

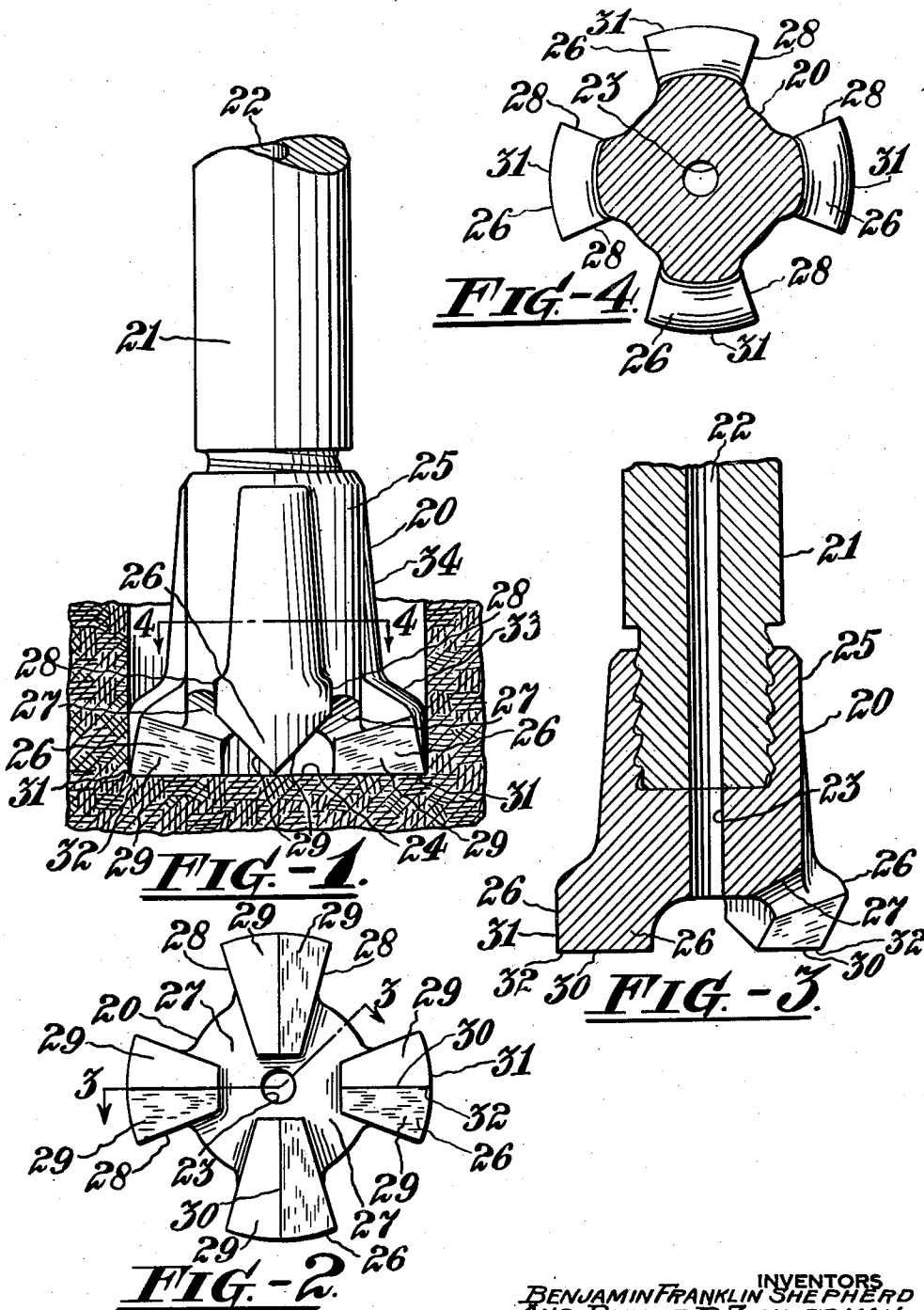
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B. F. SHEPHERD ET AL

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ROCK DRILL BIT

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INVENTORS
BENJAMIN FRANKLIN SHEPHERD
AND ROBERT D. ZIMMERMAN.
BY
Charles
THEIR ATTORNEY.

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ROCK DRILL BIT

Benjamin Franklin Shepherd and Robert D. Zimmerman, Phillipsburg, N. J., assignors to Ingersoll-Rand Company, Jersey City, N. J., a corporation of New Jersey

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This invention relates to cutting implements, and more particularly to a rock drill bit adapted to be actuated into the work by a percussive element and rotated intermittently to shift its cutting edges to new positions on the work between blows.

Prior to the adoption of the conventional radial type bit now in common use, it was the practice to form only a single taper on the outer surfaces of the wings embodying the cutting edges. With this form of construction, however, it was found to be a difficult matter to maintain the gage, that is, the distance between tips of diametrically opposed wings. The outermost corners of the bit, being inadequately buttressed, would fracture and the resulting blunted portions of the cutting wings would become rounded during the ensuing operation and seriously impede the progress of the drill bit into the rock.

A further undesirable condition occasioned by breakage of the wing tips was that the gage or diameter of the cutting portion of the drill bit was reduced to such an extent that a wide difference in gage was required between successive sizes, the usual difference in the diameters between successive drill bits being one-quarter of an inch. Obviously, gradation of such value necessitated starting bits of large diameter for drilling holes of considerable depth and consequently an undue expenditure of power.

In order to obviate these objectionable conditions it was proposed to provide the wings with a double taper, as for example a 5° wing tip clearance and a 14° wing side taper leading from the wing tip taper and constituting the outer surface of the buttress portions of the wings. By reason of this arrangement the wing tips were materially strengthened so that breakage occurred less frequently and as a result it was possible to resort to the use of a much smaller range of variations in the gages of successive bits.

In many respects the latter type of bit is a marked improvement over its predecessor but shares the common fault of increased gage surfaces accordingly as the outer ends of the wings become worn. In both types of bits the initial gage surface can be maintained for only a comparatively short portion of the serviceable life of the bit. Since, as wear on the wing ends increases the gage surface increases correspondingly until excessively large gage areas are brought into frictional engagement with the wall of the hole being drilled. This circumstance frequently creates a condition in which friction be-

tween working implement and rock face greatly retards the action of the rotation mechanism of the actuating tool and often causes such rotation mechanism to stall altogether.

The rapidity with which this condition develops depends, of course, upon the nature of the rock being drilled. In soft, moderately abrasive rock the wing wear is not of serious consequence but in hard, friable material the wings wear rapidly and necessitate frequent renewals of the drill bit in order to effect reasonable drilling progress.

According to the present invention it is contemplated to obviate the objectionable features above enumerated and to so construct the bit as to assure gage surfaces of substantially constant areas throughout the useful life of the drill bit.

A further object is to prevent binding of the drill bit on the wall of the hole being drilled.

Still another object is to assure channels of ample area for the passage of detritus and cleansing fluid from the bottom of the drill hole.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawing accompanying this specification and in which similar reference numerals refer to similar parts:

Figure 1 is a side elevation of a drill bit constructed in accordance with the practice of the invention,

Figure 2 is a plan view of the cutting end of the drill bit,

Figure 3 is an elevation, in section, of the drill bit taken through Figure 2 on the line 3-3, and

Figure 4 is a transverse view taken through Figure 1 on the line 4-4.

Referring more particularly to the drawing, 20 designates the drill bit and 21 a shank through which the blows of a percussive element, such as a rock drill of the hammer type (not shown), are transmitted to the drill bit 20. The bit is connected to the shank by threaded engagement and in the shank 21 is a passage 22 which registers with a passage 23 in the bit 20 for introducing cleansing fluid into the bottom of a drill hole 24 to flush the cuttings to the surface of the ground.

In the form of the invention illustrated, the drill bit 20 comprises a skirt portion 25, into the rearward end of which the shank 21 is threaded, and on the front end of the skirt 25 are a series of cutting wings 26, four being employed in the present instance, and arranged in cruciform fashion. The cutting wings 26 are preferably of different lengths, as for example by terminating

a pair of opposed wings more closely adjacent the axis of the bit than the remaining pair of wings and thereby proportion the cutting edges in accordance with the area of rock traversed in a complete revolution of the drill bit. The wings 26 are separated by channels 27 which are preferably of considerable depth in order to provide a ready escape for the cuttings and the fluid serving as a vehicle to convey them from the drill hole.

In accordance with the practice of the invention the cutting wings extend outside of the plane of the skirt 25, and their side surfaces 28 converge toward the central portion of the skirt so that both the cutting wings and the channels 27 are of substantially V-shape. On the front ends of the wings 26 are the usual crushing surfaces 29 which are inclined to define cutting edges 30 at their points of convergence.

The outermost faces of the wings constitute gage surfaces 31. These surfaces are coextensive with the faces of the wings and are arranged in parallelism with the axis of the drill bit so that an adequate total gage area may be presented to the wall of the drill hole in order to prevent fluting of the rock and also to buttress the outer ends or tips 32 of the cutting edges 30.

As will be readily appreciated in a structure in which the width of the cutting wings increases progressively toward the outer edges of the wings wear occasioned on the gage surfaces causes a gradual decrease in the diameter of the bit and, consequently, a progressively decreasing area of gage surface. In order, therefore, to maintain the gage surfaces of substantially constant areas the inwardly extending surfaces 33 of the projecting portions of the cutting wings are inclined at an angle best suited to compensate for loss in width of the active cutting and bearing portions of the wings incident to wear. The inclined surfaces 33 merge, in the present instance, into ribs 34 which extend longitudinally of the skirt 25 to reinforce it.

In practice, the present invention has been found to be a highly efficient device for drilling rock whose abrasive action causes rapid wear on the cutting edges and gage surfaces. For, as wear on the ends of the cutting wings takes place and in consequence of which the width of the portions of the cutting wings lying between the crushing surface 29 is progressively reduced the material lying between the inclined surfaces 33 and the crushing surfaces 29 will become correspondingly worn and in that way add to the height of the gage surfaces in approximately the proportion in which the widths of the gage surfaces decrease. In this way the areas of the gage surfaces will remain substantially constant until the cutting wings are worn to body size and the objectionable occurrence of augmented resistance to rotation by reason of a constantly and progressively increasing gage area will thereby be eliminated.

We claim:

1. A rock drill bit, comprising a body, cutting wings integral with the body and increasing in width toward their outer faces, gage surfaces on and coextensive with the outer end of the wings, and means to increase the height of the gage surface in proportion to the decrease in width

of the cutting wings accordingly as the wings become worn to maintain the areas of the gage surface constant irrespective of the degree of wear on the cutting wings.

2. A rock drill bit, comprising a body, cutting wings integral with the body having substantial portions extending beyond the periphery of the body and increasing in width toward their outer faces, gage surfaces on the outer ends of the cutting wings arranged in parallelism with the longitudinal axis of the body, and means to increase the height of the gage surface in proportion to the decrease in width of the cutting wings accordingly as the wings become worn to maintain the areas of the gage surface constant irrespective of the degree of wear on the cutting wings.

3. A rock drill bit, comprising a body, cutting wings integral with the body extending beyond the periphery of the body and increasing in width toward their outer faces, gage surfaces on and coextensive with the outer ends of the cutting wings and being in parallelism with the longitudinal axis of the body, and means to increase the height of the gage surface in proportion to the decrease in width of the cutting wings accordingly as the wings become worn to maintain the areas of the gage surface constant irrespective of the degree of wear on the cutting wings.

4. A rock drill bit, comprising a body, cutting wings on the body and being of progressively increasing width toward their outer edges, gage surfaces on the cutting wings, and means to increase the gage surface areas in direct proportion to the decrements in the width of the wings accordingly as said wings become worn and thereby maintain the areas of the gage surfaces substantially constant irrespective of the degree of wear on the cutting wings.

5. A rock drill bit, comprising a body, cutting wings on the body extending beyond the periphery of the body and being of progressively increasing width toward their outer edges, gage surfaces on the outer ends of the cutting wings, and inclined shoulders to buttress the projecting portions of the cutting wings and to increase the gage surface areas in direct proportion to the decrements in the width of the wings accordingly as said wings become worn and thereby maintain the areas of the gage surfaces substantially constant.

6. A rock drill bit, comprising a body threaded to receive a shank, a plurality of cutting wings on the body each progressively increasing in width toward its outer edge, a pair of crushing surfaces on each wing defining a cutting edge, inwardly extending surfaces formed on the wings, ribs extending longitudinally of the body and merging with the inwardly extending surfaces, and gage surfaces formed on the outer faces of the wings between the cutting edges and the inwardly extending surfaces, said inwardly extending surfaces having an inclination sufficient to increase the height of the gage surface substantially in proportion to the decrease in width of the cutting wings due to wear and thereby maintain the area of the gage surfaces substantially constant irrespective of the degree of wear.

BENJAMIN FRANKLIN SHEPHERD.
ROBERT D. ZIMMERMAN.