

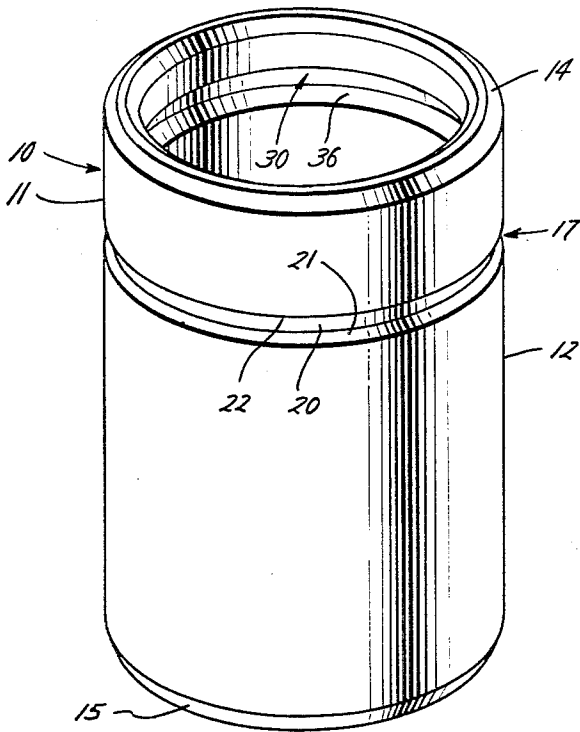
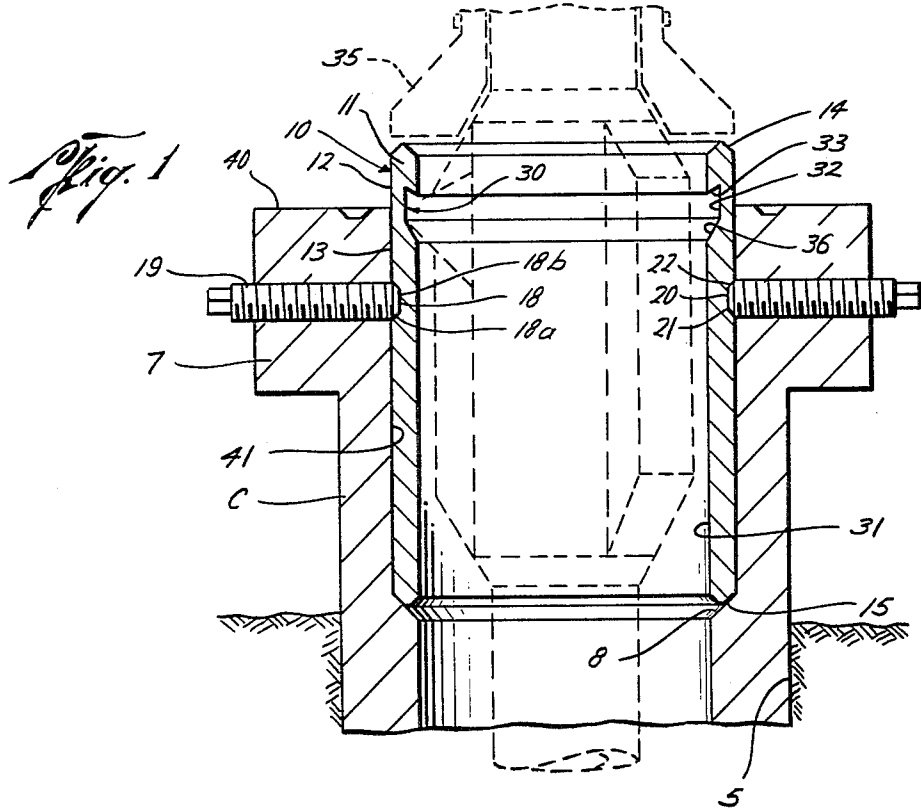
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I. CASTILLE

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BUSHING FOR CASING DURING ROTARY DRILLING OPERATIONS

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*Fig. 2*

Ignace Castille  
INVENTOR

BY

Hayden Pravel Wilson & Matthews  
ATTORNEYS

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**BUSHING FOR CASING DURING ROTARY  
 DRILLING OPERATIONS**

Ignace Castille, P.O. Box 2697, Lafayette, La. 70501

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3 Claims

**ABSTRACT OF THE DISCLOSURE**

A wear and protective bushing which can be inserted and removed by suitable apparatus in tubular members, such as casing, during rotary drilling operations which is constructed to facilitate positioning thereof during use as well as quick and ready removal when desired.

**CROSS REFERENCE TO RELATED APPLICATION**

The present invention shows a form of wear and protective bushing which is particularly adapted to be used with the seating and retrieving apparatus as disclosed and claimed in my copending application filed in the United States Patent Office on Feb. 19, 1968, and bearing Ser. No. 706,598 for "Seating and Retrieving Tool for Wear and Protective Bushings in Casing During Rotary Drilling Operations."

**BACKGROUND OF THE INVENTION**

Field of the invention

The present invention relates to a wear and protective bushing having a generally hollow tubular body with an outer cylindrical surface thereon for slidably fitting within a tubular member such as a casing that is positioned in a hole that is being drilled in the earth, the hollow tubular body having upper and lower ends thereon and an outer and inner cylindrical surface. A groove extends about the outer cylindrical surface in a plane perpendicular to the longitudinal axis of the hollow tubular body which is adapted to be engaged by suitable means such as bolts or the like for positioning the bushing within the tubular casing, and a groove is formed on the inner cylindrical surface, the groove on the inner cylindrical surface being formed of three surfaces, one of which forms the bottom of the groove, the second surface forming the upper end of the groove and being inclined inwardly and downwardly in a plane relative to the longitudinal axis of the hollow tubular body, and the third surface forming the lower, or the other end, of the groove and also being inclined in a plane downwardly and inwardly relative to the longitudinal axis of the groove so that the upper end of the groove provides an overhanging portion for engagement with an apparatus to facilitate positioning of the tubular body within the casing, and the lower end of the groove facilitating disengagement of the apparatus with the hollow tubular body after it has been positioned in the casing.

Description of the prior art

Various types of wear and protective bushings have been provided for casing during drilling operations to protect the upper end of the casing adjacent its upper end from engaging the drill bit as the drill bit is lowered into and removed from the casing during drilling operations and for inhibiting contact of the drill pipe with the casing adjacent its upper end as the drill pipe is rotated during normal rotary drilling operations so that a smooth surface is retained within the casing adjacent its upper end in order to inhibit leaks at the wellhead upon completion of the drilling operations and after the wellhead has been connected for conducting fluids from the well bore.

However, all of such devices are generally objectionable in that, first of all, such bushings heretofore incorporated grooves and slot arrangements for engaging with a positioning tool, wherein the positioning tool or apparatus must be precisely aligned with a slot and then moved or rotated in a predetermined direction to first engage with the bushing, which stepwise procedure must be reversed to disengage the apparatus from the bushing after it is seated in the casing. Thus, it has been awkward and difficult as well as time consuming, heretofore, to initially position the bushing within the casing as well as easily and quickly remove the bushing therefrom when it is desired to test the casing during drilling operations for leaks.

More specifically, the wear and protective bushings heretofore provided have not been constructed so that they could be quickly and easily engaged by a suitable apparatus for lowering into position within the casing, and for enabling the apparatus to be positively disengaged from the bushing and thereafter permit retrieving of the seating apparatus from the well bore in which the casing is positioned.

**SUMMARY OF THE INVENTION**

The above and other problems are overcome by the present invention in that a continuous groove is provided on the inner and outer cylindrical surfaces of the wear and protective bushing which enables the wear and protective bushing to be engaged on its outer surface by any suitable means such as bolts or the like to retain it seated within the casing. Additionally, the groove formed on the inner cylindrical surface is of such a configuration so that the apparatus which is adapted to seat and remove the wear and protective bushing in the casing, as desired, engages one end of the groove and serves to retain or secure the bushing and apparatus together as they are being lowered into the casing or removed therefrom, and the lower end of the surface is tapered downwardly and inwardly relative to the longitudinal axis of the tubular body of the bushing so that the members which engage the upper end of the groove can, if necessary, be forced to retracted position by pushing down on the pipe which supports the tool or apparatus from the derrick floor or other structure from which the engaging apparatus and bushing are lowered so that the apparatus may be disengaged from the bushing and retrieved from the well bore.

Also, it can be appreciated that in rotary drilling operations it may be advantageous or desirous from time to time to withdraw the bushing and to conduct tests to determine whether or not any portion of the casing has been damaged which might cause a leak therein. During such tests, it is normal to remove the wear and protective bushing, and the number of times that a wear and protective bushing may be removed and resealed within a particular well will depend upon a number of factors.

However, be that as it may, the present invention by providing a continuous groove enables the wear bushing to be engaged by the retrieving and lowering apparatus at any point therein without first aligning the apparatus relative to a particular slot arrangement on the wear bushing. Additionally, the configuration of the slot assures that the bushing will be retained in position in the apparatus as it is lowered into the well bore, and also enables the retrieving tool to be forcibly disengaged from the bushing, if necessary, in the manner as hereinabove described.

The present invention has for its primary object a bushing of a particular configuration which enables a lowering and retrieving apparatus to be quickly and easily engaged therewith for seating the bushing within the casing in a well bore, and for retrieving the bushing from the

casing in the well bore when desired with a minimum of effort in that no precise initial alignment between the lowering and retrieving apparatus and the bushing must occur, other than to merely assure that the lowering and retrieving apparatus telescopes within the wear and protective bushing.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of the upper end of the casing showing the present invention positioned therein also in sectional view, and illustrating in elevation suitable means, such as bolts, which are positioned through a flange at the upper end of the casing for engaging the groove in the external or outer cylindrical surface of the hollow tubular body for aiding in retaining it in position in the casing, and illustrating the positioning and retrieving apparatus in dotted line; and

FIG. 2 is a perspective view of the wear and protective bushing shown in section in FIG. 1 to more clearly illustrate the arrangement of the grooves in the inner and outer cylindrical surfaces thereof.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first of all to FIG. 1, the casing or tubular member of the present invention is referred to by the letter C, which casing extends downwardly into a well bore 5 in the earth's surface as illustrated in FIG. 1. The casing may be provided with an annular flange 7 at its upper end as illustrated in FIG. 1 and also provided with suitable shoulder means as illustrated at 8 for receiving and positioning the lower end of wear and protective bushing referred to generally by the numeral 10.

The wear and protective bushing 10 includes the hollow cylindrical body 11 having an outer cylindrical surface 12 thereon for slidably fitting within the bore 13 of the casing C. The tubular body 11 is also provided with an upper end 14 and a lower end 15, the lower end 15 resting on the shoulder 8 of the casing C as shown in FIG. 1 of the drawings when positioned therein.

The outer cylindrical surface 12 is provided with a groove 17 which extends about the circumference of the body 11 in a plane perpendicular to the longitudinal axis of the hollow tubular body of the casing C.

The groove 17 may be of any suitable configuration to conform with the ends 18 of the bolts 19, which ends 18 engage within the groove 17 and aid in retaining the wear and protective bushing 10 in position in the casing C as illustrated in FIG. 1 of the drawings.

As shown in the drawings, the groove 17 is provided with a flat bottom portion 20 having the two sloping edge portions 21 and 22 which diverge outwardly from each other and from their intersection with the bottom 20 as shown in FIG. 1 of the drawings.

Similarly, the ends 18 of each of the bolts 19 are provided with an annular tapered portion 18a and a flat bottom portion 18b to conform with the shape of the groove 17 as described.

The bolts 19 are positioned at suitable circumferentially spaced intervals around the flange 7 at the top of the casing C for engaging and retaining the wear and protective bushing 10 in the casing C as previously mentioned during rotary drilling operations.

A groove represented generally at 30 is provided on the inner cylindrical surface 31 of the wear and protective bushing 10, the groove 30 including a first surface 32 which is parallel to the inner and outer cylindrical surfaces 13 and 32 of the body 14 as illustrated in the drawings. The first surface forms the bottom of the groove 30. A second surface 33 intersects the upper end of the first surface 32, the second surface 33 extending continuously downwardly and inwardly in a plane relative to the longitudinal axis of the body 11 of the wear and protective bushing 10 to thereby form an overhanging or undercut portion on the upper end of the groove 31 for

receiving the seating and retrieving members of the apparatus for seating the bushing 10 within and retrieving the bushing 10 from the casing C, such apparatus being illustrated in dotted line at 35. This apparatus is described and claimed in my copending application Ser. No. 706,598, filed in the United States Patent Office on Feb. 19, 1968, for "Seating and Retrieving Tool for Wear and Protective Bushings in Casing During Rotary Drilling Operations."

The lower end surface 36 of the groove 30 is also inclined downwardly and inwardly in a plane relative to the longitudinal axis of the body 11 of wear and protective bushing 10 as shown in FIGS. 1 and 2 of the drawings.

In some forms of wear and protective bushings of the prior art, the seating and retrieving mechanism may have the tendency to remain engaged with the wear and protective bushing after it has been seated within the casing, making it somewhat difficult to dislodge or disengage the seating apparatus therefrom. Since the surface 36 is inclined downwardly, by exerting a force on the pipe upon which the seating apparatus 35 is secured, the projections which engage within the groove 30 may be forced inwardly and thereby retracted relative to the groove 30 to enable such seating apparatus 35 to be disengaged relative to the wear and protective bushing 10 for removal of the apparatus 35 from the casing C.

Sometimes during drilling operations it is desired to remove the wear and protective bushing 10 and check the casing to determine whether or not there are leaks therein.

This can be accomplished by lowering the apparatus 35, as disclosed and claimed in my prior copending application filed in the United States Patent Office on Feb. 19, 1968, bearing Ser. No. 706,598 for "Seating and Retrieving Tool for Wear and Protective Bushings in Casing During Rotary Drilling Operations" and to expand members into the groove 30 so that they engage the upper end 33 and enable the bushing to be removed from the well casing after the bolts 19 have been loosened and disengaged from the annular groove 17.

After the test has been completed, it is then desired to reseat the bushing 10 within the casing C as shown in FIG. 1 of the drawings. Of course, the number of times that the bushing 10 is removed from the casing C depends upon the well conditions and in some instances it may not be removed throughout the entire drilling operation.

The bushing 10 is provided at the location as indicated in FIG. 1 of the drawings in the casing C upon which the wellhead is to be received to inhibit damage to this portion of the casing which might cause leaks when the wellhead is positioned on the upper end 40 of the flange 7.

It can be appreciated by those skilled in the art that it is necessary periodically to remove the drill string from the well bore during rotary drilling operations to either replace the bit, or for other reasons, and the wear and protective bushing 10 prevents the bit, which is normally larger than the diameter of the drill string, from engaging the surface 41 of the casing C and thereby cutting it or otherwise damaging it.

Similarly, the wear and protective bushing 10 prevents the drill string during rotation thereof in rotary drilling operations from moving to either side and engaging the surface 41 of the casing C and wearing it or rubbing against it or otherwise scratching or damaging it, which might cause leaks adjacent the wellhead after the well has been completed and the wellhead positioned on flange surface 40 in a manner well known in the art.

As shown in the drawings, the groove 30 is positioned adjacent the upper end 14 of the hollow tubular body 11, but spaced therefrom, and the groove 17 is beneath the groove 30 but preferably closer to the upper end 14 than it is to the lower end 15 of the bushing 10 as shown in FIG. 1 of the drawings.

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Additionally, it will be noted that both the groove 17 and the groove 30 are continuous so that the bolts 19 may be engaged at any location circumferentially in the groove, and it is not necessary to align the bushing 10 relative to any slot or indentations on the outer cylindrical surface of the hollow tubular body 11 in order to engage the bolts 19 therewith.

Additionally, the groove 30, by being continuous, enables the apparatus 35 to engage therewith merely by lowering the apparatus 35 within the hollow tubular body 14. Since there are no slots which extend from the groove 30 to the upper end 14 of the hollow tubular body 11, the apparatus 35 can be quickly and easily aligned relative to the bushing 10 for engagement therewith to seat it within the casing C, or for retrieving it from the casing C. Also, once the apparatus 35 has been engaged with the casing C, it cannot be dislodged therefrom permanently by accidentally aligning it with any slots which extend from the groove 30 to the upper end 14 of the hollow tubular body 11, as may be the case with some devices of the prior art.

Furthermore, the arrangement of the bottom end of the groove 30 is such that by pushing down on the apparatus 35 at the derrick floor or other location at the earth's surface or thereabove from which the apparatus 35 is manipulated, the engaging means may be forced inwardly, if some malfunction of the apparatus 35 should occur. This enables the apparatus 35 to be positively disengaged from the bushing 10 so that it may be then removed from the casing C and normal rotary operations thereafter continued.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape, and materials as well as in the details of the illustrated construction may be made within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A protective bushing adapted to be inserted and removed by suitable apparatus in tubular members, such as casing, during rotary drilling operations comprising:

- (a) a hollow tubular body having an outer cylindrical surface for slidably fitting within a tubular member in a hole in the earth, such as a casing;
- (b) said body having an upper and lower end;

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(c) said outer cylindrical surface having a groove extending about its circumference in a plane perpendicular to the longitudinal axis of said hollow tubular body;

(d) said hollow tubular body having an inner cylindrical surface;

(e) said inner cylindrical surface having a groove extending continuously circumferentially in a plane perpendicular to the longitudinal axis of said hollow tubular body; and

(f) said groove having three surfaces, one of said groove surfaces forming the bottom of said groove and being substantially parallel to said inner and outer cylindrical surfaces of said hollow tubular member, the second of said groove surfaces forming the upper end of said groove and being inclined downwardly and inwardly relative to the longitudinal axis of said hollow tubular member to thereby form an undercut in said groove, and said third surface forming the lower end of said groove and extending from the termination of the bottom surface of the groove in a downwardly inclined plane relative to the longitudinal axis of said hollow tubular member so that the upper end surface facilitates the insertion and removal of the bushing from the tubular member, and said lower end surface facilitates disengagement between the positioning apparatus and said hollow tubular body.

2. The invention of claim 1 wherein said groove on said inner cylindrical surface of said body is positioned adjacent, but spaced from, said upper end of said body.

3. The invention of claim 2 wherein said groove on said outer cylindrical surface of said body is positioned below said groove on said inner cylindrical surface on said body.

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JAMES A. LEPPINK, Primary Examiner

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