June 19, 1951 K. H. SWART 2,557,619

REMOVABLE PIN INSTALLATION FOR WELL DRILLING CUTTER ASSEMBLIES

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Fig. 1

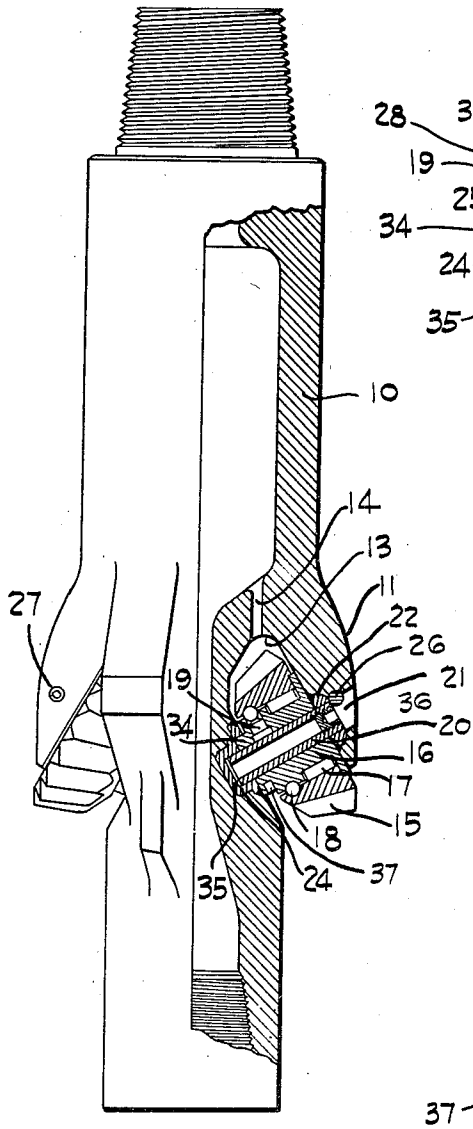
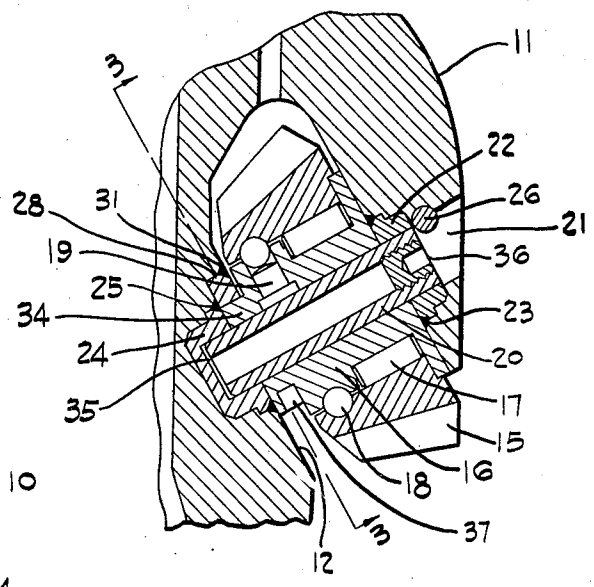


Fig. 2



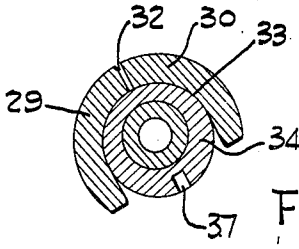


Fig. 3

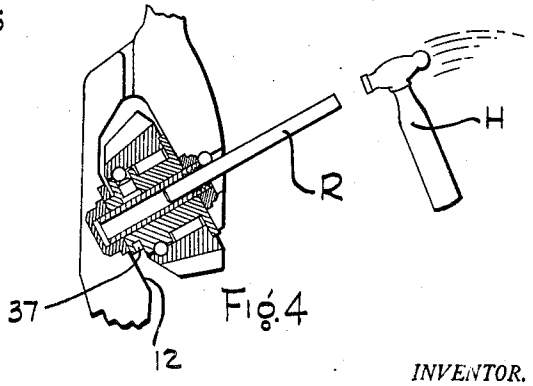


Fig. 4

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REMOVABLE PIN INSTALLATION FOR WELL DRILLING CUTTER ASSEMBLIES

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4 Claims. (Cl. 255—71)

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This invention relates to improvements in well drilling tools. An object of the invention is to provide an improved well drilling tool wherein there is a body that provides a cutter recess adapted to receive a rotary cutter assembly and to provide a novel, simple and advantageous construction for removably mounting the cutter assembly in the recess.

More specifically, an object of the invention is to provide a well drilling tool in which there is a recess adapted to receive a cutter assembly and wherein the cutter assembly has an inner sleeve about which the cutter is rotatable. The sleeve has a main pin receivable therethrough for retaining it and its associated cutter in the recess and has a novel, rugged and simple means for locking the sleeve against rotation about the pin.

Another object of the invention is to provide a well drilling tool in which there is a pin that is apt to be removed from time to time for purposes of replacement of associated structure and to provide a novel means and method of removing this pin even though it may become firmly cemented or rusted in place.

A further object of the invention is to provide a locking device for cutter assemblies of well drilling tools which is so designed that neither vibration nor drilling stresses will be capable of causing undue wear to take place between respective parts thus eliminating wear on the body on which the cutter assemblies are mounted and avoiding necessity of body repair. The improved construction is designed to enable cutter assemblies to be removed and replaced at well drilling rigs thus avoiding any necessity of taking the tool to a manufacturing plant or machine shop.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Figure 1 is a view in side elevation, parts being broken away and shown in vertical section, of a well drilling tool such as a hole opener embodying the present invention;

Fig. 2 is a partial view in vertical section illustrating a portion of Fig. 1 on an enlarged scale;

Fig. 3 is a sectional view taken substantially upon the line 3—3 upon Fig. 1 in the direction indicated; and

Fig. 4 is a view illustrating the manner in which the pin may be removed.

Referring to the accompanying drawings

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wherein similar reference characters designate similar parts throughout, the present invention has been illustrated as applied to that type of well drilling tool generally known as a hole opener designed to widen or ream a well hole to a size of larger diameter when it has been initially drilled by a bit of smaller size. It will be appreciated, however, that features of the present invention are not necessarily restricted to this type of tool but may be employed on other types of well drilling tools wherein similar constructions occur. As illustrated, the hole opener consists of a body generally indicated at 10, threaded at its ends for incorporation in a well drilling string. This body has outer arms 11 that are spaced from inner wall surfaces 12 to define cutter receiving recesses 13 that may be supplied with circulation fluid through circulation ports 14. Within the cutter recess 13 there is a rotary toothed cutter 15 that is rotatable about a sleeve 16. This sleeve provides inner races for roller bearings 17 and ball bearings 18. The sleeve and cutter are so designed that the rollers of the roller bearings may be positioned therein and the cutter 15 slipped over the sleeve 16 and the applied rollers. Thereafter, the balls 18 are fed outwardly from the interior of the sleeve 16 through a radial passage that is subsequently closed by a plug 19. This plug is retained in position so as to confine the balls 18 by a main pin 20 that is axially receivable through an inclined bore 21 that is drilled through the arm 11 and into the surface 12. Outer bushings 22 are recessed in the inner face of the arms 11 and are welded in place such as by the welds 23. In a similar manner, inner bushings 24 which enclose the inner ends of the pins 20 are recessed in the surface 12 and are welded in place such as by welds 25. The pin 20 is releasably locked in its applied position by means of a cross pin or locking pin 26 that extends through a transverse hole in the arm 11 and is retained therein such as by a pipe plug 27.

A feature of the construction resides in the manner in which the sleeve 16 is locked against rotation about the pin 20. To this end the face 12 is machined to provide a generally semi-circular shoulder 28 and quadrant-shaped segments 29 and 30 are welded such as by welds 31 against this shoulder. These segments are preferably formed of hardened steel and are welded not only to the shoulder but at their abutting ends indicated at 32. They co-operate to present an internal semi-circular surface 33 open at its

lower end toward the entrance to the recess and this semi-circular surface is somewhat eccentrically disposed with relation to the axis of the pin 20. The inner end of the sleeve 16 has a flange or hub portion 34 that is turned thereon eccentrically with relation to its central axis, as shown in Fig. 3. This eccentric inner hub portion is readily receivable through the laterally open side of the eccentric seat 33 provided by the segments 29 and 30 so that in assembling the cutter assembly made up of the cutter 15, its associated bearings 17 and 18, and the sleeve 16, it is merely necessary to slide this assembly inwardly through the lower end of the cutter recess 13 between the surface 12 and the arm 11 and cause the eccentric hub portion 34 to enter the eccentric seat or shoulder 33. Thereafter the pin 20 may be inserted through the bore 21 to lock the assembly in position.

As the sleeve 16 can only rotate about the axis of the pin 20 and has a non-concentric hub portion 34 bearing against the eccentric shoulder or seat 33, it is manifest that rotation of the sleeve is effectively prevented. In fact, any tendency of the sleeve 16 to rotate sympathetically with the cutter 15 merely serves to tighten its eccentric hub 34 against the eccentric seat 33.

In constructions of this character, sediment in the drilling fluid or rust and corrosion may tend to cement the pin 20 in place so that it becomes difficult to remove, and to obviate this difficulty the pin 20 is made hollow from end to end with a slight clearance 35 between the inner end of the pin and the bottom of the inner bushing 24. The outer end of the pin is internally threaded to receive a pipe plug or similar closure indicated at 36 and the interior of the pin is filled with a hydraulic fluid such as grease sticks. Whenever it is desired to remove the pin 20 to replace the cutter assembly after it has become worn, the plug 36 is removed and a rod R, having a diameter approximately equal to the inner diameter of the bore through the pin 20, is inserted and is given a blow with a hammer H. The grease within the pin 20 is forced inwardly and exerts against the inner end of the pin a highly hydraulic pressure commensurate with the magnitude of the blow given to the piston formed by the rod R. Such a high pressure is adequate to remove the pin even though it may have been very firmly lodged in place. Before applying the rod R and giving it a blow with the hammer H, it frequently is desirable to loosen the sleeve 16 with relation to its eccentric seat 33 and to this end the lower side of the eccentric hub portion 34 is provided with a recess 37 into which a rod may be inserted to attempt to reversely rotate the sleeve and thus free it from the eccentric seat. When this is loosened the rod R may be inserted and given a blow to drive out the pin 20 after its locking pin 26 has been removed and thus free the cutter assembly for removal through the bottom of the cutter recess 13. A new cutter assembly may then be inserted, the pin 20 re-installed and re-filled with grease, its plug 36 applied and the locking pin 26 installed.

From the above described construction it will be appreciated that the cutter assembly may be very easily inserted through the lower end of the cutter recess 13 and when installed it will be very rigidly mounted and its sleeve 16 held against rotation about the pin 20. Whenever it is desired to remove the cutter assembly the pin 20 can be forcibly expelled even though it

may have become firmly frozen in place. While the invention has been illustrated as applied to a hole opener, it is not restricted thereto but may be employed on other types of well drilling tools employing removable pins and cutter assemblies that it is desired to replace from time to time.

The purpose of making the seat 33 for the eccentric portion of the sleeve in two segments 29 and 30 is primarily to avoid warping occasioned by the welding. Except for this factor these two segments could otherwise be made integral with each other.

It is possible to provide a reasonably satisfactory construction without using the hardened segments 29 and 30 and instead to form the eccentric seat or shoulder provided thereby by machining it directly in the face of the body. However, although it is thus possible to omit the use of the hardened segments their use is generally preferred.

It is likewise possible to avoid the use of the inner bushing 24 and to merely drill a recess in the body to accommodate the inner end of the hollow pin 20. However, as will be observed from the drawing, in a tool of this character the section through the body from the inner end of the main pin to the circulation passage is relatively thin and when the body is cast this thin section is apt to be porous. Consequently there may be a danger of the high hydraulic pressure created by striking the rod R with the hammer H blowing through this thin porous section. The use of the bushing 24 is consequently preferred in that the force exerted by this high hydraulic pressure is in effect distributed over this thin body section.

Various changes may be made in the details of construction without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. In a well drilling tool, means providing spaced elements between which a cutter assembly is receivable, a main pin receivable through the assembly and bridging the space between the elements, means for locking the main pin in position, said main pin being hollow and being filled with a fluid medium, openable means normally closing the outer end of the main pin, and means providing a chamber about the inner end of the main pin which is closed except for its communication with the interior of the main pin whereby on opening the closing means a piston forming element may be inserted to force the fluid medium through the main pin to exert a pressure on its inner end, and thus expel the main pin when the main pin is released for removal.

2. In a well drilling tool, means providing spaced elements between which a cutter assembly is receivable, a cutter assembly having a sleeve about which a cutter is rotatable, a main pin receivable through the sleeve bridging the space between the elements, said sleeve having a portion which is non-concentric with relation to the axis of the pin fitting a complementary recess in one of said elements whereby the sleeve is held against rotation about the pin, said main pin being hollow from end to end thereof, means normally closing the outer end of the pin, and means forming a chamber about the inner end of the pin which is closed except for ingress thereto through the pin whereby on opening the outer end of the pin hydraulic fluid can be forced

into the chamber through the pin under high pressure to expel the pin.

3. In a well drilling tool, means providing spaced elements between which a cutter assembly is receivable, a cutter assembly having a sleeve about which a cutter is rotatable, a main pin receivable through the sleeve bridging the space between the elements, said sleeve having a portion which is non-concentric with relation to the axis of the pin receivable through a laterally open complementary recess in one of said elements whereby the sleeve is held against rotation about the pin, said main pin being hollow from end to end thereof, means normally closing the outer end of the pin, and means forming a chamber about the inner end of the pin which is closed except for ingress thereto through the pin whereby on opening the outer end of the pin hydraulic fluid can be forced into the chamber through the pin under high pressure to expel the pin.

4. In a well drilling tool, a body, a tubular pin therein, means for releasably holding the pin against withdrawal from the body, a removable closure for the entrance to the passage through

the pin, and means fitting about the inner end of the pin forming a chamber about its inner end which is closed except for its communication with the interior of the pin and a liquid in said chamber and the passage through the pin whereby on releasing the pin for withdrawal and removal of the closure the liquid in the pin may be forced toward the chamber under high pressure to expel the pin when the pin is desired to be removed.

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