Aug. 27, 1929. J. H. SWIFT ET AL 1,726,049

BIT

Filed May 3, 1926

Fig. 1.

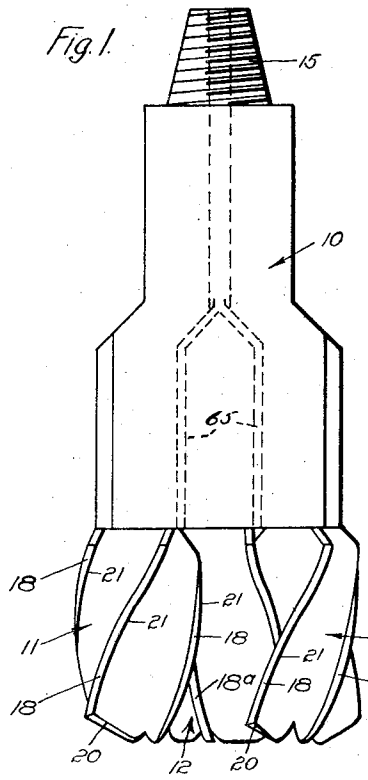


Fig. 2.

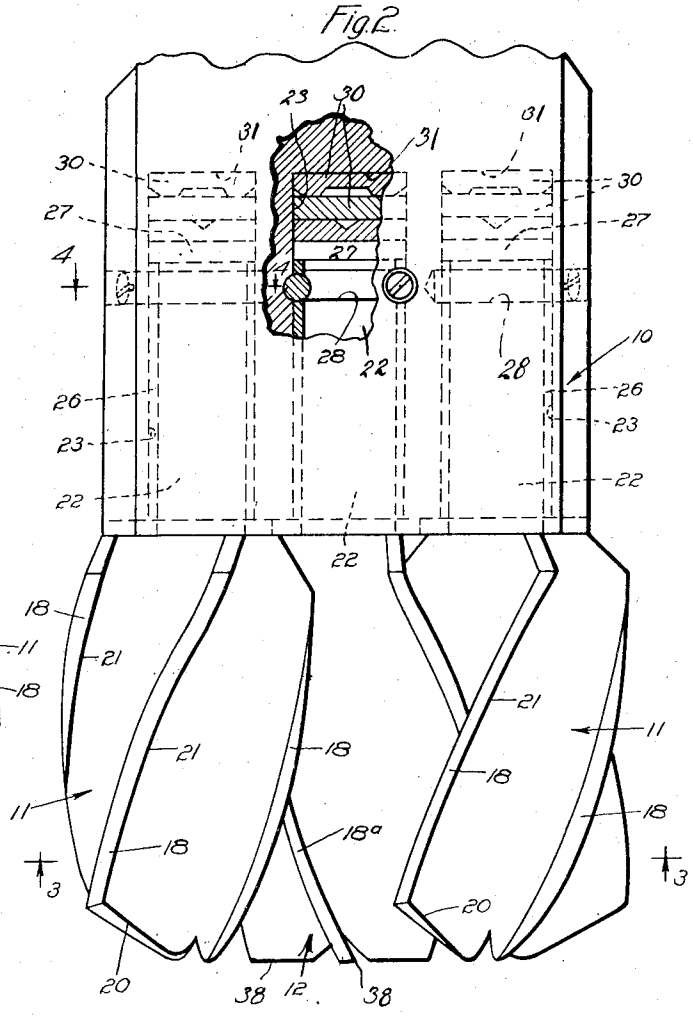


Fig. 4.

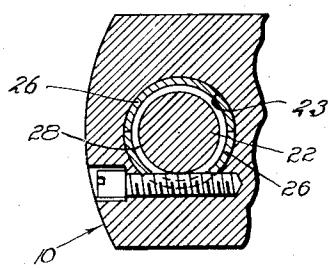
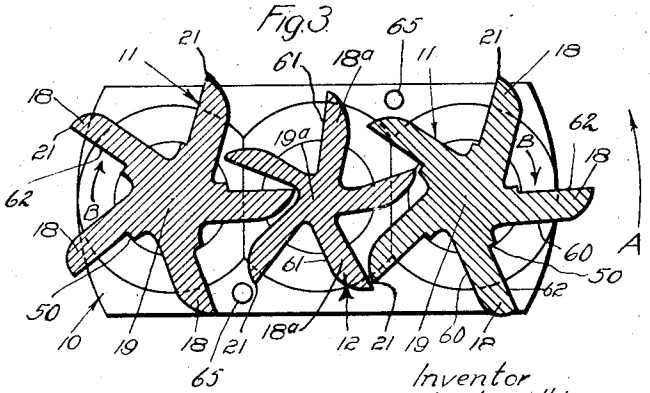


Fig. 3.



Inventor
Lloyd Dalldorf
James H. Swift
by
Attorney

Patented Aug. 27, 1929.

1,726,049

UNITED STATES PATENT OFFICE.

JAMES H. SWIFT, OF HUNTINGTON PARK, AND LLOYD DALLDORF, OF SOUTHGATE, CALIFORNIA.

BIT.

Application filed May 3, 1926. Serial No. 106,541.

This invention has to do with a bit, and it is an object of the invention to provide a bit which is effective and practical for the drilling of wells, or the like.

It is an object of the present invention to provide a bit suitable for well drilling which comprises movable cutters which cooperate to keep each other clean and in proper operating condition.

It is another object of the invention to provide a bit of the character specified comprising movable cutting parts which operate in synchronism.

A further object of the present invention is to provide a bit of the character described with cutters presenting a plurality of durable and effective cutting edges.

The various objects and features of our invention will be best and more fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description we refer to the accompanying drawings, in which:

Fig. 1 is a side elevation of a well drilling bit embodying the invention;

Fig. 2 is an enlarged side elevation of a portion of the bit showing certain parts in section;

Fig. 3 is a detailed sectional view taken substantially as indicated by line 3—3 on Fig. 2; and

Fig. 4 is an enlarged detailed section taken substantially as indicated by line 4—4 on Fig. 2.

The bit which we have provided includes, generally, a body 10, side cutters 11, and a central connecting cutter 12.

The body may, in accordance with the broader principles of our invention, be shaped and proportioned to properly carry the cutters and may be adapted to be attached to any suitable operating member. In the case of a well bit, such as we have chosen to set forth in this disclosure of our invention, the body 10 may be in the form of a forging, the lower portion of which is shaped and proportioned to properly carry the cutters. The upper end portion of the body is provided with a tapered screw threaded pin 15 whereby the body can be attached to a string of drill pipe, or the like.

In accordance with our invention the bit is provided with two or more side cutters 11 which are vertically disposed or mounted so that their axes are parallel with the vertical or longitudinal axis of the body. In the form of the invention shown in the drawings there are two side cutters 11 mounted in spaced relation and for operation about axes located at diametrically opposite sides of the central vertical axis of the body 10. In accordance with our invention each side cutter 11 is provided with one or more cutting edges adapted to project beyond the body. Cutters are mounted on or at the lower end of the body 10 so that their cutting parts are below the body and project laterally beyond the line of the side of the body. In the preferred form of our invention each side cutter 11 includes a plurality of helical blades 18 formed symmetrically around or projecting from a central hub 19. In practice the hub 19 is comparatively long and the blades extend longitudinally of the hub and spirally around it, as clearly shown throughout the drawings. The lower ends of the blades may project below the lower end of the hub and may be finished with suitable end cutting edges 20. The side or outer edges of the blades are finished to present cutting edges 21. In the particular case shown in the drawings, each cutter is provided with five blades spaced 72° apart around the axis of the hub. The cutters 11 may be mounted on or connected to the lower end portion of the body in any suitable manner. For instance, each cutter may be provided with a projection or stem 22 to be rotatably carried in a socket or opening 23 formed in the lower end of the body. The stem may be in the form of an extension or continuation of the hub of the cutter and may be turned or otherwise finished so that it is round in cross sectional configuration. In practice the stem of the cutter may be retained in proper position in the opening 23 by any suitable means. In the particular construction shown in the drawings a bushing or liner 26 is provided in the opening 23 to form a bearing for the stem. In this case a head 27 is provided on the upper end of the stem above the upper end of the bushing and the bushing is split longitudinally or formed in two sections whereby it can be assembled around the stem below the head to allow the parts to be assembled to the position shown in Fig. 2 of the drawings.

One or more retaining pins may be provided in the body to engage the sections of the bushings to retain them in the opening 23 of the body. Further, if desired, the retaining pins, which may be in the form of screws, may be carried by or in the body 10 to extend into a recess or groove 28 formed in the stem. In the construction which we have just described and which is clearly shown in the drawings, the retaining pins hold the bushing sections in place and the bushing sections operate to prevent displacement of the stem because of the head on the upper end of the stem. Further, if the retaining pins extend into a groove in the stem they will directly operate to retain the stem in place. It is desirable to provide means for taking the up thrust which comes upon the cutters, and for this purpose thrust bearings of suitable design may be provided between the upper ends of the cutter stems and the ends of the openings in the body. In the drawings we have shown thrust bearing plates 30 inserted between the heads on the stems and the ends 31 of the openings in the body. This is a form of thrust bearing which is simple and reliable and which is particularly effective in tools of this character.

The center or connecting cutter 12 is, in accordance with the broader features of our invention, provided as an interconnection between the side cutters whereby they are connected to operate in synchronism, and it is also provided with cutting parts whereby it may act as a cutter to aid the side cutters. The cutter 12 is located between the side cutters, and in the particular bit shown in the drawings, is located centrally between the side cutters and concentric with the longitudinal axis of the body 10. The cutter 12 may be formed or shaped in much the same manner as the side cutters, that is it may be provided with a plurality of helical blades 18^a which extend longitudinally of a central hub 19^a. The cutter 12 may be mounted for rotation through a stem 22 in the same manner as the side cutters. In accordance with our invention the blades of the cutters 11 and 12 are related and proportioned to mesh together in the manner most clearly shown in Fig. 3 of the drawings so that the central cutter gears together or interconnects the two side cutters so that rotary movement is communicated between the cutters. If the central cutter 12 is to be an active cutting element, it may be extended to be substantially the same length as the side cutters and the lower ends of its blades may be provided with cutting edges 38 to operate on the bottom of the hole formed by the bit, and its side edges may be finished to form cutting edges. In this connection it may, in practice, be desirable to form the end cutting edges 20 of the cutters 11 at an angle as shown in the drawings.

With the construction that we have set forth the center cutter 12 interconnects the side cutters 11 so that they rotate in the same direction as the body of the bit is rotated in the hole. During operation the body 10 is rotated in the direction indicated by the arrow A in Fig. 3 causing the cutting edges of the side cutters to engage the side and bottom of the hole with the result that the side cutters are caused to rotate in the direction indicated by the arrow B in Fig. 3. The side cutters 11 are made to rotate in synchronism or at substantially the same rate by the interconnection formed by the center cutter 12. For instance if there is a tendency for one of the side cutters to operate at a rate different from the other the center cutter forms a connection between the two side cutters which equalizes the operation of the side cutters causing them to operate in the same manner. By making the side cutters comparatively long, as shown in the drawings, the side cutting edges 21 are comparatively long and thus present long cutting parts which will effectively act on the material at the sides of the hole and cause positive turning of the cutters. Further, the blades of the several cutters in intermeshing or working between one another, keep the cutters clean and prevent the accumulation of mud or the like which might otherwise materially impair the operation of the device. In the action of the cutters as just described, the side cutters operate as the driving members to force rotation of the central cutter and in so doing the leading sides 60 of the blades of the side cutters operate on or against the rear or trailing sides 61 of the center cutter. It may in some forms be desirable to have the device such that the side cutters can not be driven by the center cutter, in which case shoulders 50 may be provided at the trailing sides 62 of the blades of the side cutters to be engaged by the blades of the center cutter in the event that the blades of the center cutter operate on the side cutters tending to drive them. With this shoulder construction, which is clearly illustrated in Fig. 3, one of the side cutters cannot operate to drive or act as the sole means of propulsion of the other side cutter, but, in the case of one side cutter tending to drive the other the construction just described operates to lock all of the cutters against relative rotation so that the cutters operate as a unit with the body until the tendency for one side cutter to drive the other is passed. Further, in operation the blades of the cutters being helical or spirally formed as above described and as clearly shown throughout the drawings and in meshing as we have described,

tend to feed the cuttings upwardly so that they will readily pass out of the hole. For the purpose of circulation suitable circulation openings 65 may be provided in the body to discharge downwardly from the lower end of the body at a point or in a manner to wash the blades of the cu ters and thereby further keep the parts in proper operating condition.

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 our invention we claim:

1. A bit of the character described including a body, and a plurality of cutters rotatably carried by the body, the cutters having meshing blades.

2. A bit of the character described including a body, and a plurality of cutters rotatably carried by the body, the cutters having meshing helical blades.

3. A bit of the character described including a body, and a plurality of cutters rotatably carried by the body, the cutters having meshing blades with cutting edges and having parallel axes of rotation.

4. A bit of the character described including a body, and a plurality of cutters rotatably carried by the body, the cutters having meshing blades with side and end cutting edges and having parallel axes of rotation.

5. A bit of the character described including a body, two cutters carried by the body and having spaced axes of rotation, and cutting parts on the cutters directly operatively connecting the cutters.

6. A bit of the character described including a body, two spaced rotatable cutters carried by the body and having helical blades, and a connecting cutter between said cutters with blades meshing with the blades of said cutters.

7. A bit of the character described including a body, two spaced rotatable cutters carried by the body and having helical blades, with end and side cutting edges, and a connecting cutter between said cutters with blades meshing with the blades of said cutters.

8. A bit of the character described including a body, a plurality of interconnected rotatable cutters carried by the body, and means whereby the cutters are operable in one direction only.

9. A bit of the character described including a body having openings in its lower end, a plurality of cutters, and stems on the cutters rotatably carried in the openings, the cutters having blades which intermesh and having parallel axes of rotation.

10. A bit of the character described including a body having openings in its lower end, a plurality of cutters, stems on the cutters rotatably carried in the openings, the cutters having blades which intermesh and having parallel axes of rotation, and means for retaining the stems in the openings.

11. A bit of the character described including a body having openings in its lower end, a plurality of cutters, stems on the cutters rotatably carried in the openings, the cutters having blades which intermesh and having parallel axes of rotation, thrust bearings in connection with the stems, and means for retaining the stems in the openings.

In witness that we claim the foregoing we have hereunto subscribed our name this 12th day of March, 1926.

LLOYD DALLDORF.
JAMES H. SWIFT.