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(54) A method of and apparatus for installing a casing under tension.

(57) A method of and apparatus for installing casing under tension is described which comprises means (120) for securing the casing (70) at one end to a first fixture which enables the casing (70) to be tensioned by applying a force to its other end. Second securing means (20) are also provided for securing the casing (70) at its other end to a second fixture (2) and there is also means (34) for elongating the casing. The second securing means (20) is adjustable in position on the casing (70) so as to be engageable with the second fixture (2) over a range of axial locations on the casing (70). The first and second securing means (120, 20) each have an abutment face (28) aligned non-axially on the casing (70) for engagement with a non-axially aligned face (62) of the first and second fixtures. Preferably, the casing (70) is tensioned by injecting pressurised fluid into the interior of the casing (70).

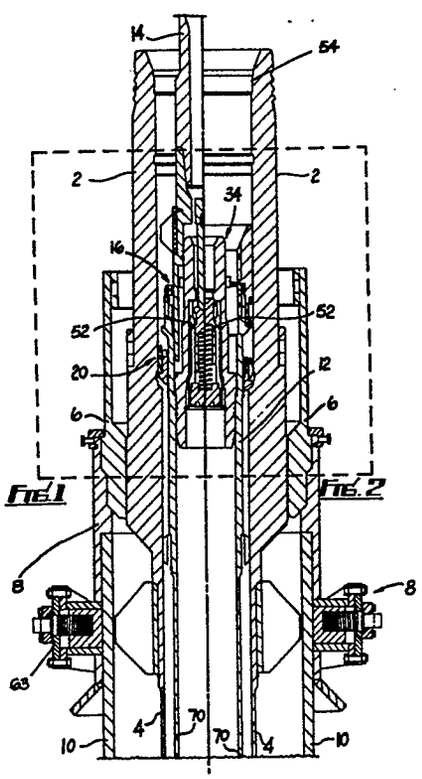

FIG. 1 FIG. 2

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A Method of and Apparatus for Installing a Casing under Tension

This invention relates to a method of and apparatus for installing casing under tension.

In situations such as tie-back where casing has to be installed at one end on a first fixture and at its opposite end on a second fixture, it is important that the casing should be under tension during installation in order to compensate for elongation due to temperature increases, which could otherwise result in buckling of the casing. These situations can arise for example in installing casing between a mudline casing support and a fixture at a surface wellhead, or between a casing support located below the mudline and a fixture at a subsea wellhead.

According to the invention there is provided apparatus for use in installing casing under tension, comprising first securing means for securing the casing at one end to a first fixture so as to allow the casing to be tensioned by applying a force to its other end, second securing means for securing the casing at the other end to a second fixture and means for elongating the casing, wherein the second securing means is axially adjustable in position relative to the casing so as to be engageable with the second fixture over a range of relative axial positions between the casing and the second fixture, and wherein the means for elongating the casing comprises means for injecting pressurised fluid into the interior of the casing.

Typically, the second securing means is adjustable in position on the casing so as to be engageable with the second fixture over a range of axial locations on the casing.

Preferably means are provided for sealing the interior of the casing in a fluid-tight manner.

The casing may be installed between a subsea wellhead and a fixture below the mudline.

Further according to the present invention there is provided a method of installing casing under tension, comprising securing the casing at one end to a first fixture, sealing the interior of the casing in a fluid-tight manner, injecting into the interior of the casing a pressurised fluid to cause the casing to undergo elongation, and securing the elongated casing at its other end to a second fixture whereby the casing is secured to said fixtures in a manner maintaining elongation of the casing on release of said pressurised fluid from the interior of the casing.

Preferably said other end of the casing is secured to the second fixture through a locking ring in screw-threaded engagement with the casing and/or with the second fixture. The second fixture may be for example a shoulder on another casing. An embodiment of this invention will now be described by way of example with reference to the accompanying drawing in which:

Fig. 1 is a sectional side view of the left-hand side of a subsea wellhead incorporating apparatus of this invention during installation of the 9 5/8 inch casing;

Fig. 2 is a sectional side view of the subsea wellhead of Fig. 1 after installation of the 9 5/8 inch casing; and,

Fig. 3 is a schematic view of an offshore oil well having a subsea wellhead.

Referring first to Fig. 3, a pre-drilled oil well 100 extends downwards through the sea bed from the mudline 130 at which a mudline suspension system 110 including a fixed casing hanger and a subsea wellhead is located. After the well 100 has been drilled concentric casing 70 is lowered from a drilling platform (not shown) to the mudline suspension system 110 and then lowered in to the oil well 100 through the subsea wellhead.

The lower end of the casing 70 is secured to a fixture at 120 below the mudline 130 and tensioned upwardly from the mudline suspension system 110, as will now be described with reference to Figs. 1 and 2.

A subsea wellhead has a housing 2 which extends upwardly from a 13 3/8 inch casing 4 and which is supported through a hanger 6 on an overshot 8 installed on a 30 inch casing 10. Overshot 8 is fixed to the casing 10 using a dog type system 63.

A 9 5/8 inch casing 70 is suspended through a hanger 12 in Fig. 1 from a running tool 14 by means of a J-type connection 16. The casing hanger 12 is screw-threaded at an upper portion 18 and engages with a correspondingly screw-threaded landing ring assembly 20 comprising an inwardly biassed split locking ring 22 and an activating ring 24. A shear pin 26 holds the activating ring 24 rigidly on a hanger sleeve 28. The locking ring 22 and activating ring 24 have correspondingly-tapered faces, and the activating ring 24 has circumferentially-spaced recesses 30 in its upper face for receiving corresponding downwardly-extending projections of a torque sleeve (not shown) which can then be used to rotate the activating ring 24.

A circumferential groove 32 in the inner face of the wellhead housing 2 is shaped to receive the locking ring 22.

A check valve assembly 34 is in screw-threaded engagement at 36 with the inner face of the 9 5/8 inch casing hanger 12 and comprises a housing 38, a sleeve 40 within the housing 38 and sealed against it by O-ring seals 48, a valve mem-

ber 42 axially slidable within the sleeve 40 and sealed against it by O-ring seals 42A, and a compression spring 44 extending between the base of a downwardly-opening recess 46 in the valve member 42 and a stop member 50 within the sleeve 40. The spring 44 biasses the valve member 42 upwardly to close off ports 52 in the wall of the sleeve 40 by means of the O-ring seals 42A.

In use, the 9 5/8 inch casing hanger 12 is run on the running tool 14 until a tie-back tool on the lower end of the casing (not shown) engages in a profile in the 13 3/8 inch casing below the mudline, in conventional fashion. The lockdown ring assembly 20 is then spaced above the groove 32 as illustrated in Fig. 1.

The check valve assembly 34 is installed in the screw-threads 36 in the inner face of the casing hanger 12 and the check valve member 42 is depressed against the bias of the spring 44, opening the ports 52. To tension and elongate the casing 70 high-pressure fluid is introduced into the casing hanger 12. The fluid passes through ports 56 in the running tool and the ports 52 in the sleeve 40 into the 9 5/8 inch casing 70. The check valve member 42 is then released, and its seals 42A close off the ports 52. The pressure above the valve assembly 34 is then released, and the trapped pressure of fluid in the casing 70 acting on the underside of the valve assembly 34 maintains the elongation of the casing. The fluid pressure is selected to produce a predetermined tensile loading on the casing 70.

A torque sleeve (not shown) is passed into the wellhead housing until its projections engage in the recesses 30 of the activating ring 24, and the sleeve is rotated to move the landing ring assembly 20 downwardly on its screw-thread engagement 18 with the casing hanger 12, until the locking ring 22 snaps into the groove 32 in the housing 2 and the hanger sleeve 28 engages in a corresponding shoulder 62 on the housing 2. Rotation of the activating ring 24 is continued, which shears the shear pin 26 and moves the activating ring 24 downwardly on the hanger sleeve 28 over the tapered face of the split ring 22, which forces the split ring 22 outwardly to lock it positively in the groove 32. The check valve member 42 can then be depressed to release the pressure below it, leaving the 9 5/8 inch casing 70 under accurate tension and supported by the landing ring assembly 20.

Fig. 2 shows the tensioned and installed 9 5/8 inch casing with the running tool 14 removed.

Modifications and improvements may be made without departing from the scope of the invention.

Claims

1. Apparatus for use in installing casing (70) under tension, comprising first securing means (120) for securing the casing (70) at one end to a first fixture so as to allow the casing (70) to be tensioned by applying a force to its other end, second securing means (20) for securing the casing (70) at the other end to a second fixture (2) and means (34) for elongating the casing, wherein the second securing means (20) is axially adjustable in position relative to the casing (70) so as to be engageable with the second fixture (2) over a range of relative axial positions between the casing and the second fixture and wherein the means for elongating the casing (70) comprises means for injecting pressurised fluid into the interior of the casing (70).

2. Apparatus according to Claim 1, further comprising means (42A) to seal the interior of the casing in a fluid-tight manner.

3. Apparatus according to Claim 1 or Claim 2, wherein the second securing means is adjustable in position on the casing.

4. Apparatus according to any of the preceding Claims, wherein the casing is adapted to be installed between a subsea wellhead (2) and a fixture below a mudline (130).

5. A method of installing casing (70) under tension, comprising securing the casing (70) at one end to a first fixture (120), sealing the interior of the casing (70) in a fluid-tight manner, injecting into the interior of the casing (70) a pressurised fluid to cause the casing (70) to undergo elongation, and securing the elongated casing (70) at its other end to a second fixture (2) whereby the casing (70) is secured to said fixtures in a manner maintaining elongation of the casing on release of said pressurised fluid from the interior of the casing(70).

6. A method according to Claim 5, wherein the other end of the casing is secured to the second fixture (2) by means of a locking ring (22).

7. A method according to Claim 6, wherein the locking ring (22) is in screw-threaded engagement with the casing (70) and/or with the second fixture (2).

8. A method according to any of Claims 5 to 7, wherein the second fixture (2) comprises a shoulder (62) on another casing.

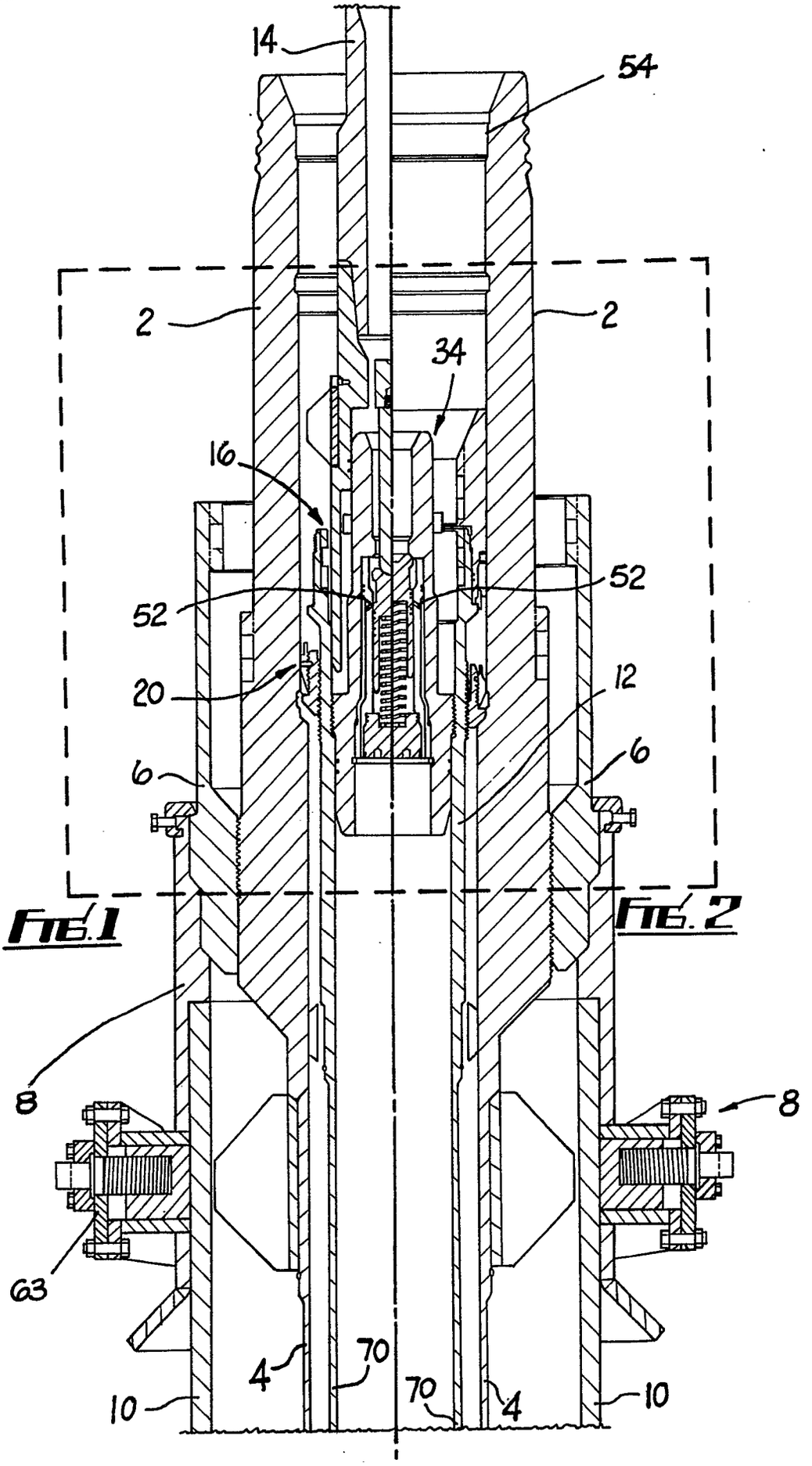
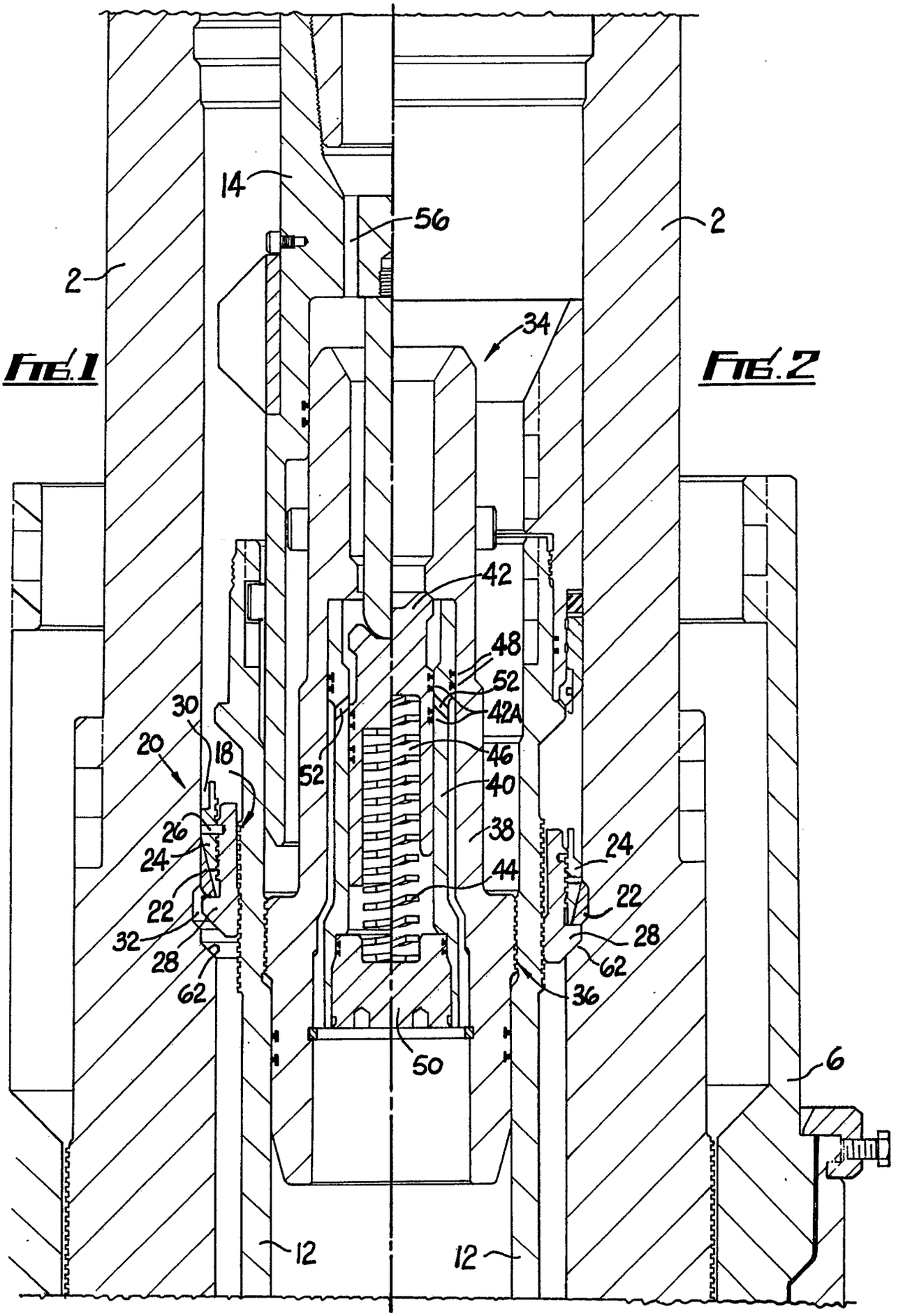


FIG. 1

FIG. 2

FIG. 1

FIG. 2



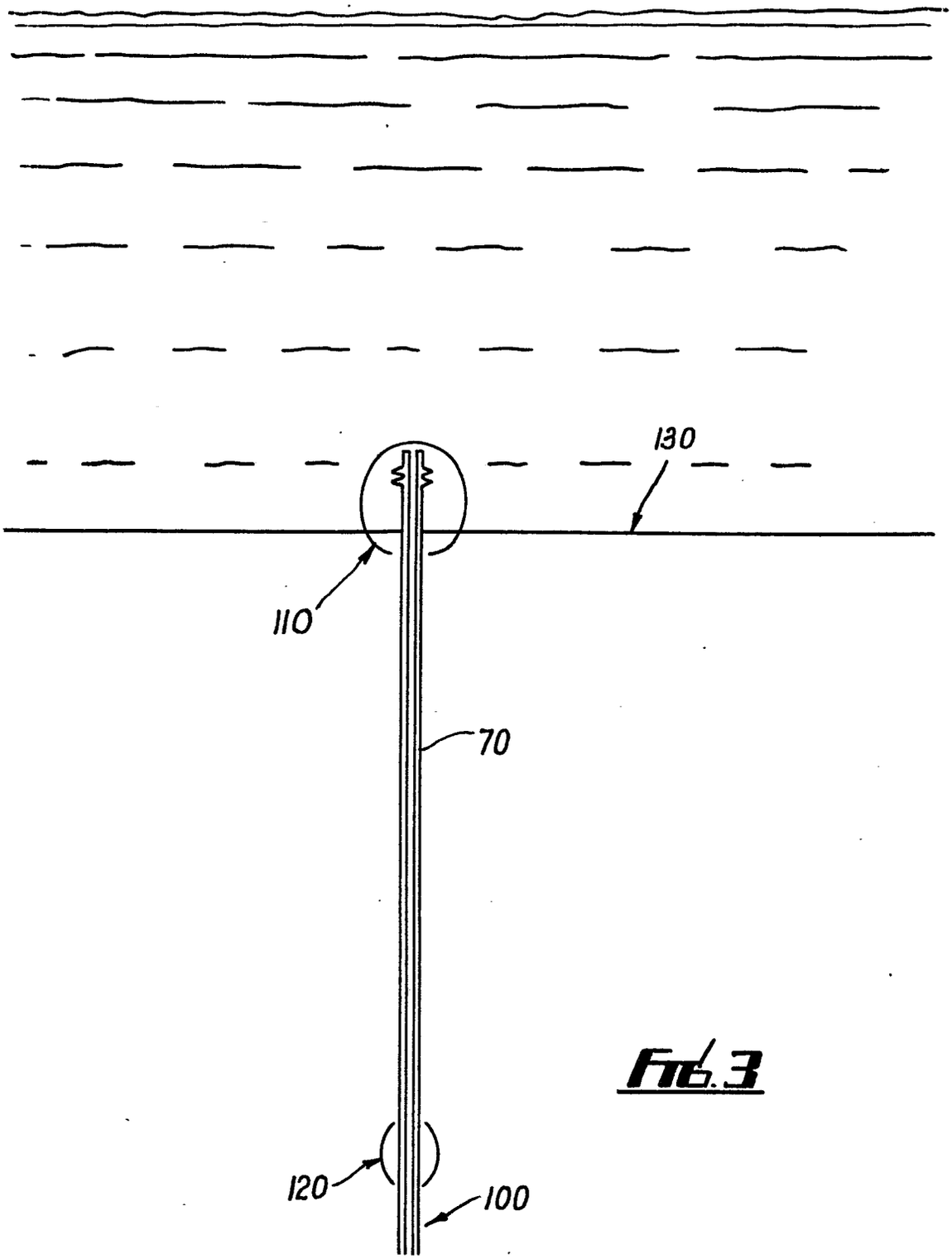


FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 31 2030

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	GB-A-2 044 318 (OTIS ENG. CORP.) * Page 4, lines 60-94 *	1-5	E 21 B 33/043 E 21 B 43/10 E 21 B 19/00
A	US-A-3 545 543 (A. KAMMERER) * Column 4, lines 9-21 *	5	
A	EP-A-0 251 595 (PLEXUS OCEAN SYST.) * Column 4, lines 26-45; figure 3 *	1,3,4,6-8	
A	US-A-3 011 552 (A. RHODES et al.) * Column 4, lines 50-71; figure 3 *	6-8	
A	US-A-2 901 044 (E. ARNOLD) * Column 6, lines 43-67; figure 3A *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 21 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22-02-1990	RAMPELMANN K.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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