Dec. 7, 1943. J. A. ZUBLIN 2,336,333

APPARATUS FOR DRILLING LATERAL BORES

Filed Jan. 27, 1942

Fig. 1.

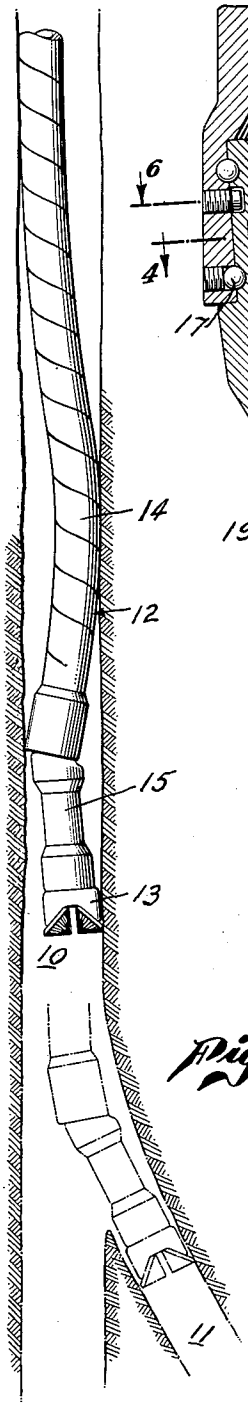


Fig. 2.

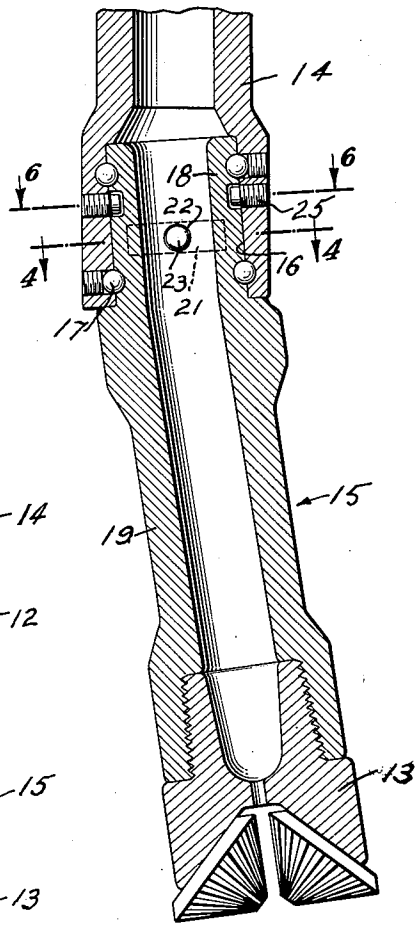


Fig. 3.

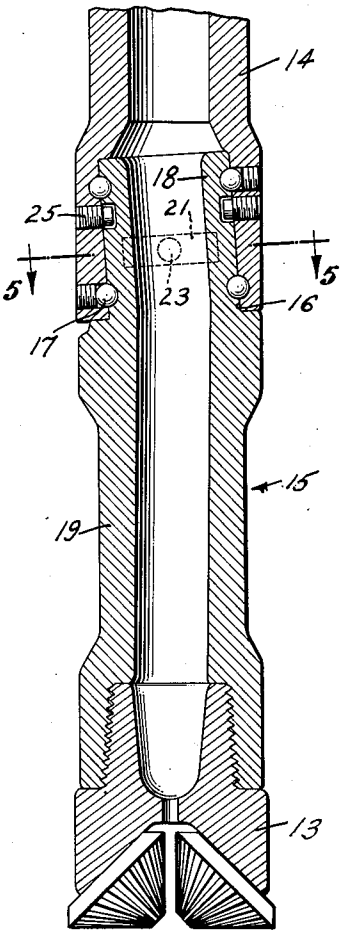


Fig. 4.

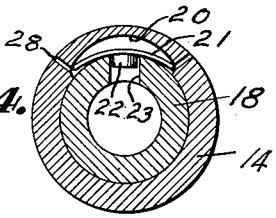
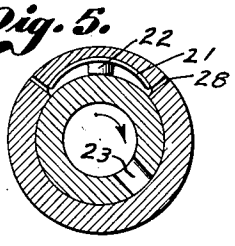


Fig. 5.



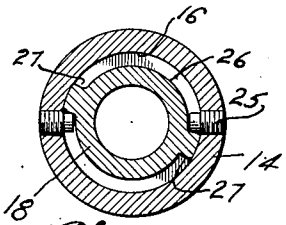


Fig. 6.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR DRILLING LATERAL BORES

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Application January 27, 1942, Serial No. 428,408

1 Claim. (Cl. 255—1.6)

This application is a continuation in part of my copending application, "Method and means to drill deviating holes," Serial No. 423,227, filed December 16, 1942.

In my prior application entitled "Method and means to drill deviating holes" Serial No. 423,227, filed December 16, 1941, there was described a method for drilling bores which extend laterally from a well. As the mouth of a lateral bore so produced is at an angle to the axis of the well bore, it is necessary to guide a bit into the lateral bore by some special means.

Such guiding may be done by means of conventional whipstocks set in the well bore, which act as deflectors and guide the bit and its elongated, resilient guide member into the lateral bore mouth. This, however, is a time-consuming and difficult operation, especially if a large number of lateral bores are to be operated upon, or the work is done in an open well bore.

In an application Serial No. 428,409 filed concurrently herewith, I have described a method of causing a bit and guide to enter the lateral bore. That method, essentially, comprises the use of a curved, resilient guide, the cutting of a straight lateral bore being accomplished with the curved guide by rotating the guide while the bit drills, the rotation of the guide preventing the curvature of the guide from causing the bit to cut a curved bore.

A normally curved resilient guide when used for cutting a straight lateral extension of a curved lateral bore must be rotated. There are instances where it is desirable to cut a straight extension of a curved lateral bore while the guide is held against rotation. Such curved guides cannot be used for this. Normally straight, resilient guides can be used for this purpose except that they cannot be readily caused to enter the lateral bore. Such straight guides also offer the advantage that they are not as greatly flexed during cutting due to their rotation in the lateral bore. It is proposed to provide a means whereby the straight guide can be caused to readily enter a lateral bore from the well.

It is, therefore, an object of the present invention to provide a resilient guide which is readily insertable in a lateral bore, but which after entry therein can be caused to drill in the same manner as would a straight resilient guide.

It is a further object of the present invention to provide a straight, resilient guide to drill a straight bore by rotation with the bit or by rotation of the bit alone.

It is a further object of the present invention to permit the drilling of straight extensions of curved lateral bores extending from a well with a minimum of bending of the resilient guide rotating the bit.

It is a further object of the present invention to provide a means for drilling straight extensions of lateral curved bores which will produce bores of the same size as the bit.

It is a further object of the present invention to provide a resilient guide which can be used to produce straight lateral bores without rotation of the guide and which can be readily inserted in the mouth of the lateral bores.

Unless a whipstock or other deflecting mechanism is utilized, every drilling assembly which is to enter a lateral bore extending from a well must contain within itself some means for pressing the bit against the well bore as the assembly is lowered. This means must also cause the bit to move outwardly when the bit reaches the lateral bore. In the case of a curved drill guide, the forcible straightening of the drill guide to permit the assembly to enter the well bore stores up elastic energy in the guide which will force the bit sideways into the lateral bore. To cause a normally straight guide to guide a bit into a lateral bore, it is necessary to provide some mechanism which causes the walls of the well bore to forcibly bend the drill guide, so that the elastic energy of the guide, which has a tendency to straighten, will force the bit against the wall of the well and drive it into the lateral bore.

Considering the straight resilient guide uninfluenced by the walls of the well bore, a short member at its lower end is utilized to carry the bit, and means is provided to hold this member at an angle to the axis of the guide. This angle and the length of this short member are such that the distance, perpendicular to the axis of the resilient guide, between the outermost portion of the bit and the opposite side of the resilient guide, is greater than the diameter of the well bore. Obviously, such an assembly will not enter the well bore unless the resilient guide is forcibly bent. Such bending stores up elastic energy in the guide, which is available to force the bit into the lateral bore when the bit reaches the mouth thereof. It is then necessary, after the bit has entered the lateral bore, to straighten out the member with relation to the resilient portion of the guide, so that the resilient portion of the guide and member form a truly straight, resilient guide for the bit. This can be done in a number of ways. One method is illustrated in the drawing shown herewith, but this is intended to be an

illustration only and is not to be considered as constituting the only method of accomplishing this result.

In general, the shown form of device for accomplishing this result consists essentially of an elongated, resilient member, of normally straight configuration, carrying on its lower end a rigid member mounted for rotation about an axis which is set at a slight angle to the axis of the elongated member. This rigid member has its lowermost portion set at a slight angle to this axis of rotation. Thus, the rigid member can be in substantial alignment with the elongated member, which is the relationship of the parts when drilling is to be started, or by rotation of the member with respect to the elongated guide the parts can be made to take an angular relationship to each other, which is the position in which the assembly is inserted into the well bore. The member and the guide can be held in the angular relationship by a suitable holding means while being inserted in the bore, and after the bit and the member have entered the lateral bore, the guide may be rotated to cause the axis of the member and the bit mounted thereon to become coincident with the axis of the resilient guide.

Referring now to the drawing:

Figure 1 is a diagrammatic view showing a device embodying the present invention in two positions of operation;

Figure 2 is a sectional view showing the lower portion of a device in Figure 1 with the parts in the relationship which they are to take when the bit is inserted in the well bore;

Figure 3 is a view similar to Figure 1 but showing the parts in the relationship which they have when drilling is to commence;

Figure 4 is a section along line 4—4;

Figure 5 is a similar section taken on line 5—5; and

Figure 6 is a similar section taken on line 6—6.

As shown in Figure 1, a well bore 10 has a lateral bore 11 extending therefrom. A resilient guide member 12 carries a bit 13 at its lower end, and the bit and guide are to be lowered into this well bore 10 and caused to enter the side bore 11. As shown in full lines in Figure 1, the resilient portion 14 of the guide has a member 15 mounted at its lower end, which, while the assembly is being lowered into the well, is cocked at such an angle to the resilient portion of the guide that the assembly cannot enter the well bore without bending the resilient portion of the guide, as explained above. This entire assembly when lowered in the well will enter the side bore 11, as shown by the dotted lines in Figure 1. After sufficient of the lower end of the guide has entered this side bore 11, the upper part of the guide is rotated by rotating the string of pipe extending to the surface of the ground. Referring now to Figures 2 and 3, the construction which permits this rotation is shown. The resilient portion 14 of the guide has a cylindrical bore 16 at its lower end. As shown, this cylindrical bore 16 is set at an angle to the axis of this resilient portion. The member 15 is rotatively mounted in this cylindrical bore, being retained therein and permitted to rotate readily by means of balls 17 running in races in the cylindrical bore and on the exterior of the member 15. The portion 18 of member 15 is set at an angle to the lower portion 19 of this member 15. As shown in Figure 2, this angularity, together with the angularity of the bore 16, causes the member 15 to have an angle with the resilient portion 14 of the entire assembly. As shown in Figure 3, rotation through substantially 180° straightens out the member 15 with respect to the resilient portion 14. Member 15 carries at its lower end the bit 13.

While the assembly is being inserted in the well bore, it is desirable to have a means for holding the member 15 against rotation with respect to the resilient portion 14 of the assembly. This holding means must be releasable while the entire device is in a lateral bore. For this reason, hydraulically operating means have been shown for releasably securing these two parts against rotation. A recess 20 is provided in the cylindrical bore 16, and carries a locking means to secure the portion 14 and the member 15 against rotation. This locking means consists of a spring 21 which has intermediate its ends a pin 22 which can enter an opening 23 extending entirely through the wall of member 15 to the interior water course 24 thereof. This pin and spring normally take the position shown in Figure 4 and prevent relative rotation between the two members. Application of pump pressure, caused by starting the pumps, forces the pin 22 out of the opening 23, and rotation of the drill pipe extending to the surface will cause the rotation of the resilient portion 14 of the guide with respect to the member 15. Thus, the member 15 can be held at an angle to the resilient portion 14 until it is desired to have them in substantial alignment.

In order to permit rotation of the member 15 by the resilient portion 14 of the guide, abutment means is provided between them. This is most simply done by the provision of a pair of removable pins 25, which are threaded into the lower portion of the resilient guide. A groove 26 is cut partially around the cylindrical portion of the member 15 opposite these pins 25. It can thus be seen that the member 15 can be rotated substantially 180° after which the pins 25 engage the ends 27 of each of the grooves 26. The pins thus serve to transmit the drilling torque to the member 15 which in turn rotates the bit.

If desired, holding means similar to the spring 21 and pin 22 may be provided to hold the device in the position shown in Figure 3. However, this is not necessary, as there is little tendency for the member 15 to rotate ahead of the drill pipe. Another optional expedient is the small openings 28 extending from the recess 20 to the exterior of the device, to relieve the pressure within the recess when the pumps are started.

The operation of the shown device should now be clear. The lower member 15 with its attached bit are simply rotated to the position shown in Figure 2, and the entire device run into the well. The tool is properly oriented by any conventional means so that the bit will enter the lateral bore 11 as shown in Figure 1. After a sufficient length of the device has entered the lateral bore, the pumps are started and the drill pipe rotated which causes the parts to assume the relationship shown in Figure 3. Rotation may be continued and the pins 25 will drive the member 15 which carries a bit 13 causing the bit to cut.

It is to be understood that the bit may be driven by other means than by this elongated, resilient guide. A flexible shaft within the guide and extending to the surface may be used. A turbine between the resilient guide and the bit may also be used. In either of these cases it

is not necessary to rotate the guide but the guide will still cut a straight bore. On the other hand, the guide is as readily inserted in the lateral bore as is a curved, resilient guide which must of course be rotated to cause it to produce a straight bore.

I claim:

An assembly for inserting a drilling bit into an existing bore extending laterally from a well bore comprising a sectional drill guide having an elongated flexible resilient upper section and an elongated rigid lower section adapted to support a drilling bit on the lower end thereof, means interconnecting said sections comprising a bore in the end of one of said sections with the axis of the bore disposed at an angle to the axis of such section and a stub shaft on the end of the other of said sections with the axis of the stub shaft disposed at an angle to the axis of such other section, means for securing said stub shaft in said bore in such manner that said upper and lower sections are capable of limited relative rotation, the magnitude of said angles and the length of said lower section being such that in one relative position the axis of said lower section extends at a sufficient angle to the axis of said upper section that said upper section will be forcibly flexed on introduction of said assembly into the well bore and upon rotation to a second relative position the axes of said sections are in substantial alignment, and releasable means for holding said sections in said first mentioned relative position.

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