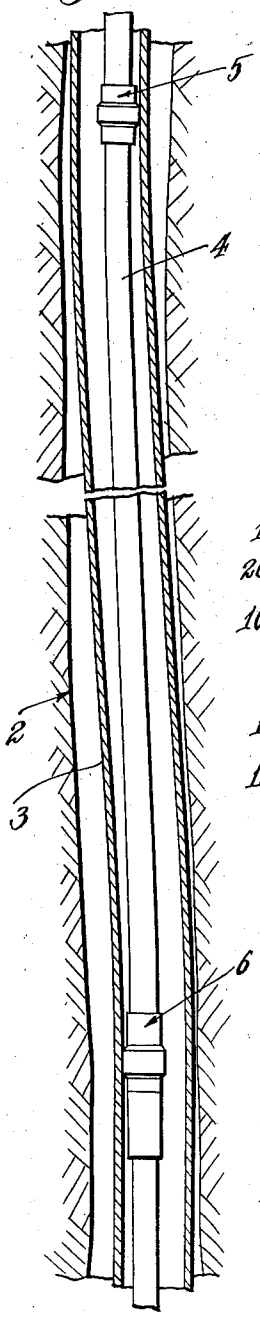
June 17, 1930. W. T. WOODS 1,764,769

DEVICE FOR PREVENTING ABRASION BETWEEN DRILL PIPES AND SURROUNDING WELL CASINGS

Filed Feb. 17, 1928 2 Sheets-Sheet 1

Fig. 1.



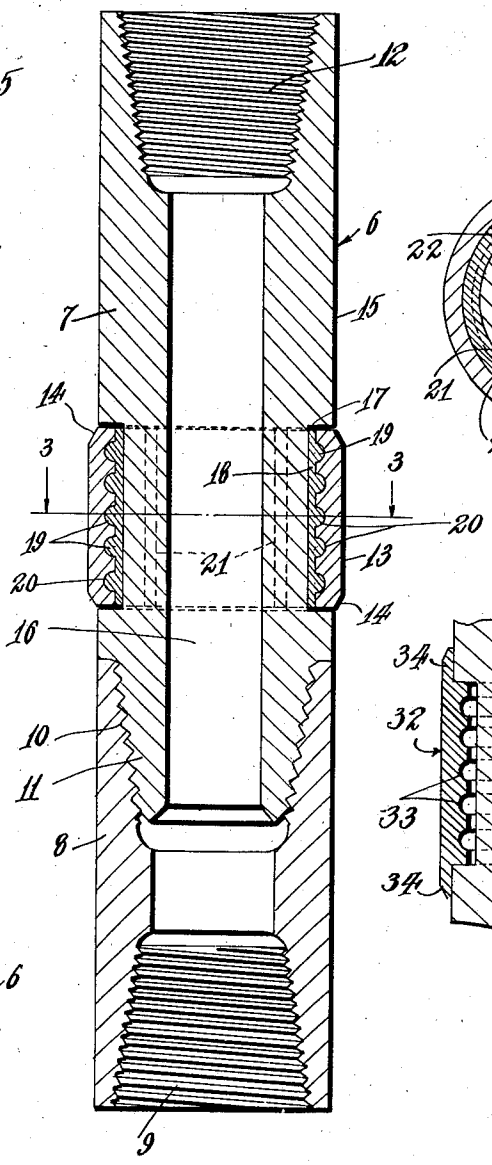
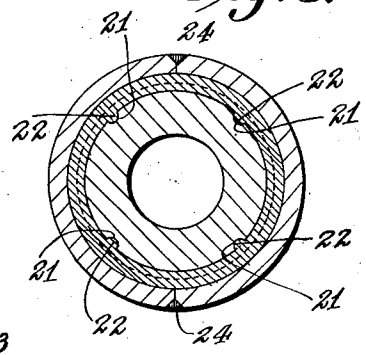


Fig. 2.

Fig. 3.



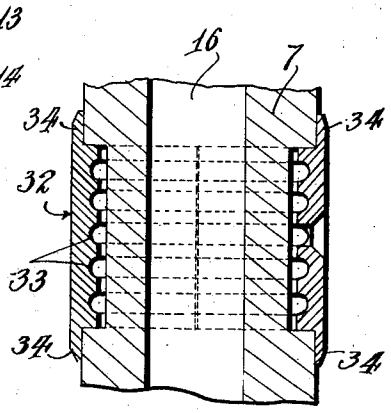


Fig. 7.

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DEVICE FOR PREVENTING ABRASION BETWEEN DRILL PIPES AND SURROUNDING WELL CASINGS

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Fig. 4.

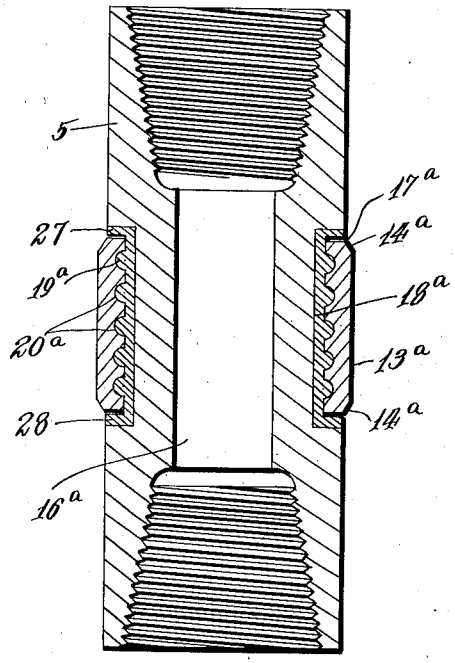
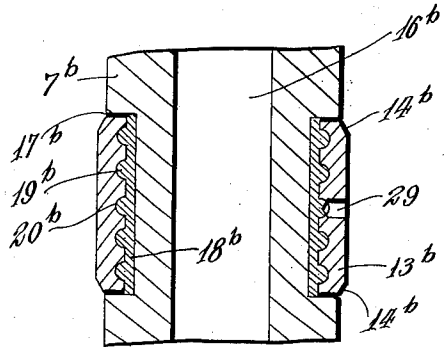


Fig. 5.



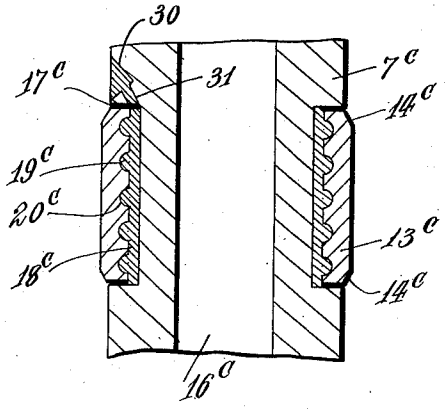


Fig. 6.

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UNITED STATES PATENT OFFICE

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DEVICE FOR PREVENTING ABRASION BETWEEN DRILL PIPES AND SURROUNDING WELL CASINGS

Application filed February 17, 1928. Serial No. 254,966.

This invention relates to the art of drilling wells by the hydraulic rotary method, and the principal object of the invention is to provide a device which will prevent abrasion between the drill pipe and the surrounding well casing.

In drilling of wells, such as oil wells, by the hydraulic rotary method, drilling fluid is continually passed down through the revolving drill pipe to the bit and returns upward therefrom between the drill pipe and the well casing to the surface of the well and carries with it in suspension the detritus, such as sand, which is removed from the formation. This circulation of the drilling fluid requires that there be a substantial space between the outside of the drill pipe and the well casing for the return flow of the drilling fluid. Inasmuch as the drill pipe in operation is subjected to considerable compression due to its own weight, and inasmuch as the hole drilled is never entirely vertical but generally follows a helical or corkscrew shape, the drill pipe, particularly the collars and tool joints thereof, contacts with the well casing at a number of points and effects a rapid abrasion of the well casing unless means are provided for preventing such abrasion.

The present invention provides a device for preventing the abrasion between the drill pipe and well casing by including a rotatable contacting sleeve surrounding the drill pipe which contacting sleeve is made of a larger outside diameter than the remainder of the drill pipe but at the same time is formed of sufficiently small diameter that ample clearance is left between the drill pipe and the well casing for the return passage of the drilling fluid and also for the introduction of fishing tools. Inasmuch as the drill pipe is of greatest weight at its couplings such as the collars or tool joints, these rotatable contacting sleeves are provided surrounding such couplings of the drill pipe.

In the device of the present invention there is further provided between the contacting sleeve and the portion of the drill pipe which is surrounded by such sleeve a supporting means for the contacting sleeve. The devices heretofore provided for the purpose of the present invention have generally included as such supporting means some form of an anti-friction bearing member such as ball or roller bearings. These ball or roller bearings have required that the drill pipe where such bearings are mounted be provided with grooves or recesses for receiving such bearings. Where the contacting sleeve has been mounted upon anti-friction bearings, these bearings have had a tendency to rapidly wear the drill pipe, and the bearings themselves at times are crushed due to the impact of the drill pipe against the wall of the casing.

An object of the present invention is therefore to provide a device of this class with supporting means for the contacting sleeve formed of bearing metal shrunk upon the drill pipe and forming an integral part thereof to the end that a support is provided for such contacting sleeve which will not be crushed when the drill pipe impacts against the well casing and which will not rapidly wear the drill pipe.

A further object of the present invention is to provide a supporting means for such contacting sleeve, which supporting means is formed of bearing metal in a form which is adapted for receiving both radial and end thrust from said contacting sleeve.

Various further objects and advantages of the present invention will be apparent from the description of the preferred forms of devices embodying the invention. For this purpose, there is hereinafter described with reference to the accompanying drawings the preferred form of device embodying the invention.

In the drawings:

Figure 1 is an elevation in partial section of a well hole and casing showing a drill pipe therein provided with the present invention;

Figure 2 is an enlarged elevation in vertical section of the tool joint which forms a part of the drill pipe shown in Figure 1;

Figure 3 is a transverse section on the line 3—3 of Figure 2;

Figure 4 is an elevation in vertical section of a slightly modified form of device illustrating the device as part of a collar for the drill pipe;

Figure 5 is an elevation in vertical section of a further modification of the invention;

Figure 6 is an elevation in vertical section of a further modification of the present invention; and

Figure 7 is an elevation in section of a mold and tool joint member.

Referring to the drawings,—2 generally indicates a well bore, the upper portion of which is lined by a well casing 3. 4 generally indicates the drill pipe disposed within the well casing.

The drill pipe 4 is shown as comprising one or more collars 5 and one or more tool joints 6. The tool joints 6 are employed between sections of the drill pipe 4 which must be frequently connected and disconnected in the various operations incidental to drilling a well. As illustrated in Figure 1, one or more of the tool joints 6 and collars 5 of the drill pipe are provided with the protecting devices of the present invention. Referring now to Figures 2 and 3 of the drawings, the tool joint 6 is indicated as formed as usual of the joint members 7 and 8. The lower member 8 is provided at its lower end with a pipe threaded socket 9 and at its upper end with a coarse threaded tapered socket or box 10. The upper joint member 7 at its lower end is provided with the usual coarse threaded tapered pin 11 and at its upper end with a threaded socket 12 threaded for engagement with pipe threads. The coarse threads 10 and 11 between the tool joint members 7 and 8 provide a means by which the tool joint may be connected or disconnected by a small number of turns. Near the pin end of the joint member 7, the joint member 7 is surrounded by a contacting sleeve 13, the ends of which are preferably tapered as indicated at 14 to prevent the sleeve catching upon the ends of the well casing sections. Said contacting sleeve 13 is formed of an outside diameter larger than that of the remainder of the tool joint 6 but sufficiently smaller than the inside diameter of the well casing 2 thereby leaving ample space therebetween for the returning drilling fluid and for the insertion of fishing tools. Above the contacting sleeve 13, the joint member 7 is made sufficiently long to provide an ample space 15 by means of which the upper joint member 7 may be engaged by tongs when it is desired to connect or disconnect the tool joint. The tool joint is shown as having the usual inner bore 16 through which the drilling fluid may be passed.

The body of the upper joint member 7 is indicated as provided with an annular recess 17 for receiving the contacting sleeve 13 and interposed between the base of said recess and the contacting sleeve 13 there is provided a supporting means in the form of a sleeve of bearing metal 18. Said sleeve of bearing metal 18 is preferably provided with one or more rings or flanges 19 which fit in complementary inner annular grooves 20 in the contacting sleeve 13 in order to provide a means for rotatably locking the sleeve 13 against axial movement and to provide a means for taking up the end thrust upon said contacting sleeve 13. The body of the tool joint member 7 is also provided with a number of longitudinal grooves 21 (see Figure 3) in the base of the annular recess 17 and the sleeve of bearing metal 18 is provided with a number of longitudinal ribs 22 fitting in said longitudinal grooves 21 to provide a means for locking the sleeve of bearing metal 18 against rotation relative to the joint member 7.

The preferred mode of manufacturing and assembling the tool joint shown in Figures 2 and 3 is as follows: Tool joint member 7 is first preferably heated to a temperature sufficient so that it will not chill the bearing metal when poured therein and the groove 17 in the joint member 7 is then enclosed by a removable mold 32 (see Figure 7) having annular grooves 33 in its inner surface corresponding to the annular grooves 20 in the contacting sleeve 13. The mold 32 is provided with means such as lugs 34 for centering the mold on the joint member 7. Molten bearing metal, such as bronze, is then poured into the mold and permitted to harden and to shrink about the body of the joint member 7. The sleeve of bearing metal thus formed then constitutes an integral part of the joint member 7. To position the contacting sleeve 13 in place, said contacting sleeve 13 is first formed in two semi-circular portions as shown in Figure 3 having the triangular grooves 24 at the meeting edges thereof. The two semi-circular portions of the contacting sleeve 13 are then placed over the sleeve 18 and welded together by welding material into the grooves 24 at the meeting edges of the bearing sleeve.

The form of the invention just described provides a drill pipe with a revoluble contacting sleeve operative for engaging the well casing when the drill pipe is forced thereagainst as indicated in Figure 1 and operative for holding the remainder of the drill pipe away from the well casing and thus protecting the well casing from abrasive contact with the drill pipe. The drill pipe may then readily rotate while the contacting sleeve 13 remains substantially stationary and the sleeve of bearing metal 18 operates to provide for the free relative rotation between the drill pipe and contacting sleeve 13 while at the same time the bearing sleeve 18 and its annular ribs or rings 19 absorb both the radial and end thrust on said contacting sleeve 13. In the operations of drilling a well the drill pipe 4 is not only revolved in the well hole but moves slowly downwardly as the well deepens, and the contacting sleeve 13 is provided with supporting means operative for taking care of both radial and end thrusts.

Now referring to Figure 4 of the drawings,

the tool joint is shown as provided with a protecting means generally similar to that shown in Figures 2 and 3. The general form of this tool joint being similar to that illustrated in Figures 2 and 3, reference is made to the description of Figures 2 and 3 for the general features of said tool joint. This form of the invention differs from the previous form in that the sleeve of bearing metal 18 is shown as having outturned end flanges 27 and 28 at its ends which provide an additional means for receiving the end thrust from the contacting sleeve 13.

Now referring to Figure 5 of the drawings, a modified form of the invention is shown in which the contacting sleeve 13^b and the sleeve of bearing metal 18^b are mounted upon a collar 7^b of the drill pipe rather than upon a tool joint. Also it is designed so that the contacting sleeve 13^b may operate as a mold when it is desired to pour the sleeve of bearing metal 18^b. This form of the invention further differs from that of Figures 2, 3 and 4 in that the contacting sleeve 13^b is initially provided with an opening 29 which serves as a means for admitting the bearing metal which is to form the sleeve 18^b of bearing metal. In this form of the invention the collar 7^b and contacting sleeve 13^b are assembled together before the pouring of the sleeve of bearing metal 18^b. In pouring the sleeve of bearing metal 18^b the sleeve 13^b operates as a mold therefor and the opening 29 as a gate. It is understood that it is preferable in pouring the sleeve 18^b to heat the member 7^b and sleeve 13^b to a temperature sufficient so that these parts will not operate to chill the bearing metal while being poured. After the bearing metal is poured, the opening 29 is cut out to remove the bearing metal and free the sleeve 13^b to allow it to rotate on the resulting formed sleeve of bearing metal. This opening 29 may then be closed by welding or by any other manner.

Now referring to the form of the invention illustrated in Figure 6, this form of the invention is generally similar to that illustrated in Figures 2 and 3 except that it is designed so that the contacting sleeve 13^c may operate as a mold when it is desired to pour the sleeve of bearing metal 18^c. For this purpose the body of the joint member 7^c is shown as provided with a recess 30 adjacent one end of the recess 17^c which recess 30 communicates through the channel 31 with the space between the sleeve 13^c and member 7^c.

While the forms of the invention herein described are well adapted to carry out the objects of the invention, it is understood that many modifications and changes may be made without departing from the spirit of the invention, and the invention includes all such modifications and changes as come within the scope of the following claims.

I claim:

1. A device for protecting a well casing from abrasion by a rotary string of drill pipe comprising a coupling member provided with an annular recess, a continuous sleeve of bearing metal cast into said recess and shrunk upon said coupling member thereby forming an integral part thereof, and a contacting sleeve disposed within said recess and revolvably mounted upon said sleeve of bearing metal, said contacting sleeve being externally of a size greater than the coupling member but substantially less than the diameter of the interior of the well casing.

2. A device for protecting a well casing from abrasion by a rotary string of drill pipe comprising a coupling member provided with an annular recess, a continuous sleeve of bearing metal cast into said recess and shrunk upon said coupling member thereby forming an integral part thereof, and a contacting sleeve disposed within said recess and revolvably mounted upon said sleeve of bearing metal, said contacting sleeve being externally of a size greater than the coupling member but substantially less than the diameter of the interior of the well casing, said sleeve of bearing metal being shaped to engage said contacting sleeve for receiving both radial and end thrust.

3. A device for protecting a well casing from abrasion by a rotary string of drill pipe comprising a coupling member provided with an annular recess, a continuous sleeve of bearing metal cast into said recess and shrunk upon said coupling member thereby forming an integral part thereof, and a contacting sleeve disposed within said recess and revolvably mounted upon said sleeve of bearing metal, said contacting sleeve being externally of a size greater than the coupling member but substantially less than the diameter of the interior of the well casing, there being interlocking means between said sleeve of bearing metal and said coupling member for holding the sleeve of bearing metal against rotation relative to said coupling member.

4. A device for protecting a well casing from abrasion by a rotary string of drill pipe comprising a coupling member provided with an annular recess, a continuous sleeve of bearing metal cast into said recess and shrunk upon said coupling member thereby forming an integral part thereof, and a contacting sleeve disposed within said recess and revolvably mounted upon said sleeve of bearing metal, said contacting sleeve being externally of a size greater than the coupling member but substantially less than the diameter of the interior of the well casing, said sleeve of bearing metal being formed to engage said contacting sleeve for receiving both radial and end thrust, there being interlocking means between said sleeve of bearing metal and said coupling member for holding

the sleeve of bearing metal against rotation relative to said coupling member.

5. A device for protecting a well casing from abrasion by a rotary string of drill pipe comprising a coupling member provided with an annular recess, a continuous sleeve of bearing metal cast into said recess and shrunk upon said coupling member thereby forming an integral part thereof, and a contacting sleeve disposed within said recess and revolvably mounted upon said sleeve of bearing metal, said contacting sleeve being externally of a size greater than the coupling member but substantially less than the diameter of the interior of the well casing, said contacting sleeve being composed of a plurality of segmental sections joined at their abutting edges.

6. A device for protecting a well casing from abrasion by a rotary string of drill pipe comprising a coupling member provided with an annular recess, a continuous sleeve of bearing metal cast into said recess and shrunk upon said coupling member thereby forming an integral part thereof, and a contacting sleeve disposed within said recess and revolvably mounted upon said sleeve of bearing metal, said contacting sleeve being externally of a size greater than the coupling member but substantially less than the diameter of the interior of the well casing, said sleeve of bearing metal being shaped to engage said contacting sleeve for receiving both radial and end thrust, said contacting sleeve being composed of a plurality of segmental sections joined at their abutting edges.

7. A device for protecting a well casing from abrasion by a rotary string of drill pipe comprising a coupling member provided with an annular recess, a continuous sleeve of bearing metal cast into said recess and shrunk upon said coupling member thereby forming an integral part thereof, and a contacting sleeve disposed within said recess and revolvably mounted upon said sleeve of bearing metal, said contacting sleeve being externally of a size greater than the coupling member but substantially less than the diameter of the interior of the well casing, there being interlocking means between said sleeve of bearing metal and said coupling member for holding the sleeve of bearing metal against rotation relative to said coupling member, said contacting sleeve being composed of a plurality of segmental sections joined at their abutting edges.

8. A device for protecting a well casing from abrasion by a rotary string of drill pipe comprising a coupling member provided with an annular recess, a continuous sleeve of bearing metal cast into said recess and shrunk upon said coupling member thereby forming an integral part thereof, and a contacting sleeve disposed within said recess and revolvably mounted upon said sleeve of bearing metal, said contacting sleeve being externally of a size greater than the coupling member but substantially less than the diameter of the interior of the well casing, said sleeve of bearing metal being shaped to engage said bearing sleeve for receiving both radial and end thrust, there being interlocking means between said sleeve of bearing metal and said coupling member for holding the sleeve of bearing metal against rotation relative to said coupling member, said contacting sleeve being composed of a plurality of segmental sections joined at their abutting edges.

9. A device for protecting a well casing from abrasion by a rotary string of drill pipe, comprising a tool joint having an annular recess therein, a contacting continuous sleeve within said recess and having an outside diameter larger than said coupling but substantially smaller than said well casing, and bearing metal interposed between said contacting sleeve and the body of said tool joint and shrunk upon said tool joint for revolvably mounting said contacting sleeve, said bearing metal and contacting sleeve having confronting surfaces shaped to provide a rotatable axial locking means for the contacting sleeve.

Signed at Los Angeles, California this 31st day of January, 1928.

WALTER T. WOODS.