

May 26, 1953

D. H. FRANCIS
ROTARY ROCK DRILLING BIT

2,639,896

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2 Sheets-Sheet 1

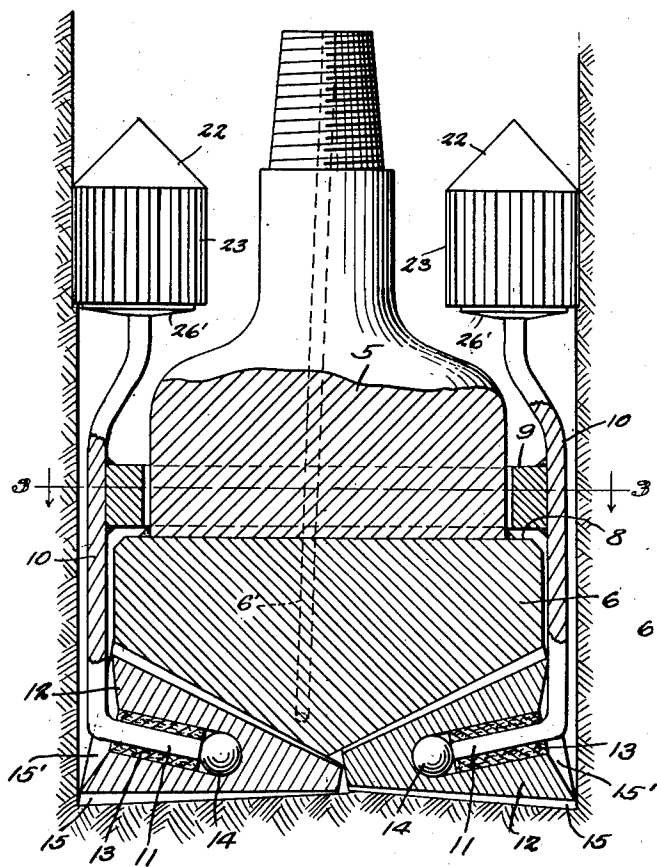


Fig. 2.

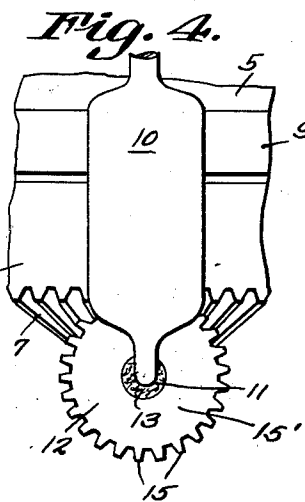


Fig. 4.

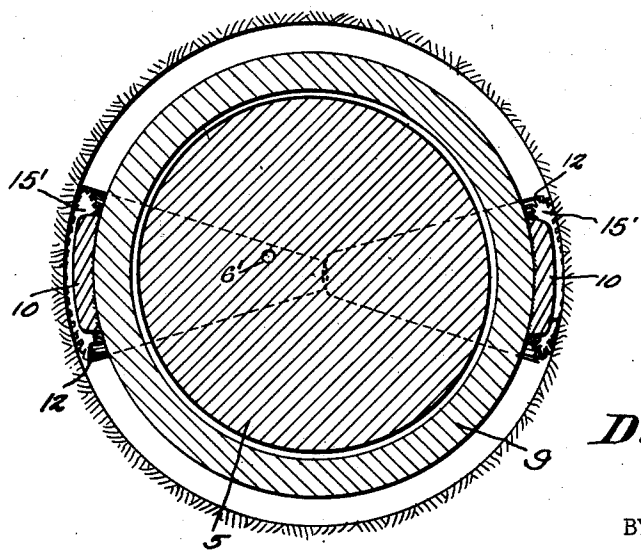


Fig. 3.

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Fig. 1.

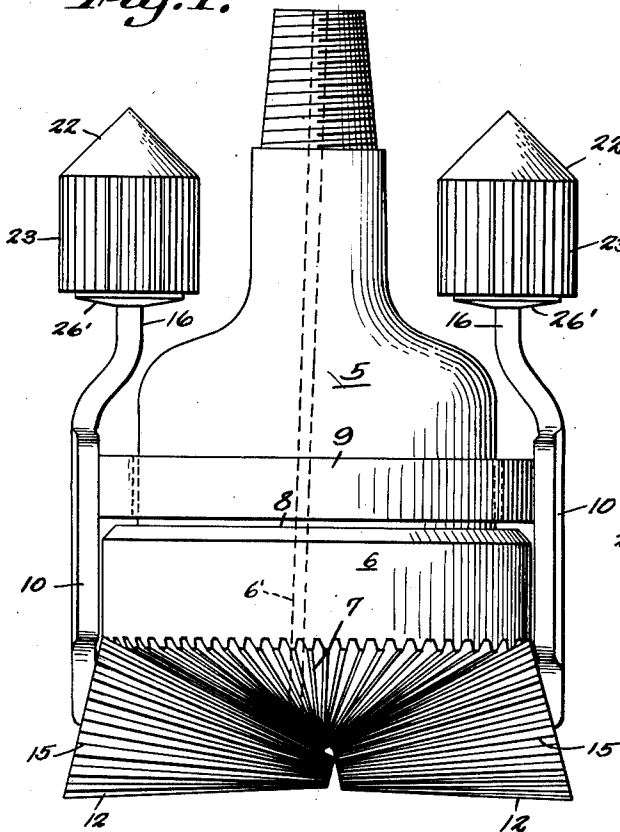


Fig. 5.

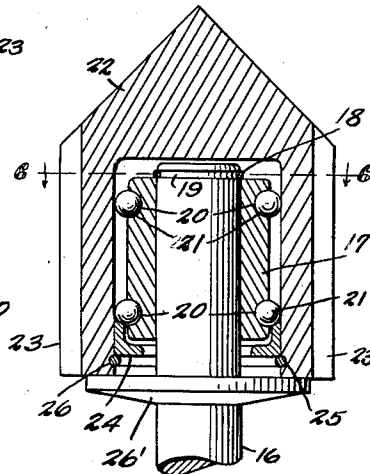


Fig. 7.

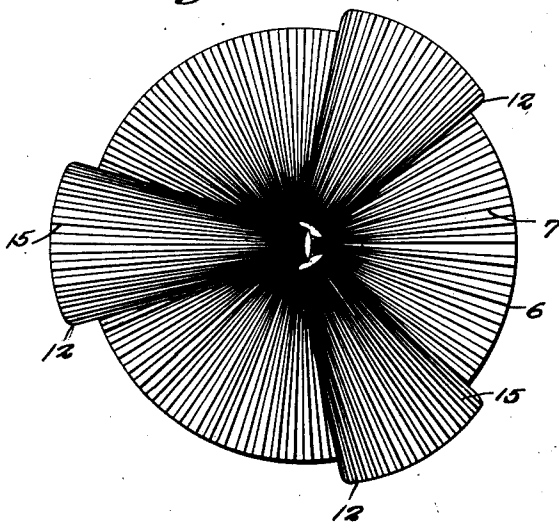
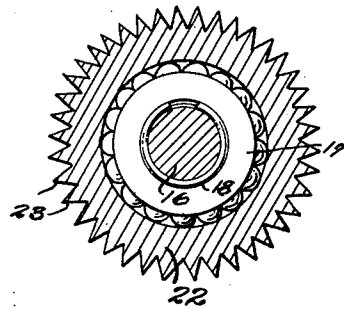


Fig. 6.



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UNITED STATES PATENT OFFICE

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ROTARY ROCK DRILLING BIT

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2 Claims. (Cl. 255-71)

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This invention relates to well drilling apparatus and more particularly to the construction of the rotary drilling bit thereof.

An important object of the invention is to provide a drilling bit of the roller type wherein rock cuttings will be ground into an exceptionally fine grained material that may be readily flushed from the hole during the drilling operation, thereby greatly lessening the possibilities of sand deposits in the hole drilled.

Another object of the invention is to provide thrust bearings for the rotary cones of the drill, thereby providing means for absorbing the lateral thrust of the cutter cones, and at the same time preserving the down-thrust action exerted by the column of the drill pipe of the apparatus, which is necessary in the drilling operation.

Still another object of the invention is to provide a floating support for the drill cones of the apparatus, which will permit of longitudinal movement of the drill cones with respect to the power gear of the apparatus to insure a true meshing of the teeth of the beveled power gear with the teeth of the drill or cutter cones, compensating for wear between the teeth of the beveled power gear and cutter cones.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts, herein-after more fully described and pointed out in the claims, it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention as claimed.

Referring to the drawing:

Figure 1 is an elevational view of an improved drilling bit constructed in accordance with the invention.

Fig. 2 is a vertical sectional view through the drilling bit illustrating the bit as operating in drilling a well.

Fig. 3 is a sectional view taken on line 3-3 of Fig. 2.

Fig. 4 is a fragmental side elevational view illustrating a cutter cone as mounted on a thrust bearing forming a part of the cutter cone supporting arm.

Fig. 5 is a vertical sectional view through one of the reamer cones forming a part of the invention.

Fig. 6 is a sectional view taken on line 6-6 of Fig. 5.

Fig. 7 is a bottom plan view of a modified form of the drill.

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Referring to the drawing in detail, the drill comprises the shank or body portion 5, which is secured to the lower end of the drill rod, not shown. This shank or body portion 5 provides a support for the beveled power gear 6, the teeth 7 thereof being disposed downwardly, the structure being provided with the bore 6' through which water passes to wash cuttings from the hole being bored.

As shown by the drawing, the beveled power gear 6 is of a diameter substantially greater than the shank or body portion 5, providing an annular shoulder 8 at the top of the beveled power gear. This shoulder 8 provides a support for the floating bearing ring 9, which fits over the shank or body portion 5 in spaced relation therewith, so that free movement of the bearing ring 9 with respect to the shank or body portion 5, will be permitted, the floating bearing ring contacting the shoulder 8 to restrict downward movement of the floating bearing ring with respect to the beveled power gear 6.

Welded to the outer surface of the floating bearing ring 9, are vertical supporting arms 10, that have inwardly inclined lower ends 11 that provide supports for the cutter cones 12, there being provided packing 13 between the cutter cones and inwardly inclined lower ends 11 of the arms 10, to exclude moisture and foreign matter from the inwardly inclined lower ends 11, which provide supports for the cutter cones 12. Disposed within the bearings of the cutter cones 12 are balls 14, which provide thrust bearings to absorb the lateral thrust of the cutter cones, but preserve the down-thrust directed to the cutter cones and exerted by the column of drill pipe with which the apparatus is used.

The large ends of the cones 12 are concaved at 15' so that a clearance is provided for the ends 11 of the supporting arms 10. The concaved ends also present sharp cutting edges for cutting the wall of the well being drilled.

The cutter cones 12 are formed with teeth 15 that mesh with the teeth 7 of the power gear 6, so that rotary movement of the beveled gear 6 will result in rotary movement of the cutter cones 12, which cutter cones accomplish the cutting operation of the drill as the drill is forced downwardly. The upper ends of the vertical supporting arms 10 are formed into supports 16 over which the bearings 17 are positioned, the bearings 17 being held in position by the snap rings 18 that fit into grooves 19 formed at the upper ends of the supports 16, the snap rings engaging the upper edges of the bearings 17. The bear-

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ings 17 are formed with ball grooves 20 in which the balls 21 operate, the balls providing a bearing surface for the cylindrical cutting members 22, that have blades 23 extending longitudinally thereof, the upper ends of members 22 being conical in construction. Bearing rings 24 are also disposed within the cylindrical cutting members, the bearing rings 24 being held in position by means of the snap rings 25 that fit into grooves 26 formed in the inner surface of the cylindrical members 22. Certain of the balls 21 of these cylindrical cutting members rest on the bearing rings, which act as thrust bearings for the cylindrical cutting members.

The cylindrical cutting members 22 rest on the annular supporting flanges 26' that are secured on the supports 16 in spaced relation with the free ends thereof.

As shown by Fig. 1 of the drawings, when these vertical supporting arms 10 have their upper ends extended slightly inwardly, the cylindrical cutting members will contact with the wall of the well being drilled, in a direct vertical line with the lower outer edges of the cylindrical cutting members, to clear the hole drilled.

These cylindrical cutting members also provide means for guiding the drill in a true vertical plane during the drilling operation.

From the foregoing it will be seen that as the beveled power gear 6 is rotated, the cutter cones 12 will be rotated drilling the opening. As the teeth of the cutter cones wear, the cutter cones are supported to move vertically owing to the floating supporting ring, with the result that a true fit between the teeth of the beveled power gear 6 and cutter cones 12 will be insured at all times.

Having thus described the invention, what is claimed is:

1. In a well drilling bit, a drill shank, a beveled power gear formed on one end of the drill shank, said drill shank having a reduced portion defining an annular shoulder, a floating annular bearing ring mounted on the drill shank spaced

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above the shoulder, said floating ring being movable longitudinally of the drill shank, vertical arms secured to said annular bearing ring at points intermediate the ends of the arms, one of the respective ends of each of said arms being extended inwardly over said beveled power gear in spaced relation therewith, providing bearings, cone shaped cutting members having teeth formed longitudinally of the outer surface thereof, mounted on said inwardly extended ends in mesh with the beveled power gear, whereby said cutting members are rotated as the power gear is rotated, and cylindrical cutting members having vertical teeth, mounted on the opposite ends of said arms for contact with the wall of the opening drilled.

2. In a well drilling bit, a drill shank, a beveled power gear formed on one end of the drill shank, said drill shank having a reduced portion adjacent to one end providing an annular shoulder spaced from the beveled power gear, an annular bearing ring loosely mounted on the reduced portion of said shank for vertical movement on said shank, said annular shoulder providing a stop against which said annular ring moves restricting movement of said annular ring in one direction, vertical arms secured to said ring and disposed opposite to each other, cutting members mounted on the lower ends of the arms engageable with the teeth of said beveled power gear, rotating the cutting members as said drill shank rotates, and cylindrical cutting members having vertical teeth on the periphery thereof, mounted on the other ends of said arms above said ring, for contact with the wall of the opening being drilled.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,778,966	Stokes	Oct. 21, 1930
1,854,624	Powell	Apr. 19, 1932