



(11) **EP 4 147 801 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.03.2023 Bulletin 2023/11

(51) International Patent Classification (IPC):
B21D 5/00 (2006.01) **B21D 5/02** (2006.01)
B21D 43/10 (2006.01) **B21D 43/11** (2006.01)

(21) Application number: **21213463.9**

(52) Cooperative Patent Classification (CPC):
B21D 5/002; B21D 5/0254; B21D 5/0281;
B21D 43/105; B21D 43/11

(22) Date of filing: **09.12.2021**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **13.09.2021 CN 202111069791**

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(54) **FULL-AUTOMATIC BENDING MACHINE**

(57) A full-automatic bending machine is disclosed. The bending machine includes a main machine of the bending machine and a positioning and clamping workbench. The main machine of the bending machine includes a main machine shell. An electric servo bending center cutter driving mechanism is arranged in the main machine shell, and an automatic cutter changing device matched with the electric servo bending center cutter driving mechanism is arranged on a bending operation opening of the main machine shell. A lower cutter of the electric servo bending center cutter driving mechanism

is provided with a local bending mechanism, the local bending mechanism includes a local bending slide rail, a left local bending assembly and a right local bending assembly. The left local bending assembly and the right local bending assembly are slidably arranged on the local bending slide rail, and are symmetrically arranged at two ends of the lower cutter. The positioning and clamping workbench includes a feeding rotary manipulator and a supporting table. The supporting table includes a positioning device and a supporting rack, and the positioning device is connected with the supporting rack into a whole.

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Description

Technical Field

[0001] The invention relates to the technical field of bending machines, and more specifically, to a full-automatic bending machine.

Background art

[0002] CNC bending machine is used to bend the cold metal sheet into various geometric cross-section shapes by using the equipped dies (general or special dies or tools). It is a sheet metal forming machine designed for cold-rolled sheet metal processing, which is widely used in sheet metal bending processing in automobile, aircraft manufacturing, light industry, shipbuilding, container, elevator, railway vehicle and other industries.

[0003] Chinese utility model patent CN210082466U discloses an electric servo bending center tool driving mechanism, which includes a first servo motor, a second servo motor, a first transmission mechanism, a second transmission mechanism, a connecting rod, a wedge-shaped tool holder and a wedge. The first servo motor is connected with the wedge-shaped tool holder through a first transmission mechanism and a connecting rod. One side of the wedge-shaped tool holder is provided with a cutter, the other side of the wedge-shaped tool holder is provided with a wedge. The oblique wedge surface of the wedge-shaped tool holder is matched with the right-angle vertical surface of the wedge block. A second servo motor is arranged on the wedge-shaped tool holder, and the second servo motor is connected with the wedge block through the first transmission mechanism. The utility model has the advantages of simple and compact structure, small occupied space, high cost performance, no hidden danger of oil leakage, high control precision, energy conservation and environmental protection.

[0004] Chinese utility model patent CN210966511U discloses an automatic tool changer of a folding machine, which includes a frame and a guide rail. The guide rail is arranged on the frame in a transverse sliding manner, and the lower side of the guide rail is provided with a groove. The first power device is arranged on the frame and is used for driving the guide rail to move. The first cutter is arranged on the frame in a transverse sliding manner. A first installation cavity is arranged inside the first cutter and the positioning device. The positioning device is arranged in the first installation cavity in a sliding manner, and when the positioning device moves to be opposite to the groove, the positioning device is used for moving to the groove and clamping the groove, so that the guide rail drives the first cutter to move. Through the technical scheme, the problem that the position of the flanging cutter is not easy to adjust in the prior art is solved.

[0005] The above two types of bending machine components have their own characteristics, and there is no

main machine of the bending machine with the above two types of bending machine components in the prior art, so the development of the bending machine needs to be improved.

[0006] In addition, the length of the bending tool of the existing automatic bending machine is not variable and is mostly the same as the maximum folding length. When a product needs to be bent at both ends but not in the middle, the product cannot be bent on an automatic bending machine, so that the operation of the bending machine has certain limitations.

[0007] At the same time, the bending supporting platform of the bending machine is often provided with a plate positioning device, the existing plate positioning device generally adopts two chocks to position the part to be bent, and a single symmetrical positioning mechanism can only be used for positioning a plate with a symmetrical shape and is not applicable when the plate is in an asymmetrical shape. When a bevel edge with a complex structure needs to be bent, due to the incapability of accurate positioning, the situations that the parts cannot be bent or the bending size cannot meet the requirements often occur in production. Meanwhile, the support of the table top of the existing bending supporting table to the plate cannot meet the bending requirements, and the contact surface between the table top of the supporting table and the plate is large, so that the plate is inconvenient to move on the table surface of the supporting table.

[0008] Chinese utility model patent CN209792325U discloses a feeding rotary manipulator, which includes a base and a rack. The rack can reciprocate in the horizontal direction relative to the base under the driving of a rack driving device. The rack has a C-shaped structure, the upper part of the rack is provided with a horizontal moving seat. One side of the upper part of the rack is provided with an up-and-down moving seat, and the up-and-down moving seat is hinged with the horizontal moving seat through a connecting rod. An upper rotating device is arranged on the up-and-down moving seat. The upper rotating device is connected with a pressure rod in a driving way, and an upper pressing block is arranged at the lower end of the pressure rod. A lower rotating device is arranged on one side of the lower part of the rack, and a lower pressing block is arranged on an output shaft of the lower rotating device. The lower pressing block is positioned right below the upper pressing block. An output shaft of that lower rotating device is coaxially arranged with the pressure rod. A material pushing device is arranged in the throat of the rack. The manipulator of the utility model is used together with the main bending machine, which can realize various bending processes without three-dimensional movement of the plate, and the positioning, translation and rotation of the plate on the working table are all realized by the manipulator.

[0009] The feeding rotary manipulator disclosed in Chinese utility model patent CN209792325U only has the functions of rotation and clamping, and cannot effectively position the sheet.

[0010] Therefore, it's an urgent problem to provide a fully automatic bending machine by those skilled in the art.

Summary of the Invention

[0011] In view of this, the present invention provides a fully automated bending machine to solve at least one of the problems set forth in the background above.

[0012] In order to realize the scheme, the invention adopts the technical scheme as follows.

[0013] A full-automatic bending machine including a main machine of the bending machine and a positioning and clamping workbench is disclosed.

[0014] The main machine of the bending machine includes a main machine shell. An electric servo bending center cutter driving mechanism is arranged in the main machine shell. An automatic cutter changing device matched with the electric servo bending center cutter driving mechanism is arranged on a bending operation opening of the main body shell, and a local bending mechanism is arranged on a lower cutter of the electric servo bending central cutter driving mechanism. The local bending mechanism includes a local bending slide rail, a left local bending assembly and a right local bending assembly. The left local bending assembly and the right local bending assembly are arranged on the local bending slide rail in a sliding manner and are symmetrically arranged at two ends of the lower cutter.

[0015] The positioning and clamping workbench includes a feeding rotary manipulator and a supporting table. The supporting table includes a positioning equipment and a supporting rack, and the positioning equipment is connected with the supporting rack into a whole.

[0016] The positioning equipment includes a left positioning device and a right positioning device, and a gap is reserved between the left positioning device and the right positioning device.

[0017] The left positioning device includes a left frame and a front and rear moving frame. The front and rear moving frame is arranged in a concave cavity at the center of the left frame in a sliding manner. The front and rear moving frame is in transmission connection with a front and back moving driving component arranged on the left frame. Two sides of the top of the front and rear moving frame are provided with comb-shaped movable brush plates. The left frame is provided with a left fixed brush plate which is matched and spliced with the movable brush plates on the two sides of the front and rear moving frame.

[0018] The right positioning device includes a right frame and a right fixed brush plate arranged on the top of the right frame.

[0019] The front and rear moving frame and the right frame are both provided with a transverse moving assembly. The transverse moving assembly includes a transverse movement driving device and a positioning clamping piece which is in transmission connection with

the transverse movement driving device.

[0020] The front and rear moving frame is fixedly connected with the transverse movement driving device, and the front and rear moving frame is in sliding connection with the positioning clamping piece.

[0021] The right frame is fixedly connected with the transverse movement driving device and is connected with the positioning clamping piece in a sliding manner.

[0022] Strip-shaped positioning clamping piece moving openings are respectively reserved between the movable brush plates arranged on the two sides of the top of the front and rear moving frames and in the middle of the right fixed brush plate.

[0023] Preferably, in the above full-automatic bending machine, both the left local bending assembly and the right local bending assembly are provided with a local bending tool set and a tool selection cylinder.

[0024] The left local bending assembly includes a left mounting frame and a left cutter driving mechanism. The left cutter driving mechanism is mounted on the left mounting frame and includes a left driving motor, a left synchronous pulley, a left driving synchronous pulley, a left driven synchronous pulley, a first guide wheel and a second guide wheel.

[0025] The right local bending assembly includes a right mounting frame and a right cutter driving mechanism. The right cutter driving mechanism is mounted on the right mounting frame and includes a right driving motor, a right synchronous pulley, a right driving synchronous pulley, a right driven synchronous pulley, a third guide wheel and a fourth guide wheel.

[0026] The left driving motor is in transmission connection with the left driving synchronous pulley, the left synchronous pulley is sleeved on the left driving synchronous pulley and the right driven synchronous pulley, the left synchronous pulley is connected with the local bending tool set close to the left local bending assembly, and the left synchronous be <

[0027] The right driving motor is in transmission connection with the right driving synchronous pulley. The right synchronous pulley is sleeved on the right driving synchronous pulley and the left driven synchronous pulley, the right synchronous pulley is connected with the local bending tool set close to the right local bending assembly. The right synchronous pulley is guided by the second guide pulley and the third guide pulley.

[0028] The local bending tool set is formed by detachably connecting a number of local bending cutters into a whole through a bayonet mechanism, and the two cutter selection cylinders are respectively arranged on the left mounting frame and the right mounting frame and are respectively positioned at one side of the two local bending tool sets.

[0029] Preferably, in the above full-automatic bending machine, the bayonet mechanism includes a bayonet wheel and a spring bayonet pin. The bayonet wheel is fixed on one side of the local bending cutter through a stud, a bayonet wheel hole is formed on the other side

of the local bending cutter, a spring bayonet pin mounting hole is formed above the bayonet wheel hole, and the upper part of the bayonet wheel hole is communicated with the spring bayonet pin mounting hole. The spring bayonet is installed in the spring bayonet installation hole, and a snap ring on the spring bayonet can reciprocate along the axis of the spring bayonet installation hole.

[0030] The clamping wheels extend into the clamping wheel holes of the adjacent local bending cutters and are locked by the clamping rings of the spring bayonet pins, so that the locking between the adjacent local bending cutters is realized.

[0031] Preferably, in the above full-automatic bending machine, the action end of the spring bayonet pin extends out of the local bending tool, and the piston rod of the tool selection cylinder is provided with a pressing block which can be matched with the action end.

[0032] Preferably, in the above full-automatic bending machine, the local bending cutter is provided with a mounting groove matched with the lower cutter, and the mounting groove can be clamped into a convex strip on the top of the lower cutter.

[0033] Preferably, in the above full-automatic bending machine, one of the local bending tools of each local bending tool set is respectively connected with the local bending slide rail in a sliding manner through a slide block.

[0034] Preferably, in the above full-automatic bending machine, the support frame includes a left support frame body, a right support frame body, a left platen and a right platen. The left platen is mounted on the top of the left support frame body and the right platen is mounted on the top of the right support frame. A number of flexible support bodies are distributed on the left platen and the right platen. A gap is reserved between the left support frame body and the right support frame body.

[0035] A base of the feeding rotary manipulator is arranged below the support rack. A rack of the feeding rotary manipulator extends out of a gap between the left support frame body and the right support frame body to above the left platen and the right platen, and the rack can reciprocate in the gap between the left support frame body and the right support frame. The material pushing device, the lower pressing block and the upper pressing block of the feeding rotary manipulator can act in a gap between the left supporting frame body and the right supporting frame body and a gap between the left positioning device and the right positioning device.

[0036] Preferably, in the above full-automatic bending machine, the positioning clamping piece includes a shell, a clamping tongue and a driving cylinder. One side of the shell is provided with a sliding block, and the front and rear moving frames and the right frame are provided with sliding rails matched with the sliding block. The middle part of the clamping tongue is hinged on the top opening of the shell. The top end of the clamping tongue extends out of an opening at the top of the shell, and the bottom end of the clamping tongue is positioned in the shell and

provided with a strip-shaped hole. The driving cylinder is fixedly connected outside the shell, and a piston rod of the driving cylinder extends into the shell and is hinged with a strip-shaped hole at the bottom end of the clamping tongue through a pin shaft. The clamping tongue and the driving cylinder are provided with two groups and are arranged in parallel.

[0037] Preferably, in the above full-automatic bending machine, the back-and-forth moving driving assembly includes a first driving motor, a first lead screw and a first nut. The first nut is screwed on the first lead screw and is fixedly connected with the back-and-forth moving frame. The first lead screw is fixed on the left frame through a bearing and a first synchronous pulley installed at one end of the first lead screw is in transmission connection with a second synchronous pulley installed on a motor shaft of the first driving motor through a synchronous pulley and the first driving motor is fixedly installed at the bottom of the left frame.

[0038] Preferably, in the above full-automatic bending machine, the transverse movement driving device includes a second driving motor, a second lead screw and a second nut. The second nut is screwed on the second lead screw, and the second nut is fixedly connected with the bottom of the shell. The front and rear moving frame and the right frame are fixed on the second lead screw through bearings. A third synchronous pulley arranged at one end of the second lead screw is in transmission connection with a fourth synchronous pulley arranged on a motor shaft of the second driving motor through a synchronous pulley. The second driving motor is installed on the front and rear moving frame or the right frame.

[0039] According to the technical scheme, compared with the prior art, the full-automatic bending machine disclosed by the invention has the advantages that the electric servo bending center cutter driving mechanism of the main machine of the bending machine is simple and compact in structure, small in occupied space, high in cost performance, free of oil leakage hidden danger, high in control precision, energy-saving and environment-friendly. The automatic tool changing device can automatically assemble different tool lengths according to different bending lengths required by different products to correspond to the corresponding bending lengths, and high-precision parts are adopted to ensure the overall precision of the tool after the tool is changed, so that the tool does not need to be corrected again. It saves a lot of time and labor costs for enterprises.

[0040] The automatic bending machine with the local bending mechanism can well solve the bending problem of products with two ends bent but no middle bent, so that the automatic bending machine can adapt to more products, and the flexibility of the automatic bending machine can be better reflected.

[0041] A positioning and clam workbench can realize various bending procedure without three-dimensional movement of a plate through a feeding rotary manipulator, and the positioning, translation and rotation of the

plate on the workbench surface are all realized by the manipulator. The positioning device consists of a left part and a right part. The right positioning device is fixed, and the left positioning device can move back and forth. Whether the sheet is positioned with collinear end faces or not, the equipment can easily cope with it. The contact surface between the table top of the supporting table and the plate is small, so that the plate is convenient to move on the table top of the supporting table, and the support of the table surface of the bending supporting table to the plate can meet various bending requirements.

Description of Drawings

[0042] In order to more clearly illustrate the embodiments of the present disclosure or the technical solutions in the prior art, the drawings required to be used in the description of the embodiments or the prior art will be briefly described below. Obviously, the drawings in the following description are only the embodiments of the present invention. For those of ordinary skills in the art, other figures may also be obtained from the figures provided.

FIG. 1 is a schematic diagram of an overall structure of the disclosure.

FIG. 2 is a structural schematic diagram of the main machine of the bending machine.

FIG. 3 is a structural diagram of the main machine of the bending machine without the automatic tool changer.

FIGs. 4-5 are three-dimensional structural diagrams of the partial bending mechanism at different angles.

FIG. 6 is a top view of a partial bending mechanism.

FIG. 7 is a hollowed-out schematic diagram of the portion A in FIG. 4.

FIG. 8 is a structural diagram of the positioning and clamping workbench.

FIG. 9 is a structural diagram of the supporting table.

FIG. 10 is a structural diagram of the positioning device.

FIG. 11 is a structural diagram of the left positioning device.

FIG. 12 is a structural diagram of the left positioning device when the movable brush plate and the left fixed brush plate are not installed.

FIG. 13 is a schematic diagram of the internal structure of the left positioning device.

FIG. 14 is a structural diagram of the right positioning device without the right fixed brush plate.

FIG. 15 is a structural diagram of the positioning clamp.

FIG. 16 is an enlarged view of the portion B in FIG. 9.

FIG. 17 is a structural schematic diagram of the feeding rotary manipulator.

Detailed description of embodiments

[0043] In the following, the technical solutions in the embodiments of the disclosure will be described clearly and completely in combination with the accompanying drawings of the embodiments of the disclosure. Obviously, the described embodiments are only a part of the embodiments, but not all of them. Based on the embodiments of the disclosure, all other embodiment obtained by a person of ordinary skill in that art without creative efforts fall within the scope of protection of the disclosure.

[0044] The embodiment of the invention discloses a full-automatic bending machine, which includes a main machine of the bending machine 1 and a positioning and clamping workbench 2.

[0045] The main machine of the bending machine includes a main machine shell 1-25. An electric servo bending center cutter driving mechanism 1-26 is arranged in the main machine shell 1-25. An automatic cutter changing device 1-27 matched with the electric servo bending center cutter driving mechanism 1-26 is arranged on a bending operation port of the main machine shell 1-25. The lower cutter 1-4 of the electric servo bending center cutter driving mechanism 1-26 is provided with a local bending mechanism 1-28. The local bending mechanism 1-28 includes a local bending slide rail 1-1, a left local bending assembly 1-2, and a right local bending assembly 1-3. Wherein the left local bending assembly 1-2 and the right local folding assembly 1-3 are slidably mounted on the local bending slide rail 1-1, and are symmetrically disposed at both ends of the lower cutter 1-4.

[0046] The positioning and clamping workbench includes a feeding rotary manipulator 2-29 and a supporting table. The supporting table includes a positioning device and a supporting rack, and the positioning device is connected with the supporting rack into a whole.

[0047] The positioning device includes a left positioning device 2-1 and a right positioning device 2-2. A gap is reserved between the left positioning device 2-1 and the right positioning device 2-2.

[0048] The left positioning device 2-1 includes a left frame 2-3 and a front and rear moving frame 2-4. The front and rear moving frame 2-4 is slidably installed in a concave cavity in the center of the left frame 2-3. The front and rear moving frame 2-4 is in transmission connection with a back-and-forth moving driving assembly installed on the left frame 2-3. The two sides of the top of the front and rear moving frame 2-4 are provided with a comb-shaped front and rear movable brush plates 2-5. The left frame 2-3 is provided with a left fixed brush plate 2-6 matched and spliced with the comb-shaped front and rear movable brush plates 2-5 on the two sides of the front and rear moving frame 2-4.

[0049] The right positioning device 2-2 includes a right frame 2-7 and a right fixed brush plate 2-8 mounted on the top of the right frame 2-7.

[0050] The front and rear moving frame 2-4 and the right frame 2-7 are both provided with a transverse mov-

ing assembly. The transverse moving assembly includes a transverse movement driving device and a positioning clamping piece 2-9 which is in transmission connection with the transverse movement driving device.

[0051] The front and rear moving frame 2-4 is fixedly connected with the transverse movement driving device, and the front and rear moving frame 2-4 is connected with the positioning clamping piece 2-9 in a sliding manner.

[0052] The right frame 2-7 is fixedly connected with the transverse movement driving device, and the right frame 2-7 is connected with the positioning clamping piece 2-9 in a sliding manner.

[0053] Strip-shaped positioning clamping piece moving openings are respectively reserved between the comb-shaped front and rear movable brush plates 2-5 arranged on the two sides of the top of the front and rear moving frames 2-4 and in the middle of the right fixed brush plate 2-8.

[0054] In order to further optimize the above technical solution, both the left local bending assembly 1-2 and the right local bending assembly 1-3 are provided with a local bending tool set 1-5 and a tool selection cylinder 1-6.

[0055] The left local bending assembly 1-2 includes a left mounting frame 1-7 and a left tool driving mechanism. The left tool driving mechanism is mounted on the left mounting frame 1-7. The left tool driving device includes a left driving motor 1-8, a left synchronous pulley 1-9, a left driving synchronous pulley 1-10, a left driven synchronous pulley 1-11, a first guide wheel 1-12 and a second guide wheel 1-13.

[0056] The right local bending assembly 1-3 includes a right mounting frame 1-14 and a right tool driving mechanism. The right tool driving mechanism is mounted on the right mounting frame 1-14. The right cutter driving mechanism includes a right driving motor 1-15, a right synchronous pulley 1-16, a right driving synchronous pulley 1-17, a right driven synchronous pulley 1-18, a third guide wheel 1-19 and a fourth guide wheel 1-20.

[0057] A left driving motor 1-8 is in transmission connection with a left driving synchronous pulley 1-10. A left synchronous pulley 1-9 is sleeved on the left driving synchronous pulley 1-10 and a right driven synchronous pulley 1-18. The left synchronous pulley 1-9 is connected with a local bending tool set 1-5 close to a left local bending assembly 1-2, and the left synchronous pulley 1-9 is guided by the first guide wheel 1-12 and the fourth guide wheel 1-20.

[0058] A right driving motor 1-15 is in transmission connection with a right driving synchronous pulley 1-17. The right synchronous pulley 1-16 is sleeved on the right driving synchronous pulley 1-17 and the left driven synchronous pulley 1-11. The right synchronous pulley 1-16 is connected with a local bending tool set 1-5 close to a right local bending assembly 1-3. The right synchronous pulley 1-16 is guided by the second guide wheel 1-13 and the third guide wheel 1-19.

[0059] The local bending tool set 1-5 is formed by de-

tachably connecting a number of local bending tools 1-21 into a whole through a bayonet mechanism. Two tool selection cylinders 1-6 are provided and respectively mounted on the left mounting frame 1-7 and the right mounting frame 1-14 and respectively located at one side of the two local bending tool sets 1-5.

[0060] In order to further optimize the above technical scheme, the bayonet mechanism includes a bayonet wheel 1-22 and a spring bayonet pin 1-23. The bayonet wheel 1-22 is fixed on one side of the local bending cutter 1-21 through a stud. A bayonet wheel hole is formed on the other side of the local bending cutter 1-21. A spring bayonet pin mounting hole is formed above the bayonet wheel hole, and the upper part of the bayonet wheel hole is communicated with the spring bayonet pin mounting hole. The spring bayonet pin 1-23 is installed in the spring bayonet pin installation hole. The snap ring 1-24 on the spring bayonet pin 1-23 can reciprocate along the axis of the mounting hole of the spring bayonet pin.

[0061] The clamping wheel 1-22 extends into the clamping wheel hole of the adjacent local bending cutter 1-21 and is locked by the clamping ring 1-24 of the spring bayonet pin 1-23, so that the adjacent local bending cutters 1-21 are locked.

[0062] In order to further optimize the above technical scheme, the action end of the spring bayonet pin 1-23 extends out of the local bending cutter 1-21. The piston rod of the tool selection cylinder 1-6 is provided with a pressing block which can be matched with the action end.

[0063] In order to further optimize the above technical solution, the local bending cutter 1-21 is provided with a mounting groove matched with the lower cutter 1-4, and the mounting groove can be clamped into a convex strip on the top of the lower cutter 1-4 of the bending machine.

[0064] In order to further optimize the above technical solution, one of the local bending tools 1-21 of each local bending tool set 1-5 is slidably connected to the local bending slide rail 1-1 through a slide block.

[0065] In order to further optimize the above technical scheme, the support frame includes a left support frame body 2-23, a right support frame body 2-24, a left platen 2-25 and a right platen 2-26. The left platen 2-25 is installed on the top of the left support frame body 2-23, and the right platen 2-26 is installed on the top of the right support frame body 2-24. A number of flexible supporting bodies 2-27 are distributed on the left platen 2-25 and the right platen 2-26. A gap is reserved between the left support frame body 2-23 and the right support frame body 2-24.

[0066] The base 2-30 of the feeding rotary manipulator 2-29 is installed below the support rack. The rack 2-31 of the feeding rotary manipulator 2-29 extends above the left platen 2-25 and the right platen 2-26 through a gap between the left support frame body 2-23 and the right support frame body 2-24. The rack 2-31 can reciprocate in the gap between the left support frame body 2-23 and the right support frame body 2-24. The pushing device 2-32, the lower pressing block 2-33, and the upper press-

ing block 2-34 of the feeding rotary manipulator 2-29 can operate in the gap between the left support frame body 2-23 and the right support frame body 2-24, and in the gap between the left positioning device 2-1 and the right positioning device 2-2.

[0067] In order to further optimize the above technical scheme, the positioning clamping piece 2-9 includes a shell 2-10, a clamping tongue 2-11 and a driving cylinder 2-12. One side of the shell 2-10 is provided with a sliding block, and the front and rear moving frames 2-4 and the right frame 2-7 are provided with sliding rails matched with the sliding block. The middle part of the clamping tongue 2-11 is hinged on the top opening of the shell 2-10. The top end of the clamping tongue 2-11 extends out of the top opening of the shell 2-10, and the bottom end of the clamping tongues 2-11 is positioned in the shell 2-20 and is provided with a strip-shaped hole. The driving cylinder 2-12 is fixedly connected outside the shell 2-10, and the piston rod of the driving cylinder 2-12 extends into the shell 2-10 and is hinged with the strip-shaped hole at the bottom end of the clamping tongue 2-11 through a pin shaft.

[0068] In order to further optimize the above technical solution, two groups of clamping tongues 2-11 and driving cylinders 2-12 are provided and arranged in parallel.

[0069] In order to further optimize the above technical solution, the back-and-forth moving driving assembly includes a first driving motor 2-13, a first lead screw 2-14 and a first nut 2-15. The first nut 2-15 is screwed on the first lead screw 2-14 and is fixedly connected with the back-and-forth moving frame 2-4. The first lead screw 2-14 is fixed on the left frame 2-3 through a bearing. In addition, a first synchronous pulley 2-16 installed at one end of the first lead screw 2-14 is in transmission connection with a second synchronous pulley 2-17 installed on a motor shaft of the first driving motor 2-13 through a synchronous pulley. The first driving motor 2-13 is fixedly installed at the bottom of the left frame 2-3.

[0070] In order to further optimize the above technical solution, the transverse movement driving device includes a second driving motor 2-18, a second lead screw 2-19 and a second nut 2-20. The second nut 2-20 is in threaded connection with the second lead screw 2-19 and is fixedly connected with the bottom of the shell 2-10. The front and rear moving frames 2-4 and the right frame 2-7 are fixed with a second screw rod 2-19 thereon through a bearing. The third synchronous pulley 2-21 installed at one end of the second lead screw 2-19 is connected with the fourth synchronous pulley 2-22 installed on the motor shaft of the second driving motor 2-18 through a synchronous pulley. The second driving motor 2-18 is mounted on the front and rear moving frame 2-4 or the right frame 2-7.

[0071] In order to further optimize the above technical solution, the flexible supporting body 2-27 is a supporting brush. The supporting brush is installed in the mounting holes uniformly distributed on the top of the left platen 2-25 and the right platen 2-26, and the bristles of the

supporting brush extend out of the mounting holes.

[0072] In order to further optimize the above technical solution, one side of the left platen 2-25 and the right platen 2-26 away from the positioning device is connected with an extension plate 2-28 for mounting the sheet clamping device.

[0073] The feeding rotary manipulator 2-29 includes a base 2-30 and a rack 2-31. The rack 2-31 is driven by a rack driving device to reciprocate horizontally relative to the base 2-30. The rack 2-31 is of a C-shaped structure. The upper part of the rack 2-31 is provided with a horizontal moving seat. One side of the upper part of the rack 2-31 is provided with an up-and-down moving seat, and the up-and-down moving seat is hinged with the horizontal moving seat through a connecting rod. An upper rotate device 2-36 is arranged on the up-and-down move seat. The upper rotating device 2-36 is drivingly connected with a pressure rod, and an upper pressing block 2-34 is arranged at the lower end of the pressure rod. A low rotating device 2-35 is arranged on one side of the lower part of the rack 2-31. A lower pressing block 2-33 is arranged on an output shaft of the lower rotating device. The lower pressing block 2-33 is positioned right below the upper pressing block 2-34. An output shaft of the low rotating device is coaxially arranged with the pressure rod. A material pushing device 2-32 is arranged in the throat of the rack.

[0074] Working principle of the positioning and clamping workbench:

When the end faces of the plates are collinear, the left positioning device 2-1 and the right positioning device 2-2 are adjusted to be flush, and the positions of the positioning clamping pieces 2-9 on the left positioning device 2-1 and the right positioning device 2-2 are adjusted through the transverse movement driving devices on the left positioning devices 2-1 and right positioning devices 2-2, so that the distance adjustment is realized. Then the two corners of the sheet are positioned by the positioning clamping piece 2-9.

[0075] When the end face of the plate is not collinear and is an oblique line or other irregular shapes, the distance between the front and rear moving frame 2-4 is adjusted by adjusting the front and back moving driving assembly of the left positioning device 2-1. Then the positions of the positioning clamping pieces 2-9 on the left positioning device 2-1 and the right positioning device 2-2 are adjusted by the transverse movement driving devices on the left positioning device 2-1 and the right positioning device 2-2 to realize the distance adjustment. Finally, the two non-collinear corners of the sheet are positioned by the positioning clamping piece 2-9.

[0076] A number of flexible supporting bodies 2-27 on the supporting rack can meet the supporting requirements for the plates.

[0077] The plate is clamped by the lower pressing block 2-33 and the upper pressing block 2-34 of the feeding rotary manipulator. The plate can be rotated by the lower rotating device 2-35 and the upper rotating device

2-36. The plate can be moved to the positioning device for positioning by the pushing device 2-32, so that various bending processes can be realized by cooperating with the bending host. The positioning, the translation and the rotation of the plate on the working table are realized by the manipulator.

[0078] The embodiments in this specification are described in a progressive manner, and each embodiment focuses on the differences from other embodiments, and the same and similar parts among the embodiments are referred to each other. For the device disclosed in the embodiment, since it corresponds to the method disclosed in the embodiment, the description is relatively simple. If it is relevant, please refer to the description in the method section.

[0079] The foregoing description of the disclosed embodiments will enable any person skilled in the art to make or use the invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be implemented in other embodiments without departing from the spirit or scope of the invention. So, the present invention is not to be limited to the embodiments shown herein, but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

Claims

1. A full-automatic bending machine (1), comprising a main machine of the bending machine (1) and a positioning and clamping workbench (2);

wherein the main machine of the bending machine (1) comprises a main machine shell (1-25); an electric servo bending center cutter driving mechanism (1-26) is arranged in the main machine shell (1-25), and an automatic cutter changing device (1-27) matched with the electric servo bending center cutter driving mechanism (1-26) is arranged on a bending operation opening of the main machine shell (1-25); **characterized in that** a local bending mechanism (1-28) is arranged on a lower cutter (1-4) of the electric servo bending central cutter driving mechanism (1-26); the local bending mechanism (1-28) comprises a local bending slide rail (1-1), a left local bending assembly (1-2) and a right local bending assembly (1-3); wherein the left local bending assembly (1-2) and the right local bending assembly (1-3) are arranged on the local bending slide rail (1-1) in a sliding manner and are symmetrically arranged at two ends of the lower cutter (1-4);

the positioning and clamping workbench (2) comprises a feeding rotary manipulator (2-29) and a supporting table, the supporting table comprises positioning equipment and a support-

ing rack, and the positioning equipment is connected with the supporting rack into a whole; the positioning equipment comprises a left positioning device (2-1) and a right positioning device (2-2), and a gap is reserved between the left positioning device (2-1) and the right positioning device (2-2);

the left positioning device (2-1) comprises a left frame (2-3) and a front and rear moving frame (2-4), and the front and rear moving frame (2-4) is arranged in a concave cavity at the center of the left frame (2-3) in a sliding manner; the front and rear moving frame (2-4) is in transmission connection with a front and back moving driving component arranged on the left frame (2-3); two sides of the top of the front and rear moving frame (2-4) are provided with comb-shaped movable brush plates (2-5); the left frame (2-3) is provided with a left fixed brush plate (2-6) matched and spliced with the movable brush plates (2-5) on the two sides of the front and rear moving frame (2-4);

the right positioning device (2-2) comprises a right frame (2-7) and a right fixed brush plate (2-8) arranged on the top of the right frame (2-7); the front and rear moving frame (2-4) and the right frame (2-7) are both provided with a transverse moving assembly, and the transverse moving assembly comprises a transverse movement driving device and a positioning clamping piece (2-9) in transmission connection with the transverse movement driving device; the front and rear moving frame (2-4) is fixedly connected with the transverse movement driving device; the front and rear moving frame (2-4) is in sliding connection with the positioning clamping piece (2-9);

the right frame (2-7) is fixedly connected with the transverse movement driving device and is connected with the positioning clamping piece (2-9) in a sliding manner; and strip-shaped positioning clamping piece moving openings are respectively reserved between the comb-shaped movable brush plates (2-5) arranged on the two sides of the top of the front and rear moving frames (2-4) and in the middle of the right fixed brush plate (2-8).

2. The full-automatic bending machine (1) of claim 1, wherein both the left local bending assembly (1-2) and the right local bending assembly (1-3) are provided with a local bending tool set (1-5) and a tool selection cylinder (1-6);

the left local bending assembly (1-2) comprises a left mounting frame (1-7) and a left cutter driving mechanism; wherein the left cutter driving mechanism is mounted on the left mounting

- frame (1-7) and comprises a left driving motor (1-8), a left synchronous pulley (1-9), a left driving synchronous pulley (1-10), a left driven synchronous pulley (1-11), a first guide wheel (1-12) and a second guide wheel (1-13);
 the right local bending assembly (1-3) comprises a right mounting frame (1-14) and a right cutter driving mechanism; wherein the right cutter driving mechanism is mounted on the right mounting frame (1-14) and comprises a right driving motor (1-15), a right synchronous pulley (1-16), a right driving synchronous pulley (1-17), a right driven synchronous pulley (1-18), a third guide wheel (1-19) and a fourth guide wheel (1-20);
 the left driving motor (1-8) is in transmission connection with the left driving synchronous pulley (1-10); the left synchronous pulley (1-9) is sleeved on the left driving synchronous pulley (1-10) and the right driven synchronous pulley (1-18); the left synchronous pulley (1-9) is connected with the local bending tool set (1-5) close to the left local bending assembly (1-2), and the right driving motor (1-15) is in transmission connection with the right driving synchronous pulley (1-17); the right synchronous pulley (1-16) is sleeved on the right driving synchronous pulley (1-17) and the left driven synchronous pulley (1-11); the right synchronous pulley (1-16) is connected with the local bending tool set (1-5) close to the right local bending assembly (1-3); the right synchronous pulley (1-16) is guided by the second guide pulley and the third guide pulley;
 the local bending tool set (1-5) is formed by detachably connecting a plurality of local bending cutters (1-21) into a whole through a bayonet mechanism, and the two cutter selection cylinders are respectively arranged on the left mounting frame (1-7) and the right mounting frame (1-14) and are respectively positioned at one side of the two local bending tool sets (1-5).
3. The full-automatic bending machine (1) of claim 2, wherein the bayonet mechanism comprises a bayonet wheel (1-22) and a spring bayonet pin (1-23); the bayonet wheel (1-22) is fixed on one side of the local bending cutter (1-21) through a stud; a bayonet wheel hole is formed on the other side of the local bending cutter (1-21), and a spring bayonet pin mounting hole is formed above the bayonet wheel hole; the upper part of the clamping wheel hole is communicated with the spring bayonet pin mounting hole; the spring bayonet pin (1-23) is installed in the spring bayonet installation hole, and a snap ring (1-24) on the spring bayonet pin (1-23) can reciprocate along the axis of the spring bayonet installation hole;
 4. The full-automatic bending machine (1) of claim 3, wherein the action end of the spring bayonet pin (1-23) extends out of the local bending tool set (1-5), and the piston rod of the tool selection cylinder (1-6) is provided with a pressing block capable of matching with the action end.
 5. The full-automatic bending machine (1) of claim 4, wherein the local bending tool set (1-5) is provided with a mounting groove matched with the lower tool, and the mounting groove can be clamped into the convex strip on the top of the lower tool.
 6. The full-automatic bending machine (1) of claim 5, wherein one of the local bending tools of each local bending tool set (1-5) is connected with the local bending slide rail (1-1) in a sliding manner through a sliding block respectively.
 7. The full-automatic bending machine (1) of claim 1, wherein the support frame comprises a left support frame body (2-23), a right support frame body (2-24), a left platen (2-25) and a right platen (2-26); the left platen (2-25) is installed on the top of the left support frame body (2-23) and the right platen (2-26) is installed on the top of the right support frame; a plurality of flexible support bodies are distributed on the left platen (2-25) and the right platen (2-26); a gap is reserved between the left support frame body (2-23) and the right support frame body (2-24); a base of the feeding rotary manipulator (2-29) is arranged below the support rack; a rack of the feeding rotary manipulator (2-29) extends out of a gap between the left support frame body (2-23) and the right support frame body (2-24) to above the left platen (2-25) and the right platen (2-26), and the rack can reciprocate in the gap between the left support frame body (2-23) and the right support frame; the material pushing device (2-32), the lower pressing block (2-33) and the upper pressing block (2-34) of the feeding rotary manipulator (2-29) can act in a gap between the left support frame body (2-23) and the right support frame body (2-24) and a gap between the left positioning device (2-1) and the right positioning device (2-2).
 8. The full-automatic bending machine (1) of claim 7, wherein the positioning clamping piece (2-9) comprises a shell (1-25), a clamping tongue (2-11) and a driving cylinder (2-12); one side of the shell (1-25) is provided with a sliding block; the front and rear moving frames (2-4) and the right frame (2-7) are

provided with sliding rails matched with the sliding block; a middle part of the clamping tongue (2-11) is hinged on the top opening of the shell (1-25); a top end of the clamping tongue (2-11) extends out of an opening at the top of the shell (1-25); the bottom end of the clamping tongue (2-11) is positioned in the shell (1-25) and is provided with a strip-shaped hole; the driving cylinder (2-12) is fixedly connected outside the shell (1-25), and a piston rod of the driving cylinder (2-12) extends into the shell (1-25) and is hinged with a strip-shaped hole at the bottom end of the clamping tongue (2-11) through a pin shaft; and the clamping tongue (2-11) and the driving cylinder (2-12) are provided with two groups and are arranged in parallel.

9. The full-automatic bending machine (1) of claim 8, wherein the back-and-forth moving driving assembly comprises a first driving motor (2-13), a first lead screw (2-14) and a first nut (2-15); the first nut (2-15) is in threaded connection with the first lead screw (2-14), and the first nut (2-15) is fixedly connected with the front and rear moving frame (2-4); the first lead screw (2-14) is fixed on the left frame (2-3) through a bearing, a first synchronous pulley (2-16) installed at one end of the first lead screw (2-14) is in transmission connection with a second synchronous pulley (2-17) installed on a motor shaft of the first driving motor (2-13) through a synchronous pulley and the first driving motor (2-13) is fixedly installed at the bottom of the left frame (2-3).
10. The full-automatic bending machine (1) of claim 9, wherein the transverse movement driving device comprises a second driving motor (2-18), a second lead screw (2-19) and a second nut (2-20), the second nut (2-20) is in threaded connection with the second lead screw (2-19), and the second nut (2-20) is fixedly connected with the bottom of the shell (1-25); the front and rear moving frame (2-4) and the right frame (2-7) are fixed on the second lead screw (2-19) through bearings; a third synchronous pulley (2-21) arranged at one end of the second lead screw (2-19) is in transmission connection with a fourth synchronous pulley (2-22) arranged on a motor shaft of the second driving motor (2-18) through a synchronous pulley; and the second driving motor (2-18) is installed on the front and rear moving frame (2-4) or the right frame (2-7).

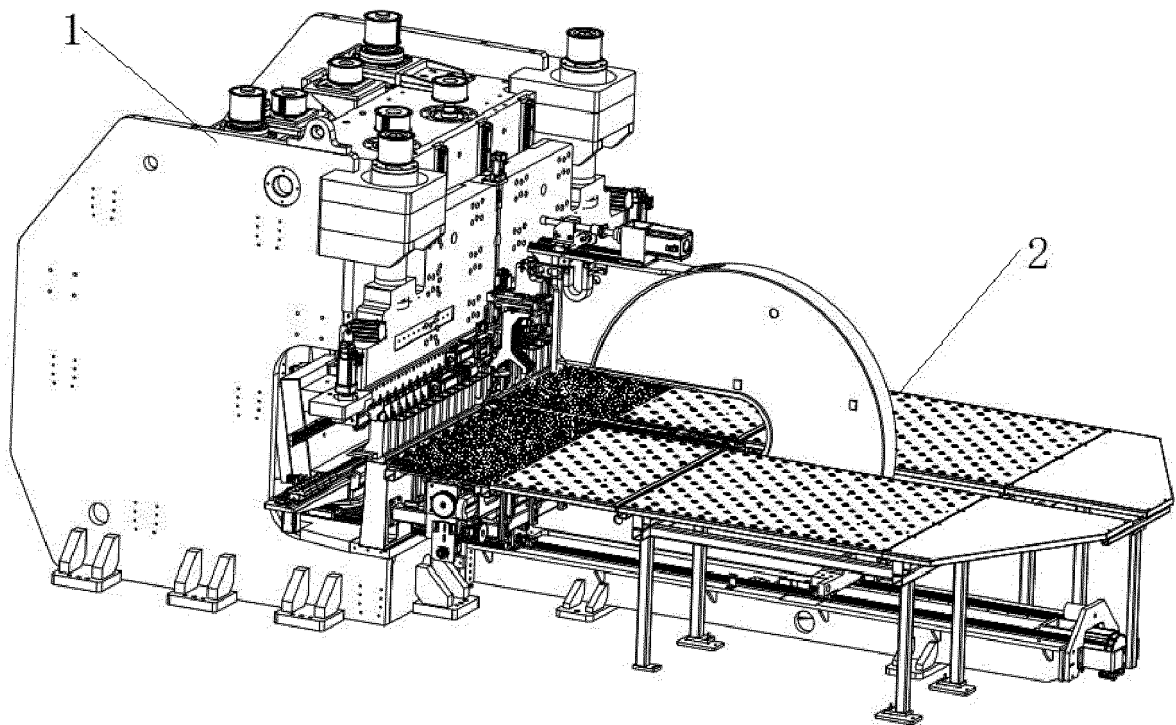


FIG. 1

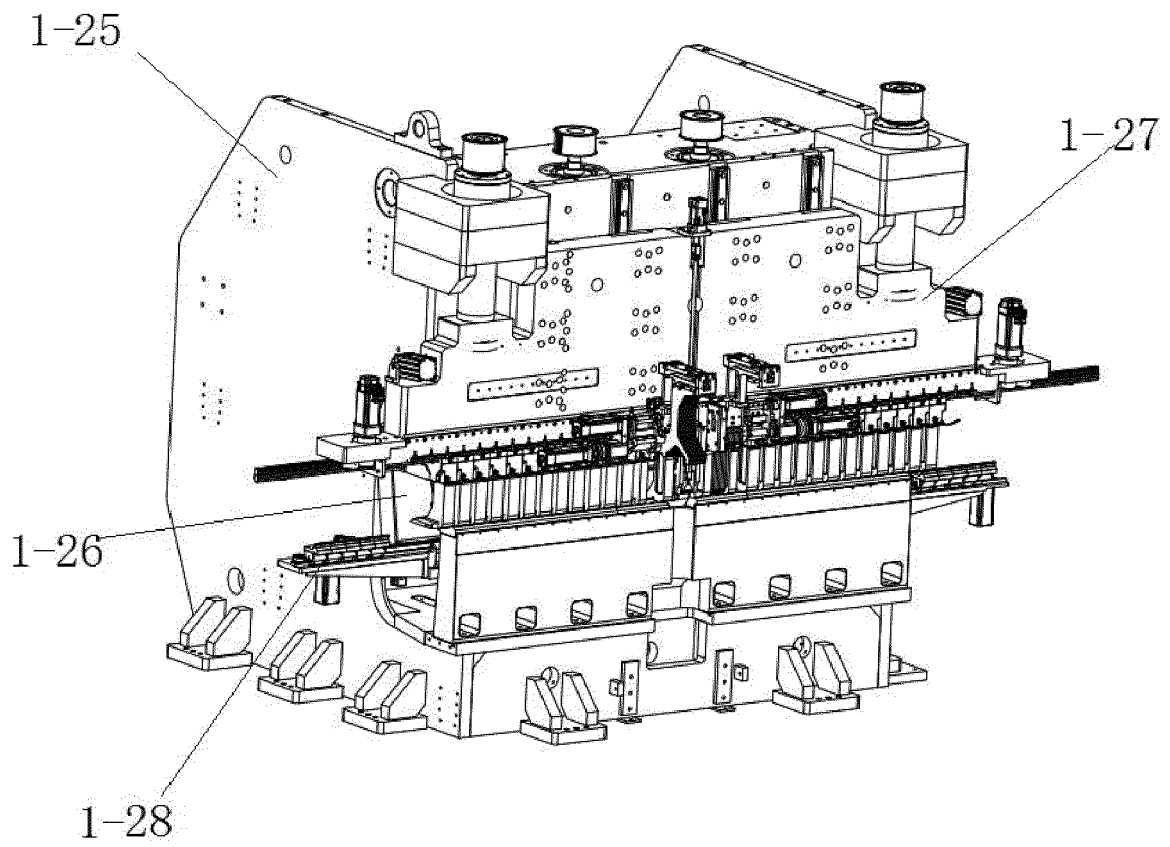


FIG. 2

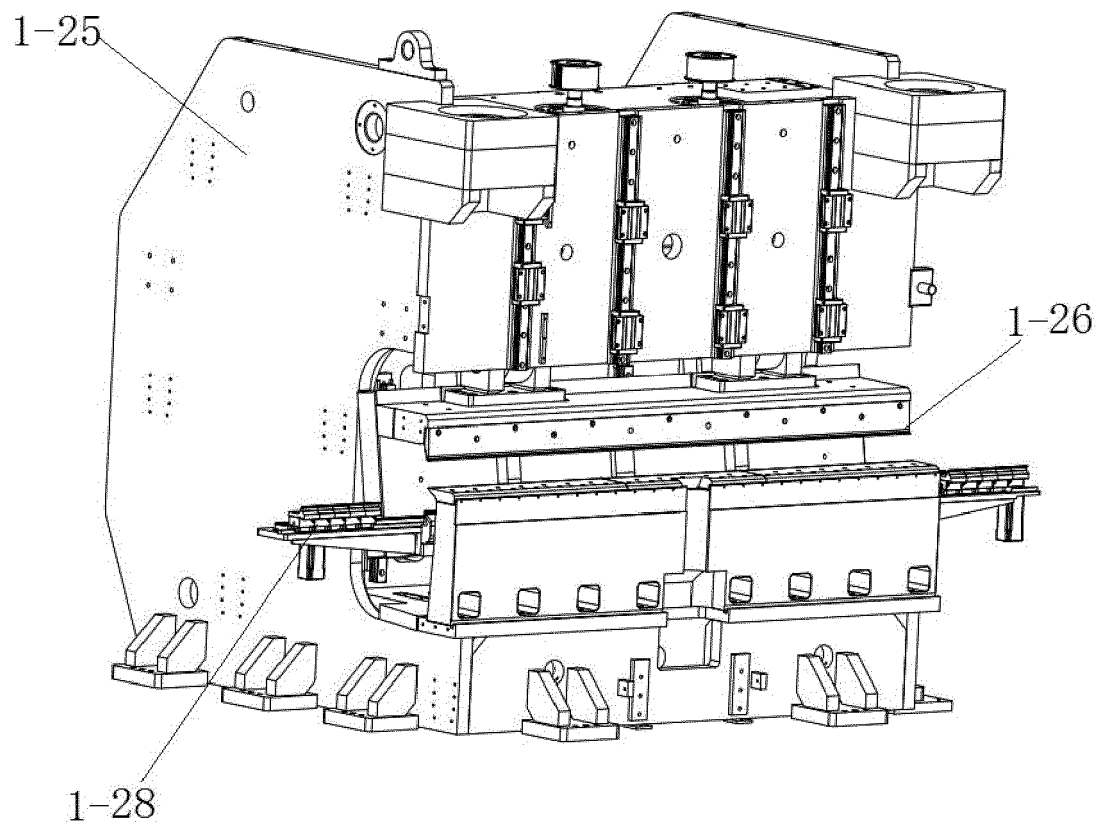


FIG. 3

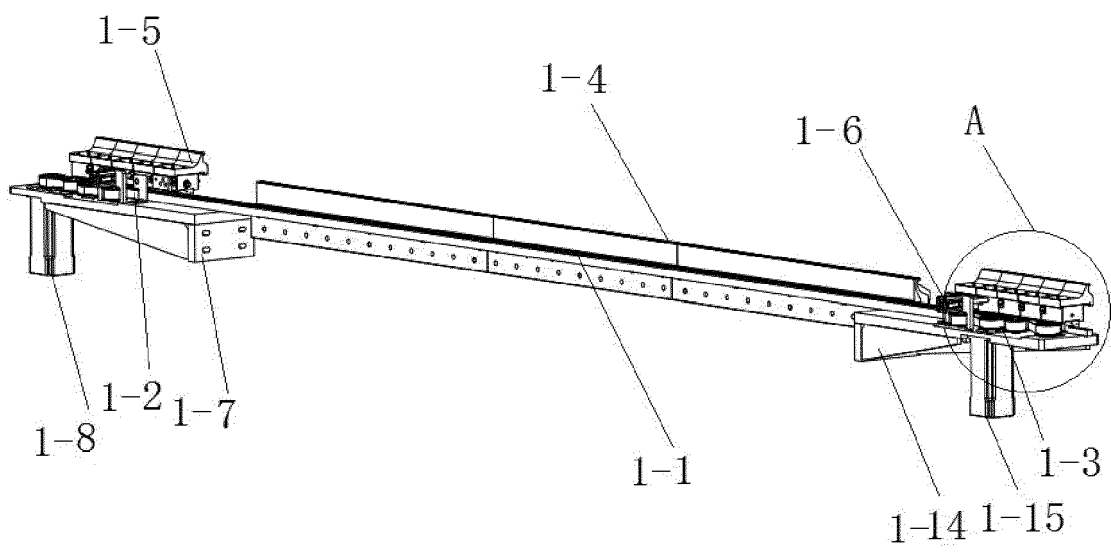


FIG. 4

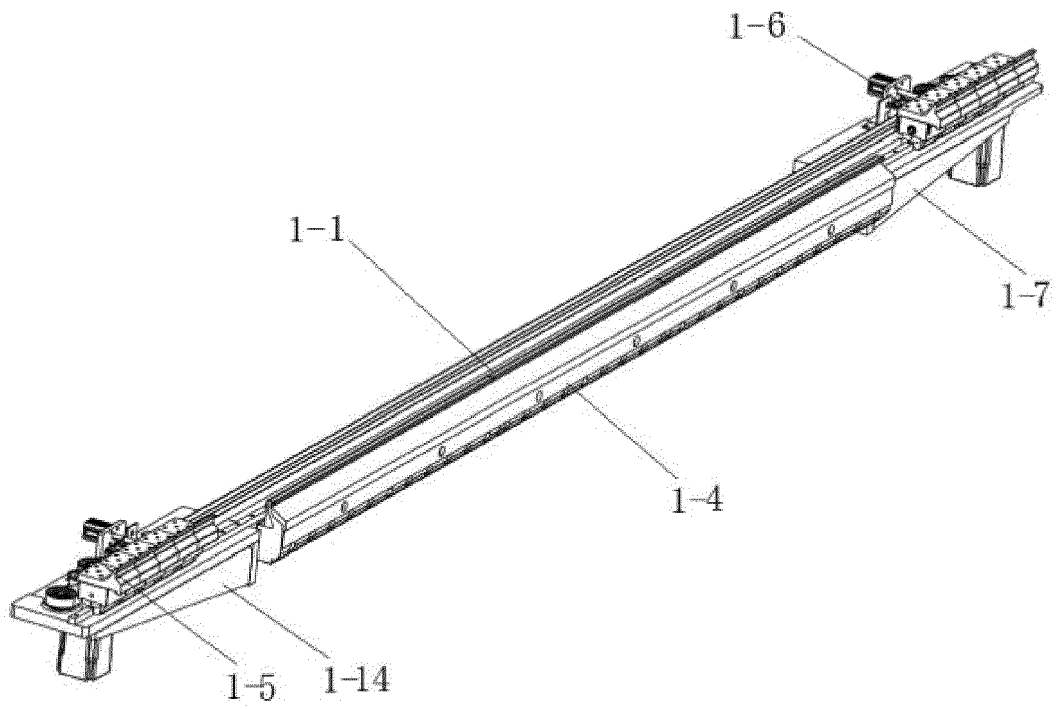


FIG. 5

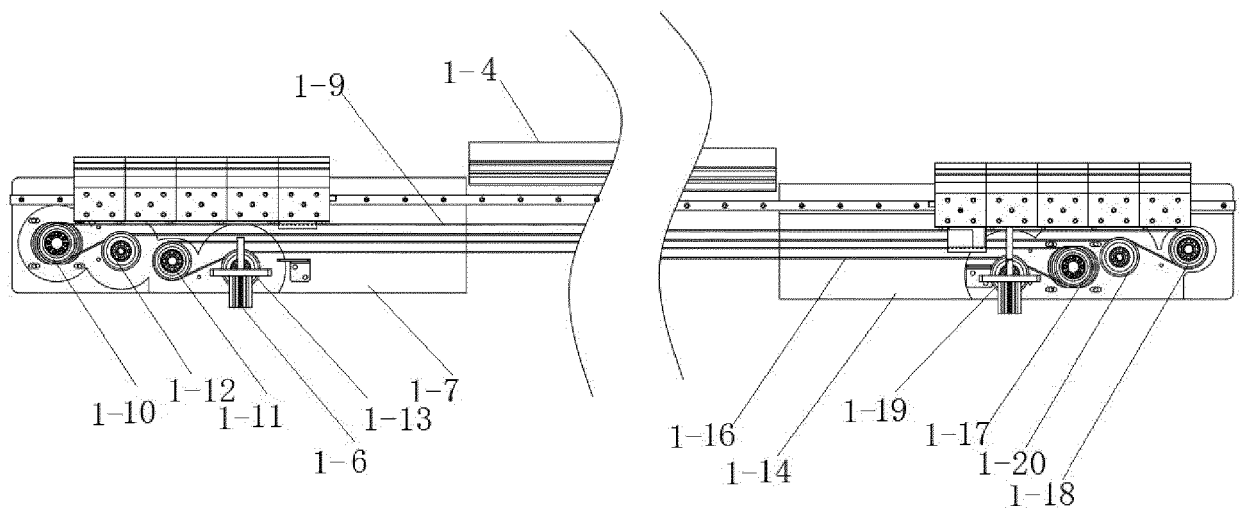


FIG. 6

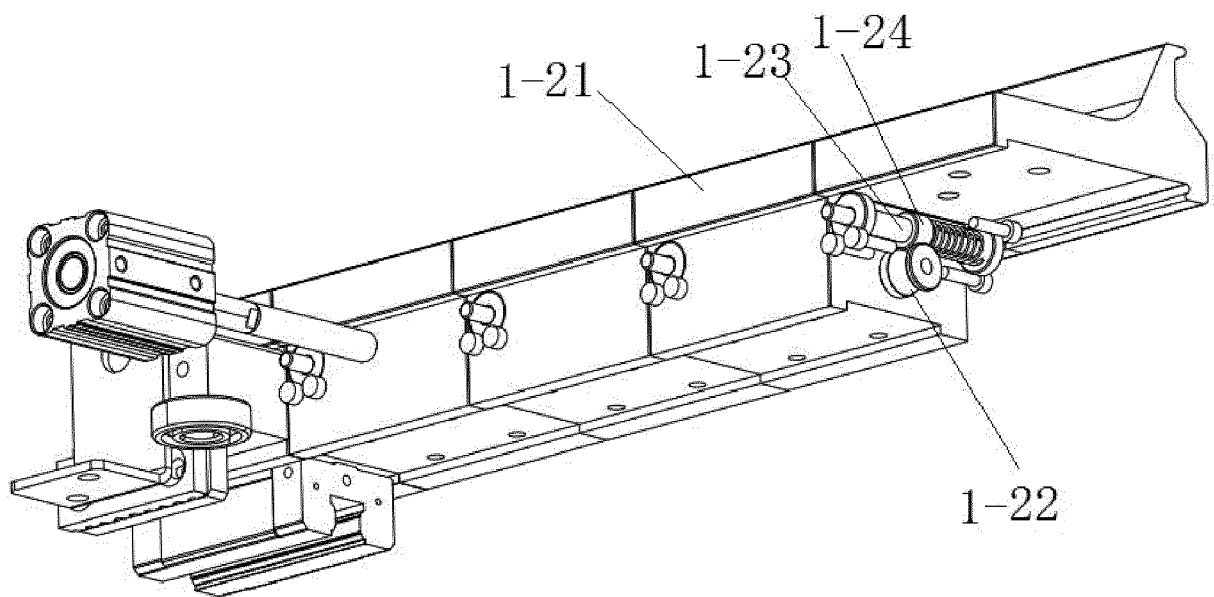


FIG. 7

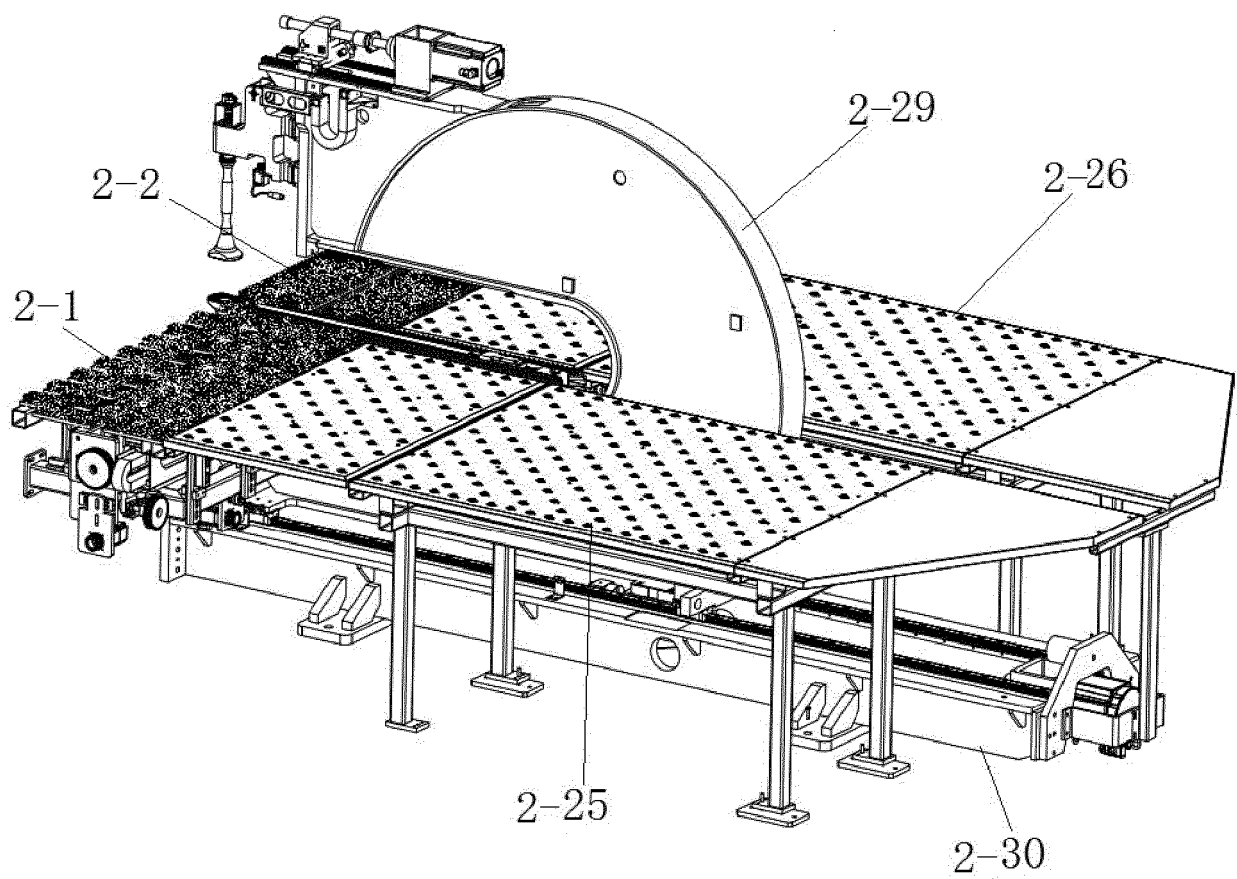


FIG. 8

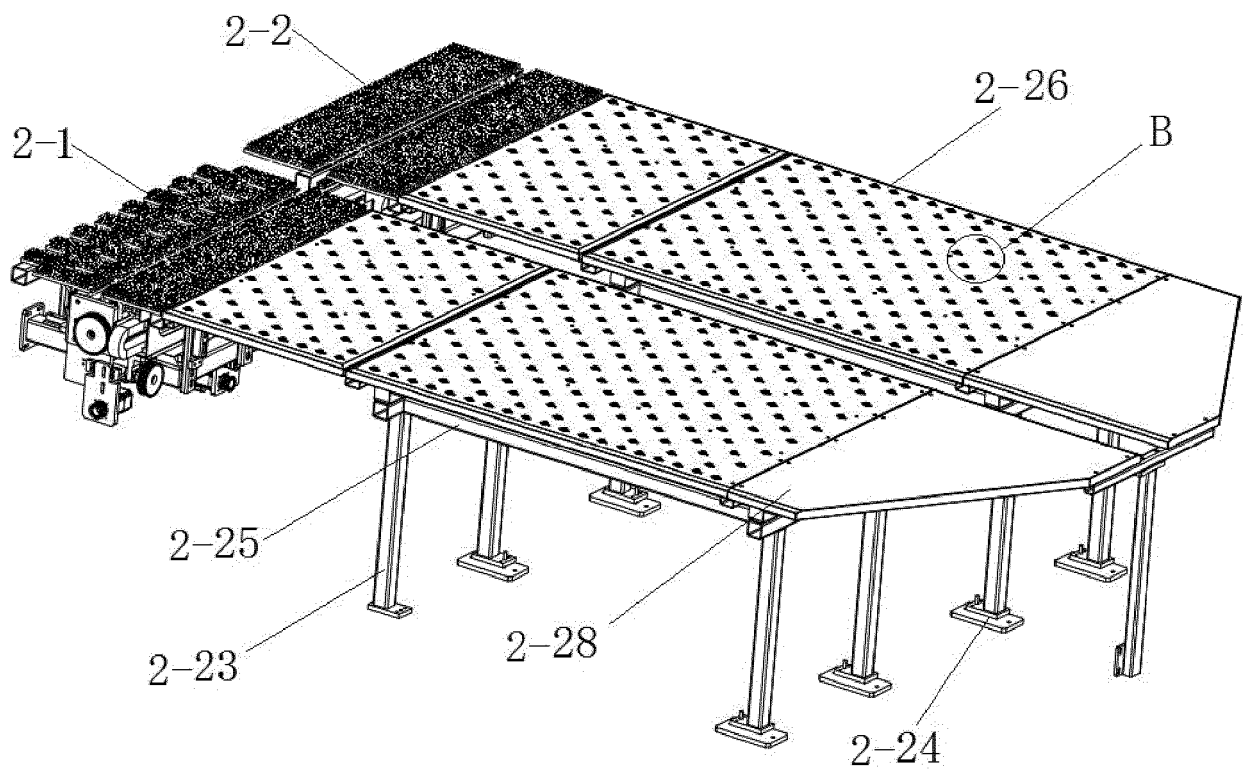


FIG. 9

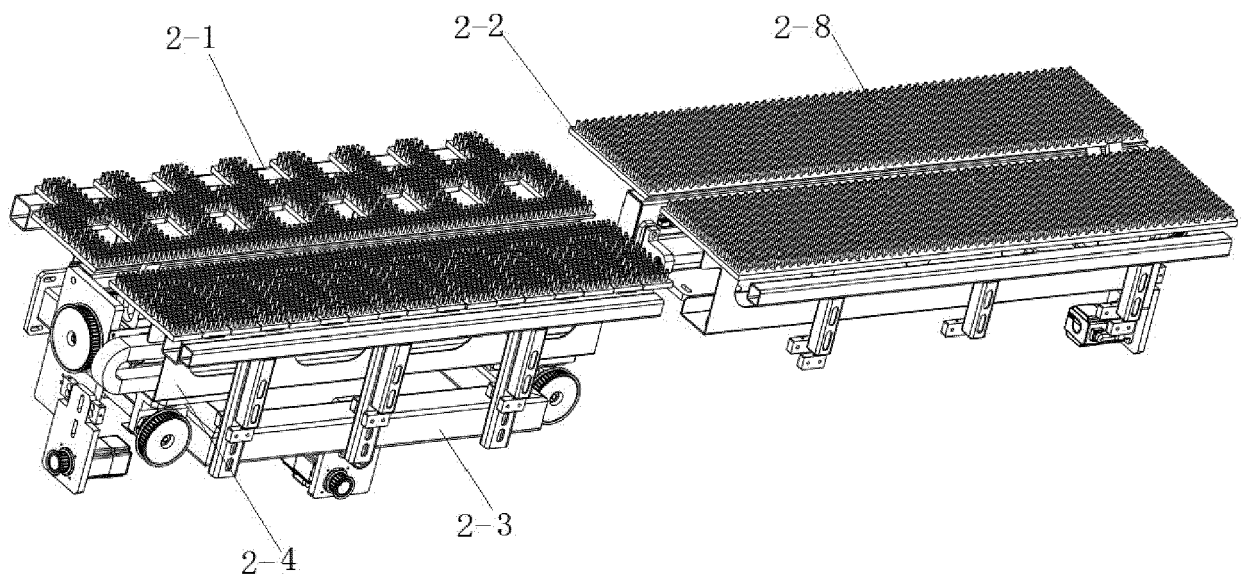


FIG. 10

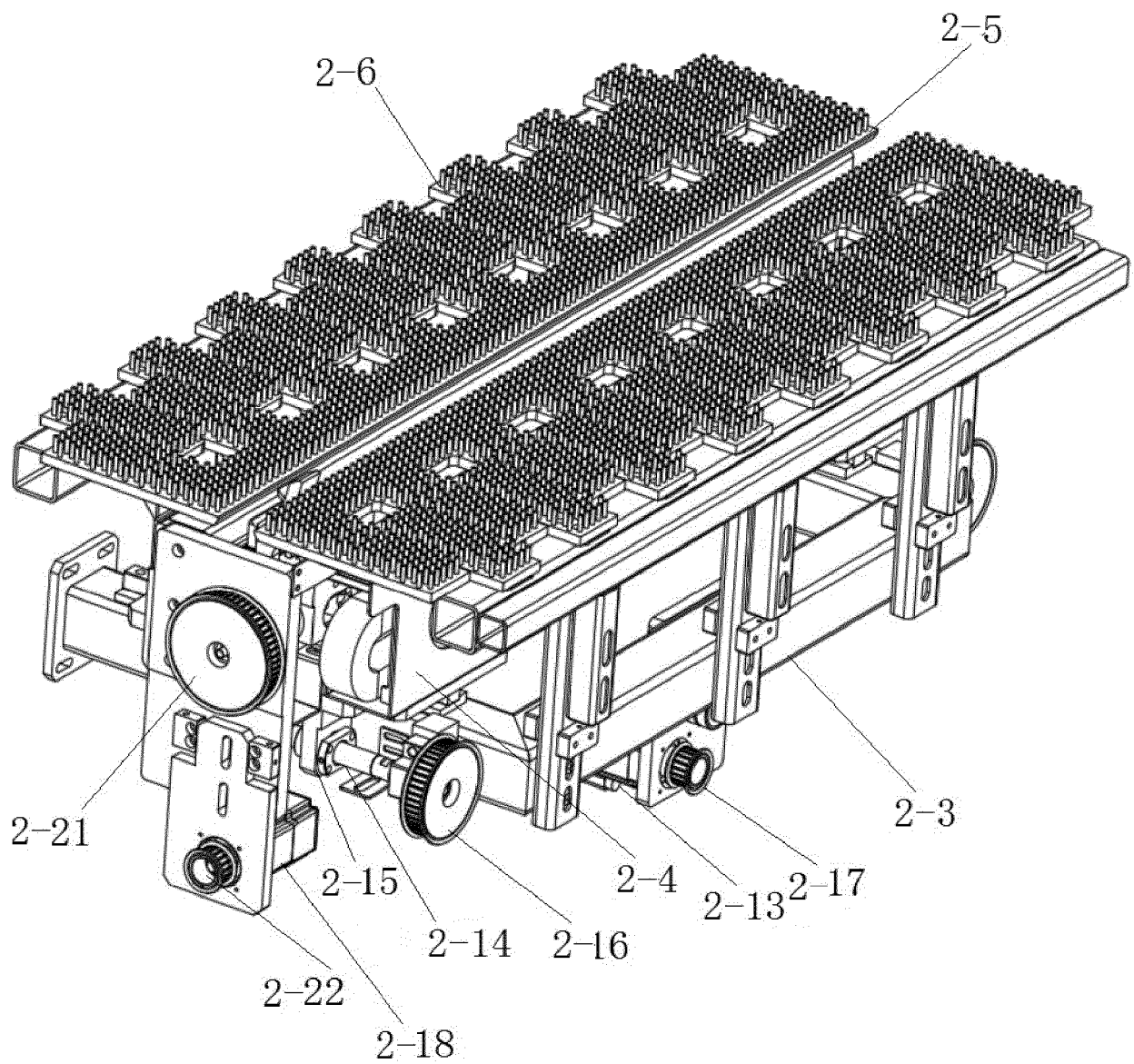


FIG. 11

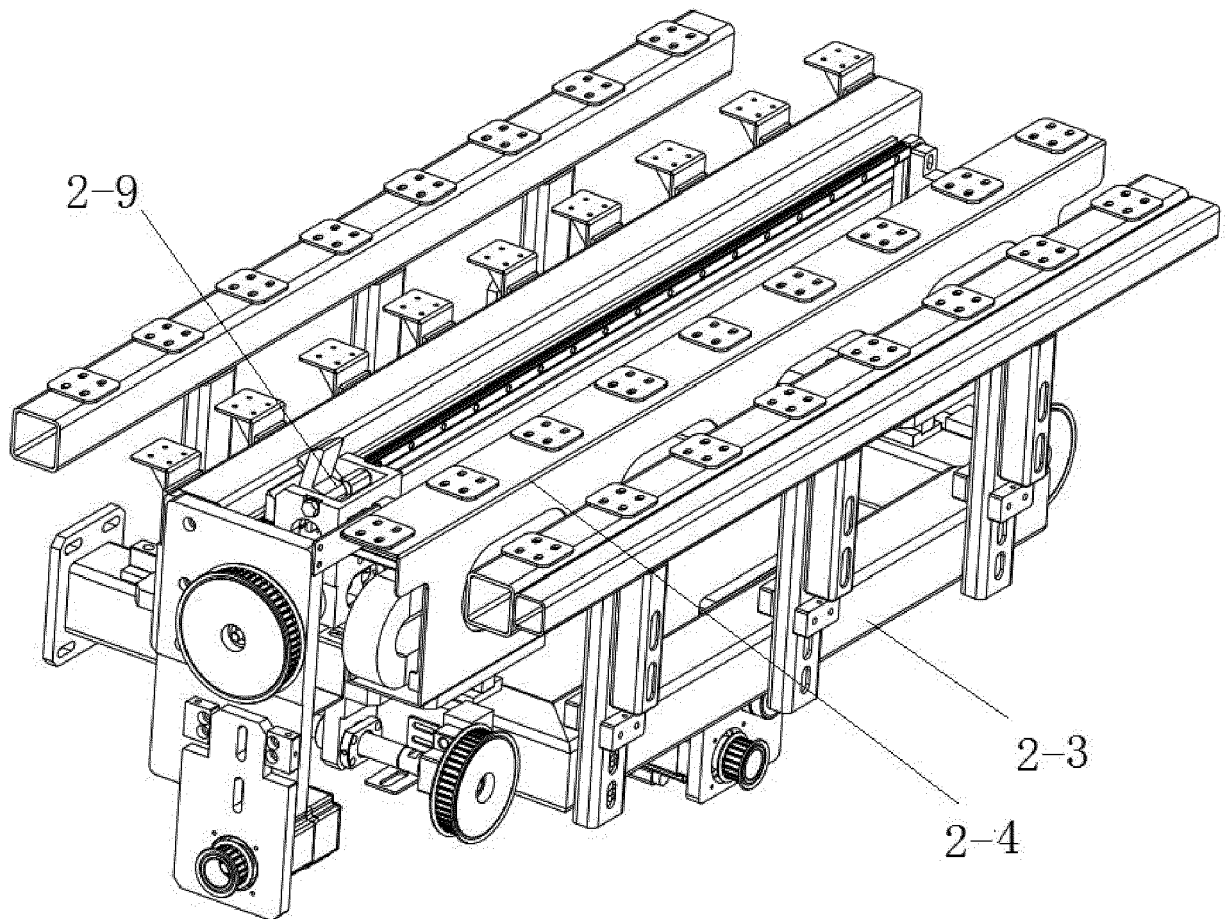


FIG. 12

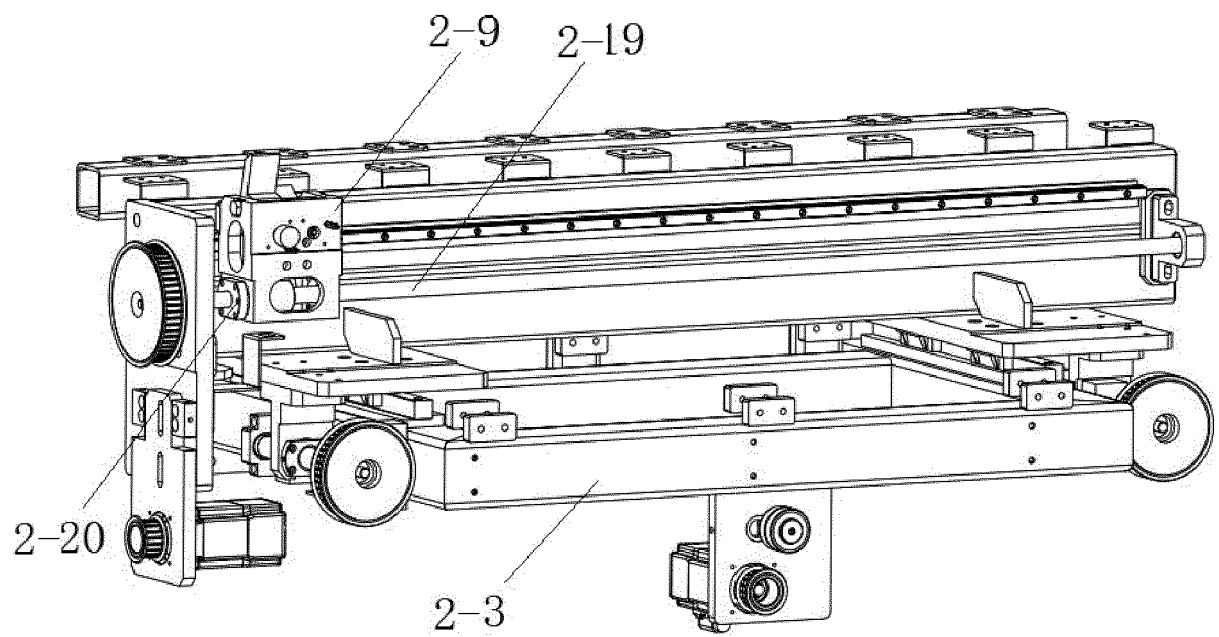


FIG. 13

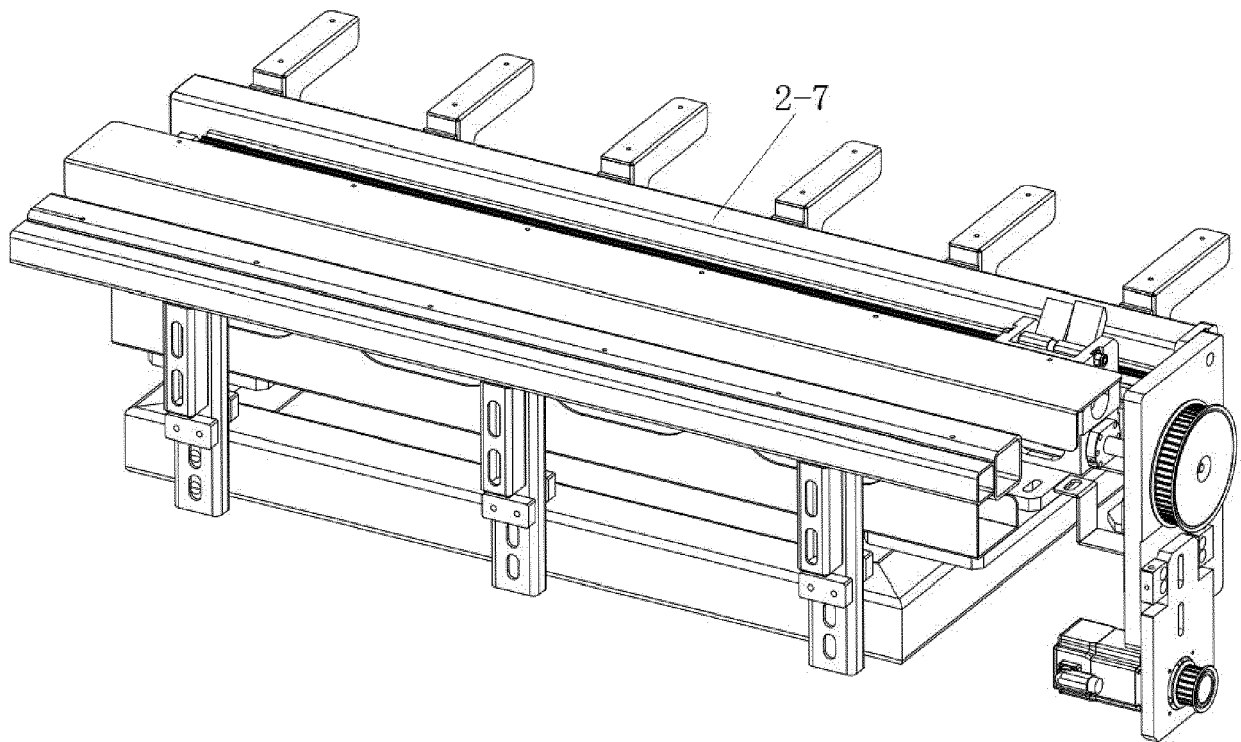


FIG. 14

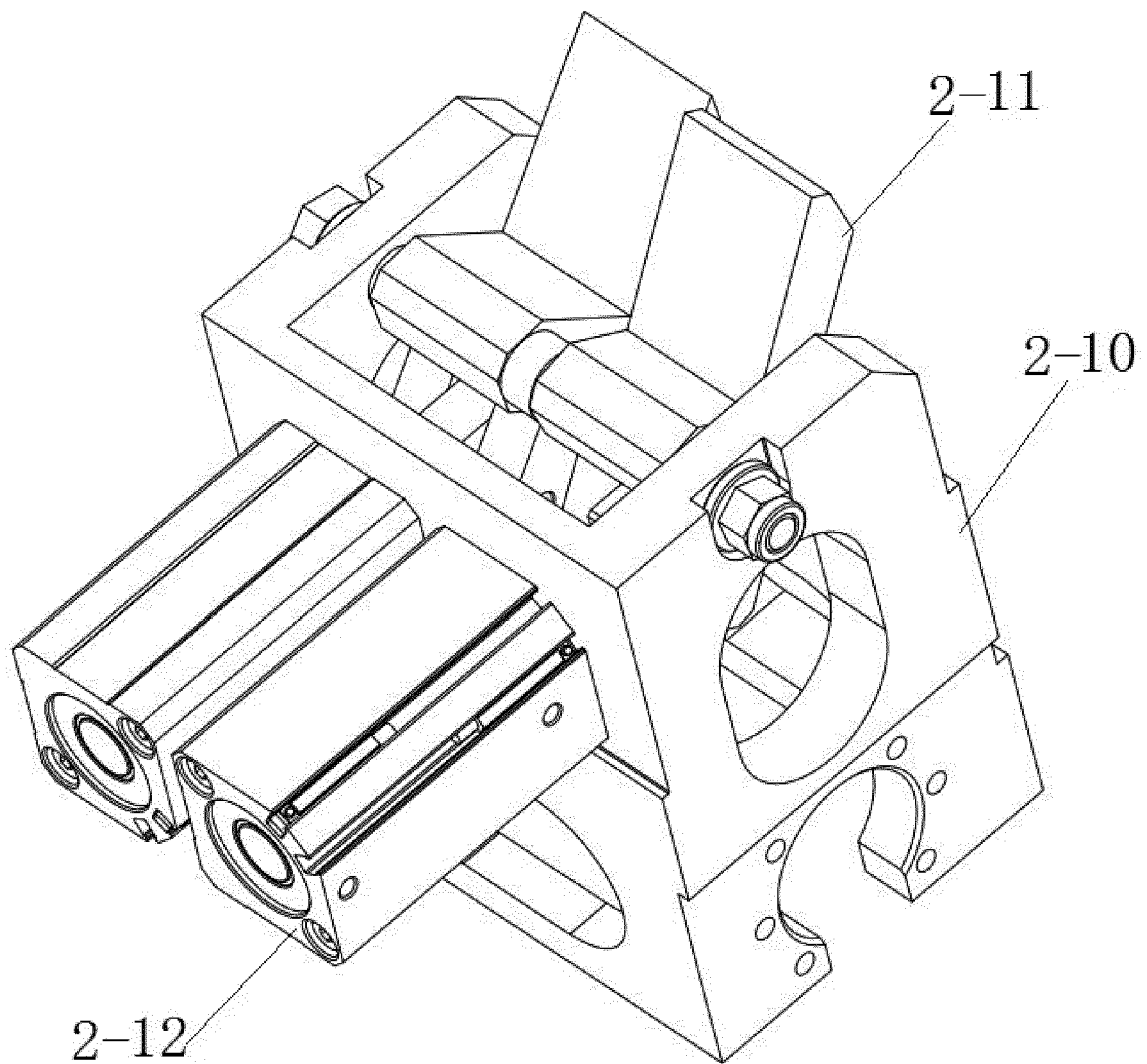


FIG. 15

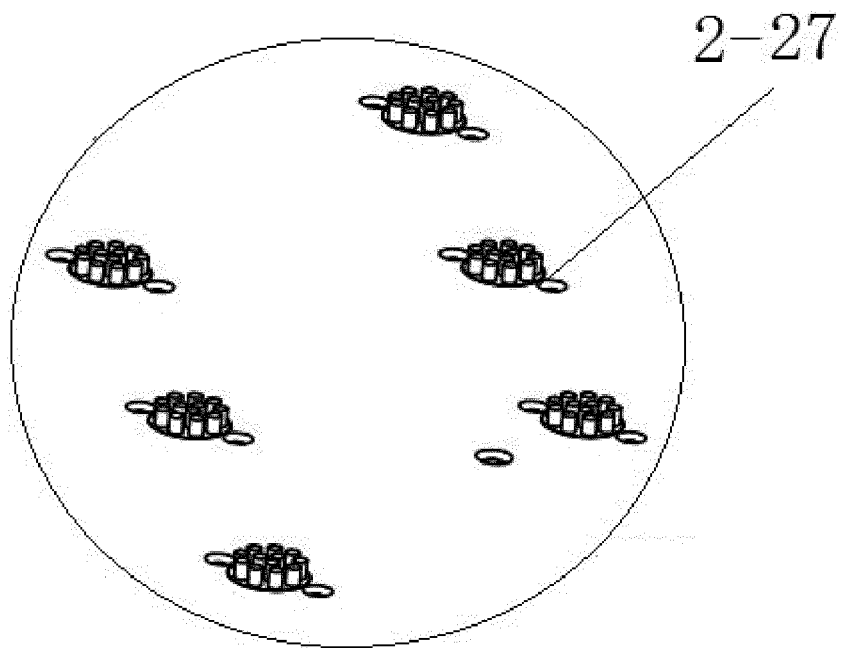


FIG. 16

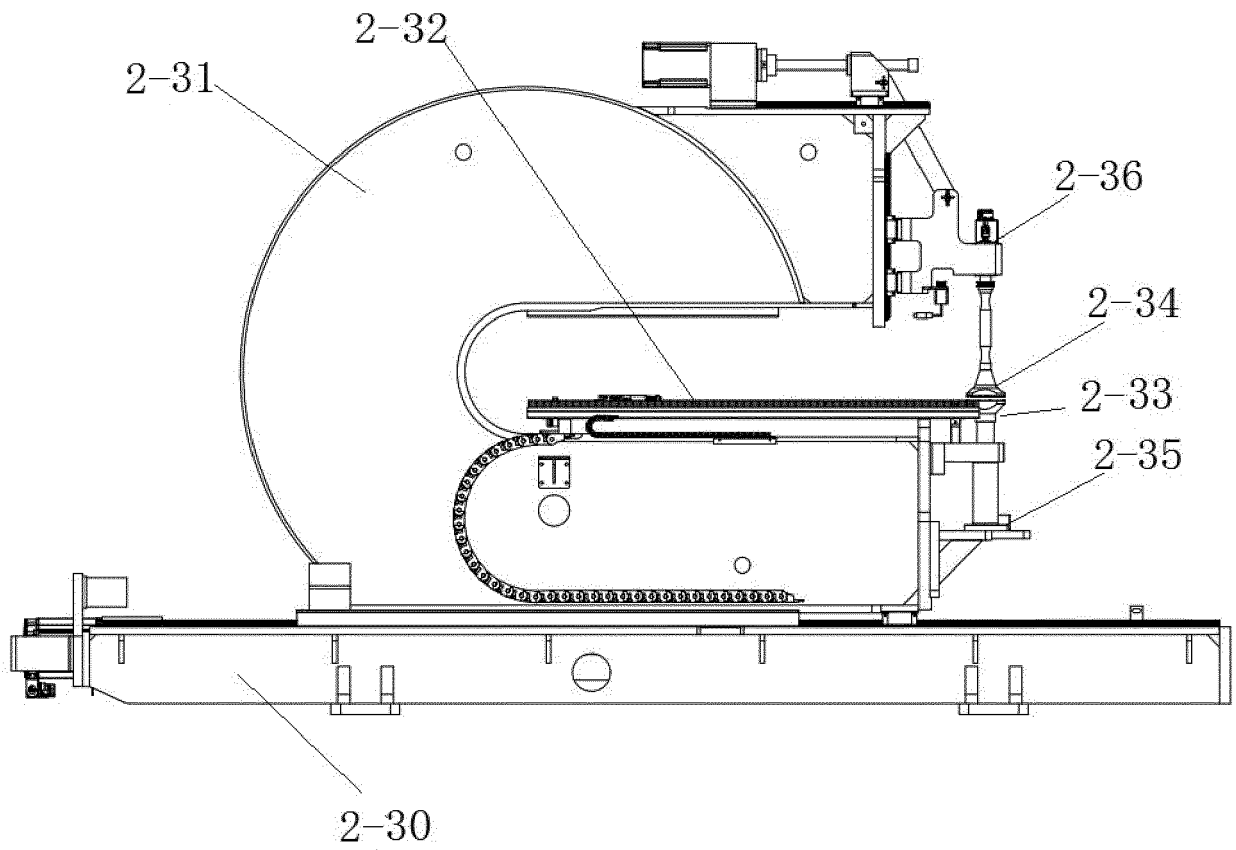


FIG. 17



EUROPEAN SEARCH REPORT

Application Number

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	CN 210 082 466 U (YANGZHOU HANZHI NUMERICAL CONTROL MACHINERY CO LTD) 18 February 2020 (2020-02-18) * figure 2; example 1 * -----	1-10	INV. B21D5/00 B21D5/02 B21D43/10 B21D43/11
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A,D	CN 209 792 325 U (YANGZHOU HANZHI CNC MACHINERY CO LTD) 17 December 2019 (2019-12-17) * claims 1-9; figure 1 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B21D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 May 2022	Examiner Vesterholm, Mika
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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20-05-2022

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	CN 209792325	U	17-12-2019	NONE

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