

FAST-RESPONSE TOOL-CHANGING TELESCOPIC MECHANISM AND INSTALLATION METHOD THEREOF

TECHNICAL FIELD

[0001] The present invention relates to the technical field of tool changer, and in particular to a fast-response tool-changing telescopic mechanism and installation method thereof.

BACKGROUND

[0002] The tool magazine and its tool changer are means that meet the tool storage and tool changing requirements in automated machining processes. They are the core components of the computer numeric control (CNC) machining center, and their automatic tool-changing mechanism and tool storage function have changed the traditional human-based production mode, reducing non-cutting time, improving machining efficiency, and reducing production costs.

[0003] In the prior art, the tool changer usually needs to remove the tool from the holder of the tool magazine by a tool-changing arm, rotates the tool by 180 degrees, and then delivers it to the spindle for installation. In the process of taking out the tool from the tool magazine by the tool-changing arm, an oil cylinder is needed to push the arm to draw the tool.

[0004] However, when the oil cylinder drives the tool-changing arm to draw the tool, the friction resistance of the oil cylinder is large and the response speed of the piston rod is slow, resulting in a delay in the tool drawing action, affecting the efficiency of the tool changing. In addition, at the moment when the piston rod begins to move, the pressure difference power is prone to cause the tool-changing arm to shake, thereby affecting the tool changing accuracy.

SUMMARY

[0005] The present invention solves the technical problem discussed in the background by providing a fast-response tool-changing telescopic mechanism and installation method thereof.

[0006] To this end, the present invention provides a fast-response tool-changing telescopic mechanism, comprising: a fixed seat;

[0007] a tool-changing shaft rotatably provided in the fixed seat and having at an end thereof extending out of the fixed seat a sliding chamber provided along the central axis;

[0008] a tool-changing barrel sleeved on the outer side of a segment of the tool-changing shaft extending out of the fixed seat, with one end away from the fixed seat being connected to a tool-

drawing cover, and the other end close to the fixed seat being connected to a tool-changing arm;
[0009] a piston rod provided in the sliding chamber with its driving end fixedly connected to the tool-drawing cover, configured to drive the tool-changing barrel to drive the tool-changing arm to draw the tool outward;

[0010] wherein two guide grooves are symmetrically provided on both sides of the tool-changing shaft, and a guide block is provided on the tool-changing barrel corresponding to the guide grooves, with one end of the guide block passing through the tool-changing barrel and extending into the guide grooves, wherein the guide grooves are provided with a first booster block and a second booster block along the sliding track, and wherein an elastic component for providing an initial starting force to the guide block is provided between the first booster block and the second booster block and the guide block.

[0011] Further, the elastic component is provided on the opposite surfaces of the first booster block and the second booster block, and the elastic component comprises a guide rod and two springs sleeved on the guide rod;

[0012] wherein one end of the guide rod is fixed on the first booster block close to the fixed seat, and the other end passes through the second booster block along the sliding track, and wherein a plurality of positioning holes are evenly spaced at intervals on a segment of the guide rod extending out of the second booster block;

[0013] wherein the second booster block away from the fixed seat is fixed to the guide rod by passing a pin shaft through the positioning hole; and

[0014] wherein the guide block is provided between the two springs.

[0015] Further, the elastic component is provided in the first booster block and the second booster block;

[0016] wherein the first booster block and the second booster block are provided with a sliding chamber therein, one end of the sliding chamber close to the guide block extending towards the inner center to form a retaining ring;

[0017] wherein the elastic component comprises a telescopic rod and a spring, the telescopic rod being provided in the sliding chamber and provided at an end thereof within the sliding chamber with a convex ring that abuts against the retaining ring; and

[0018] wherein the spring is sleeved on a segment of the telescopic rod extending out of the sliding chamber, and a limitd circlip is provided at an end of the telescopic rod extending out of the sliding chamber.

[0019] Further, the elastic component is provided at the bottom of the guide block;

[0020] wherein the elastic component comprises an outer sleeve and a sliding rod coaxially

provided inside the outer sleeve, the outer sleeve being embedded in a recess at the bottom of the guide block, and a segment of the sliding rod extending out of either end of the outer sleeve being sleeved with a spring; and

[0021] wherein a limit circlip is provided at either end of the sliding rod.

[0022] Further, the guide groove extends through the fixed seat along the axis in a direction away from the fixed seat, and an adjustment hole is provided on the cylindrical surface of the tool-changing barrel to adjust the second booster block located at the end position for drawing the tool.

[0023] Further, a position detection component is provided between the opposite surfaces of the fixed seat and the tool-changing arm;

[0024] wherein the position detection component comprises a proximity switch, a sensing disk and two connecting shafts, the two connecting shafts being symmetrically provided on both sides of the tool-changing barrel and passing through the tool-changing arm to connect to the sensing disk, so that the sensing disk moves synchronously with the tool-changing barrel; and

[0025] wherein the proximity switch is fixed on the fixed seat and is configured to detect the position of the moving sensing disk.

[0026] Further, the guide block comprises a sliding key and a fixing key for fixing the sliding key on the tool-changing barrel; and

[0027] wherein the tool-changing barrel is provided with an adjustment slot for passage of the sliding key.

[0028] Further, the length of the adjustment slot along the sliding track direction is greater than the length of the sliding key;

[0029] wherein the ends of the adjustment slot and the sliding key are both arc-shaped surfaces; and

[0030] wherein a pressure sensing sheet is provided between the two arc-shaped surfaces of the adjustment slot and the sliding key.

[0031] Further, the first booster block and the second booster block are provided in the guide groove of the tool-changing shaft to form a tool-drawing booster section, a translation section and a tool-returning booster section; and

[0032] wherein when the guide block slides to the translation section, the two springs are in a free state, and when the guide block slides to the tool-drawing booster section or the tool-returning booster section, the spring located on the corresponding side is in a compressed state, and the reaction force generated by the compressed spring acts on the guide block.

[0033] The present invention provides an installation method for a fast-response tool-changing telescopic mechanism, comprising the following steps:

[0034] assembling a piston rod and a tool-changing shaft, and installing the assembly into a fixed seat;

[0035] fixing a first booster block at an end close to the mounting seat, and providing a second booster block in a guide groove according to the tool-drawing distance of a tool-changing arm;

[0036] sleeving a tool-changing barrel connected to the tool-changing arm onto the tool-changing shaft, and providing a tool-drawing cover at an end of the tool-changing barrel away from the tool-changing arm, with the driving end of the piston rod fixedly connected to the tool-drawing cover; and

[0037] extending a guide block into a guide groove through the cylindrical wall of the tool-changing barrel when the tool-changing barrel slides to half the tool-drawing distance, and finally fixing the guide block on the tool-changing barrel.

[0038] The present invention is advantageous in that it overcomes the starting friction resistance of the oil cylinder through the provision of the first booster block, the second booster block and the elastic component, thereby improving the response speed of the piston rod when starting at the end position, avoiding action delay, and thus improving the tool change efficiency. At the same time, the reaction force of the elastic component can make the tool-changing barrel respond quickly, effectively avoiding the influence of the power difference on the tool change accuracy.

BRIEF DESCRIPTION OF DRAWINGS

[0039] In order to more clearly illustrate the embodiments of the present invention or the technical solutions in the prior art, the accompanying drawings to be used in the description of the embodiments or prior art will be briefly described below. It is obvious that the accompanying drawings in the following description are only some of the embodiments recorded in the present invention, and other accompanying drawings can be obtained according to these accompanying drawings without creative work for those of ordinary skill in the art.

[0040] FIG. 1 is a structural schematic diagram of the fast-response tool-changing telescopic mechanism according to an embodiment of the present invention;

[0041] FIG. 2 is a front view of a fast-response tool-changing telescopic mechanism according to an embodiment of the present invention;

[0042] FIG. 3 is an A-A sectional view of FIG. 2;

[0043] FIG. 4 is a structural schematic diagram of an elastic component disposed between two booster blocks according to an embodiment of the present invention;

[0044] FIG. 5 is a structural cross-sectional view of an elastic component disposed between two

booster blocks according to an embodiment of the present invention;

[0045] FIG. 6 is another structural schematic diagram of an elastic component disposed between two booster blocks according to an embodiment of the present invention;

[0046] FIG. 7 is another cross-sectional view of an elastic component disposed between two booster blocks according to an embodiment of the present invention;

[0047] FIG. 8 is a structural schematic diagram of an elastic component disposed at the bottom of a guide block according to an embodiment of the present invention;

[0048] FIG. 9 is a structural cross-sectional view of an elastic component disposed at the bottom of a guide block according to an embodiment of the present invention;

[0049] FIG. 10 is an B-B sectional view of FIG. 2;

[0050] FIG. 11 is a schematic structural diagram of a guide block according to an embodiment of the present invention; and

[0051] FIG. 12 is a schematic diagram of a sliding key extruding a pressure sensing sheet in an adjustment slot according to an embodiment of the present invention.

[0052] Reference signs: 1. Fixed seat; 2. Tool-changing shaft; 21. guide groove; 3. Tool-changing barrel; 31. Adjustment hole; 32. Adjustment slot; 4. Piston rod; 5. Tool-drawing cover; 6. Guide block; 61. Sliding key; 62. fixing key; 7a. First booster block; 7b. Second booster block; 8. Elastic component; 81a. Guide rod; 82a. Spring; 81b. Telescopic rod; 82b. Limit clamp spring; 81c. Outer sleeve; 82c. Sliding rod; 9. Position detection component; 91. Proximity switch; 92. Sensing disk; 93. Connecting shaft; 10. Pressure sensing sheet.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0053] The technical solutions in the embodiments of the present invention will be described clearly and completely in conjunction with the accompanying drawings in the embodiments of the present invention. Obviously, the described embodiments are only a portion of the embodiments of the present invention, rather than all the embodiments.

[0054] It should be noted that when an element is referred to as being "fixed to" another element, it can be directly on the another element or an intermediate element may also be present. It should be noted that when an element is referred to as being "connected to" another element, it can be directly on the another element or an intermediate element may also be present. The terms "vertical", "horizontal", "left", "right" and similar expressions used herein are for illustrative purposes only and do not mean that they are the only mode of implementation.

[0055] Unless otherwise defined, all technical and scientific terms used herein have the same

meaning as commonly understood by those skilled in the art of the present invention. The terms used herein are for the purpose of describing specific embodiments only and are not intended to limit the invention. The term "and/or" as used herein includes any and all combinations of one or more of the related listed items.

[0056] As shown in FIGS. 1 to 4, the present invention provides a fast-response tool-changing telescopic mechanism, comprising: a fixed seat 1; a tool-changing shaft 2 rotatably provided in the fixed seat 1 and having at an end thereof extending out of the fixed seat 1 a sliding chamber provided along the central axis; a tool-changing barrel 3 sleeved on the outer side of a segment of the tool-changing shaft 2 extending out of the fixed seat 1, with one end away from the fixed seat 1 being connected to a tool-drawing cover 5, and the other end close to the fixed seat 1 being connected to a tool-changing arm; a piston rod 4 provided in the sliding chamber with its driving end fixedly connected to the tool-drawing cover 5, configured to drive the tool-changing barrel 3 to drive the tool-changing arm to draw the tool outward; wherein two guide grooves 21 are symmetrically provided on both sides of the tool-changing shaft 2, and a guide block 6 is provided on the tool-changing barrel 3 corresponding to the guide grooves 21, with one end of the guide block 6 passing through the tool-changing barrel 3 and extending into the guide grooves 21, and the guide grooves 21 are provided with a first booster block 7a and a second booster block 7b along the sliding track, and an elastic component 8 for providing an initial starting force to the guide block 6 is provided between the first booster block 7a and the second booster block 7b and the guide block 6.

[0057] In a preferred embodiment of the present invention, when the tool-changing arm translates and locks the tool in the tool magazine, the tool-changing barrel 3 is in a retracted state and the guide block 6 and the first booster block 7a work together to put the elastic component 8 into a compressed state. When the hydraulic oil enters the oil inlet chamber through the oil inlet pipeline, the reaction force of the elastic component 8 acts on the guide block 6, increasing the starting force of the tool-changing barrel 3 during tool drawing on the basis of hydraulic power, which can make the piston rod 4 respond quickly and drive the tool-changing barrel 3 to extend synchronously, thereby realizing the tool drawing action of the tool-changing arm. When the tool-changing arm completes the tool drawing action and rotates to change the tool, the guide block 6 on the tool-changing barrel 3 compresses the elastic component 8 at the other end. The compressed elastic component 8 imposes a reaction force on the guide block 6. When the hydraulic oil enters the oil return chamber through the oil return pipeline, the reaction force and the oil pressure work together on the piston rod 4, so that the piston rod 4 starts quickly at the rotating tool change point and retracts to the tool drawing point, thereby realizing the entire tool changing process of the

tool-changing arm. The present invention overcomes the starting friction resistance of the oil cylinder through the provision of the first booster block 7a, the second booster block 7b and the elastic component 8, thereby improving the response speed of the piston rod 4 when starting at the end position, avoiding action delay, and thus improving the tool change efficiency. In addition, the reaction force of the elastic component 8 can make the tool-changing barrel respond quickly, effectively avoiding the influence of the power difference on the tool change accuracy.

[0058] In a preferred embodiment of the present invention, as shown in FIGS. 3 to 5, the elastic component 8 is provided on the opposite surfaces of the first booster block 7a and the second booster block 7b. Specifically, the elastic component 8 comprises a guide rod 81a and two springs 82a sleeved on the guide rod 81a. One end of the guide rod 81a is fixed on the first booster block 71a close to the fixed seat 1 by means of a threaded structure, and the other end passes through the second booster block 7b along the sliding track, so that the second booster block 7b can slide along the axis. In order to ensure that the spring 82a has a starting power for the guide block 6 when the tool-changing barrel 3 is at the rotating tool change point, a plurality of positioning holes are evenly spaced at intervals on a segment of the guide rod 81a extending out of the second booster block. The positioning holes are perpendicular to the axis and pass through the guide rod. The second booster block 7b away from the fixed seat 1 is fixed to the guide rod 81a by passing a pin shaft through the positioning hole, so as to determine the relative positions of the first booster block 7a and the second booster block 7b. At this point, the guide block 6 is disposed between the two springs 82a, and the guide block 6 slides along the guide groove 21. When sliding to the end position, the guide block 6 compresses the spring 82a on one of the booster blocks, thereby generating a reaction force that provides an initial starting force for the end position, so as to achieve a rapid response of the piston rod 4.

[0059] On the basis of the above described embodiments, in order to avoid the limitation of the length of the guide rod 81a on the tool drawing distance, preferably, as shown in FIGS. 3, 6 and 7, the elastic component 8 is provided in the first booster block 7a and the second booster block 7b to adopt the combination of the booster blocks and the elastic component 8. Specifically, the first booster block 7a and the second booster block 7b are provided with a sliding chamber therein, one end of the sliding chamber close to the guide block 6 extending towards the inner center to form a retaining ring. The elastic component 8 comprises a telescopic rod 81b and a spring 82a. The telescopic rod 81b is provided in the sliding chamber and provided at an end thereof within the sliding chamber with a convex ring that abuts against the retaining ring. The spring 82a is sleeved on a segment of the telescopic rod 81b extending out of the sliding chamber, and a limit circlip 82b is provided at an end of the telescopic rod 81b extending out of the sliding chamber.

[0060] When installing the first booster block 7a and the second booster block 7b, first pass the telescopic rod 81b through the sliding chamber, then sleeve the spring 82a on a segment of the telescopic rod extending out of the sliding chamber, and then install the limit circlip 82b in the limit ring recess at the end of the telescopic rod. At this point, the spring 82a abuts against the limit circlip 82b, and the telescopic rod 81b is in a fully extended state. Then, the first booster block 7a and the second booster block 7b are fixed in the guide groove 21 by bolts. The segment of the bolt located in the sliding chamber has a limiting effect on the telescopic rod 81b, which effectively avoids the loss of the ability to adjust the starting force due to overcompression of the spring 82a.

[0061] The present invention also provides a structure in which the elastic component 8 is separated from the first booster block 7a and the second booster 7b, as shown in FIGS. 8 and 9. The elastic component 8 is provided at the bottom of the guide block 6. The elastic component 8 comprises an outer sleeve 81c and a sliding rod 82c coaxially provided inside the outer sleeve 81c. The length of the sliding rod 82c is greater than the length of the outer sleeve 81c, and the two ends of the sliding rod 82c extend out of the outer sleeve 81c and are embedded in a recess at the bottom of the guide block 6 through the outer sleeve 81c. A segment of the sliding rod 82c extending out of either end of the outer sleeve 81c is sleeved with a spring 82a, and a limit circlip is provided at either end of the sliding rod 82c for limiting the axial movement of the spring 82a, so as to form a bidirectional buffer at the bottom of the guide block 6. In addition, in order to facilitate the installation of the guide block 6 on the outer sleeve 81c, the outer sleeve 81c is provided in an I-shape, so that the baffles located at both ends of the outer sleeve 81c can well fix the guide block 6, thereby ensuring the consistency of the movement of the elastic component 8 and the guide block 6 during the sliding process.

[0062] When the tool-changing arm draws the tool, the tool needs to be completely separated from the pocket and kept within a safe distance from the spindle. Therefore, in order to allow the tool-changing barrel 3 to have a sufficient tool drawing distance on the tool-changing shaft 2, as shown in FIGS. 4 and 11, the guide groove extends 21 through the fixed seat 1 along the axis in a direction away from the fixed seat 1, and an adjustment hole 31 is provided on the cylindrical surface of the tool-changing barrel 3 to adjust the second booster block 7b located at the end position for drawing the tool. The present invention can adjust the position of the far-end second booster block 7b on the tool-changing barrel 3 through the adjustment hole 31 to ensure the stability of the initial starting force at the end position for tool drawing when returning the tool.

[0063] The tool-changing arm achieves the entire tool change process by first drawing the tool and then rotating to change the tool. Therefore, in order to avoid misoperation in the process of

tool drawing, as shown in FIG. 1, a position detection component 9 is provided between the opposite surfaces of the fixed seat 1 and the tool-changing arm. The position detection component 9 can sense the tool-changing arm when the tool is drawn correctly, so that the tool-changing arm can rotate for the next step to change the tool, thus avoiding tool collision caused by program misoperation. In addition, in order to ensure the accuracy of the position detection, the position detection component 9 is provided close to the end of the tool-changing arm. Specifically, as shown in FIGS. 3 and 10, the position detection component 9 comprises a proximity switch 91, a sensing disk 92 and two connecting shafts 93. The two connecting shafts 93 are symmetrically provided on both sides of the tool-changing barrel 3 and pass through the tool-changing arm 3 to connect to the sensing disk 92, so that the sensing disk 92 moves synchronously with the tool-changing barrel 3. The proximity switch 91 is fixed on the fixed seat 1 and is configured to detect the position of the moving sensing disk 92.

[0064] In the present invention, one end of the guide block 6 needs to be fixed on the tool-changing barrel 3, and the other end needs to extend into the guide groove 21 while keeping a sliding gap with the side wall of the guide groove 21, so as to follow the tool-changing barrel 3 and slide along the guide groove 21. As shown in FIG. 11, the guide block 6 is preferably provided with a split structure. The guide block 6 includes a sliding key 61 and a fixing key 62 for fixing the sliding key 61 to the tool-changing barrel 3. An adjustment groove 32 through which the sliding key 61 passes is provided on the tool-changing barrel 3. When the tool-changing barrel 3 is set on the cutter changer shaft 2, in which case it needs to be positioned in the circumferential direction, the sliding key 61 is placed into the guide groove 21 through the adjustment groove 32, so that the tool-changing barrel 3 can be initially positioned in the circumferential direction to ensure the position of the guide block 6 in the guide groove 21, and the fixing key 62 is fixed on the sliding key 61. After simulating the tool drawing process of the tool-changing barrel 3, the position of the tool-changing barrel 3 is adjusted, and the fixing key 62 is finally fixed on the tool-changing barrel 3, effectively reducing the installation and commissioning time of the guide block 6, and ensuring the position accuracy of the guide block 6 in the guide groove 21 and the adjustment groove 32.

[0065] Based on the above described embodiment, and as shown in FIG. 12, the length of the adjustment slot 32 along the sliding track direction is greater than the length of the sliding key 61.

[0066] The ends of the adjustment slot 32 and the sliding key 61 are both arc-shaped surfaces. A pressure sensing sheet 10 is provided between the two arc-shaped surfaces of the adjustment slot 32 and the sliding key 61. The arc-shaped surface of the sliding key 61 is pushed by the elastic component 8, which compresses the pressure sensing sheet 10 to obtain the starting force of the

elastic component 8 on the sliding key 61. By providing the pressure sensing sheet 10, the starting force at the end position may be adjusted to an appropriate range, which can enable piston rod 4 to respond quickly when hydraulic oil enters, improving the efficiency of tool changing.

[0067] When the elastic component 8 is disposed between the opposite surfaces of the first booster block 7a and the second booster block 7b, the first booster block 7a and the second booster block 7b are provided in the guide groove 21 of the tool-changing shaft 2 to form a tool-drawing booster section, a translation section and a tool-returning booster section. When the guide block 6 slides to the translation section, the two springs 82a are in a free state, and when the guide block 6 slides to the tool-drawing booster section or the tool-returning booster section, the spring 82a located on the corresponding side is in a compressed state, and the reaction force generated by the compressed spring 82a acts on the guide block 6.

[0068] The present invention further provides an installation method for a fast-response tool-changing telescopic mechanism, comprising the following steps:

[0069] assembling a piston rod 4 and a tool-changing shaft 2, and installing the assembly into a fixed seat 1;

[0070] fixing a first booster block 7a at an end close to the mounting seat, and providing a second booster block 7b in a guide groove according to the tool-drawing distance of a tool-changing arm;

[0071] sleeving a tool-changing barrel 3 connected to the tool-changing arm onto the tool-changing shaft 2, and providing a tool-drawing cover 5 at an end of the tool-changing barrel 3 away from the tool-changing arm, with the driving end of the piston rod 4 fixedly connected to the tool-drawing cover 5; and

[0072] extending a guide block 6 into a guide groove 21 through the cylindrical wall of the tool-changing barrel 3 when the tool-changing barrel 3 slides to half the tool-drawing distance, and finally fixing the guide block 6 on the tool-changing barrel 3.

[0073] Those skilled in the industry should understand that the present invention is not limited by the foregoing embodiments. The foregoing embodiments and descriptions only illustrate the principles of the present invention. Without departing from the spirit and scope of the present invention, the present invention will have various changes and improvements, which fall within the scope of the claimed invention. The scope of protection claimed by the present invention is defined by the appended claims and their equivalents.

What is claimed is:

1. A fast-response tool-changing telescopic mechanism, comprising:
 - a fixed seat;
 - a tool-changing shaft rotatably provided in the fixed seat and having at an end thereof extending out of the fixed seat a sliding chamber provided along the central axis;
 - a tool-changing barrel sleeved on the outer side of a segment of the tool-changing shaft extending out of the fixed seat, with one end away from the fixed seat being connected to a tool-drawing cover, and the other end close to the fixed seat being connected to a tool-changing arm;
 - a piston rod provided in the sliding chamber with its driving end fixedly connected to the tool-drawing cover, configured to drive the tool-changing barrel to drive the tool-changing arm to draw the tool outward;
 - wherein two guide grooves are symmetrically provided on both sides of the tool-changing shaft, and a guide block is provided on the tool-changing barrel corresponding to the guide grooves, with one end of the guide block passing through the tool-changing barrel and extending into the guide grooves, wherein the guide grooves are provided with a first booster block and a second booster block along the sliding track, and wherein an elastic component for providing an initial starting force to the guide block is provided between the first booster block and the second booster block and the guide block;
 - wherein the elastic component is provided in the first booster block and the second booster block;
 - wherein the first booster block and the second booster block are provided with a sliding chamber therein, one end of the sliding chamber close to the guide block extending towards the inner center to form a retaining ring;
 - wherein the elastic component comprises a telescopic rod and a spring, the telescopic rod being provided in the sliding chamber and provided at an end thereof within the sliding chamber with a convex ring that abuts against the retaining ring; and
 - wherein the spring is sleeved on a segment of the telescopic rod extending out of the sliding chamber, and a limit circlip is provided at an end of the telescopic rod extending out of the sliding chamber;
 - wherein the first booster block and the second booster block are provided in the guide groove of the tool-changing shaft to form a tool-drawing booster section, a translation section and a tool-returning booster section;
 - wherein when the guide block slides to the translation section, the two springs are in a free

state, and when the guide block slides to the tool-drawing booster section or the tool-returning booster section, the spring located on the corresponding side is in a compressed state, and the reaction force generated by the compressed spring acts on the guide;

wherein the tool-changing barrel is in a retracted state and the guide block and the first booster block work together to put the elastic component into a compressed state, wherein when the hydraulic oil enters the oil inlet chamber through the oil inlet pipeline, the reaction force of the elastic component acts on the guide block, increasing the starting force of the tool-changing barrel during tool drawing on the basis of hydraulic power, which can make the piston rod respond quickly and drive the tool-changing barrel to extend synchronously, wherein when the tool-changing arm completes the tool drawing action and rotates to change the tool, the guide block on the tool-changing barrel compresses the elastic component at the other end, the compressed elastic component imposing a reaction force on the guide block, the reaction force together with the oil pressure in the return pipeline acts on the piston rod, so that the piston rod starts quickly at the rotating tool change point and retracts to the tool drawing point;

wherein the guide block comprises a sliding key and a fixing key for fixing the sliding key on the tool-changing barrel, and wherein the tool-changing barrel is provided with an adjustment slot for passage of the sliding key;

wherein the length of the adjustment slot along the sliding track direction is greater than the length of the sliding key;

wherein the ends of the adjustment slot and the sliding key are both arc-shaped surfaces; and

wherein a pressure sensing sheet is provided between the two arc-shaped surfaces of the adjustment slot and the sliding key, wherein the arc-shaped surface of the sliding key is pushed by the elastic component, which compresses the pressure sensing sheet to obtain the starting force of the elastic component on the sliding key, and wherein the starting force at the end position is adjusted to an appropriate range, so that the piston rod can respond quickly when hydraulic oil enters.

2. The fast-response tool-changing telescopic mechanism according to claim 1, wherein the guide groove extends through the fixed seat along the axis in a direction away from the fixed seat, and wherein an adjustment hole is provided on the cylindrical surface of the tool-changing barrel to adjust the second booster block located at the end position for drawing the tool.

3. The fast-response tool-changing telescopic mechanism according to claim 1, wherein a position detection component is provided between the opposite surfaces of the fixed seat and the tool-changing arm;

wherein the position detection component comprises a proximity switch, a sensing disk and

two connecting shafts, the two connecting shafts being symmetrically provided on both sides of the tool-changing barrel and passing through the tool-changing arm to connect to the sensing disk, so that the sensing disk moves synchronously with the tool-changing barrel; and

wherein the proximity switch is fixed on the fixed seat and is configured to detect the position of the moving sensing disk.

4. An installation method for the fast-response tool-changing telescopic mechanism according to claim 1, comprising the following steps:

assembling a piston rod and a tool-changing shaft, and installing the assembly into a fixed seat;

fixing a first booster block at an end close to the mounting seat, and providing a second booster block in a guide groove according to the tool-drawing distance of a tool-changing arm;

sleeving a tool-changing barrel connected to the tool-changing arm onto the tool-changing shaft, and providing a tool-drawing cover at an end of the tool-changing barrel away from the tool-changing arm, with the driving end of the piston rod fixedly connected to the tool-drawing cover; and

extending a guide block into a guide groove through the cylindrical wall of the tool-changing barrel when the tool-changing barrel slides to half the tool-drawing distance, and finally fixing the guide block on the tool-changing barrel.