Nov. 25, 1952 A. ARUTUNOFF 2,619,325

CORE DISINTEGRATING DRILLING TOOL

Filed Jan. 2, 1952 2 SHEETS—SHEET 1

Fig. 1

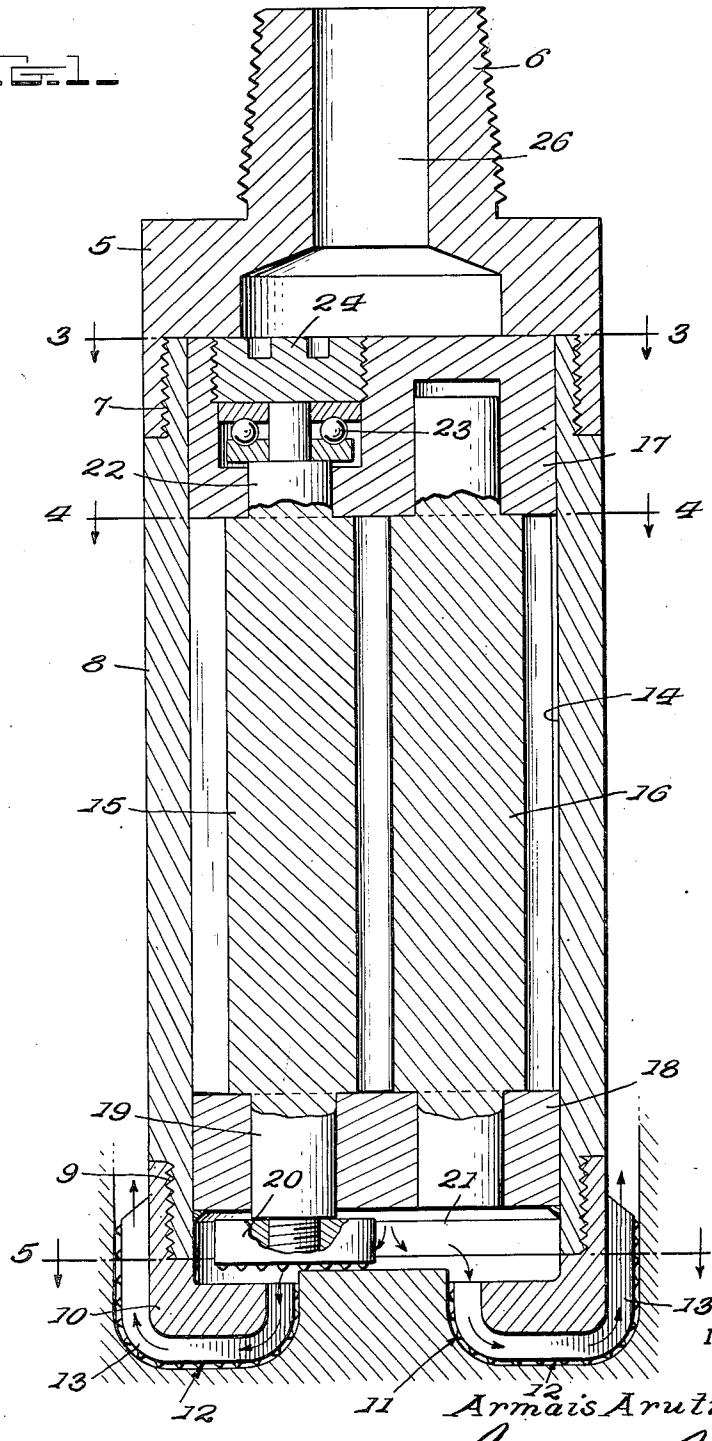

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FIG. 2

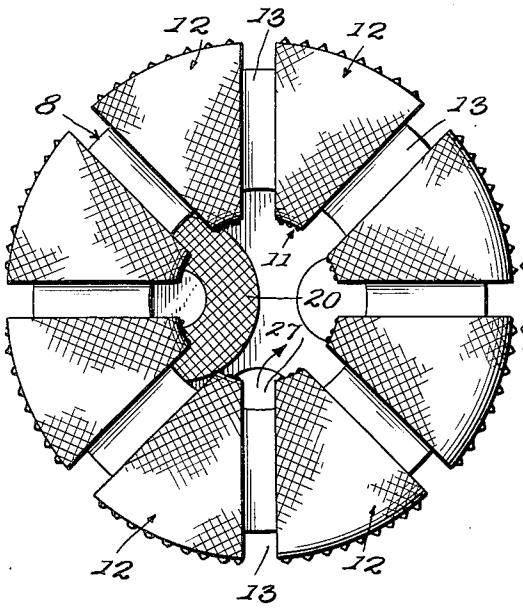


FIG. 4

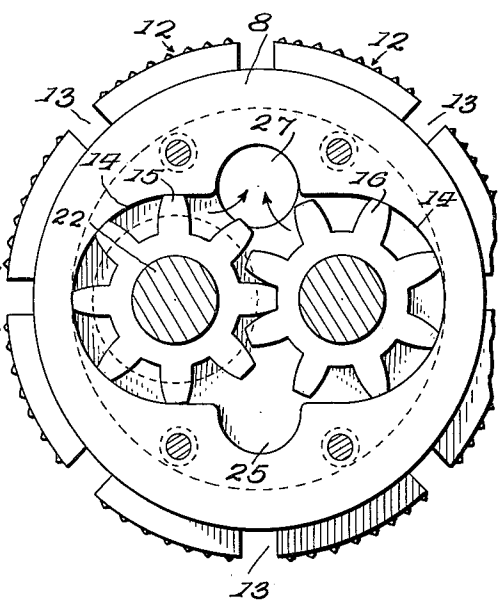


FIG. 3

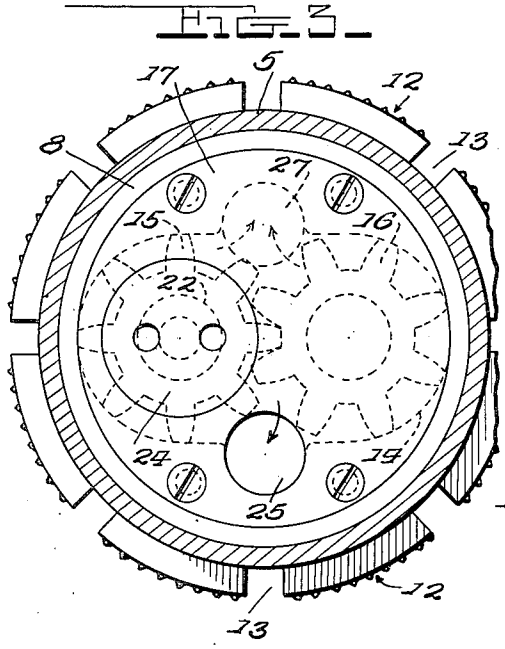
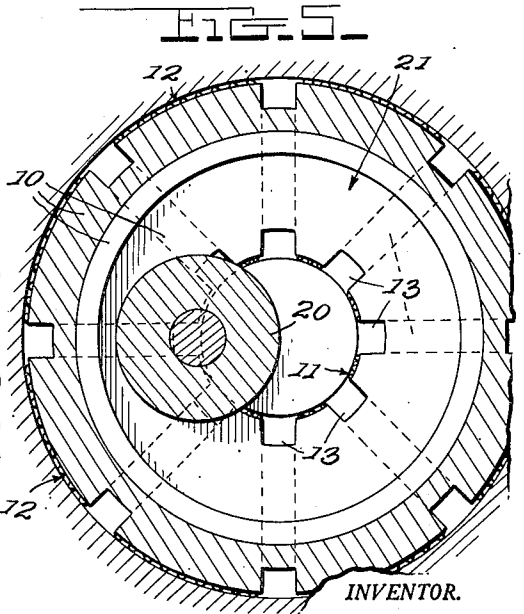


FIG. 5



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CORE DISINTEGRATING DRILLING TOOL

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14 Claims. (Cl. 255—72)

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This invention relates to a rotary rock drilling bit and more particularly a diamond-studded bit having a main cutting head provided with a supplemental core-removing or disintegrating bit.

Ordinarily, diamond bits used in connection with hard rock drilling operations by the rotary method are limited in their penetrating speed by the core of rock which forms in the central portion of the hole. The lack of cutting speed at the center of the rotary bit materially retards the operation because the rock core in the central portion is not actually cut but must be crushed by the weight on the bit before progress is possible. It is, therefore, the object of my invention to provide a rotary bit having a main cutting head of the type which provides a central core-receiving recess at its cutting end and is provided with a supplemental core-removing bit so arranged with respect to the core receiving recess as to disintegrate the core as the main cutting head progresses.

Another object of my invention is to provide a self-contained drilling tool wherein the supplemental core-removing bit is driven by a fluid-operated motor housed in the main body structure which supports the cutting head.

A further object of the invention is to provide a rotary bit equipped with a fluid-operated supplemental core-removing bit, wherein the fluid employed for operating the motor is utilized as a flushing medium in disposing of the cuttings.

Still another object of the invention is to provide a relatively simple cutting unit which is compact and sturdy in construction and one which may easily be assembled and dismantled for purposes of cleaning and repairs.

With the above and other objects in view which will appear as the description proceeds, my invention consists in the novel features herein set forth, illustrated in the accompanying drawings, anl more particularly pointed out in the appended claims.

Referring to the drawings in which numerals of like character designate similar parts throughout the several views,

Figure 1 is a longitudinal sectional view of my improved bit;

Figure 2 is a bottom end view of the diamond bit or main cutting head;

Figure 3 is a transverse sectional view taken on line 3—3 of Figure 1;

Figure 4 is a similar sectional view taken on line 4—4 of Figure 1; and

Figure 5 is a transverse sectional view taken on line 5—5 of Figure 1, showing the overlapping relationship of the supplemental bit and the core-receiving recess of the main cutting head.

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In the drawings, referring first to Figure 1, 5 represents the base portion of a hollow cylindrical shank or coupling member, reduced and threaded as at 6 to facilitate connection to the usual hollow drill stem (not shown). The cylindrical base portion 5 of the shank is recessed and internally threaded as at 7 to receive complementary threads at the upper end of a cylindrical body 8 which serves both as a housing for a fluid-operated motor and as a supporting member for the main cutting head as will hereinafter appear.

The lower end of the body 8 is reduced and threaded as at 9 to engage complementary internal threads on the upstanding connecting flange of the main cutting head 10, the cutting portion of which is preferably diamond-studded and extends radially slightly beyond the periphery of the cylindrical body 8. The central portion of the cutting head 10 is recessed as at 11, to form an annular cutting area which is preferably divided into a series of segmental cutting units 12 by an intervening series of channels 13 which radiate from and communicate with the central recess 11. As seen in Figures 1 and 2, each of these channels extends entirely around the cutting surface of the head 10, so as to establish free communication from the central recess 11 to the periphery of the head.

Turning to Figure 4, the central portion of the body 8 is provided with a cavity 14 which is substantially elliptical in cross section, for receiving a pair of elongated gears 15 and 16, which are longitudinally arranged in meshing relation and rotatably supported between upper and lower end plates 17 and 18 respectively (Figure 1). The end plates may be secured in place in the cavity 14 by any suitable means. The spindle 19 at the lower end of the gear 15 is reduced and extended below the lower end plate 18 where it is threaded to receive and support a supplemental bit or grinding wheel 20 which also is preferably diamond-studded on its cutting face.

The supplemental bit 20 is disposed within a transverse recess 21, formed between the lower end plate 18 and the interior of the main cutting head 10 and extends radially beyond the core-receiving recess 11 in the latter. The supplemental bit 20 and its supporting spindle 19 are arranged eccentrically with respect to the axis core-receiving recess 11, as seen in Figure 1, and

its peripheral boundary overlaps the central portion of the core-receiving recess.

In order to take up the vertical thrust of the supplemental bit, the upper spindle 22 of the gear 15 is provided with a thrust bearing 23, disposed in an enlarged opening in the upper end plate 17, which opening may be provided with an inset, adjustable, threaded cover 24.

As best seen in Figures 3 and 4, the gear motor formed in the body 8 has an elongated fluid inlet passage 25 on one side which opens through the end plate 17 and communicates at its upper end with the central passageway 26 in the shank 5. On the opposite side is provided an elongated fluid discharge passage 27 opening through end plate 18 and communicating at its lower end with the transverse recess 21. Thus, when fluid is forced from the drill stem and shank 5 into the inlet passage 25 on one side of the meshing gears 15 and 16, the gears are caused to revolve respectively in opposite directions, the gear 15 rotating the supplemental bit 20. As the gears rotate the driving fluid passes with them and enters the discharge passage 27 from whence it is discharged into the transverse recess 21 at the lower end of the body 8. The discharged fluid thus flows over the core in recess 11 and through the several channels 13 between the cutting units 12, carrying with it all of the cuttings which are then forced to the surface.

It will be apparent that during this operation the main body 8 and cutting head 10 are continuously rotated by the stem attached to the shank 5, and as the cutting head turns, the axis of the simultaneously rotating supplemental bit 20 follows a circular path which continuously overlies the core forming in the central recess 11. Thus, the core is constantly disintegrated by the bit 20 as the main cutting head progresses.

In the designing of my improved cutting unit the dimensions of the various parts are proportioned with due regard to the amount of circulating fluid necessary to carry the cuttings as well as an optimum surface speed of rotation of the grinding wheel 20. If the gears 15, 16 are of insufficient length, the speed of rotation may become too high for economical utilization of the life of the diamonds on the grinding wheel and therefore the gears should be sufficiently long for the surface speed of the grinding wheel to be only slightly greater than the surface speed of the periphery of the main cutting head 10 when a normal amount of fluid is being circulated through the motor.

It will thus be seen that I have provided a relatively simple self-contained drilling tool which is sturdy in construction, efficient and positive in operation, and easily assembled and dismantled for purposes of cleaning and repair. The novel arrangement of the eccentric supplemental bit which constantly overlies the core and is operated by the same fluid utilized to wash away the cuttings, causes a progressive disintegration of the core without the necessity of withdrawing the drill head from the hole to remove the core whenever the core barrel becomes full.

From the foregoing it is believed that my invention may be readily understood by those skilled in the art without further description, it being borne in mind that numerous changes may be made in the details of construction without departing from the spirit of the invention as set forth in the following claims. For example, while the drawings illustrate this device as embodying a single supplemental bit 20 mounted on the extension of gear 15, it will be understood that I may also employ an additional supplemental bit on the extension of the companion gear 16.

I claim:

1. A rotary bit comprising a connecting shank, a cylindrical body secured to said shank and depending therefrom, a main cutting head carried by the lower extremity of said body and having a central core-receiving recess at its cutting end, forming an annular cutting portion, a chamber in said body, housing a fluid-actuated motor, a coaxial cavity in said body between said motor and main cutting head and extending radially beyond the core-receiving recess in the latter, a supplemental core-removing bit rotatable by said motor and lying in said cavity in eccentric relation to the axis of the core-receiving recess, with its radial boundary overlying the axis of the latter, means for admitting fluid under pressure to the motor chamber for operating the motor, and fluid discharge means from the chamber to said cavity, whereby said fluid is discharged adjacent the cutting surfaces of the bit.

2. A rotary drilling unit comprising a main cutting head having a central core-receiving recess at its cutting end, forming an annular cutting portion, a connecting shank secured to said head by an intervening cylindrical body portion, a fluid-actuated motor housed in said body portion, a coaxial cavity in said body portion between said motor and main cutting head and extending radially beyond the core-receiving recess in the latter, a supplemental core-removing bit rotatable by said motor and lying in said cavity in eccentric relation to the axis of the core-receiving recess, with its radial boundary overlying the axis of the latter, a fluid inlet to said motor and a fluid outlet therefrom, the latter communicating with said coaxial cavity, whereby fluid is discharged adjacent the cutting surfaces of said head and supplemental bit.

3. A rotary drilling unit as claimed in claim 2, wherein said fluid-actuated motor comprises a gear motor, said supplemental bit being operatively connected to one of the gears thereof.

4. A rotary drilling unit as claimed in claim 3, wherein said supplemental core-removing bit consists of a grinding wheel mounted on a spindle of one of said gears.

5. A rotary drilling unit as claimed in claim 4, wherein said last-named gear is provided at its upper end with a thrust bearing.

6. A rotary drilling unit as claimed in claim 2, wherein the cutting face of said main cutting head is provided with a series of fluid passageways arranged in communication with said coaxial cavity.

7. A rotary drilling unit as claimed in claim 6, wherein said passageways radiate from the central core-receiving recess.

8. A rotary bit comprising a connecting shank, a cylindrical body secured to said shank and depending therefrom, a main cutting head carried by the lower extremity of said body and having a central core-receiving recess at its cutting end, forming an annular cutting portion, a chamber in said body, at least two longitudinally disposed, elongated meshing gears in said chamber, upper and lower end plates in said chamber, forming bearings for the respective ends of said gears, a coaxial cavity in said body between the lower end plate and main cutting head and extending radially beyond the core-receiving recess in the latter, a supplemental core-removing bit secured coaxially to one of said gears and lying in said

cavity in eccentric relation to the axis of the core-receiving recess, with its radial boundary overlying the axis of the latter, means for admitting fluid under pressure to one side of said gear chamber for operating the gears, and fluid discharge means from the chamber to said cavity whereby said fluid is discharged adjacent the cutting surfaces of the bit.

9. A rotary bit as claimed in claim 8, wherein the cutting surface of said main cutting head is diamond-studded.

10. A rotary bit as claimed in claim 8, wherein the cutting face of said supplemental core-removing bit is diamond-studded.

11. A rotary bit as claimed in claim 8, wherein the dimensions of the gears are such as to effect a surface speed of the grinding gear which is slightly greater than the surface speed of the periphery of the main cutting head, when a normal amount of fluid is being circulated through the gear motor.

12. A self-contained drilling tool comprising a main cutting head, rotatable about a first axis and having a central core-receiving recess at its cutting end, forming an annular cutting portion, a cavity in said main cutting head, a supplemental core-removing bit rotatably mounted in said cavity about a second axis, eccentric with respect to said first axis, the radial boundary of said supplemental bit lying within the radial confines of the cutting portion of said main cutting head, and extending radially across the core-receiving recess in the latter, at least to the center thereof, and fluid-actuated means for operating said supplemental bit.

13. A tool as claimed in claim 12, wherein said first and second axes lie parallel but in laterally spaced relation.

14. A tool as claimed in claim 12, including means for discharging said bit-operating fluid adjacent the cutting surfaces of said main cutting head and supplemental bit.

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