

Description

A driving head for telescopic drill rods and machine comprising said head

The present patent application for industrial invention relates to a driving head for telescopic drill rods and to a machine comprising said head.

Several drilling techniques are known in the state of the art; one of them provides for using a rotary drilling tool mounted at the end of a set of telescopic rods and is usually defined as rotary technique.

Rods are driven into rotation by a driving head operatively connected with a machine; by means of suitable driving means the driving head drives said rods into rotation around their axis, in such manner to transmit motion to the tool mounted at the end of the head rod.

According to such technique, an axial thrust must be sometimes transmitted to the tool or rods, in addition to a rotary momentum.

In order to guarantee a suitable axial thrust for a series of different operations, some telescopic rods are provided with a special internal and external rack distinguished by the particular shape of the teeth.

Such a solution is disclosed in the European patent application EP 0 335 059 in the name of the same applicant.

In brief, said telescopic rods comprise automatic coupling racks, wherein the teeth comprise at least one intermediate section extending in orthogonal direction to the axis of rotation and coinciding with the direction of the vector of the force applied in case of axial thrust or traction.

The driving head of the machine adapted to transmit the momentum and axial force to said telescopic rods comprises a frame to which a cylindrical collar is revolvingly associated, being internally provided with driving racks adapted to engage with the driven racks of

each rod to transmit both the angular momentum and the axial force (either thrust or traction).

For this reason, the driving racks and the driven racks are complementary and are provided with complementary teeth for mutual engagement.

The Applicant has noted that, in spite of being an excellent solution, such a solution is impaired by some drawbacks.

The driving racks, which are obtained in one piece with the cylindrical collar in such manner to protrude from its internal surface, are subject to high wear, both for the considerable loads involved, and for the fact that their use is higher than the driven racks.

In spite of being an excellent solution in terms of resistance, such a solution is impaired by the fact that the replacement of the driving racks is a rather long and difficult operation.

As a matter of fact, some material must be provided, for example by means of welding with a suitable template, to restore the correct shape of the teeth. Such an operation is a long and difficult operation.

Moreover, it was noted that teeth repaired in this way are subject to higher wear compared to new teeth, thus causing the early wear of the driven racks of the rods.

After some studies the Applicant has discovered that the latter drawback is caused by the natural welding shrinkage that may alter, in some cases, the profile of the tooth, when the material has deposited.

Because of the level of the existing forces, if the profiles of the driven teeth and the driving teeth do not have a high level of conjugation, high wear is generated between the parts, thus causing not only the dissipation of mechanical energy and the general heating of the driving head, but also the early wear of the driving and/or driven teeth, according to the specific case.

In other words, the technique that is currently used to repair the teeth of racks originates three types of drawbacks:

- difficulty to obtain the best profile in terms of engagement;

- difficulty in the repair operation;
 - excessive overheating attributable not so much to the dissipation of mechanical energy, but to the fact that in the repair operation of the tooth by means of welding, some material is melt, with consequent
- 5 change of the mechanical properties of the cylindrical collar and potential damage of seals and bearings connecting the collar to the frame of the driving head.

DE 40 38 424 discloses a Kelly borehole drilling arrangement provided with a rotating drill head coupled with telescopic pipes. The

10 outermost Kelly pipe extends below the drill head and remains in rotary connection with the transmission piece.

The purpose of the present invention is to provide a driving head for telescopic rods able to solve the problems of the prior art.

These purposes are achieved by the present invention according

15 to the first attached claim.

The applicant has devised a driving head for telescopic drill rods wherein the cylindrical collar is provided with at least one internal surface comprising at least one driving rack coupled with the cylindrical collar with removable connection means, preferably of screw type.

20 More precisely, the racks are fixed to the cylindrical collar by means of screws, although mechanical centering means are also provided to withstand the stress suffered by the rack.

In this way, the replacement of the driving racks is simple and fast, without the aforementioned problems related to welding shrinkage. In

25 fact, when the first wear signs appear, the driving racks (limitedly to the ones that are actually worn out) can be dismounted and replaced with new driving racks, thus maintaining the ideal coupling with the driven racks.

Moreover, the models of drill rods can be changed (for example,

30 with rods having racks with a different shape) without changing the entire driving head, by simply changing the cylindrical collar.

The present invention also comprises additional ameliorative characteristics, which are the object of the attached dependent claims.

An additional purpose of the present invention is a machine provided with a driving head according to the present invention.

5 For explanatory reasons, the description of the invention continues with reference to attached drawings, which only have an illustrative, not limiting value, wherein:

Fig. 1 is a perspective view of a driving head according to the present invention;

10 Fig. 2 is a machine provided with the head of Fig. 1;

Fig. 3 is a detail of a rack section of the head of Fig. 1;

Fig. 4 is a partial cross-sectional view of the head of Fig. 1.

Referring to Figs. 1 and 2, a driving head (1) for telescopic drill rods (A) comprises a frame (2) and a cylindrical collar (3) rotatably
15 coupled with said frame (2).

The cylindrical collar (3) is provided at least with one internal surface from which at least one driving rack (5) protrudes, being adapted to be coupled with corresponding driven racks of telescopic drill rods (A),

The driven racks are realized according to the precepts of the
20 European patent application EP 0 335 059.

Likewise, the driving racks (5) have a complementary shape with respect to the driven racks and are therefore provided with teeth (50) with at least one intermediate section extending in orthogonal direction to the axis of rotation, as shown in Fig. 3.

25 Generally speaking, the precepts of the present invention may be used regardless of the shape of the tooth (50), which might simply have a wedge-like shape (without the aforesaid intermediate section). However, the best advantages are found in this application, which must be considered as preferential.

30 The collar (3) is driven into rotation around its axis with actuation means (4) that are preferably hydraulic actuation means.

In some embodiments, the actuation means (4) are associated with the frame (2) and also comprise hydraulic engines to transmit the angular momentum to the collar (3). According to other embodiments, the actuation means (4) are kinematic mechanisms that transmit the angular momentum to the collar (3), whereas the engines are housed on the machine (10).

The frame (2) is slidingly coupled with a rectilinear track (12) to determine a linear movement of said actuation head (1) along the direction of the track (12) parallel to the axis of rotation of the collar (3) to transmit an axial force, either a thrust force or a traction force, to the rods (A), according to the specific requirements.

The movement of the frame (2) along the track (12) is controlled by driving means (13), for example hydraulic cylinders.

Going back to the driving rack (5), as shown in the example, the collar (3) has a plurality of racks (5) protruding from its internal surface.

The number and angular position of said driving racks (5) vary according to the needs and can be chosen by the expert of the field without any inventive effort.

Each driving rack (5) is coupled with the cylindrical collar (3) by means of removable connection means (6) that consist in screw connection means in the embodiment shown.

Moreover, mechanical centering means are provided between rack and collar, thus contributing to withstand the existing forces.

Now referring to Fig. 4, the removable screw connection means (6) comprise a threaded hole (60) obtained on the internal side of said collar (3), a housing (61) obtained in said driving rack (5), a bolt (62) with enlarged head adapted to be screwed into said threaded hole (60) and passing through said housing (61) to engage said driving rack (5).

More specifically, the housing (61) comprises a first section (61A) with first diameter that is open on one side of said driving rack (5) facing the internal surface of said collar (3).

Moreover, the housing (61) comprises a second section (61B) with second diameter that is open on one side of the driving rack (5) opposite to the side facing said internal surface of the collar (3).

5 The second diameter is at the same time higher than the first diameter and lower than the diameter of said enlarged head of said bolt (62), in such manner to obtain coupling by interference of shape, which is simple to realize and assemble.

In order to improve the mechanical resistance properties of the coupling between driving rack (5) and collar (3), given the existing forces,
10 the removable connection means (6) are disposed at least in correspondence of the teeth (50) of each rack (5), as shown in Fig. 3.

Another advantageous characteristic in terms of sturdiness derives from the fact that a first (6A) and a second (6B) row of removable connection means (6) are provided.

15 For each row (6A, 6B) connection means (6) are disposed linearly.

A first row (6A) is in proximal position to the teeth (50) and is provided with a removable connection means (6) in correspondence with each tooth (50).

Instead, the second row (6B) of removable connection means (6)
20 is disposed in remote position to said teeth (50) and provided with a removable connection means (6) in correspondence of each valley between two adjacent teeth (50).

According to another embodiment, not shown in the attached figures, a stud-bolt is provided instead of the bolt (62), protruding from
25 the internal surface of the collar and being inserted into the hole (61) to lock the driving rack (5) with a nut.

The operation principle and the spatial disposition of the removable screw connection means are similar to the ones described above, therefore omitting a detailed description.

30 According to another embodiment (not shown in the attached figures), the removable connection means are bayonet connection means, and not screw connection means, for instance with pins adapted

to fix each driving rack (5) to the collar (3). In such a case, the pins are inserted by interference in the hole (60) of the collar (3) and engage the rack (5) in the same way.

Such a solution can be advantageously used because, during the
5 various operating conditions, the pins are only subject to cutting forces, and not to a force along their extraction direction.

Moreover, another advantage of such a solution is that it is easy to install, although if additional difficulties are encountered to extract the pins with a suitable puller.

10 Furthermore, many additional variants are possible within the reach of an expert of the field in the light of the precepts herein disclosed, which are therefore to be considered as an integral part of the present invention.

Claims

1) A driving head (1) for telescopic drill rods (A) comprising:
- a frame (2),
- a cylindrical collar (3) rotatably coupled with said frame (2),
- actuation means (4) to drive said cylindrical collar (3) into
5 rotation,

characterized in that

said cylindrical collar (3) is provided at least with one internal
surface comprising at least one driving rack (5) adapted to be coupled
with corresponding driven racks of telescopic drill rods (A),
10 said driving rack (5) is coupled with said cylindrical collar (3) by
means of removable connection means (6).

2) A driving head (1) as claimed in claim 1, wherein said
removable connection means (6) are removable screw connection
means (6).

15 3) A driving head (1) as claimed in claim 2, wherein said
removable screw connection means (6) comprise:

- a threaded hole (60) obtained in said internal surface of said
collar (3),
- a housing (61) obtained in said driving rack (5),
20 - a bolt (62) with enlarged head adapted to be screwed into said
threaded hole (60) and passing through said housing (61) to engage said
driving rack (5).

4) A driving head (1) as claimed in claim 3, wherein said housing
(61) of the driving rack comprises a first section (61A) with first diameter
25 that is open on one side of said driving rack (5) facing the internal surface
of said collar (3), and a second section (61B) with second diameter that
is open on one side of said driving rack (5) opposite to the one facing
said internal surface of said collar (3), said second diameter being higher
than the first diameter and lower than a diameter of said enlarged head
30 of said bolt (62).

5) A driving head (1) as claimed in any one of the preceding claims, wherein said driving rack (5) comprises a plurality of adjacent teeth (50), characterized in that said removable connection means (6) are disposed at least in correspondence of said teeth (50).

5 6) A driving head (1) as claimed in claim 5, wherein said adjacent teeth (50) are separated by valleys, characterized in that said head (1) comprises a first row (6A) of removable connection means (6) linearly disposed in proximal position to said teeth (50) and in correspondence of the latter, and a second row (6B) of removable connection means (6)
10 linearly disposed in remote position to said teeth (50) and in correspondence of a valley between two adjacent teeth (50).

7) A driving head (1) as claimed in any one of the preceding claims, wherein said driving rack (5) comprises teeth (50) provided with at least one intermediate section that extends in orthogonal direction to
15 the axis of rotation.

8) A machine (10) comprising a driving head (1) for telescopic drill rod (A) as claimed in one or more of the preceding claims.

9) A machine (10) as claimed in claim 8, comprising
- a rectilinear track (12) to which said frame (2) of said driving
20 head (1) is slidingly coupled,
- driving means (13) to slidingly actuate said frame (2) along said track (12).