Aug. 16, 1927. 1,639,065

G. F. THAGARD

UNPLUGGABLE BIT

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Fig. 1.

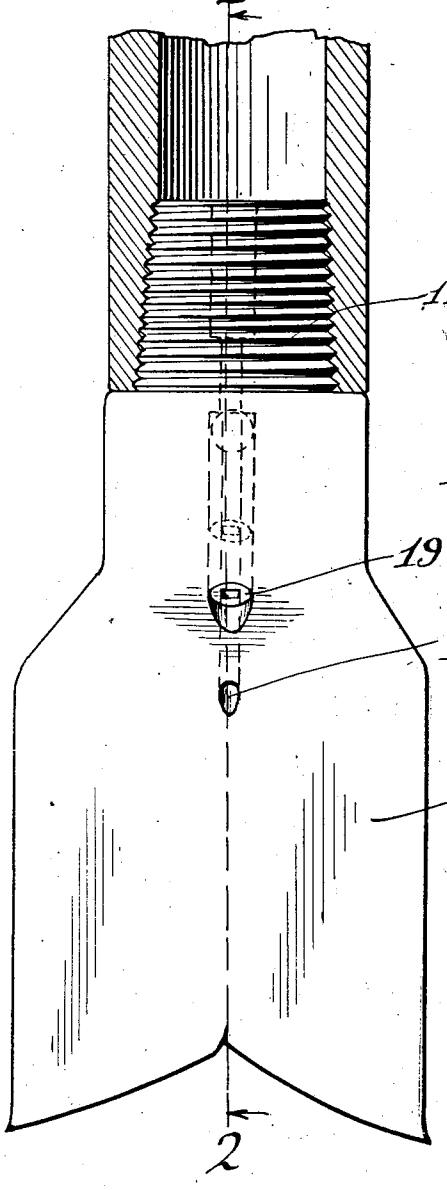


Fig. 2.

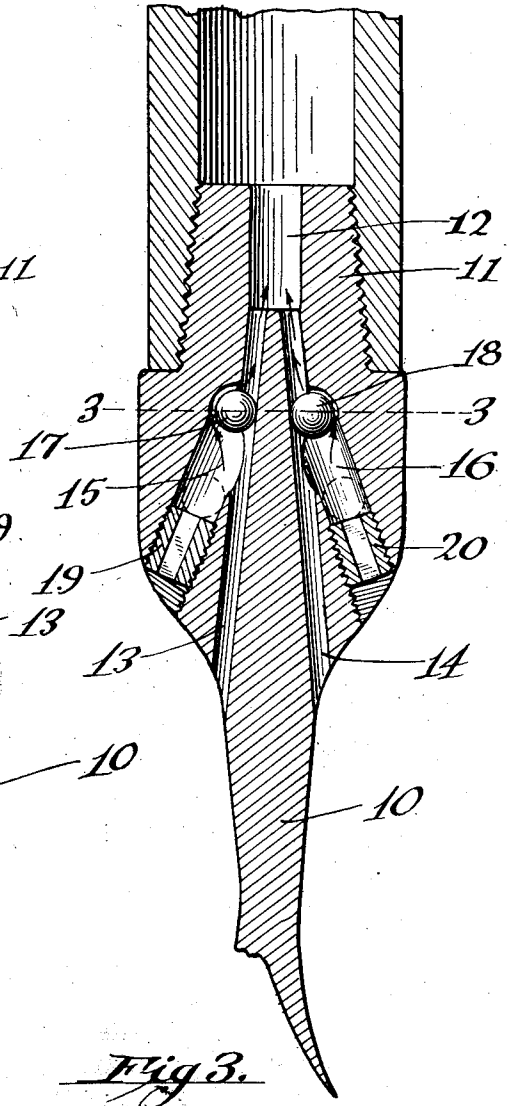
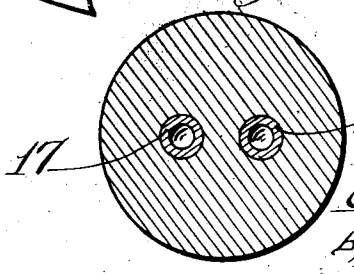


Fig 3.



Witness

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UNITED STATES PATENT OFFICE.

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UNPLUGGABLE BIT.

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This invention relates to improvements in drill bits used in drilling wells.

Most drill bits used in connection with rotary drilling outfits have discharge passages formed in their bodies through which circulation fluid is discharged during the drilling operations. In lowering the bit into the well hole to continue drilling, it frequently occurs that the drill bit strikes the side of the hole and solid matter passes upwardly through the discharge passages and into the drill pipe, tending to plug up the discharge passages, so that when the circulation mud pumps are applied, it is difficult and sometimes impossible to have the circulation fluid discharged. The same effect sometimes happens when the drill bit is at the bottom of the hole and the pressure applied by the circulation pumps is temporarily released, allowing the fluid in the hole to flow up through the discharge passages and into the drill pipe, carrying with it solid material which is apt to plug the discharge passages.

An object of this invention is to provide a drill bit of improved construction wherein the upward flow of fluid through the discharge passages in the bit is effectively prevented or retarded in such a manner that solids cannot pass upwardly through the discharge passages.

With the foregoing and other objects in view which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Figure 1 is a side elevation of a drill bit of the improved construction,

Fig. 2 is a vertical section taken substantially on the line 2—2 of Fig. 1, and

Fig. 3 is a horizontal section taken upon the line 3—3 of Fig. 2.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, the bit on which the invention is illustrated as having been embodied is a fish tail bit indicated at 10, although it will be readily understood that the invention is capable of being applied to various other types of bits which have discharge passages for the discharge of circulation fluid. As is conventional in this class of bits, the drill bit is provided with a pin 11 threaded for attachment to the drill pipe. In the pin there is formed a vertical bore 12 with which two upwardly convergent discharge passages 13 and 14 communicate. The above mentioned construction is conventional, and circulation fluid which is forced downwardly through the drill pipe enters the bore 12 and is discharged through the downwardly divergent discharge passages 13 and 14.

The invention consists of forming two upwardly convergent bores 15 and 16 in the body of the bit which have their upper ends communicating with the discharge passages 13 and 14 respectively. The bores 15 and 16 are greater in diameter than the diameters of the discharge passages. Within each of the bores 15 and 16 there is a hollow steel ball, such as is indicated at 17 and 18. These balls have diameters slightly smaller than the diameters of their respective bores 15 and 16 so that they are freely slidable therein. The lower end of each of the bores is threaded to receive tubular members 19 and 20, which preferably have squared apertures therethrough, so that they can be readily screwed into place upon the insertion of a square object. The tubular members 19 and 20 serve to maintain the balls 17 and 18 in their respective bores and adjacent the upper ends of the bores.

The operation of the improved drill bit is as follows: When there is any tendency for fluid to flow upwardly through the discharge passages 13 and 14, which may be created upon lowering the bit into the hole or stopping the circulation pumps, fluid also tends to rise or flow upwardly through the tubular members and through the two bores, causing the galls 17 and 18 to rise within the bores and substantially close the discharge passages 13 and 14. If the upper end of each bore is so formed as to provide a good seat, the balls 17 and 18 act as check valves, preventing flow of fluid up through the discharge passages and also the bores, so that no fluid or solid material can enter the drill pipe or the bore 12. This construction wherein a good seat is provided is very advantageous when the bit is used in shallow drilling. In this case the balls 17 and 18 not only prevent the solid material from passing up through the bit and plugging it, but also serve as float valves for preventing any fluid from entering the drill pipe. In the case of deep drilling, however, it is disadvantageous to completely prevent the entrance of liquids into the drill pipe, be-

cause of the fact that the high pressure at the bottom of the well hole may be capable of collapsing the lower end of the drill pipe. Consequently, when the bit is used in deep drilling, it is highly desirable that the seat for the balls 17 and 18 be otherwise than a perfect seat, so that the balls when in their seated positions will allow liquids to pass slowly through the discharge passages 13 and 14 and thus partially equalize the pressures on the inside and outside of the lower end of the drill pipe. At the same time, however, the balls 17 and 18 function as strainers, allowing the liquid to seep through but preventing any solid material from getting by which might plug the passages.

When it is desired to continue the drilling operations, the circulation pumps are again started and upon the downward flow of fluid within the drill pipe, the balls 17 and 18 drop to the bottom of their respective bores, assuming positions on top of the tubular members 19 and 20, as indicated by dotted lines upon Fig. 2. Because of the fact that the bores 15 and 16 are greater in diameter than the diameters of the passages 13 and 14, there is no tendency or danger of the balls preventing downward flow of fluid through the passages. The tubular members 19 and 20 are preferably so arranged that the balls are maintained very near the passages 13 and 14, so that there is very little or no tendency of solid material, such as sand or grit, collecting in the bores 15 and 16 on top of the balls, which might prevent the upward movement of the balls when there was an upward flow of fluid through the bit. When the balls are in their lower position it is not intended that they seat upon the upper ends of the tubular members so as to close them. This will be effectively prevented because of the fact that the apertures in the tubular members are square. Consequently, as there is some clearance between the balls and the sides of their respective bores upon the downward flow of fluid, some fluid may escape past the balls through the bores and through the tubular members, keeping the bores clean.

It will be noted that by the improved construction the discharge passages 13 and 14 remain straight and that when there is a downward flow of fluid through the drill bit, these passages are entirely or complete unobstructed. By reason of this fact the application of the invention to a drill bit is such that there is no material increase of pressure required to be exerted by the circulation pumps to discharge the circulation fluid through the bit.

It is understood that various changes may be made in the detail of construction without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. A drill bit having a straight discharge passage therethrough for the discharge of circulation fluid, there being a cavity arranged in the bit communicating with said discharge passage, and a closure receivable wholly within said cavity capable of moving into said discharge passage so as to prevent or retard upward flow therethrough.

2. A drill bit having a discharge passage formed in its body, a bore communicating with said passage, a ball disposed within said bore adapted to close said passage so as to prevent or retard upward flow therethrough, and means for maintaining said ball within said bore.

3. A drill bit having a discharge passage formed in its body, a bore communicating with said passage, a ball disposed within said bore adapted to close said passage so as to prevent or retard upward flow therethrough, and means for maintaining said ball within said bore, said ball and bore being of a greater diameter than the diameter of said passage.

4. A drill bit having a plurality of discharge passages formed in its body and bores communicating with each of said passages, hollow balls disposed in each of said bores adapted to close said passages so as to prevent or retard the upward flow of fluid therethrough, and means for maintaining said balls within their respective bores.

5. A drill bit having a plurality of discharge passages formed in its body and bores communicating with each of said passages, hollow balls disposed in each of said bores adapted to close said passages so as to prevent or retard the upward flow of fluid therethrough, and means for maintaining said balls within their respective bores, said balls and bores being of greater diameters than the diameters of the passages with which they are associated.

6. A drill bit having two downwardly divergent straight discharge passages formed in its body through which circulation fluid is adapted to be discharged, there being two bores formed in said body, each of which communicates with one of said discharge passages, each bore being of a greater diameter than the diameter of the discharge passage with which it is associated, a hollow ball disposed within each bore which is greater in diameter than the diameter of the passage with which it is associated and which is adapted to close the passage so as to prevent or retard the upward flow of fluid therethrough, and a tubular member threaded into the lower end of each bore for maintaining the ball therein.

7. A drill bit having two downwardly divergent straight discharge passages formed in its body through which circulation fluid is adapted to be discharged, there being two

bores formed in said body, each of which communicates with one of said discharge passages, each bore being of a greater diameter than the diameter of the discharge passage with which it is associated, a hollow ball disposed within each bore which is greater in diameter than the diameter of the passage with which it is associated and which is adapted to close the passage so as to prevent or retard the upward flow of fluid therethrough, and a tubular member threaded into the lower end of each bore for maintaining the ball therein adjacent the discharged passage.

8. The combination with a drill bit having a plurality of discharge passages formed in its body, of means forming strainers in said passages which function to prevent solids from passing upwardly through the passages, but permit liquids to pass upwardly therethrough.

9. The combination with a drill bit having a plurality of discharge passages formed in its body, of means forming strainers in said passages which function to prevent solids from passing upwardly through the passages, but permit liquids to pass upwardly therethrough, said means being so arranged as to leave the discharge passages completely unobstructed when there is a downward flow of fluid therethrough.

In testimony whereof I have signed my name to this specification.

GEO. F. THAGARD.