



Hot Melter Auxiliary Connection Device

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Abstract: PPR pipe and PE pipe are widely used and used in a large amount. The connection mode is mainly hot melt connection, but there are some defects. In order to avoid being scalded by high temperature die head when users use hot melters, there is a large deviation in the connection of PPR pipe and PE pipe, which leads to water leakage or pipe damage at the connection. In this paper, through modular theoretical analysis and SOLIDWORKS three-dimensional modeling software, a three-dimensional model of the auxiliary connection device of the hot melter composed of three-claw clamping mechanism, skateboard docking mechanism and pipe diameter adjustment mechanism is designed. Ideally, the rational use of the auxiliary connection device of the hot melter can reduce the safety hazards during use and improve the accuracy and reliability of the connection process. The auxiliary connection device of the hot melter provides a reference for the research of PPR pipe and PE pipe welding operation, and has certain development significance for the welding technology of PPR pipe and PE pipe.

Keywords: PPR Tube; Hot Melter; Modular Theoretical Analysis; Welding; Hot Melter Auxiliary Connection Device; Three-Claw Clamping Mechanism;

1 INTRODUCTION

With the continuous progress of living standards and science and technology, the status of PPR (Polypropylene-Random) pipe and PE (Polypropylene) pipe in housing decoration and gas transportation can not be underestimated. It has the characteristics of corrosion resistance, high toughness, excellent flexibility, long service life, and high safety of water transmission [1], Because of its unique characteristics better than galvanized steel pipe, galvanized steel pipe can be eliminated, and now widely used in housing decoration, gas transportation and other pipeline transportation fields. Because of its wide use and large amount of use, its connection is a very worthy of attention. Nowadays, PPR pipe and PE pipe are mainly connected with fusion connection, mechanical seal connection, pressure-free pipe connection and so on. [2]-[4]. In life, the hot melt pipe is often connected by the hot melt of the hot melter and then the pipe is connected. The hot melt pipe of the hot melter is used to lay an important foundation for the subsequent connection of the pipe, and there are also certain defects. In terms of safety, because the user is too close to the hot melt die during the hot melt process, a slight mistake will be scalded by the high temperature die ; in terms of technology, if the user does not have a certain experience, improper operation during docking will lead to leakage of water or instability of pipe docking, resulting in waste of materials and economic losses. At present, the small PE pipe hot melt connection machine for home decoration is used [5]. A small PE pipe hot melt connection machine suitable for home installation and other

occasions has been developed, but it can not clamp pipes of different diameters more effectively. In order to avoid potential safety hazards when using hot melters, and to fuse pipes of different diameters more effectively, while ensuring accurate docking to reduce material losses, this paper designs an auxiliary connection device for hot melters. This paper uses modular theory [6], The SOLIDWORKS three-dimensional modeling software was used to design the three-dimensional model of the hot melt auxiliary connection device composed of the three-claw clamping mechanism, the skateboard docking mechanism, and the pipe diameter adjustment mechanism.

2 MODULAR ANALYSIS OF AUXILIARY CONNECTING DEVICE OF HOT MELTER

2.1 PROBLEMS IN WELDING OF HOT MELTER

Hot melter is an important tool for connecting PPR pipe and PE pipe. After hot melt of hot melter, the pipe connection is more convenient, but there are some defects in hot melter. This paper analyzes from the following aspects :

(1) In terms of safety, during the hot melt process, the high-temperature die head is an indispensable part of the hot melt, and because of its potential safety hazards. In the process of hot melting, the user needs to hold the pipe with both hands to make the pipe dock with the die. When docking with the die, the distance between the two hands and the high temperature die is close, and a little carelessness will be scalded.

(2) In terms of technology, the hot melter only plays the role of hot melt. In the process of docking between pipes, if the user does not have certain operational experience, it will lead to docking deviation, affecting the normal use of PPR pipes and PE pipes, forcing water leakage or unreliable pipe connection, resulting in waste of materials and economic losses.

2.2 MODULAR ANALYSIS AND DESIGN OF AUXILIARY CONNECTING DEVICE FOR HOT MELTER

Modular design is a design method that decomposes the product into multiple functional modules [7]. It has many advantages, such as better support for customization, easier implementation of component updates, and shorter product development cycles.. Modular design is widely used in many important fields, and complex products can be designed and developed more flexibly and efficiently.

The modular design analysis of the auxiliary device of the hot melter is to first analyze and design the auxiliary connecting device of the single-diameter PPR pipe and PE pipe hot melter, and design different components for the different problems of the hot melter and the functions to be realized.. The auxiliary connecting device of the hot melter, that is, the auxiliary connecting device of the multi-diameter PPR pipe and PE pipe hot melter, is to optimize and improve the mechanism that constitutes the auxiliary connecting device of the single-diameter PPR pipe and PE pipe hot melter or redesign other mechanisms to meet the functional requirements of the auxiliary connecting device of the multi-diameter PPR pipe and PE pipe hot melter.

The design steps of the auxiliary connection device of the hot melter : first, analyze the problems of the hot melter and design the corresponding mechanism to solve the problems, consider the feasibility of the designed mechanism, and optimize it to meet the functional requirements. Secondly, different mechanisms are combined to form a single-diameter hot melter auxiliary connection device, and different mechanisms must be coordinated to complete the hot melting and docking of the pipe. Finally, in order to solve the singleness of the connection of the auxiliary connection device of the single-diameter hot melter, the mechanism of the auxiliary connection device of the single-diameter hot melter is analyzed, and the optimization design is carried out to form the auxiliary connection device of the multi-diameter hot melter, that is, the auxiliary connection device of the hot melter.

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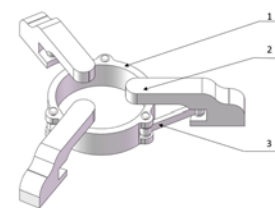
diameter hot melter is analyzed, and the optimization design is carried out to form the auxiliary connection device of the multi-diameter hot melter, that is, the auxiliary connection device of the hot melter.

3 DESIGN OF AUXILIARY CONNECTION DEVICE FOR SINGLE-DIAMETER HOT MELTER

Firstly, the auxiliary device of the single-diameter pipe hot melter is analyzed, and then the mechanism that meets the functional requirements of the single-diameter pipe fusion auxiliary device is designed to optimize the problems in the improvement mechanism.

3.1 DESIGN OF THREE-CLAW CLAMPING MECHANISM

In terms of safety, in order to avoid the user too close to the die, the design of mechanical structure clamping pipe can better ensure the safety of the user. The designed clamping mechanism must replace the hands to clamp the pipe tightly, so as to avoid loosening at work and unable to meet the functional requirements. The three-jaw chuck has the characteristics of large clamping range, strong clamping force, strong flexibility and convenient operation, which is very in line with the selection of clamping mechanism. The clamping mechanism is designed with reference to the three-jaw chuck, and the designed clamping mechanism is as shown in Figure 1. There are three-jaw clamping mechanisms on both sides of the hot melt, which push the clamping claw to the center of the clamping ring to fix the pipe, and then use the sizing bolt to lock the pipe, thus completing the clamping process.



1.GRIPPING RING ; 2. CLAMPING CLAWS ; 3. CLAMPING ROD

FIG. 1 THREE-CLAW CLAMPING MECHANISM

If the three-claw clamping mechanism docks the pipe, the pipe will be stuck by the three-claw clamping mechanism and cannot be taken out as shown in Fig.2.For its optimization and improvement, the clamping ring is designed to be open-loop as shown in Fig.3.After the welding is completed, the pipe will be taken out, and the pipe will not be stuck by the three-claw clamping mechanism.

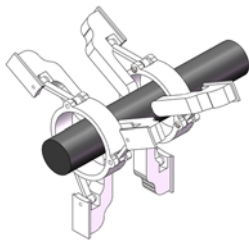


FIG. 2 THE PIPE IS STUCK

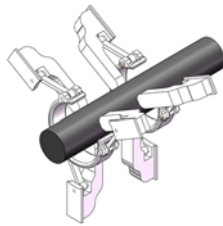


FIG.3 AFTER OPTIMIZATION OF THE CLAMPING RING

FIG. 4 SKATEBOARD DOCKING MECHANISM

If the three-jaw clamping mechanism docks the pipe, the pipe will be stuck in the clamping mechanism and cannot be taken out as shown in Figure 5. Therefore, the joystick is improved. The improved slide plate docking mechanism is shown in Figure 6, and the push handle is connected without getting stuck.

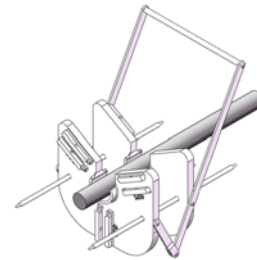


FIG. 5 THE PIPE IS STUCK

3.2 DESIGN OF SKATEBOARD DOCKING MECHANISM

In terms of technology, the clamping mechanism has the effect of fixing the pipe, there is no role in moving the pipe, the pipe to be clamped to carry out the hot melt, docking, you need the mechanism to assist the clamping mechanism to slide the docking. Considering the size of the three-claw clamping mechanism and the ability to better play the role of the three-claw clamping mechanism, it is decided to design the docking mechanism as a skateboard. The designed skateboard docking mechanism is shown in figure 4. When the three-claw clamping mechanism completes the clamping, the handle is promoted, and the skateboard clamping mechanism drives the three-claw clamping mechanism to move closer to the hot melt or the pipe. In view of the deviation of the fusion, the axial line of the pipe, the hot melt and the clamping mechanism is designed on the same line.

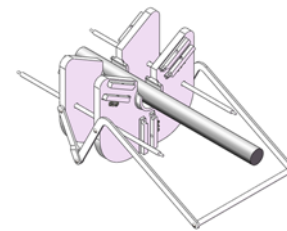
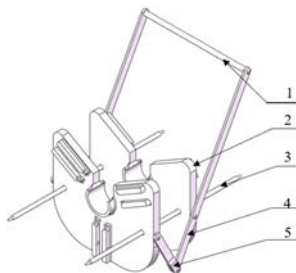


FIG. 6 AFTER THE JOYSTICK IS IMPROVED

The sizing hole is set in the chute of the sliding plate docking mechanism, and then the sizing bolt is designed. When the clamping claw clamps the pipe, the sizing bolt is inserted into the sizing hole to fix the pipe of the diameter as shown in Fig.7.



1.HANDLE ; 2.SKATEBOARD ; 3.GUIDE ROD ; 4.CONTROL ROD ; 5.AUXILIARY CONNECTING ROD

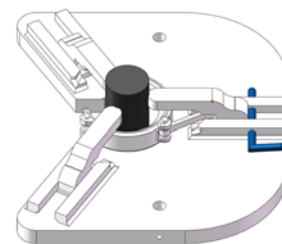
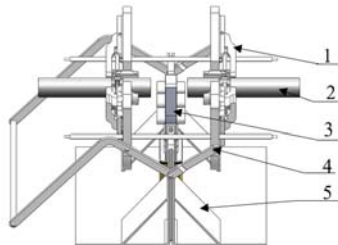


FIG. 7 SIZING BOLT INSERTED INTO SIZING HOLE

3.3 AUXILIARY CONNECTION DEVICE OF SINGLE DIAMETER HOT MELTER

In order to solve the existing problems of the hot melter, the auxiliary device of the single-diameter pipe hot melter is analyzed and designed. The auxiliary connecting device of the single-diameter hot melter composed of a three-jaw clamping

mechanism and a sliding plate docking mechanism is designed as shown in Fig. 8. The auxiliary connecting device of the single-diameter hot melter can solve the problems of the hot melter in terms of safety and technology, but it can only be welded to the PPR pipe and PE pipe of a single diameter.



1.THREE-CLAW CLAMPING MECHANISM ; 2.TUBE ; 3.HOT MELTER ;4.SKATEBOARD DOCKING MECHANISM ; 5. RACK

FIG.8 AUXILIARY CONNECTION DEVICE OF SINGLE-DIAMETER HOT MELTER

4 DESIGN OF AUXILIARY CONNECTION DEVICE FOR MULTI-DIAMETER HOT MELTER

The auxiliary connection device of single-diameter hot melter only meets the fusion of single-diameter pipes. In order to solve the single use of the auxiliary connection device of single-diameter hot melter, some of its mechanisms are optimized and improved, and the mechanism is redesigned to meet the functional requirements of multi-diameter pipes.

4.1 PARTIAL MECHANISM OPTIMIZATION OF AUXILIARY CONNECTION DEVICE FOR SINGLE-DIAMETER HOT MELTER

The three-claw clamping mechanism can meet the clamping of single-diameter pipes, but its sizing bolt can only fix a single-diameter pipe as shown in Figure 9. To meet the functional requirements of clamping multiple diameters, the three-claw clamping mechanism needs to be improved. This design considers the use of a sizing bolt to insert the sizing hole to fix the pipe. If too many sizing holes are set at the same chute, the sizing hole at the slot is too concentrated, and the sizing hole is easy to be damaged under long-term action. The phenomenon affects the normal use. The sizing hole is distributed to the three chutes as shown in Figure 10, which can effectively solve the problem of the destruction of the sizing hole. When the target pipe is clamped, the sizing bolt is inserted into the sizing hole of the corresponding diameter to fix the pipe.

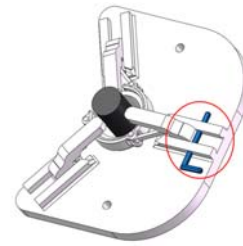


FIG.9 SIZING BOLT LOCKING THREE CLAWS

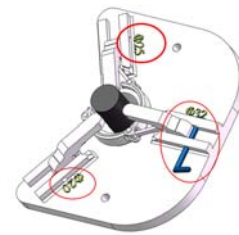
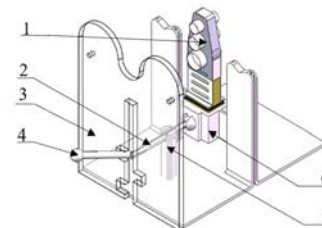


FIG. 10 IMPROVED SIZING HOLE

4.2 THE AUXILIARY CONNECTING DEVICE MECHANISM OF SINGLE DIAMETER HOT MELTER IS INCREASED

So far, the only problem is that the diameter of the hot melter can not be adjusted, and it is difficult to adjust the diameter of the hot melter without increasing the mechanism. Therefore, the mechanism can be increased to enable it to adjust the diameter of the pipe. The hot melter is placed vertically on the auxiliary device, and the designed mechanism can make the hot melter move in the vertical direction, which is convenient for the transformation of the diameter of the pipe. The downward force is applied to the regulating handle, and when the hot melter die is adjusted to the target pipe diameter, the regulating handle is stuck to the corresponding position of the pipe diameter on the rack plate as shown in figure 11, and then the optimized three-claw clamping mechanism, the slide plate connection mechanism, and the pipe diameter adjustment mechanism are combined to form the final hot melter auxiliary connection device of this design.



1.HOT MELTER MODEL ; 2. CONNECTING ROD ; 3. RACK PLATE ; 4.ADJUST THE HANDLE ; 5.ADJUSTING THE SUPPORT ROD ; 6.FIXTURE OF HOT MELTER

FIG. 11 PIPE DIAMETER ADJUSTMENT MECHANISM

4.3 DESIGN OF AUXILIARY CONNECTION DEVICE FOR HOT MELTER

Through the optimization and improvement of the partial mechanism of the auxiliary connecting device of the single-diameter hot melter and the increase of the diameter mechanism of the hot melter, the problems of the hot melter are solved, and the functional requirements of the multi-diameter pipe are satisfied. Finally, the three-jaw clamping mechanism, the sliding plate docking mechanism, the diameter adjustment mechanism and the frame constitute the final auxiliary connecting device of the hot melter, as shown in Fig.12.

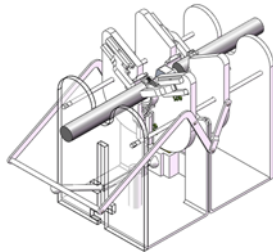


FIG.12 OVERALL ASSEMBLY DIAGRAM OF HOT MELTER AUXILIARY DEVICE

4.4 HOT MELTER AUXILIARY CONNECTION DEVICE OPERATION STEPS

The operation steps of the auxiliary connecting device of the hot melter are :

- (1) Pipe clamping : The pipe is placed in an appropriate position, and the clamping claw is pushed to the center of the clamping ring to clamp the pipe, and the sizing bolt is inserted into the corresponding sizing hole to fix the pipe.
- (2) Pipe hot-melt : When hot-melt, the pipe diameter adjustment mechanism is used to adjust the diameter of the target hot-melt die, and the sliding plate docking mechanism is pushed to connect the clamped pipe with the hot-melt die.
- (3) Pipe connection : After hot melting, the sliding plate docking mechanism is pulled to separate the pipe from the hot melter die. After the pipe diameter adjustment mechanism is put down the hot melter, the sliding plate docking mechanism is pushed again to connect the two pipes.
- (4) Take-out device : Take out the sizing bolt, loosen the clamping claw, take out the auxiliary connecting device of the hot melter, and complete all the operation steps of the auxiliary connecting device of the hot melter.

5 CONCLUSION

In this paper, through the analysis and design of modular theory, using SOLIDWORKS three-dimensional modeling software, a hot melt auxiliary connection device composed of three claw clamping mechanism, sliding plate docking mechanism and pipe diameter adjustment mechanism is designed to solve the safety and technical problems in the fusion of hot melts. It plays an important role in the fusion of PPR pipes and PE pipes, ensuring the safety of users and improving the accuracy of fusion. This hot melt auxiliary connection device provides a reference for the research of fusion operation of PPR pipes and PE pipes, and has certain development significance for the fusion technology of PPR pipes and PE pipes. It also provides some design ideas for the optimization and improvement of hot melts in the future.

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