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[54] DRILLING BIT WITH INTEGRAL STABILIZER
4 Claims, 3 Drawing Figs.

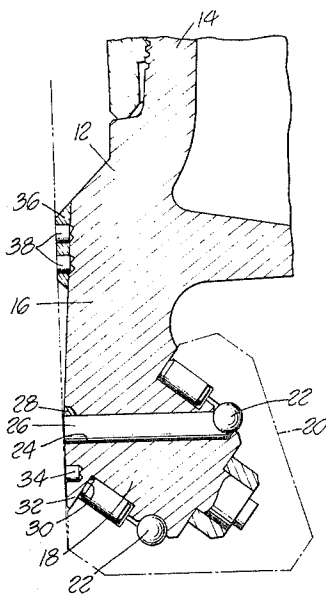
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[51]	Int. Cl.....	E21b 9/10
[50]	Field of Search.....	175/325, 356, 374, 375, 408

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ABSTRACT: A rotary drilling bit having depending legs with rotary cutters journaled thereon, the legs terminating downwardly in relatively thin portions facing radially outwardly and the bit body being provided with hard metal wear-resisting stabilizer shoes integral therewith and preferably located vertically above the legs to resist lateral movement of the tool in the formation resulting from lateral movement of the drill string above the tool and thereby reduce wear of the tool legs, and especially their lower portions.



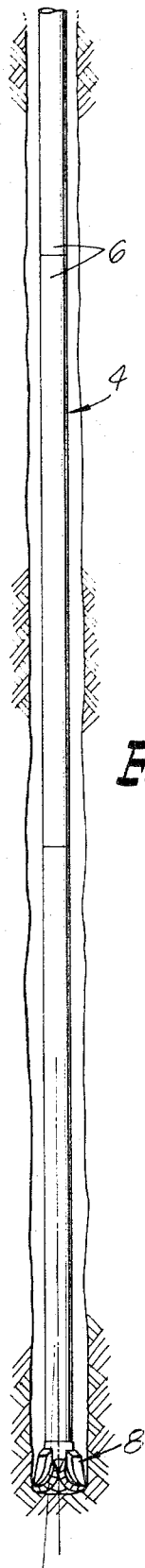


FIG. 1.

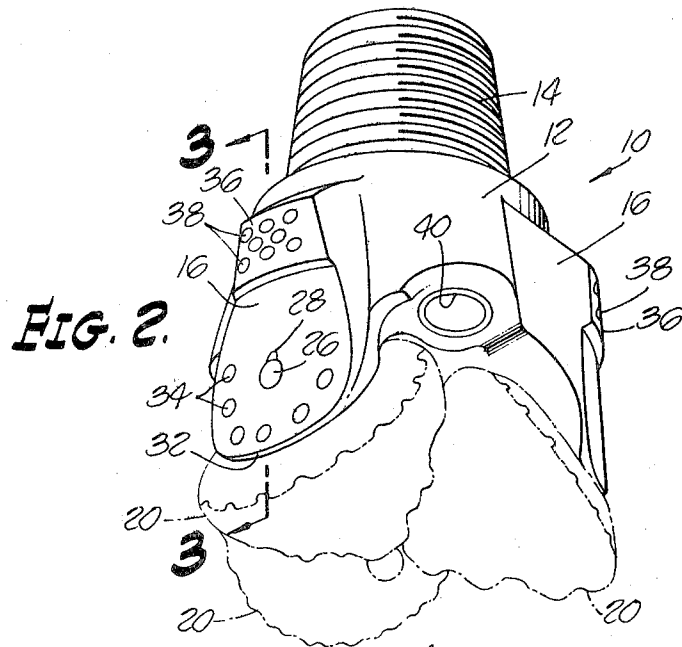


FIG. 2.

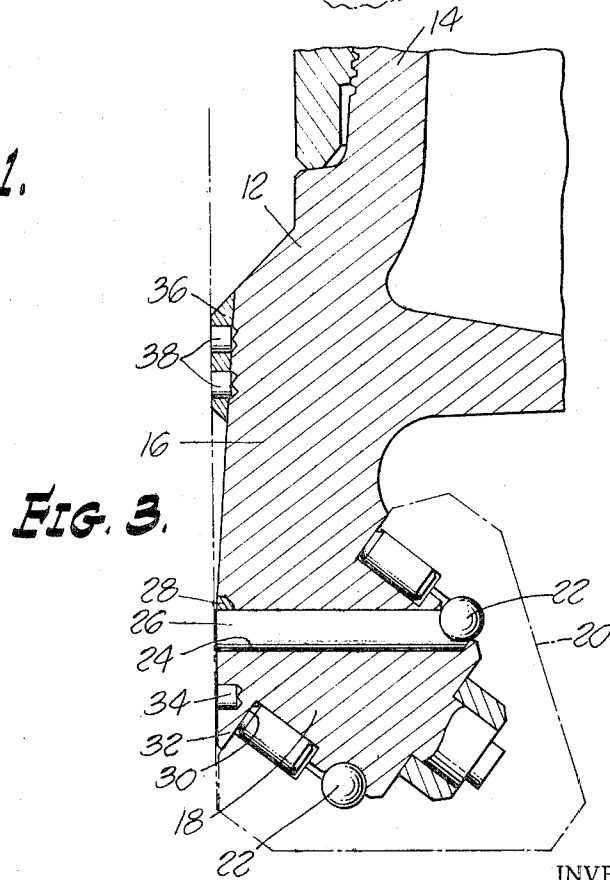


FIG. 3.

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DRILLING BIT WITH INTEGRAL STABILIZER

This invention relates to drilling tools and more particularly to drill bits for drilling through rock and other hard formations in drilling oil wells. It relates primarily to rotary bits having depending legs with rotary cutters thereon, the cutters being mounted on journals extending inwardly and downwardly from the inner sides of the legs.

Drilling bits of this type are conventionally suspended from drill pipe extending downwardly from the drilling rig at the surface. Generally the string of drill pipe is rotated by the drilling rig and this rotation is transmitted to the bit at the bottom of the hole. In some cases rotation of the tool is accomplished through the use of a turbine or fluid motor mounted on the bottom of string of drill pipe just above the bit. In either case the drill pipe or drilling string, being of less diameter than the hole being drilled downwardly through the formation, is subject to lateral whipping or other movement. This of course creates a certain amount of angularity to the string and it is imparted to a certain degree to the drilling tool itself. In drill bits of the type mentioned above, this results in a tilting of the tool which while of not great angularity, causes excessive pressure of the lower portions of the legs of the bit against the rough rocky formation as the tool is rotated. Because of the dictates of limited space in which to accommodate the rotary cutter on the bottom of the bit and the inward and downward angularity of their journals, the upper ends of the journals, where they extend from the bottoms of the legs, define leg bottom portions which are quite thin when considered in the environment in which they operate. Because of the peculiarities of the bit structure, and particularly the lower portions of the cutter journal supporting legs, undue lateral swinging or rocking motion of the bit will greatly reduce the life of the tool since the lower portions of the legs will relatively rapidly wear away.

Stabilizers for the drilling string have been used heretofore but they are located above the drilling tool and quite often some distance away from it, so that the tool still has an opportunity to move or tilt laterally. Stabilizers have also been used on subs located in the string just above the drilling bit but they are not located as critically close to the bottoms of the legs of the bit as desired and it is by far better drilling practice to eliminate subs where possible. Additionally, a sub with stabilizing means thereon comprises considerable additional structure which is not only costly but requires labor in its addition to the string.

It is a general object of the invention to provide means for stabilizing a drilling tool such as a drill bit having depending legs which reduce in thickness at their bottom portions because of the nature of their construction wherein the stabilizing means is not mounted some distance above the tool so that its effect is greatly lost but is mounted directly on and made integral with the body of the drilling tool so that it is immediately above the leg structure it is intended to protect and forms a part of the tool body itself so that an extra structure, such as a sub, is not required. Another object is to provide a stabilizer located directly upon the body of a drilling tool which is of hard metal, a term of art denoting carburized steel, a hard metal welded overlay or the like, so that the critical wear resisting stabilizing portions of the tool can be made much harder than it would be practical to make the entire tool body.

It is customary to manufacture rotary tools of this type with their bodies reducing in diameter upwardly to provide room for the escape of cuttings and also to remove a major circumferential outer portion of the tools from wear producing contact with the formation being drilled. This conventional shape adapts itself quite well to the incorporation of my stabilizing means since wear resisting hard metal can be laid on the outside of the body by welding procedures and/or hard metal elements can be attached to the body by other means in thicknesses sufficient to greatly lengthen the life of the tool and still keep the overall diameter of the upper portion of the tool within the limits provided by the diametrical cutting path or bore described by the rotary cutters.

The above and other objects and advantages will more fully appear from the following description in connection with the accompanying drawing:

FIG. 1 is a more or less diagrammatic illustration of a portion of a drill string with a conventional drill bit or tool mounted on the lower end thereof;

FIG. 2 is a perspective view of a drill bit with the rotary cutter shown in broken lines and with an embodiment of my invention incorporated in the body of the bit;

FIG. 3 is an enlarged sectional detail taken approximately on the line 3—3 of FIG. 2.

In FIG. 1 there is illustrated a drill string, generally indicated at 4, made up of the usual sections of drill pipe 6 threadedly connected and suspended from and rotated by a drilling rig at the surface of the ground. On the lower end of the drill string 4 is shown a drill bit 8 which is of conventional type and the details of which are not set forth therein.

In FIGS. 2 and 3 there is shown a drill bit 10 which is similar to the bit of FIG. 1 except that it graphically includes the structure of my invention. The bit 10 includes a body 12 having an upper threaded extension 14 to which the lowest section of drill pipe is threadedly connected in the usual manner. Extending downwardly from the bit body 12 are legs 16. As shown in FIG. 3, each leg 16 has an inwardly and downwardly directed journal 18 which is adapted to rotatably support a cutter illustrated at 20 in broken lines. The cutter may be mounted upon ball bearings 22 and additional bearing elements in a manner well known in the art. Customarily the bearing balls 22 are inserted through a passage 24 which is subsequently closed by a pin 26 secured by a weld 28.

The base of the journal 18 is defined by a surface of revolution 30 lying in a plane normal to the longitudinal axis of the journal 18. Due to the fact that the cutters 20 must perform at least a part of their cutting action at or approximately at the outer diameter of the tool as a whole, the journal 18 is so located that the surface of revolution 30 defines a relatively thin tapering bottom leg portion 32. The leg 16 and its bottom portion 32 are generally known in the field as a shirrtail, and the bottom of the shirrtail compared to the ruggedness of the tool and its environment is quite thin.

In order to reduce wear on the leg or shirrtail bottom 32, hard metal inserts 34 can be placed in the legs 16 but it has been found that even with this protection against wear, the tools at the lower leg portions will wear away unduly because of whipping or other lateral movement of the tool imparted to it through the drill string which may extend into the ground thousands of feet. As stated above, the use of stabilizers on the drill string and on subs or short sections of string immediately above the tool alleviate the condition to some extent but do not control lateral motion of the tool at the critical point which is the body of the tool itself. In order to do this I have provided stabilizer pads 36 which may comprise quantities of hard weld metal applied to the upper outer portion of the leg, and if desired, even this hard metal may be rendered more wear resistant by the inclusion of nonferrous inserts 38, such as tungsten carbide. It should be noted that the outer surface of the stabilizer 36 is preferably on a diameter which coincides with that of the bottom portions of the legs 16. It should also be noted that the rotary cutters 20 describe a circular path the outer diameter of which coincides with the outer diameter of the bottoms of the legs 16 and the stabilizers 36. Therefore, the stabilizers define a diameter which is no greater than that of the path of the cutters so that the tool will not jam in the formation because of the stabilizers. But by making the diameter defined by the stabilizers the same as that of the cutters and the bottom portions of the legs 16, the stabilizers not only prevent the tool from rocking or tilting laterally, but provide considerable additional hard metal wear surface on the tool body itself so that the life of the tool is greatly increased. The stabilizers provide wear resistant and lateral motion preventing elements but are much more rugged than the thin lower ends or shirrtails of the legs 16 and by spacing them about the tool body and placing them only at the critical locations,

namely directly above and quite close to the legs, the pumping of mud and carrying off of formation cuttings is not interfered with. It might be pointed out here that in some tools there are provided outlets 40 for drilling mud pumped down from the surface and directly upon the rotary cutters 20.

It should of course be understood that changes can be made in the exact form, details and proportions of the construction without departing from the spirit of the invention.

I claim:

1. A well-drilling tool for use on the lower end of a drilling string and having a rotary drill body portion with rotatable cutter means thereon wherein the improvement comprises: legs on said body portion having downwardly and outwardly slanting shirttail portions, the lower end of said shirttail portions comprising outer diameter surfaces of the tool, said cutters being mounted for rotation on said legs, said cutters, upon rotation of said body, defining a circular path of cut of substantially the same diameter as the lower end of said shirttail portions, said legs having radially outwardly facing upper portions on said body entirely above said cutters and above the bottoms of said shirttail portions, and hard metal stabilizer shoes on said upper portions of said legs which extend outwardly from said legs to substantially the same diameter as said circular path of cut.

2. The structure of claim 1, and said legs being integral with the remainder of said body portion, the legs having integral cutter journals thereon having longitudinal axes, and said stabilizer shoes being integral with said drill body portion.

3. The structure in claim 2, and said cutter journals being

directed downwardly and inwardly from the lower ends of said legs, said lower ends of said legs having surfaces of revolution about the bases of said journals and concentric to the longitudinal axes of the journals, and defining, with the outer walls of said legs, relatively thin tapering leg ends, and said stabilizer shoes being in vertical alignment with said relatively thin tapering leg ends.

4. A well-drilling tool for use on the lower end of a drilling string wherein the tool comprises a drill body having a central axis of rotation and having rotatable cutter means thereon, wherein the body comprises an upper section having legs extending downwardly therefrom at spaced points about said axis of rotation, those parts of the drill body above the legs, and radially outwardly facing portions of the drill body between said legs, being of less diameter than a diameter defined by the upper portions of said legs, the legs have radially outwardly disposed faces slanting outwardly from upper to lower portions thereof, the lower portions of said legs comprising the outer diameter surfaces of said tool rotatable cutters being supported by said legs, the cutter, when the drill body is rotated, defining a circular path having a diameter substantially coincident with a circular path defined by the lower portions of said legs, the upper portions of the legs having stabilizer pads of hard facing material thereon and extending outwardly therefrom, said pads having radially outwardly disposed faces on a circular path whose diameter is approximately the same as that of the circular path described by the lower portions of said legs.

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