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LINER HANGER PACKER

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Fig. 1

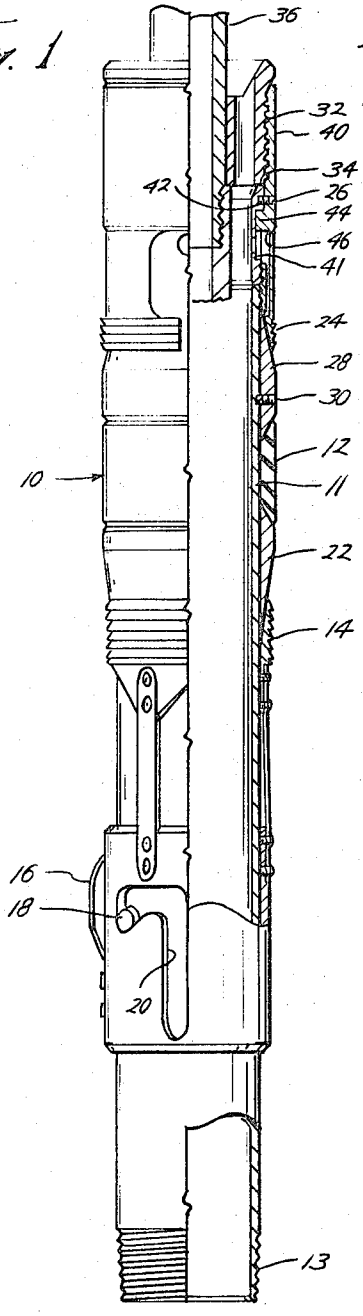
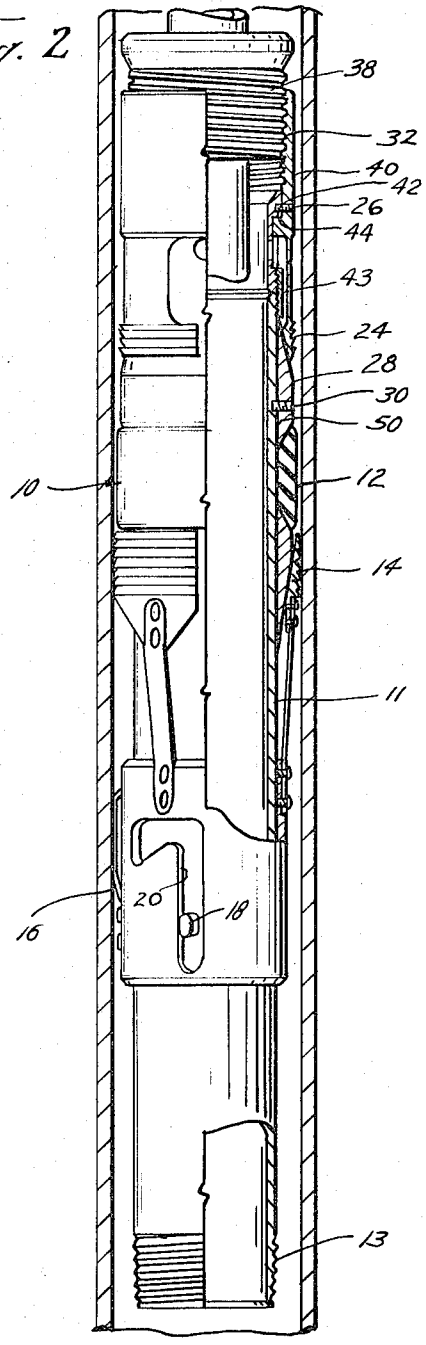


Fig. 2



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LINER HANGER PACKER

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ABSTRACT OF THE DISCLOSURE

A liner hanger packer having a sealing member about a tubular body with hanging slips positioned below the sealing member, said holddown slips positioned above the sealing member with a hanger support member slidably connected to the body and connected to the holddown slips including a threaded connection for support from a setting tool with the threads extending adjacent the upper end of the body whereby a downward force can be directed through the body by the setting tool without setting the holddown slips. Shear means between the holddown slips and the body and second shear means between the holddown slips cone having a higher shearing strength than the first shear means, and shoulder means between the body and the holddown slips whereby when the body is raised relative to the holddown slips the holddown slips are retracted, and releasing means connected between the body and the hanging slips normally holding the hanging slips in a retracted position.

The present invention relates to a liner hanger packer, and more particularly, relates to a liner hanger having a packer and holddown slips for supporting a liner in a well bore.

SUMMARY

The present invention is directed to a liner hanger packer having a packer about a tubular body, hanging slips releasably connected to the body and positioned below the packer and holddown slips slidably positioned about the body and above the packer in which a hanger support member is slidably connected to the body and connected to the holddown slips and includes internal threads for connection to a setting tool which is abutted against the upper end of the body so that its downward setting force can be exerted through the body by the setting tool without setting the holddown slips and in which a first shear means is provided between the holddown slips and the body and a second shear means is provided between a cone connected to the holddown slip assembly and having a higher shearing strength than the first shear means and shoulder means is provided between the body and the holddown slips so that when the body is raised relative to the holddown slips the holddown slips may be retracted and the packer retrieved.

Generally, it is an object of the present invention to provide a liner hanger with holddown slips and a pack off which is fully retrievable.

Further, it is an object of the present invention to provide a liner hanger having a packer and holddown slips which will not set prematurely but can be hung at any point in the well bore without having to tag bottom, which has a large bypass area for the passage of tools and prevention of hangup by gravel packing, and which is fully retrievable.

A still further object of the present invention is the provision of a liner hanger packer having holddown slips connected to a hanger support member including internal threads extending to the body of the hanger so that a setting tool can set the hanging slips without prematurely setting the holddown slips and in which the body includes a shoulder positioned to retract the holddown slips so that the hanger may be fully retrieved by lifting it by either the support member or the internal surface of the body.

Still a further object of the present invention is the provision of a liner hanger packer having a tubular body with a sealing member about a portion of the body, hanging slips about the body below the packer for supporting the hanger in the well bore and which is provided with holddown slips slidably positioned about the body above the sealing member and held in a normally retracted position, and a hanger support member slidably connected to the body and to the holddown slips and which includes internal threads for connecting to a setting tool with the threads extending to the upper end of the body so that a downward force can be exerted through the body by the setting tool for setting the hanging slips without setting the holddown slips and shoulder means between the body and the holddown slips whereby when the body is moved upwardly relative to the holddown slips the holddown slips may be retracted and the hanger retrieved.

A still further object of the present invention is the provision of a liner hanger having a packer and holddown slips in which shear pins are connected between the hanger body and both the holddown slips and the cone in contact with the holddown slips, the shear pin between the cone and the body having a greater strength than the shear pin between the slips and the body whereby the slips may be accurately set and retracted at the proper time.

Other and further objects, features and advantages will be apparent from the following description of presently preferred embodiments of the invention, taken in conjunction with the accompanying drawing, where like character references designate like parts throughout the several views, and where,

FIGURE 1 is an elevational view, partly in cross-section of one embodiment of the liner hanger packer of the present invention, and

FIGURE 2 is an elevational view, partly in cross-section illustrating the apparatus of FIGURE 1 in a partially set position.

Referring now to the drawing, the reference numeral **10** generally indicates the liner hanger packer of the present invention which generally includes a tubular body **11**, a sealing member or packer **12**, hanging slips **14**, and holddown slips **24**. The body **11** generally includes a threaded connection **13** at its lower end for connection to a suitable liner (not shown). The top end of the apparatus **10** is connected to a setting tool **36** for connection in a string to the well surface .

The packer **12** may be of any suitable material such as rubber or lead and is slidably positionel about the exterior circumfrenece of a portion of the body **11**. A first or lower cone **22** is slidably positioned about the body **11** below and against the sealing packer **12** for movement against the packer for expanding the packer outwardly in a sealing relationship with a casing (not shown). The hanging slips **14** are normally held in a retracted position by suitable releasing means as the apparatus **10** is lowered into the well bore. The releasing means may be conventional bow springs **16** connected to the slips **14**, a jay slot **20** also connected to the slips **14** and a pin **18** moveable in the jay slot and connected to the body **11**. Thus, the hanging slips **14** may be set by lifting up on the body **11** and rotating the body **11** counterclockwise from the surface thus releasing the pin **18** for movement into the long leg of the jay slot. Further downward movement of the body **11**, as best seen in FIGURE 2, will cause the slips **14** to ride upon the cone **22** expanding the sealing packer **12** outwardly and moving the slips **14** outwardly into engagement with a well casing for supporting the apparatus **10** in the casing.

A support member 40 is provided in slidable engagement with the body 11 and supporting shoulders 42 and 44 are provided on support 40 and the body 11, respectively for supporting the body 11 from the member 40. The support member 40 includes connecting means such as threads 32 for connection to and support by a connecting nut 38, which is part of the setting tool 36, for supporting the apparatus 10 from a conventional setting tool 36. Preferably, the connecting means 32 are left handed threads which it is noted extend to the upper end 34 of the body 11 so that the connecting nut 38 may be made up in the apparatus 10 against the upper end 34 of the body 11. Thus, as best seen in FIGURE 1, a downward force may be exerted through the setting tool 36 directly to the body 11 by the setting tool to actuate and set the hanging slips 14 without shearing the shear pin connection 26 which is provided between the support 40 and the body 11, and prematurely setting the holddown slips 24.

After the hanging slips 14 are set, the setting tool 36, which includes a kelly joint, may be rotated, for example four times to the right thus backing the connecting nut 38 away from the upper end 34 of the body 11 as seen in FIGURE 2. Any suitable non-rotatable means such as spline 41 may be provided between member 40 and the body 11 to allow rotation between the tool 36 and the member 40. A downward force may again be exerted on the setting tool 36 and the connecting nut 38 for moving the holddown slips 24 downwardly on an upper or second cone 28 for setting the holddown slips 24 by shearing shear pin 26.

The second cone 28 is positioned around the outer circumference of the body 11 and adjacent the packer 12. In order to prevent setting of the holddown slips 24 when the hanging slips 14 are set, the cone 28 is prevented from relative movement to the body 11 by suitable means such as a shear pin 30 connected between the upper cone 28 and the body 11 or by an abutting shoulder means such as a coupling 43 secured about the body 11, or both. It is advantageous to have pin 30 set at a much higher shear strength than the shear pin 26, and only sheared and released to allow relative movement between the body 11 and the upper cone 28 on a predetermined force during retrieval. Pin 30 thereby prevents premature releasing of the holddown slip 24.

After the apparatus 10 is set in the casing with both the hanging slips 14 and the holddown slips 24 actuated, conventional operation of the setting tool and the liner such as for gravel packing may be carried out after which the working string and the setting tool 36 may be released from the apparatus 10 and removed from the well bore.

When it is desired to remove the liner hanger apparatus 10 from the well bore, the nut 38 or any conventional spear may be utilized to catch the inside of the liner for fully retrieving the liner without leaving fragments or junk in the well bore. For instance, if the nut 38 is connected to the inside of the internal threads 32 in the supporting member 40 the supporting member 40 can be moved upwardly and since it is connected to the holddown slips 24, the slips 24 will be retracted from the cone 28 which is held in place by the coupling 43 and/or the shear pin 30 to release the holddown slips 24 and thereby removing the entire apparatus 10. However, since it may be difficult to spear member 40, as an alternative a spear may be used to catch the inside of the body 11 of the apparatus 10 and on an upward pull will shear the pin 30 allowing relative movement between the body 11 and upper cone 28 allowing the coupling 43 to move upwardly and contact a releasing shoulder 46 connected to the slips 24 thereby retracting the slips 24 off of the cone 28. Thus, the apparatus 10 is fully retrievable and after removal from the well bore the shear pins 26 and 30 and the packer 12 may be replaced and is readily reusable.

In operation, the setting tool is made up connected to the liner hanger apparatus 10, as shown in FIGURE 1, with the connecting nut 38 made up fully to rest against and contact the upper end 34 of the body 11, and the liner (not shown) is connected to the threads 13 at the lower end of the body 11. After placing the apparatus 10 in the hole at the desired location the working string is picked up and turned approximately one-half turn to the left to unjay the pin 18 and move it to the long leg of the jay slot 20 thereby allowing the hanging slips 14 to be actuated by slacking off on the working string to move the slips 14 up the incline of the lower cone 20 and moving the cone 20 against the sealing packer 12 to expand it to a sealing relationship with the casing (not shown). At this point the apparatus 10 is supported in the well bore. The setting tool 36 is then rotated, for example approximately four turns to the right to back off the connecting nut 38 from engagement with the upper end 34 of the body 11. The tool is now in the position shown in FIGURE 2. Then a downward force is applied by the working tool 36 to the support member 40. While the shear pin 26 may be omitted it is useful in indicating that a downward force, for example 6000 lbs. must be exerted to shear pin 26 and to insure that the holddown slips 24 will be securely set as they move downwardly over the upper cone 28 into engaging position. Thus, the liner hanger 10 is set in both an upward and downward direction and any other conventional hanger operation can take place after which the working string and the setting tool 36 are rotated and removed from the well bore.

If it becomes desirable to retrieve the hanger liner 10, the setting tool 36 can be run into the hole and the connecting nut 38 threaded into the engaging thread 32 and picked up which will retract the holddown slips 24 and retrieve the apparatus 10 intact. The liner hanger 10 can also be retrieved with a conventional spear that will catch the inside of the liner body 11 by shearing the pin 30 thereby allowing the liner body 11 to be moved relative to the cone 28 and the holddown slips 24 until the coupling 43 engages the contacting shoulder 46 on the holddown slips 24 thereby retracting them from the upper cone 28 and releasing the liner hanger 10 from the casing. Normally the shear pin 30 is set for a high shearing force, for example 60,000 pounds to insure that the holddown slips 24 are not released accidently. Thus, the liner hanger 10 in fully retrievable.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein. While a presently preferred embodiment of the invention is given for the purpose of disclosure, numerous changes in the details of construction and arrangement of parts can be made which will readily suggest themselves to those skilled in the art and which are encompassed within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A liner hanger packer comprising,
a tubular body,
a sealing member about a portion of the body,
a first cone movably positioned on said body and below the sealing member,
hanging slips slidably positioned about the body and adjacent the first cone,
releasing means connected between the body and said hanging slips normally preventing the hanging slips moving relative to the body,
a second cone positioned about the body and above the sealing member,
holddown slips slidably positioned about the body adjacent the second cone,
a hanger support member slidably connected to the body and connected to the holddown slips and including internal threads for connection to a setting tool, said threads extending to the upper end of the body whereby a downward force can be exerted di-

rectly through the body by a setting tool without setting the holddown slips,

nonrotatable means between the support member and the body for transmitting rotative movement between the member and the body,

contacting shoulders between the support member and the body for supporting the body from the support member, and

shoulder means between the body and the holddown slips whereby when the body is raised relative to the holddown slips the holddown slips are retracted.

2. The apparatus of claim 1 including,

shear means between the holddown slips and the body holding the slips in a retracted position.

3. The apparatus of claim 1 including,

first shear means between the holddown slips and the body holding the slips in a retracted position,

second shear means between the second cone and the body, said second shear means having a higher shearing strength than said first shear means, and

shoulder means between the body and the holddown slips whereby when the body is raised relative to the holddown slips the holddown slips are retracted.

4. In a liner hanger packer having a tubular body, a sealing member about a portion of the body, a first cone movably positioned on said body and below the sealing member, hanging slips slidably positioned about the body adjacent the first cone, releasing means connected between the body and the hanging slips normally holding the hanging slips in a retracted position relative to the first cone, the improvement comprising,

a second cone positioned about the body and above the sealing member,

holddown slips slidably positioned about the body adjacent the second cone,

shear means connected between the holddown slips and the body for normally holding the holddown slips in a retracted position,

hanger support member slidably connected to the body and connected to the holddown slips and including left handed threads for connection to a setting tool, said threads extending adjacent the upper end of the body whereby downward force can be exerted directly through the body by a setting tool without setting the holddown slips,

contacting shoulders between the support member and the body for supporting the body from the support member, and

shoulder means between the body and the holddown slips whereby when the body is raised relative to the holddown slips the holddown slips are retracted.

5. In a liner hanger packer having a tubular body, a sealing member about a portion of the body, the first cone movably positioned on said body and below the sealing member, hanging slips slidably positioned about the body adjacent the first cone, releasing means connected between the body and the hanging slips normally holding the hanging slips in a retracted position relative to the first cone, the improvement comprising,

a second cone movably positioned about the body and above the sealing member,

holddown slips slidably positioned about the body adjacent the second cone,

first shear means connected between the holddown slips and the body for normally holding the holddown slips in a retracted position,

second shear means between the second cone and the body, said second shear means having a higher shearing strength than said first shear means,

hanger support member slidably connected to the body and connected to the holddown slips and including internal threads for connection to a setting tool, said threads extending to the upper end of the body whereby a downward force can be exerted directly through the body by a setting tool without setting the holddown slips,

a retraction shoulder on the holddown slips positioned to be engaged by the coupling when the body is raised relative to the holddown slips for releasing the holddown slips.

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