

Design of a New Type of Bowl Plug and Its Disassembling Device

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Abstract: In order to solve the problem that bowl plug and cylinder hole cavity are difficult to disassemble due to interference fit. Through designing a new type of bowl plug and its disassembly device, the disassembly device is connected with the new bowl plug by the matching shaft, and through the fixing of the support plate and the support frame, the bowl plug can be easily disassembled under the action of the automatic traction device, so as to save manpower and improve work efficiency.

Keywords: New Type; Automatic Traction; Matching Shaft; Telescopic Cylinder

1. Introduction

The sealing of the bowl plug needs to be guaranteed by the comprehensive factors of design matching, production process and part quality, so the problem of seal failure will inevitably occur in the mass production process [1~3]. The failure of the bowl plug is difficult to disassemble, this is because the bowl plug assembly in the cylinder hole cavity belongs to interference fit and the use of sealant in the assembly process, which leads to the disassembly process of the bowl plug and its testing of the operator's level and time-consuming and laborious, if the improper operation may lead to parts damage, thereby increasing the cost of production and maintenance, it is not easy for the efficient development of enterprises. Therefore, enterprises urgently need a bowl plug that is easy to disassemble to save production time and improve production efficiency [4~6]. In view of the problems existing in the production of enterprises, a new type of bowl plug and its disassembly device are designed. The matching part of the matching shaft is connected with the new type of bowl plug, and the disassembly of the bowl plug is realized under the traction of the automatic traction device, which makes the process of replacing the bowl plug very convenient and greatly reduces the damage of

parts. It has improved the production efficiency of the enterprise [7~8].

2. Design of New Bowl Plug

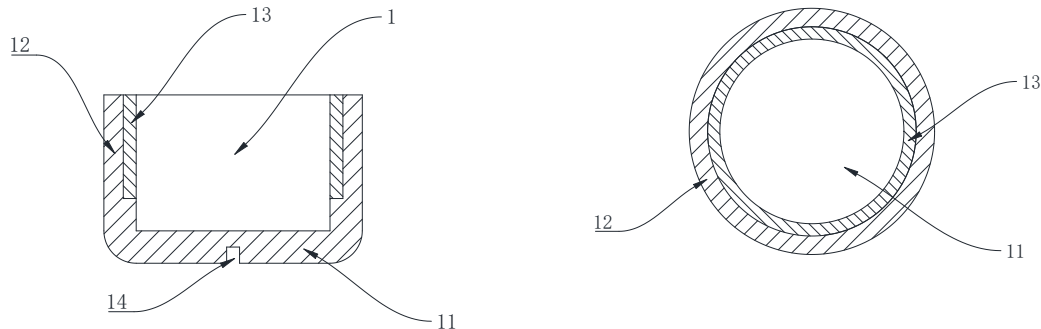
2.1 Design Purpose

The design requirements for the new type of bowl plug: not only to retain the old version of the bowl plug connection firmness and quality, but also to ensure that it is easy to disassemble and replace, has achieved the role of saving manpower and improving production efficiency.

2.2 Design Content

In order to achieve the purpose of designing a new type of bowl plug without changing the size and shape of the mounting hole of the bowl plug, resulting in additional costs, the design of the new bowl plug is mainly focused on the inside of the connecting part and the end of the capping part, so that its shape structure does not change. According to the design idea of the new bowl plug, a structure which can be movable disassembled and connected with the external device is designed to facilitate the traction of the external device. Its general shape design is: the capping part is round, the connecting part is round tube shape, and the general bowl plug is no different. The selection of the new bowl plug can be based on the common detachable connection methods of metal parts, including: pin connection, pin connection, elastic ring connection, cassette connection, thread connection. Due to the small internal space of the bowl plug is not conducive to the use of the latch and cassette connection, and the elastic ring and pin connection are easy to break and loosen, so choose a threaded connection with high strength and good reliability. The new bowl plug is designed with an internal thread inside its connection part for easy detachable connection to an external device. And a matching groove is designed in the outer part of the bowl plug cover to facilitate the separation of the bowl plug and the traction device. In this way, it can ensure that the disassembly of the bowl plug is convenient

without changing its shape. Its structure is shown



in Figure 1.

Figure 1. Structural Diagram of the New Bowl-Type Plug

Among them, 1, bowl plug main body; 11. Capping part; 12, connecting part; 13, internal thread; 14. Coordination Department.

3. Design of Disassembly Device

3.1 Design Purpose

The design purpose of the new bowl plug removal device is that it can be matched with the screw thread structure on the new bowl plug, can realize the role of external force assisted manual traction, and the disassembly process is simple and does not damage the bowl plug.

3.2 Design Content

3.2.1 The Overall Design Scheme of the Disassembly Device

Considering that the disassembly device needs to cooperate with the new bowl plug and is convenient to use. That determines the structural design of the disassembly device to be compact and small. Considering the actual installation environment of the bowl plug, a disassembly device is designed to drive the disassembly of the bowl plug by a traction device. The idea of this disassembly device is as follows:

The whole disassembly device includes three parts: matching shaft, traction device and support component. The structure of the disassembly device is shown in Figure 2. The part connected with the bowl plug is the mating shaft, which is connected with the traction device and installed on the supporting part. The supporting part is in contact with the mounting surface of the bowl plug to play a supporting role, and the disassembly of the bowl plug is realized under the drive of the traction device.

3.2.2 Design of Matching Shaft

The design of the matching shaft mainly includes three parts: matching handle, matching part and pulling part. The structure of the

matching shaft is shown in Figure 3. The mating part and the traction part are made of external threads; The mating part and the mating shaft are designed for detachable connection; The outer wall of the matching handle is designed with a non-slip line, and the matching part can be screwed into the inner side of the bowl plug connection part by turning the matching handle.

Among them, 2, matching shaft; 21, with the handle; 22, coordination department; 23, external thread; 24, traction department.

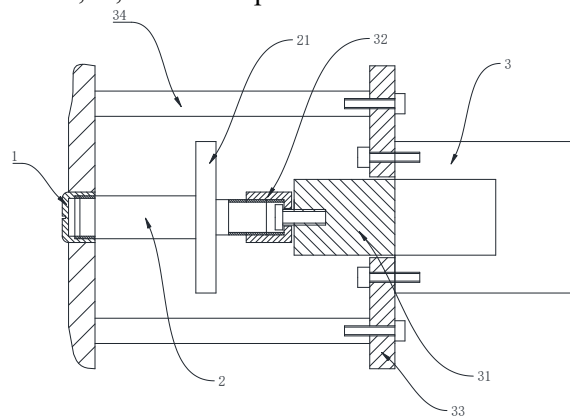


Figure 2. Structural Diagram of the Disassembly Device

Among them, 1, the new bowl plug; 2, matching shaft; 3, traction device; 21, with the handle; 31, expansion shaft; 32, traction parts, 33; 34, support parts.

3.2.3 Design of Traction Device

The design of traction device mainly includes automatic traction device and traction parts, and the structure of traction device is shown in Figure 4.

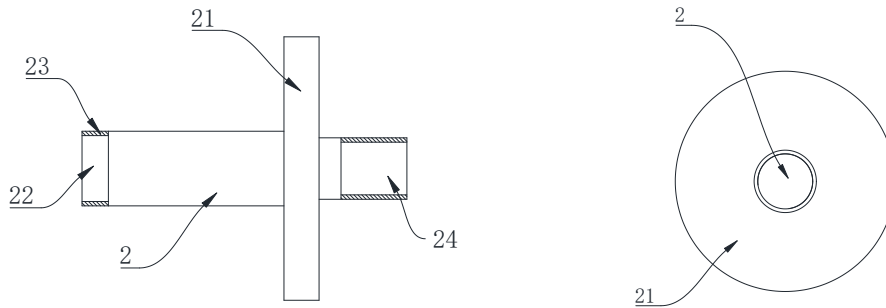


Figure 3. Structure Diagram of Mating Shaft

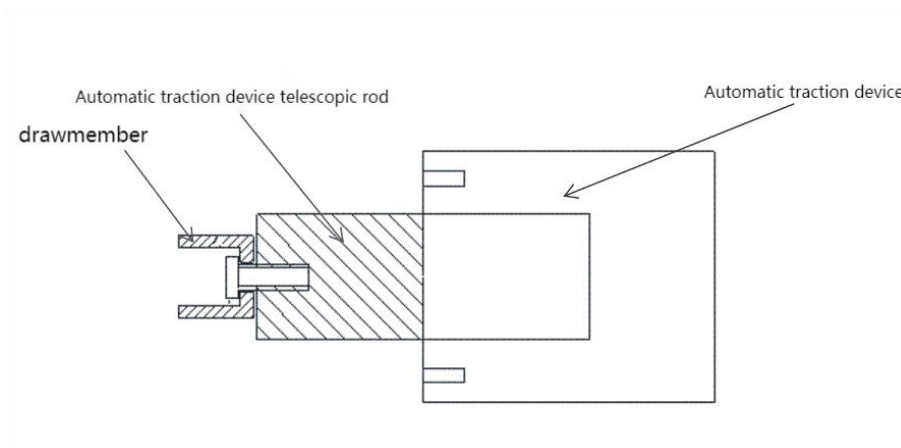


Figure 4. Structural Drawing of the Traction Device

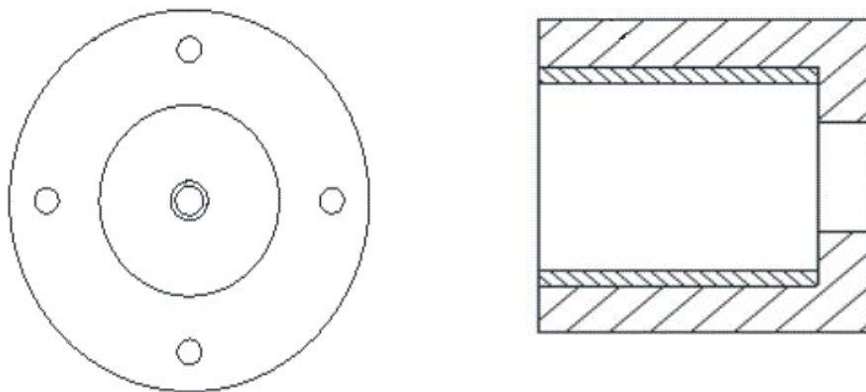


Figure 5. Structure Diagram of the Traction Device and Traction Parts

The plan of the automatic traction device and the structure of the traction parts are shown in Figure 5.

The traction part is designed with internal thread, and one end of the traction part is designed with a hole less than the thread hole and the screw hole at the end of the expansion shaft is connected with the gap screw through the gap screw. The purpose of using the gap screw is to make the traction part rotate with the gap screw as the shaft so that the other end is connected

with the matching shaft through the thread connection.

The automatic traction device is a kind of telescopic shaft, the end rotation can be connected to the traction part, and the axis of the matching shaft is the power source of the coaxial axis, through the automatic traction device to drive the matching shaft along the axial movement of the telescopic shaft. The automatic traction device is designed with a plurality of

threaded holes, so that it can be fitted with the threaded holes on the support component.

3.2.4 Design of Support Components

A support component consists of a support disk and a support component, which are connected together by screws. Figure 6 shows the structure of the support component.

The support plate is connected to the support rod by screws, and is also the mounting part of the traction device, which is also connected by screws.

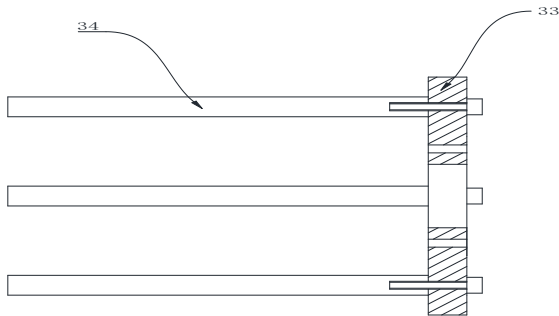


Figure 6. Structure Diagram of Support Components

33, support plate;34, support rod

3.2.5 Function Realization of the Bowl Plug Disassembly Device

In use, the mating part of the mating shaft can be first screwed into the internal thread of the bowl plug through the external thread, and then the traction part and the traction part can be combined together, or the traction part and the traction part can be combined together first, and then the mating part of the mating shaft can be screwed into the internal thread of the bowl plug

through the external thread, at this time, the axis of the bowl plug, the mating shaft and the expansion shaft are located in the same straight line. Start the automatic traction device, the expansion shaft shrinks, and drives the bowl plug from the mounting surface, so that the bowl plug is removed, and then the matching slot is rotated in the opposite direction by matching with the screwdriver of the corresponding pattern, so that the internal thread and external thread are rotated away, and the bowl plug can be removed from the mating shaft.

4. Bowl Plug Air Tightness Test

In order to verify the feasibility of the design of the new bowl plug, the air tightness test of the bowl plug was carried out, and its experimental structure was shown in Table 1.

5. Conclusion

- (1) According to the existing water leakage problem through the deformation of the bowl plug, a threaded bowl plug is designed to solve the leakage problem caused by the pressing deformation of the bowl plug; The advantage is that it can be directly screwed according to the convenience, and the torque and Angle can be controlled;
- (2) At the same time, design a disassembly tool with its threaded bowl plug, the disassembly device is convenient, efficient, durable and other characteristics, free the labor force, improve the repair and replacement efficiency of the bowl plug;

Table 1. Bowl Type of Plug Air Tightness Test

Method	The test process	Number of test pieces	Air tight leakage (cc/min)	Standard for air-tight leakage amount (cc/min)
Pressure difference test	The compressed air of 7bar, pre-inflated for 5s, inflated for 40s, equilibrated for 28s, measured for 28s, and vented for 5s.	trial 1	0.34	≤1.4
		Trial 2	0.16	
		Trial 3	0.24	
		Trial 4	0.31	
		Trial 5	0.36	
		Trial 6	0.41	
		Trial 7	0.25	
		Trial 8	0.28	
		Trial 9	0.32	
		Trial 10	0.32	

(3) The test verifies the air tightness of the new bowl-shaped plug. It adopts 7bar compressed air, pre-aerates 5s, aerates 40s, balances 28s, measures 28s, and exhauts 5s, and its airtight leakage does not exceed 1.4cc/min. The bowl-shaped plug meets the requirements of airtight.

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