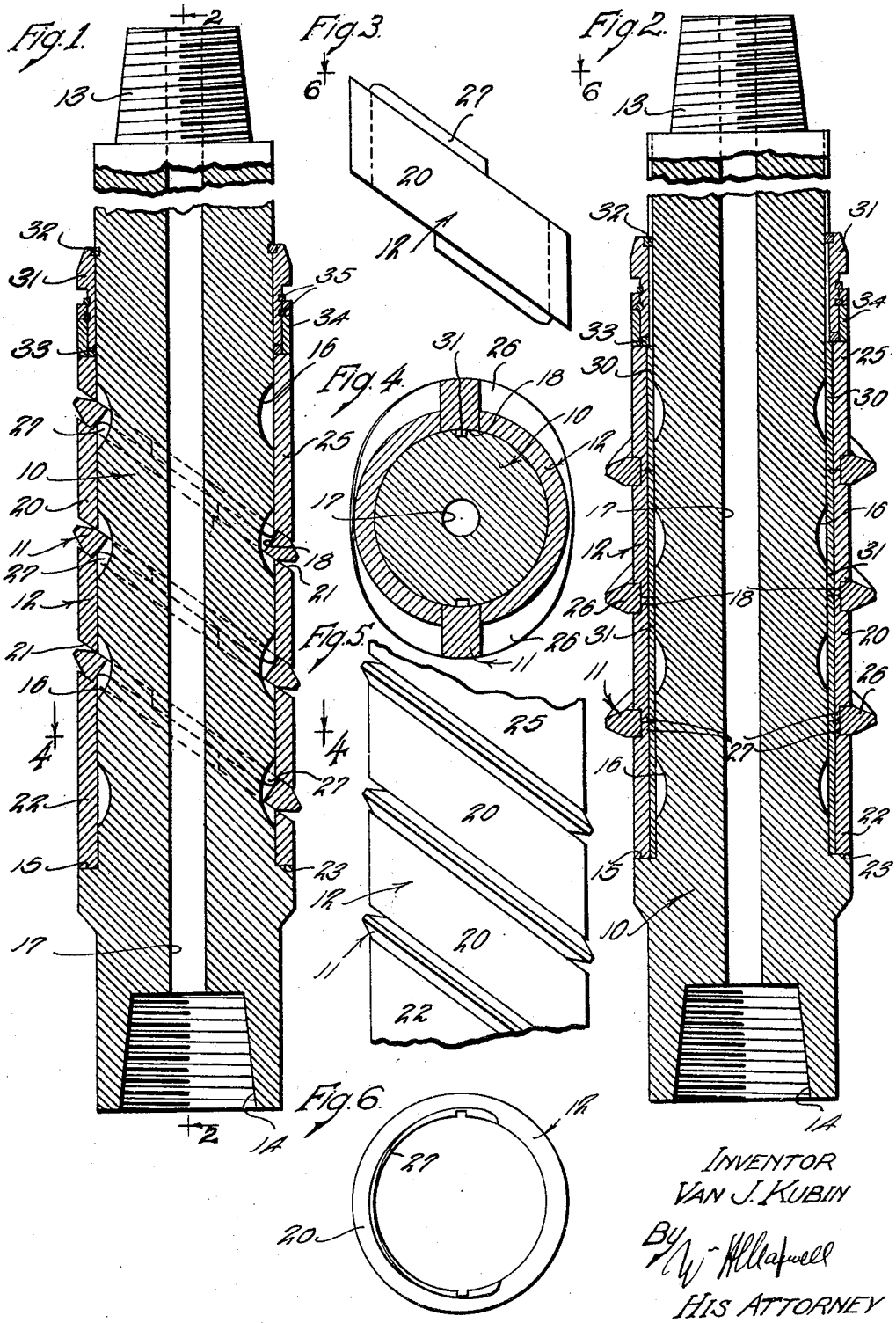
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REAMER

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REAMER

Application filed August 25, 1930. Serial No. 477,627.

This invention relates to a well drilling tool and relates more particularly to a well reamer. It is a general object of the invention to provide a simple, practical, and effective reamer construction.

It is an object of this invention to provide a reamer that embodies a plurality or series of rotatable annular cutters surrounding a body or shank and mounted to rotate in planes tilted relative to the axis of the shank.

It is another object of the invention to provide an improved mounting or bearing assembly for rotatably mounting a plurality of spaced annular cutters on a shank so that they are rotatable in planes inclined relative to the axis of the shank.

Another object of the invention is to provide a reamer in which the parts are simple and inexpensive of manufacture.

It is a further object of the invention to provide a well reamer of the character mentioned in which the cutters and the bearings or spacers for rotatably supporting the cutters are readily detached or removed from the shank for repair or replacement.

Other objects and features of the invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference will be had to the accompanying drawing, in which:

Fig. 1 is a longitudinal detailed sectional view of the reamer provided by the present invention. Fig. 2 is a longitudinal detailed sectional view taken as indicated by line 2—2 on Fig. 1. Fig. 3 is a side elevation of one of the spacers for rotatably supporting the cutters. Fig. 4 is a transverse detailed sectional view taken as indicated by line 4—4 on Fig. 1. Fig 5 is a side elevation of a portion of the reamer, and Fig. 6 is a top or plan view of a spacer.

The reamer provided by the present invention includes, generally, a shank or body 10, a plurality of annular cutters 11, and means 12 for rotatably mounting the cutters 11 on the body 10 so that they are rotatable in planes tilted or angularly disposed relative to the longitudinal axis of the body 10.

The body 10 is provided to carry the cutters 11 and is adapted to be inserted in an operating string. The body 10 is elongated and is provided at its ends with means for connection or attachment to parts of an operating string. In the particular form of the invention illustrated in the drawing, a tapered screw-threaded pin 13 is provided at one end of the body and a screw-threaded socket 14 is provided at the opposite end of the body. A radial annular shoulder 15 is provided on the body 10 a short distance from one of its ends. The body 10 is preferably of round cross sectional configuration and is preferably of uniform diameter between the shoulder 15 and the screw-threaded pin 13. A plurality of longitudinally spaced annular grooves 16 are provided in the exterior of the body 10. The grooves 16 are preferably equally spaced apart and are rounded as illustrated in the drawing. The shank or body 10 is provided with a central longitudinal fluid passage 17 extending completely through it from one end to the other.

The cutters 11 are annular and are mounted around the shank 10 so that their peripheries are effective in engaging the formation. There may be any desired number of cutters 11 provided on the reamer and the body 10 may be proportioned to carry as many cutters as desired. The cutters 11 are supported or mounted on the body 10 by the means 12 so that they are rotatable in planes inclined relative to the longitudinal axis of the body 10. The openings 18 in the annular cutters 11 are axial concentric openings and are proportioned so that the cutters may be readily arranged or slid over the body 10. The cutters are supported on the body 10 by means 12 so that their diametrically opposite portions extend into the adjoining or successive spaced grooves 16 as clearly illustrated in Fig. 1 of the drawing. The grooves 16 are formed so that one portion or side of a cutter may be arranged in a groove and the opposite portion of the cutter may be swung into the other groove 16. The peripheral portions or edges of the cutters 11 are formed to effectively engage or act on the formation. In the particular form

of the invention shown in the drawing, the peripheral portions of the cutters 11 are beveled so that the cutters present effective peripheral cutting edges.

The means 12 rotatably supports the cutters 11 on the body so that they are rotatable in inclined planes and are spaced longitudinally of the body 10. The cutter mounting means 12 is such that the cutters 11 may be easily and quickly removed from the body 10 for repair or replacement. The means 12 includes spacers 20 arranged between the cutters 11. The spacers 20 are slidable on the body 10 and are provided with parallel opposite ends angularly disposed relative to their axes. The angularly disposed ends 21 of the spacers 20 are provided to rotatably support the cutters 11. When the body 10 is provided with the radial shoulder 15, an end spacer 22 is provided at the end of the cutter assembly and has an end 23 normal to its central axis to abut against the shoulder 15. The other end of the spacer 22 is angularly disposed to rotatably carry a cutter 11. A similar end spacer 25 may be provided at the opposite end of the cutter assembly. The inclined ends of the spacers 20, 22, and 25 are flat to effectively rotatably support the flat sides of the cutters 11. The spacers of the cutters 11 are proportioned and related so that the diametrically opposite portion 26 of the cutters project considerable distances from the spacers to engage the formation and to positively cause rotation of the cutters.

The spacers 20, 22, and 25 are provided at their cutter supporting ends with bearing parts 27 to extend into the openings 18 of the cutters for supporting the cutters radially. The bearing parts 27 project axially from the angular ends of the spacers and extend into the openings 18 of the cutters. The outer walls of the bearing parts 27 are curved concentric to the axes of rotation of the cutters to effectively support the cutters for rotation. As the axes of rotation of the cutters 11 are tilted relative to the axis of the body 10, the axes of the bearing parts 27 are tilted relative to the central axes of the spacers. Due to their inclined axes of curvature, the bearing parts 27 terminate adjacent one edge of each spacer and have inclined outer walls at the opposite edge of the spacer for supporting the cutter.

The bearing parts 27 are oppositely arranged or disposed at the opposite ends of the intermediate spacers 20 so that the parts 27 of two adjacent spacers abut to provide a substantially annular radial bearing for the cutters 11. At the point where the cutters 11 extend into the grooves 16 one of the spacers has a plain flat portion, while the opposing spacer has a bearing part 27 extending into the opening 18 of the cutter. The bearing parts 27 of the spacers abut to properly space the spacers and prevent binding of the cutters 11 during operation. During operation of the reamer the longitudinal thrusts on the cutters 11 are taken by the angularly disposed ends of the several spacers and the radial thrusts are taken by the bearing parts 27.

In accordance with the invention means is provided for preventing rotation of the spacers 20, 22, and 25 on the body 10. Keys 30 fit into longitudinal keyways 31 in the body 10 and the several spacers to prevent rotation of the spacers. With the assembly of cutters and spacers just described it will be obvious that the several cutters 11 may be supported on the body to rotate in spaced parallel angularly disposed planes as illustrated in the drawing or that they may be supported on the body by the spacers 11 so that they are rotatable in planes tilted in different directions. In accordance with the preferred form of the invention the keyways 31 for receiving the keys 30 are provided at diametrically opposite points on the body 10, and in the openings of the spacers so that the spacers 11 may be arranged in different rotative positions. The grooves 16 are annular or extend completely around the body and are spaced so that the cutters 11 may be arranged to rotate in planes tilted in different directions by properly arranging the various spacers 20, 22, and 25.

The invention provides means for detachably holding the assembly of the cutters 11 and the spacers on the body 10. The shoulder 15 prevents longitudinal movement of the assembly of cutters and spacers in one direction on the body 10, and any suitable means may be provided on the body for preventing movement of the assembly in the opposite direction. In the drawing I have illustrated a means for retaining the cutter assembly on the body that is set forth and claimed in my co-pending application entitled Reamer, filed Aug. 25, 1930, Serial Number 477,628. In the drawing I have shown an improved means for detachably retaining the cutter assembly on the body. The cutter assembly retaining means includes a main retaining sleeve 31 slidable on the body 10 and normally held in the retaining position by a split ring 32. The sleeve 31 is normally held in position against the sleeve 32 by a split ring 33 arranged against the end of the spacers 25. An outer sleeve 34 is slidable on the main sleeve 31 and is locked in position where it extends over the ring 33 by suitable spring locking means 35 arranged in grooves in the sleeve 31.

It is believed that the utility of the reamer provided by the present invention will be readily apparent from the foregoing detailed description. It it to be noted that the invention provides a reamer that is particularly simple and inexpensive of construction. The bearings or spacers 20, 22, and 25 and the cutters 11 are of simple construction and are

easily and quickly removed from the body 10. The spacers effectively support the cutters 11 for rotation in inclined planes. By rotating in planes inclined relative to the longitudinal axis of the tool, the cutters 11 are particularly effective in engaging the formation as the portions 26 project considerable distances from the central axis of the tool. The cutters 11 are positively caused to rotate during operation of the reamer so that the wear is evenly distributed along their peripheral edges. The cutters 11 cannot track in the formation during operation of the reamer and are particularly effective in forming a smooth round bore.

Having described only a typical preferred form of my invention, I do not wish to limit myself to the specific details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims:

Having described my invention, I claim:

1. A well tool of the character described including, a body, annular cutters surrounding the body rotatable in planes tilted relative to the longitudinal axis of the body and having peripheral cutting parts, and spacers between the cutters rotatably supporting the cutters.

2. A well tool of the character described including, a body, annular cutters surrounding the body rotatable in planes tilted relative to the longitudinal axis of the body and having peripheral cutting parts, spacers between the cutters, and bearing parts on the spacers extending into the cutters.

3. A well tool of the character described including, a body, annular cutters surrounding the body rotatable in planes tilted relative to the longitudinal axis of the body and having cutting parts, spacers between the cutters having ends inclined relative to their axes, and bearing parts on the ends forming radial supports for the cutters, the bearing parts of adjoining spacers being in abutment.

4. A well tool of the character described including, a body, cutters having openings passing the body, spacers on the body between the cutters having ends inclined relative to their axes and rotatably supporting the cutters, and a single key holding the spacers against rotation on the body.

5. A well tool including, a body, annular cutters surrounding the body and rotatable in planes tilted relative to the axis of the body, spacers between the cutters, bearing parts on the ends of the spacers extending into the cutters to rotatably support the cutters, and a common means for holding the several spacers against rotation.

6. A well tool of the character described including, a body having longitudinally spaced grooves, a plurality of annular cutters surrounding the body and angularly positioned so that they have diametrically opposite portions extending into successive grooves, and means for supporting the cutters to rotate about planes tilted relative to the axis of the body.

7. A well tool of the character described including, a body having longitudinally spaced angular grooves, a plurality of annular cutters surrounding the body and angularly positioned so that they have diametrically opposite portions extending into successive grooves, and means for supporting the cutters to rotate about planes tilted relative to the axis of the body.

8. A well tool of the character described including, a body having longitudinally spaced grooves, a plurality of annular cutters surrounding the body and angularly positioned so that they have diametrically opposite portions extending into successive grooves, and means for supporting the cutters to rotate about planes tilted relative to the axis of the body, including spacers between the cutters having bearing parts at their ends.

9. A well tool of the character described including, a body having longitudinally spaced grooves, a plurality of annular cutters surrounding the body and angularly positioned so that they have diametrically opposite portions extending into successive grooves, and means for supporting the cutters to rotate about planes tilted relative to the axis of the body, including spacers between the cutters, and axially projecting bearing parts at the ends of the spacers extending into the cutters.

In witness that I claim the foregoing I have hereunto subscribed my name this 11 day of July, 1930.

VAN J. KUBIN.