

[54] DRILL ROD COUPLING 3,567,254 3/1971 Parssinen..... 287/117

[75] Inventors: Ernst Lennar Johansson; Karl Lennart Gosta Lumen, both of Sandviken, Sweden

[73] Assignee: Sandvik Aktiebolag, Sandviken, Sweden

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[56] References Cited

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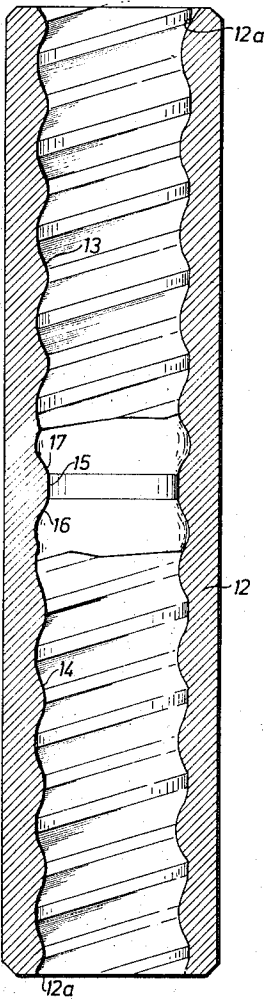
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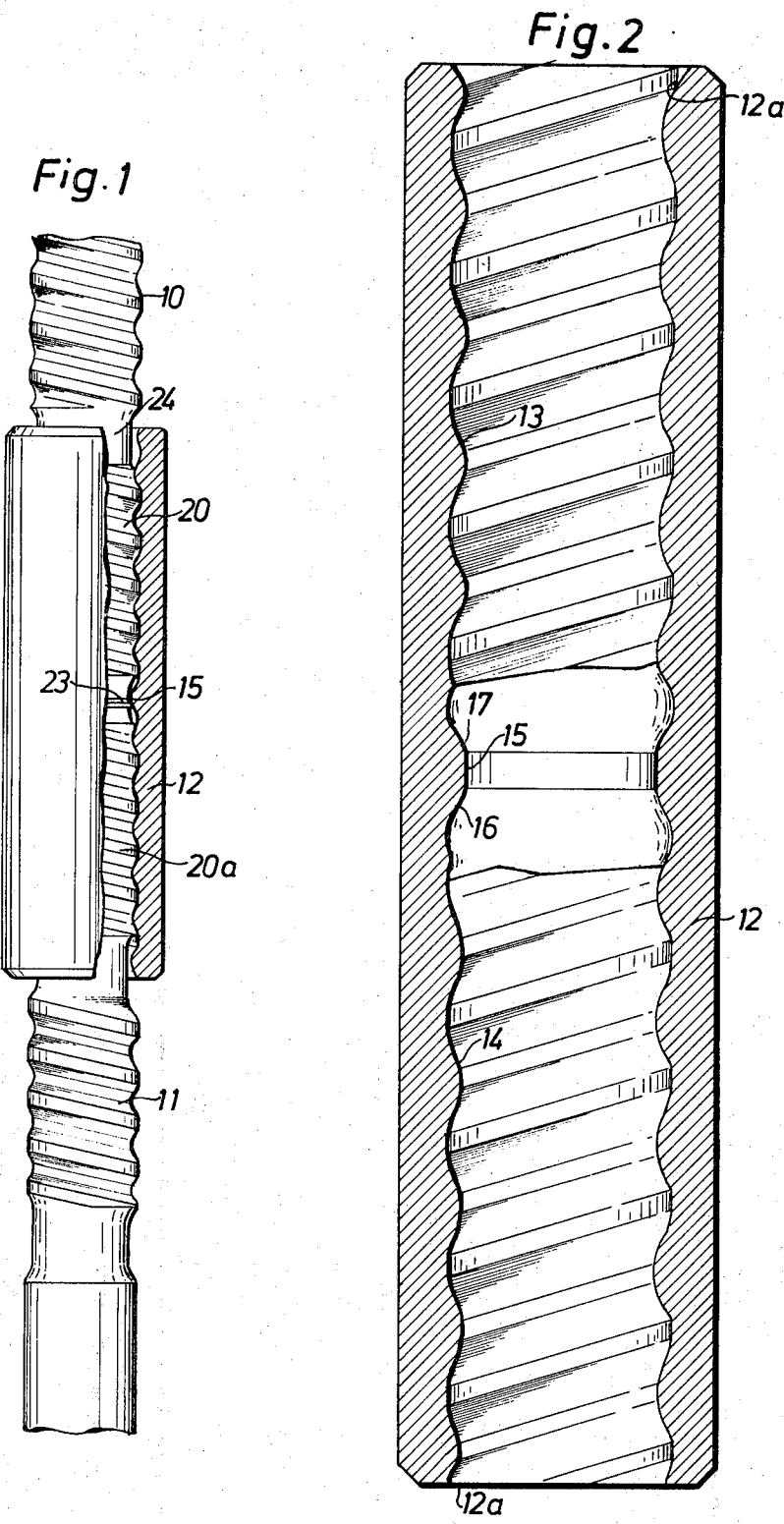
Primary Examiner—Andrew V. Kundrat  
Attorney, Agent, or Firm—Pierce, Scheffler & Parker

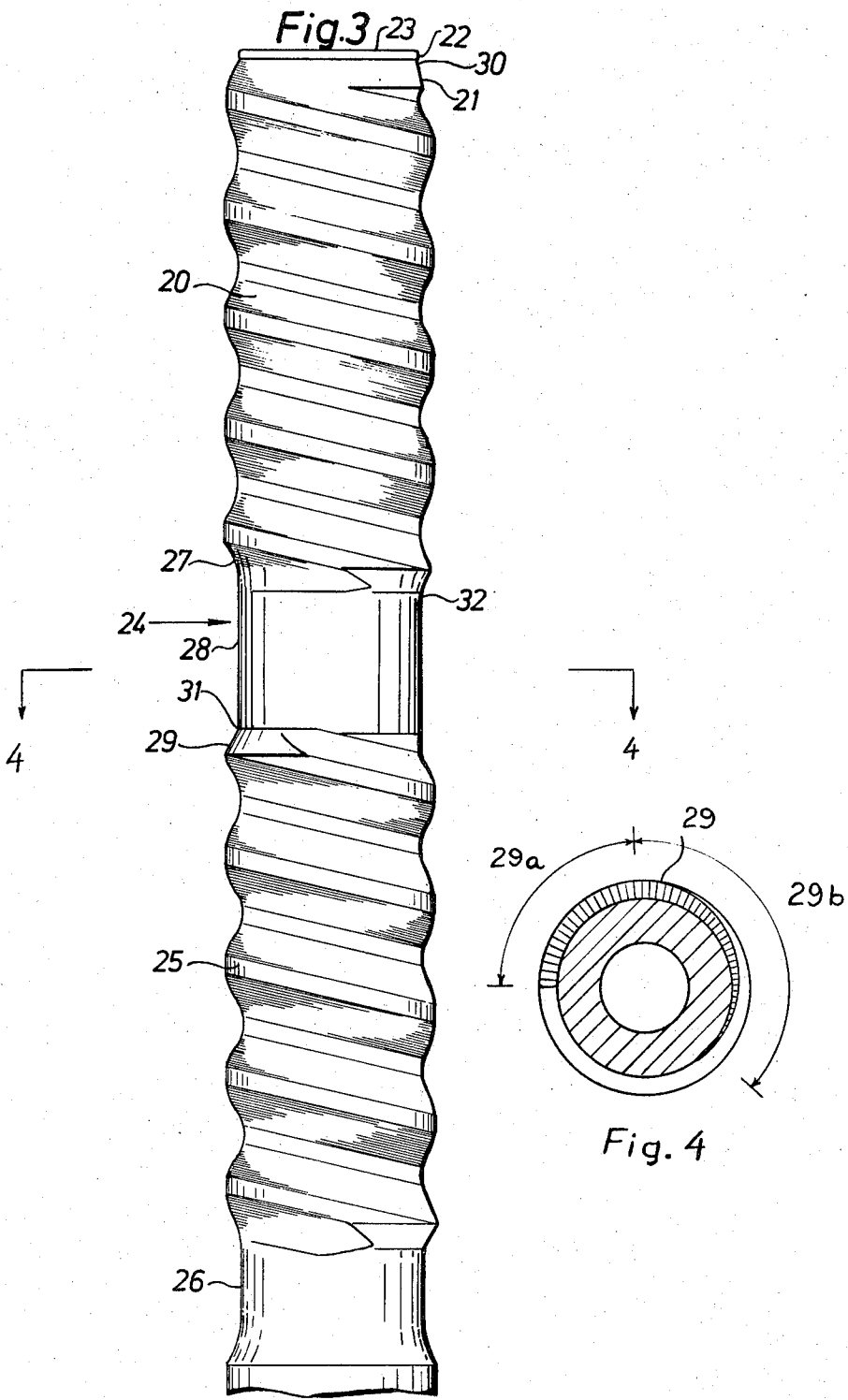
[57] ABSTRACT

A drill rod coupling assembly in which each of two rods has at least two spaced sets of threads, the outer of which are coupled by a sleeve so that percussive force is transmitted through the abutting ends of the rods. The threads at the end of each rod are designed for surface to surface contact with matching surfaces on a stop in the sleeve. Whenever the outer set of threads is worn or broken they may be cut off and a new end similar to the original end is provided and may be coupled by the sleeve.

2 Claims, 4 Drawing Figures







## DRILL ROD COUPLING

This application is a continuation-in-part of our application Ser. No. 104,560, filed Jan. 7, 1971 and now abandoned.

The present invention relates to drill rod couplings by which two sections of the drill rod are coupled together coaxially and are designed so that all percussive forces are transmitted through the rods alone and not through the coupling element. The present drill rod coupling arrangement is also designed to permit removal of worn or broken threads and recoupling of the rods by the provision of additional sets of threads arranged axially and sequentially along each rod and separated by portions of reduced cross-sectional area. Furthermore the coupling sleeve is provided with an inner stop for the rods when they are inserted therein and the ends of the sleeve are relieved so that they do not abut or engage the rod, thus relieving fatigue stresses.

It is previously known from U.S. Pat. No. 3,211,484 to Karlsson et al., to provide a drill rod with two consecutive sets of threads at each end, and when the outer set of threads is worn out the section may be cut off so as to permit use of the inner set of threads. In this patent there is provided a stop on the rod for preventing the coupling sleeve from being screwed too far onto it, said stop abutting against the end of the coupling sleeve. This has the disadvantage that the base of the thread is in touch with the sleeve which increases the liability for fatigue failures.

It is also known to provide a continuous thread along the entire length of a drill rod. In this case there is a stop in the middle of the sleeve for preventing the rod from being screwed beyond the stop. This has the disadvantage that when the outer end is worn out and cut off, the new end must be shaped to match the stop within the sleeve.

According to the present invention there are provided two or more consecutive sets of threads on the rods to be coupled, the ends of each rod being adapted to be stopped by a stop in the sleeve, and the sets of threads being separated by a section of reduced cross-sectional area which after cutting off the outer thread has a shape similar to the original end of the rod for cooperating with the stop in the sleeve. There is thus no need to shape the new end after cutting off the outer thread.

The present invention will now be described in detail with reference to the accompanying drawings in which similar reference numerals refer to similar parts:

FIG. 1 shows two drill rods coupled according to the invention with a portion of the coupling element cut away,

FIG. 2 shows a cross-sectional view of the coupling element,

FIG. 3 shows an elevational view of one drill rod according to the invention,

FIG. 4 shows a section on the line 4—4 in FIG. 3.

According to FIG. 1 the drill rods 10 and 11 are shown coupled together coaxially by the coupling element 12. The coupling element 12 or sleeve is provided with threads 13 and 14 as seen in FIG. 2. Threads 13 engage the threads 20 of rod 10. Similar threads 20a on rod 11 engage threads 14 of the sleeve. The ends of the rods 10 and 11 abut at 23 and a stop 15 is provided in the center portion of the sleeve 12.

In FIG. 2 details of the sleeve are shown including the relieved end portion 12a. The opposed conical sides 16 and 17 of the stop 15 are shown and in the illustrated embodiment they have an angle of about 30° to the axis of the sleeve.

FIG. 3 shows one rod having an end abutment surface 23 and a conical transition section 21 and a cylindrical section 22 to be described more fully hereinafter. Between the threads 20 and the second set of threads 25 there is a section 24 having a reduced cross-sectional area including conical or sloping transitions 27 and 29. At the outer or remote end of the second set of threads 25 there is provided another section 26 having a reduced cross-sectional area of a shape similar to that of section 24. It is to be noted particularly that the shape of the section 24 is such that when threads 20 are worn or broken and are removed by cutting across the section 24, the portion remaining on the rod adjacent threads 25 will have a shape corresponding to the shape 21 and 22 as seen at the end of the rod, thus providing the same shaped end for the shortened rod. The diameter of section 24 should be at the most equal to the bottom diameter of the rod thread and preferably somewhat smaller. The section 24 can for instance have a diameter that is 2 percent less than the bottom diameter of the rod thread. Correspondingly the stop in the sleeve should have an internal diameter that is equal to or somewhat smaller than the internal diameter of the sleeve thread.

The stop 15 on the sleeve forms an annular ridge on the inside of the sleeve, the tapering surfaces 16 and 17 on said ridge constituting stop surfaces cooperating with matching stop surfaces 21 or, when the thread 20 is cut off, stop surfaces 29 on the coupled rods.

The stop surfaces 16 and 17 on the sleeve are substantially conical with a straight or slightly convex generatrix. The stop surfaces 21 and 29 on the rod should match the surfaces 16 and 17 so that a surface contact is established. This is important because the pressure on these surfaces becomes rather high when the reciprocating motion of the rod is transferred to the sleeve.

It can be noted that while the surfaces 16 and 17 form uninterrupted annular rotation surfaces around the whole circumference that surface 21 (and 29) extends in the illustrated case only along about half the circumference, because the surface 21 is a rotation surface and the thread is helical so they interfere with each other. The length of the circumferential extension of the surface 21 (and 29) depends on the pitch of the thread and on the width of the rib of the thread. Because the circumference of the surface 21 (and 29) is thus reduced it is especially important to have a good matching between the stop surfaces. The rotation surfaces 16, 17, 21 and 29 are coaxial with the drill axis.

FIG. 4 shows a section of the drill rod at the portion 24. The contact surface 29 is shaded, and as shown, a part of it marked 29a has a full height from the surface 28 to the top of the thread while the rest of it marked 29b has a tapering height.

The stop surfaces 16, 17, 21 and 29 should be inclined 20° - 45°, preferably 25° - 35°. An optimal value is 30° which secures a good abutment contact without wedging and provides a smooth curvature in order to lessen fatigue ruptures. If the taper is curved these angles refer to the average taper.

The fillet radius 30 between portions 21 and 22 may be rather small, for instance 2.5 mm, because the end of the rod is not subjected to fatigue failures. The fillet 31 between portions 28 and 29 must be larger, for instance 10 mm, in order to reduce fatigue cracking, and the fillet 32 at the rear end of the thread is suitably of the same size order. The taper 27 of the rear end of the rod thread is shaped with regard to the fatigue strength and should be 20°–45°. In practice 25° has been found suitable.

With particular reference to section 24 of reduced cross-sectional area, it has been found that such sections have a higher fatigue strength than the threaded portion itself.

According to FIG. 3 the transition sections 21 and 22 are shown as conical and cylindrical respectively, but, if desired the transition section may be formed as a continuous curved taper. In the embodiment illustrated in FIG. 3 the center portion of the section 24 is provided with a short straight section 28 which after cutting off the worn section of threads provides the cylindrical portion 22 as seen at the end of the rod.

When assembling the drill rod coupling, one section of rod is screwed into the sleeve until it abuts the stop 15 and then the second section of rod is screwed in the other end of the sleeve. The axial dimensions of the transition sections 21 and 22 are such that the ends 23 of the abutting rods will meet just before the second rod meets the stop 15, whereby percussive forces are transmitted directly through the abutting surface 23 and not through the sleeve. If desired the first rod section may be screwed in as far as it will go and then backed off a small fraction of a turn so that the section 21 will be spaced very slightly from the side 16 of the stop 15 and when the second rod is inserted the end face thereof will abut the end surface of the first rod just before its transition section corresponding to section 21 strikes the opposed side 17 of stop 15. In this case, also all of the percussive force will be transmitted through the end faces of the rods since neither of the rods directly abut the stop 15. In either case, it will be seen that there is a small spacing between one or both sides 16 and 17 of stop 15 and the conical surfaces, such as 21, of the rod ends, when the ends 23 abut each other.

The length of the sleeve and the length of the sets of threads are designed so that when assembled the outer ends of the sleeve 12 which is relieved, as at 12a, is opposite the section 24 of reduced cross-sectional area, whereby there is no engagement between the ends of the sleeve and the rods. This feature reduces the danger of breakage at the ends of the sets of threads. As is known, during use, the rods are subject to a certain

amount of bending and the relieved portion 12a enables the bending to take place without exerting excessive strain on the rods or the ends of the sleeve.

Although the invention has been described with particular reference to the drawings, it will be understood that various modification may be employed. For instance, there may be provided three or more sets of threads instead of the two shown for each rod, and if desired the threads themselves may be of a different type than the one illustrated as long as they are suitable for percussion drilling. Instead of the illustrated thread having one entrance (start) there may be used a thread having two or more entrances (starts).

What is claimed is:

1. A drill rod coupling assembly comprising two drill rods and a coupling sleeve therefor, each rod being provided with at least two sets of threads, each set intersecting at the lead end thereof with a tapered contact surface and spaced from each other axially along the axis of said rod, the end of each rod being provided with a tapered contact surface for abutting a stop in the sleeve and a transverse end surface for abutting the transverse end surface of the second rod when coupled by said sleeve, said sleeve being provided with two sets of internal threads for engagement with the threads of the outer set of threads of each rod and a stop between said two sets of internal threads for limiting the movement of a rod into said sleeve, said stop forming a ridge having on both sides tapered contact surfaces spaced axially from the adjacent end of each set of internal threads and matching the tapered contact surface on the two meeting rods, said tapered contact surfaces having an average inclination of 20° to 45° in relation to the drill axis, the space between said at least two sets of threads of each rod being formed by an unthreaded portion representing a tapered reduction in cross-sectional area which develops, when cut transversely therethrough to remove worn threads at the outer end of the rod, a tapered contact surface which matches a tapered contact surface on the sleeve, and which has an axial projection that at least partly extends between the top and the bottom of the thread, all the said tapered contact surfaces being rotation surfaces coaxial with the drill rods, and not more than one of the tapered end portions of said rods, when the transverse end surfaces thereof are in abutment, engaging the stop in said sleeve in surface contact therewith.

2. A drill rod coupling assembly as claimed in claim 1 in which the space between the sets of rod threads has a slightly smaller diameter than the bottom diameter of the rod thread.

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