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(54) Title: DUAL BORE PACKER WITH AXIALLY OFFSET MANDREL THREADS

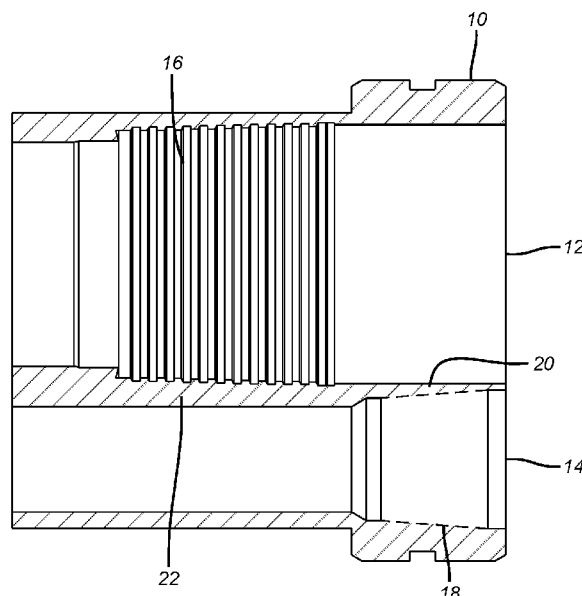


FIG. 1

(57) Abstract: A dual bore packer features axially offset tapered thread connections so that the pressure rating and size of the connections in each of the bores can be as large as possible. This is enabled by providing as thick a wall as possible between the bores in the zone where the connecting tapered thread is placed.



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KM, ML, MR, NE, SN, TD, TG).

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DUAL BORE PACKER WITH AXIALLY OFFSET MANDREL THREADS

FIELD OF THE INVENTION

[0001] The field of the invention is dual bore packers and more particularly packers where the mandrel end connections are axially offset to allow greater wall area about the thread for the required pressure rating.

BACKGROUND OF THE INVENTION

[0002] Typically dual bore packers have two adjacent bores with threaded end connections for connecting a tubular string or a cable. One application for dual bore packers is for electric submersible pump service where the smaller of the bores is for a power cable to the pump and the larger bore is connected to the discharge of the pump to bring produced fluids to the surface.

Some examples of dual bore packers with axially aligned threads are US 9611722 and US 6390198.

[0003] Typically the threaded connections have to deliver a required pressure rating and if the threads are disposed next to each other at the upper face of the mandrel there has to be a tradeoff between making the thread as large as possible for less resistance to flow and making the connections stout enough to handle the anticipated operating pressures for the application. Since the thread forms are tapered juxtaposing two threads near each other limits the available wall between them so as to reduce the pressure rating of the connections. In dual bore packers the center of each bore is offset from the center of the packer.

[0004] The present invention offers a simple solution to this design conflict between making the bores as large as possible and giving the connections the highest possible pressure rating. The solution is to axially offset the threads in adjacent bores to maximize the available surrounding wall thickness so that in a given packer mandrel size the diameter and pressure rating of the two bores is maximized. These and other aspects of the present invention will be more readily apparent to those skilled in the art from a description of the preferred embodiment and the associated drawings while recognizing that the full scope of the invention can be determined from the appended claims.

SUMMARY OF THE INVENTION

[0005] A dual bore packer features axially offset tapered thread connections so that the pressure rating and size of the connections in each of the bores can be as large as possible. This is enabled by providing as thick a wall as possible between the bores in the zone where the connecting tapered thread is placed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a section view of a dual bore packer showing the offset thread locations in adjacent bores;

[0007] FIG. 2 is an end view of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0008] A mandrel end **10** of a dual bore packer of a type known in the art is shown in FIG. 1. First bore **12** is disposed parallel to second bore **14**. In one application bore **12** is larger than bore **14** such as in applications for an electric submersible pump where the production discharge line from the pump is connected to bore **12** and a power cable goes through bore **14**. Typically the bores **12** and **14** have their centers offset from the center of the mandrel **10**. Bore **12** has a threaded connection **16** axially offset and preferably not overlapping from thread **18** in bore **14**. In the case of more bores than two it is preferred that each connection be at least offset if not non-overlapping from all the other connections on the mandrel. Because thread **18** is tapered, the result is the wall **20** between the bores **12** and **14** gets thinner. The same is true for thread **16** at wall portion **22**. However, because threads **16** and **18** are axially offset and preferably non-overlapping in the axial direction there is no need to reduce the pressure rating of either threaded connection because placement of the thread takes away some of the wall. Instead the available wall thickness at each thread location is as large as possible availing a higher pressure rating to the connection than if the two threads were axially aligned or even if they were only in part axially overlapping. While tapered threads are discussed as the end connections, those skilled in the art will appreciate that other types of connections are envisioned whether threaded, socket welded, bayonet or another form of connection.

[0009] The above description is illustrative of the preferred embodiment and many modifications may be made by those skilled in the art without departing from the invention whose scope is to be determined from the literal and equivalent scope of the claims below:

We claim:

1. A connection arrangement for a multi-bore packer for borehole use,
characterized by:
a mandrel (10) having multiple bores (12,14), each said bore having a connection (16,18) wherein connections in said bores are axially offset from each other.
2. The connection arrangement of claim **1**, wherein:
said connections (16,18) do not axially overlap.
3. The connection arrangement of claim **2**, wherein:
said connections (16,18) comprise tapered thread.
4. The connection arrangement of claim **2**, wherein:
at least one said connection starts at an end of said mandrel.
5. The connection arrangement of claim **2**, wherein:
said bores (12,14) are different sizes.
6. The connection arrangement of claim **2**, wherein:
said bores have centers offset from a center of said mandrel (10).
7. The connection arrangement of claim **2**, further comprising:
a power cable for an electric submersible pump connected to one of said bores and a tubular string connected to another of said bores to direct flow from said pump to a remote location.
8. The connection arrangement of claim **1**, wherein:
said mandrel (10) comprises two said bores (12,14) .

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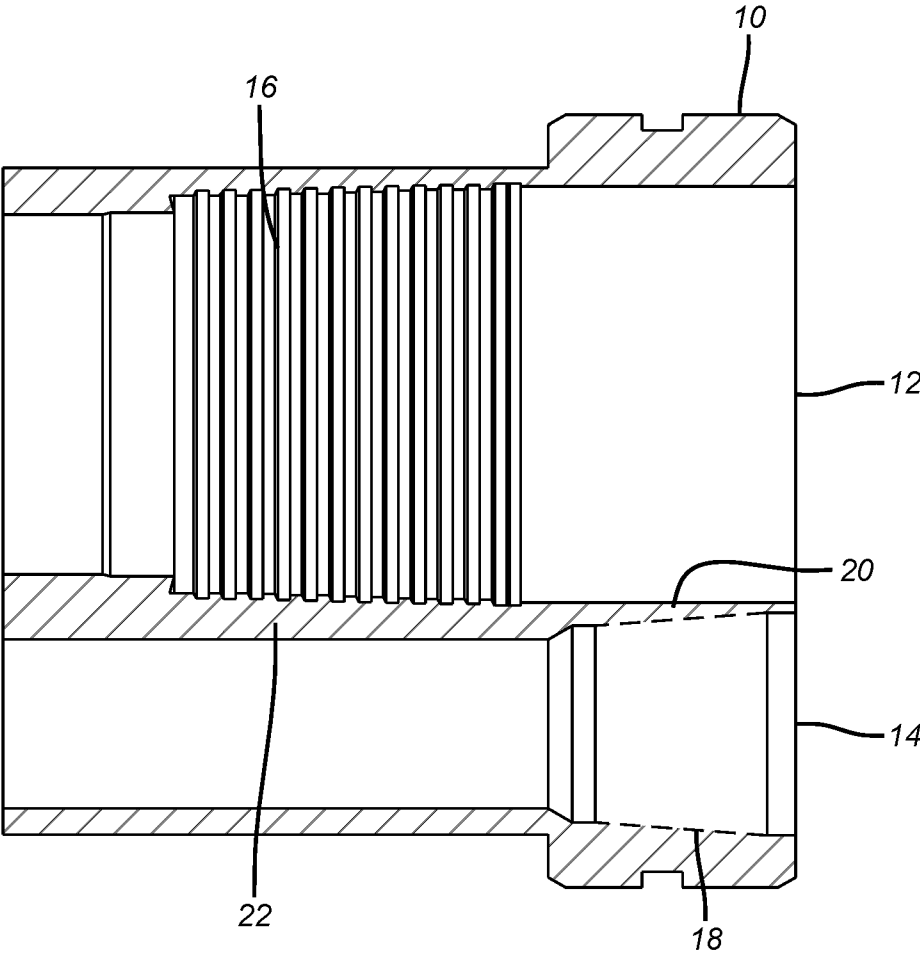


FIG. 1

2/2

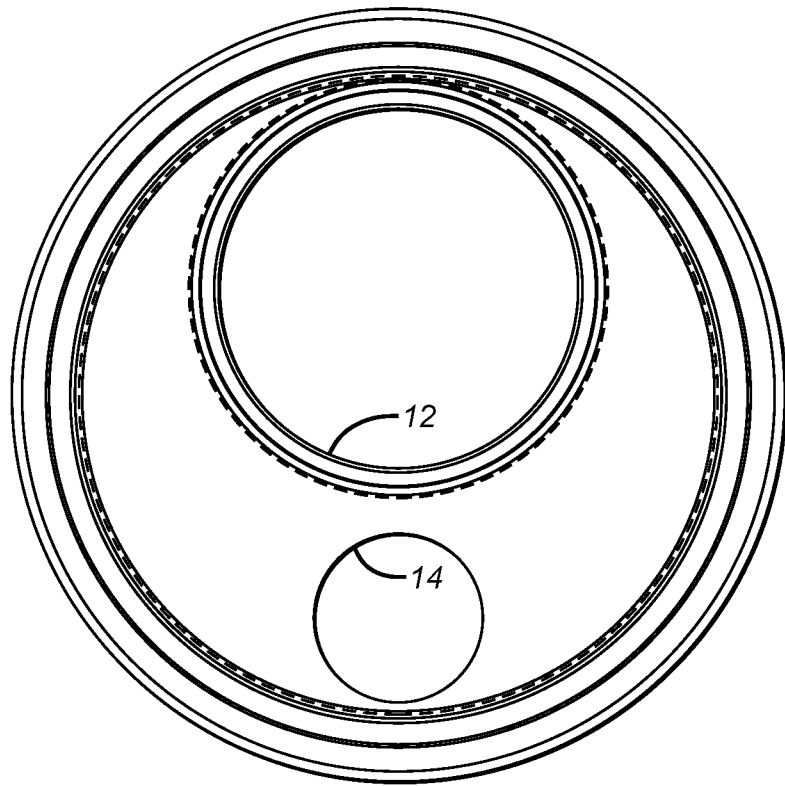


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/031543**A. CLASSIFICATION OF SUBJECT MATTER****E21B 33/12(2006.01)i, E21B 17/02(2006.01)i**

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)

E21B 33/12; E21B 43/12; E21B 23/06; E21B 34/04; E21B 33/122; E21B 7/08; E21B 23/03; E21B 17/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: connection, multi-bore, packer, mandrel, offset

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4930573 A (LANE et al.) 05 June 1990 See column 5, line 66 - column 9, line 15; and figures 1-2, 5A-5B, 8-10.	1-8
A	US 6158513 A (NISTOR et al.) 12 December 2000 See column 17, line 13 - column 18, line 46; and figures 1-2, 9-13, 18-21.	1-8
A	WO 2014-028365 A2 (BP CORPORATION NORTH AMERICA, INC. et al.) 20 February 2014 See paragraphs [0029]-[0031]; and figures 1-3.	1-8
A	US 4467866 A (VAZQUEZ et al.) 28 August 1984 See column 4, line 12 - column 10, line 29; and figures 1, 1A-1B, 2-4.	1-8
A	US 4505331 A (AKKERMAN, NEIL H.) 19 March 1985 See column 2, line 62 - column 4, line 60; and figures 1A-1B, 2.	1-8



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/031543

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US 4505331 A	19/03/1985	None	