July 18, 1939. W. I. BETTIS 2,166,116

WELL CASING PROTECTOR

Filed Dec. 6, 1937

Fig. 2.

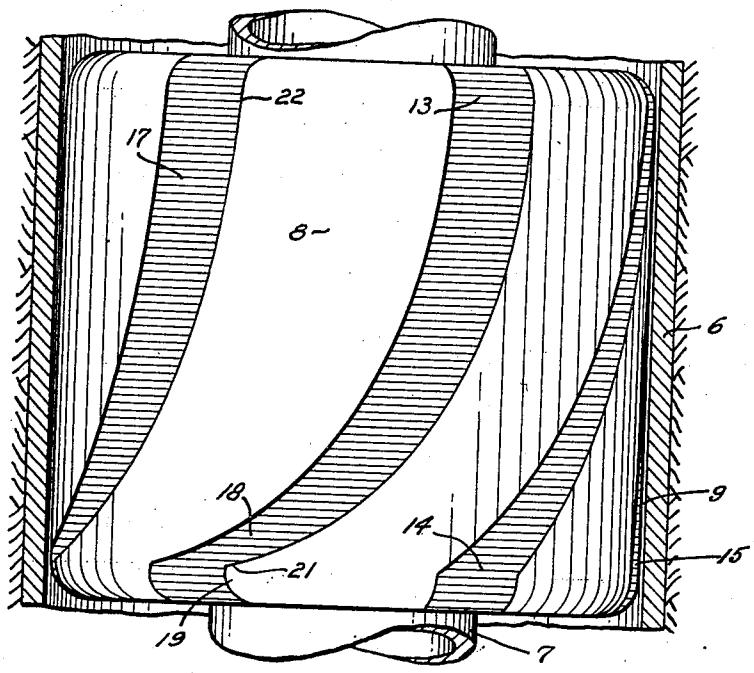
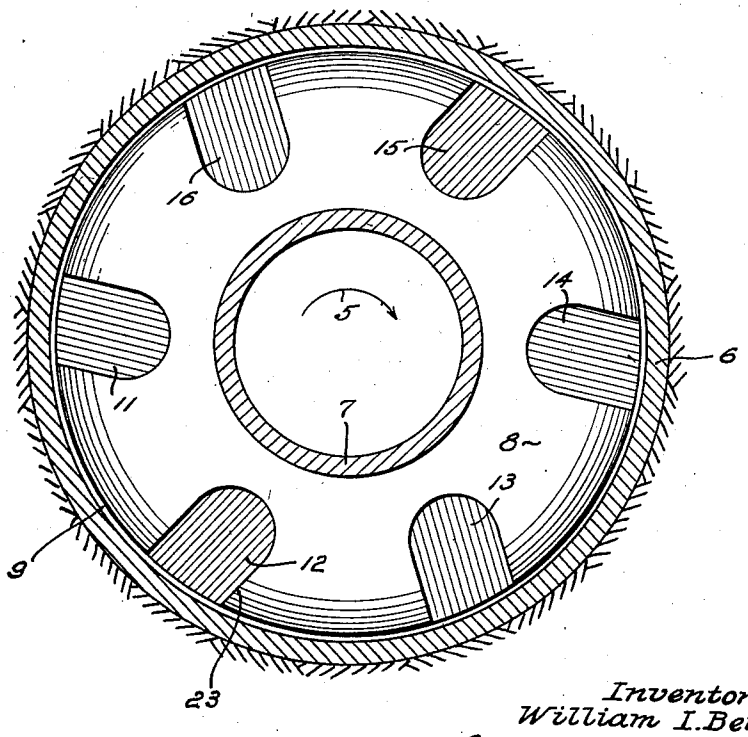


Fig. 1.



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2,166,116

WELL CASING PROTECTOR

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9 Claims. (Cl. 308—4)

My invention relates to well casing protectors, and particularly to types thereof which are adapted for use in deep well drilling operations. The principal objects of the invention are; first, to provide further improved means for obtaining straight drill holes; second, to furnish additional means for preventing damaging vibration in suspended drill strings; third, to supply another and simpler way for reducing net flow resistance of circulating fluid in deep well drilling; and, fourth, to accomplish the stated objects concurrently, by means of a relatively inexpensive device of great simplicity.

My objects are attained in the manner illustrated in the accompanying drawing, in which:

Figure 1 is a plan view of a deep well in horizontal cross-section, with an embodiment of my invention therein; and

Figure 2 is a central elevational section of said well, showing an elevation of said embodiment therein.

Similar reference numerals refer to similar things throughout both views.

In a companion patent application, filed concurrently herewith, I discussed, at some length, the desirability of utilizing the entire cased bore of the well as a guide for keeping the drill pipe centered therein; to secure straighter drill holes, and to reduce damaging vibration of suspended drill strings. Three specific protector constructions for doing these things, without necessity for increasing flow resistance of the circulating fluid, were disclosed in said companion application. The present application discloses a fourth specific construction for the same purposes, but possessing features which differ from the other three is certain important respects. The claims herein do not read on the disclosures of said compansion application.

Prior U. S. Patent No. 1,573,031, issued jointly to Leroy H. Perry and myself, and U. S. Patent No. 1,863,740 issued to myself alone, neither show nor claim certain features of construction which are disclosed herein; and the present claims do not read upon either of said prior disclosures.

In the accompanying drawing, it is assumed that the drilling rotation employed will be clockwise, when looking downwardly, as indicated by arrow 5. Sections of well casing are shown at 6, and of drill pipe within the casing at 7.

The present invention consists of a cylindrical annulus of resilient material, such as suitably compounded vulcanized rubber. It is so proportioned that, when stretched around the drill pipe with which it is to be used, as shown at 8, it will grip the pipe very tightly, and be practically immovable thereon in service. The outside diameter of the device is made such that, when thus stretched, it will fit within the casing of the wall being drilled, with very little clearance, as indicated at 9. By means of such devices, the drill pipe may be kept closely centered in the casing at all times; and the casing can thus be utilized to guide the pipe to attain a straight drill hole. The slight clearance, moreover, prevents objectionable vibration of the drill pipe.

In order to provide for the necessary upward flow of circulating fluid past the protector, which the small clearance 9 would otherwise prevent, I form a plurality of relatively deep and wide quasi-helical grooves in the outer cylindrical portion of the device. These grooves provide channels for the circulating fluid, and concurrently act as impellers therefor when the drill pipe is rotated in the casing in the direction of arrow 5.

In the drawings, six such grooves are shown, and the impelling surfaces thereof are indicated at 11, 12, 13, 14, 15 and 16 respectively. The leading surface opposite impelling surface 12 is shown in Fig. 2 at 17. The leading surface opposite impelling surface 13 is shown in the lower portion of Fig. 2 at 18; and impelling surface 13 itself is shown near the top of the figure; since these two surfaces merge into one another, by reason of the helical shape, and because of the rounded inner end walls of the grooves.

The peculiar appearance at the lower ends of the helical grooves, as seen in elevation in Fig. 2 at 19, is due to the rounded ends of the protector body, to afford easier entrance into and withdrawal from, the casing.

I prefer to shape the impelling surfaces with an entrance angle of about 30° from horizontal, as at 21; and to have the upper ends of these surfaces practically vertical, as at 22. Such surfaces are not truly helical, of course, but I consider them somewhat more satisfactory for the present purposes.

It will be obvious that, particularly with high rotative speeds, fluid which is impelled by the grooves will tend to be thrown outwardly against the casing, by reason of centrifugal force. This effect will tend to center the device in the casing; and it is advantageous to the extent that it exists, since it reduces friction between the protector and casing. However, the impelling surfaces may be made non-radial if desired, as shown in Fig. 1 at 23. Such formation tends to cause the circulating fluid to flow toward the inner ends of the helical grooves.

It will be obvious, to those familiar with the art, that many changes in detail can be made in the device described, without departing from the essence of the invention. Therefore I do not limit myself to the forms herein shown and described, except as set forth in the appended claims.

I claim as my invention:

1. A device of the character described, comprising; a cylindrical annulus of resilient rubber-like material, adapted for mounting upon a co-axial drill pipe; the annulus having quasi-helical grooves in its outer cylindrical portion, extending from end to end thereof; and said grooves being adapted to convey and impel circulating fluid, when the device is axially rotated within a cylindrical casing which it fits with small clearance.

2. A device of the character described, comprising; a cylindrical annulus of resilient rubber, adapted for encircling and gripping a drill pipe; the annulus having quasi-helical grooves in its outer cylindrical portion, extending from end to end thereof; and said grooves being adapted to convey and impel circulating fluid, when the device is axially rotated within a cylindrical casing which it fits with small clearance.

3. A device of the character described, comprising; a cylindrical annulus of resilient vulcanized rubber having wear-resisting qualities in the presence of water lubrication; the annulus being adapted for encircling and gripping a drill pipe, and having quasi-helical grooves in its outer cylindrical portion, extending from end to end thereof; and said grooves being adapted to convey and impel circulating fluid, when the device is axially rotated within a cylindrical casing which it fits with small clearance.

4. A device of the character described, comprising; a cylindrical annulus of resilient and readily yielding rubber, adapted for being stretched around a co-operative drill pipe to grip it; and, when so stretched, to fit within a co-operative well casing with small clearance; the outer cylindrical portion of the device having quasi-helical grooves formed therein from end to end; and said grooves being adapted to convey and impel circulating fluid, when the device is so-stretched upon said drill pipe, and rotated within said casing.

5. In combination; a cylindrical well casing; a rotary drill pipe within the casing; and a cylindrical annulus of resilient rubber-like material, monted co-axially upon the pipe, and fitting within the casing with small clearance; the annulus having quasi-helical grooves in its outer cylindrical portion, extending from end to end thereof; and said grooves being adapted to convey and impel circulating fluid, when the drill pipe is rotated.

6. In combination; a cylindrical well casing; a rotary drill pipe within the casing; and a cylindrical annulus of resilient rubber, encircling and gripping the drill pipe, and fitting within the casing with small clearance; the annulus having quasi-helical grooves in its outer cylindrical portion, extending from end to end thereof; and said grooves being adapted to convey and impel circulating fluid, when the drill pipe is rotated.

7. In combination; a cylindrical well casing; a rotary drill pipe within the casing; and a cylindrical annulus of resilient vulcanized rubber, stretched around the drill pipe to grip it, and fitting within the casing with small clearance; the annulus having quasi-helical grooves in its outer cylindrical portion, extending from end to end thereof; and said grooves being adapted to convey and impel circulating fluid, when the drill pipe is rotated.

8. A device as defined by claim 1 wherein the impelling surfaces of the grooves are directed inwardly and rearwardly with respect to the direction of rotation.

9. A device as defined by claim 1 wherein the leading surfaces of the grooves are substantially radial; and wherein the impelling surfaces are directed inwardly and rearwardly with respect to the direction of rotation, and substantially parallel to said leading surfaces.

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