

Development of a Safe Self-centering Tapping and Threading Device

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Abstract: This paper introduces a safe self-centering Tapping and Threading Device, which combines the functions of the hinge bar and the die holder to achieve the purpose of convenient and efficient thread processing, reducing the labor intensity of workers and ensuring product quality. Improve production efficiency, reduce production costs, and improve economic efficiency.

1. Introduction

In lathe processing threads below M20, reamers or plate toothholders are often used to clamp the taps and screw die for threading or tapping. In the process of machining, it is necessary to locate the center line of the spindle by the top hole of the tailstock. The deviation of the workpiece axis from the center line of the lathe spindle is easy to occur, and the orientation is not easy to guarantee. Thus, the deviation of the thread sleeve or the deviation of the thread sleeve will occur.

When processing, the left hand plate is needed to move the hinge or the plate tooth frame, and the right hand rotates the tailstock to make the two feed synchronously. This is more laborious, and it is easy to produce the phenomenon of tap or plate tooth fracture, resulting in the increase of the rejection rate of the workpiece and the loss of the tool.

It is difficult to meet the rapid development of modern machinery industry for the processing of threads by ordinary hinges and plate toothholders. How to process internal and external threads quickly and efficiently and reduce the waste rate and tool loss has become a new market target.

On the one hand, there is almost no such fixture. Analyse the results of market information, and produce a product that can win in the competition in the future as the development goal.

2. Design Scheme of Safe Self-centering Tapping and Threading Device

It will be creative and exploitative to combine the structural characteristics of traditional hinges and plate toothholders and combine them into a new tapping and threading device based on the principle of innovative mechanical design.

Firstly, according to the defects of tap and screw die processing, the transfer body and force transfer body of machine tool tailstock are designed by floating alignment method under the condition of fixed tail. It can automatically adjust positioning and alignment with the relative rotation of the tap or screw die and the workpiece, so as to ensure that the requirement can still be reached when the center line of the spindle deviates from the axis of the workpiece.

Secondly, in order to reduce the friction between the tailstock and the guide rail surface, according to the thread length of most workpieces, the tailstock of the machine tool is connected to the body to design the guide groove hole. The force transfer body only needs to move freely through the guide groove hole in the tailstock of the machine tool, while the tailstock of the machine tool can be fixed.

Finally, a protective device and a clamp for taps and screw die are designed on the head of the force transfer body, which can clamp various taps and screw die and protect them from damage.

3. Implementation Scheme of Safe Self-centering Tapping and Threading Device

Firstly, according to the top hole structure of lathe tailstock, thread length of most workpieces, common tap and plate-tooth fixture, the specific structure of the tailstock switching body, guide slot hole length, protection device and tool clamping body of the new fixture are designed respectively.

Then calculate and determine the actual size of each part of the new fixture, draw part drawings and formulate processing technology. The material used should be analyzed and determined. Material selection should ensure that it is easy to machine. Fig. 1 is the overall assembly drawing of the self-centering tapping and threading device.

In the picture, 1. Force transfer body, 2. Tool clamping body, 3. Lathe tailstock adapter body, 4. Force transfer shaft, 5. Shaft shoulder, 6. Length guide shaft, 7. Auxiliary guide shaft, 8. Parts yield hole, 9. Tool clamping hole, 10. Force transfer shaft sleeve hole, 11. Tool fastening screw, 12. Lathe tailstock adapter handle, 13. Force transfer body adapter, 14. Length guide shaft sleeve hole, 15. Auxiliary guide shaft sleeve hole, 16. Thrust Spring, 17. Guide groove hole, 18. Guide bolt, 19. Pre-tightening spring, 20. Annular groove, 21. Locking inclined groove, 22. Locking sleeve, 23. Ball pin, 24. Compression screw, 25. Compression spring, 26. Chip discharge hole, 27. Taper clamping sleeve, 28. Screw die switching sleeve.

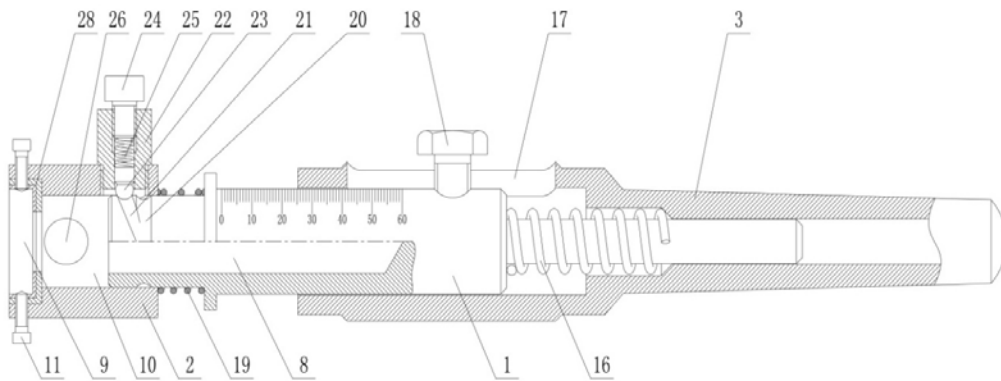


Fig. 1 Overall assembly drawing

4. Innovative Institution of Safe Self-centering Tapping and Threading Device

4.1 Protective devices

Common screw taps (screw die) are often damaged due to excessive friction resistance when they are used. If the screw taps (screw die) rotate, the sleeve components connecting the screw taps (screw die) can rotate relative to the sleeve body, thus avoiding the torsional breakage of the screw taps (screw die) relative to the sleeve body. Based on the above ideas, combined with comprehensive innovation theory and transplantation innovation theory, inspired by the turnout principle of track and combined with the actual situation of work, a new protection device is designed, as shown in Figure 2.

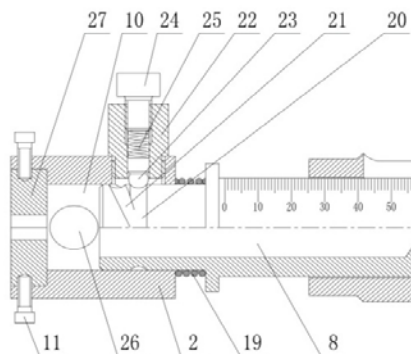


Fig. 2 Schematic diagram of overload protection device

When the processing resistance of the inner thread is greater than the damage force of the tap, the relative slip will occur between the ball pin 23 and the locking inclined groove 21, and the torque of the tap will not increase until the ball pin 23 slides into the ring groove 20 from the locking inclined groove 21, the pre-tightening spring 19 is compressed, and the tool holder 2 rotates idly to protect the tap from overload.

Similarly, this protective device is also applicable to the protection of screw die.

4.2 screw die transfer sleeve

Combining the principle of toy "doll" with the theory of transplantation innovation, we design the screw die transfer socket group, as shown in Figure 1-28.

4.3 Taper clamping sleeve

The inner quadrangular holes of the taper clamping sleeve are designed into different quadrangular holes according to the size of the taper handle, as shown in Fig. 2-27, and the fit clearance between them is 0.5-1 mm. When the workpiece is not clamped properly, the taper has the floating amount of automatic centering.

4.4 Self-centering structure

The fit clearance between the force transfer body and the tailstock transfer body of machine tool is 0.5-1 mm. When the workpiece is not clamped properly, the tap or the screw die have the floating amount of automatic centering.

5. Working Principle of 4 Safe Self-centering Tapping and Threading Device

Taking the processing of internal threads as an example, the operation steps are as follows:

Step 1: Insert the taper handle of the lathe tailstock into the lathe tailstock for fixing, adjust the pre-tightening force of the tightening screw according to the size of the internal thread to be processed, so that the ball head pin is placed in the locking chute under the set pre-tightening force, and then select a tap for processing and a taper clamping sleeve matching with the tap, place the tap clamping sleeve into the tool clamping hole, and tighten the tool. Fixed the screw, complete the fixing of the tap clamping sleeve in the tool clamping hole, then insert the square handle at the end of the tap into the tap clamping sleeve, and then adjust the axial position of the tap until the top of the tap is close to the hole opening of the screw hole to be processed, while ensuring that the compression of the thrust spring is greater than the tapping stroke.

Step 2: Start the lathe, control the spindle of the lathe to rotate forward, the thrust spring to output the axial thrust in reverse, so that the tap can feed automatically, and determine the feed through the scale of the fixed-length guide axis. When the processing resistance of the internal thread is less than the damage force of the tap, there is no relative slip between the ball head pin and the locking chute, and the lathe provides the tap with continuous rotating moment, straight. When the processing resistance of the internal thread is greater than the damage force of the tap, the relative sliding will occur between the ball pin and the locking chute, and the torque of the tap will not increase until the ball pin slides into the ring chute from the locking chute, the pre-tightening spring is compressed, the tool holder body rotates idly, and the tap is protected by overload.

Step 3: Control the spindle inversion of the lathe after processing; when no overload protection occurs, the tap will exit the screw hole directly; when overload protection occurs, under the reverse thrust of the pre-tightening spring, the ball head pin will return from the ring slot to the locking inclined slot through the spindle inversion of the lathe, and then the tap will exit the screw hole; until the thrust spring restores its initial length, then the ball head pin will return to the locking inclined slot. The tap is withdrawn from the tap clamping sleeve.

The principle of processing external and internal threads is basically the same. This product can also clamp reamers for reaming, which is not described here.

6. Conclusion

The new fixture combines the functions of the hinges and the plate toothholder with the comprehensive innovation theory, breaks through the limitation of the original tools, and achieves the goal of efficient thread processing. It can not only clamp different specifications of taps and screw die below M20, but also realize self-centering, protect the taps and screw die from damage, and also hold different specifications of reamers. To achieve floating automatic centering, the thread is not easy to cover or offset; the protective device structure can protect the tap and screw die from damage in use; from manual thread processing to automatic processing, reduces the labor intensity of workers, ensures product quality, improves production efficiency, reduces production costs and improves economic efficiency. The safe multi-functional self-centering tapping and threading device proposed in this paper has been patented and authorized.

Acknowledgements

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