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ROLLER BIT

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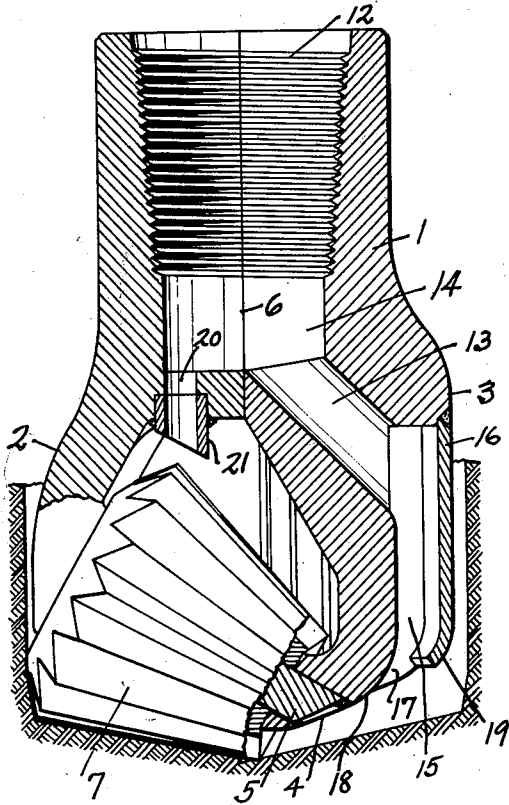


FIG. 2.

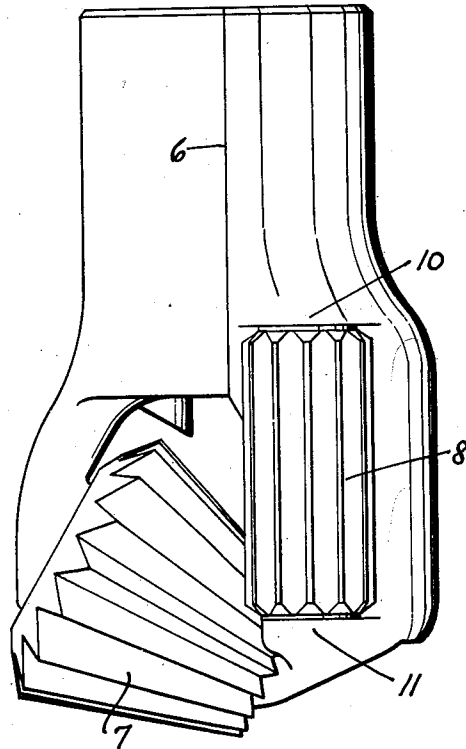


FIG. 1.

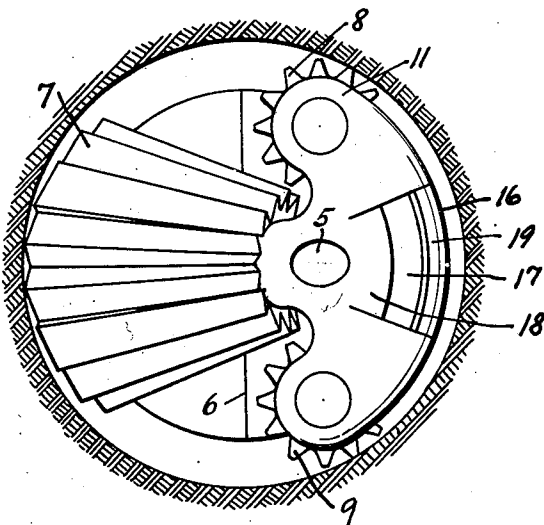


FIG. 3.

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ROLLER BIT

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6 Claims. (Cl. 255—71)

This invention relates to well drilling apparatus and more especially is directed to roller drill bits.

In prior art roller bit constructions difficulty has been encountered in obtaining adequate strength in the smaller sizes because the limited dimensions of the device restrict the sizes and load capacities of the supports, shafts, bearings and cutters.

Bits having a single roller cutter have been developed and various means have been provided for feeding drilling fluid from the drill stem through the drill bit and into the well bore, but all of these improvements have failed to attain the effectiveness desired.

In many instances the manner of feeding the drilling fluid into the well bore tends to erode the bottom of the hole especially in soft formation and causes the bit to deviate laterally resulting in a crooked bore.

An object of this invention is to provide a roller bit construction which will avoid the prior art disadvantages.

Another object of this invention is to provide a roller bit having a single cutter and constructed to feed drilling fluid directly to the cutter and into the hole drilled in a novel manner.

A further object of this invention is to provide a drill bit having passages for supplying drilling fluid to the cutting element thereof and into the bore of the hole drilled which avoids erosion of the bottom of the bore and any tendency for lateral deviation of the bit.

With these and other objects in view which will appear more fully hereinafter, the invention resides in the parts and combinations described in the following specification and illustrated in the drawing.

In the drawing:

Fig. 1 is an elevational view of a drill bit constructed to embody the features of the present invention.

Fig. 2 is a longitudinal sectional view of the bit shown in Fig. 1 illustrating the same in a well bore.

Fig. 3 is a bottom view of the drill bit illustrated in the preceding figures.

It has been found that a roller drill bit constructed with a single roller cutter can be constructed for use in drilling wells of comparatively small bore and still employ a relatively large cutter, shaft and bearing which will impart great strength and durability to the structure.

The present invention utilizes such type of construction. As shown in the drawing the drill bit comprises a hollow body 1 having two legs

2 and 3 depending therefrom. Leg 2 is of light solid construction and is of a shorter length than the leg 3. On the other hand leg 3 is rather massive and extends downwardly beyond leg 2. In addition leg 3 has its lower end portion projecting radially inwardly to the axis of rotation of the bit body and is provided with an aperture 4 to receive the lower end of the inclined roller cutter shaft 5. The other end of shaft 5 may be integral with the lower end of leg 2.

At this point it should be noted that the cutter body is formed of two or more portions, one portion carrying the leg 2, and another portion carrying the leg 3, the portions being welded or otherwise joined together along the line 6. Such a construction enables the bit to be more easily and economically made and assembled. In assembling the portions together the roller cutter 7 may be mounted on the shaft 5 and the lower end of said shaft may be inserted in the opening 4 and welded therein when the portions of the bit body are joined together.

With the roller cutter shaft 5 supported as illustrated, a substantially conical roller cutter 7 may be rotatably mounted thereon with its large end adjacent the leg 2 and its small end adjacent the lower end of the leg 3. A roller cutter so mounted will effectively cut into the formation at the bottom of the well bore without undue wear on the teeth of the cutter.

In order that the drill bit as a whole may be caused to rotate about its true axis and not gyrate within the well hole, two reamer cutters 8 and 9 are provided. These reamer cutters are mounted for rotation on substantially vertical axes disposed on each side of leg 3.

As a matter of fact, the reamer cutters 8 and 9 are supported for rotation by upper and lower lateral extensions 10 and 11 on each side of the leg 3. With this construction the two reamer cutters 8 and 9 and the cutter 7 are arranged in a substantially triangular formation so that there will be a three-point bearing contact between the reamer cutters and the cutter 7 and the wall of the well bore. It will be found that by spacing the reamers and cutter approximately 120° apart the cutter will be properly positioned in cutting relation to the bottom of the well bore.

The inner portion of the hollow bit body 1 is provided with a tapered threaded part 12 adapted to receive the lower end of the drill stem.

Careful consideration has been given the routing of drilling fluid through the bit of the pres-

ent invention and in this connection it will be noted that leg 3 has a passageway 13 formed therein which communicates with the chamber 14 provided in the bore of the bit body. Passageway 13 extends downwardly and outwardly through the leg 3 and communicates with a slot-like recess 15 formed in the outer surface of the leg 3 and extending substantially in an axial direction. Closing the outer portion of the slot 15 is a deflection shield 16 which is welded to the leg 3 and extends downwardly toward the bottom thereof. It will be noted that the lower end of the slot 15 is left open to provide a discharge orifice 17 for the drilling fluid which is supplied through the drill stem into the chamber 14 and from which it is passed through the passageway 13 downwardly into the duct formed by the slot 15 having its lateral opening closed by the shield 16. It will be noted that the bottom of the slot 15 is deflected inwardly at its lower portion as indicated by reference character 18 and that the lower end of the shield 16 is bent inwardly as indicated by reference character 19. This will tend to direct the drilling fluid discharged from the orifice 17 radially inwardly toward the roller cutter 7.

By bending the lower end of the shield 19 in the proper direction the stream of drilling fluid may be deflected to either precede or follow the roller cutter 7 in its passage around the bottom of the hole which is being drilled, or may be aimed directly at the cutter 7.

In addition to the flow of drilling fluid through the leg 3 and down into the well hole, the present invention also provides for the playing of a stream of drilling fluid onto the teeth of the cutter 7 in order to clean the same. For this purpose the lower end of the chamber 14 is provided with a discharge opening 20 into which is fitted a nozzle 21. The size of the orifice 20 and the nozzle 21 is such as to cause a stream of relatively high velocity to be discharged onto the teeth of the cutter when out of engagement with the formation into which the well is being drilled.

It will be noted from the drawing that the cross section of the passageway 13 is much larger than that of the orifice 20 and this provides for the major portion of the drilling fluid flowing through the passageway 13 and out through the duct formed by the slot 15. The discharge of the major portion of the fluid through the orifice 17 at the lower end of slot 15 confines the circulation between the end of the drill bit and the bottom of the well hole and deflects the return flow around the cutter 7 and along the reamer cutters 8 and 9.

One of the principal features of the drilling fluid flow in the present invention is that the large fluid opening formed by the orifice 17 at the lower end of the slot 15 permits a large volume of flow of drilling fluid to pass through said orifice at a comparatively low velocity into the bottom of the well hole. It is more desirable to have a large volume of flow carrying away the formation as fast as it is cut rather than to have a small volume high velocity flow which will have a severe jetting action on the bottom of the hole which may wash out a softer formation and cause the bit to be deflected laterally resulting in the boring of a crooked hole.

From the foregoing description it will be appreciated that the present invention provides a drill bit in which the roller cutters are disposed in the most useful manner and in which drilling

fluid is supplied so as to effectively wash away the formation cut by the roller cutters without any jetting action on the bottom of the hole.

Having described my invention, I claim:

1. A rotary roller drill bit comprising a hollow body having two legs depending therefrom, one of said legs having a passageway therein inclined downwardly from the interior of the hollow body toward the outer portion of said leg, a rotary cutter supported for rotation between the ends of said legs, said leg having the passageway therein also having a recess formed in the outer surface thereof, communicating with the passageway and extending axially of said leg, and a shield welded to said recessed leg and closing the outer portion of said recess to convert said recess into a duct for the discharge of drilling fluid fed down through the hollow body and passageway.
2. A rotary roller drill bit comprising a hollow body having two legs depending therefrom, one of said legs having a passageway therein inclined downwardly from the interior of the hollow body toward the outer portion of said leg, a rotary cutter supported for rotation between the ends of said legs, said leg having the passageway therein also having a recess formed in the outer surface thereof, communicating with the passageway and extending axially of said leg, a shield welded to said recessed leg and closing the outer portion of said recess to convert said recess into a duct for the discharge of drilling fluid fed down through the hollow body and passageway, and a nozzle communicating with the hollow body and positioned above the cutter for discharging a jet of drilling fluid onto said cutter.
3. A rotary roller drill bit comprising a hollow body having two legs depending therefrom, one of said legs having a passageway therein inclined downwardly from the interior of the hollow body toward the outer portion of said leg, a rotary cutter supported for rotation between the ends of said legs, said leg having the passageway therein also having a recess formed in the outer surface thereof, communicating with the passageway and extending axially of said leg, and a shield welded to said recessed leg and closing the outer portion of said recess to convert said recess into a duct for the discharge of drilling fluid fed down through the hollow body and passageway, the lower inner wall of said recess being curved inwardly of the leg containing the same and the lower end of said shield being curved inwardly to direct the discharge of fluid from the duct toward said cutter.
4. A rotary roller drill bit comprising a hollow body having two legs depending therefrom, one of said legs having a passageway therein inclined downwardly from the interior of the hollow body toward the outer portion of said leg, a rotary cutter supported for rotation between the ends of said legs, said leg having the passageway therein also having a recess formed in the outer surface thereof, communicating with the passageway and extending axially of said leg, a shield welded to said recessed leg and closing the outer portion of said recess to convert said recess into a duct for the discharge of drilling fluid fed down through the hollow body and passageway, the lower inner wall of said recess being curved inwardly of the leg containing the same and the lower end of said shield being curved inwardly to direct the discharge of fluid from the duct toward said cutter, and a nozzle communicating with the hollow body and positioned above the

cutter for discharging a jet of drilling fluid onto said cutter.

5. A rotary roller drill bit comprising a hollow body having two legs depending therefrom, one of said legs having a passageway therein inclined downwardly from the interior of the hollow body toward the outer portion of said leg, a rotary cutter supported for rotation between the ends of said legs, said leg having the passageway therein also having a recess formed in the outer surface thereof, communicating with the passageway and extending axially of said leg, a shield welded to said recessed leg and closing the outer portion of said recess to convert said recess into a duct for the discharge of drilling fluid fed down through the hollow body and passageway, and a nozzle communicating with the hollow body and positioned above the cutter for discharging a jet of drilling fluid onto said cutter, the cross section of the passageway and duct being considerably greater than that of the nozzle whereby the greater portion of the drilling fluid will be discharged through the duct.

6. A rotary roller drill bit comprising a hollow body having two legs depending therefrom, one

of said legs having a passageway therein inclined downwardly from the interior of the hollow body toward the outer portion of said leg, a rotary cutter supported for rotation between the ends of said legs, said leg having the passageway therein also having a recess formed in the outer surface thereof, communicating with the passageway and extending axially of said leg, a shield welded to said recessed leg and closing the outer portion of said recess to convert said recess into a duct for the discharge of drilling fluid fed down through the hollow body and passageway, and a nozzle communicating with the hollow body and positioned above the cutter for discharging a jet of drilling fluid onto said cutter, the cross section of the passageway and duct being considerably greater than that of the nozzle whereby the greater portion of the drilling fluid will be discharged through the duct, and the discharge orifice of said duct being large enough to avoid jet action of fluid discharged therefrom against the bottom of the bore in which the drill is used.

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