March 1, 1966 W. E. SCARBOROUGH 3,237,427

DRILL COLLAR

Filed July 29, 1963

Fig. 1

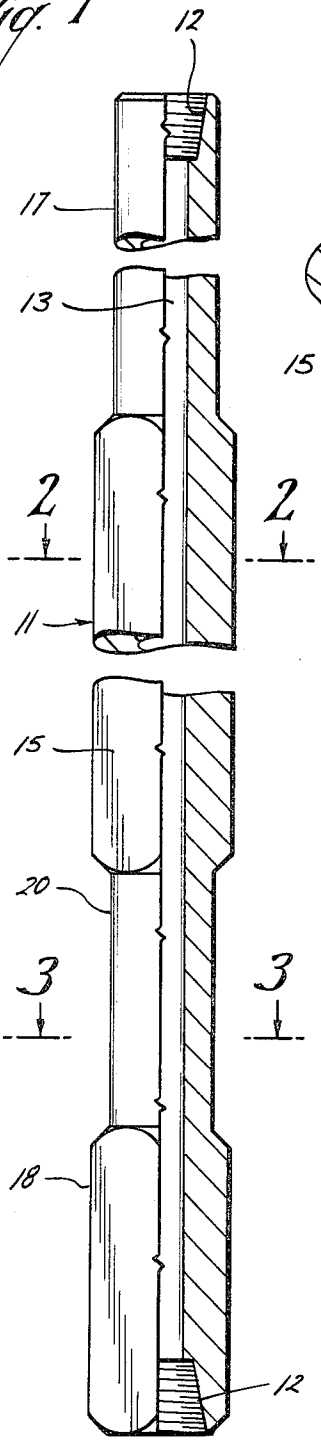


Fig. 2

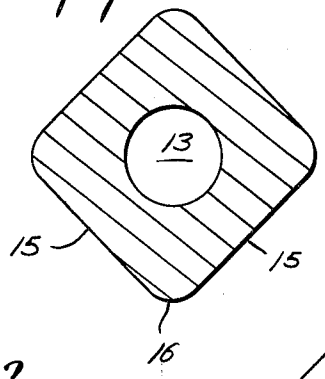


Fig. 3

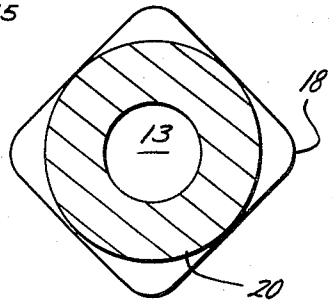


Fig. 4

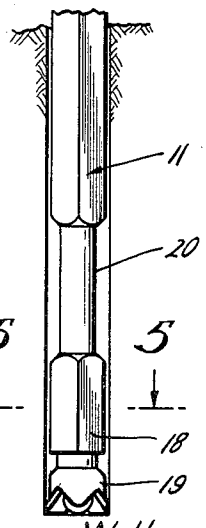
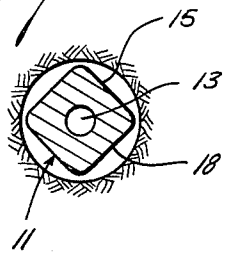


Fig. 5



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DRILL COLLAR

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This invention relates generally to deep well drilling tools and more particularly to a drill collar for use in a rotary drilling string.

Drill collars are used in drilling strings to concentrate a weight load on a drilling bit at the lower end of the string. A drill collar comprises a long and heavy member connectable in the string immediately above the bit, and has a longitudinal bore therethrough for conducting drilling fluid to the bit. Two or more collars may be used in tandem depending upon the desired weight to be applied to the bit. Drill collars having cross-sectional shapes which are substantially square have come into use in the rotary drilling of wells, as one means of controlling hole deviation. Such drill collars usually have a configuration wherein the corners have been somewhat rounded, and are used to stabilize or guide the bit so that the hole may be substantially vertical and to prevent sharp deviations of the bore hole being drilled. The diagonal distance across the square section corners is made to substantially conform to, or is made a fraction of an inch under, the diameter of the bore hole. If, as is usually the case, the ends of the square drill collar are machined to provide cylindrical tong space, then of course the square section of the collar will be somewhat remote from the bit, and lateral components of force on the bit and the end of the collar may cause the bit to deviate from its path. With the collar of the invention, a drill collar is provided which has a substantially square cross-sectional portion adjacent the bit, and has a cylindrical portion remote from the bit, to accommodate pipe wrenches or tongs used in screwing the collars together or in unscrewing them.

It is a general object of this invention to provide a new and improved drill collar for use in a drilling string.

Another object is to provide a new and improved drill collar which will stabilize and guide a drilling bit during the drilling operation.

Another object is to provide a drill collar having generally a substantially square cross section wherein a portion of said substantially square cross section is immediately adjacent the drilling bit, and wherein a cylindrical tong portion is provided somewhat removed from the drilling bit.

Another object is to provide a new and improved drill collar which guides and stabilizes the string in the hole and yet provides for the free passage of drilling fluid thereby.

Other objects will become apparent from the following description and the accompanying drawings, in which:

FIG. 1 is a side elevation of the drill collar of the invention shown partly in section.

FIG. 2 is a cross-sectional view taken along lines 2—2 in FIG. 1.

FIG. 3 is a cross-sectional view taken along lines 3—3 in FIG. 1.

FIG. 4 is a diagrammatic view showing the drill collar and a drilling bit in position in a bore hole.

FIG. 5 is a cross-sectional view taken along lines 5—5 in FIG. 4.

Referring to the drawings, a rotary drill collar is shown generally at **11**, and may be provided with threaded boxes **12** at the ends thereof for attachment to another drill collar, to a lower end of a drill pipe string, or to a drilling

substitute or adapter which is attached to a drilling bit. A bore **13** extends longitudinally through the collar to provide for communication of drilling fluid therethrough, as is well known.

The drill collar **11** may have a generally square cross section throughout most of its length with flats **15** and corners **16**, which, as illustrated, may be rounded. The upper end of the drill collar **11** may be provided with a portion **17** which is generally cylindrical in shape. The cylindrical end **17** is provided so that the collar may be grasped by a pipe wrench or tongs in order to screw or unscrew it from another collar or from the rest of the parts in a drill string. The lower end **18** of the drill collar is generally square in cross-sectional shape as is shown in FIG. 3.

Since the flats **15** provide for adequate return passage area for the circulating fluid, between the drill collar and the wall of the bore being drilled, the corners **16** of the drill collar may extend radially to a position where they almost touch the walls of the bore hole, thereby laterally stabilizing the drilling bit in its rotary operation so that a more nearly vertical bore hole may be produced, having fewer sharp deviations or "dog legs."

As may be seen in FIGS. 4 and 5, the drill collar **11** is attached to a drilling bit **19** shown in operating position at the bottom of a bore hole. The drill collar **11** may have a cylindrical portion **20** provided thereon which is somewhat removed from the drilling bit **19**. The cylindrical portion **20** is provided so that the drill collar may be grasped with a pipe wrench or tongs in order to screw or unscrew it onto or from the drill bit or from another member in a drilling string. As will be apparent, the lower, square cross-sectional portion **18** of the drill collar is immediately adjacent the drilling bit, and in this position, it affords a stabilizing influence close to the drill bit so that the drill bit **19** is not easily laterally deflected from its path. Since the corners **16** of the collar extend substantially to the diameter of the bore hole being drilled, it will be apparent that substantial lateral stabilization for the bit is afforded, and further, the flats **15** of the collar provide with the wall of the bore hole, adequate area for the return of drilling fluid and cuttings dislodged by the drill bit upwardly thereby to the surface of the earth.

In the rotary drilling of deep wells, the formations penetrated by the drill bit are frequently composed of alternate hard and soft layers which may be disposed or bedded in planes at an angle other than normal to the direction of drilling. This condition, coupled with the tendency of the drill collar to buckle under compressive loads, may result in deviation of the bore hole from a desired path. The "square" drill collar of the invention effects a stiffening and centering of the lower end of the drilling string, immediately adjacent the drill bit, to alleviate the tendency of the bit to deviate from the established center of the hole previously drilled.

Thus the invention provides a drill collar having a generally square cross-sectional shape or configuration, and provides for the employment of such cross-sectional shape immediately above the drilling bit in order to alleviate the tendency of the drilling string to drift laterally during rotation thereof. The cylindrical portion **20** being somewhat more flexible than the square section of the drill collar is disposed in a position remote from the bit rather than immediately adjacent to such bit. The cylindrical portion **20** of the drill collar is formed at regular tong height to accommodate rotary tongs. Thus a collar having a new and improved use, and having a practical configuration is provided whereby such drill collars may be employed in the drilling of deep wells with standard rig equipment since no special tools are necessary to handle

the "square" drill collar provided by the invention. In other words the corner portions of the drill collar may bear on the wall of the bore hole immediately above the drill bit as the drill string is rotated during the regular drilling operation, and thus will resist the tendency of the bit to deviate from its path, and the cylindrical portion, which does not provide sufficient lateral stabilization for the bit but is necessary for the accommodation of tongs, is somewhat removed from the drill bit.

This invention is not limited to the embodiment shown. Various changes within the scope of the following claims will occur to those skilled in the art.

What is claimed is:

1. A drill collar connectable at its upper end into a rotary drill string, and connectable at its lower end to a drilling bit, said drill collar having a substantially square cross-sectional portion with rounded corners immediately above said bit, and having a generally cylindrical cross-sectional portion spaced from said drilling bit, the said square portion having a diagonal dimension substantially the same as the diameter of the drilling bit.

2. A drill collar connectable at its ends into a rotary drill string, and having a portion substantially square in cross-section immediately adjacent the lower end thereof, and a cylindrical portion extending upwardly from said square portion, the corners of said square portion being effective to laterally stabilize the drill collar as the drill string is rotated in a bore hole.

3. An elongate member, suitable for connection into a rotary drilling string for drilling a well bore, and having a fluid passageway extending longitudinally therethrough, the lower end of said member being substantially square in cross-sectional shape, the said member having a substantially cylindrical portion above said square sectional portion adapted to be engaged with rotary tongs for screwing and unscrewing the member into and out of said rotary drill string, the corners of said square lower end being disposed so that they are in close proximity to the wall of the well bore during drilling operations.

4. A drill collar connectable at its ends into a rotary drill string, and having a bore extending longitudinally therethrough, said drill collar having a substantially square cross-sectional shape with rounded corners at the lowermost end thereof and having a first cylindrical portion above said lower end, and a second substantially square cross-sectional shape adjacent the upper end of said first cylindrical portion, and a second cylindrical portion adjacent the upper end of said collar, the corners of said square portions being effective to laterally stabilize the drill collar as the drill string is rotated in a bore hole.

5. A drill collar having a fluid conducting means extending longitudinally therethrough, the upper end of said collar being substantially cylindrical in cross-sectional shape, the lowermost end of said drill collar being substantially square in cross-sectional shape, a second portion of said drill collar being substantially cylindrical in cross-sectional shape immediately above the said lower cross-sectional shaped portion, the said drill collar being substantially square in cross-sectional shape between said upper cylindrical portion and said second mentioned cylindrical portion.

6. An elongate drill collar member having a generally square cross-sectional shaped portion at the lowermost end thereof, and a generally cylindrical cross-sectional portion adjacent said lower square portion, and a generally square cross-sectional shape extending from the said cylindrical shape longitudinally upwardly of said collar, and a second cylindrical portion adjacent the upper end of said collar.

7. A drill collar having a fluid conducting means extending longitudinall therethrough, the said drill collar having two portions generally square-shaped in cross section, the first square portion being located immediately adjacent the lower end of said collar, the collar having a portion cylindrical in cross-section immediately above said first square section portion, the said second square cross-sectional portion of the collar being located above said cylindrical portion.

8. A drill collar having a fluid conducting means extending longitudinally therethrough, and having two portions substantially square in cross-sectional configuration, the first cross-sectional portion of the collar being located immediately adjacent the lower end thereof, the said collar having a cylindrical portion adjacent said lower square portion, the second square portion of said collar extending upwardly from said cylindrical portion.

9. A drill collar having first and second square shaped portions, the first square portion being located adjacent the lower end of said collar, and the second square portion being located remote from the lower end of said collar, and a cylindrical portion extending between said first and second square portions.

10. A drill collar having a first portion substantially square in cross section adjacent the lower end thereof, and a second portion substantially cylindrical in cross section adjacent the upper end of said first square portion, and a third portion substantially square in cross section adjacent the upper end of said second cylindrical portion.

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