Aug. 6, 1929. W. V. SEIFERT 1,723,381

ROTARY DRILL BIT

Filed July 25, 1922 2 Sheets-Sheet 1

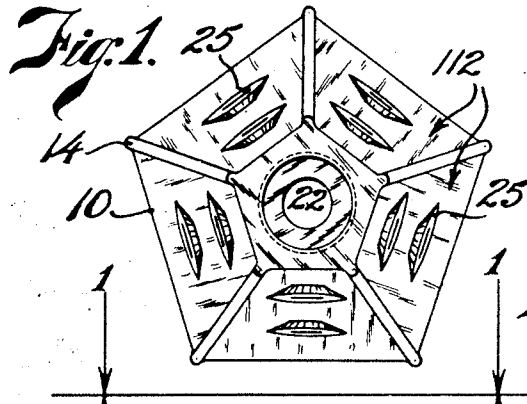


Fig. 1.

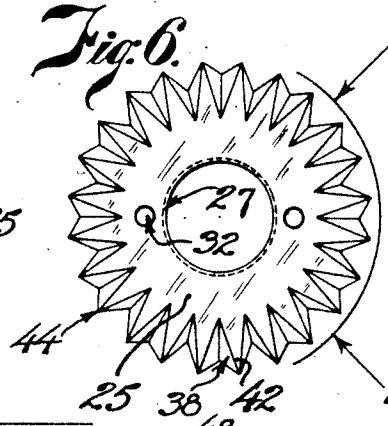


Fig. 6.

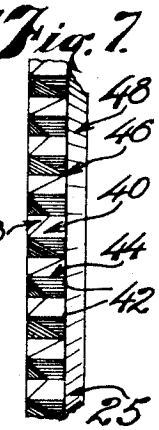


Fig. 7.

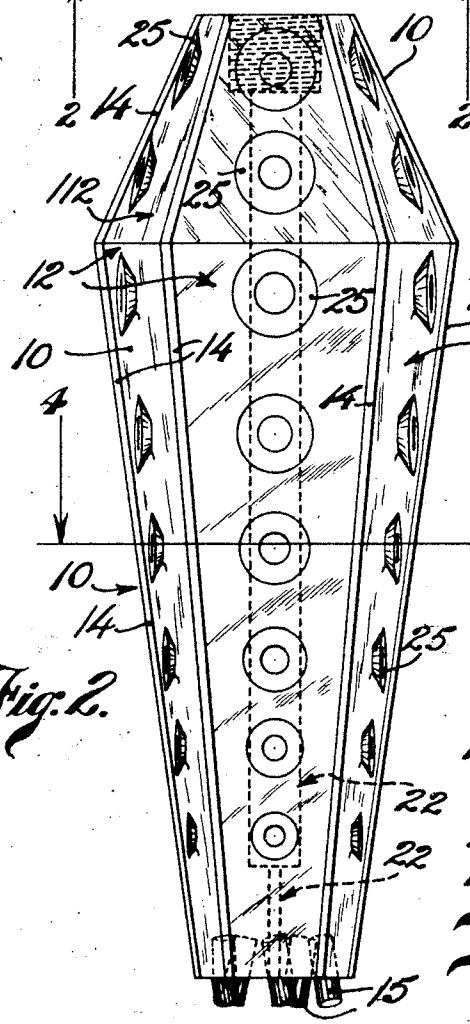


Fig. 2.

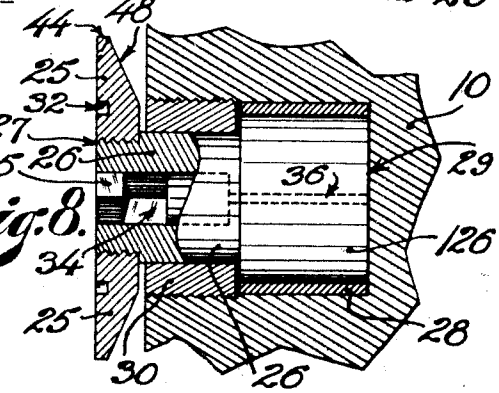


Fig. 8.

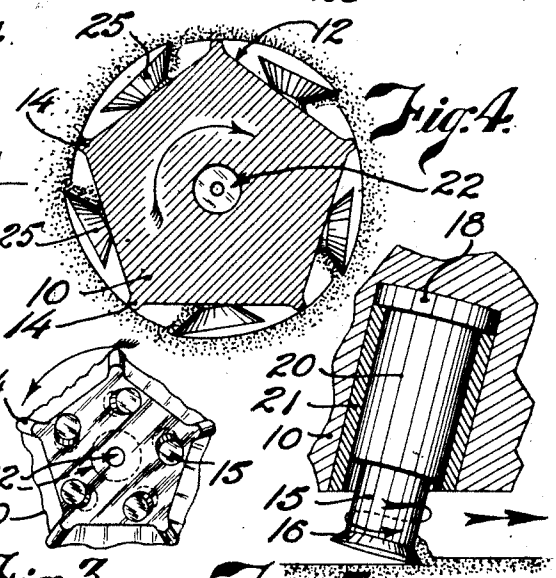


Fig. 4.

Fig. 3.

Fig. 5.

3 3

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ROTARY DRILL BIT

Filed July 25, 1922 2 Sheets-Sheet 2

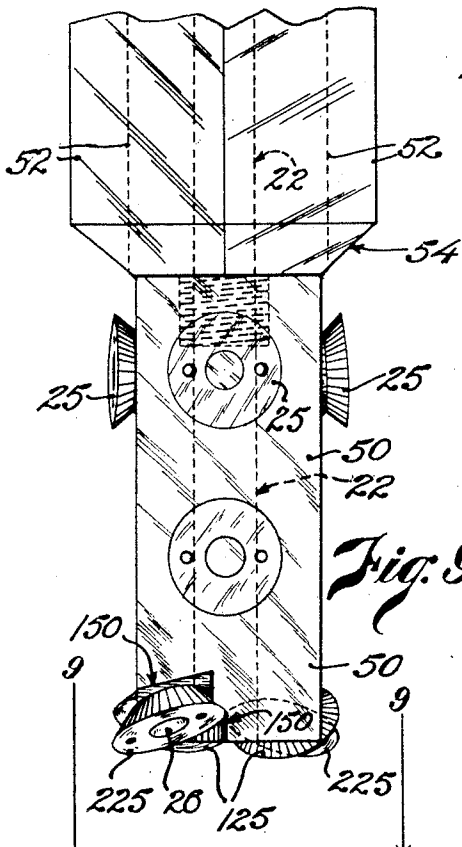


Fig. 9.

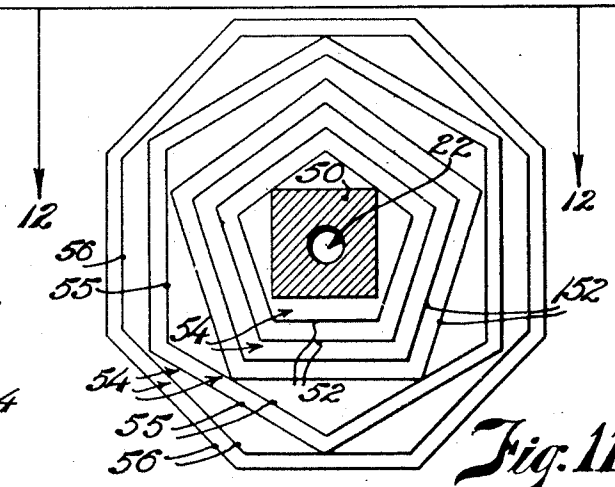


Fig. 11.

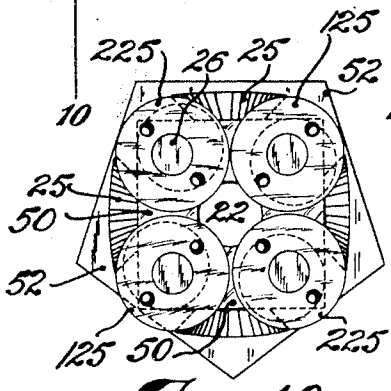


Fig. 10.

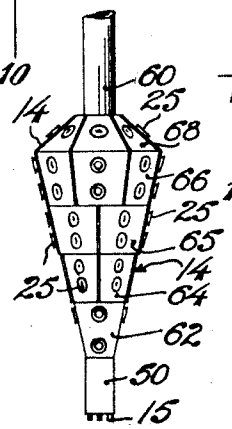


Fig. 13.

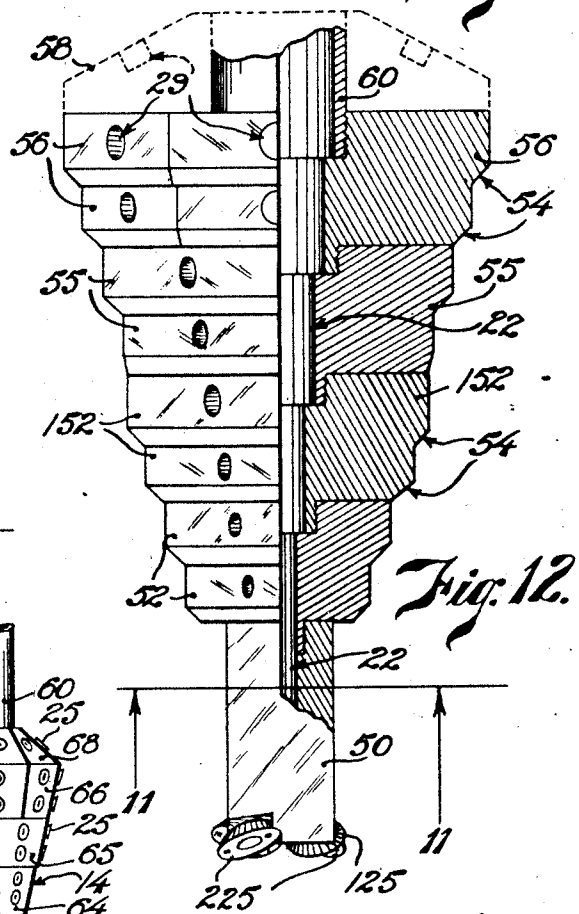


Fig. 12.

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Patented Aug. 6, 1929. 1,723,381

UNITED STATES PATENT OFFICE.

WILLIAM V. SEIFERT, OF DENVER, COLORADO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNIVERSAL ROTARY BIT COMPANY, A CORPORATION OF COLORADO.

ROTARY DRILL BIT.

Application filed July 25, 1922. Serial No. 577,302.

The object of this invention is to provide a bit for rotary drills which shall be comparatively simple, highly efficient, and wherein the wearing parts may be readily replaced at low cost.

The invention resides in a bit body of polygonal cross section whereby a plurality of flat faces are provided for the mounting of cutting discs. These cutting discs are set at angles to the axis of the bit for insuring clearance of the same from the walls of the hole, and preferably said discs are of special construction for rapid cutting and for rapid clearing of the cuttings from the discs themselves. Said discs are removably mounted upon rotatable mountings for ready replacement. The bit body also has a gradual taper longitudinally thereof so that the same gradually descends in the hole as the same is cut whereby the edges of the bit body serve to maintain the walls of the hole and prevent pebbles, rocks or earth from falling directly upon the discs. Thus the discs are left free for maximum efficiency. The lower end of the bit body receives renewable means which constitute the point of the bit, such means being preferably in the form of rotary devices set at various angles to insure a clean and rapid cut at the bottom of the hole.

In the accompanying drawings wherein certain embodiments of the invention are disclosed,

Fig. 1 is a plan of one form of the bit; see line 1—1;

Fig. 2 is a side elevation thereof; see line 2—2;

Fig. 3 is a lower end view taken from line 3—3 of Fig. 2;

Fig. 4 is a cross section taken on line 4—4 of Fig. 2 and indicating the arrangement and functions of the various parts;

Fig. 5 is a vertical section showing one of the rotary devices of the point;

Fig. 6 is a face view in detail of one of the improved discs;

Fig. 7 is an edge detail thereof from line 7—7 of Fig. 6;

Fig. 8 is a cross section through one of the discs and its mounting;

Fig. 9 is a fragmentary elevation of a modified form of bit and point arrangement, as indicated by line 9—9 of Fig. 10;

Fig. 10 is an end view thereof taken from line 10—10 of Fig. 9;

Fig. 11 is a view partially in end elevation and partially in section taken on line 11—11 of Fig. 12;

Fig. 12 is a view partially in elevation and partially in vertical section showing the entire bit of the general form of Figs. 9, 10 and 11;

Fig. 13 is an elevation of another form which is a composite of the other forms.

In the form of Figs. 1 and 2, the body 10 of the bit is preferably integral, the lower or principal portion thereof having a plurality of flat faces 12 which taper as they extend downward so that the bit tapers downward as a whole. Preferably the upper portion of the bit tapers upward, and has a plurality of flat faces 112 corresponding in number to the faces 12. Thus the bit is polygonal in cross section, and the flat faces are for the purposes of receiving cutting discs 25. The body has at the edges between its faces, longitudinal beads 14 provided for the purpose of preventing rocks dislodged in the operation of the tool, from falling in from the wall of the excavation upon the sharpened edges of the cutting disks which are mounted upon the faces of the body between the beads with their cutting edges contiguous to a circle exceeding in diameter that of the beads in the same cross sectional plane to a determinate cutting depth of the disks.

The lower end of the body 10 is squared off perpendicular to the axis of the bit to provide a downwardly extending face, and from this face a plurality of rotary cutting stems 15 project at various angles to the axis of the bit. Preferably the exposed extremities of the stems or spindles 15 are upset slightly at 16 to form integral cutting discs. As the amount of upset is slight, these stems are somewhat in the nature of drills and permit the entire bit to fall after having been elevated as by riding up over a rock, without maaterial damage to the extremities thereof. The inner ends of the stems or spindles 15 are provided with enlarged heads 18 whereby said spindles are retained within cavities in the end of bit body 10 through the medium of bushings 21 pressed into said cavities and in which bushings an intermediate portion 20 of each of the spindles is journaled.

The center of the bit body 10 is provided with water passages 22, and at the upper end

the body is threaded for receiving the lower end of the driving element 60 (Fig. 12). The discs 25 mounted upon the flat faces 12 are of various sizes in the form of Fig. 2 and increase in size as the width of the respective face increases. These discs are removably mounted upon rotary spindles 26 by means of threads at 27. The inner ends 126 of the spindles 26 are enlarged as shown and work upon bushings 28, while the smaller portions work upon retaining bushings 30 threaded into the cavities 29 in which the spindles are received and in which they rotate. The discs 25 may be provided with openings 32 for receiving a removing tool, and each spindle 26 is provided with a squared opening 34 which serves the double purpose of receiving a square tool when removing or attaching a disc and of receiving oil or grease which reaches the bottom of the bore or cavity 29 through a small passage 36, a cork or plug 35 being provided to protect the oil or grease and to move inward against the pressure without for the purpose of positively feeding the oil or grease inward.

Preferably each disc 25 is notched transversely at 40 to provide peripheral teeth 42 whose transverse edges 44 are sufficiently sharp to form cutting edges. From the bases of the teeth tapering clearing cuts or notches 38 are provided on one side of the disc, the far corner of the notch 38 extending in some instances at least, to the opposite side of the base of the respective tooth as indicated at 46. Thus at each point 46 a further cutting portion is provided by the sharp corner. The side of the disc opposite the tapering notches or grooves 38 is beveled as seen at 48, this side being disposed opposite the face of the body 10 of the bit. The axes of the spindles of the discs 25 are disposed at angles to the respective radii of the bit body so as to throw the rear of the cutting portion of each disc inward from the forward portion and thus cause the rear or trailing portion to clear the wall of the hole, as best seen in Fig. 4. In this manner the leading portions of the cutting edges of the discs are positioned somewhat outward of the path of the edges of the faces 12 and the beads 14 where the latter are used, while the trailing portions of said edges are positioned adjacent or within the path of said edges or beads.

In the general form of Figs. 9, 10, 11 and 12, the polygonal cross section of the bit body at all points is retained and flat faces are provided for mounting the discs 25 thereon. But instead of having the faces continuous and producing the taper of the bit body by tapering said faces, the taper is produced by providing a plurality of sections of gradually changing sizes, and preferably the number of sizes upon these sections varies, the number increasing as the diameter of the section increases. In this manner a greater number of discs may be placed upon the sides of the body and the discs 25 may be all of the same size or approximately so.

Thus for the lower end of the bit, a square section 50 may be used upon whose flat faces the discs 25 are mounted as in the other form. Next above this a pentagonal section 52 may be employed, and as shown this section may have two zones of different width. Also it may be convenient when the height of the individual sections is not great, to have a second pentagonal section 152 also having two zones of different width or diameter. In practice, the lower edges of each section and zone will be wiped off or beveled as indicated at 54 to form beveled faces which cause one zone or section to taper somewhat more gradually into the adjacent one. Above the pentagonal sections, a hexagonal section 55 having two zones may be employed, and next above an octagonal section 56 having two zones. A cap 58 whose upper faces taper upwardly toward the center may be used, corresponding with the upwardly tapering faces 112 of the form of Fig. 2. The driving element 60 will have connection with the upper section, and the various sections will be removably connected in order that a sectional bit of any desired size or form may be built up.

Upon the lower end of the lowermost section of this form, discs like the discs 25 are used instead of the cutting stems 15. These discs are arranged in two pairs 125 and 225 disposed at diagonally opposite corners, all discs being set at an angle to the axis of the bit and one pair being set at a greater angle than the other. The inner edges of these discs are the trailing edges and the end of the section 50 is cut out as indicated at 150 to receive such inner portions, said inner portions thus being partially embedded in the section 50.

Fig. 13 shows a form of bit composed of a plurality of sections which are polygonal in form and have various numbers of sides as in the form of Fig. 12. The faces of each section taper however, so that it is not necessary to cut or wipe off the lower edges to produce a more or less uniform taper of the bit body as a whole. Here we have a square lower end 50 like that of Fig. 12 provided with the cutting stems 15 of Figs. 2 and 5. Above this in order comes a tapered section 62 which is square in cross section, a tapered pentagonal section 64, a tapered hexagonal section 65, a tapered octagonal section 66, and an upwardly tapered octagonal section 68 to fit section 66. The upper sections are provided with beads 14, but the square sections do not require beads to perform the wall retaining function since their corners project far enough.

In the operation of the device, the bits will be rotated as indicated by arrows with the

result that the cutting stems 15 or the discs 125 or 225 on the lower end of the respective bit will cut out the bottom of the hole. As the bit rotates and descends the spiral path of each of the discs 25 will cause the sides of the hole to be gradually cut away until the desired diameter is obtained. The number of discs 25, 125, 225 and of the stems 15 will be such as to perform the work efficiently. The inclination of all the discs and of the stems 15 will be such as to cause rotation of the various parts individually as the bit body is rotated. The passage of water down through the water channels 22 causes the débris to be washed upward around the bit and to the top of the hole. When the hole cannot be drilled readily the stems 15 will preferably be employed at the lower end of the bit since they will better resist the shock when the bit rides up over rocks and drops after passing over them. The form of cutting disc shown in Figs. 6, 7 and 8 will clear itself as the work progresses and at the same time efficient cutting edges are presented. When a disc wears out a new one is substituted upon the respective spindle 26. Lubrication is insured by pressure upon the cork or plug 35 in the outer end of each lubricant carrying opening 34.

The upwardly beveled faces 112, 58 and 68 which carry discs 25 are provided for the purposes of assisting the bit in drilling its way upward in the event of a cave-in.

I claim:

1. A rotary drill bit comprising a tapering body of polygonal section, having beads at the edges between its faces, and cutting members on said faces having their cutting edges contiguous to a circle exceeding in diameter that of the beads in the same cross sectional plane to a determinate cutting depth of the members.

2. A rotary drill bit comprising a tapering body having a plurality of faces arranged in series superposed one above another, and cutting members on said faces, the number of faces in the series varying in ratio to the respective diameters of the body.

3. A rotary drill bit having a plurality of faces arranged in series superposed one above another, and cutting members on said faces, each lower series having a lesser number of faces than the series immediately above the same.

4. A rotary drill bit comprising a body having longitudinal beads at equal distances from its axis and cutting members on the body between said beads, having their cutting edges in a circle slightly exceeding that of the beads in the same cross-sectional plane to a determinate cutting depth of the members.

5. A bit for deep well drilling through earth and rock comprising in combination a bit body rotatable about a vertical axis, a plurality of exteriorly located rotatable cutters of frusto-conical shape mounted on shafts carried in holes in the bit body, the cutting edges of said cutters being provided by the conjunction of the conical surface of the cutter with its flat end face, said cutters being arranged to engage the material to be cut at angles substantially less than 90°, whereby to loosen the material with a cutting wedging action, and being arranged at different distances from the axis of the bit to cut a plurality of paths of different diameters, there being a greater number of cutters provided to cut the paths of greater diameter than are provided to cut the paths of smaller diameter, whereby the cutting wear on the respective cutters is practically uniformly distributed.

6. A bit for deep well drilling through earth and rock comprising in combination a bit body rotatable about a vertical axis, a plurality of exteriorly located rotatable cutters of frusto-conical shape mounted on shafts carried in holes in the bit body, the cutting edges of said cutters being provided by the conjunction of the conical surface of the cutter with its flat end face, said cutters being arranged to engage the material to be cut at angles substantially less than 90°, whereby to loosen the material with a cutting wedging action, and being mounted at different distances from the axis of the bit whereby to cut a plurality of paths of different diameter, said cutters being distributed on said bit body so that the cutting wear on one cutter will not be greatly disproportionate to the wear on other cutters.

7. A bit for deep well drilling through earth and rock comprising in combination a bit body rotatable about a vertical axis, a plurality of exteriorly located rotatable cutters of frusto-conical shape mounted on shafts carried in holes in the bit body, the cutting edges of said cutters being provided by the conjunction of the conical surface of the cutter with its flat end face, said cutters being arranged to engage the material to be cut at angles substantially less than 90°, whereby to loosen the material with a cutting wedging action, and being mounted on said bit body at different elevations and different distances from the axis of the bit, whereby to cut a plurality of paths of increasing diameter, said cutters being distributed on said bit body so that the cutting wear on one cutter will not be greatly disproportionate to the wear on other cutters.

In testimony whereof I affix my signature.

WILLIAM V. SEIFERT.