

DRILLING IMPLEMENT AND METHOD FOR OPERATING A DRILLING IMPLEMENT

The invention relates to a drilling implement with a derrick or mast, a drill drive guided on said derrick or mast for driving a drill rod and a gear placed between the drill drive and drill rod for transmission purposes.

Frequently with such a drilling implement different drilling methods are to be carried out or during a complex drilling procedure different demands are made on the rotation speed and/or torque of the drill or drill rod respectively.

One possibility for meeting these different demands consists of using different drilling implements. However, in the case of complex drilling procedures this involves a considerable expenditure, because e.g. successive drilling steps have to be carried out with different drilling implements.

Thus, e.g. with known drilling implements the rotation speed of a drill drive can be regulated or controlled. Thus, even with a single drilling implement it is possible to implement different rotation speeds and torques on the drill rod or drill respectively. However, this suffers from the disadvantage of the relatively high constructional expenditure for the motor and the complex control. Thus, such a drilling implement is associated with comparatively high manufacturing and maintenance costs. A drilling implement with a regulatable drill drive is described in JP 8-226372. JP 07-076984 describes the use of hydraulic motors having two speeds and an additional change in the hydraulic drive of the motors from series to parallel connection.

As an alternative drilling implements with shiftable gears have been proposed. Said gears generally have a relatively complex construction. A drilling implement with an adaptable gear ratio between the drill drive and drill rod is e.g. known from JP 2002-97882. In order to provide different rotation speeds and torques on the drill rod said

specification proposes the provision of two different gear ratio stages, which can be used as desired.

The known drilling implements allowing an adaptation of the rotation speed of the drill rod either have a complex drive or a complex gear.

Against this background the object of the invention is to provide a drilling implement and a drilling method, which with a very simple and low-maintenance construction of the drilling implement, permit an easy adaptation of the rotation speed of a drill rod.

According to the invention this object is achieved in that the gear can be disengaged for inverting the gear ratio and is placed in reversible manner on the drill drive.

For adapting the rotation speed of the drill rod and consequently the drill connected thereto, the gear is disengaged from the drill drive, reversed and connected to the drill drive again in the reversed state.

Thus, a gear inlet connected in a first state to the drill drive is used in a second, reverse state for connection to the drill rod. Simultaneously, a gear outlet provided for connection to the drill rod in a first state, is connected to the drill drive in the second, reversed state.

For this purpose the gear inlet and gear outlet are designed in such a way that they are in each case connectable both to the drill drive and the drill rod.

Thus, in simple manner the drilling implement according to the invention is able to provide two different transmission ratios and consequently drill rod rotation speeds.

The gear can have a relatively simple construction. In particular, the gear can be a non-shiftable gear, which is fundamentally known from drilling implements. There is also no need for a drill drive adapted to the drilling procedure and no modification of a hydraulic coupling. The drill drive can be a motor supplying only a single rotation speed, i.e. it need not be controllable or regulatable respectively with respect to rotation speed.

A particularly preferred embodiment of the inventive drilling implement is characterized in that the gear has a drive unit with a first connecting device for connection to the drill drive and a driven unit with a second connecting device for connecting to the drill rod

and that the first connecting device and second connecting device have a substantially identical construction.

The drive unit can in particular be a shaft, which is placed at a gear inlet and can be referred to as the driving shaft. For connection to the drill drive, particularly an output shaft of the drill drive, which can also be referred to as the motor output shaft, a first connecting device is provided on the drive unit. Said connecting device can be connected positively, non-positively or in self-substance manner to the drill drive or motor output shaft and to the gear respectively. It is particularly preferred that the connection between the drill drive and gear can be made by positive engagement, e.g. via a toothed connection or a key and slot connection.

At a gear outlet the gear has a driven unit, which can also be constructed as a shaft and referred to as the driven shaft. The driven unit can be connected to the drill rod by means of a second connecting device.

It is fundamentally possible to have a different construction of the first and second connecting devices and e.g. following the reversal of the gear for connection to the drill drive or drill rod respectively, are replaced or provided with in each case adapted adapters. However, it is particularly preferable for the first and second connecting devices to have a substantially identical construction. As a result in particularly simple manner, in the reversed state the gear can be again connected to the drill drive and drill rod. The driven unit is connected to the drill drive and the drive unit to the drill rod.

According to an embodiment of the invention, the gear has an annular construction. This is understood to mean in particular that both the drive unit and driven unit are constructed as at least partly hollow shafts. The annular gear offers the advantage that the motor output shaft and the drill rod can be particularly easily connected to the gear, in that they are in each case introduced into the hollow shafts. By suitable connecting devices, particularly disengageable couplings, such as are known basically from the prior art, the nested shafts are connected to rotate.

A particularly preferred embodiment of the invention involves that the gear can be flanged to the drill drive. As a result of the flanged connection, it is ensured that the gear can be disengaged from the drill drive without significant expenditure. To be able to also flange the gear to the drill drive in the reversed state, it is particularly preferred

for substantially identical flanges to be provided at the gear inlet and gear outlet. The flange located in each case on the side of the drill rod can have no function when the gear is installed.

For compensating an angular displacement between the drill drive and gear, it is particularly preferable for the gear to be connectable to the drill drive via a universal joint. As a result of the universal joint placed between drill drive and gear, an angle between the longitudinal axes of the motor output shaft and the drive unit, particularly drive shaft, can be bridged.

According to a preferred development of the invention, the drill drive is placed on a first slide guided on the derrick. For the axial feed or advance of the drill and drill rod, the drill drive and gear are axially displaced on the derrick, so that there is fundamentally no need for telescopable rods for axial feed purposes.

In a particularly preferred embodiment of the invention the gear is placed on a second slide guided on the derrick. This arrangement permits a particularly comfortable gear reversal. For this purpose it is proposed the following course of action. Initially the connection between drill drive and gear is disengaged and the drill rod is removed from the gear. The second slide is then axially fixed on the derrick and the first slide with the drill drive is moved axially away from the second slide. The gear is then reversed. The first slide with the drill drive is then moved axially again towards the gear for connection to the gear in the reversed state.

It is particularly advantageous if the gear is placed in rotary manner on the second slide in order to allow an easy reversal of the gear without releasing it from the second slide. Thus, the weight of the gear can also be carried by the second slide during reversal and makes it possible for an operator to perform a gear ratio adaptation without significant force expenditure. It is also advantageous in this connection for the second slide to have a brake for axial fixing to the derrick.

A further development of the invention is that at least one universal joint is provided between the gear and drill rod. The universal joint is particularly advantageous if the drill rod is guided on the derrick by means of an own rod guide. The universal joint permits a compensation of an angular displacement between the longitudinal axes of the driven unit of the gear and the drill rod.

It is particularly preferable for the drill drive to be guided on a first slide, the gear on a second slide and the drill rod on a rod guide on the derrick. As a result of the two slides and the rod guide the aforementioned method for reversing the gear can be implemented with particular ease. Both the drill drive and the drill rod can be held on the derrick during the reversal of the gear. Advantageously in this embodiment two universal joints are provided, which are located between the drill drive and gear or between the gear and drill rod respectively.

According to the invention it is advantageous for the gear to have a gearbox with two substantially identically constructed flange connections. As a result in the starting state and in a reversed state the gear can be connected to the drill drive without an adapter.

The inventive method for operating the drilling implement is characterized in that the gear is disengaged from the drill drive for inverting the gear ratio, is reversed and in the reversed state is reconnected to the drill drive. This method makes it possible to execute a change of the gear ratio, e.g. for adapting to a different drilling procedure, in a particularly time-saving and inexpensive manner. It is possible to avoid a complicated conversion of the drilling implement or even a replacement of the drilling implement by a different drilling implement.

The invention is exemplary further described hereinafter relative to the attached drawings, wherein show:

Fig. 1 A drilling implement with a drill drive and a gear with a transmission to high speed.

Fig. 2 An embodiment of a drill drive with directly flanged on gear for torque increase purposes.

Fig. 3 The gear of fig. 2, additionally with a universal joint at the gear outlet.

Fig. 4 An embodiment of a drill drive with gear with a transmission to high speed and universal joint at the gear inlet; and

Fig. 5 The gear shown in fig. 4, additionally with a universal joint at the gear outlet.

Fig. 1 shows an inventive drilling implement 1 with a mast or derrick 20, a drill drive 22 and a gear 40. Drilling implement 1 has a vehicle 10 comprising a lower chassis 12 and

an upper chassis 14 articulated in rotary manner thereto. The derrick 20 is pivotably placed on the upper chassis 14. By means of a pivoting cylinder 18, the derrick 20 can be pivoted from a substantially vertical operating position into a substantially horizontal transportation position. In a rear region of the upper chassis 14 is placed a winch 15, which receives a cable 17, which leads to a guide pulley located in the upper region of the derrick. The derrick 20 also has a derrick head 24. In its operating position the derrick 20 is placed in front of a front region of the vehicle 10. On a front side of the derrick, i.e. a side facing away from the vehicle 10, the derrick 20 has a guide device 26 on which a first slide 30 can be guided along said derrick 20. The guide device 26 has two guide rails, which are positioned laterally in a front region of the derrick. The first slide 30 has four guide jaws 32 and in each case two guide jaws 32 can be slidably engaged with a guide rail. On the first slide 30 is provided a feed drive 34, which serves to move the first slide 30 along the derrick 20. For this purpose there are placed two fixed chains 38 on derrick 20. The feed drive 34 is connected to rotate with two driving pinions, which are so connected to the fixed chains 38 that on operating the feed drive 34 said feed drive 34, together with the first slide 30, is moved along the fixed chains 38.

The first slide 30 also has a drill drive 22 provided for the rotary driving of a drill rod. Thus, the drill drive 22 can also be called as rotary drive. The drill rod can e.g. be a kelly bar or also a drilling tube used for supporting the drill or bore hole during so-called kelly drilling. Below the drill drive 22 is flanged by means of a first universal joint 42 a gear 40, which raises the speed and lowers the torque. In this embodiment the drilling implement 1 is e.g. suitable for displacement or CSV drilling operations which require a high speed.

Gear 40 is placed on an own, second slide 46, which is also guidable along the derrick 20. Below the gear 40 is flanged a second universal joint 44 provided for receiving the drill rod.

According to the invention, gear 40 is placed in disengageable and reversible manner on the drill drive 22 for inverting the gear ratio. For guiding and/or locking the drill rod a rod guide 50 is provided below the gear 30 and the second universal joint 44. Said rod guide is fixed to derrick 20.

Fig. 2 shows an embodiment of an inventive gear 40. The gear 40 is so positioned in the shown view that it brings about a transmission to a low speed and therefore causes

a torque increase. A high torque is e.g. required for kelly drilling. The gear 40 is connected directly, without a universal joint, to the drill drive 22. For this purpose a gearbox, which receives the gear 40, is flanged to the first slide 30. Drill drive 22 and gear 40 are rotary mutually in engagement. For this purpose a motor output shaft of drill drive 22 is connected via a coupling to a drive unit of gear 40 constructed as a hollow shaft. At the end of the gear 40 opposite to the drill drive 22, a drill rod can be so connected to the gear 40 that a torque is transmitted thereto.

Fig. 3 shows the gear 40 with drill drive 22 shown in fig. 2, additionally with a second universal joint 44 placed beneath gear 40. The second universal joint 44 is provided for receiving a drill rod.

Fig. 4 shows a gear 40 with a transmission to a high a speed, i.e. the gear 40 brings about a speed increase and a torque decrease. A first universal joint 42 is placed between gear 40 and drill drive 22. The gear 40 is placed on a second slide 46 guided on derrick 20. The second slide 46 is guided along the same guide device 26 as the first slide 30.

Fig. 5 shows the arrangement of fig. 4, additionally with a second universal joint 44 provided beneath gear 40.

CLAIMS

1. Drilling implement having
 - a derrick,
 - a drill drive guided on said derrick for driving a drill rod and
 - a gear placed between drill drive and the drill rod for transmission purposes,
wherein
for inverting the gear ratio, the gear is placed in disengageable, reversible manner on the drill drive.
2. Drilling implement according to claim 1,
wherein
the gear has a drive unit with a first connecting device for connecting to the drill drive and a driven unit with a second connecting device for connecting to the drill rod and
the first connecting device for connecting to the drill rod and the second connecting device have a substantially identical construction.
3. Drilling implement according to claim 1,
wherein
the gear has an annular construction.

4. Drilling implement according to claim 1,
wherein
the gear can be flanged to the drill drive.
5. Drilling implement according to claim 1,
wherein
the gear can be connected by means of a universal joint to the drill drive.
6. Drilling implement according to claim 1,
wherein
the drill drive is placed on a first slide guided on the derrick.
7. Drilling implement according to claim 1,
wherein
the gear is placed on a second slide guided on the derrick.
8. Drilling implement according to claim 1,
wherein
there is at least one universal joint between gear and the drill rod.
9. Drilling implement according to claim 1,
wherein
the gear has a gearbox with two substantially identically constructed flange connections.
10. Method for operating a drilling implement with a derrick, a drill drive for driving a drill rod guided on the derrick and a gear positioned between drill drive and the drill rod for transmission purposes, particularly according to claim 1,
wherein
for inverting the gear ratio, the gear can be disengaged from the drill drive, reversed and reconnected to the drill drive in the reversed state.