Design and Manufacture of the Cylinder Head Sub-assembly Duct Chamfer Device

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Abstract: The engine cylinder head sub-assembly duct chamfer processing unit, including the guide and tool mechanism, which consists of the first drive assembly and the guide assembly attached to it, the first drive assembly is used to drive the guide assembly to guide the workpiece in the first direction, and the tool mechanism consists of the second drive assembly and the tool assembly. The tool assembly consists of the tool holder and several tools that are attached to it for removal, and the second drive assembly is connected to the tool holder to drive the tool holder in the second direction. By setting up the guide mechanism and the tool mechanism, the guide mechanism can adjust the position of the cylinder head before it enters the chamfer process, ensuring that the head attitude is within a reasonable error range, improving the precision of the processing and adapting to the different dimensions of the cylinder head; the tool mechanism can adjust the position of the tool before the chamfer process is carried out. Improve processing accuracy; by setting up a detachable tool, it can accommodate the chamfered demands of the different types of cylinder head ducts and is highly adaptable.

Keywords: Cylinder Head Sub-Assembly; Conduit Chamfer; Guide Mechanism; Tool Mechanism

1. Introduction

The cylinder head sub-assembly is one of the important box components of the entire engine, and the processing of the conduit holes is the key point in its processing [1~4]. When processing the cylinder head conduit, the processed catheter hole needs to be chamfered by the chamfered processing equipment. The existing chamfering equipment cannot accommodate the chamfering needs of the catheters in different sizes and models of the cylinder head, cannot satisfy the processing requirements, and has low processing precision [5~7].

2. Overall design of the Conduit Chamfer Device

2.1 Guidance Mechanism Design

For the design of the guide mechanism, consideration is given to the first drive assembly and the guide assembly. The first drive assembly is connected to the guide assembly, the first drive assembly is used to drive the guide assembly to guide the workpiece to be processed in the first direction, and the first direction is the transport direction of the workpiece to be processed.

The guide assembly consists of at least two deflector plates positioned relative to each other in the third direction, the third direction, the second direction, and the first direction intersect, creating a space for positioning between the two guide plates, and the first drive assembly consists of at least two first cylinders. The two first cylinders are connected to the two guide plates, the first cylinder is used to adjust the spacing of the positioning space. Each deflector has a guide face facing the opposite deflector, the guide face is curved, and the gap between the two guide faces decreases gradually in the first direction. There are several guide rollers on the guide surface, and several guide rollers are set apart in the extended direction of the guide surface. The second drive assembly consists of the first motor and the spindle rail module, which is connected to the first motor, the spindle rail module is used to drive the first motor in the first direction, and the output of the first motor is connected to the tool assembly. The spindle rail module consists of the second motor, the spindle and the moving plate, the length of the spindle is set in the first direction, the output of the second motor is connected to the spindle, the

moving plate is connected to the spindle. The second motor is used to drive the moving plate along the spindle. The chamfer processing unit also includes a stop mechanism consisting of the third drive and stop, the third drive connected to the stop, and the third drive used to drive the stop to limit the processing workpiece in the second direction. The third driver consists of the second cylinder, which contains the stop blocks, the second cylinder is connected to the stop blocks, and the second cylinder is used to drive the stop blocks in the second direction.

2.2 Tool Mechanism Design

For the design of the tool mechanism, consider the second drive assembly and the tool assembly, which includes the tool holder and multiple tools, each tool can be attached to the tool holder and the second drive assembly is connected to the tool holder. The second drive assembly is used to drive the cutterbed in the second direction, which intersects the first direction.

2.3 Auxiliary Mechanism Design

For the design of the auxiliary mechanism, including the clamping mechanism, the clamping mechanism consists of the fourth drive assembly and the clamping assembly, the fourth drive assembly is connected to the clamping assembly, and the fourth drive assembly is used to drive the clamping assembly. The processing workpiece is clamped in the third direction, with the third, first and second directions intersecting. The clamping assembly consists of at least two opposing clamps, which create a clamping space between the two clamps, the fourth drive assembly consists of at least two third cylinders, the two third cylinders are connected to each clamp plate, and the third cylinder is used to adjust the spacing of the clamping space.

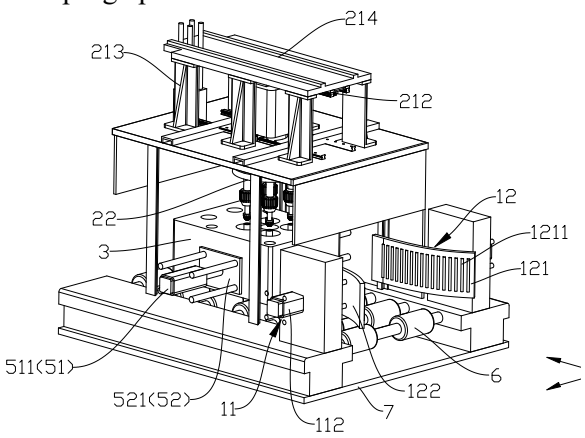

Figure 1. Illustration of the Construction of the Chamfer Processing Unit

11, the first drive assembly; 111, the first cylinder I; 112, the first cylinder II; 12, the guide assembly; 121, First deflector; 1211, guide pulley; 122, second deflector; 41, stop; 411, stop; 51, Fourth drive assembly; 511, third cylinder; 52, clamping assembly; 521, clamp plate; 6, transport roller; 7, The base plate;

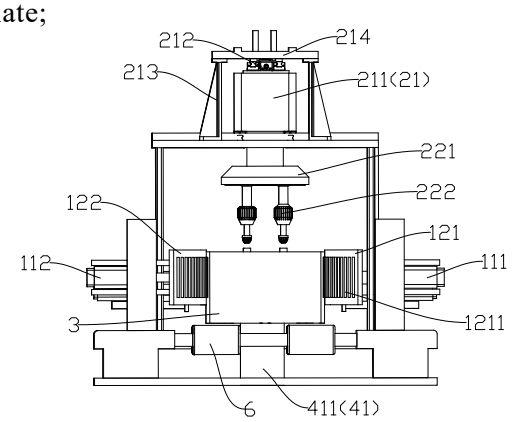

Figure 2. Front View of the Chamfer Processing Unit

21, Second Drive Assembly; 211, first Motor; 212, Screw Rail Module; 2121, Second Motor; 2122, Spindle; 2123, moving plate; 2124, spindle bearing block; 2125, coupling; 213, spindle support block; 214, Fixing plate; 22, tool assembly; 221, tool holder; 222, tool;

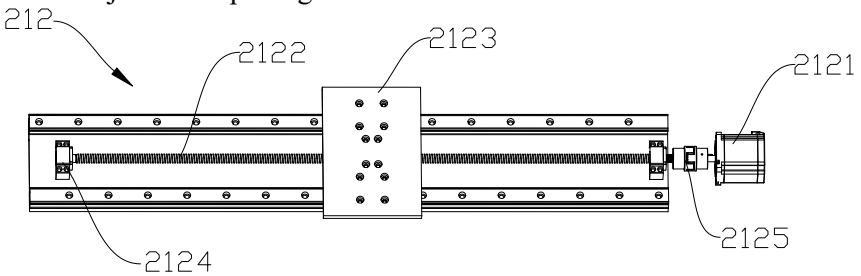

Figure 3. Schematic Illustration of the Spindle Guide Molding Structure of the Chamfer Processing Unit

3. How It Works

Figures 1 to 2 show the construction of the chamfer processing unit for the implementation mode, and figure 3 shows the construction of the spindle rail module 212 for the implementation mode. In figures 1 and 2, the two directions that are essentially parallel to the top surface of the backplane 7 and intersect each other are referred to as the first direction X and the third direction Z, and the first direction X is perpendicular to the third direction Z, the second direction Y is essentially perpendicular to the base plate 7 (that is, the vertical direction), and, The second direction Y, the first direction X, and the third direction Z are perpendicular to each other.

The chamfer processing unit consists of the base plate 7 and the guide and tool mechanism set on the base plate 7, as shown in figures 1 to 3, which consists of the first drive assembly 11 and the guide assembly 12, which are connected to the guide assembly 12, according to the implementation method. The first drive assembly 11 is used to drive the guide assembly 12 to guide the workpiece to be processed 3 in the first direction X and the workpiece to be processed 3 in the engine head. The tool mechanism consists of the second drive assembly 21 and the tool assembly 22, the tool assembly 22 includes the tool holder 221 and several tools 222, each tool 222 can be connected to the tool holder 221, and in production, different tools 222 can be replaced according to the cylinder head model. Chamfers of different sizes are possible, with the second drive assembly 21 connected to the tool holder 221, the second drive assembly 21 used to drive the tool holder 221 along the second direction Y and the second direction Y perpendicular to the first direction X.

The chamfer processing unit is set up by setting the guide and the tool mechanism. The guide mechanism consists of the first drive assembly 11 and the guide assembly 12. The first drive assembly 11 drives the guide assembly 12. The guide assembly 12 guides the workpiece 3 to be processed in the first direction X, the first direction X is the transport direction of the workpiece 3 to be processed. The tool mechanism includes the second drive assembly 21 and the tool assembly 22. The second drive assembly 21 drives the tool assembly 22 in the second direction Y, thus adjusting the position of the tool 222 before the chamfering process. Improve processing accuracy; tool assembly 22 includes tool holder 221 and several tools 222 that are detachable to it, making it easy to change different tools 222 by setting a detachable tool 222, able to accommodate the chamfered requirements of the different head guide tubes, enabling the chamfering of different conduit sizes, Highly adaptable.

The guide assembly 12 consists of two deflector plates set opposite Z in the third direction, creating a space for positioning between the two guide plates, the first drive assembly 11 consists of at least two first cylinders, the two first cylinders are connected to each deflector, and the first cylinder is used to adjust the spacing of the locating space. The chamfer processing unit also includes the transport roller 6, which moves the cylinder head in the first direction X, the guide assembly 12 includes the first guide plate 121 and the second guide plate 122, which are set relative to the transport roller 6, and the first guide plate 121 and the second guide plate 122, which create a space for positioning. The first drive assembly 11 consists of the first cylinder I 111 and the first cylinder II 112. The rod of cylinder I 111 is connected to the first deflector 121, the rod of cylinder I 112 is connected to the second deflector 122, and the cylinder head is moved on the transport roller 6. Cylinders I 111 and II 112 respectively move the first deflector 121 and the second deflector 122 close to or away from each other to adjust the positioning space gap. The position of the cylinder head before it enters the chamfered process is adjusted to ensure that the position of the cylinder head is within a reasonable error range, improving the processing accuracy of the cylinder head, and also by adjusting the positioning space gap. Can accommodate different cylinder heads, meet processing needs and have good suitability.

Each deflector has a guide face facing the opposite deflector, the guide face is curved, and the gap between the two guide faces is reduced gradually along the first direction X. The first guide 121 has the first guide surface, the second guide 122 has the second guide surface, the first guide surface and the second guide surface are curved, and the distance between the first guide surface and the second guide surface is gradually reduced along the first direction X. By setting the curved guide surface and gradually reducing the gap between the two guide surfaces in the first

direction X, the cylinder head can be easily positioned correctly through the guidance of the first guide plate 121 and the second guide plate 122 in the event of a poor initial position, ensuring that the head position is within a reasonable error. Further improve processing accuracy. There are several guide rollers 1211 on the guide surface, and several guide rollers 1211 are spaced along the extension of the guide surface. The guide roller 1211 is plastic and prevents scoring on the side of the cylinder head in contact with the guide roller 1211 when transferring the cylinder head. By setting a number of guide rollers 1211 on the guide surface, it is easy to guide the cylinder head when it is transmitted in the first direction X, ensure that the head attitude is within a reasonable error range, and improve the processing accuracy of the chamfer process.

As shown in Figure 3, The second drive assembly 21 consists of the first motor 211 and the spindle guide module 212, which is connected to the first motor 211, the spindle guide module 212 which is used to drive the first motor 211 in the first direction X, and the output of the first motor 211 which is connected to the tool assembly 22. Also includes the retaining plate 214 and the screw support 213, the retaining plate 214 is mounted on the top of the multiple screw support 213, the screw rail mold set 212 is mounted on the lower face of the retaining plate 214, the screw rail mold set 212 includes the second motor 2121, the screw 2122, The mobile plate 2123, the spindle bearing block 2124 and the coupling 2125, the length of the spindle 2122 is set in the first direction X, the output shaft of the second motor 2121 is fitted with a coupling 2125 to the spindle 2122, and the spindle 2122 is mounted on the spindle bearing block 2124. The mobile plate 2123 is connected to the screw 2122, the second motor 2121 is a stepper motor, the first motor 211 is mounted at the bottom of the mobile plate 2123, and the first motor 211 is the spindle motor. When chamfered, the second motor 2121 moves the mobile plate 2123 along the spindle 2122, and the second motor 2121 turns the spindle 2122, which in turn moves the mobile plate 2123 connected to the spindle 2122 along the spindle 2122, to be moved to the preset position. The first motor 211 moves the tool assembly 22 in an upright direction to chamfer the cylinder head duct. By setting the high precision spindle guide module 212, the first motor 211 can be positioned precisely in the direction of cylinder head movement, and the head can be chamfered using tool 222 to improve processing accuracy. It is suitable for different cylinder head conduit and similar chamfered processing, and is suitable for use.

The chamfer processing unit also includes a stop mechanism consisting of the third drive and the stop 41, the third drive connected to the stop 41, and the third drive used to drive the stop 41 in order to treat the processing workpiece 3 with the stop in the second direction Y. The third driver consists of the second cylinder, the stop 41 consists of the stop block 411, the second cylinder is connected to the stop block 411, and the second cylinder is used to drive the stop block 411 in the second direction Y, when chamfered. After the cylinder head is transferred to the preset position by means of transport roller 6, the second cylinder drive stop 411 moves upwards in the second direction Y, so that the top of the stop 411 fits against the bottom of the cylinder head, so that the cylinder head is positioned precisely and the tool mechanism can be chamfered. Guaranteed processing accuracy.

The chamfer processing unit also includes a clamping mechanism consisting of the fourth drive assembly 51 and the clamping assembly 52, the fourth drive assembly 51 connected to the clamping assembly 52, and the fourth drive assembly 51 used to drive the clamping assembly 52 to handle the processing workpiece 3 clamping in the third direction Z. The third direction Z, the first direction X, and the second direction Y are perpendicular to each other. The clamping assembly 52 consists of two opposing clamps 521, which forms the clamping space between the two clamps 521, the fourth drive assembly 51 contains two third cylinders 511, the two third cylinders 511 are connected to each clamp 521, and the third cylinder 511 is used to adjust the spacing of the clamping space. When chamfered, the two third cylinders 511 each drive the clamps 521 closer to each other or away from each other, and when the clamps 521 are driven closer to each other, the clamps the heads securely to further position and secure the heads. The cylinder head is easily chamfered and when finished, the two third cylinders 511 drive the two clamps 521 away from each other, releasing the cylinder head so that it is transmitted to the next process via the transport roller 6.

The chamfer processing unit is set up by setting the guide and the tool mechanism. The guide mechanism consists of the first drive assembly 11 and the guide assembly 12, the first drive assembly 11 drives the guide assembly 12, which directs the workpiece to be processed 3 to move in the first direction X, thus adjusting the position of the cylinder head before it enters the chamfer process. The tool mechanism consists of the second drive assembly 21 and the tool assembly 22, the second drive assembly 21 drives the tool assembly 22 in the second direction Y. The tool assembly 22 includes the tool holder 221 and a number of tools 222 that are attached to it for removal, thus adjusting the position of the tool 222 before the chamfer process is carried out. By setting the detachable tool 222, it is easy to replace different tools 222, can accommodate the chamfered demand of the catheters on the different cylinder head models, and can achieve the correct application of chamfering of different catheter sizes.

4. Conclusion

(1) The chamfer of the engine cylinder head sub-assembly duct can be chamfered and deburred in a manner that is designed as a whole;

(2) The engine head sub-assembly conduit chamfer processing unit is made up of pilot and tool/auxiliary structures without manual involvement, and interfaces with the automated production line, providing a basic reference point for intelligent black lamp factories.

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