

June 25, 1963

H. PISTOLE ETAL

3,095,053

DRILL BIT

Filed Feb. 1, 1960

3 Sheets-Sheet 1

FIG. 2.

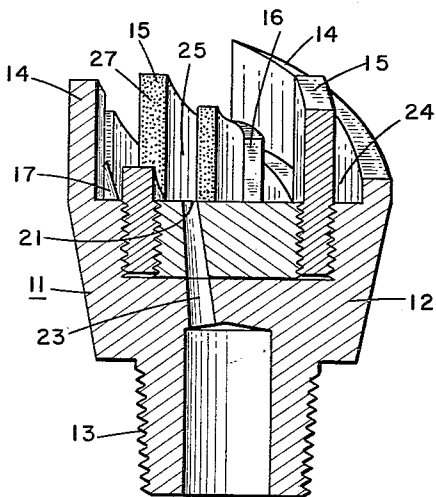
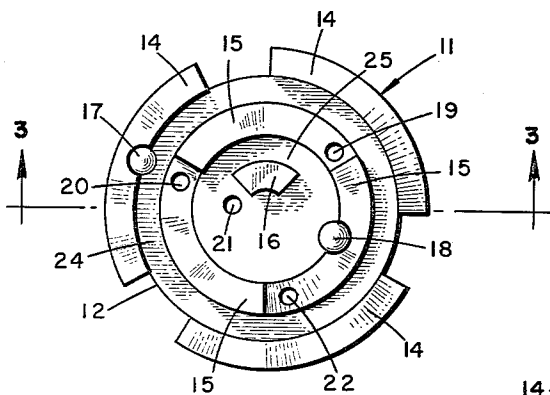


FIG. 3.

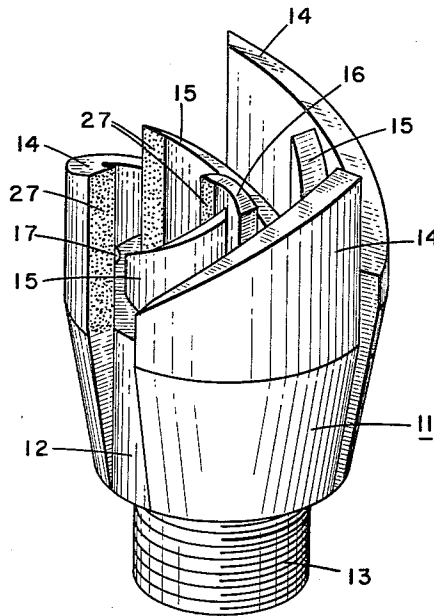


FIG. 1.

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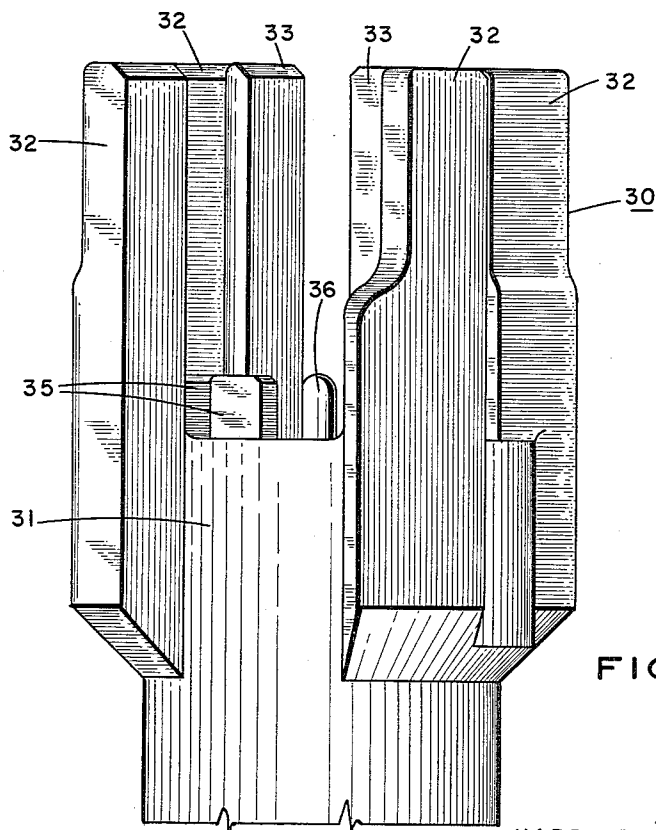


FIG. 5.

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3 Sheets-Sheet 3

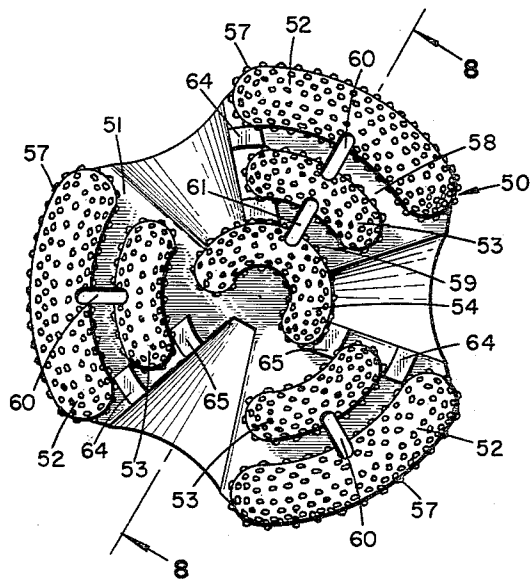


FIG. 7.

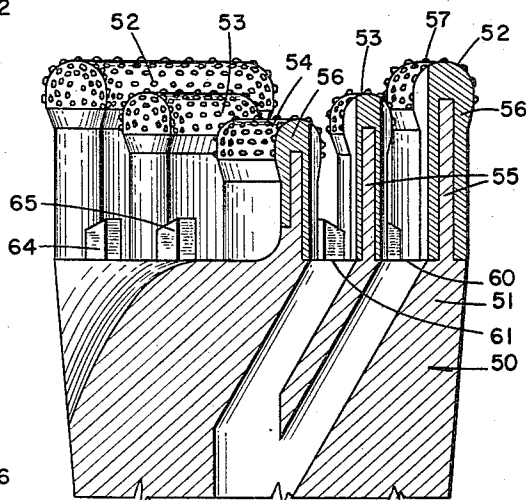


FIG. 8.

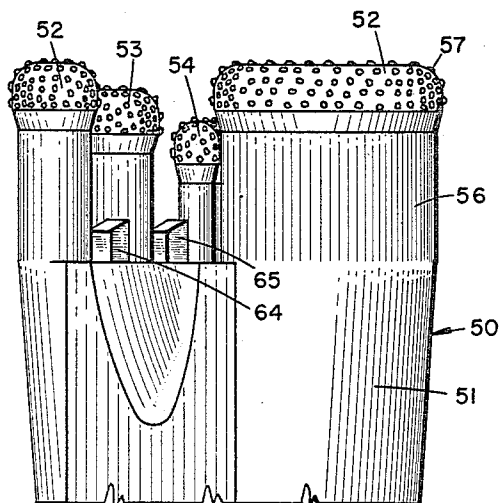


FIG. 6.

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3,095,053
DRILL BIT

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9 Claims. (Cl. 175—329)

The present invention is directed to an improved drill bit. More particularly, the invention is concerned with a concentric blade drill bit. In its more specific aspects, the invention is concerned with a drill bit which has a plurality of rows of concentric blades.

The present invention may be briefly described as a drill bit which comprises a body member having a plurality of blades arranged concentrically thereon to provide freeways between the concentric blades. The body member is formed to provide at least one port which is arranged to discharge drilling fluid in the freeway. The undrilled portion of the formation remaining within the freeway is fractured by the vibration of the drill bit and by the action of the fluid discharged into the freeway. A breaker means is arranged in the freeway such that the breaker means fractures any formation material remaining in the freeway.

In the practice of the present invention, it is contemplated that the blade may be provided with a covering of an abrasive material on at least the cutting face thereof. The abrasive material may suitably be tungsten carbide, diamonds, or other hard material known and used for this purpose.

The blades on the body member of the drill bit in accordance with the present invention may be curved inwardly or the blades may be of any shape subject to strength requirements provided that no portion of the blade is outside the track of the cutting surface. The blades are arranged in concentric rows with a freeway or space between the rows and in each of the freeways is arranged a breaker means, and ports in the body member are arranged to discharge into the freeway.

In employing the drill bit of the present invention, the rows of concentric blades cut out the formation material as the drill bit is rotated at the end of a hollow drill string and shells of formation material remain in the freeways in the drill bit. These shells are cylindrical in form and are broken up by the vibration of the drill bit and by impingement of drilling fluid discharged in the freeways from the ports. Otherwise, the breaker means in the freeways bear downwardly on the shells of cylindrical formation material and fracture same with the drilling fluid washing the formation material into the annulus of the well bore for return to the earth surface in the drilling fluid.

The present invention will be further illustrated by reference to the drawing in which:

FIG. 1 is an isometric view of a drill bit in accordance with the present invention;

FIG. 2 is a plan view of the drill bit of FIG. 1;

FIG. 3 is a view taken along the lines 3—3 of FIG. 2;

FIG. 4 is a plan view of another form of drill bit of the present invention;

FIG. 5 is an elevational view of the drill bit of FIG. 4;

FIG. 6 is an elevational view of another form of a drill bit;

FIG. 7 is a plan view of the drill bit of FIG. 6; and

FIG. 8 is a sectional view of the drill bit of FIGS. 6 and 7.

Referring now to the drawing and particularly to FIGS. 1 to 3, inclusive, numeral 11 designates a drill bit comprised of a body member 12 which has a threaded coupling 13 for threadedly connecting into the end of a drill stem. The body member 12 is provided with concentric blades

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14, 15, and 16 between which are the freeways 24 and 25. Breaker means 17 and 18 are attached to the body member 12 within the freeway areas 24 and 25. Ports 19, 20, 21, and 22 are arranged to discharge fluid into the freeway areas 24 and 25.

Referring particularly to FIG. 3 it will be seen that the port 21 communicates with a passageway 23 in the body member 12, such that drilling fluid may be discharged within the freeway 25.

It is to be noted that the blades 14, 15, and 16 taper rearward towards the body member 12 to strengthen the blade in the direction of rotation while avoiding excessive bearing contact with the formation, and also providing opening for the flushing action of the fluid discharge. On the leading faces of the blades 14, 15, and 16 shown as 27 in FIG. 1 is placed the abrasive material that protects the blades and erodes the formation.

Referring now to FIG. 4 and FIG. 5, a drill bit 30 is provided with a body member 31 and has elongated flat-sided concentric blades 32 and 33, the blades 32 being the outward ring of the drill bit 31 while the blades 33 are the inward ring. Arranged between the blades 32 and 33 in the freeway designated by the numeral 34 are breakers 35. Arranged in the freeway nearing the center of the body member 31 is a breaker 36 shown more clearly in FIG. 5. This breaker 36 is eccentric to the axis of the body member 31. As shown most clearly in FIG. 4, the drill bit 30 is provided with a plurality of ports 37, 38, 39, and 40 which are directed to discharge drilling fluid in the freeways of the drill bit 30.

In FIGS. 6 to 8, inclusive, another drill bit of the present invention is described. Referring to FIGS. 6 to 8, inclusive, a drill bit such as 50 is provided with a body member 51 having concentric blades 52, 53, and 54. The concentric blades 52, 53, and 54 are formed on a base member 55 shown more clearly in FIG. 8 on which there is built up a matrix 56 of hardened material such as tungsten carbide. Imbedded in the tungsten carbide as shown clearly in FIG. 8 is a layer of diamonds 57 which provides an abrasive cutting head for the concentric blades 52, 53, and 54. It is to be noted that in the freeways 58 and 59 there are arranged ports 60 and 61. Also at the head of each of the freeways 58 and 59 are arranged breaker means 64 and 65. A series of breaker means 64 and 65 serves in cooperation with the discharge of drilling fluid through ports 60 and 61 and causes the thin cylindrical shells of formation material, which are left in the freeways 58 and 59, to be fractured or broken by the impact of the high velocity streams of drilling fluid and by the bearing downwardly of the breakers 64 and 65 on the cylindrical shells of formation material.

From the several figures of the drawing, it will be clear that inner and outer concentric blades are provided with the inner blades having a length no greater than the length of the outer blades and, in fact, in FIGS. 1 to 3 and 6 to 8, inclusive, the inner blades are shorter than the outer blades.

The present invention is of considerable importance and utility in that the drill bit of the present invention may be used to drill formation material rapidly by rotating a drill string having a drill bit of the present invention on the lower end thereof at rates much more rapid than is possible with the prior art drilling bits. For example, a bit in accordance with the present invention drilled limestone from 2 to 3 times faster than conventional rock bits. Drill bits constructed in accordance with the present invention have drilled from 40 to 50 feet per hour. This is twice the rate obtainable with conventional rock bits in the same formation.

The present invention is therefore of importance and utility and involves a new principle in rotary drilling operations by virtue of the arrangement of the concentric

blades with freeways between the concentric blades which leaves cylindrical shells of the formation material in the grooves or freeways between the concentric blades. These shells of formation material are shattered or fractured by the drilling fluid impinging thereon and by the bearing down on the thin shell of formation material of the breakers in the grooves or freeways. By virtue of providing the breaker points in the freeways, the bit does not ride on uncut formation but the breaker points cause the uncut formation to be fractured and to be removed with the drilling fluid.

The nature and objects of the present invention having been completely described and illustrated, what we wish to claim as new and useful and secure by Letters Patent is:

1. A drill bit adapted to be connected to a hollow drill string comprising a body member having a plurality of inner and outer blades arranged concentrically thereon to provide at least one groove between the inner and outer concentric blades, the inner blades having a length no greater than the length of the outer blades, said body member being formed to provide a passageway adapted to communicate with said hollow drill string, said passageway having at least one port arranged to discharge drilling fluid in said groove, and at least one breaker means on said body member arranged in said groove, said breaker means and discharge of drilling fluid through said port fracturing formation material in said groove.

2. A drill bit adapted to be connected to a hollow drill string comprising a body member having a plurality of inner and outer blades arranged concentrically thereon to provide grooves between the inner and outer concentric blades, the inner blades having a length no greater than the length of the outer blades, said body member being formed to provide a passageway adapted to communicate with said hollow drill string, said passageway having ports arranged to discharge drilling fluid in said grooves, and breaker means on said body member arranged in each groove at the head thereof, said breaker means and discharge of drilling fluid through said ports fracturing formation material in said grooves.

3. A drill bit adapted to be connected to a hollow drill string comprising a body member having a plurality of inner and outer blades arranged concentrically thereon to provide grooves between the inner and outer concentric blades, the inner blades having a length no greater than the length of the outer blades, said blades having an abrasive material covering at least the cutting face thereof, said body member being formed to provide a passageway adapted to communicate with said hollow drill string, said passageway having ports arranged to discharge drilling fluid in said grooves, and breaker means on said body member arranged in each groove, said breaker means and discharge of drilling fluid through said ports fracturing formation material in said grooves.

4. A drill bit in accordance with claim 3 in which the abrasive material is tungsten carbide.

5. A drill bit in accordance with claim 3 in which the abrasive material comprises diamonds.

6. A drill bit adapted to be connected to a hollow drill string comprising a body member having a plurality of inner and outer blades arranged concentrically thereon to provide grooves between the inner and outer concentric blades, the inner blades having a length no greater than the length of the outer blades, said body member being formed to provide a passageway adapted to communicate with said hollow drill string, said passageway having ports arranged in said grooves to discharge drilling fluid, and breaker means on said body member arranged in each groove, said breaker means and discharge of drilling fluid through said ports fracturing formation material in said grooves.

7. A drill bit adapted to be connected to a hollow drill string comprising a body member having a plurality of horizontally spaced-apart inner and outer blades arranged concentrically thereon to provide grooves between the inner and outer concentric blades, the inner blades having a length no greater than the length of the outer blades, said body member being formed to provide a passageway adapted to communicate with said hollow drill string, said passageway having ports arranged to discharge drilling fluid in said grooves, and breaker means on said body member arranged in each groove, said breaker means and discharge of drilling fluid through said ports fracturing formation material in said grooves.

8. A drill bit in accordance with claim 1 in which the blades are flat sided.

9. A drill bit adapted to be connected to a hollow drill string comprising a body member having a plurality of inner and outer blades arranged concentrically thereon to provide grooves between at least two rows of inner and outer concentric blades, the inner blades having a length no greater than the length of the outer blades, said body member being formed to provide a passageway adapted to communicate with said hollow drill string, said passageway having a plurality of ports arranged to discharge drilling fluid in said grooves, and breaker means on said body member arranged in each groove, said breaker means and discharge of fluid through said ports fracturing cylindrical shells of formation material in said grooves.

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