June 2, 1953 F. A. SCOTT ET AL 2,640,735

STABILIZER FOR DRILL COLLARS AND DRILL PIPES

Filed Feb. 17, 1947 2 Sheets-Sheet 1

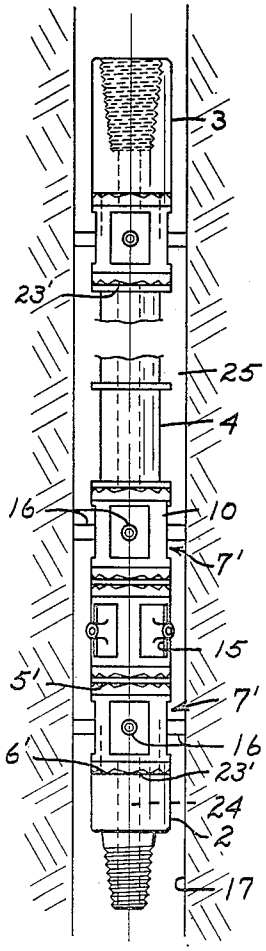

Fig. 2.

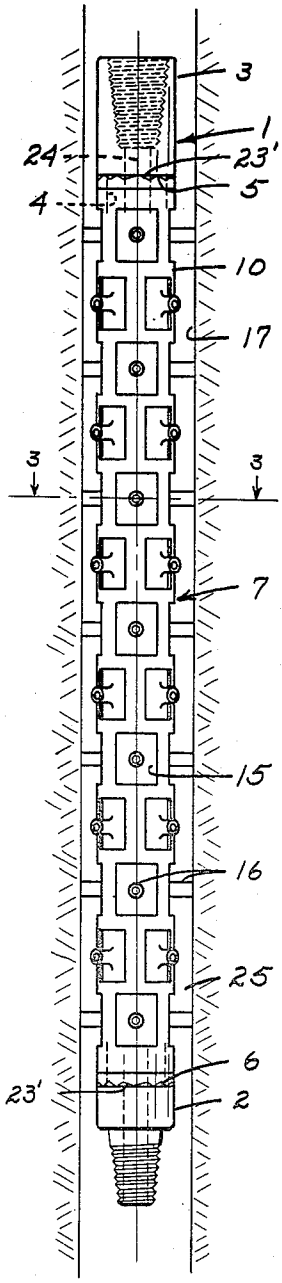

Fig. 1.

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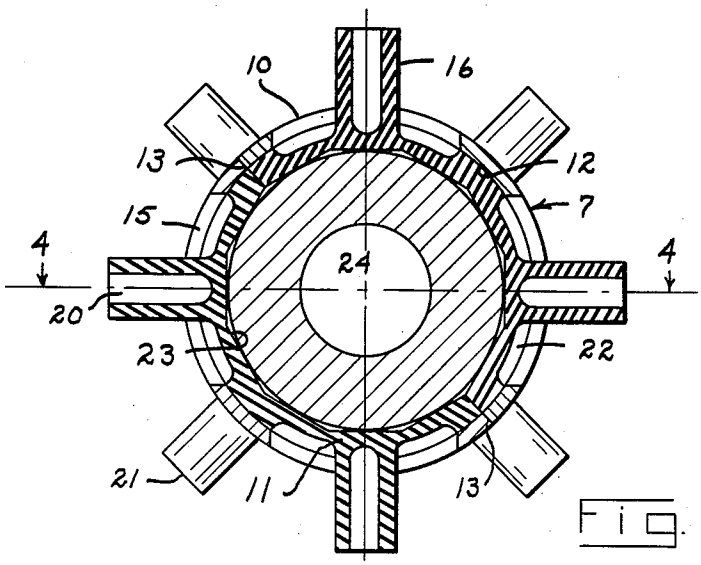

Fig. 3.

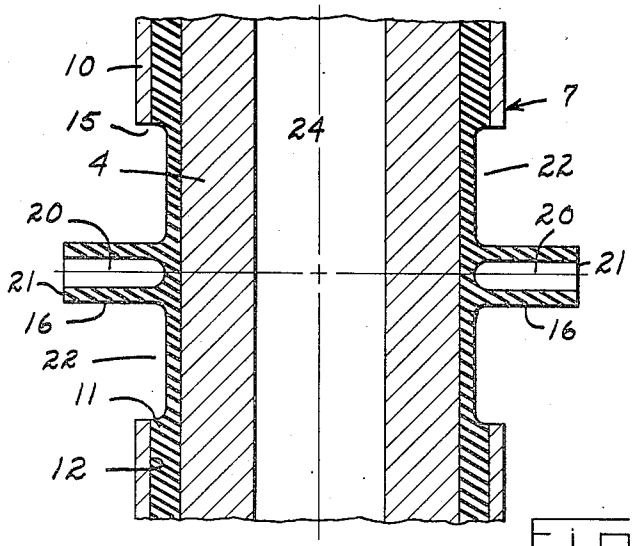

Fig. 4.

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STABILIZER FOR DRILL COLLARS AND DRILL PIPE

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Application February 17, 1947, Serial No. 729,142

4 Claims. (Cl. 308—4)

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This invention relates to the art of rotary well drilling and more particularly to the stabilization of a string of drill pipe and/or drill collars during such drilling.

In the rotary method of drilling wells the bore hole is formed by attaching a bit upon the lower end of a drill string, such string and bit being rotated by means of power applied at the surface. Weight may be applied to the bit by permitting the drill string or stem, comprising interconnected drill pipe sections, to rest in part upon the bit. In some cases, however, a weight of 40,000 to 50,000 lbs. is needed for effective drilling. In such a case it is impractical to apply this weight by means of the superposed drill stem as considerable flexing of the stem thereby occurs with resulting damage to the stem and production of a crooked hole. To avoid this condition, it is customary to provide a series of drill collars adjacent the bit and these drill collars are relied upon to provide the necessary weight upon the bit to effect advancement thereof.

Various factors involved in drilling cause instability in the rotating drill string, whether such string comprises only drill stem sections or, in combination therewith, a plurality of drill collars. Such instability contributes greatly to any tendency to produce a crooked hole, and also produces destructive effect upon the drill string itself. The present invention is concerned with and it is an object of the invention to provide a stabilizer to be used in the drill string so that instability thereof is minimized. Another object is to provide a stabilizer whereby the drilling of a straight hole is effected, or a theretofore crooked hole is straightened.

Still another object of the invention is to provide a drill stem stabilizer that will dampen the propagation of waves in the drill stem and thereby minimize the production of alternating stresses which are superposed upon the normal stresses within a drill stem.

A still further object is to maintain elements of the drill stem and tool joints out of contact with a surrounding casing or well bore wall whereby abrasion of such elements is minimized.

Another object of the invention is to provide a stabilizer that may be inserted at any suitable point or points in a drill string, such device including a swiveled portion resiliently engageable with the surrounding walls of the well bore so that the drill stem is stabilized.

The invention comprehends a device having a plurality of resilient projections extending outwardly thereof. These projections engage the walls of the surrounding well bore and their inherent stiffness serves to dampen any vibrations initiated in the drill stem.

Another object of the invention is to provide a stabilizer having outstanding projections which are sufficiently flexible that the device is capable of passing obstructions within the bore hole.

Still another object of the invention is to provide a swiveling stabilizer for drill stems in which a body of resilient material rotatably surrounds a journal portion of the drill stem and presents outwardly extending integral projections to engage the surrounding walls of the well bore.

A still further object of the invention is to provide a stabilizer including relatively rotatable parts, the outermost of which presents outwardly extending resilient stabilizing projections.

The foregoing objects together with other objects and advantages of the invention will be fully apparent from the following description considered in connection with the accompanying drawings in which:

Fig. 1 is a vertical elevational view of one form of the invention showing the normal position of the device when in use in a well bore;

Fig. 2 is a vertical elevational view of an alternate form of stabilizer comprising a plurality of short sections;

Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a short vertical section taken on line 4—4 of Fig. 3.

While the term "drill pipe" is used herein it is to be understood that such term comprehends a drill string that may comprise drill pipe sections exclusively or may include drill collars used in the manner above indicated.

The invention as shown in Fig. 1 of the drawings comprises a body section or sub 1, provided with pin and box terminals 2 and 3 so that the stabilizer can be readily connected in a drill string between successive sections thereof. The central portion 4 of the sub 1 is reduced in cross section thereby presenting upper and lower spaced shoulders 5 and 6, the assembly 7 surrounding this reduced portion being rotatably mounted between these shoulders.

The assembly 7 comprises a metal sheath 10 to which a body 11, of resilient material, such as natural or synthetic rubber or the like is united upon its inner periphery at 12. This assembly is preferably formed in halves so that it can be readily placed about the reduced portion 4 of the sub 1 and then secured in place as by welding along the meeting edges 13 of the sheath 10.

The sheath 10 has a plurality of openings 15 therein in staggered relation throughout its circumference and for a selected portion of its length. The body 11 includes projections 16 which extend outwardly through the openings 15. Although these projections comprise resilient material yet they possess sufficient inherent stiffness that their concerted action when in engagement with the surrounding wall of a well bore, as shown at 17 in Figs. 1 and 2, is sufficient to produce desired stabilizing of the drill string of which the stabilizer is an element.

The stabilizer must necessarily be capable of axial movement as it is lowered into a well or as drilling progresses. Furthermore, it must be also capable of passage through restrictions that

may exist within the well bore. The resilient nature of the projections 16 permits these projections to flex as necessary and thus permit such movement. To enhance flexibility preferably the projections 16 are provided with central bores 20 which extend inwardly from the ends 21 of the projections for the major portion of their length.

To further facilitate reduction in the overall cross section of the stabilizer and permit movement thereof past obstructions in the well, the body 11 is recessed at 22 within each of the openings 15 in the sheath 10. When a projection 16 is deflected it may, when necessary, partially enter within such recess and in this manner the entire device may enter and pass through a restricted passage which is substantially the peripheral diameter of the sheath 10.

In order to minimize the contact area between the periphery of the sub 1 and the inner periphery of the body 11, and also to facilitate the admission of well fluids to lubricate the contacting surfaces between the sub and the swiveled assembly 7, the inner periphery of the body 11 has longitudinally extending flattened areas 23, as best seen in Fig. 3. In a similar manner the ends of the body 11 are sinuously relieved as indicated at 23', to provide spaced points of contact with shoulders 5 and 6 and lubrication for the thrust between the assembly 7 and the respective shoulders. This structure enables the assembly 7 to remain stationary within the well bore while the sub freely rotates therein as drilling progresses.

It is to be understood, of course, that during drilling a flushing fluid is pumped downwardly through the passage 24 within the stabilizer and thence, after passing through the bit therebelow, moved upwardly within the space 25 about the stabilizer as such fluid returns to the surface.

The operation of the device as thus far described is believed apparent from the foregoing description. By way of summary and further illustration it will be pointed out that a selected number of the stabilizer units are incorporated in the drill string as it is lowered into the well bore. As deemed necessary, units may be successively interconnected and/or may be provided at spaced points in the drill stem. When the bit is upon bottom, drilling progresses in the conventional manner, it being understood that the projections 16 extend outwardly and engage the wall of the well bore. As above pointed out, the inherent stiffness of these projections produce the desired stabilizing effect.

To facilitate manufacture, repair and the production of stabilizers of selected lengths, as well, to desirably distribute bearing stresses within the stabilizer structure, the device may be fabricated with a plurality of short assemblies 7' surrounding the sub 1 as shown in Fig. 2. In this form of the invention the assemblies 7' are positioned within reduced areas on the sub whereby each assembly is rotatably mounted intermediate upper and lower shoulders 5' and 6'. It seems apparent that such structure permits flexibility in constructing a stabilizer unit of a desired length and selectively positioning the stabilizer assemblies along such length.

Broadly, the invention comprehends a stabilizer for use in drill strings when drilling wells by the rotary method, it being understood that such stabilizer shall dampen any movement of the drill string transversely of the axis of rotation thereof whereby the objects and advantages of the invention are attained.

We claim:

1. A stabilizer for drill stems comprising, a body of resilient material rotatably mounted upon at least a portion of the drill stem and having a plurality of resilient outwardly extending projections thereon, and a sheath of rigid material fitting closely upon said body and having openings therein through which said projections pass for engagement with a surrounding wall to exert a stabilizing force upon the drill stem, the interior of said body having longitudinally extending flattened areas to admit well fluids between the body and the drill stem.

2. A stabilizer for drill stems comprising, a body of resilient material rotatably mounted upon at least a portion of the drill stem and having a plurality of resilient outwardly extending projections thereon, and a sheath of rigid material fitting closely upon said body and having openings therein through which said projections pass for engagement with a surrounding wall to exert a stabilizing force upon the drill stem, said projections being hollow to permit flexing thereof as the drill stem and stabilizer move axially of an obstructed bore.

3. A stabilizer for drill stems comprising, a body of resilient material rotatably mounted upon at least a portion of the drill stem and having a plurality of resilient outwardly extending projections thereon, and a sheath of rigid material fitting closely upon said body and having openings therein through which said projections pass for engaging with a surrounding wall to exert a stabilizing force upon the drill stem, the material of the body being recessed at said openings to enhance flexibility of the projections and to permit flexing of the projections to a position substantially within the peripheral surface of the sheath.

4. A stabilizer for drill stems comprising, a sub for connection in the drill stem, spaced shoulders on said sub, a body of resilient material rotatably surrounding said sub between said shoulders, a sheath of rigid material surrounding said resilient material and having a plurality of openings therein, and projections on said body extending outwardly through said openings to resiliently engage a surrounding wall and exert a stabilizing force upon the drill stem, at least one of the end surfaces of said body being intermittently relieved radially to provide spaced points of contact with the adjacent shoulder whereby well fluids are admitted to the shoulder and to the interior of the body.

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