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Czarnecki et al.

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[54] **CONNECTION THREAD SYSTEM FOR SETS OF EXTENSION DRILL RODS**

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[52] **U.S. Cl.** **287/117,** 287/125

[51] **Int. Cl.** **F16b 7/00**

[58] **Field of Search** ...287/117, 125; 285/390; 85/46, 85/47

[56] **References Cited**

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[57] **ABSTRACT**

Drill rod sets having rod diameters starting at about 3.75 cm. and increasing, have threads with flank angles between about 50° and 70°. The sets of the drill rods all have the same pitch angle, so that the pitch of the threads of the rods themselves will vary as the diameter of the rods increases. The pitch angle is selected to have a value of between 6° and 8°, preferably about 6.5°, with a flank angle of 60°. To improve resiliency, particularly during locking and unlocking, one or more essentially longitudinal grooves are formed in the lands of the threads.

8 Claims, 5 Drawing Figures

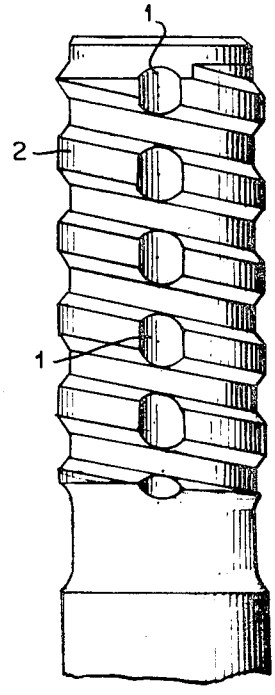
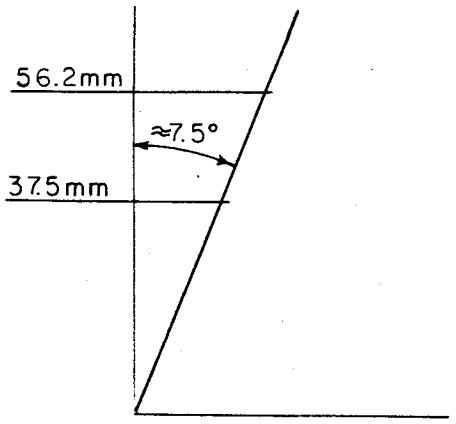


FIG. 1a



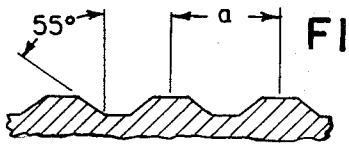


FIG. 1b

FIG. 2

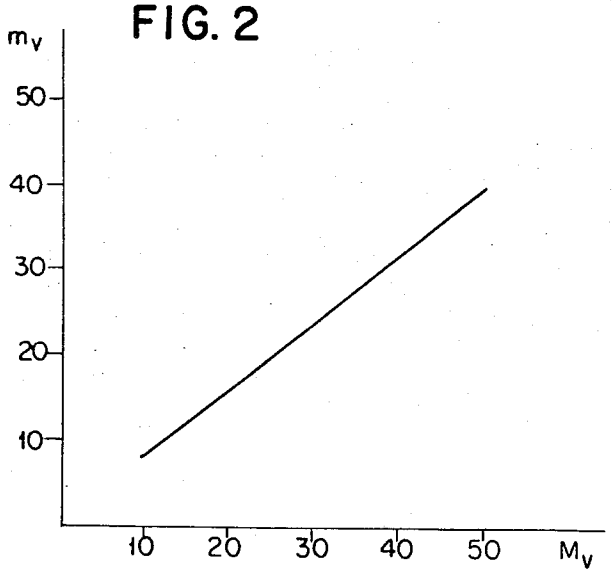
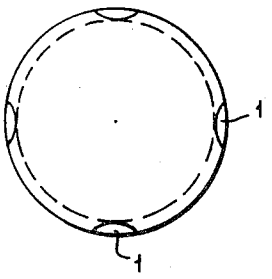


FIG. 3a



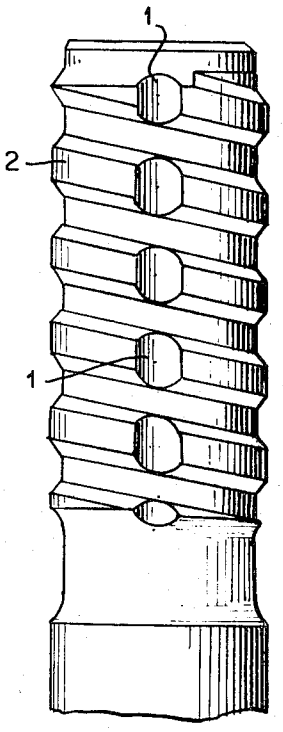


FIG. 3b

CONNECTION THREAD SYSTEM FOR SETS OF EXTENSION DRILL RODS

The present invention relates to a single entrance thread system for extension drill rod connections, and more particularly to male and female threads of a thread diameter range which is equal to and larger than about 3.75 cm., and in which the flank angle of the thread has a value of between 50° and 70°.

No consistant standard system of threads for extension drill connections of heavier equipment has been developed. Such extension drill connections are used in rock drills and usually have thread diameters larger than 3.75 cm. Frequently such rock drill extensions come in sets of varying, and increasing diameters; the ratio of pitch angle to flank angle, and its relationship to the diameter of the thread has not been systematically arranged. Three thread types are most commonly used: (1) a pitch angle of between 6°–4.8°, with flank angles of about 70°; (2) pitch angles of 6.7° to 4.7°, with flank angles of 65°; and (3) pitch angles between 11.2° to 8.4°, with flank angles of 55°; the large pitch angle of this type of thread has two entrances or starts, that is, it is of the double-helix type.

Connections made with threads having the first two types of threads are frequently difficult to loosen after the connection has been used. During use, this type of connection can get very tightly locked. The connection according to the third form, on the contrary, has a tendency to loosen by itself during drilling. Additionally, in use it has been found that such a connection rapidly wears the threads. It is also difficult to manufacture large threaded connections with a double entrance, because the two thread entrances must be exactly matched to each other so that the thread will act as a unit in the connection.

It has been customary to make the pitch, that is the rise per revolution, identical for threads of drill rods having different diameters. This necessarily requires that the threads have different pitch angles. It has been found that the ratio both of the connecting and disconnecting torque then varies for different thread diameters. The heavier connections, with a lesser pitch angle are more difficult to loosen than the smaller connections, after having been joined with the same connecting torque.

It is an object of the present invention to provide a thread system which can be applied to sets of drill rod connections of different diameters, starting from about 3.75 cm., in which the connecting and disconnecting torque has a straight-line relationship in a diagram having connecting and disconnecting torques as coordinate axes.

SUBJECT MATTER OF THE PRESENT INVENTION

Briefly, the thread system for drill rod extensions, having rod diameters of about 3.75 cm. and greater, is so arranged that the threads have always the same flank angle, this angle being selected between about 50° and 70°; the pitch angle of the threads of all rods is also the same, regardless of the diameter of the rods. As a result, the pitch of the thread for rods of different diameters will change with the diameter. The value of this constant pitch angle is selected to fall between about 6° and 8°, preferably about 6.5° for a flank angle of 60°.

It has been found that by keeping the pitch angle constant, and within the range given above, the threads are relatively easy to loosen, while still maintaining a sufficiently tight connection so that, in use, the threads will not come apart. Additionally, by a suitable choice of the flank angle, the threads can be made highly wear resistant, so that a well adapted surface pressure and suitable wear area and volume is obtained.

According to a feature of the invention, at least one of the elements to be threaded together, preferably the rod portion, has one or more substantially longitudinally extending grooves. Thus, the thread helix is given a certain amount of resiliance, which improves the locking of the male and female elements together, holds them tight during drilling operation, while also assisting in loosening of the joint for disassembly.

The invention will be described by way of example with reference to the accompanying drawings, wherein:

FIG. 1*a* is a developed diagrammatic illustration of a thread in accordance with the invention;

FIG. 1*b* is a fragmentary cross sectional view of the thread in accordance with the present invention and illustrating angular relations;

FIG. 2 is a diagram of torque characteristics of the thread of FIG. 1*b*;

FIG. 3*a* is top view of a thread with four longitudinal grooves; and

FIG. 3*b* is a side view of the thread of FIG. 3*a*.

A thread, preferably of trapezoidal form as seen in FIG. 1*b* has a flank angle for example of 55°. The distance between adjacent lands of the thread, that is the pitch a varies in accordance with the diameter of the thread. The pitch angle is indicated in FIG. 1*a* which shows a developed diagram. As is clearly apparent from FIG. 1*a*, a thread on a rod having a diameter of 37.5 mm will have a lesser pitch than a thread on a rod of a diameter of 56.2 mm — the pitch angle of 7.5° remaining constant. Any suitable flank angle can be used, the range of from 50° to 70° having been found suitable. It has been found that a variation of pitch angle of between about 6° and 8° gives good results in that the compromise between tightness of coupling and capability of separation of the joint is maintained.

FIG. 2 illustrates a diagram in which the connecting torque M_v is shown on the abscissa, with respect to the disconnecting torque m_v, shown on the ordinate. The straight line is representative of the connection-disconnecting torque relationship. This line is independent of variation in diameter; as can be seen, the respective connecting and disconnecting torque fall on a straight line, independent of thread diameter.

In order to obtain a certain degree of resiliance in the thread helix, which is advantageous for locking before and during drilling, as well as for loosening thereafter, the helix can be provided with one or more essentially longitudinally extending grooves 1 (FIG. 3*a*, *b*) in the lands of the rod portion of the thread. In order to obtain a thread which is easy to produce by conventional manufacturing methods, the thread 2 is formed with a trapezoidal cross section (see also FIG. 1*b*). This shape permits easy manufacture and ready unthreading as well as re-threading thereafter.

The female coupling will, of course, will have a thread matching that of the male coupling, for example as illustrated in FIG. 1*b*, where the illustration may represent both an outside thread fragment as well as an inside thread portion.

Drill rods in sets can be made with the thread system of the present invention in sizes from about 3.75 cm up to 10 cm, for example in steps of 0.6 cm.

We claim:

1. Standard thread system for cylindrical rock drill rod connections having a continuous thread diameter of at least 3.75 cm, said thread having a flank angle between about 50° – 70°;

wherein the pitch angle of the threads regardless of diameter of the thread is constant, and selected to fall between 6° and 8°, whereby the pitch of the threads of different diameter, will vary in accordance with the diameter, and the connecting and disconnecting torques for the same flank angle of thread will be positioned along the same line in a diagram having these torques as coordinate axes, irrespective of thread diameter.

2. Thread system according to claim 1 wherein the flank angle is about 60° and the pitch angle is about 6.5°.

3. Thread system according to claim 1 wherein the thread has trapezoidal cross sectional form.

4. Thread system according to claim 1 wherein at least one essentially longitudinal groove is formed along the length of the lands of the threads to provide resilience in the thread helix for assembly and disassembly.

5. Thread system according to claim 1 wherein the flank angle is about 60°, the pitch angle is about 6.5°, the thread has trapezoidal cross sectional form, and wherein at least one essentially longitudinal groove is formed along the length of the lands of the threads to provide resilience in the thread helix for assembly and disassembly.

6. A set of cylindrical rock drill rod connections having continuous thread diameters of at least about 3.75 cm, said threads having a flank angle between about 50° – 70°;

said set including at least two connections in which the threads have different diameters,

wherein the pitch angle of the threads on all connections of the set, regardless of diameter of the connection in the set is constant, and selected to fall between 6° and 8°, whereby the pitch of the threads on the connections of the set, and of different diameter, will vary in accordance with the diameter, and the connecting and disconnecting torques for the same flank angle of thread will be positioned along the same line in a diagram having these torques as coordinate axes, irrespective of thread diameter.

7. The set of drill connections according to claim 6 containing more than two connections in which the threads are all of different diameters.

8. The set of drill connections according to claim 6 wherein said set of connections have a plurality of diameters, the diameter of each successive connection increasing in steps of about 0.6 cm.

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