

April 22, 1958

C. T. SMIECINSKI
LUBRICATED WELL DRILL
Filed April 16, 1956

2,831,660

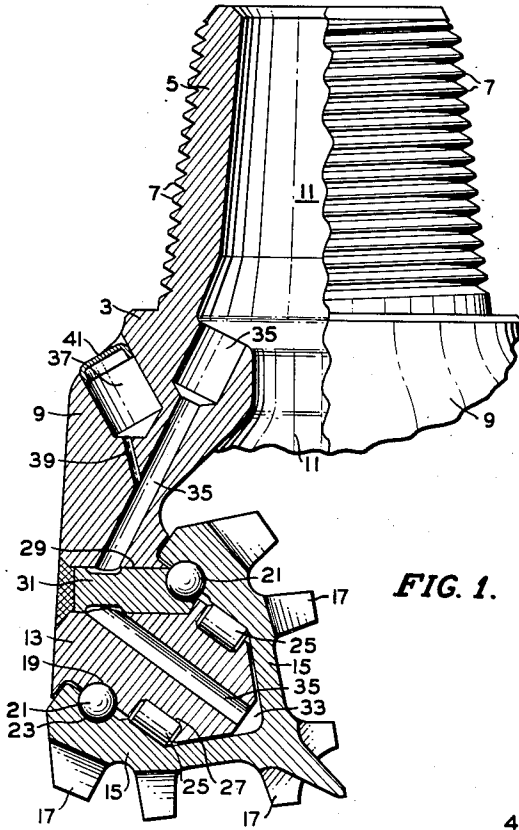


FIG. 1.

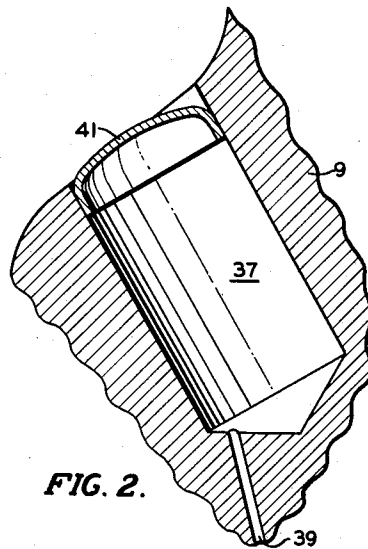


FIG. 2.

INVENTOR.

C. T. SMIECINSKI

BY

John H. Widdowson

ATTORNEY

1

2,831,660

LUBRICATED WELL DRILL

Casimir T. Smiecinski, Wichita, Kans., assignor to National Oil Tool Co., Inc., Wichita, Kans., a corporation of Kansas

Application April 16, 1956, Serial No. 578,403

3 Claims. (Cl. 255—304)

This invention relates to well drilling. In a more specific aspect this invention relates to well drilling means. In a still more specific aspect this invention relates to drill bits which have rotatable cone-cutters bearing mounted on shafts and which are used in drilling with gaseous drilling fluids.

It has long been known in the art to drill wells, particularly oil wells, with rotary drilling equipment using rotating cone-shaped cutters to cut up and break up the formation in the bottom of the well during drilling. In such drilling a drilling fluid usually called drilling mud is passed down the drill pipe to the bottom of the hole where it picks up the cuttings, and then the fluid and cuttings are forced up around the drill pipe to the surface. It is most common to use a colloid or relatively stable water suspension as the drilling fluid, and such drilling fluids have the advantage of removing the frictional heat from the drill bits built up as a result of the drilling operation, keeping the bearings relatively cool to add to their life. Drilling with gaseous drilling fluids is not so common as with drilling mud. However, such is quite widely used both in exploration as well as production drilling particularly where water is not readily available, and air and/or substantially inert combustion gas from engines and the like, has been used. The gaseous fluid is forced down the drill pipe to the bottom of the hole. There the gas stream picks up the cuttings produced by the well drill and lifts them back to the surface through the annular space between the wall of the hole and the drill pipe. Such has proven successful, but heat buildup in the drill bit is not dissipated satisfactorily and bearings mounting the cutters on the drill bit shafts are short lived due to lack of lubrication. I have invented a new drill bit structure which overcomes the problems encountered with gaseous drilling fluid rotary drilling, and my new drill bit structure provides for removing heat directly from the drill bit and the bearings thereof, and it provides for continuous lubrication of the bearings during drilling operation.

The new drill bit of my invention for use with gaseous drilling fluids is mountable on a drill pipe which carries the gaseous drilling fluid to the bottom of the hole, most commonly mounted at the drill collar or tool joint thereof. The drill bit has a shaft, and a cutter is rotatably mounted on this shaft and spaced therefrom by bearings between the cutter and shaft. The drill bit has a conduit therein which communicates between the drill pipe and the space between said cutter and shaft when the drill is mounted on the drill pipe. In operation this conduit carries a portion of the gaseous drilling fluid to the bearings to cool same. The new drill bit of my invention has a lubricant reservoir therein which communicates with the drill conduit. In operation lubricant passes from the reservoir to the conduit where it is picked up by the gas drilling fluid which carries it to the cutter bearings to lubricate same.

It is an object of my invention to provide new well drilling means.

2

It is another object of my invention to provide new cone-cutter type drill bits for use in rotary drilling using gaseous drilling fluids, particularly drills which provide for removing frictional heat from the drills produced during drilling, and which provide for lubricating the bearings of the drills.

It is still another object of my invention to provide drill bits for gaseous drilling fluid operation which are more efficient and which have long life.

Other objects and advantages of my invention will become apparent to those skilled in the art upon reading this disclosure.

Drawings accompany and are a part of this disclosure. The drawings depict preferred specific embodiments of my new drill means, and it is to be understood that such are not to unduly limit the scope of my invention.

On the drawings,

Fig. 1 is a side elevation view partly broken away and partly in central longitudinal section showing a drill bit having a preferred specific embodiment of my invention.

Fig. 2 is an enlarged cross-sectional view of the lubricant reservoir thereof.

Following is a discussion and description of the new drill bit means of my invention made with reference to the drawings whereon the same reference numerals are used to indicate the same parts or structure. The discussion and description is of preferred specific embodiments of the new drill bits of my invention, and it is to be understood that such is not to unduly limit the scope of my invention.

The drill bit depicted in the drawings has a head 3 with a shank portion 5 which is tapered upwardly and which has threads 7 thereon so that the drill can be engaged with a tool joint or drill collar (not shown) of a usual string of well drilling tools.

The lower or forward end of the drill bit has a pair of legs 9 which extend downwardly and which are preferably integral with the head 3 and shank 5. One of the legs 9 is shown broken away and removed, it being the same as the leg 9 shown in central longitudinal cross section in Fig. 1. If desired, the drill bit can have more than two legs, three leg members and assemblies therewith spaced around the head 3 and shank 5 being common drill bit structure. The shank 5 and head portion 3 is hollow having channel 11 centrally located therein through which drilling gas is delivered to the points of cutting in the bottom of the hole.

Each leg 9 has a shaft portion 13 which is inwardly inclined and which is substantially cylindrical. On these shafts are rotatably mounted the cone-shaped cutters 15 having teeth 17. These cutters rotate in operation and move on the bottom of the hole as the drill bit is rotated by the drill pipe. Shaft 13 has a circumferential raceway 19 therein near its base to receive the ball bearings 21, and cone-cutter 15 has a corresponding raceway 23 to receive these same ball bearings. Roller bearings 25 are mounted in a circumferential raceway 27 in the outer portion of shaft 13 and roll against a raceway surface on the inside of the cutter 15. With the cutter 15 mounted in position on shaft 13 and roller bearings 25 in place, ball bearings 21 are introduced into their raceways 19 and 23 through a transverse hole 29 in the leg 9 and shaft 13 of the drill bit. A plug 31 is suitably fixed in hole 29 such as by welding same in the hole. This plug 31 holds ball bearings 21 in place and its inner end is properly recessed to form a portion of raceway 19. These bearings 21 and 25 rotatably mount cutter 15 on shaft 13 and space the cutter from the shaft. The inner end of shaft 13 in the tapered portion is preferably cut off to form a distinct void space 33 with the inner portion of the cutter 15 recess.

Head 3, leg 9 and shaft 13 have a longitudinal conduit

35 therethrough which communicates between channel 11 in shank 5 and void space 33. The lower portion of conduit 35 is preferably drilled in shaft 13 into hole 29, and the upper portion is preferably drilled in head 3 and leg 9 into hole 29. At the point of juncture of the two portions of conduit 35 in hole 29, plug 31 is reduced in diameter so that there is a continuous passageway from channel 11 to void space 33. In operation a portion of the gas drilling fluid from the drill pipe and channel 11 is picked up and passed through conduit 35 to the void space 33, then over shaft 13 between same and cutter 15 and over bearings 25 and 21 to cool same and remove heat from the drill bit built up during drilling.

Head 3 and leg 9 have a reservoir 37 formed therein, and this reservoir 37 is in communication with conduit 35 via a conduit 39 connecting same. A removable cap 41 is provided to close reservoir 37. Reservoir 37 holds lubricant for lubricating bearings 21 and 25 during drilling. Any lubricating substance which is liquid, or which becomes liquid at the drill bit temperature during operation can be used. Petroleum lubricating oil has been found satisfactory, with conduit 39 of relatively small size so that the reservoir will maintain a flow of the oil to conduit 35 over a period of time. And, in sizing conduit 39 for the desired lubricant one should keep in mind that my new means works as a jet aspirator or pump to deliver the lubricant, with the gas stream in conduit 35 acting as the fluid jet in passing the outlet of conduit 39. I prefer to use a lubricating grease which is solid at room temperature and liquid at drill bit operating temperatures. The reservoir 37 is packed with such grease and cap 41 placed thereon before lowering the drill bit into the hole. When the drill bit is operated, heat built up melts the grease which is pumped and runs into conduit 35 via conduit 39. In any case during drilling the gas stream in conduit 35 picks up the lubricant and carries it to bearings 21 and 25 to lubricate same. Reservoir 37 is easily recharged by removing cap 41.

The result of my structure is a gas well drill with lubricated bearings and which runs cool in operation.

As will be evident to those skilled in the art, various modifications of this invention can be made, or followed, in the light of this disclosure and discussion, without departing from the spirit or scope of the disclosure or from the scope of the claims.

I claim:

1. A well bit for rotary drilling apparatus utilizing a rotating drill pipe having a drill collar or tool joint on its lower end portion and wherein a gas used as the drilling fluid is passed down through said drill pipe, comprising, an upper shank portion adapted for engagement with said drill collar or tool joint and having a central channel therethrough in communication with said drill pipe when in engagement, a plurality of leg portions extending downwardly from said shank portion and spaced therearound, each of said leg portions having an inwardly inclined shaft portion having a plurality of circumferential bearing races formed therein, each of said shaft portions having a hollow cone-shaped cutter rotatably mounted thereon and spaced therefrom, said cutters having bearing races formed therein on the inside thereof corresponding to said bearing races in said shaft portions, bearings

mounted in said corresponding races to mount said cutters and space said cutters and shafts, each of said leg portions and its shaft portion having a gas drilling fluid conduit therethrough communicating with said channel in said shank portion and the space between said cutter and shaft portion, and each of said leg portions having a lubricant reservoir therein having a conduit therefrom communicating with said gas drilling fluid conduit, said well bit adapted to receive when in engagement with said drill collar or tool joint and during drilling operation a portion of the gas drilling fluid passed down said drill pipe, allow for the passage of said portion of said gas drilling fluid through said gas drilling fluid conduits into said spaces between said cutters and shafts and over said bearings to cool same, and adapted to deliver lubricant from said reservoirs to said gas drilling fluid conduit to be picked up by said gas fluid and delivered to said bearings to lubricate same.

2. In a drill bit for gaseous drilling fluid mountable on a drill pipe carrying said gaseous fluid, a leg member, a shaft on the outer end portion of said leg member, a cutter rotatably mounted on said shaft, corresponding bearing races in said shaft and cutter, bearings mounted in said races spacing said cutter and shaft, a conduit in said leg and shaft communicating between said drill pipe and the space between said cutter and shaft, said conduit constructed to allow the delivery of a portion of said gaseous fluid during drilling operation to said space to cool said bearings, a separate lubricant reservoir in said leg, and a second conduit communicating between said reservoir and said first-named conduit, said second conduit constructed to allow passage of lubricant from said reservoir to said first-named conduit, to be picked up by said gaseous fluid during drilling operation and delivered to said bearings to lubricate same.

3. In a drill bit, for gaseous drilling fluid mountable on a drill pipe for carrying said gaseous fluid, a shaft, a cutter rotatably mounted on said shaft and spaced therefrom, bearings mounted between said cutter and shaft, a conduit in said drill bit, which communicates between said drill pipe and the space between said cutter and shaft when said drill bit is mounted on said drill pipe, said conduit constructed to allow the delivery of a portion of said gaseous drilling fluid during drilling operation to said space to cool said bearings, a separate lubricant reservoir in said drill bit, and a second conduit in said drill bit, said second conduit communicating between said reservoir and said first-named conduit, said reservoir and second conduit constructed to allow the delivery of lubricant to said first-named conduit to be picked up by said gaseous drilling fluid flowing therein during drilling operation and deliver said lubricant to said bearings.

References Cited in the file of this patent

UNITED STATES PATENTS

1,136,134	Hughes	Apr. 20, 1915
1,564,820	Blanchard	Dec. 8, 1925
1,674,579	Van Hamersveld	June 19, 1928
1,921,702	Reed	Aug. 8, 1933
2,661,932	Woods	Dec. 8, 1953
2,751,196	Smith	June 19, 1956