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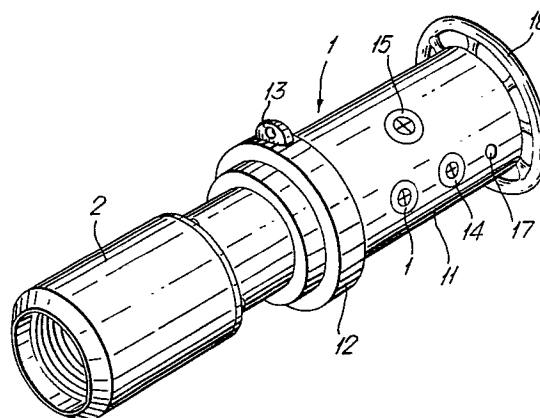
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⑤④ **Bolting system for blow out preventers.**

⑤⑦ A bolt installation device (1) which may be used for the installation of hydraulically pretensioned bolts in a blow out preventer consisting of an operating head (2) by which the bolts are pretensioned, integral with a housing (11) containing a pump unit, tank for hydraulic oil and associated pressure valves. The device includes a suspension means (13) and has provision for controlling (18) and rotating the device.



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Bolting System for Blow Out Preventers

The present invention relates to a bolt installation device for use in the assembly of blow out preventers.

Conventional blow out preventers for use in oil wells or oil drillings consist of a generally cylindrical body located coaxially around the drill pipe, access ports in the body allowing access of a pair of ram seals each comprising a longitudinally split cylinder which may be forced against the drill pipe in blow out conditions. The ram seals are driven by a pair of rams acting horizontally, the entire ram system encased in a bonnet connected to the body by bonnet bolts extending through the bonnet, ram supports and body. The ram seals require frequent servicing, normally every three months, necessitating removal of the bonnet bolts. These are designed to withstand the full working pressure of the blow out preventer and thus on reassembly have to be adequately tightened. Experience has shown that the torque tightening of solid bolts has been time consuming and has lead to galling problems in the threads and between bolt flange and bonnet face. The overriding concern however is the lack of predictability of the load in the bolt.

The present invention is based on the discovery that hydraulically pretensioned bolts may be used as bonnet bolts, and the subsequent development of a device for their installation either during manufacture or for service maintenance which may be carried out in close proximity to the drill head for example on a drill rig.

According to the present invention a bolt installation device for use in the installation of hydraulically pretensioned bolts in a blow out preventer comprises an operating head by which, in use, the hydraulic bolts are pretensioned, the head being integral with a housing containing a pump unit, a tank for hydraulic oil and a high pressure control valve for controlling, in use, the flow of hydraulic oil to the operating head and a high pressure release valve for

controlling the flow of oil from the operating head back to the tank, the device provided with means for suspension and with controlling means which allow rotation of the device and by which means bolt fitting and bolt removal can be effected.

5 Preferably the housing is of generally cylindrical shape and lies on the same axis as the bolt head. For ease of operation it is preferred that the means of suspension should be located at or near the centre of gravity, and-
10 that the controlling means be located at or near the end of the housing distant from the operating head.

In its preferred form the device is "torpedo shaped" and this compact design allows great ease of operation. This is essential where service maintenance is concerned since
15 blow out preventers are normally used in four-high stacks, linked together in a tubular frame, and this seriously restricts access to the bonnet bolts.

The operating head of the device is preferably the standard form of operating head for a hydraulically
20 pretensioned fastener, for example of the type disclosed in U.K. 1 136 280 or more preferably U.K. 1 382 192. In general these consist of a closed cylindrical chamber and a piston member which is a close sliding fit in the cylindrical chamber. An expandable tube or sac, of rubber or other
25 suitable material, or a disc of resilient material abuts against the working face of the piston and bears on the wall of the chamber to form a seal, and a conduit extends through the cylinder wall and is coupled to the line delivering high pressure hydraulic fluid from the pressure pack. The open
30 end of the chamber is threaded.

In the device of the present invention the operating head is semi-permanently connected to the housing and the components located within the housing. Thus in normal operation, no high pressure hydraulic connections need to be
35 made or broken during the bolt fitting or bolt removal process, but the operating head can be dismantled and

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separated from the housing and other component parts for servicing.

Any suitable means for suspension may be used. One method is to have a metal ring with an integral eye bolt located at or near the centre of gravity of the device. Alternatively the housing may be provided with a necked region in which a sling may be located. However preferably the housing is provided with a trunnion bearing at or near the centre of gravity and an eye bolt is located on the outer ring thereof.

In order to control the fitting and removal of hydraulically pretensioned bolts with the device of the present invention the controlling means is preferably a hand wheel mounted with its mid-point lying in line with the axis of the operating head and housing.

The high pressure valve for controlling the flow of hydraulic oil to the operating head and the release valve to control the flow of oil from the operating head back to the tank may be comprised of a double valve. Handwheels or the like for operating the valves or double valve are mounted on the housing. An air pressure reducing valve to control the hydraulic pressure developed by the pump may be located inside or outside the housing. The device of the present invention is entirely self contained in use other than requiring a compressed air line, and this may be connected by means of a snap on quick release connection, one part of which is mounted on the housing.

Preferably the thread on the operating head is a left hand thread. This is because there is a possibility of thread corrosion on the bolts, and left hand threading enables easier removal should this occur. In a preferred embodiment a four start thread is used.

The bolt installation device of the present invention may be used for the installation of hydraulic bolts of the conventional type, for example as disclosed and claimed in U.K. patent 1 382 192, in which a load rod is located with

clearance in a blind bore within the shank of the bolt. The end of the bolt distant from the blind end of the bore is threaded to mate with the thread on the operating head of the installation device, and when connected the end of the load rod distant from the blind end is in face to face relationship with the piston member of the operating head. Alternatively however the shank of the bolt may be bored throughout its length and threaded internally at the end distant from that which will mate with the operating head. The load rod used in this alternative bolt is threaded to mate with the internal thread of the bolt shank, and the distant end from the thread faces on to the piston member of the operating head during use.

An embodiment of the invention will now be described with reference to the accompanying drawing in which Figure 1 is a perspective view of a self-contained bolt installation device in accordance with the invention and Figure 2 is an axial cross section through the operating head.

Figure 1 shows a bolt installation device 1 including an operating head 2 for the hydraulic bolt. The operating head 2 is shown in more detail in Figure 2 and comprises a closed cylindrical chamber 3 provided by a cup shaped body and having a conduit 4 through the end face. A cylindrical housing 5 having a flange 6 at one end face is bolted to the operating head 2 and houses a high pressure tube 7 through which hydraulic oil can be passed. The high pressure tube is coupled to the conduit 4 through a high pressure junction 8. A piston 9 is located in the cylinder 3 and is a close sliding fit with the chamber wall. A disc 10 of resilient material abuts the working face of the piston member 9. This provides a seal against leakage of hydraulic fluid through the space between the wall of the piston member and the wall of the cylinder 3. The periphery of the disc 10 always bears radially outwards against the wall of the cylinder to provide the seal. The hardness of the material from which the disc 10 is made and its thickness in relation to its diameter are such that in use when a pressure of

hydraulic oil acts in the cylinder 3, the compression of the disc 10 against the piston member 9 causes the disc to act radially outwards against the wall of the cylinder with even greater pressure and thus improves the seal. The Shore hardness of the material from which disc 10 is made is in the range 10 to 100 and preferably 40 to 70. Medium hard nitrile rubber is particularly suitable.

The cylindrical housing 5 is fixed at the end distant from the operating head to a housing 11 in which a pressure pack comprising a self-contained pump unit, tank for hydraulic fluid, control valves and pipings are mounted. A metal trunnion 12 with an eye bolt 13 are mounted close to the junction between the pressure pack housing 11 and cylindrical housing 5. The control valves consist of a pressure control 14 to control the flow of hydraulic oil to the operating head 2, a pressure release valve 15 to control the flow of oil back to the tank and an air regulator 16. An air line connector 17 of the snap-on, quick release type is also mounted on the pressure pack housing 11. A hand wheel 18 is fixed at the end of the pressure pack housing distant from the operating head, with its mid point lying in line with the axis of the pressure pack and operating head. The pressure gauge for detecting in use the pressure of hydraulic oil is mounted within the boundary of the hand wheel 18, which thereby offers it some protection. In use the bolt assembly device is mounted by means of the eye bolt 13 which is located in the trunnion at or near the centre of gravity of the device, and the handwheel 18 is used to control the operation of the device.

The use of the device of the present invention in the fitting and removal of bonnet bolts will now be described. The bonnet is closed and bonnet bolts each consisting of a bolt shank having an axial bore within the shank, are located in the bonnet in the conventional manner using an air operated air runner and socket. The bolts are screwed home and the bolt runner and socket are removed. A load

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rod which fits with clearance is located in the axial bore, this being permanently fitted by screwed in, if the axial bore is open at both ends, or where the axial bore has a closed end is fitted before the bolt is to be preloaded.

5 The bolt assembly device, lifted by means of the trunnion, is screwed onto the bolt head, this screwing action controlled by means of the handwheel 18. Advantageously the operating head 2 is provided with a 4 start left hand thread so that the system is screwed on to the bolt in an anti-

10 clockwise manner. An air supply line is then connected to the quick release connector 17. Operation of the air regulator valve 16 starts the pump and controls the pressure delivered by the pump up to the bolt's operating pressure. A bursting disc built into the hydraulic system prevents

15 overpressurisation of the bolt. On reaching the bolt operating pressure, the high pressure valve 14 to the operating head 2 and the air regulator valve 16 are closed. This effects a prestretch of the bolt within its elastic limit. Using the integral handwheel 18, or a torque bar if

20 necessary the whole assembly is turned clockwise thus tightening the bolt. The hydraulic pressure is released by opening the pressure release valve, and the bonnet bolt, in attempting to return to its original length, applies a clamping load to the bonnet assembly. The bolt assembly

25 device is removed from the bolt head by clockwise rotation. If the hydraulically pretensioned bolt incorporate a removable load rod, this is removed and a protective cover fitted to the head of the bolt. The bolt may be removed when desired by reversing the above sequence.

30 By use of a bolt assembly device as described in the present specification, no high pressure hydraulic connections need to be made or broken at any time during fitting or removing the bolts.

Claims

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1. A bolt installation device for use in the installation of hydraulically pretensioned bolts in a blow out preventer comprising an operating head 2 by which in use the hydraulic bolts are pretensioned, a housing 11 containing a pump unit, a tank for hydraulic oil and a high pressure control valve for controlling in use the flow of hydraulic oil to the operating head and a high pressure release valve for controlling the flow of oil from the operating head back to the tank, characterised in that the operating head 2 is integral with the housing 11, and is provided with a means for suspension 13 and controlling means 18 which allow rotation of the device and by which means bolt fitting and bolt removal can be effected.
2. A device as claimed in claim 1 in which the housing 11 is of generally cylindrical shape.
3. A device as claimed in claim 1 or claim 2 in which the housing 11 lies along the same axis as the operating head 2.
4. A device as claimed in any one of claims 1 to 3 in which the means of suspension 13 is located at or near the centre of gravity of the device.
5. A device as claimed in claim 4 in which the means of suspension is a trunnion bearing 12.
6. A device as claimed in any preceeding claim in which the means of controlling the fitting of bolts and their removal is a handwheel 18 located at the end of the housing 11 distant from the operating head 2.

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Fig. 1.

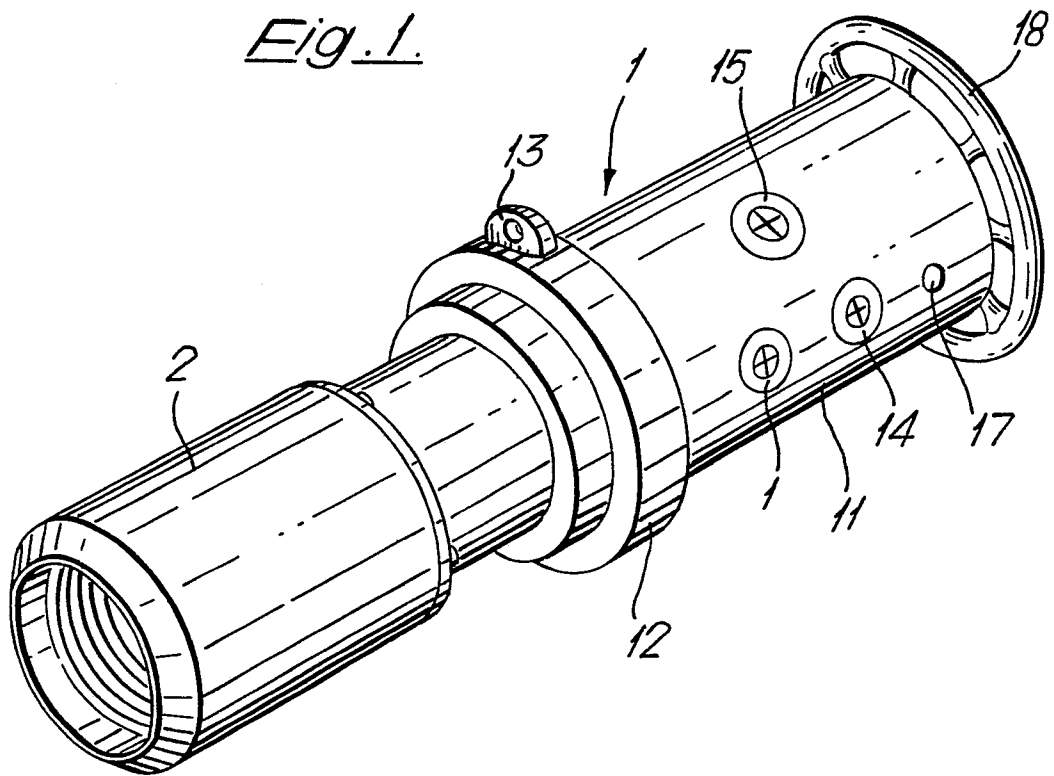
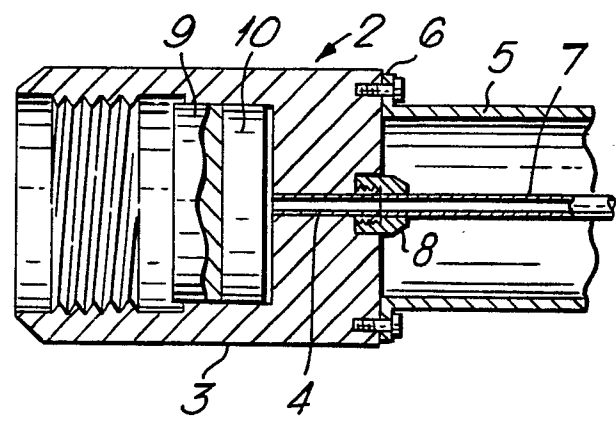


Fig. 2.



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European Patent
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EUROPEAN SEARCH REPORT

Application number

EP 79 302 273.2

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>GB - A - 1 233 777</u> (TORQUE TENSION LTD.) * fig. 1 * --	1	E 21 B 33/06 B 25 B 29/02 F 16 B 31/00
	<u>GB - A - 1 511 300</u> (THE ENGLISH ELECTRIC COMPANY LTD.) * fig. 1 * --	1	
	<u>US - A - 2 760 393</u> (G.D. STOUGH) * column 2, line 40 * --	6	TECHNICAL FIELDS SEARCHED (Int. Cl.)
	<u>US - A - 3 099 434</u> (LE ROY S. DE MART) * fig. 2 * --	2,3, 5	B 25 B 29/00 E 21 B 33/00 F 16 B 31/00
	<u>US - A - 3 115 332</u> (J.C. SINGLETON et al.) * fig. 1 * --	2,4	
	<u>US - A - 4 027 559</u> (G. WALLRAFEN) ----		
☒ The present search report has been drawn up for all claims			CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons &: member of the same patent family, corresponding document
Place of search	Date of completion of the search	Examiner	
Berlin	23-01-1980	ZAPP	