

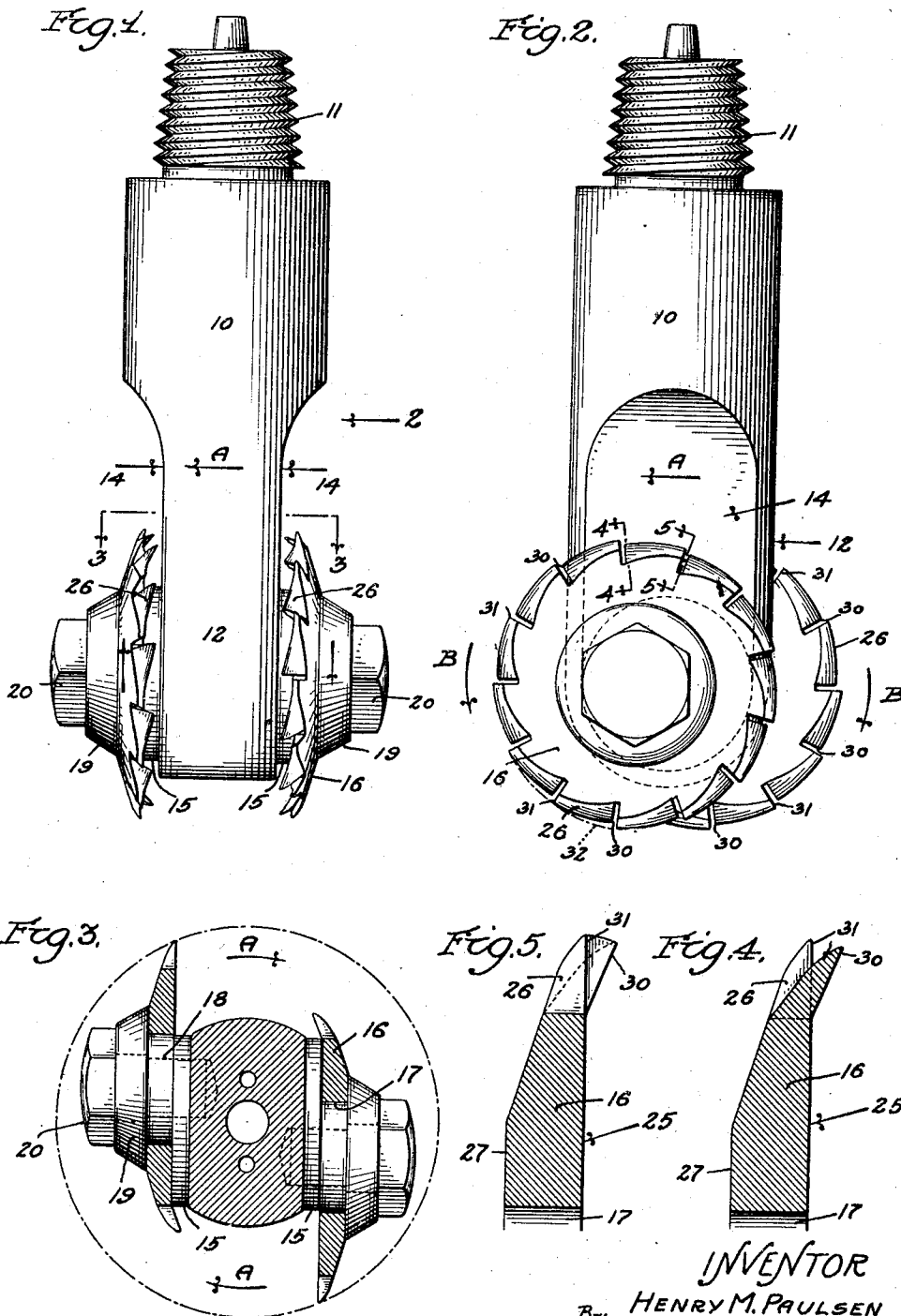
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ROTARY DISK DRILL

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ROTARY DISK DRILL

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My invention relates to rotary disk drills such as are used in the drilling of oil wells, being more particularly of the type in which a pair of revoluble disks are mounted in offset relation to each other on the opposite sides of a single drill shank.

In using disk drills of the character referred to, employing common forms of disks now in use, the disks rapidly wear, such wear commonly being uneven, so that the periphery of the disk frequently assumes an oval shape due to its lack of rotation or to intermittent rotation. These faults are undesirable, both from an economic viewpoint and also for the reason that the hole is not symmetrical.

It is one of the principal objects of my invention to produce a disk drill of the class described provided with disks of such form and shape as to be effective in the production of a hole of substantially uniform contour at a maximum advancing or drilling speed.

The accomplish this desirable result, I provide a disk having a serrated edge forming teeth, which teeth are provided with a particular inclination by means of which the teeth are caused to track during the revolution of the disk as it rotates about the axis of the drill stem, so that the line of contact between each tooth and the material being cut is at least approximately in line with the axis of the disk instead of at right angles thereto.

Other objects and advantages will appear hereinafter from the following description and drawings.

Referring to the drawings, which are for illustrative purposes only,

Fig. 1 is a side elevation of a drill embodying a form of my invention.

Fig. 2 is a face view of the drill shown in Fig. 1.

Fig. 3 is a sectional plan view on line 3—3 of Fig. 1.

Fig. 4 is an enlarged sectional view through a portion of a disk on line 4—4 of Fig. 2, and

Fig. 5 is a sectional view similar to Fig. 4 on line 5—5 of Fig. 2.

More particularly describing the form of

less resistance to the rotation of the disk than or body 10 provided at its upper end, with a threaded pin 11 for attachment to the ordinary drill pipe (not shown). The head 10 terminates in a downwardly extending reduced portion or shank 12, the opposite sides of the shank having flat faces 14, provided with bosses 15, to receive the inner faces of disks 16. The disks 16 are provided with a central bore or opening 17 which receives a ring or sleeve 18 and are held thereon by means of a collar 19 held in place by means of a bolt 20, which extends through the collar 19 and sleeve 18 into the shank 12.

The sleeve 18 is of slightly greater thickness than the disk 16, so that the disk may rotate on the sleeve. It is to be understood that the disk mounting just described may be modified, as will readily occur to those skilled in the art, and that the form of mounting adopted may be of any desired form, provided the disks are not clamped or held against rotative movement on their axis.

Attention is called to the fact that the disks are mounted in offset relation to each other, as clearly shown in Figs. 2 and 3, and that the drill is rotated in the direction of the arrow A in Fig. 3, resulting, due to such offset relation, in a rotation of the disks about their axis in the direction of the arrows B shown in Fig. 2.

Each disk 16 has a flat or straight inner face 25 extending entirely across the disk to the base of a series of teeth 26 forming the cutting edge of the disk. The outer face of the disk is flat at its central portion 27, from which portion it is angularly inclined toward the inner face of the disk, thus diminishing the thickness toward the cutting edge of the disk.

The teeth 26 are formed by serrating the edge of the disk substantially on radial lines and then by setting the teeth thus formed so that the rear end 30 of each tooth extends angularly inward beyond the face 25 of the disk, as clearly shown in Figs. 4 and 5, the forward portion 31 of each tooth remaining in line with the inner face of the disk.

It is to be noted that by bending the rear

portion of each tooth inwardly, as above described, the periphery of the disk is shortened (see Fig. 5) at the rear portion of each tooth.

All of the teeth at the cutting edge of the disk being formed in the manner described, the disk is provided with a variable periphery consisting of a plurality of teeth, each tooth having its cutting edge angularly disposed in two directions, that is angularly across the edge of the disk and downwardly toward the axis of rotation of the disk.

The construction of the disks just described aids in the rotation of the disks and in addition to this rotating cutting action there is also a raking or scraping action which is very important as the rear end of the cutting edge of each tooth extends as a sharp wedge into the formation. The combined cutting and scraping action just described, due to the novel shaped teeth on the disks, makes a hole that is slightly roughened with spiral projections which materially aids the disks in taking hold and results in the rapid advancement of the hole with comparatively slight wear of the disks.

It might be stated that drill bits of the class described, using my invention, have been used with great satisfaction in petroleum production, and while it is difficult to accurately state the exact action of these disks while in operation, it is obvious that the greater digging efficiency of my bit over other bits having serrated disks lies in the tooth construction. This construction is, perhaps, limited to three fundamental features, (1) the manner in which the teeth are cut, (2) the direction in which they are set, and (3) the manner in which they are set, which governs the form of the periphery of the outside cutting surface of teeth. It will be noted that in my invention the depth of each tooth is about twenty per cent. of the disk radius. The direction in which the teeth are set is such that the rear portion of each tooth extends inward, thus the cutting edge 31 is bent at an angle which approaches a plane containing the axis of the disk. The manner of setting the tooth, by keeping the forward portion in the original disk contour and bending the rear portion forward, gives a variable periphery to the tooth surface from which it derives its shearing action, tending to produce grooves in the hole. This last mentioned feature is also probably instrumental in producing more rapid rotation of the disks. For instance, assuming the bit 10 to be rotating in the direction of the arrow A, the forward end 31 of the tooth 26 (relative to the rotation of the bit) is in contact with the formation, and as the bit 10 rotates, the disk 16 tends to be rotated in the direction of the arrow B, and due to the fact that the periphery of the rear end 30 of the teeth is less than that of the forward end 31, the resultant action of the individual teeth in the formation is one of

shearing more than scraping, which offers less resistance to the rotation of the disk than would be the case if the entire tooth surface 32 had a uniform periphery, as shown by the dotted lines in Fig. 2. Further, since the teeth are set at an angle which approaches a line parallel with the axis of the bit, it is obvious that there will be a greater force tending to rotate the disk than would be the case if the teeth were set at an angle perpendicular to said axis, in which case the disk would tend to drag, similar to a plane disk.

It might be added that there is, within certain limits, a definite angle at which the teeth must be set to give the most efficient results. This angle is dependent upon the size of the disk, being in a ratio with the diameter of the disk. I find that I obtain very satisfactory results by setting the teeth in the ratio of about one-sixteenth inch for a two and one-half inch disk.

I claim as my invention:

1. For use in combination with the shank member of a rotary drill bit: a pair of complementary disks rotatably mounted on said shank, the axes of said disks being substantially parallel and offset equidistant from the axis of said shank in a plane substantially perpendicular with said shank axis; said disks having teeth formed in the circumference thereof, said teeth being set with the rear portion of each tooth, relative to the rotation of the bit, bent from the face of the disk toward said shank, the front portion of the tooth remaining in the original disk contour.

2. For use in combination with the shank member of a rotary drill bit: a pair of complementary disks rotatably mounted on said shank, the axes of said disks being substantially parallel and offset equidistant from the axis of said shank in a plane substantially perpendicular with said shank axis; said disks having teeth formed in the circumference thereof; said teeth having a decreasing periphery toward the axis of said shank.

3. For use in combination with the shank member of a rotary drill bit: a pair of complementary disks rotatably mounted on said shank, the axes of said disks being substantially parallel, and offset equidistant from the axis of said shank in a plane substantially perpendicular with said shank axis; said disks having teeth formed in the circumference thereof; said teeth being set in a manner such that the peripheral cutting edge of each tooth approaches a plane containing the axis of the disk and extends downwardly towards said disk axis, and inwardly toward the axis of said shank.

4. For use in combination with the shank member of a rotary drill bit: a pair of complementary disks rotatably mounted on said shank, the axes of said disks being substantially parallel, and offset equidistant from the axis of said shank in a plane substantially

perpendicular with said shank axis; said disks having teeth formed in the circumference thereof; the rear corners of said teeth being set toward the axis of said shank in a manner such that the peripheral cutting edge of each tooth approaches a plane containing the axis of the disk; and a front corner on each tooth remaining in the original disk contour.

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5. A disk for a rotary drill, adapted to be rotatably mounted upon a shank and having teeth formed in the circumference thereof; said teeth being set so that a corresponding radial face on each tooth remains in the original contour of the disk, the other radial face being bent inwardly from the contour of the disk toward the axis of the disk.

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6. A disk for a rotary drill adapted to be rotatably mounted upon a shank, and having teeth formed in the circumference thereof, said teeth being formed by serrations having a depth of substantially twenty percent. of the disk radius and set so that a corresponding radial face on each tooth remains in the original disk contour and a peripheral cutting edge of each tooth forms an inwardly extending acute angle with the inside face of the disk.

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7. A disk for a rotary drill bit, adapted to be rotatably mounted upon a shank, comprising: a disk member having a serrated periphery and a substantially flat inner face disposed in a plane parallel with the axis of said shank, said serrations forming circumferential teeth and one corner of said teeth being set from the plane of said inner face toward the shank axis.

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- In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 28th day of July, 1927.

HENRY M. PAULSEN.

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