

Dec. 20, 1960

F. L. LE BUS, SR
MAGNETIC DRILL JOINT
Filed Oct. 6, 1958

2,965,406

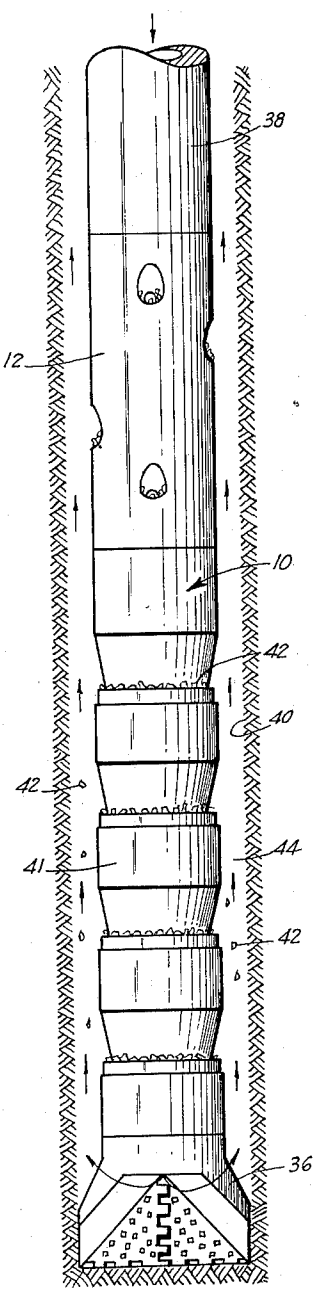


Fig. 1

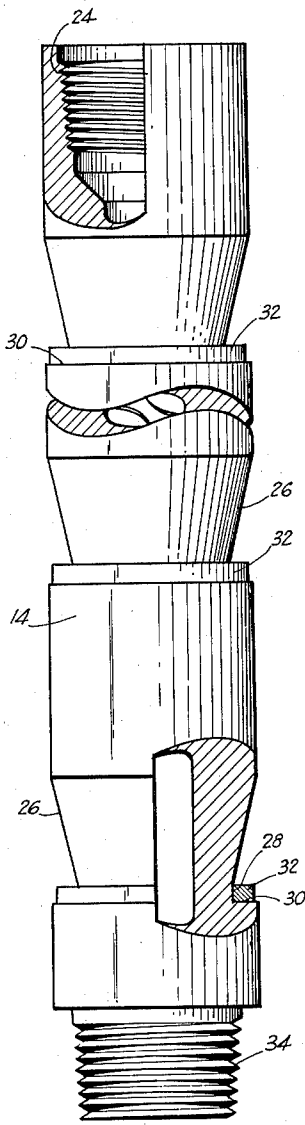


Fig. 3

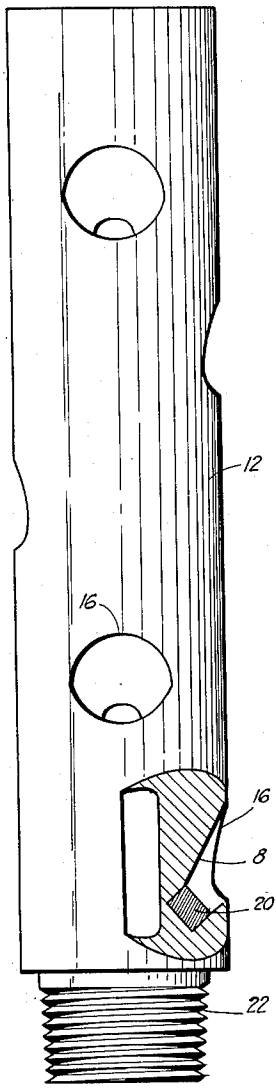


Fig. 2

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2,965,406

MAGNETIC DRILL JOINT

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Filed Oct. 6, 1958, Ser. No. 765,360

3 Claims. (Cl. 294—65.5)

This invention relates to improvements in well bore drilling apparatus, and more particularly, but not by way of limitation, to an improved apparatus for cleaning out the well bore during the drilling operation.

In the drilling of well bores, and the like, metallic particles frequently become loose within the bore and greatly hinder the drilling operation. For example, drill teeth, or other parts of the drill frequently break off during the drilling process and tend to float around the drill string with the drilling fluid. In addition, bits of metallic junk are frequently inadvertently dropped into the well bore during the drilling operation. These particles of steel and iron, and the like, are usually very hard, and may cause serious damage to the drilling equipment within the bore. It is, therefore, desirable to eliminate these particles from the well bore. The method normally utilized today for removal of the undesirable metallic particles from the well bore comprises withdrawing the drill string from the bore in order to permit the lowering of a suitable fishing tool therein for picking up the particles. This is a costly and time consuming operation, particularly in the drilling of relatively deep well bores.

The present invention contemplates a novel apparatus for the removal of metallic particles from the well bore during the drilling operation. The present invention provides a magnetic drill joint adapted to be interposed in the drill string above the drill bit in order to attract any floating metallic particles thereto as the drill string is rotated during the normal drilling operation. The drilling fluid normally circulated downwardly through the drill string and upwardly in the annular space therearound tends to float the metallic particles upwardly around the outer periphery of the drill string and the magnetic drill joint interposed therein. The drill joint provides a magnetic force field for attracting the metallic particles thereto and the magnetic force retains the particles thereagainst during the drilling operation, thus substantially eliminating any damage to the drilling equipment which might result from the loose bits of junk, and the like, in the well bore. It will be apparent that the magnetic drill joint eliminates the necessity of interrupting the drilling operation for the lowering of a fishing tool within the bore to retrieve the damaging metallic particles. The magnetic drill joint functions to clean the well bore during the normal drilling operation and does not in any manner interfere with the drilling operation. The novel drill joint is simple and efficient in operation, and economical and durable in construction.

It is an important object of this invention to provide an improved apparatus for drilling a well bore.

It is another object of this invention to provide a novel apparatus for removing metallic particles from a well bore during the normal drilling operation without interfering therewith.

Another object of this invention is to provide a magnetic drill joint adapted to be interposed in the drill string

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for attracting metallic particles thereto during the drilling operation.

Still another object of this invention is to provide a magnetic drill joint which is simple and efficient in operation and economical and durable in construction.

Other objects and advantages of the invention will be evident from the following detailed description, read in conjunction with the accompanying drawings, which illustrate my invention.

In the drawings:

Figure 1 is a side elevational view of a drill string having the novel magnetic drill joint interposed therein, and disposed within a well bore.

Figure 2 is a side elevational view, partly in section, of one portion of the novel drill joint.

Figure 3 is a side elevational view, partly in section, of a second portion of the novel drill joint.

Referring to the drawings in detail, reference character 10 refers in general to a magnetic drill joint having an upper sleeve 12 and a lower sleeve 14. The upper sleeve 12 is provided with a plurality of longitudinally and circumferentially spaced recesses or pockets 16. The pockets 16 preferably extend downwardly at an angle, as shown at 18 (Fig. 2), for receiving a suitable magnet member 20 at the bottom thereof. The magnet 20 may be secured within the pocket 16 in any well known manner (not shown). It will be apparent that a magnet 20 is provided in each of the pockets 16. The upper sleeve 12 is provided with a threaded stud member 22 at the lower end thereof as viewed in the drawings for cooperating with a mating threaded box member 24 provided in the upper end of the lower sleeve 14 in order to secure the sleeves 12 and 14 in longitudinal alignment, as is well known.

The lower sleeve 14 is provided with a plurality of longitudinally spaced annular grooves or recesses 26. The walls of the recesses 26 are preferably tapered downwardly and inwardly, but not limited thereto, and are provided with a substantially straight sided portion 28 at the lower end thereof. An annular shoulder 30 is provided on the outer periphery of the sleeve 14 adjacent the lower portion 28 of each of the grooves 26 for receiving an annular magnet member 32 thereon. The magnet 32 may be comprised of a plurality of arcuate segments (not shown) in order to facilitate disposition thereof on the shoulder 30 and around the sleeve 14, if desired. The magnet 32 may be secured on the shoulder 30 in any well known manner (not shown). It will be apparent that a magnet 32 is provided on each of the shoulders 30. It is preferable that the outer diameter of the magnets 32 is slightly smaller than the outer diameter of the sleeve 14 in order to protect the magnets 32 from damage or from being dislodged during the drilling operation.

The sleeve 14 is provided with a threaded stud member 34 at the lower end thereof, as viewed in the drawings, for receiving a suitable drill bit 36 thereon, as is well known. In addition, the upper sleeve 12 is provided with a threaded box member (not shown) adapted to receive the threaded stud member (not shown) of a drill string, generally indicated at 38 (Fig. 1). Thus, the drill joint 10 may be interposed in the drill string 38 above the drill bit 36.

Operation

The magnetic drill joint 10 is interposed in the drill string 38 above the drill bit 36, as hereinbefore set forth. The drill string 38 is then utilized in the usual manner for the drilling of a well bore 40. As the bit 36 penetrates the bore 40, metallic particles 42, such as broken teeth from the bit, or other steel or iron junk, or the like, may tend to collect in the annular space 44 between the

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drill string and the well bore. Drilling fluid (not shown) is normally circulated downwardly through the drill string 38 and drill joint 10 and through the drill bit 36 for discharge therefrom throughout the drilling operation. The drilling fluid usually circulates around the drill bit 36 and upwardly in the annular space 44, as shown by the arrows 46. The circulating fluid tends to float the particles upwardly therewith and around the magnetic drill joint 10.

The magnets 32 of the lower drill joint sleeve 14 provide a magnetic force field which attracts many of the metallic particles 42, and the particles adhere to the magnets 32, as clearly shown in Fig. 1. Some of the particles, however, may not pass through or be caught in the magnetic force field of the magnets 32, or for some other reason may by-pass the magnets 32. These particles will continue to travel upwardly in the annular space 44. It will be apparent that the velocity of the fluid, as well as the floating particles 42, will decrease during the upward travel in the annular space 44, thus permitting the magnets 20 provided in the pockets 16 of the upper sleeve 12 to magnetically attract substantially all of the metallic particles 42 which have by-passed the lower magnets 32. As hereinbefore set forth, the pockets 16 extend downwardly and angularly in the sleeve 12. Thus, the metallic particles tend to settle down on the magnets 20 in the bottom of the pockets, and the force of gravity assists the magnetic force in maintaining the particles 42 in the pockets 16. In this manner, substantially all of the metallic particles which may be present in the annular space 44 during the drilling operation will be attracted to the magnetic drill joint 10, and precluded from falling downwardly in the well bore. Thus, the drilling equipment will not be damaged by the hard steel, or other metallic particles in the well bore.

It will be apparent that either the upper sleeve 12 or the lower sleeve 14 may be utilized separately in the drill string 38, if desired, in order to provide a magnetic drill joint therefor. However, it has been found that the combination of the upper and lower sleeves provides a very efficient removal or cleaning of the well bore during the drilling operation.

From the foregoing, it will be apparent that the present invention provides a novel apparatus for drilling well bores wherein a magnetic drill joint is interposed in the drill string for attracting any metallic particles which may be loose in the well bore during the drilling operation. The magnetic drill joint cleans the well during the normal drilling operation and in no manner interferes therewith, thus greatly facilitating the drilling operation by eliminating the use of special fishing tools for removal of the metallic particles from the well bore. The drilling operation may proceed substantially uninterrupted and without danger of damage to the drilling equipment by the loose junk, and the like, in the well bore. The apparatus is simple and efficient in operation and economical and durable in construction.

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Changes may be made in the combination and arrangement of parts as heretofore set forth in the specification and shown in the drawings, it being understood that any modification in the precise embodiment of the invention may be made within the scope of the following claims without departing from the spirit of the invention.

I claim:

1. A magnetic drill joint for a drill string which comprises a sleeve member adapted to be interposed in the drill string during the drilling of a well bore, a plurality of longitudinally spaced annular recesses provided on the outer periphery of the sleeve member, and outwardly extending circumferential shoulder provided on the outer periphery of the sleeve member adjacent each of the recesses, an annular magnet member secured to each of the shoulders to provide a magnetic force field around the sleeve in the well bore to attract metallic particles thereto for cleaning of the well bore during the drilling operation.

2. A magnetic drill joint for a drill string which comprises a sleeve member adapted to be interposed in the drill string during the drilling of a well bore, a plurality of longitudinally and circumferentially spaced recesses provided on the outer periphery of the sleeve, said recesses extending inwardly and downwardly in the sleeve, a magnet member secured in the bottom of each recess to provide a magnetic force field around the sleeve to attract metallic particles thereto whereby the particles will collect on the magnet for cleaning of the well bore during the drilling operation.

3. A magnetic drill joint for a drill string which comprises upper and lower sleeve members secured in longitudinal alignment and adapted to be interposed in the drill string during the drilling of a well bore, a plurality of longitudinally and circumferentially spaced pockets provided on the outer periphery of the upper sleeve, said pockets extending inwardly and downwardly in the sleeve, a magnet member secured in the bottom of each pocket, a plurality of longitudinally spaced annular grooves provided on the outer periphery of the lower sleeve member, an outwardly extending circumferential shoulder provided on the outer periphery of the lower sleeve member adjacent each of the grooves, an annular magnet member secured to each of the shoulders to cooperate with the first mentioned magnet members to provide a magnetic force field around the upper and lower sleeves in the well bore to attract metallic particles thereto for cleaning the well bore during the drilling operation.

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