March 4, 1958 C. M. STANDRIDGE 2,825,412

WELL BORE APPARATUS

Filed May 21, 1954

Fig. 1

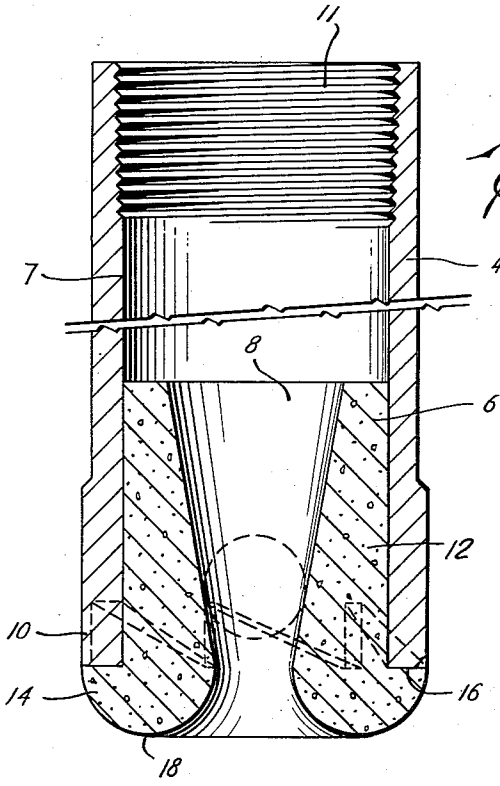


Fig. 4

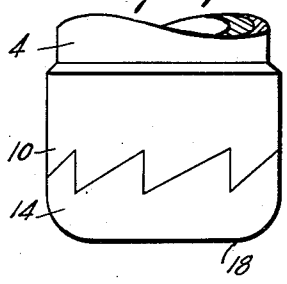


Fig. 2

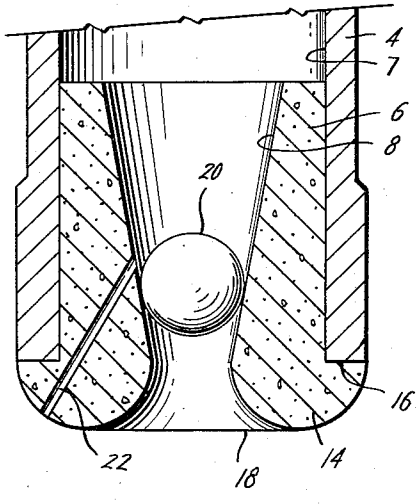
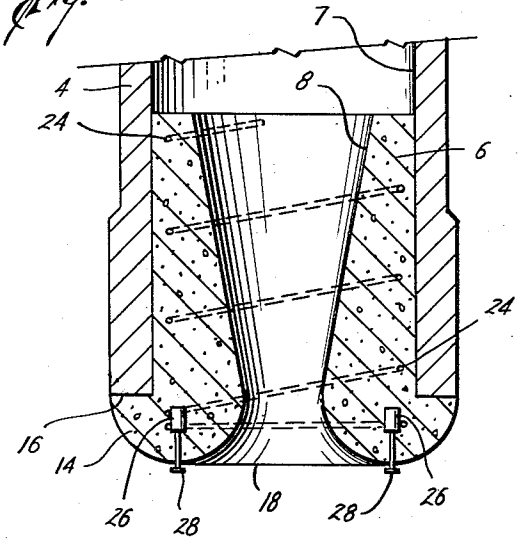


Fig. 3



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WELL BORE APPARATUS

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This invention relates to well bore apparatus and more particularly to guided well bore apparatus and a guide shoe therefor.

During well drilling operations, especially in drilling oil, gas and like wells, tools are lowered into the well bore to perform various operations. Many such well bores change direction below the surface of the earth, such as in directional drilling, or have dog legs and the like. In these wells, as well as in straight wells, the rotary shoe or other tool attached to the bottom of the string of pipe many times side tracks the well bore thereby resulting in the loss of many feet of well bore already drilled including tools, pipe and the like therein.

It is therefore an object of the present invention to provide guided well bore apparatus or guide shoes therefor so that the apparatus will follow the existing well bore when being lowered therein.

Another object of the present invention is the provision of guided well bore apparatus or tools including the combination of a body member having an open lower end and a readily removable guide plug therein so that the apparatus or tools may be lowered into the existing well bore without sidetracking and the guide plug may readily be removed so that the apparatus can function as intended.

A still further object of the present invention is the provision of guided well bore apparatus and a guide shoe for tools and the like by which apparatus or tools may be moved laterally in the well bore.

A further object of the present invention is the provision of a guide plug for oil well tools and the like which includes means for removing the plug on contacting a fish, such as lost pipe or tools, in the well bore so that the tools may be operated as intended.

Yet a further object of the present invention is the provision of a guide plug for oil well tools and the like which contains an explosive so that such tools may be guided in the well bore while being lowered therein and may be shattered by striking a fish in the well bore so that the fish may be washed over and the tool perform its intended functions.

Other and further objects and features of the invention will be apparent from the following description of examples of the invention, given for the purpose of disclosure and taken in connection with accompanying drawing, where like character references designate like parts throughout the several views. While it is to be understood that the guided well bore apparatus of the present invention may include or be used in combination with any well bore apparatus having an open lower end, the following examples are given in connection with rotary shoes such as are used on the lower end of overshots, outside cutters, and the like. Other uses, of course, will readily suggest themselves to those in the art.

In the drawing:

Figure 1 is a side elevation, in section, of a guide shoe constructed according to the invention.

Figure 2 is a fragmentary side elevation, in section, of a modification of the invention illustrated in Figure 1,

Figure 3 is a fragmentary side elevation, in section, of still another modification of the invention, and

Figure 4 is a reduced fragmentary elevation of a guide shoe constructed according to the invention.

Referring now to the drawing and particularly to Figure 1, the numeral 4 designates a rotary shoe which may be secured to the lower end of an oil well tool, such as an overshot, into which is secured the guide plug 6. The guide plug 6 has an axially-extending fluid passage 8 therethrough and the rotary shoe 4 is provided with the drilling or cutting teeth 10 at its lower extremity. The upper extremity of rotary shoe 4 is here shown containing internal threads 11 by which the shoe 4 may threadedly be secured to any other apparatus or tools to be lowered into the well bore, such as an overshot or string of drill pipe. Of course, any coupling means other than the internal threads 11 may be used for connecting the shoe 4 to the tool or it may be an integral part thereof and form the lower portion of the tool.

The guide plug 6 includes the body 12 and the bottom 14. As shown in the drawing the body 12 is cylindical in cross-section in order to complement the cylindrical bore 7 of the shoe 4 in which the body 12 snugly fits. A shoulder 16 is provided adjacent the bottom 14 which abuts against the teeth 10 of the rotary shoe 4 to limit inward movement of the guide plug 6 relative to the rotary shoe 4. The shoulder 16 preferably extends out at least as far as the external walls of the rotary shoe 4 below which shoulder the bottom 14 curves downwardly and inwardly to the lower rounded surface 18 and then upwardly to form the fluid passage 8 extending substantially axially throughout the entire plug member 6, as mentioned previously.

The fluid passage 8 through plug member 6 is flared and has its smaller end in the bottom 14 so that this passage is thus adapted to sealingly receive and seat the ball 20, best seen in Figure 2, the purpose of which will be made apparent later.

The plug member is usually precast and inserted into the body member where it is held by friction. It is preferred that the plug member be frangible to the extent that it will shatter upon an explosive charge being detonated or crumble when the guided apparatus of this invention strikes other well bore apparatus, tools, pipe and the like already in the well bore. Cement, Bakelite, plastics and other cementitious materials are satisfactory.

In operation, the rotary guide shoe is attached to pipe or other tools as desired and pipe or tools are then lowered into the well bore. During the lowering operation the rounded bottom 14 of the guide plug guides the pipe or tool downwardly in the well bore, through dog legs, bends, turns and the like and effectively prevents sidetracking of and loss of the well bore.

As the apparatus to which the guide shoe 4 is connected is lowered into the well bore the fluids that are usually present in such a bore flow upwardly through fluid passage 8 and the apparatus is readily lowered to the desired location.

As the plug member 6 is made of a frangible material it will often shatter and fall out of the body member 4 when it strikes the fish or other tool in the well bore sought by the operator of the guided apparatus. However, if this does not occur, or there is no such object for it to strike, the operator may drop the ball 20, best seen in Figure 2, down the string of pipe, not shown, supporting the guided apparatus so that the ball 20 seats in the lower end of the fluid passage 8, as illustrated. Well fluid in the string of pipe is then put under pressure by the pumps until sufficient force is applied against the upper portions of the guide plug 6 to force the guide plug out of

the lower end of the body member 4. With the plug member removed, the apparatus or tool is now ready for whatever use was intended, such as washing or telescoping over a string of pipe, fish and the like.

It should be noted that in many instances it is unnecessary to pump or drop the ball 20 to pump out the guide plug 6. In the event the passage 8 there through is smaller than the bore there above, sufficient pressure may be applied to the guide plug 6 to pump it out of the lower end of the rotary shoe 4.

Figure 2 shows a modification of the apparatus of Figure 1 in that a fluid port 22 has been added which passes from the wall of fluid passage 8 downwardly and outwardly through the bottom 14 of the guide plug 6. This fluid port is so designed that its opening in the wall of fluid passage 8 is above the ball 20 when the ball 20 is seated in passage 8. This fluid port 22 is also small enough so that fluid force exerted downwardly through the rotary shoe 4 against the upper portions of the guide plug 6 and the ball will be sufficient to force the guide plug 6 out of rotary shoe 4.

The modification of Figure 2 is advantageous in that when the tool reaches the level desired and the tool is not positioned directly over the lost tool or other device which is desired to be manipulated, the lower end of the tool may be moved laterally in the well bore. By seating the ball 20 in the fluid passage 8 as shown in Figure 2, fluid may be forced down into passage 8 under pressure insufficient to force plug member 6 out of body member 4, but which fluid will, however, be forced through fluid port 22. The fluid passing through fluid port 22 will react against the rotary shoe 4 and the guide plug 6 and move them laterally in the bore hole. By rotating the apparatus in the bore hole this lateral movement may be controlled. When the tool has thus been located as desired, increased pressure may be put on the fluid in the body member and the plug member forced out of it. Thus the port 22 advantageously assists in positioning the tool as desired in the well bore.

Figure 3 illustrates another modification of the invention which is especially useful when it is not possible or practical to drop the ball 20 into the fluid passage 8. The modification of Figure 3 is in all respects identical with that of Figure 1 except that contact explosive means has been inserted in the guide plug 6 so that the guide plug is shattered when striking tools or pipe lodged in the bore hole.

Primacord is satisfactory as an explosive means as it may be conveniently placed in the plug when the plug is formed and the explosive force of the primacord, while sufficient to destroy the plug, will not harm the rotary shoe 4 on the tool to which it is connected. As shown in Figure 3 the primacord 24 may be wound in the body 12 of guide plug 6, which primacord is exploded by the detonating means set in the bottom 14 when the guide plug is forced against tools or pipe, not shown, lodged in the bore hole. The detonating means here illustrated are the blasting caps 26 with the extensions 28 projecting below the bottom 14 of the guide plug 6. To insure detonation, a plurality of the shock sensitive blasting caps may be used.

With the modification shown in Figure 3 the guided tool is lowered into position and upon striking a lodged tool or other object in the well bore, the guide plug is destroyed by the explosive which is set off when the extensions 28 strike the lodged tool thereby jarring the blasting caps. The rotary shoe 4 is not damaged by the detonation and the tool may then be manipulated or telescoped over the upper end of the stuck pipe or tools, as may be the case.

While the guide plug 6 has been described as inserted in the lower end of the rotary shoe 4, it is apparent that the guide plug may be inserted into the open lower end of any tool or pipe to coact therewith to guide the tool or pipe to the desired location in its descent in the well bore. Also, the shoe 4 may either be a part of the tool itself that is to be lowered into the hole or may be a separate unit which, when combined with the guide plug is secured to some other well bore equipment. Also, while the guide plug 6 may be held in the lower end of the rotary shoe 4 by friction, as described; obviously, it may be latched or otherwise releasably secured therein, such as by shear pins and the like. Also, the explosive may be detonated electrically from the surface.

It is therefore apparent that the present invention is one which fulfills the objects previously set forth and attains other objects and has advantages and features which are inherent therein.

Numerous changes in details and rearrangement of parts may be made which are within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In apparatus for lowering into a well bore, a body having an open lower end, a guide plug removably disposed in said lower end of the body, said guide plug having a passage therethrough adapted to receive a ball to seal said passage against downward flow of fluid whereby the guide plug may be pumped out the lower end of the body, an external shoulder on said plug seated against and covering the lower end of the body, and a fluid port communicating between the said passage above said ball when seated and the exterior of the apparatus whereby passage of well fluid under pressure through said port moves said lower end laterally in the well bore.

2. The invention of claim 1, wherein the guide plug is formed of frangible material.

3. The combination comprising, a hollow body adapted to be lowered into a well bore, said body suspended by the lower end of a string of pipe, a guide plug frictionally held in the lower portion of the body, an axial passageway extending through the guide plug, adapted to receive a ball to seal said passageway against downward flow of fluid whereby the guide plug may be pumped out the lower end of the body, the string of pipe, body and passageway forming a fluid passage, a ball freely movable in the fluid passage above the passageway and adapted to seat therein, and a fluid port communicating between the said passage above said ball when seated and the exterior of the apparatus whereby passage of well fluid under pressure through said port moves said lower end laterally in the well bore.

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