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Most of the drill pipes used by coal mine drilling rigs are connected by conical thread joints, which have good alignment and meet the working condition of one-way rotation and torsion, but can not rotate in reverse. A new type of self locking forward and reverse drill pipe structure in the rod was studied to realize the mechanical self-locking of thread pair connection and the automatic release of drill pipe machinery. From the back to the previous releases, the drill pipe connection has good rigidity, large bearing torque and good stability, which can meet the requirements of automatic addition of drill pipe.

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Study on Self-locking Forward and Reverse Drill Pipe in Rod

Yi-Kang Tang^α & Chun-Dong Xu^σ

ABSTRACT

Most of the drill pipes used by coal mine drilling rigs are connected by conical thread joints, which have good alignment and meet the working condition of one-way rotation and torsion, but can not rotate in reverse. A new type of self locking forward and reverse drill pipe structure in the rod was studied to realize the mechanical self-locking of thread pair connection and the automatic release of drill pipe machinery. From the back to the previous releases, the drill pipe connection has good rigidity, large bearing torque and good stability, which can meet the requirements of automatic addition of drill pipe.

Keywords: self-locking; forward and reverse drill pipe; sticking drill; holding drill.

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I. INTRODUCTION

Most of the drill pipes used in the drilling of coal mine drilling rigs are conical and threaded joints, which have good neutrality and can meet the one-way twisting condition, but also have the defect of not being able to rotate in the opposite direction. In the actual process of underground drilling in coal mines, the phenomenon of hole

collapse is very likely to occur due to the influence of complex strata, which will lead to sticking and drilling accidents, which need to be reversed to assist in solving. At this time, there is no problem with the reversal of the power head of the drilling rig. The conventional ordinary drill pipes in the hole are threadedly connected and cannot be reversed. Therefore, a drill pipe capable of forward and reverse rotation is required to solve the problem that the thread does not loosen during reverse rotation.

At present, the forward and reverse drill pipes are mainly plug-in type to transmit the forward and reverse torque, and the axial positioning connection is performed with key pins or screws to transmit the axial load. The main problem is that the drill pipe needs to be manually unlocked. For disassembly, the torque application range is small, the gap at the joint is large, the deflection of the drill pipe is large, and the mechanical automatic disassembly cannot be realized.

II. IN-ROD SELF-LOCKING FORWARD AND REVERSE DRILL ROD STRUCTURE

The self-locking forward and reverse drill pipe in the rod consists of a core tube, an outer tube, a limit pin, a spring limit ring, and a spring. The overall structure is shown in Figure 1

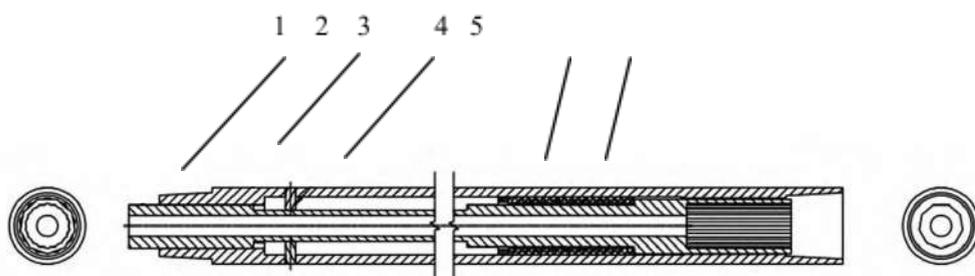


Figure 1: Schematic diagram of the structure of the self-locking forward and reverse drill pipe in the rod
1. Core tube 2. Outer tube 3. Limit pin 4. Spring limit ring 5. Spring

The new structure of the outer pipe is shown in Figure 2. The internal structure of the male joint is designed as an inner polygon. The shape is the same as that of the ordinary drill pipe. It is made of friction welding of the male joint, the female joint and the steel pipe to realize the extension

and torque of the drill pipe. The front and rear ends are respectively provided with connecting threads and tooth-shaped grooves matched with the core pipe, and the pipe body and the joints at both ends are friction welded.

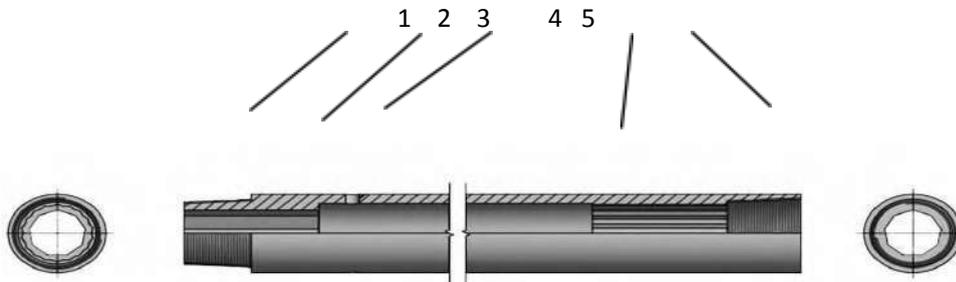


Figure 2: Schematic diagram of the outer tube structure

1. Male thread 2. Male internal tenon 3. Limit pin hole 4. Female internal tenon 5. Female thread

The male thread and the female thread complete the length of the drill pipe and carry the drilling torque; the inner tenon of the male head and the male tenon of the core pipe are clearance fit to carry the anti-rotation torque, and the male tenon of the core pipe can slide along the axial direction; the limit pin hole is determined The position of the limit pin bears the thrust of the spring; the limit pin moves to a suitable position after the core tube is loaded into the outer tube, and the insertion limit pin is welded firmly to limit the core tube from slipping out of the outer tube (drill pipe); the inner tenon of the female head and the core The pipe transition tenon is matched and can move along the axis, and the core tube female

tenon transmits torque to the drill pipe through the transition tenon to realize the interlocking of the drill pipe.

The structure of the core tube is shown in Figure 3. The outer shape of one end is an outer polygon, which cooperates with the inner polygon of the outer tube male joint to transmit the torque load; Matching, realizes that the taper thread pair of the male and female joints of adjacent drill pipes is tightened to form a self-locking taper thread pair in the matching rod. The taper thread pair does not disengage when reversed (the drill pipe can be reversed), and there is a water supply through hole in the center.

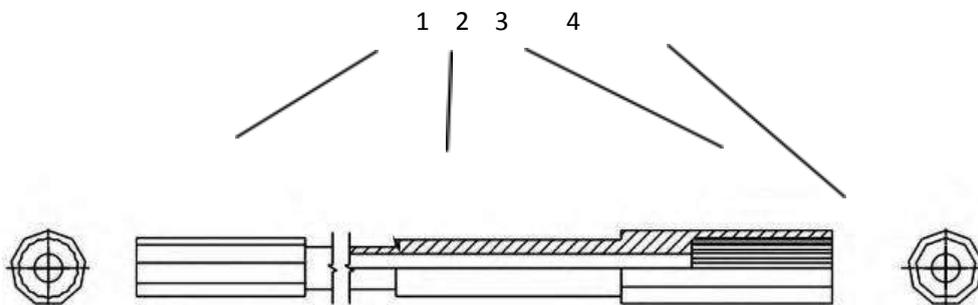


Figure 3: Schematic diagram of the core tube structure

1. Self-locking male tenon 2. Water hole 3. Self-locking female tenon 4. Transition tenon

The self-locking male tenon and the self-locking female tenon are composed of regular polygons, which are located at the male joint end of the drill pipe, and are toothed with the male joint to carry the anti-rotation torque. When self-locking, the self-locking female tenon is inserted; the water passage is the flushing water channel; The transition tenon is located at the end of the core tube and is a regular polygon, which transmits the torque of the male tenon to the female end of the drill pipe.

When the taper thread of the latter drill pipe joint is tightened through the limit pin, the spring limit ring and the spring between the outer tube and the core tube, the inner core tube is pushed to compress the spring, and the outer polygonal structure at the front end of the core tube extends into the previous one. The inner polygonal structure of the drill pipe core tube is matched to realize the self-locking and reversing functions of the drill pipe thread pair. After each drill pipe is connected, the last end is connected with the drilling water supply water braid thread pair to realize the self-locking of the last drill pipe. The first drill pipe male joint and the inner polygon at the root of the taper thread of the drill bit realize the self-locking of the first taper thread pair.

In the process of drilling and drilling, all drill pipes rely on the inner and outer polygonal structures of adjacent drill pipes to realize mechanical self-locking. Any forward and reverse construction operations will not cause the loosening of the thread pairs between the drill pipes. The outer polygonal structure of the core pipe not only cooperates with the polygonal structure in the male joint of its own outer pipe, but also cooperates with the polygonal structure in the inner core pipe of the latter drill pipe to bear the drilling torque. Since it is a multilateral load bearing, it can bear a large torque.

After the drilling construction is completed, when disassembling the drill pipe, it can only start from the last thread pair. After removing the tail water braid, the inner core pipe of the last drill pipe moves the core pipe backward under the elastic force of the spring, releasing the thread. The first thread pair (male joint thread pair) in front of the drill pipe unlocks the self-locking of one drill pipe, removes one drill pipe from the back to the front

in turn, releases the self-locking of the adjacent previous drill pipe, and gradually unlocks the drill pipes one by one Taper thread pair.

The spring limit ring defines the position of the spring and realizes the compression of the spring. The spring realizes the reset of the core tube and completes the unlocking of the drill pipe.

III. THE WORKING PRINCIPLE OF THE SELF-LOCKING FORWARD AND REVERSE DRILL PIPE IN THE ROD

In-rod self-locking forward and reverse drill pipe is a drill pipe mechanism that uses the conditional interlocking principle between adjacent drill pipe joint threads to realize the forward and reverse interlocking of drill pipes., use the self-locking core pipe of the middle drill pipe to insert the self-locking core pipe of the last drill pipe during the screwing process of the last drill pipe and insert the core pipe of the most front drill pipe to realize the interlocking of the joints of the first two pipes, remove the last drill pipe, and the intermediate core pipe is under the spring force Under the action of the automatic reset, realize the unlocking of the first two drill pipe joints, so as to achieve the reverse self-locking function of the drill pipe.

The working principle of the self-locking forward and reverse drill pipe in the rod is shown in Figure 4.

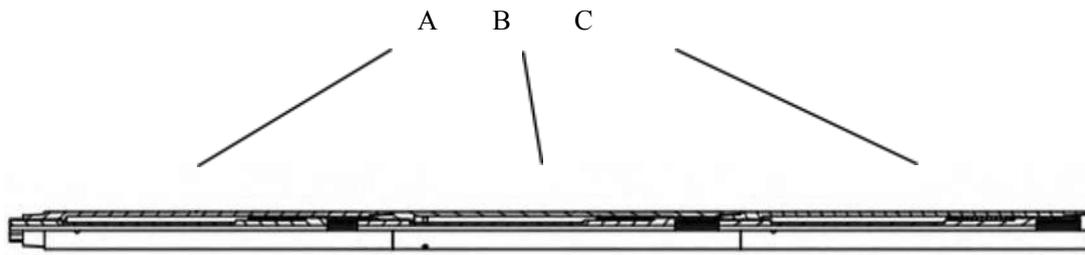


Figure 4: Working principle diagram of self-locking forward and reverse drill pipe in the rod

Three adjacent drill rods are connected in sequence, drill rods A and B are connected, and the male thread of drill rod B is screwed into the female thread of drill rod A to realize the connection of drill rods. At this time, there is no interlock between drill rods A and B; C drill pipe add-on, C drill pipe male thread is screwed into B drill pipe female thread; C drill pipe male joint pushes the core pipe forward, core pipe self-locking male tenon is inserted into A drill pipe self-locking female tenon, realizes A, B Interlock of drill pipe.

and load, and good stability. The problem of connecting rods of traditional drill pipes is avoided, and a new and reliable design idea of forward and reverse drill pipes is provided.

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When the drill pipe is disassembled, the drill pipe can only be unlocked sequentially from the back to the front, and the drill pipe can be disassembled in sequence. Unscrew the male thread of the drill pipe C; the core pipe of the drill pipe B moves out of the self-locking female tenon of the core pipe of the A drill pipe under the action of the spring, so as to unlock the drill pipes A and B; Unlocking of the previous drill pipe.

III. CONCLUSION

The traditional forward and reverse drill pipe relies on the fluid pressure of the medium in the hole to push the piston, and the piston pushes the limiter to move radially and insert it into the thread groove, thereby limiting the thread rotation. The pressure in the hole and the tightness of the piston in the hole affect the solution of the drill pipe. Card success rate. This paper studies a new type of self-locking forward and reverse drill pipe in the rod, and introduces its structure and working principle in detail.

Through the mechanical structure, the self-locking of the drill pipe thread pair is realized, which has high reliability, large bearing torque