June 6, 1967 J. A. VERTSON 3,323,326

WELL DRILLING SHOCK ABSORBER

Filed Aug. 2, 1965

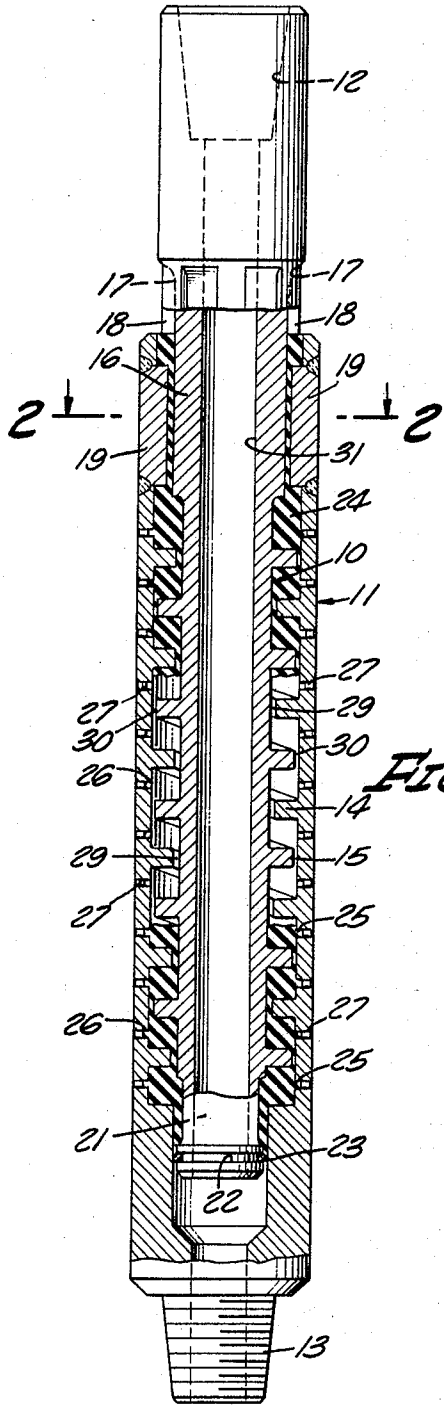


FIG. 1.

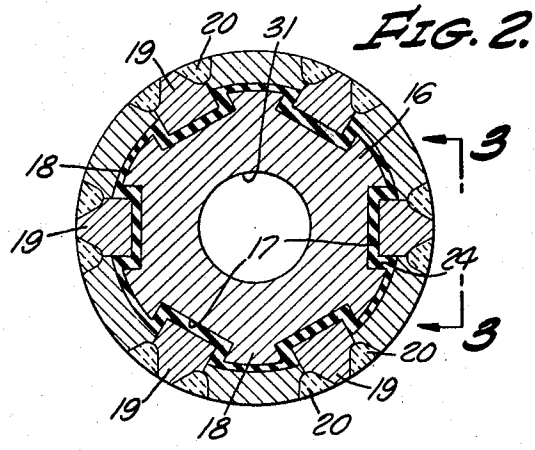


FIG. 2.

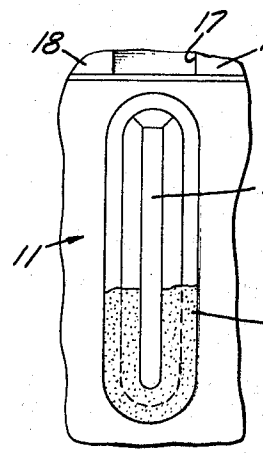


FIG. 3.

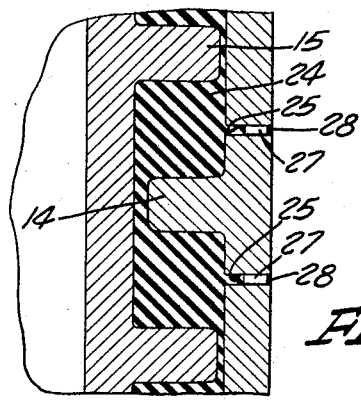


FIG. 4.

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WELL DRILLING SHOCK ABSORBER

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This invention relates to a well drilling shock absorber and may be considered as an improvement over the drill pipe shock absorber disclosed in my prior U.S. Patent No. 2,765,147 issued October 2, 1956.

Explanatory of the present invention, when wells are being drilled by a rotary well drilling string, vibrations are transmitted to or are set up in the well drilling string that detrimentally affect it. That is particularly true where the bit that is employed is in the nature of a rock bit employing rotary roller type cutters having piercing teeth on the exterior thereof which penetrate the formation that is being drilled. When such a bit is being rotated on the bottom of the well bore under heavy load, the impacts of the penetrating teeth set up vibrations of relatively high frequency, and these, if transmitted to the well drilling string, are apt to cause fatigue of parts thereof.

A primary object of the present invention is to provide an improved form of shock absorber which will retard the transmission of vibrations created by the bit to the string of the drill pipe.

With the foregoing and other objects in views, which will be manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention wherein:

FIGURE 1 is a view in side elevation of the shock absorber embodying the present invention, parts being broken away, and shown in vertical section, and a portion of the rubber-like material being shown as having been removed so as to illustrate details of construction.

FIGURE 2 is a horizontal section taken substantially upon line 2—2 upon FIGURE 1.

FIGURE 3 is a partial view taken substantially upon line 3—3 upon FIGURE 2 in the direction indicated.

FIGURE 4 is a partial view on an enlarged scale of the portion of FIGURE 1.

Referring to the accompanying drawings, wherein similar reference characters designate similar parts throughout, the improved shock absorber consists essentially of two telescopically arranged parts, the inner of which is generally indicated at **10** and the outer of which is generally indicated at **11**. These parts each have a means at an end thereof providing for the attachment and incorporation of the shock absorber in a rotary well drilling string. Thus, as illustrated, the upper end of the inner part **10** has an internally threaded box **12**, and the lower end of the outer part **11** has an externally threaded pin **13**. The box and pin enable the shock absorber to be incorporated in the drill string and, in the usual situation, the pin **13** is attachable directly to the well drilling bit, such as by a sub, not shown. Drill collars at the lower end of the rotary drill pipe, when employed, are connected to the top of the shock absorber by means of the box **12**. While the insertion of the shock absorber between the bit and the drill collars is the preferred arrangement, it will be appreciated that, if desired, the shock absorber can be inserted between the drill collars and the lower end of the drill pipe.

On the interior of the outer part **11**, there is formed a coarse fast thread or helical rib **14** which extends for a major portion of the length of the outer part **11**. Similarly, on the exterior of the inner part **10**, there is formed a coarse fast thread or helical rib **15**. These ribs are in

vertical opposition to each other and are also in spaced relation to each other.

The upper end of the inner part **10** is enlarged, as indicated at **16**, and vertical grooves **17**, see FIGURE 2, are formed in this enlargement defining vertically extending keys or splines **18**. The upper end of the outer part **11** has vertically extending openings formed therein, in which are disposed vertically extending keys or splines **19**. These keys or splines are welded in place such as by welders **20** and, when thus welded, the keys or splines **19** project into the grooves **17** so as to be disposed in horizontal opposition to the splines **18** on the inner part **10**. Although the splines **18** and **19** are in opposition to each other horizontally, they are nevertheless in spaced relation to each other.

The lower end of the inner part **10** has a short extension **21** that provides a ring group **22** for a lower O-ring **23**. This O-ring fits snugly within the cylindrical lower end of the outer part **11**.

The spaces between the opposed helical ribs **14** and **15** and between the opposed vertical splines **18** and **19** are filled with deformable elastic rubber or a rubber-like composition **24**. A synthetic rubber-like composition resistant to oil is preferred. This rubber-like composition is preferably bonded to one of the parts **10** or **11** by applying a bonding composition to the metal of the selected part prior to the introduction of the rubber-like composition. To install the rubber-like composition, a plurality of entrances or gates **25** are formed in the outer part **11**, and diametrically opposite these entrances or gates there are vents **26**. The assembled parts **10** and **11** are positioned in a mold, not shown, that enables the rubber composition to be injected into or forced into the entrances or gates **25**. This composition in its uncured state flows through the spaces between the opposed ribs **14** and **15** expelling the air from the spaces through the vents **26**. Downward flow of the uncured rubber-like composition is arrested or limited by the O-ring **23**. Upward flow of the rubber-like composition can occur to fill the spaces between the opposed splines **18** and **19**. While these spaces are being filled, a collar, not shown, is usually applied around the upper end of the inner part **10** so as to confine the rubber-like composition to the interior of the outer part **11**. After the rubber-like composition has been injected, it is cured in situ and, as previously explained, it is bonded to at least one of the two metal parts **10** or **11**. In removing the mold, the small portions of rubber-like composition that are in the entrances or gates **25** and in the vents **26** are broken, and these gates and vents may be plugged with metallic plugs **27** which are welded in place, such as by welds **28**.

It will be noted that clearances **29** exist between the interior of the helical rib **14** and the exterior of the inner part **10**. Clearances **30** which may be as great as the clearances **29** also exist between the helical rib **15** and the interior of the outer part **11**.

When the shock absorber is incorporated in the drill string, torsion and weight stresses are transmitted from the drill pipe to the bit through the opposed vertical keys **19** and **18** and between the opposed vertical ribs **14** and **15**. However, as these parts are in spaced relation to each other, even though opposed, and the intervening space is filled with elastic deformable rubber-like material, the stresses will be adequately transmitted. The rubber-like composition being solid, as being distinguished from foam or porous rubber, is deformable although it is relatively incompressible in the sense that most liquids are incompressible. When there is a tendency for the inner part **10** to become displaced either vertically or horizontally with relation to the outer part **11**, the clearance spaces above referred to permit of deformation of

the rubber-like composition to accommodate the required movement. However, when the stresses are relived, the elasticity of the rubber-like composition returns the parts to their normal or relaxed positions. Vibrations created by the rotating bit, instead of being transmitted directly to the well drilling string thereabove, are effectively dampened by the rubber-like composition **24** that is disposed between the opposed ribs and splines of the two parts.

As illustrated, the two parts **10** and **11**, collectively considered, have a continuous axial bore or passage **31** therethrough to conduct circulation fluid from the drill pipe to the bit. This circulation passage is kept constantly open regardless of deformations of the rubber-like material occasioned by the movement of one part relative to the other.

Various changes may be made in the details of the construction without departing from the spirit and scope of the present invention as defined by the appended claims.

I claim:

1. A well drilling shock absorber including two telescopically arranged parts each having a means at one end thereof for attachment to parts of a well drilling string, said parts having vertically opposed helical ribs thereon disposed in spaced relation to each other, and vertically extending splines also disposed in spaced relation to each other, and deformable elastic rubber-like material filling the spaces between the ribs and between the splines through which torsional and axial stresses can be transmitted from one part to the other.

2. A well drilling shock absorber including two telescopically arranged parts each having a means at one end thereof for attachment to parts of a well drilling string, said parts having vertically opposed helical ribs thereon disposed in spaced relation to each other, and vertically extending splines also disposed in spaced relation to each other, and deformable elastic rubber-like material filling the spaces between the ribs and between the splines through which torsional and axial stresses can be transmitted from one part to the other, said rubber-like material being bonded to at least one of the parts.

3. A well drilling shock absorber including two telescopically arranged parts each having a means at one end thereof for attachment to parts of a well drilling string, said parts having vertically opposed helical ribs thereon disposed in spaced relation to each other, and vertically extending splines also disposed in spaced relation to each other, and deformable elastic rubber-like material filling

the spaces between the ribs and between the splines through which torsional and axial stresses can be transmitted from one part to the other, there being clearances between the ribs and splines on each part and the opposed part into which the rubber-like material is deformable.

4. A well drilling shock absorber including two telescopically arranged parts each having a means at one end thereof for attachment to parts of a well drilling string, said parts having vertically opposed helical ribs thereon disposed in spaced relation to each other, and vertically extending splines also disposed in spaced relation to each other, and deformable elastic rubber-like material filling the spaces between the ribs and between the splines through which torisonal and axial stresses can be transmitted from one part to the other, there being clearances between the ribs and splines on each part and the opposed part into which the rubber-like material is deformable, the rubber-like material being bonded to at least one of the parts.

5. A well drilling shock absorber including two telescopically arranged inner and outer space parts, each having a side wall and means at at least one end thereof for attachment to parts of a well drilling string, each of said parts having a helical rib axially disposed relative to the other and extending toward and terminating short of the side wall of the other part, said outer part having injection gate means therethrough open to the space between said parts, said outer part having vent means therethrough spaced from said injection gate means, deformable elastic rubber-like material injected in the spaces between the ribs and the side walls of said parts, and plugs in said injection gate means and said vent means.

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