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Fisher, Jr. et al.

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[54] **GRIPPING MEMBER FOR WELL TOOLS OR THE LIKE**

[75] Inventors: **Ernest Pillow Fisher, Jr.**, Carrollton; **David Lewis Abney, Jr.**, Stafford, both of Tex.

[73] Assignee: **Dresser Industries, Inc.**, Dallas, Tex.

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[52] **U.S. Cl.** **166/216,** 166/134

[51] **Int. Cl.** **E21b 23/00**

[58] **Field of Search** 166/206, 216, 217, 134

[56] **References Cited**

UNITED STATES PATENTS

3,664,417	9/1970	Conrad	166/216
3,548,936	12/1970	Kilgore	166/217

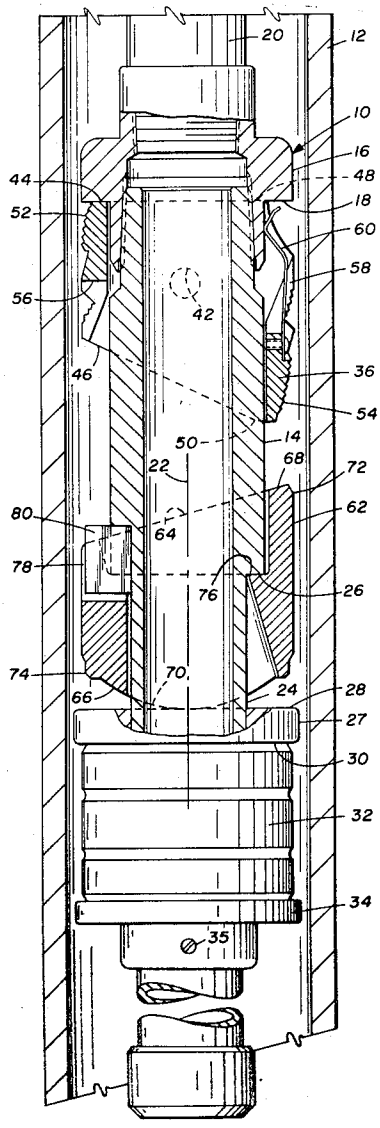
Primary Examiner—James A. Leppink

Attorney, Agent, or Firm—John N. Hazelwood; William E. Johnson, Jr.; Michael J. Caddell

[57] **ABSTRACT**

The improved gripping member disclosed herein includes a unitary body arranged to encircle a portion of the well tool and having upper and lower ends and a wall engaging portion located adjacent the upper and lower ends. The wall engaging portions are disposed on relatively opposite sides of the unitary body. The gripping member is arranged to move on the well tool from a retracted position wherein the wall engaging portions are out of engagement with the wall and a holding position wherein the wall engaging portions are in engagement with the wall. Means, for example a pair of bow springs are disposed on the unitary body on opposite sides thereof and at a generally normal position relative to the location of the wall engaging portions. The bow springs are arranged to extend into frictional engagement with the wall of the well bore to resist movement of the gripping member therethrough so that other portions of the well tool can be moved relatively to the gripping member when desired.

6 Claims, 3 Drawing Figures



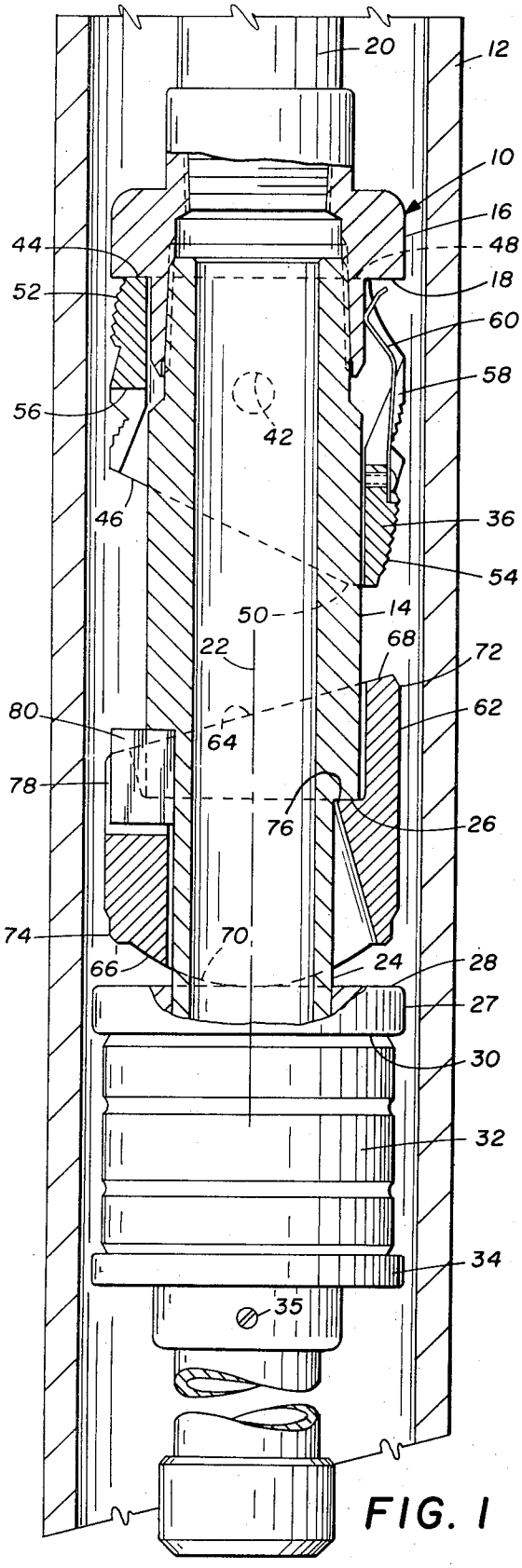


FIG. 1

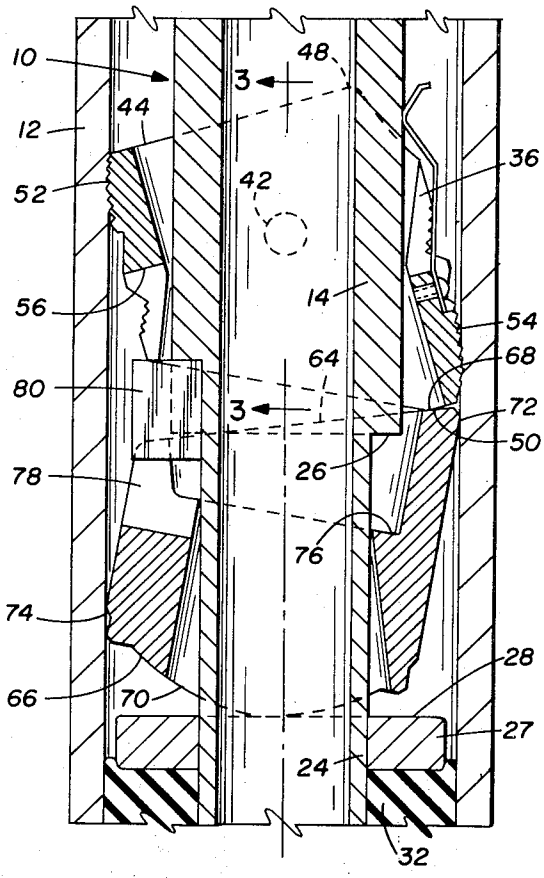


FIG. 2

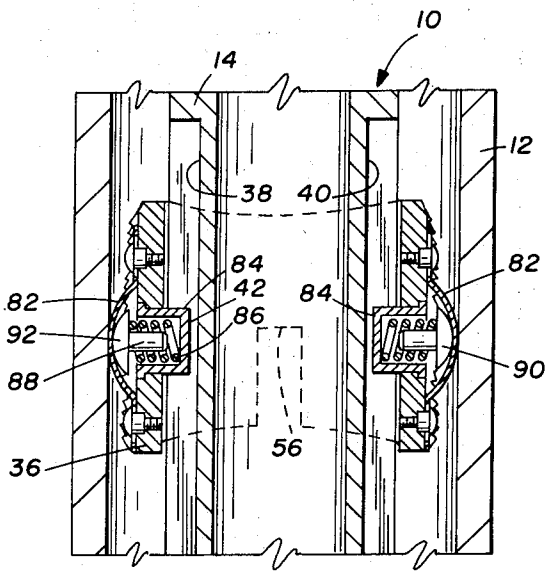


FIG. 3

GRIPPING MEMBER FOR WELL TOOLS OR THE LIKE

BACKGROUND OF THE INVENTION

This invention relates generally to improved gripping members for well tools or the like. More particularly, but not by way of limitation, this invention relates to an improved unitary type gripping member having drag members or the like integrally located thereon.

U.S. Pat. No. 3,548,936, issued Dec. 22, 1970, to M. D. Kilgore, et al., illustrates a number of packer embodiments incorporating unitary gripping members. That patent also clearly discloses the function and operation of the unitary gripping member.

As will be apparent to those skilled in the art of well tools, it is necessary to downhole tools to provide some means for providing relative movement between various parts of the tool while the tool is disposed in the well bore. One means utilized in the past for providing such relative movement has been to utilize either drag springs or drag blocks which are resiliently biased outwardly into engagement with the casing. Several variations of the drag spring/drag block arrangement are shown in the above-mentioned U.S. patent. Such drag springs or drag blocks have usually been carried in a body mounted on the well tool that is releasable when it is desired to cause the relative movement of the parts, such as during the setting of the well tool in the well bore. Providing such drag blocks and drag springs on a separate body not only increases the cost of the manufacture of the well tool, but also increases the length and weight of the tool.

Accordingly, it is one object of this invention to provide an improved gripping member having the drag member mounted directly on the gripping member.

Another object of the invention is to provide an improved gripping member for well tools which permits the overall cost of the tool to be reduced by the use of the improved gripping member having drag members thereon.

Still another object of the invention is to provide an improved gripping member which permits the overall weight and size of the tool to be reduced by the use of the gripping member having drag members thereon.

SUMMARY OF THE INVENTION

The improved gripping member of this invention includes: a unitary body member having top and bottom ends and having a casing engaging portion located adjcent each of the top and bottom ends. The casing engaging members are located on relatively opposite sides of the unitary body member. The improved gripping member also includes a drag member located on each side of the unitary body member and mounted thereon and arranged to extend outwardly into engagement with the wall of the well bore. The drag members are constructed in such a manner that they are resiliently urged outwardly into frictional engagement with the wall of the well bore.

The foregoing and additional objects and advantages of the invention will become more apparent as the following detailed description is read in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a view, partly in elevation and partly in cross-section, illustrating a packer having a gripping member thereon that is constructed in accordance with the invention.

FIG. 2 is a view of a portion of FIG. 1 showing the components thereof in another operating position.

FIG. 3 is a transverse cross-sectional view of a portion of FIG. 2 taken generally along the line 3—3 of FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing and to FIG. 1 in particular, shown therein and generally designated by the reference character 10 is a well packer incorporating gripping means that is constructed in accordance with the invention. The well packer 10 is illustrated as being disposed in a casing 12 that is located in a well bore (not shown).

The well packer 10 includes a tubular body or mandrel 14 that is threadedly connected at its upper end with an adaptor 16 that provides a downwardly facing shoulder or abutment 18. The adaptor 16 is threadedly connected with a conduit or running-in string 20 that extends to the surface of the well bore. The conduit 20 is utilized for the purpose of moving the well packer 10 through the well bore.

The tubular body 14 and packer 10 has a longitudinal or axial centerline 22 that is coincident with the centerline of the casing 12 when the packer 10 is concentrically disposed therein. The tubular body 14 includes a portion 24 of reduced diameter forming a downwardly facing, exterior flange 26 for purposes that will be explained hereinafter. It will be noted that the reduced diameter portion 24 extends through a flange or abutment member 27 which is slidingly positioned thereon.

The abutment member 27 provides an upwardly facing surface 28 and a downwardly facing surface 30 that is in engagement with deformable packing 32. The lower end of the packing 32 is in engagement with an abutment 34 that is attached to the tubular body 14 by one or more shear screws 35. It will be appreciated that movement of the abutment member 27 and the abutment 34 relatively together will deform the packing 32 into sealing engagement with the casing 12 and with the tubular body 14 in a manner well known in the well packer art.

Encircling the tubular body 14, just below the downwardly facing shoulder 18, is a gripping member 36 that is arranged for both sliding and pivoting movement with respect to the tubular body 14. To provide such movement, the exterior of the tubular body 14 is provided with a pair diametrically opposed slots 38 and 40 (see FIG. 3). Pivot means 42 carried by the gripping member 36 are located in the slots 38 and 40 and will be described in more detail hereinafter.

The gripping member 36 illustrated includes an upper end 44 and a lower end 46 that are angularly disposed with respect to each other. The upper end 44 includes a contact portion 48 that is offset from the pivot axis of the gripping member 36 in a direction to cause the gripping member 36 to rotate toward the retracted position illustrated in FIG. 1 when in engagement with the downwardly facing shoulder 18.

The lower end 46 on the gripping member 36 includes a contact portion 50 that is offset from the pivot axis of the gripping member 36 in the same direction

as was contact portion **48.** It can be seen that engagement of the contact portion **50** will cause the gripping member **36** to pivot toward the casing engaging portion illustrated in FIG. **2.**

The gripping member **36** also includes an upper gripping portion **52** and a lower gripping portion **54** disposed adjacent the upper and lower ends **44** and **46** respectively. The gripping portions **52** and **54** are preferably provided with teeth to enhance their frictional engagement with the casing **12.**

The gripping member **36** is relieved from the bottom end **46,** providing a downwardly facing shoulder **56** thereon. Similarly, the gripping member **36** is relieved from the upper end **44** providing an opening **59** through which a leaf-type spring **60** extends. The spring **60** has one end that is attached to the gripping member **36** and the other end frictionally engaging the tubular body **14** resiliently urging the gripping member **36** toward the retracted position shown in FIG. **1.**

Encircling the tubular body **14** between the gripping member **36** and the movable abutment member **27** is an articulated head **62.** The articulated head **62** includes a top end **64** and a bottom end **66.** The top end **64** includes a contact portion **68** that is engagable with the contact portion **50** on the lower end **46** of the gripping member **36.** The bottom end **66** of the head **62** includes an arcuate contact portion **70** configured in such a manner that the contact portion **70** engages the movable abutment member **27** along a line extending through and disposed normally to the centerline **22.**

The head **62** also includes an upper casing engaging portion **72** located adjacent to the top contact portion **68** and a lower casing engaging portion **74** located adjacent to the bottom end **66** and on the relatively opposite side of the head **62** from the contact portion **72.** The head **62** has been counterbored from the top end **64** providing an upwardly facing shoulder **76,** which when in the retracted position, is in engagement with the downwardly facing flange **26** on the tubular body **14** to aide in retaining the head **62** in the retracted position shown in FIG. **1** as the well packer **10** is lowered into the well bore.

A slot **78** extends from the top end **64** of the head **62** and is sized to receive a lug **80** which is welded to or otherwise secured to the tubular body **14.** The lug **80,** in cooperation with the slot **78,** aides in maintaining the head **62** in alignment with the gripping member **36** so that the contact portions **50** and **68** will be in the proper position for engagement during the operation of the well packer **10.** The lug **80** also functions during the retrieval of the well packer **10** to engage the downwardly facing shoulder **56** in the gripping member **36** to move the gripping member **36** from the set or casing engaging position to the retracted position.

It is necessary in the operation of the well packer **10** to provide some means for affording relative movement between various parts of the packer **10.** The transverse cross-section of FIG. **3** illustrates the structure of drag springs **82,** which are directly mounted on the gripping member **36** and are resiliently biased into frictional engagement with the casing **12.**

As can be seen therein, the pivot means **42** includes a pair of pivot bushings or members **84** that extend through the wall of the gripping member **36** and project into the slots **38** and **40** formed in the tubular body **14.** The bushings **84** are each counterbored to receive a coil spring **86** which encircles stem **88** of pins **90.** Each of the pins **90** has an enlarged head **92** that engages one end of the springs **86** while the other end of the springs **86** is in engagement with the bushings **84.** The arrangement is such that the springs **86** bias the pins **90** outwardly against the interior of the drag springs **82.** If the drag springs **82** have sufficient spring characteristics and will afford a sufficient life for the operation of the well packer **10,** the pins **90** and springs **86** can be omitted.

It should be pointed out that the provision of the drag springs **82** directly on the gripping member **36** is an arrangement not heretofore known and affords the advantage of being able to omit a separate drag spring or drag block assembly and, thus, shorten the overall length of the well packer as well as considerably decreasing the cost.

OPERATION OF THE PREFERRED EMBODIMENT

With the conduit **20** connected to the packer **10,** the packer **10** is lowered into the casing **12** until the packer **10** reaches the desired location in the well bore. As the packer **10** moves downwardly, the drag springs **82** are in frictional engagement with the casing **12** so that the gripping member **36** rides upwardly in the slots **38** and **40** engaging the upper end **44** of the gripping member **36** in with the shoulder **18.** Such engagement, plus the action of the spring **60,** retains the gripping member **36** in the retracted position.

It should also be noted that the upwardly facing annular shoulder **76** on the articulated head **62** will remain in engagement with the downwardly facing shoulder **26** on the tubular body **14.** With the shoulders **26** and **76** in engagement, the articulated head **62** remains in the retracted position illustrated in FIG. **1.**

After the packer **10** has reached the desired position in the casing **12,** the conduit **20** is raised pulling the tubular body **14** upwardly therewith. Due to the frictional engagement of the drag springs **82** with the casing **12,** the gripping member **36** remains in a relatively fixed position. The upward movement of the tubular body **14** carries the lower abutment **34** upwardly, raising the packer **32,** the movable abutment member **27,** and the articulated head **62** therewith toward the relatively fixed gripping member **36.**

Continued upward movement of the tubular body **14** brings the contact portion **68** on the upper end **64** of the head **62** into engagement with the contact portion **50** on the lower end **46** of the gripping member **36.** When this occurs, the gripping member **36** is pivoted about the pivot means **42** until the casing engaging portions **52** and **54** thereon frictionally engage the casing **12** locking the gripping member **36** in the casing **12.**

Simultaneously, the articulated head **62** rotates or pivots on the tubular body **14** until the casing engaging portions **72** and **74** thereon are in engagement with the casing **12** as illustrated in FIG. **2.** The lower contact portion **70** of the articulated head **62** is in engagement with the movable abutment member **27** along a line that extends through and normal to the axial centerline **22** of the tubular body **14.**

From the foregoing, it can be seen that the gripping member **36** due to the location of the casing engaging portions **52** and **54** thereon and the offset location of the contact portion **68** on the lower end **46** will normally have a tendency to exert an eccentric load on anything engaging the contact portion **68.** To compen-

sate for this, the articulated head **62** is pivoted in an opposite direction to the pivotal direction of the gripping member **36** and engages the casing through casing engaging portions **72** and **74** to transfer the lateral component of the eccentric loading force into the casing **12** thereby counteracting any moment that the gripping member **36** may impose. Further, the arrangement of the contact portion **70** on the head **62** prevents the imposition of any, other than a load parallel to the centerline **22** from being imposed upon the movable abutment member **27.** Thus, the packer **10** will remain substantially concentric with the casing **12** during the imposition of setting forces on the packer **10.**

After the gripping member **36** has been set, additional upward movement of the tubular body **14** moves the fixed abutment **34** relatively toward the movable abutment member **27** deforming the packing **32** therebetween. The packing **32,** under the force imposed by the fixed abutment **34,** deforms into fluid-tight sealing engagement with the tubular body **14** and with the casing **12.**

To remove the packer **10** from the well bore, additional upward force is imposed upon the conduit **20** and tubular body **14** until the shear screws **35** part permitting the tubular body **14** to move upwardly relative to the gripping member **36.** The upward movement of the tubular body **14** continues until the lug **80** thereon engages the downwardly facing shoulder **56** on the gripping member **36.** This engagement forces the gripping member **36** to rotate from the set position illustrated in FIG. **2** to the retracted position illustrated in FIG. **1.**

After the gripping member **36** has been released, the head **62** is returned to its retracted position and the movable abutment member **27** moves relative to the fixed abutment **34** permitting the packing **32** to return to its undeformed condition. After the foregoing has occurred, it is only necessary to continue raising the conduit **20** to remove the well packer **10** from the well bore.

From the foregoing, it should be apparent that a well packer constructed in accordance with this invention includes a unitary gripping member and means associated therewith that prevents the imposition of a moment on the packer which would otherwise tend to move the packer out of concentricity with the casing and thus interfere with the setting of the packer in the well.

Not only does a packer constructed in accordance with this invention avoid the nonconcentric location of the packer, but it also avoids the imposition of eccentric loads on moving parts of the packer which could and, have in the past, occasionally resulted in the jamming of the moving parts.

As will be apparent from the foregoing, the provision of the drag means directly on the gripping member avoids the necessity for providing a separate drag body. The elimination of the separate drag body permits the packer to be reduced in length and complexity with the attendant reduction in size, weight, and cost.

It will be understood that the embodiment described in detail hereinbefore is presented by way of example only and that many changes and modifications can be made thereto without departing from the spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Gripping apparatus arranged to be moveably mounted on a well tool and arranged to engage a well bore wall or the like to hold the well tool in the well bore, said apparatus comprising:

a unitary tubular gripping member having first and second ends, said gripping member being pivotally mounted on said well tool;

a bore extending through said gripping member intersecting said ends for receiving a portion of the well tool;

a plurality of gripping teeth adjacent each end of and located on generally opposite sides of said gripping member, the distance between said toothed portions being greater than the diameter of the well bore whereby said toothed portions can engage the well bore wall; and

a portion intermediate said ends having a dimension less than the diameter of the well bore, whereby the well tool can move through the well bore; and,

friction means on said gripping member for engaging the well bore wall, whereby the well tool can be moved telescopically through said gripping member.

2. The gripping apparatus of claim **1** wherein said means for frictionally engaging the well bore wall includes at least a pair of members resiliently biased relatively outwardly with respect to said body member toward the well bore.

3. The gripping apparatus of claim **1** wherein said means for frictionally engaging the well bore wall includes:

at least a pair of outwardly-bowed, leaf springs;

a pin having an enlarged head engaging each said leaf spring; and,

a coil spring for each said leaf spring encircling each said pin and having one end engaging said body member and another end engaging the heads of said pins resiliently biasing said leaf springs relatively outwardly toward the well bore wall.

4. The gripping apparatus of claim **1** and also including:

a pair of aligned holes extending through the wall of said body member at approximately 90° relative to the location of said wall engaging portions; and,

a pivot member positioned in each of said holes and projecting into said bore forming a pivot axis for said body member.

5. The gripping apparatus of claim **5** wherein:

said pivot members include a bore extending partially therethrough from the exterior of said body member; and,

said means for frictionally engaging the well bore wall includes

an outwardly bowed, leaf spring overlying each said pivot member, and

mean engaging said pivot members and said leaf springs for resiliently biasing said leaf springs toward the well bore wall.

6. The gripping apparatus of claim **5** wherein said means engaging said pivot members and leaf springs includes:

a pin disposed in the bore of each said pivot member and having a head portion in engagement with said leaf springs; and,

a coil spring encircling each said pin having one end engaging said pivot members and another end engaging the head portion of said pins resiliently urging said pins outwardly into engagement with said leaf springs.

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