June 5, 1956 R. G. PETER 2,749,092

DRILL BIT

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Fig. 1

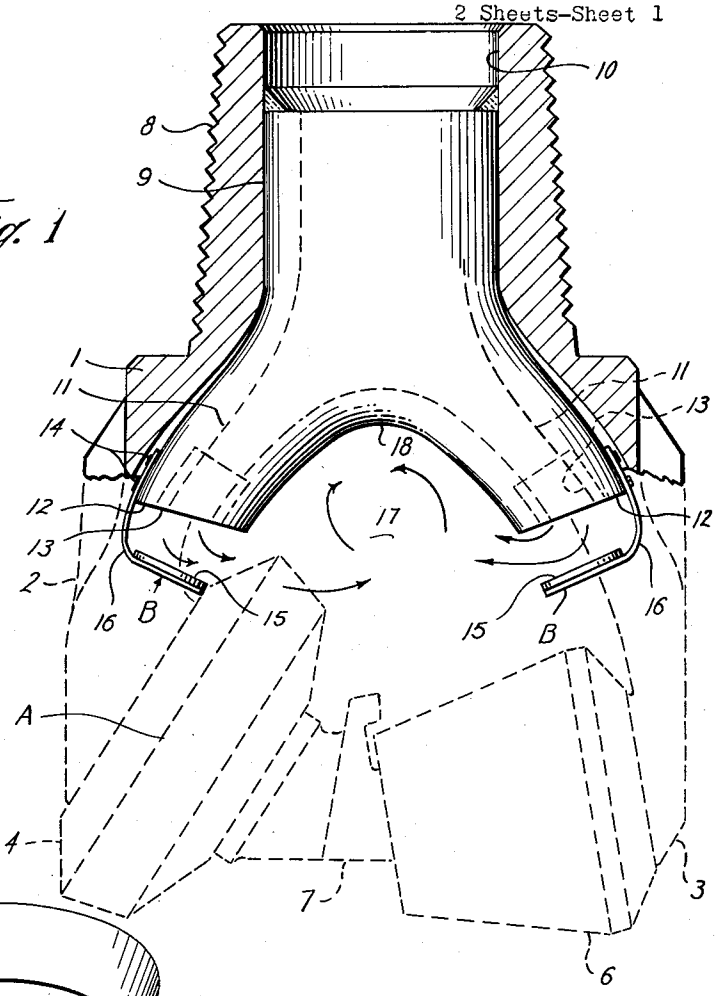
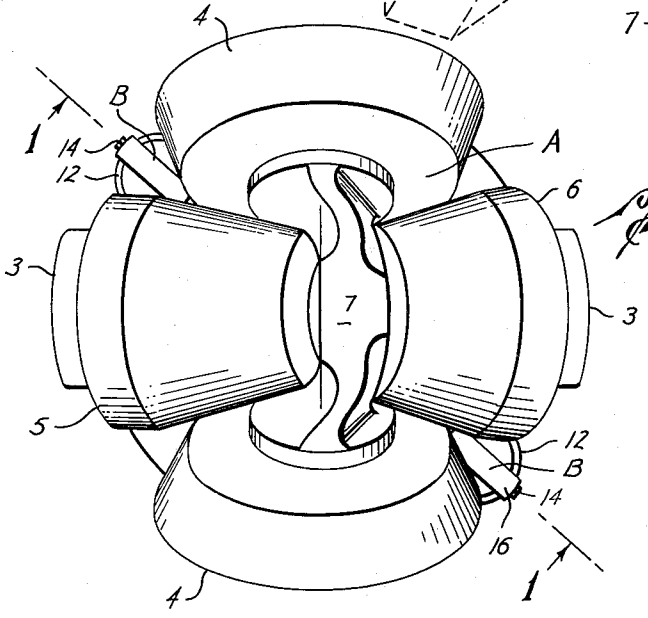


Fig. 2



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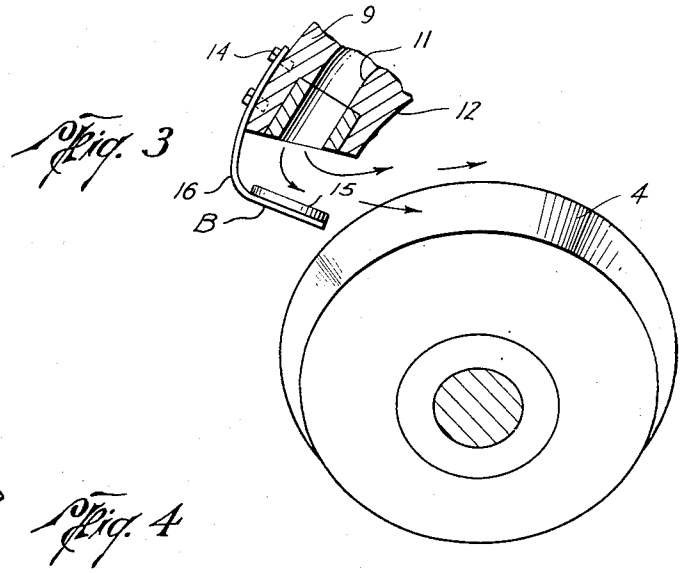


Fig. 3

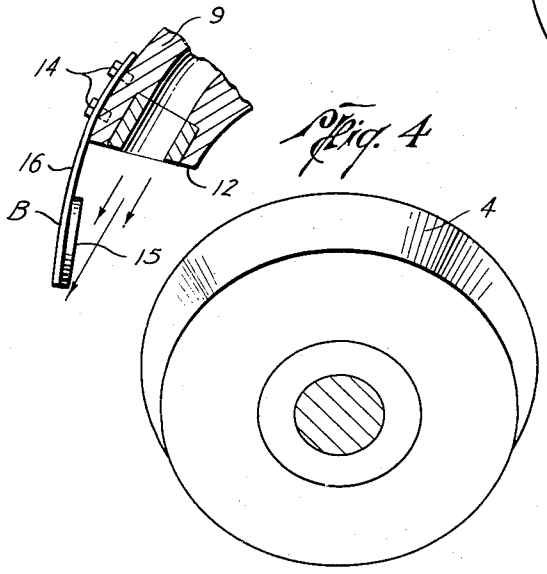


Fig. 4

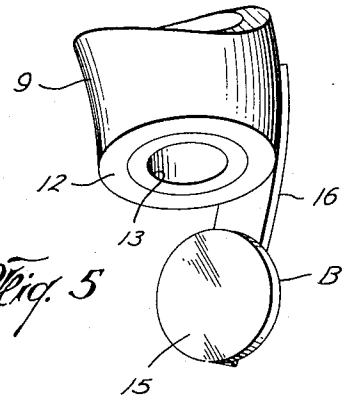


Fig. 5

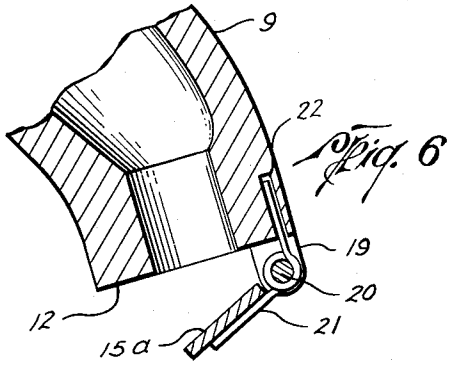


Fig. 6

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DRILL BIT

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Application August 1, 1952, Serial No. 302,211

3 Claims. (Cl. 255—315)

This invention relates generally to drill bits and more in particular to means in roller bits for directing drilling fluid pumped therethrough.

In the drilling of deep wells, the drill bit is attached to the end of a drill stem and lowered to the bottom of the hole. The drill stem is then rotated causing the drill bit to penetrate the formation, and drilling fluid is pumped downwardly through the drill stem and drill bit to remove cuttings dislodged by the drilling operation, and carry them upwardly, in the space between the drill stem and the wall of the hole, to the surface of the earth. Drill bits in common use may be provided with rollers to cut or crush the formation, and may be provided with nozzles to discharge drilling fluid toward the bottom of the hole so that cuttings or particles of formation dislodged by the bit during the drilling operation may be removed from the bottom of the hole. In certain instances, the drill bit may become packed or "balled up" when it is lowered by the drill stem to the bottom of the hole: that is, the cuttings dislodged by previous drilling operations, and other material or detritus already in the hole, may accumulate about the rollers and pack the drill bit as it is being lowered into the hole. As the drilling operation progresses, the bit may "ball up" with cuttings at intervals, especially in the drilling of soft, sticky formations. "Balling up" of the drill bit may occur particularly in those roller bits in which the drilling fluid is discharged from the bit head and directed toward the bottom of the hole; accordingly, the fluid thus directed may not serve to clean properly the drill bit rollers and adjacent parts. As a result of this, the rollers may not freely rotate when the drill stem is rotated and the bit therefore does not efficiently drill the formation.

A general object of this invention is to provide a drill bit having new and improved nozzles which will serve not only to discharge fluid toward the bottom of the hole but also to clean the bit of accumulated cuttings and detritus.

Another object is to provide a new and improved bit in which the drilling fluid pumped therethrough may be utilized alternatively to clean the drill bit and the bottom of the bore hole.

A specific object is to provide a new and improved fluid nozzle having a fluid diverter adapted to divert fluid in accordance with the volume of fluid passing through the nozzle in a given time interval.

Another specific object is to provide a new and improved drill bit fluid directing device wherein the device may be fluid operated so that fluid pumped therethrough at a relatively low velocity or pressure will be directed to clean the bit, and fluid pumped therethrough at a relatively high velocity or pressure will be directed to clean the hole being drilled by the bit.

Other objects and advantages will hereinafter appear from the following description and the accompanying drawings wherein, by way of illustration, this invention is set forth.

In the drawings:

Fig. 1 is a view taken along line 1—1 of Fig. 2.

Fig. 2 is a bottom plan view of a drill bit showing an arrangement of drilling fluid nozzles in the drill bit.

Fig. 3 is a fragmentary sectional view showing schematically how the fluid diverter may divert fluid to clean the bit roller.

Fig. 4 is a fragmentary sectional view showing schematically how the fluid may be discharged downwardly.

Fig. 5 is a fragmentary view showing how the fluid diverter may be shaped.

Fig. 6 is a fragmentary view showing a modified fluid diverter.

Referring to Figs. 1 and 2, a drill bit is indicated generally by the letter A and the bit head is indicated at 1. The bit head 1 may have oppositely disposed side roller bearing extensions 2 and oppositely disposed cross roller bearing extensions 3. Side rollers 4 may be rotatably mounted in the usual manner on the said side roller bearing extensions 2, and cross rollers 5 and 6 may be rotatably mounted in the usual manner on cross roller bearing extensions 3. The inner ends of the bearing extensions 2 and 3 may be secured to a bridge 7. The bit has a threaded shank 8 which is adapted to be connected to a drill stem (not shown). A drilling fluid nozzle 9 is disposed within the bore 10 of the shank 8, and has downwardly and outwardly diverging fluid passageways 11. The lower ends 12 of the nozzle 9 may be directed to discharge drilling fluid toward the bottom of the hole. A wear resisting insert 13 may be provided in the lower end 12 of the nozzle 9.

A fluid diverting device, indicated generally by the letter B, is secured to the nozzle end 12 by means of screws 14 or any other suitable means. The diverter B may be composed of a wear resisting plate 15 secured by brazing or other suitable means to a spring 16 which is attached to the nozzle end 12 as above described. The wear resisting plate 15 of the fluid diverter B is disposed in the path of the fluid being discharged from the nozzle ends 12 of the nozzle 9, and urged by the spring 16 to a position substantially as shown in Figs. 1 and 3. The fluid discharged from the nozzle ends 12 will thus impinge the plate 15 and be diverted thereby. Since the plate 15 is resiliently positioned by means of the spring 16 in the path of the fluid being discharged from the nozzle ends 12, the amount of fluid diverted by the diverter will be inversely proportional to the velocity or pressure of fluid impinging the said plate 15. That is; when drilling fluid at a relatively low velocity or pressure impinges the plate 15 a greater amount of the fluid will be diverted from its nozzle directed course; but when fluid at a relatively high velocity or pressure impinges the said plate, the resistance of the spring 16 urging the plate 15 to the position in the path of the fluid is overcome, and a relatively smaller amount of the fluid is diverted from its nozzle directed course.

Thus the diverter B is adapted to permit the fluid being discharged from the said nozzle ends to clean the bottom of the hole being drilled by the drill bit and is also adapted to divert a portion of the fluid being discharged from the ends 12 of the fluid nozzle 9, toward the rollers 4, 5 and 6 and toward the recess 17 above the said rollers to clean the drill bit. The recess 17 above the rollers is formed by the lower portion of the bit head 1; the lower portion 18 of the nozzle 9; the side roller bearing extensions 2; and the cross roller bearing extensions 3.

Fig. 3 shows schematically how the diverter B may act to divert drilling fluid to clean the drill bit rollers and adjacent parts, and Fig. 4 shows schematically how a relatively higher velocity or pressure of the fluid impinging on the said diverter will cause it to open to a position in which the flow of the fluid is substantially

unimpeded by the fluid diverter, thereby utilizing the fluid to clean the bottom of the bore hole.

Fig. 5 shows the fluid diverter B wherein the wear resisting plate **15** may be of a circular shape.

Fig. 6 shows a modification of the fluid diverter device wherein the lower end **12** of the fluid nozzle **9** may have a lug **19** adapted to receive a pin **20**. A wear resisting plate **15***a*, which may be a hard metal plate, is brazed or otherwise secured to one end of a torsion coil spring **21**. The nozzle end **12** may have therein a socket **22** adapted to receive the free end of the spring **21**. The diverter device is mounted by inserting the free end of the spring **21** into the socket **22**; pin **20** is then passed through the coil of the spring **21** and secured to the lug **19** in a suitable manner. The spring **21** urges the plate **15***a* substantially to the position shown in Fig. 6. This diverter is similar in its operation to the diverter B, hereinbefore and hereinafter described.

In operation, the drill bit A is secured, by means of the threaded shank **8**, to the end of a drill stem (not shown), which is then lowered to the bottom of the bore hole and rotated to cause the bit to penetrate the formation. During the lowering thereof, the drill bit may have become "balled up" or packed, with cuttings standing in the hole, which have been dislodged during the previous drilling operations. The cuttings may accumulate about the side rollers **4** and the cross rollers **5** and **6** and especially in the recess **17**, thus "balling up" the drill bit before it is rotated on the bottom of the bore hole. "Balling up" or packing of the drill bit may be so severe that the rollers may not turn freely, upon rotation of the drill stem, and thus may skid and be worn flat, materially reducing the useful life of the drill bit. "Balling up" of the drill bit may occur from time to time as the drilling operation progresses.

In order to alleviate this "balling up" of the drill bit, I provide the fluid diverter B to divert drilling fluid, being pumped through the drill stem and fluid nozzle **9**, to clean the drill bit of the cuttings and detritus which may have become packed therein.

After the drill bit has been lowered into the hole, the drilling operator may cause fluid at a relatively low velocity or pressure to be pumped through the drill stem. The fluid then will impinge the diveter B, and a portion of the fluid will be diverted to clean the drill bit, as above described. After the drill bit is cleaned, the operator may increase the velocity or pressure of the fluid being pumped and proceed with the drilling operation in the usual manner. The relatively higher velocity or pressure of the fluid impinging the diverter will cause it to become substantially inoperative to divert the fluid towards the drill bit, and thus the fluid will be discharged substantially toward the bottom of the hole to clean therefrom the cuttings dislodged during the drilling operation.

As the drilling operation progresses, the bit may again become "balled up" with cuttings, causing the drill bit to penetrate the formation being drilled at a slower rate; whereupon, in formations where "balling up" of the drill bit is known to occur, the operator may reduce the velocity or pressure of the fluid being circulated so that the "balled up" bit may be cleaned by diverting the fluid thereon in the manner above described; thereafter, normal drilling operations may again be resumed.

This invention is not limited to the embodiments shown. Various changes, within the scope of the following claims, will be apparent to those skilled in the art.

I claim:

1. A cross roller bit having a head, cross rollers and side rollers mounted in the lower portion of said head, a drilling fluid nozzle mounted in said head above said cross and side rollers and having its lower discharge end disposed adjacent to said rollers, and a fluid diverter having a hard metal plate spaced from said discharge end and including means resiliently securing said plate to the lower end of said fluid nozzle to cause said plate, when fluid issuing from said nozzle is discharged thereagainst, to divert fluid against said rollers should the velocity or pressure of said fluid be relatively low, and to divert fluid to the bottom of the hole being drilled by said bit should the velocity or pressure of said fluid be relatively high.

2. A drill bit having a drilling fluid nozzle forming a part thereof and a drilling fluid directing device having a hard metal plate spaced from the discharge end of said nozzle and carried by means resiliently securing said plate to the lower discharge end of said nozzle and disposed laterally across the path of drilling fluid issuing from said nozzle, said fluid directing device being adapted to be actuated by the drilling fluid issuing from said nozzle and discharging against said plate to a position where it is not disposed across the path of the drilling fluid when the fluid issuing from said nozzle has a relatively high velocity or pressure whereby said drilling fluid is directed downwardly to clean the bottom of the hole being drilled by said bit, said fluid directing device remaining in a position with said plate disposed across the path of the fluid issuing from said nozzle when the fluid has a relatively low velocity or pressure whereby said drilling fluid is directed in a manner to clean said bit.

3. A drill bit having a drilling fluid nozzle forming a part thereof and a drilling fluid diverter device having a hard metal plate spaced from the discharge end of said nozzle and carried by means resiliently securing said plate to the lower discharge end of said nozzle and disposed laterally across the path of drilling fluid issuing from said nozzle, said device being adapted to divert fluid issuing from said nozzle to clean said bit should the velocity or the pressure of said fluid impinging upon said plate be relatively low, and alternatively to clean the bottom of the hole being drilled by said bit should the velocity or the pressure of said fluid impinging upon said plate be relatively high.

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