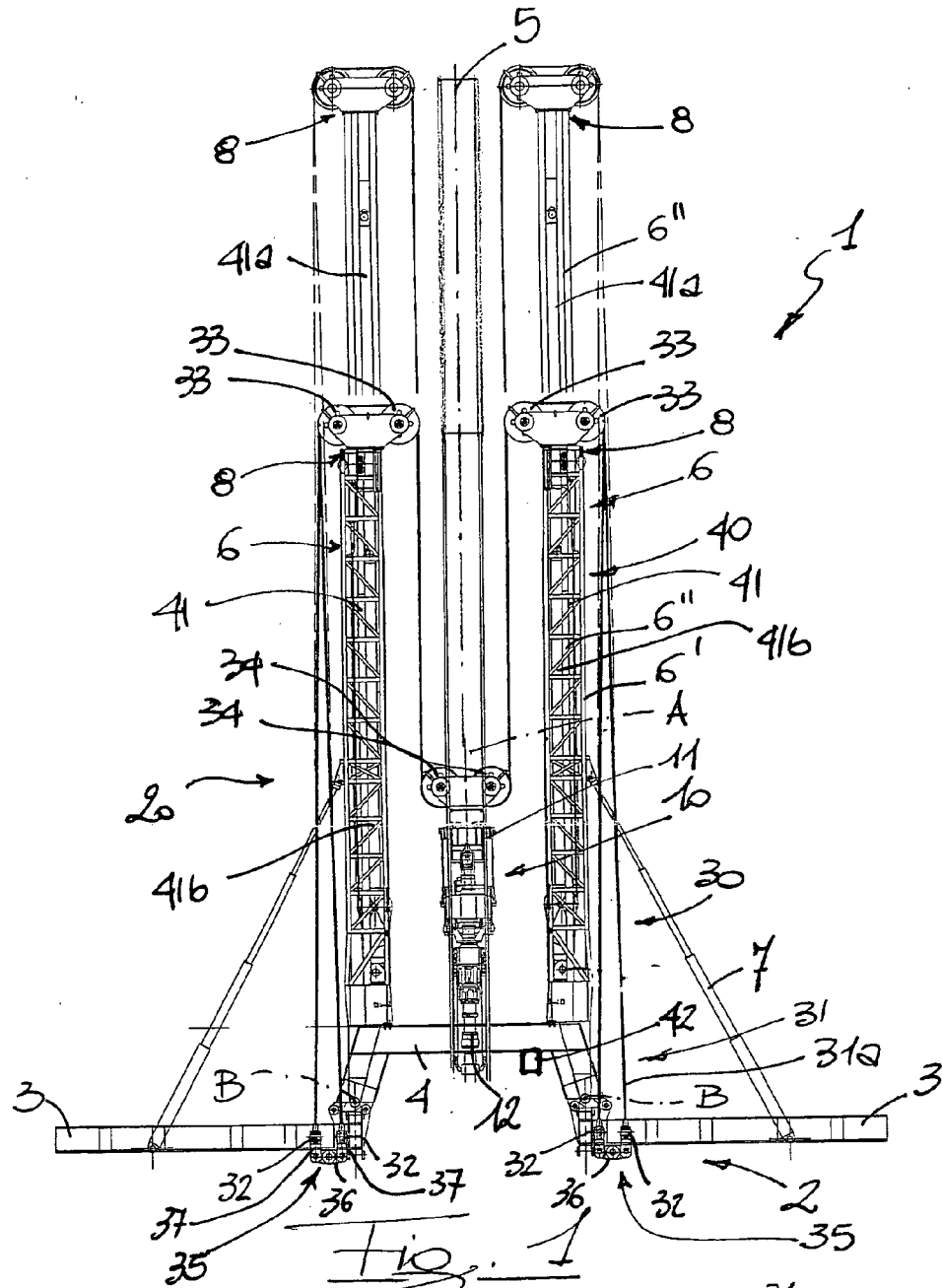
[0023] It is intended that the present invention should not be limited to the forms of embodiment which are herein described and illustrated, which are to be considered as examples of forms of embodiment of the drilling unit, and which may instead be subject to further modifications relating to the shape and disposition of its parts, as well as to details pertaining to construction and assembly.

Claims

1. Drilling unit (1) comprising a top drive which is mobile along a drilling axis (A) in order to move drilling rods, and a movement group of the top drive (10) comprising, in its turn, a cable device (30) and a hydraulic device (40) which co-operates with the cable device (30) in order to move the top drive (10) along the drilling axis (A); the unit (1) comprising two drilling masts (6) which are arranged facing and parallel to each other and a support guide (5) which is arranged side by side and in an intermediate position in relation to the two drilling masts (6) in order to support and slide the top drive (10) along the drilling axis (A); the hydraulic device (40) being provided with a hydraulic actuator (41) for each drilling mast (6) which is suitable for modifying a longitudinal length of the drilling mast (6) itself, and with a control station (42) for the actuation of the hydraulic actuators (41) either in contemporary or independent fashion.
2. Drilling unit according to Claim 1, **characterised by** the fact that each drilling mast (6) is a telescopic

mast (6) defined by a fixed trellis (6') and a sliding trellis (62) inside the fixed trellis (6'); the relative hydraulic actuator (41) being interposed between the fixed trellis (6') and the mobile trellis (6'') in order to modify the length of the telescopic mast (6) in such a way as to move the top drive (10) along the said support guide (5). 5

3. Drilling unit according to Claim 2, **characterised by** the fact that the cable device (30) is provided with at least a pair of hanging sheaves (33) for each drilling mast (6) which are arranged at the head of the relative mobile trellis (6''), and with at least an additional pair of hanging sheaves (34) which are associated with the top drive (10). 10 15
4. Drilling unit according to Claim 3, **characterised by** the fact of comprising a trolley (11) which is coupled in sliding fashion along the said guide (5) in order to support the said top drive (10) and the relative pair of hanging sheaves (34). 20
5. Drilling unit according to Claim 4, **characterised by** the fact that the cable device (30) comprises at least a double pull of cables, each of which is fixed at its own opposite ends to respective dead ends and which winds around a respective pair of hanging sheaves of each telescopic mast (6) and around a respective pair of hanging sheaves of the top drive (10). 25 30
6. Drilling unit according to Claim 5, **characterised by** the fact that the said hydraulic actuators (41) are defined by relative hydraulic cylinders (41). 35
7. Drilling unit according to Claim 6, **characterised by** the fact that the said hydraulic cylinders (41) present equal entities of engine power.
8. Drilling unit according to any of the preceding Claims whatsoever, **characterised by** the fact of comprising a support structure (2) on which are mounted the drilling masts (6) and the support guide (5). 40 45 50 55





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 01 3368

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 97/23706 A (MARITIME HYDRAULICS AS [NO]; VATNE PER [NO]) 3 July 1997 (1997-07-03) * page 2, line 34 - page 3, line 18; figures 3,4 *	1-8	INV. E21B7/02 E21B15/00 E21B19/084
A	CA 1 169 627 A1 (CANADIAN DRILLING EQUIP) 26 June 1984 (1984-06-26) * page 7, line 37 - page 8, line 18; figure 3 *	1-8	
			TECHNICAL FIELDS SEARCHED (IPC)
			E21B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 September 2007	Examiner BELLINGACCI, F
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03.92 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 01 3368

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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12-09-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9723706	A	03-07-1997	AT 261054 T 15-03-2004
		AU 1213397 A 17-07-1997	
		CA 2240582 A1 03-07-1997	
		DE 69631788 D1 08-04-2004	
		EP 0868593 A1 07-10-1998	
		JP 2000502765 T 07-03-2000	
		NO 955271 A 23-06-1997	

CA 1169627	A1	26-06-1984	NONE
