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DRILL GUIDE

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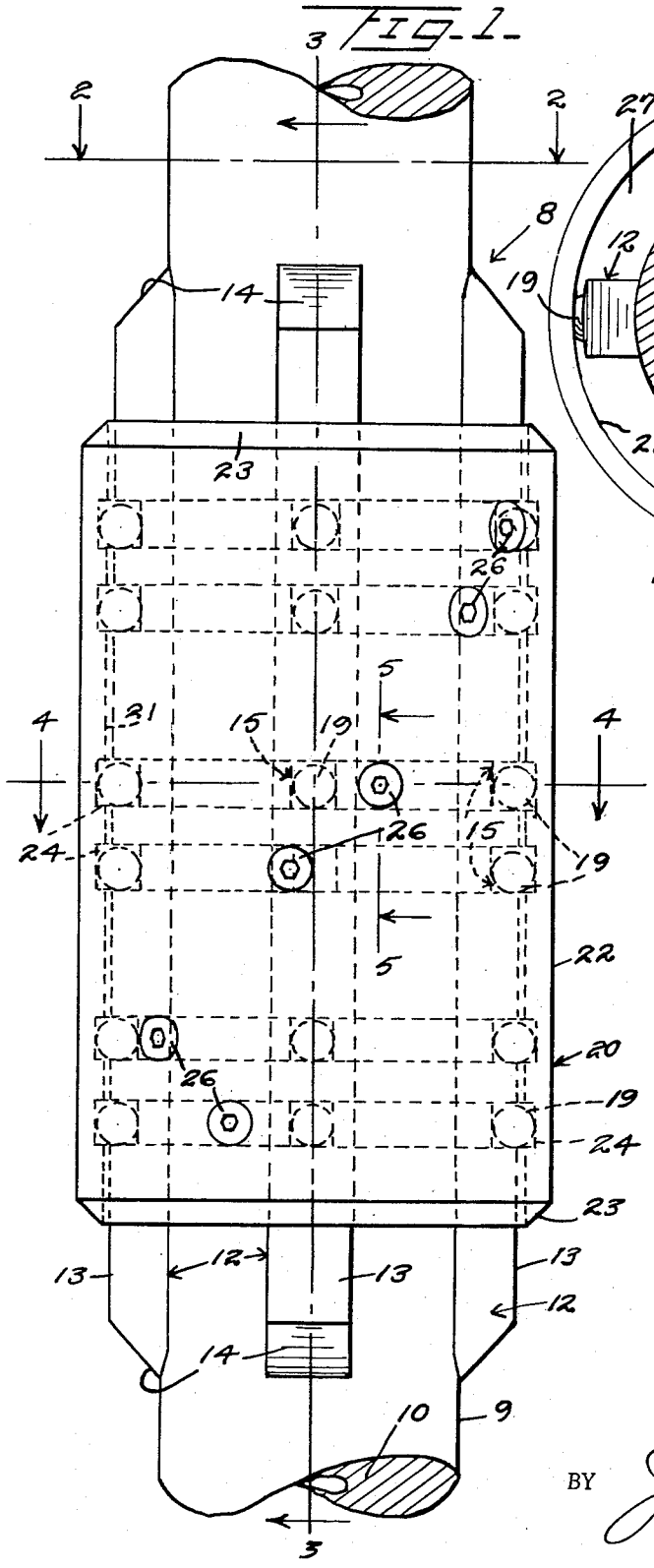
FIG. 1



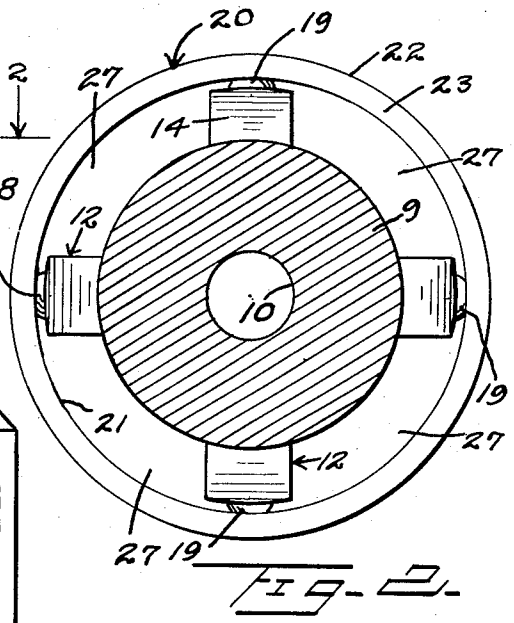


FIG. 2

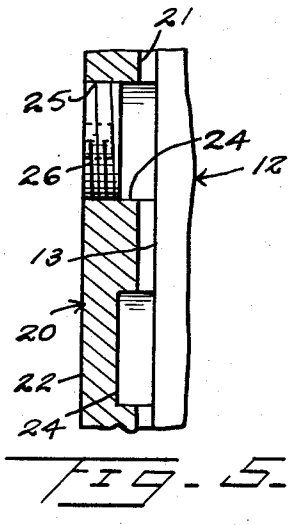


FIG. 5

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Fig. 3

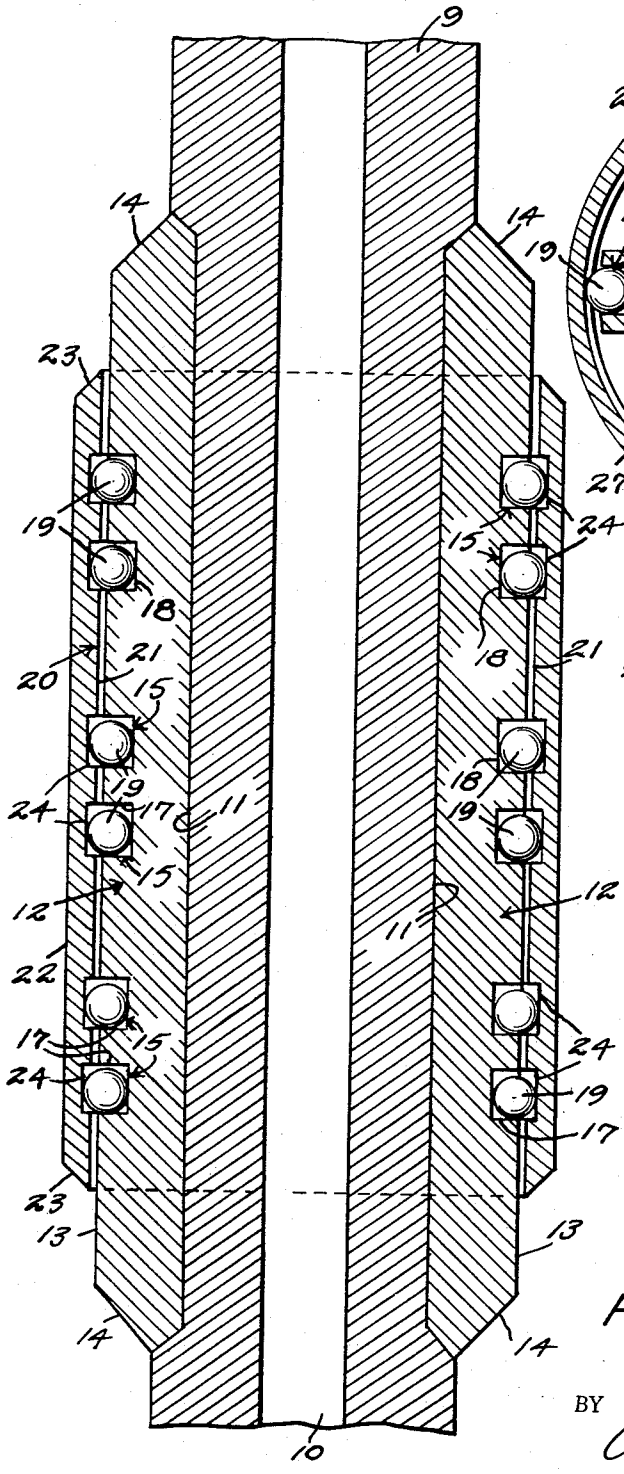


Fig. 4

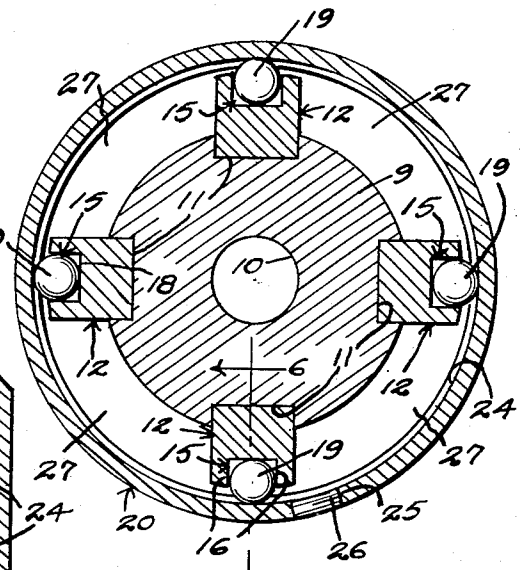
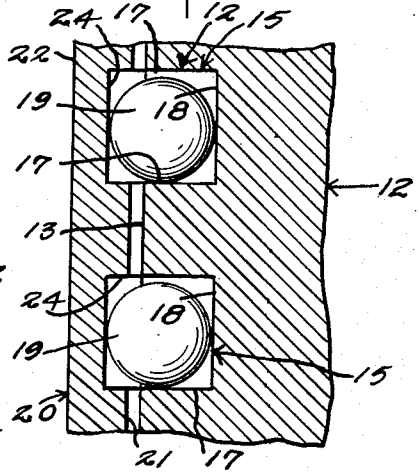


Fig. 6



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DRILL GUIDE

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ABSTRACT OF THE DISCLOSURE

A drill guide attached to and made a part of a drilling string for centralizing a drill bit and collar assembly in a bore hole, including a bore wall engaging sleeve in which a part of the drilling string is journaled and anti-friction bearing means rotatably connecting the sleeve to said part of the drilling string and combining therewith to form passages for the flow of drilling fluid between said part and the sleeve.

This invention relates to a drill guide which is attached to and made a part of a drilling string for centralizing a drill bit and drill collar assembly in a bore hole to maintain the drill bit directed toward a predetermined target during the drilling operation.

More particularly, it is an aim of the invention to provide a drill guide including a sleeve which is maintained substantially stationary by frictional engagement with the wall of a bore hole and in which a body member, forming a part of the drilling string, is disposed for rotation and is maintained in a position axially of said sleeve.

A further object of the invention is to provide a drill guide providing passages for the flow of drilling fluid therethrough.

Another object of the invention is to provide a drill guide which reduces the torque normally caused by a drill string rubbing on the wall of the bore hole.

Various other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, illustrating a presently preferred embodiment thereof, and wherein:

FIGURE 1 is a side elevational view of the drill guide;

FIGURE 2 is a cross sectional view thereof taken substantially along a plane as indicated by the line 2—2 of FIGURE 1;

FIGURE 3 is a longitudinal sectional view taken substantially along a plane as indicated by the line 3—3 of FIGURE 1;

FIGURE 4 is a cross sectional view taken substantially along a plane as indicated by the line 4—4 of FIGURE 1;

FIGURE 5 is an enlarged fragmentary longitudinal sectional view, taken substantially along a plane as indicated by the line 5—5 of FIGURE 1, and

FIGURE 6 is an enlarged fragmentary longitudinal sectional view taken substantially along a plane as indicated by the line 6—6 of FIGURE 4.

Referring more specifically to the drawings, the drill guide in its entirety is designated generally 8 and includes an elongate rigid body member 9 of circular cross section having a centrally disposed bore 10 extending longitudinally therethrough. The body 9 is provided with four longitudinally extending circumferentially spaced grooves 11 for accommodating inner portions of four corresponding ribs 12 which may be secured to the body 9 in any conventional manner, with inner portions thereof conformably fitting in the grooves 11, as seen in FIGURES 3 and 4. Ribs 12 have substantially flat outer faces 13 which are equally spaced from the longitudinal center of the body 9 and which preferably terminate in beveled ends 14.

Each rib 12 is provided with six corresponding sockets 15 which open through the outer face 13 thereof. Each socket 15 has parallel side walls 16, as seen in FIGURE 4, and parallel top and bottom walls 17, as seen in FIGURE 6, which are disposed at right angles to the side walls 16, as seen in dotted lines in FIGURE 1. Each socket 15 has a rear wall 18 which is disposed parallel to the outer face 13 of the rib. Each of the sockets 15 of each of the ribs 12 contains a steel ball bearing 19 which is of a diameter less than the spacing between the socket walls 16 or the socket walls 17. Each ball bearing 19 has a diameter greater than the depth of the socket 15 and a radius less than the depth of said socket, so that less than one-half of the ball bearing protrudes from the socket when the ball bearing is abutting the rear wall 18, as seen in FIGURE 6.

A rigid sleeve 20 of cylindrical cross section has an inner wall face 21 of a diameter somewhat greater than the spacing between the outer faces 13 of two oppositely disposed ribs 12, as clearly illustrated in FIGURES 2, 3 and 4. The sleeve 20 has a smooth outer face 22 which is provided with beveled ends 23, and said sleeve is of a length less than the length of the ribs 12. The sleeve 20 is provided with six annular internal grooves 24 which open through its inner face 20 and which are spaced apart distances corresponding to the spacing between the sockets 15 of each rib 12. The grooves 24 are of a width corresponding to the spacing between the top and bottom walls 17 of each socket 15. The inner diameter of the sleeve 20 and the depth of the grooves 24 are such that the ball bearings 19 protrude into said grooves to support the sleeve 20 concentrically around the body 9. It will be noted that each groove 24 is engaged by four ball bearings 19, one contained in the socket 15 of each rib 12, and said sockets and grooves form ball bearing races, and, in combination with said ball bearings, constitute anti-friction bearing means for mounting the sleeve concentrically on the body 9.

The sleeve 20 is provided with threaded openings 25 one of which opens into each of the grooves 24 and which openings are normally closed by threaded plugs 26. The openings 25 and plugs 26 are staggered relative to one another, as seen in FIGURE 1. The openings 25 are of a diameter corresponding to the width of the grooves, as seen in FIGURE 2, so that when the plugs 26 are removed, ball bearings 19 can be applied to the sockets 15 through said openings when the openings are in alignment with the sockets. It is for this reason that the openings are staggered, so that only a single opening will be in alignment with the socket in any position of rotation of the sleeve 22 on the body 9. The inner ends of the plugs 26 are shaped to conform to the shape of the beds of the grooves 24 and are disposed flush therewith, as seen in FIGURE 5, so that the ball bearings 19 can roll unobstructed across the inner ends of said plugs.

The body 9 is interposed in and forms a part or section of an otherwise conventional drill string, not shown. The smooth outer surface 22 of the sleeve 20 is adapted to engage the wall of a bore hole, not shown, to maintain the body member 9 and the drill string, of which it forms a part, centered in the bore hole. The smooth outer surface 22 of the sleeve enables the sleeve to slide readily longitudinally of the bore hole either as the drill string is being advanced downwardly therein or as being withdrawn therefrom. However, said outer surface 22 frictionally engages the wall of the bore hole to remain substantially stationary, with respect to rotational motion, as the body member 9 rotates about its longitudinal axis with the drill string, so that the sleeve 20 forms a guide in which the body member 9 revolves and by which it is maintained centered with respect to said sleeve by the anti-friction bearing means 15, 19, 24 and which anti-friction bearing means additionally functions to support the sleeve on the body member 9.

The ribs **12** combine with the sleeve **20** to form four passages **27**, as seen in FIGURES 2 and 4, through which drilling fluid may pass between the body member **9** and sleeve **20** and longitudinally thereof.

A drill string may be provided with any number of drill guides **8**, depending upon the length thereof.

It will be readily apparent that the body **9** could be provided with three instead of four ribs **12** and with any number greater than four, if so desired.

Various other modifications and changes are contemplated and may be resorted to without departing from the function or scope of the invention as hereinafter defined by the appended claims.

I claim as my invention:

1. A drill guide comprising an elongated rigid body member forming a drill string section, a cylindrical guide sleeve having an outer bore wall engaging surface, anti-friction bearing means rotatably mounting the sleeve on the body member and providing means journaling the body member to rotate in and be guided by the sleeve, said body member being provided with at least three longitudinally extending circumferentially spaced ribs protruding outwardly therefrom and around which the sleeve is disposed, each rib having longitudinally spaced outwardly opening sockets, said sleeve having inwardly opening annular grooves with which the sockets are aligned, and ball bearings confined in said sockets and grooves and rotatably connecting the sleeve to the body member, said sockets, grooves and ball bearings constituting said anti-friction bearing means.

2. A drill guide comprising an elongated rigid body member forming a drill string section, a cylindrical guide sleeve having an outer bore wall engaging surface, anti-friction bearing means rotatably mounting the sleeve on the body member and providing means journaling the body member to rotate in and be guided by the sleeve, said body member having longitudinally extending ribs protruding outwardly therefrom and provided with sockets forming bearing races of said anti-friction bearing means and around which the sleeve is disposed concentrically of the body member, said ribs combining with the body member and sleeve to provide circumferentially spaced longitudinal drilling fluid passages therebetween opening beyond the ends of the sleeve.

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