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(54) **RELEASE LUGS FOR A JARRING DEVICE**

(57) A release mechanism for a jarring tool is formed by a plurality of segmented release lugs (17). Each lug (17) includes a plurality of axial spaced projections (18) on an inner surface and a plurality of grooves (37) on an outer surface. The projections (18) have either different widths or are separated by varying distances and re-

leaseably engage corresponding grooves (32) in a mandrel (21) located within a housing of the tool. The release lugs (17) are positioned between a trigger sleeve (16) and the mandrel (21). The release lugs (17) are supported by an annular ring member (220).

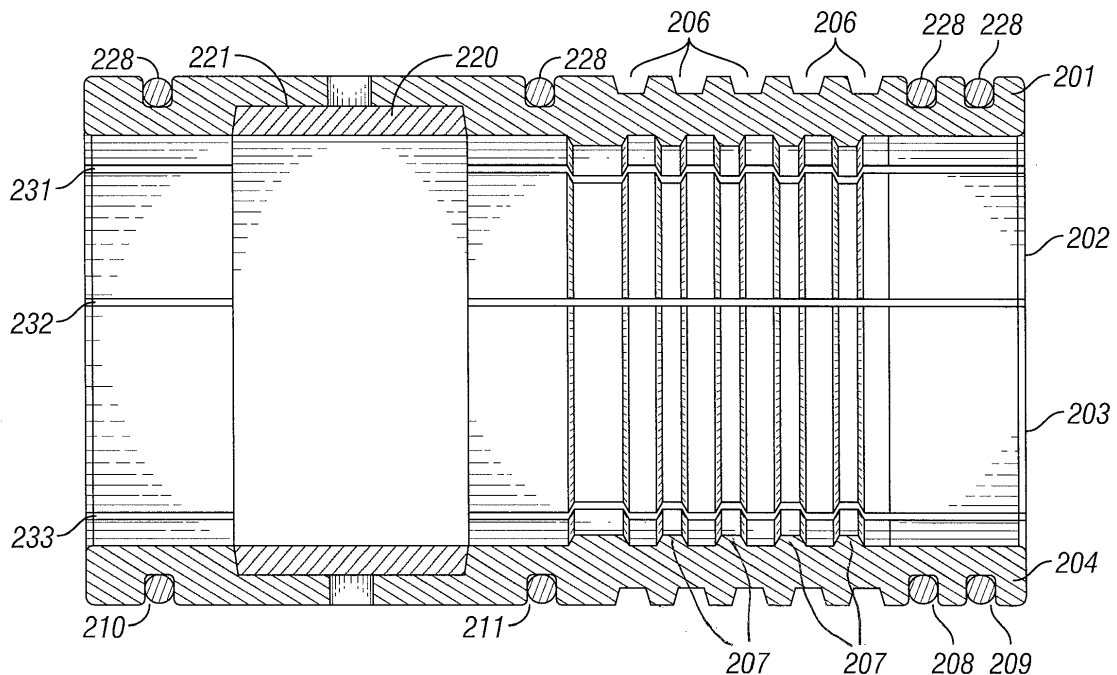


FIG. 11

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Description

BACKGROUND OF INVENTION

1. Field of the Invention

[0001] This invention is directed to a release mechanism for a mandrel of a jarring device commonly referred to as a jar. Jars are used in the well drilling industry to free downhole tools that may become lodged in a well. An upward or downward force can be supplied to a tubular string which includes the affected tool in order to break free the tool from the well bore.

2. Description of Related Art

[0002] Typically, a release mechanism in the form of an annular collet is provided which normally prevents axial movement of the mandrel. The mandrel is spring biased to move with significant force in an upward or downward direction. If a sufficient force is placed on the mandrel, the collet will release.

[0003] U.S. Patent No. 5,022,473 discloses a release assembly which comprises a plurality of angular segments 62 and 162 that engage in slots 86 and 88, and 186 and 188 respectively. It has been found that this arrangement can result in the segments 62 and 162 becoming out of alignment which could result in the failure of the release mechanism. As disclosed in the patent, the jar requires two sets of release lugs to withstand the anticipated tensile load. In this design the two lug assemblies must be spaced further apart than the total travel of the jar to prevent the lower lug from inadvertently engaging the groove of the upper lug assembly. If a third lug assembly were necessary it would have to be spaced a distance greater than the jar stroke from the lower set. This would significantly increase the total length of the jar and also the cost.

BRIEF SUMMARY OF THE INVENTION

[0004] The present invention solves the above noted problem by providing a plurality of angular lug segments each of which has two or more projections that engage corresponding grooves in the mandrel.

[0005] In order to avoid misalignment or a jarring situation, the projections have either a differing width or are spaced at different distances. The grooves on the mandrel have a complementary configuration as will be explained below.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0006] The invention will now be further and more particularly described, by way of example only, and with reference to the accompanying drawings, in which:

FIG. 1 is a cross-sectional view of a first embodiment of the release lugs as shown in a neutral position.

FIG. 2 is a cross-sectional view of the first embodiment of the release lugs just prior to release of the mandrel.

FIG. 3 is a cross-sectional view of the release lugs of FIG. 1 in a release position with the mandrel initially moving.

FIG. 4 is a cross-sectional view of the mandrel in a completely released position.

FIG. 5 is a perspective view of a release lug according to a first embodiment of the invention.

FIG. 6 is a perspective view of a plurality of release lugs forming a release mechanism according to a first embodiment of the invention.

FIG. 7 is a cross-sectional view of a second embodiment of the release lugs shown in a neutral position.

FIG. 8 is a cross-sectional view of the release lugs of the second embodiment in a fully released mode.

FIG. 9 is a segmented cross-sectional view of an entire jar including the release lugs of FIG. 7.

FIG. 10 is a cross-sectional view taken along line 10-10 of FIG. 9.

FIG. 11 is a cross sectional view of a third embodiment of a release mechanism according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0007] FIG. 1 illustrates a release mechanism including a plurality of release lugs 17 surrounding mandrel 21 of the jar such as that shown in FIG. 9.

[0008] The jar includes a central housing 11, a Belleville spring stack 12, a restrictor orifice 14 and one or more check valves 13, an annular sleeve 15 surrounding mandrel 21 and an annular trigger sleeve 16 having an inwardly projecting lip 33. Annular trigger sleeve 16 is spring biased against a shoulder 9 provided in housing 11 by a spring 19 at lip 33. A lubricant fitting housing 151 is threadedly coupled to the downhole portion of housing 11.

[0009] As shown in FIG. 5, each release lug 17 includes a plurality of projections 18 of varying width on its interior surface. Projections 18 in this embodiment are evenly spaced from each other. The exterior surface of the release lug includes a plurality of grooves 37 which are adapted to receive projections 36 of the trigger sleeve 16 as shown in FIG. 4. A plurality of smaller grooves 41, 42, 43 and 44 are also provided on the exterior surface of release lugs 17 and are adapted to hold garter springs 38 as shown in FIG. 6. A plurality of the release lugs are used to form a release mechanism as shown in FIG. 6 having spaces 45 between the release lugs. Although six release lugs are shown any number of segments for example, 2 thru 12 may be used.

[0010] In the rest position shown in FIG. 1, surfaces 35 of the release lugs are in contact with the interior surface of trigger sleeve 16 and projections 18 are located

within grooves 32 provided on the outer surface of mandrel 21. As an upward force is applied to mandrel 21 which would be from the left as shown in FIG. 1, mandrel 21 and release lugs 17 will travel to the left, thereby compressing Belleville spring stack 12. As the surfaces 35 align with grooves 31 of the trigger sleeve 16, the beveled surfaces of the projections and grooves of the trigger sleeve, release lugs and mandrel grooves will allow the surfaces to be forced outwardly into grooves 31 resulting in projections 18 disengaging from grooves 32 in the mandrel. The mandrel then is free to move in an upward direction or to the left as shown in FIG. 4. The overall operation of a hydraulic jar is well known and explained in U.S. Patent No. 6,290,004 and 7,510,008.

[0011] In order to reload the jar, a downward force is placed on the mandrel which will move the mandrel downward. The garter springs 38 will cause the release lugs to return to their original position with the projections 18 in grooves 32.

[0012] Spring 19 which is now compressed will move trigger sleeve 16 back to the neutral position shown in FIG. 1. In the embodiment of FIGS. 7 and 8, the release lugs 57 have been changed to include a plurality of projections 58 that are non-uniformly spaced apart from each other rather than having varying widths. The grooves 59 in the mandrel are also spaced apart accordingly to receive projections 59 in the neutral position as shown in FIG. 7. The outer surfaces of the release lugs are formed in the same fashion as the lugs shown in FIG. 5 so that in the released position of FIG. 8, surfaces 35 of the release lug are located within grooves 31 of the trigger sleeve 16.

[0013] FIG. 9 illustrates an embodiment of a complete jarring tool that incorporates the release lugs of the embodiment shown in FIGS. 7 and 8. The jar includes a connector 100 for connecting the jar to a tubular string, upper housing members 102 and 103, lubricating fitting 104, central housing 11, a lower lubricating fitting 151, lower housing member 152 and lower connector 141. The jar also includes a Bellville spring stack 12. The housing members are threadably connected to each other at 130, 131, 132, 133, 134 and 135. The mandrel of the jar includes an upper portion 160 which is threadedly connected to connector 100, a central portion 21 and a lower portion 153. The mandrel portions are connected together by threads at 136 and 158. Suitable seals are provided at 121, 122, 123, 124, 125, 126, 129 and 139. A floating piston 127 surrounds the lower portion of mandrel 153. A lubricating material is introduced into the housing through fittings 140 and 141. The upper portion of the mandrel 160 includes an annular raised portion 138 which acts as a hammer against an anvil shoulder 137 on housing upper end member 102. As shown in FIG. 10, upper housing member 103 may comprise a hexagon surface 171 which receives a hexagon outer surface 172 on the mandrel portion 160.

[0014] The jarring tool of FIG. 9 may incorporate the release lugs shown in the embodiments of FIG. 5 or that

of the embodiment of FIGS. 7 and 8.

[0015] FIG. 11 illustrates a third embodiment of the release mechanism. It also includes a plurality of individual release lugs 201-204 and those not shown that are spaced apart by a distance 231, 232, 233 along their entire length.

[0016] Each release lug includes a plurality of external grooves 206 and a plurality of internal ridges 207 that cooperate with a trigger sleeve and mandrel in the same manner as previous embodiments. An inner annular ring 220 is positioned within an interior groove 221 provided in each release lug. Ring 220 acts as a stabilizer for the release lugs. An annular garter spring 228 may be positioned in each of the grooves 210, 211, 208, 209 provided in each release lug in the manner shown in FIG. 6. As shown and mentioned above in relation to the release lugs 17 and 57, in a modification the release lugs 201-204 may have the external grooves 206 and/or the internal ridges 207 of differing axial widths, or differing axial spacings.

[0017] Although the present invention has been described with respect to specific details, it is not intended that such details should be regarded as limitations on the scope of the invention, except to the extent that they are included in the accompanying claims.

Claims

1. A release mechanism for a jarring tool having a mandrel (21), the mechanism comprising:
 - a plurality of arcuate release lugs (17; 201-204), each release lug including an inner surface and an outer surface;
 - a plurality of axially spaced projections (18; 207) on the inner surface of the release lugs and a plurality of grooves (37; 206) on the outer surface of the release lugs,
 - an annular ring member (220) supporting the release lugs,
 - a mandrel (21) having a plurality of axially spaced grooves (32) on an outer surface of the mandrel; and
 - an annular trigger sleeve (16) surrounding the mandrel (21), the release lugs (17; 201-4) being positioned between the annular trigger sleeve (16) and the mandrel(21).
2. A release mechanism for a jarring tool as claimed in claim 1 wherein the projections (18; 207) have different axial widths.
3. A release mechanism for a jarring tool as claimed in claim 1 or claim 2 wherein the grooves (32) in the mandrel (21) have a width corresponding to the width of the projections (18; 207) on the inner surface of the release lugs (17; 201-4).

4. A release mechanism for a jarring tool as claimed in any one of the preceding claims including three projections (18; 207) that are axially spaced from each other by a different distance. 5
5. A release mechanism for a jarring tool as claimed in claim 4 including at least three grooves in the outer surface of the mandrel, the grooves being axially spaced from each other by a different distance. 10
6. A jarring tool comprising:
- a housing (11);
 - a mandrel (21) having a plurality of axially spaced grooves (32); 15
 - a trigger sleeve (16) surrounding the mandrel (21);
 - a plurality of axially extending arcuate release lugs (17; 201-4) having an inner and outer surface, each lug including a plurality of axially spaced projections (18; 207) on its inner surface and a plurality of grooves (206) on its outer surface; 20
 - said release lugs (17; 201-4) being positioned between the mandrel (21) and the trigger sleeve (16); and 25
 - a spring means (12) surrounding the mandrel (21) and,
 - an annular ring member (220) supporting the release lugs (201-204). 30
7. A jarring tool as claimed in claim 6 wherein the projections have varying widths.
8. A jarring tool as claimed in claim 6 or claim 7 including three projections that are axially spaced from each other of a different distance. 35
9. A jarring tool as claimed in any one of claims 6 to 8 further including an anvil (137) on the housing (102, 103) and a hammer surface (138) on the mandrel. 40
10. A jarring tool as claimed in any one of claims 6 to 9 further including a plurality of garter springs (38; 228) surrounding the release lugs (17; 201-4) thereby forming a circular array of release lugs which engages an outer surface of the mandrel (21). 45
11. The release mechanism of any one of claims 6 to 10 wherein each release lug (201-4) includes an interior groove (221) and the annular ring member (220) is positioned within the interior grooves of the release lugs (201-4). 50

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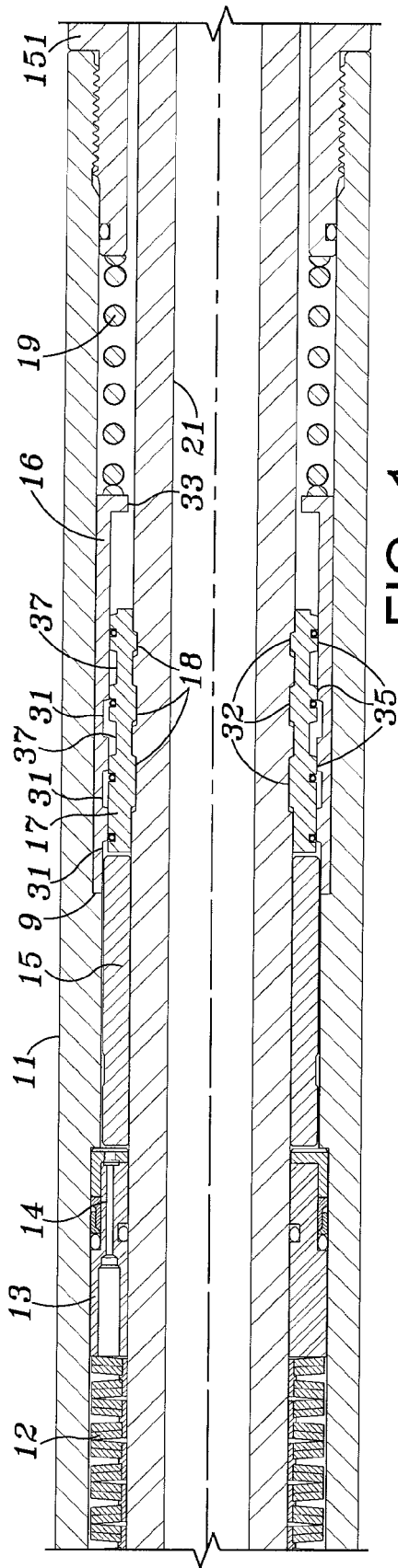


FIG. 1

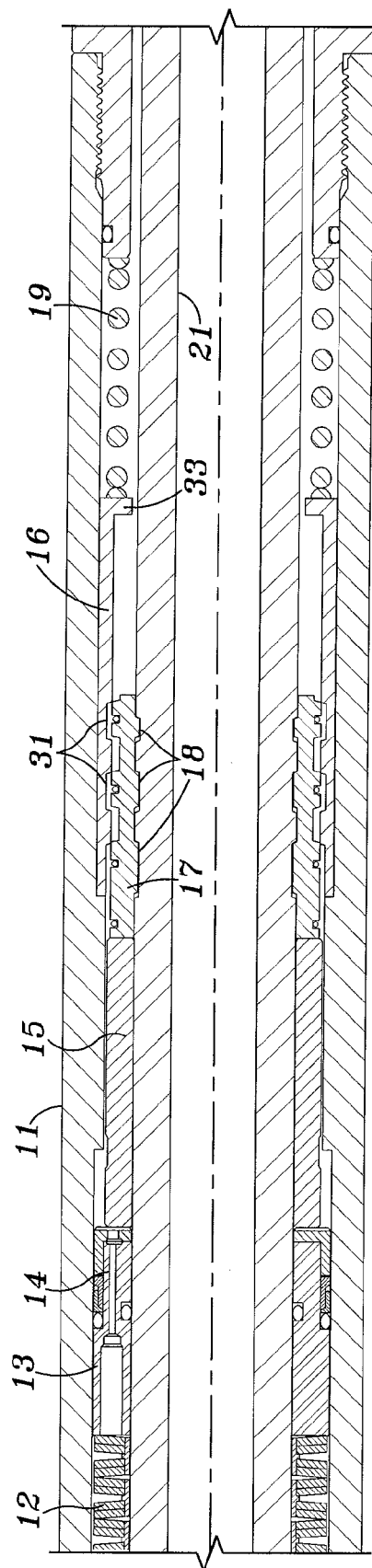


FIG. 2

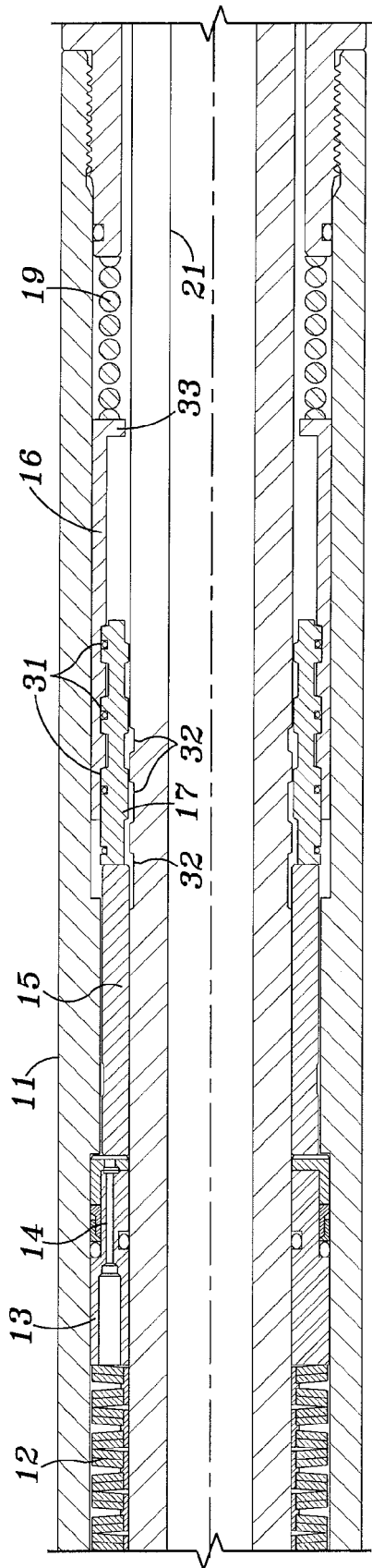


FIG. 3

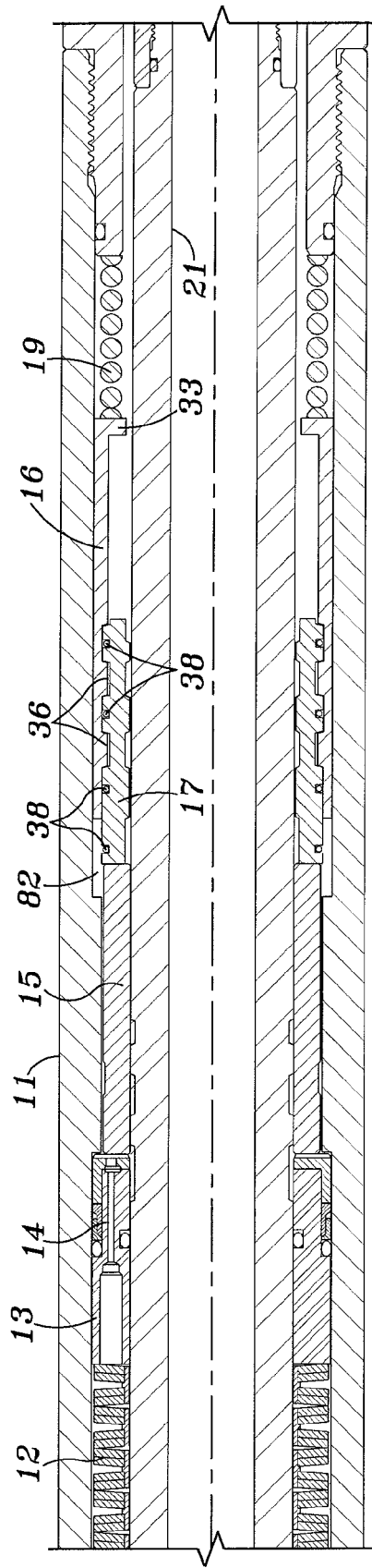


FIG. 4

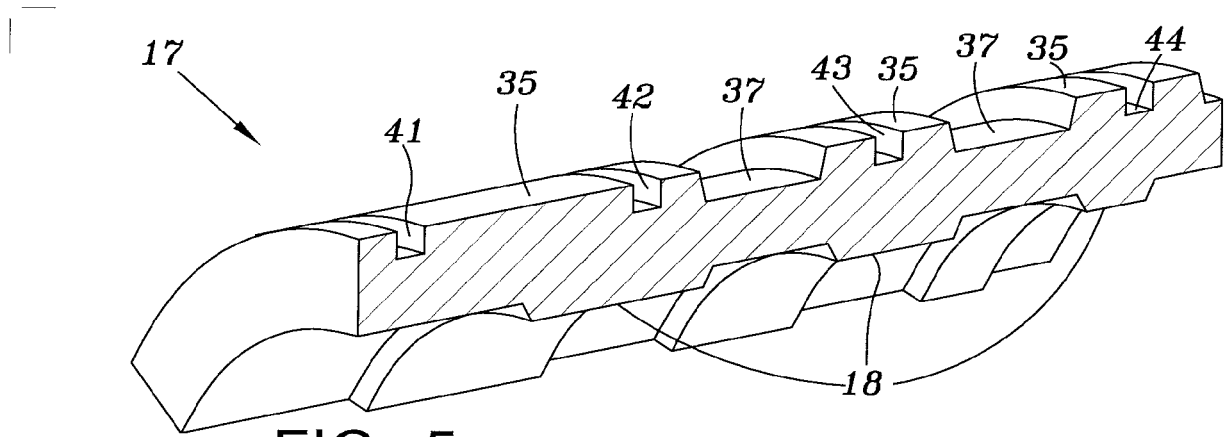


FIG. 5

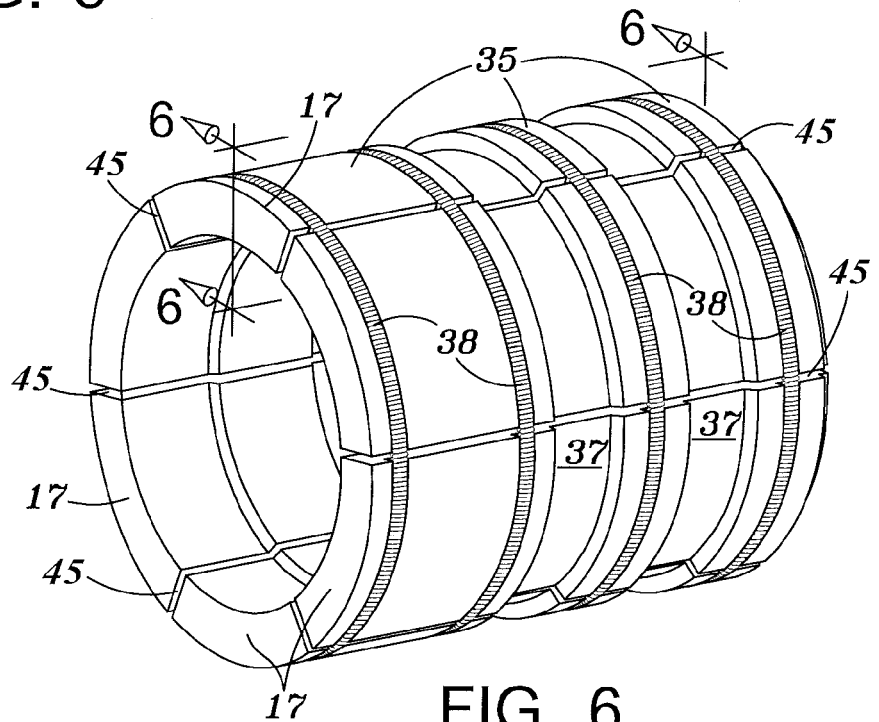


FIG. 6

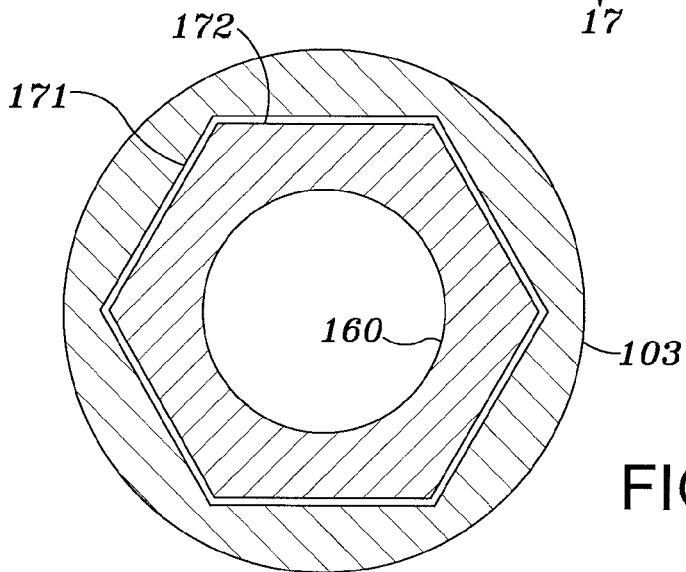


FIG. 10

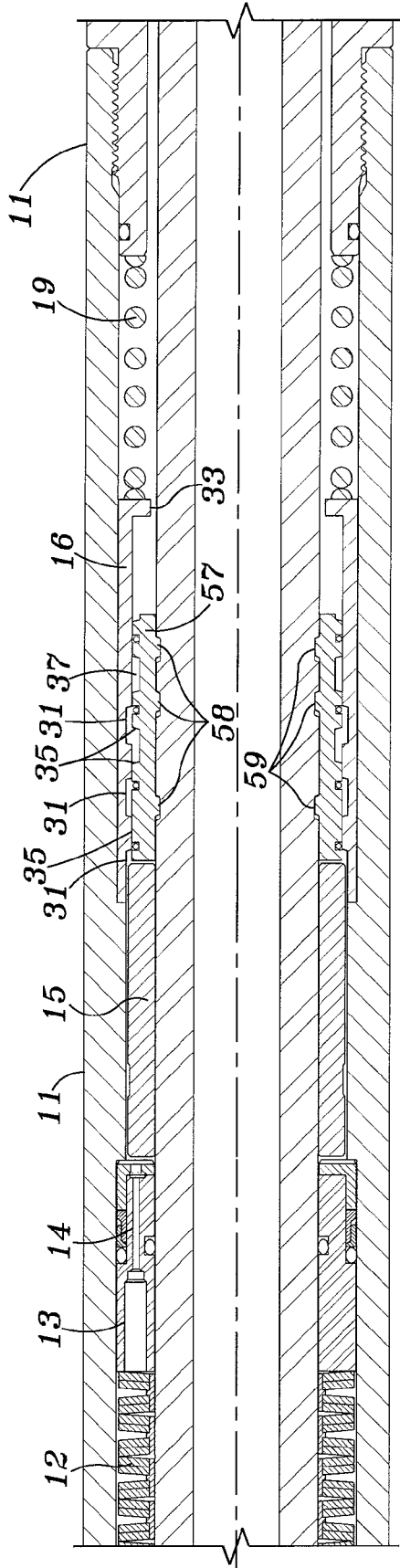


FIG. 7

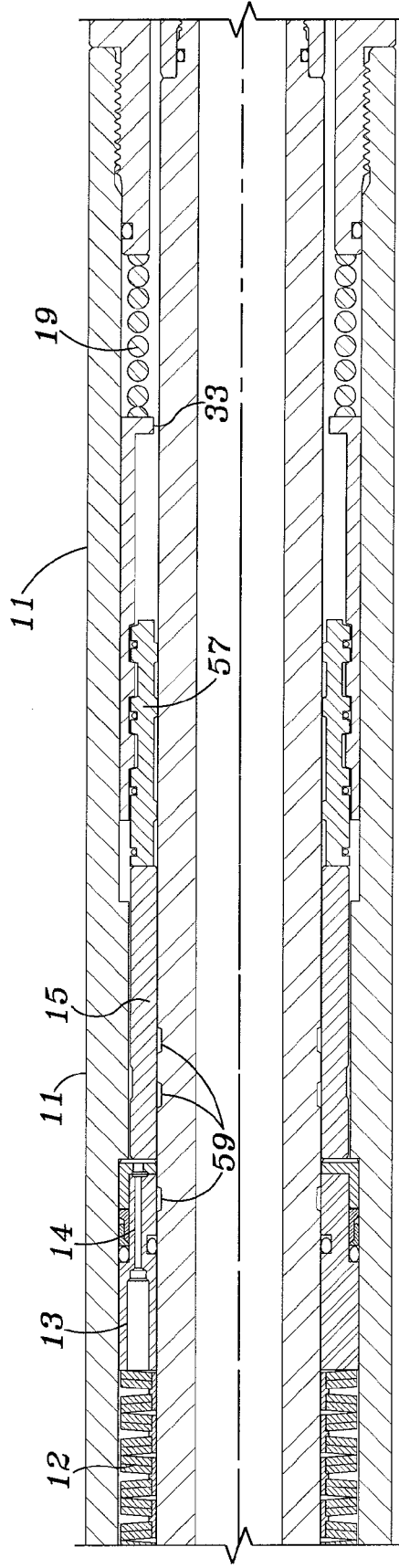


FIG. 8

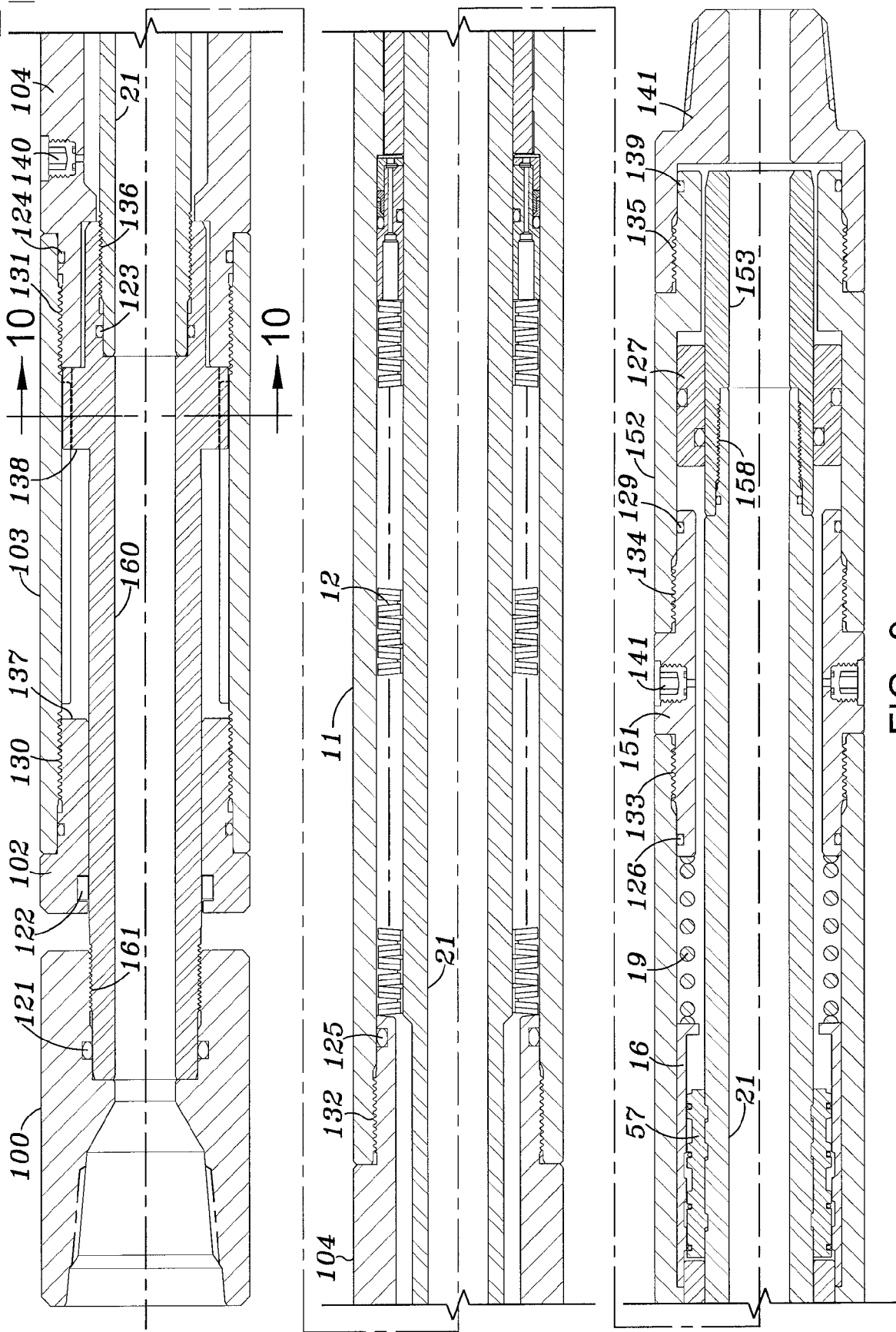


FIG. 9

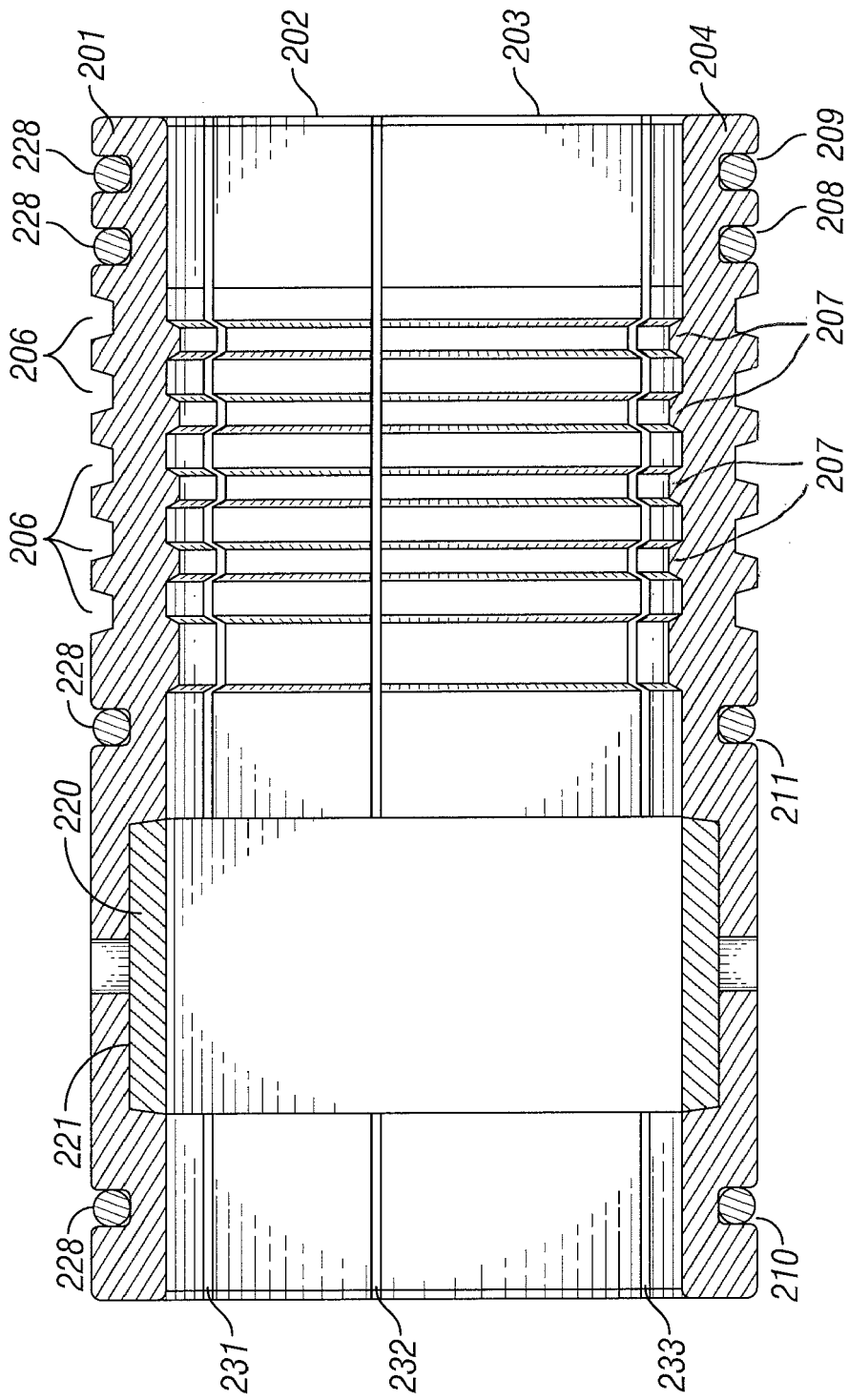


FIG. 11



PARTIAL EUROPEAN SEARCH REPORT

Application Number

under Rule 62a and/or 63 of the European Patent Convention.
This report shall be considered, for the purposes of subsequent proceedings, as the European search report

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| | | | TECHNICAL FIELDS SEARCHED (IPC) |
| | | | E21B |
| INCOMPLETE SEARCH | | | |
| The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out. | | | |
| Claims searched completely : | | | |
| Claims searched incompletely : | | | |
| Claims not searched : | | | |
| Reason for the limitation of the search: see sheet C | | | |
| Place of search | | Date of completion of the search | Examiner |
| Munich | | 23 October 2019 | Pieper, Fabian |
| CATEGORY OF CITED DOCUMENTS | | | |
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EPO FORM 1503 03.82 (P04E07)



**INCOMPLETE SEARCH
SHEET C**

Application Number
EP 19 17 2632

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Claim(s) completely searchable:
1-5, 11

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Claim(s) not searched:
6-10

Reason for the limitation of the search:

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The search has been restricted to the subject-matter indicated by the applicant in his letter of 12-09-2019 filed in reply to the invitation pursuant to Rule 62a(1).

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

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5 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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23-10-2019

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