(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 201 616 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
**28.06.2023 Bulletin 2023/26**

(21) Application number: **21942799.4**

(22) Date of filing: **14.12.2021**

(51) International Patent Classification (IPC):
***B26D 7/26*** *(2006.01)* ***B26F 1/40*** *(2006.01)*

(86) International application number:
**PCT/CN2021/138070**

(87) International publication number:
**WO 2022/247236 (01.12.2022 Gazette 2022/48)**

(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: **24.05.2021 CN 202110567905**

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# (54) KNIFE DIE SUPPLY SYSTEM AND HIGH-SPEED INTELLIGENT CUTTING PROCESSING CENTER USING SAME

(57) The present invention relates to a die cutter supply system, which includes a die cutter storage rack and a drive device disposed within a frame. Die cutters are stacked up and down in different layers in the storage rack. Guide columns are respectively disposed at four corners of the frame. Guide sleeves slidable cooperating with the guide columns are disposed on the storage rack. The drive device drives the storage rack to move up and down along the guide columns. The drive device includes synchronous belts disposed at the right and left sides of the frame, and each synchronous belt is provided with a cutter rack fixing plate, one end of which is fixed to the synchronous belt and the other end is fixed to the storage rack at this side. The two synchronous belts drive the storage rack to move up and down through respective cutter rack fixing plates at the same time. The present invention further provides a high-speed smart cutting and processing center using the system. In the present invention, with the synchronous belt structure, the drive structure is simplified and the device volume is effective reduced. Thus, the repeatability of the up and down moving position of the die cutter storage rack is improved, thereby ensuring good device stability.

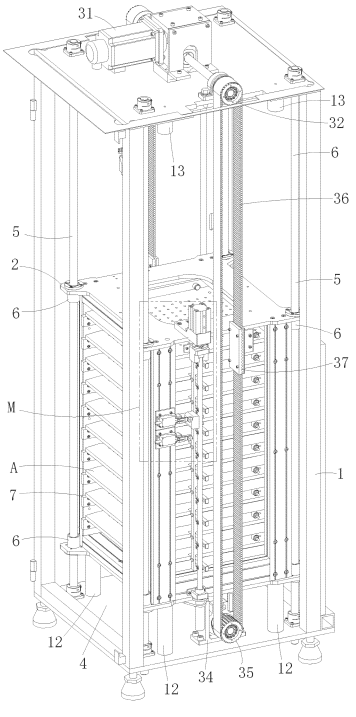


FIG.2

EP 4 201 616 A1

## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to the technical field of automatic cutting machines, and in particular to a die cutter supply system and a high-speed smart cutting and processing center using the system.

### BACKGROUND

**[0002]** The die cutters of the existing cutting machines are usually fixed mounted on the heads of the cutting machines and the die cutters need to be replaced manually each time the die cutters are to be changed to another model. This requires huge workload as well as position and angle debugging following each change of the die cutters, leading to much time wastes and low production efficiency as well as uncontrolled quality. Although some cutting machines adopt automatic die cutter change technology, these cutting machines are complex in structure, large in volume, huge in land occupation area, high in failure rate and poor in running stability.

### SUMMARY

### TECHNICAL PROBLEMS

**[0003]** In order to address the above technical problems, the present invention provides a die cutter supply system and a high-speed smart cutting and processing center using the system, which feature simple structure, small volume and good stability.

### SOLUTIONS TO THE PROBLEMS

**[0004]** The present invention is achieve by providing a die cutter supply system, which includes a frame and a die cutter storage rack and a drive device disposed within the frame. An exit-entry portion for die cutters to enter and exit the storage rack is disposed at back and front sides of the frame respectively. A plurality of die cutters are stacked up and down in different layers in the storage rack. Guide columns are respectively disposed at four corners of the frame, and guide sleeves slidable cooperating with the guide columns are disposed on the storage rack. The drive device drives the storage rack up and down along the guide columns. The drive device includes a motor gear box provided with a dual-output shaft, driving belt wheels, a driven shaft, driven bearings, driven belt wheels and synchronous belts. The motor gear box is disposed on the top of the frame. Two driving belt wheels are respectively disposed on both ends of the output shaft. Two driven bearings are fixed at a lower portion of the frame and located below the storage rack. The driven shaft is penetrated through the two driven bearings, and the driven belt wheels are disposed on both ends of the driven shaft. The driving belt wheels drive the driven belt wheels to rotate by the synchronous belts. A synchronous belt is disposed on left and right sides of the frame respectively, and each synchronous belt is provided with a cutter rack fixing plate. One end of the cutter rack fixing plate is fixed on the synchronous belt, and the other end is fixed on the storage rack at this side.

**[0005]** Furthermore, a plurality of sideways for placing die cutters are disposed up and down at right and left sides of the storage rack respectively. A die cutter locking device for positioning a die cutter in a slideway is disposed at the right side of the storage rack. The die cutter locking device includes a locking cylinder, a locking operation rod, locking bearings, driving rods, locking rods, locking rod rotary shafts, and a rotary shaft fixing rod. The locking cylinder is fixed on an upper portion of the storage rack, and the locking operation rod is fixedly connected with an output shaft of the locking cylinder. The locking operation rod is penetrated through two locking bearings, and the two locking bearings are fixed on the storage rack and respectively located at both ends of the locking operation rod. The locking operation rod is slid up and down along the locking bearings under the drive of the locking cylinder. The rotary shaft fixing rod is fixed at a side of the storage rack, and the rotary shaft fixing rod is provided with a plurality of avoiding holes corresponding to a placement position of each layer of die cutter. The driving rods, the locking rods and the locking rod rotary shafts are respectively disposed at a side of the placement position of each layer of die cutter by sets. The locking rods are provided with a waist-shaped hole, a rotary shaft hole, and an arc-shaped portion. The locking rod rotary shafts are penetrated through the rotary shaft fixing rod and the rotary shaft holes of the locking rods to movably connect the locking rods in the avoiding holes of the locking rods. One end of the driving rods is fixed on the locking rods, and the other end is movably inserted into the waist-shaped holes of the locking rods. The arc-shaped portions of the locking rods are fitted into limiting grooves of side edges of the die cutters. The locking operation rod slides up and down and thus drives the locking rods to rotate around the locking rod rotary shafts through the driving rods.

**[0006]** Furthermore, a roller is disposed at a sidewall of each slideway 7.

**[0007]** Furthermore, the locking operation rod is provided with a contact block, and an upper travel switch and a lower travel switch cooperating with the contact block are respectively disposed on the frame.

**[0008]** Furthermore, a cutter rack support column is disposed at the bottom of the storage rack, and a cutter rack limiting column is disposed on the top of the frame 1.

**[0009]** Furthermore, a stop switch triggered by the storage rack is disposed on the frame.

**[0010]** The present invention is achieved by providing a high-speed smart cutting and processing center. The high-speed smart cutting and processing center uses the above die cutter supply system.

## BENEFICIAL EFFECTS OF THE PRESENT INVENTION

**[0011]** Compared with the prior arts, in the die cuter supply system and the high-speed smart cutting and processing center using the system in the present invention, the die cutter supply system includes a die cutter storage rack and a drive device disposed within the frame; the die cutters are stacked up and down in different layers in the storage rack; the guide columns are respectively disposed at four corners of the frame; guide sleeves slidable cooperating with the guide columns are disposed on the storage rack; the drive device drives the storage rack to move up and down along the guide columns; the drive device includes synchronous belts disposed at the right and left sides of the frame, and each synchronous belt is provided with a cutter rack fixing plate, one end of which is fixed to the synchronous belt and the other end is fixed to the storage rack at this side; the two synchronous belts drive the storage rack to move up and down through respective cutter rack fixing plates at the same time. With the synchronous belt structure, the drive structure is simplified, and the device volume is effectively reduced, and further the repeatability of the up and down moving position of the die cutter storage rack is improved, thereby ensuring good device stability. On the other hand, the present invention facilitates change of die cutters, which not only shortens the change time but also increases the working efficiency. Further, accurate positioning can be achieved so as to improve the cutting accuracy of the high-speed smart cutting and processing center.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0012]**

FIG. 1 is a front view of a preferred embodiment of a die cutter supply system in the present invention.

FIG. 2 is a stereoscopic schematic diagram of FIG. 1.

FIG. 3 is a stereoscopic schematic diagram of FIG. 2 from another perspective.

FIG. 4 is a partially-enlarged view of an M part in FIG. 2.

FIG. 5 is a stereoscopic schematic diagram of a die cutter in FIG. 2.

FIG. 6 is a stereoscopic schematic diagram of a locking rod in FIG. 2.

## DETAILED DESCRIPTION OF THE EMBODIMENTS

**[0013]** In order to make the technical problems, the technical solutions and the beneficial effects clearer and more intelligible, the present invention will be further elaborated in combination with accompanying drawings and specific embodiments. It should be understood that the specific embodiments described herein are used only to explain the present invention rather than limit the present invention.

**[0014]** By referring FIGS. 1 to 4 at the same time, a preferred embodiment of a die cutter supply system of the present invention includes a frame 1 and a die cutter storage rack 2 and a drive device 3 disposed within the frame 1.

**[0015]** An exit-entry portion 4 for die cutters A to enter and exit the storage rack 2 isdisposed at back and front sides of the frame 1 respectively. The exit-entry portion 4 at one side is used to connect with a high-speed smart cutting and processing center to provide a desired die cutter A for the high-speed smart cutting and processing center. The exit-entry portion 4 at the other side is used to change and sequentially configure the die cutters A in the frame 1. A plurality of die cutters A are stacked up and down in different layers in the storage rack 2. Guide columns 5 are respectively disposed at four corners of the frame 1. Guide sleeves 6 slidably cooperating with the guide columns 5 are disposed on the storage rack 2. The drive device 3 drives the storage rack 2 up and down along the guide columns 5.

**[0016]** The drive device includes a motor gear box 31 provided with a dual output shaft, driving belt wheels 32, a driven shaft 33, driven bearings 34, driven belt wheels 35 and synchronous belts 36. The motor gear box 31 is disposed on the top of the frame 1. Two driving belt wheels 32 are respectively disposed on both ends of the output shaft. Two driven bearings 34 are fixed at a lower portion of the frame 1 and located below the storage rack 2. The driven shaft 33 is penetrated through the two driven bearings 34, and the driven belt wheels 35 are disposed on both ends of the driven shaft 33. The driving belt wheels 32 drive the driven belt wheels 35 to rotate by the synchronous belts 36. A synchronous belt 36 is disposed on left and right sides of the frame 1 respectively, and each synchronous belt 36 is provided with a cutter rack fixing plate 37, one end of the cutter rack fixing plate 37 is fixed on the synchronous belt 36, and the other end is fixed on the storage rack 2 at this side. The two synchronous belts 36 drive the storage rack 2 to move up and down along the guide columns 5 through respective cutter rack fixing plates 37 at the same time. With the synchronous belt technology, the structure of the drive device 3 is simplified and the repeatability of the up and down moving position of the storage rack 2 is improved, thereby increasing the running stability.

**[0017]** A plurality of slideways 7 for placing the die cutters A are disposed at the left and right sides of the storage rack 2 respectively and a die cutter locking device 8 for positioning the die cutters A in the slideways 7 is disposed at the right side of the storage rack 2.

**[0018]** The die cutter locking device 8 includes a locking cylinder 81, a locking operation rod 82, locking bear-

ings 83, driving rods 84, locking rods 85, locking rod rotary shafts 86, and a rotary shaft fixing rod 87. The locking cylinder 81, the locking bearing 83, and the rotary shaft fixing rod 87 are respectively fixed to the storage rack 2.

**[0019]** The locking cylinder 81 is fixed on an upper portion of the storage rack 2, and the locking operation rod 82 is fixedly connected with an output shaft of the locking cylinder 81. The locking operation rod 82 is penetrated through two locking bearings 83 which are fixed on the storage rack 2 and respectively located both ends of the locking operation rod 82. The locking operation rod 82 is slid up and down along the locking bearings 83 under the drive of the locking cylinder 81. The rotary shaft fixing rod 87 is fixed at a side of the storage rack 2, and the rotary shaft fixing rod 87 is provided with a plurality of avoiding holes 871 each corresponding to a placement position of the each layer of die cutter A.

**[0020]** The driving rods 84, the locking rods 85 and the locking rod rotary shafts 86 are disposed at a side of the placement position of each layer of die cutter A respectively by sets. As shown in FIG. 6, the locking rod is provided with a waist-shaped hole 851, a rotary shaft hole 852 and an arc-shaped portion 853 respectively, where the waist-shaped hole 851 and the arc-shaped portion 853 are located at both sides of the rotary shaft hole 852. The locking rod rotary shafts 86 are penetrated through the rotary shaft fixing rod 87 and the rotary shaft holes 852 of the locking rods 85 to movably connect the locking rods 85 in the locking rod avoiding holes 871 such that the locking rods 85 can rotate around the locking rod rotary shafts 86. One end of the driving rods 84 is fixed on the locking rods 85, and the other end is movable inserted into the waist-shaped holes of the locking rods 85. The arc-shaped portions 853 of the locking rods 85 are fitted into limiting grooves B of side edges of the die cutters A, as shown in FIG. 5.

**[0021]** The locking operation rod 82 slides up and down and thus drives the locking rods 85 to rotate around the locking rod rotary shafts 86 through the driving rods 84, such that the arc-shaped portions 853 of the locking rods 85 are fitted into the limiting grooves B of the die cutters A so as to lock up the die cutters A, or the arc-shaped portions 853 of the locking rods 85 are released from the limiting grooves B of the die cutters A so as to unlock the die cutters A.

**[0022]** The locking operation rod 82 is provided with a contact block 88, and an upper travel switch 10 and a lower travel switch 11 cooperating with the contact block 88 are respectively disposed on the frame 1. The contact block 88 moves up and down along with the locking operation rod 82 to trigger the upper travel switch 10 and the lower travel switch 11 respectively so as to limit the upper and lower positions for the movement of the locking operation rod 82, thereby improving the operation safety of the die cutter locking device 8.

**[0023]** With the locking cylinder 81 as power, the response time of the die cutter locking device 8 can be shortened and the working efficiency of the die cutter supply system can be improved.

**[0024]** A roller 9 is disposed at a sidewall of each slideway 7. The rollers 9 are located above the die cutters A and close to the exit-entry portion 4 at the back of the frame 1, so as to achieve limiting and guiding effect when the die cutters A are guided into or out of the storage rack 2. A cutter rack support column 12 is disposed at the bottom of the storage rack 2 and fixed on the frame 1. A cutter rack limiting column 13 is disposed on the top of the frame 1. In this embodiment, four cutter rack support columns 12 are disposed correspondingly at four corners of the bottom of the storage rack 2, and four cutter rack limiting columns 13 are disposed correspondingly at four corners of the top of the frame 1. In this way, the safety and stability of the storage rack 2 can be improved.

**[0025]** A stop switch 14 triggered by the storage rack 2 is disposed on the frame 1. The stop switch 14 is used to limit a descending position of the storage rack 2, thereby improving the movement safety and stability of the storage rack 2.

## EMBODIMENTS OF THE PRESENT INVENTION

**[0026]** The present invention is achieved by providing a high-speed smart cutting and processing center. The high-speed smart cutting and processing center uses the above die cutter supply system. The die cutter supply system can automatically provide the die cutters A desired for cutting operation to the high-speed smart cutting and processing center.

**[0027]** The above descriptions are made only to preferred embodiments of the present invention and are not used to limit the present invention. Any modifications, equivalent replacements and improvements and the like made within the spirit and principle of the present invention all shall be encompassed in the scope of protection of the present invention.

## Claims

1. A die cutter supply system, comprising: a frame and a die cutter storage rack and a drive device disposed within the frame, wherein an exit-entry portion for die cutters to enter and exit the storage rack are disposed at back and front sides of the frame respectively, a plurality of die cutters are stacked up and down in different layers in the storage rack, guide columns are respectively disposed at four corners of the frame, guide sleeves slidably cooperating with the guide columns are disposed on the storage rack, and the drive device drives the storage rack up and down along the guide columns; the drive device comprises a motor gear box provided with a dual output shaft, driving belt wheels, a driven shaft, driven bearings, driven belt wheels and synchronous belts, the motor gear box is disposed on the top of the frame, two driving belt wheels are respectively disposed on

both ends of the output shaft, two driven bearings are fixed at a lower portion of the frame and located below the storage rack, the driven shaft is penetrated through the two driven bearings, the driven belt wheels are disposed on both ends of the driven shaft, the driving belt wheels drive the driven belt wheels to rotate by the synchronous belts, a synchronous belt is disposed on left and right sides of the frame respectively, each synchronous belt is provided with a cutter rack fixing plate, one end of the cutter rack fixing plate is fixed on the synchronous belt, and the other end is fixed on the storage rack at this side.

**2.** The die cutter supply system of claim 1, wherein a plurality of sideways for placing die cutters are disposed up and down at right and left sides of the storage rack respectively, a die cutter locking device for positioning a die cutter in a slideway is disposed at the right side of the storage rack, the die cutter locking device comprises a locking cylinder, a locking operation rod, locking bearings, driving rods, locking rods, locking rod rotary shafts, and rotary shaft fixing rods, the locking cylinder is fixed on an upper portion of the storage rack, the locking operation rod is fixedly connected with an output shaft of the locking cylinder, the locking operation rod is penetrated through two locking bearings, the two locking bearings are fixed on the storage rack and respectively located at both ends of the locking operation rod, the locking operation rod is slid up and down along the locking bearings under the drive of the locking cylinder, the rotary shaft fixing rod is fixed at a side of the storage rack, the rotary shaft fixing rod is provided with a plurality of avoiding holes corresponding to a placement position of each layer of die cutter, the driving rods, the locking rods and the locking rod rotary shafts are respectively disposed at a side of the placement position of each layer of die cutter by sets, the locking rods are provided with a waist-shaped hole, a rotary shaft hole, and an arc-shaped portion, the locking rod rotary shafts are penetrated through the rotary shaft fixing rod and the rotary shaft holes of the locking rods to movably connect the locking rods in the avoiding hole of the locking rods, one end of the driving rods is fixed on the locking rods, the other end is movably inserted into the waist-shaped holes of the locking rods, the arc-shaped portion of the locking rods is fitted into limiting grooves of side edges of the die cutters and the locking operation rod slides up and down and thus drives the locking rods to rotate around the locking rod rotary shafts through the driving rods.

**3.** The die cutter supply system of claim 2, wherein a roller is disposed at a sidewall of each slideway.

**4.** The die cutter supply system of claim 2, wherein the locking operation rod is provided with a contact block, and an upper travel switch and a lower travel switch cooperating with the contact block are respectively disposed on the frame.

**5.** The die cutter supply system of claim 1, wherein a cutter rack support column is disposed at the bottom of the storage rack, and a cutter rack limiting column is disposed on the top of the frame.

**6.** The die cutter supply system of claim 1, wherein a stop switch triggered by the storage rack is disposed on the frame.

**7.** A high-speed smart cutting and processing center, using the die cutter supply system of any one of claims 1 to 5.

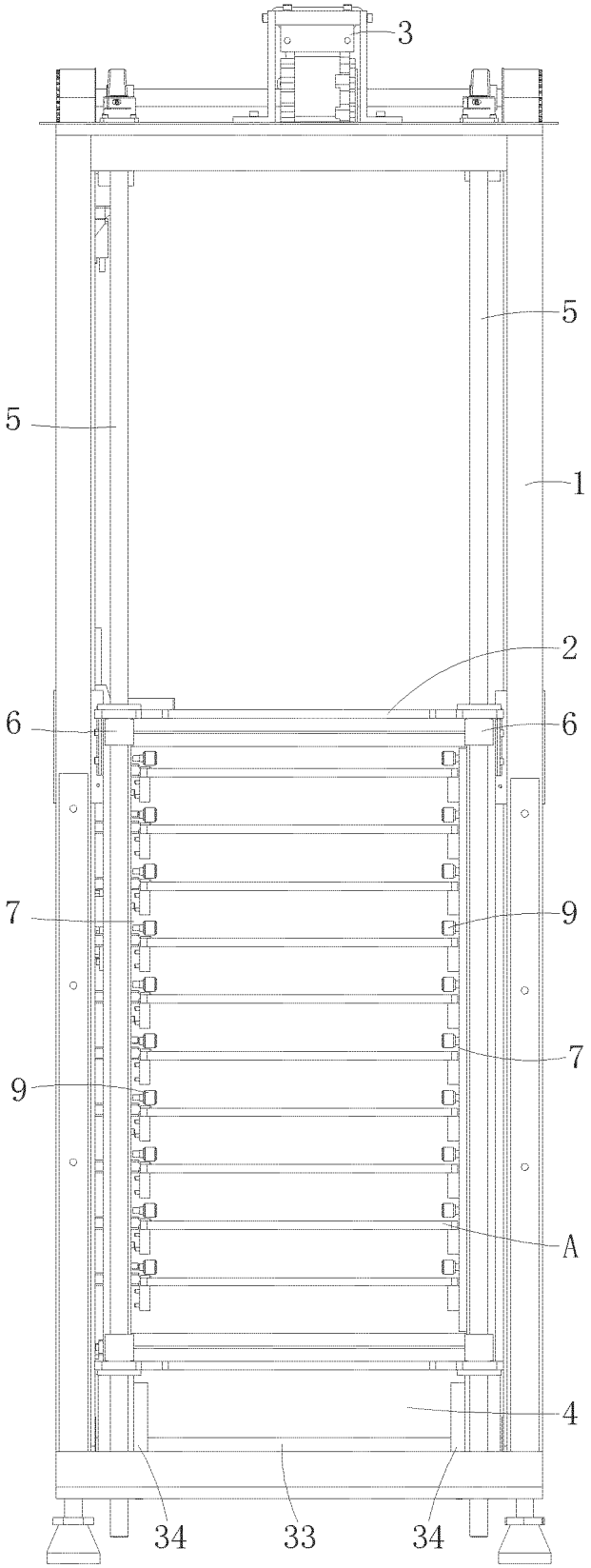


FIG.1

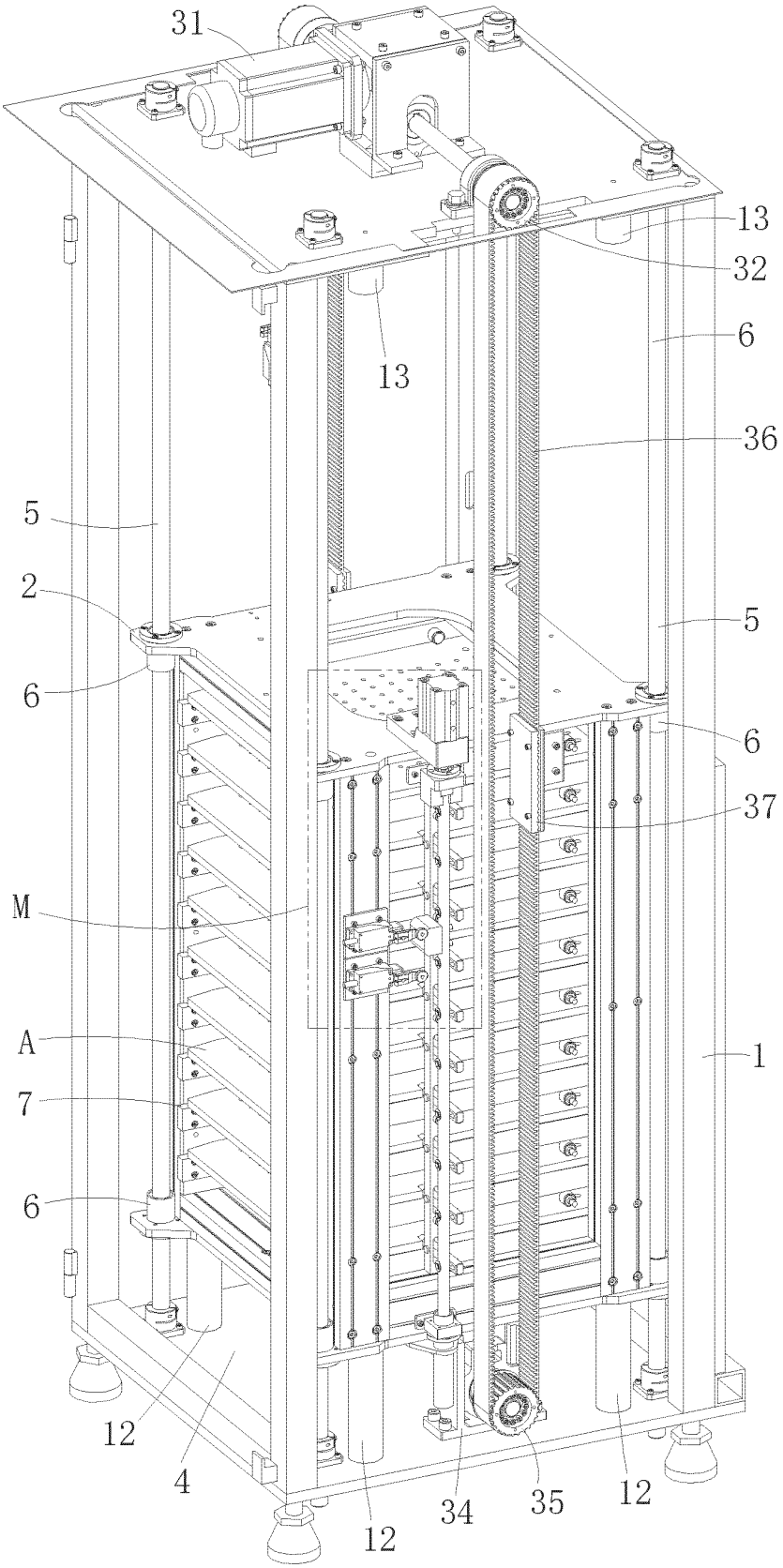


FIG.2

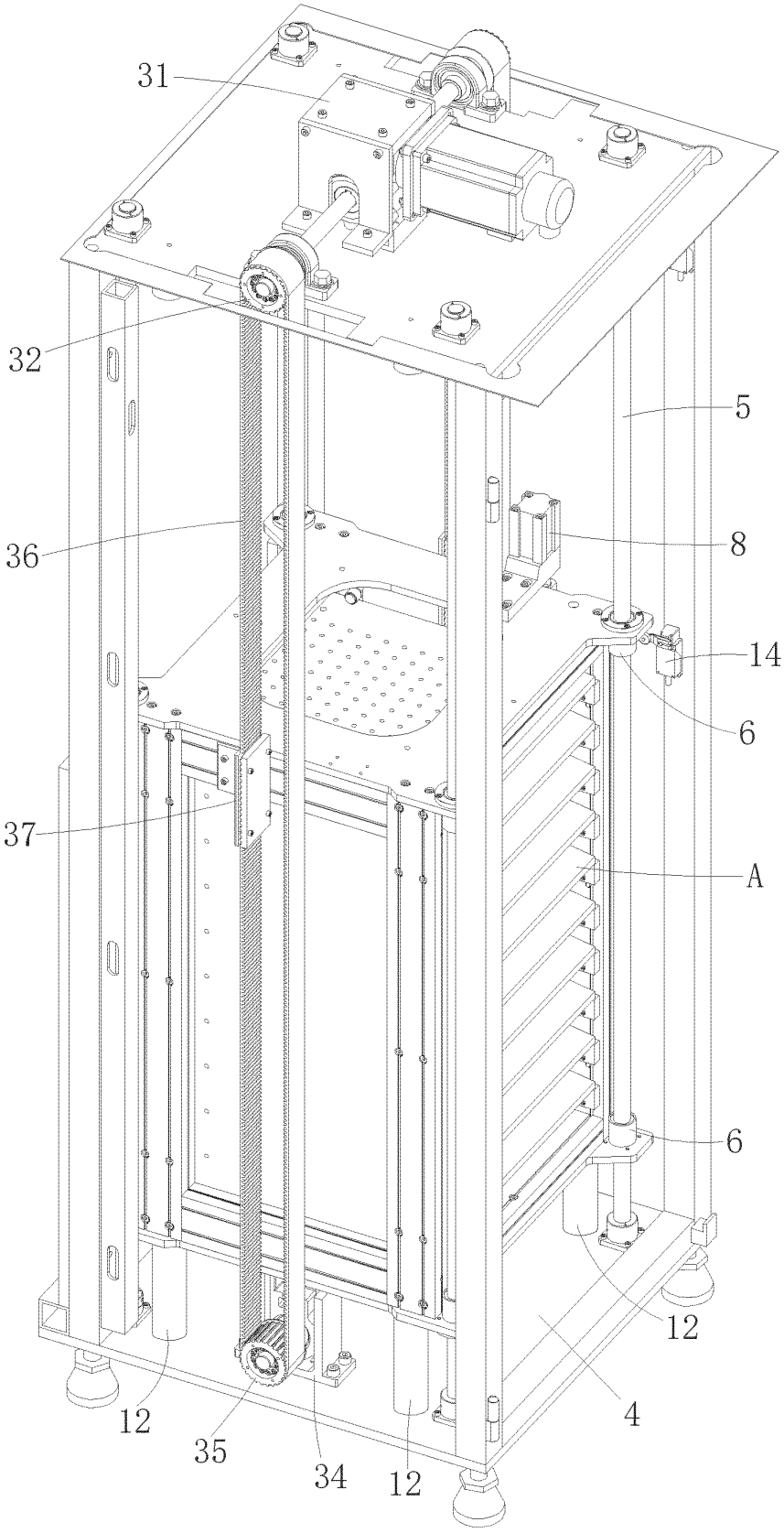


FIG.3

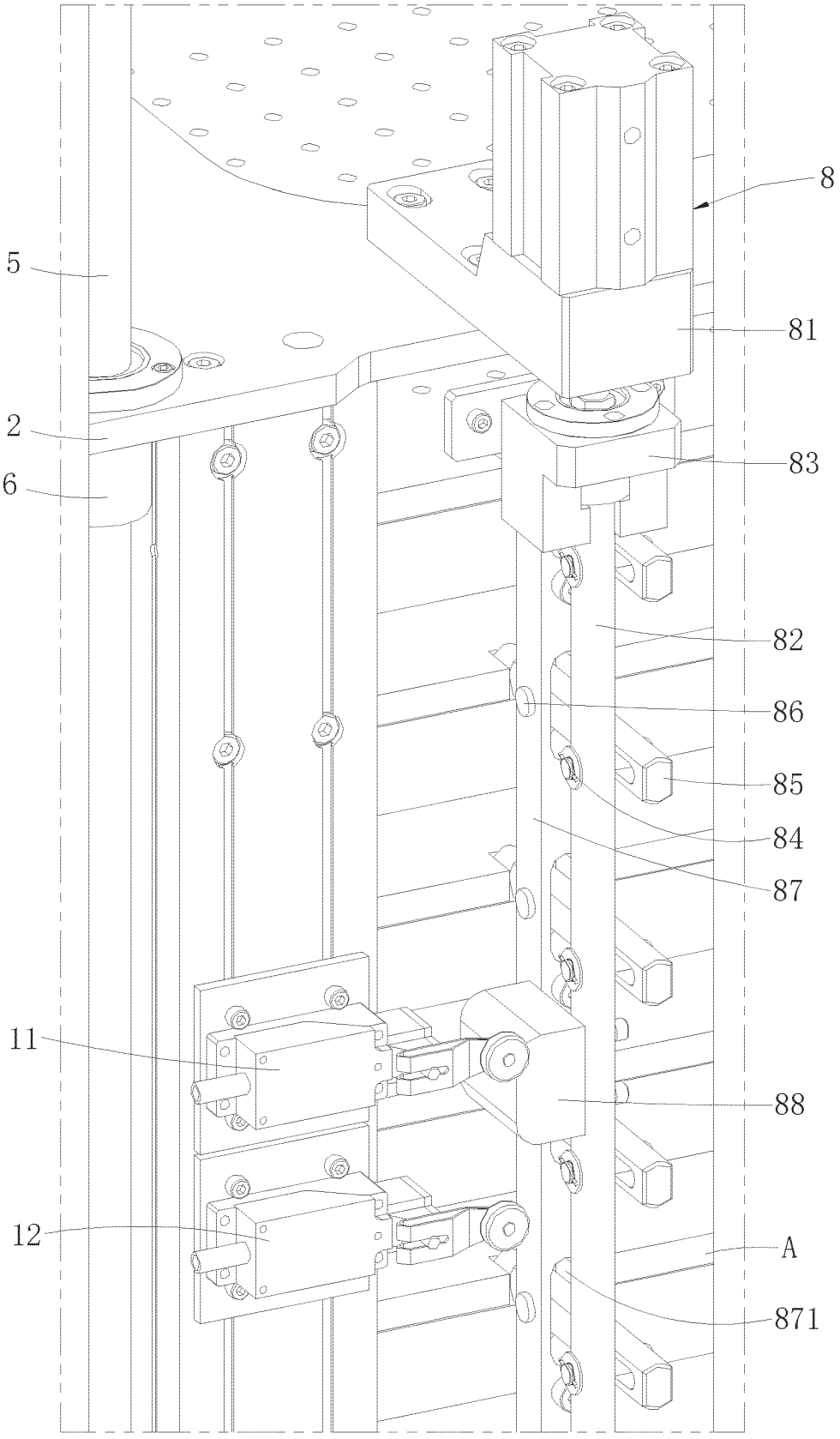


FIG.4

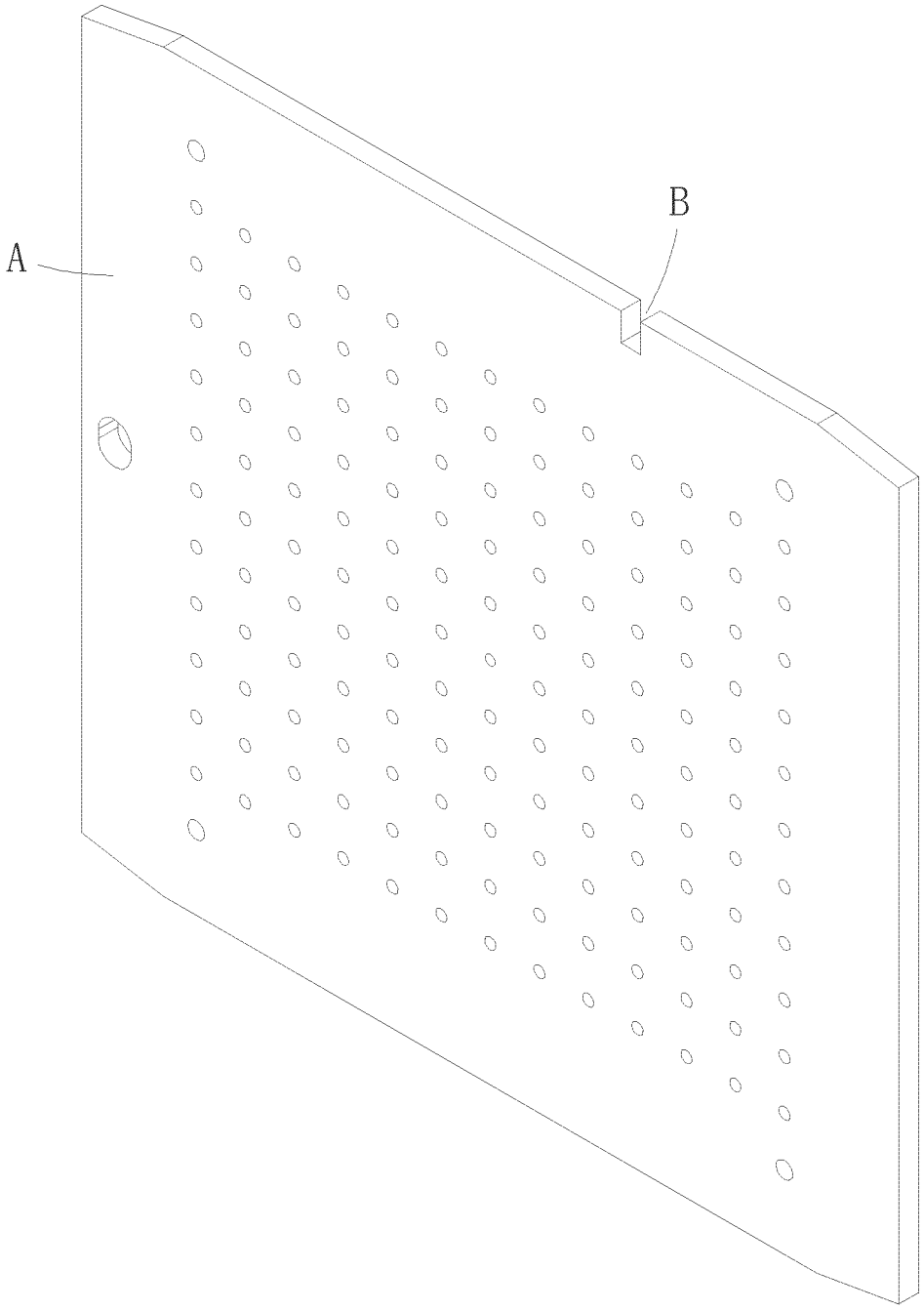


FIG.5

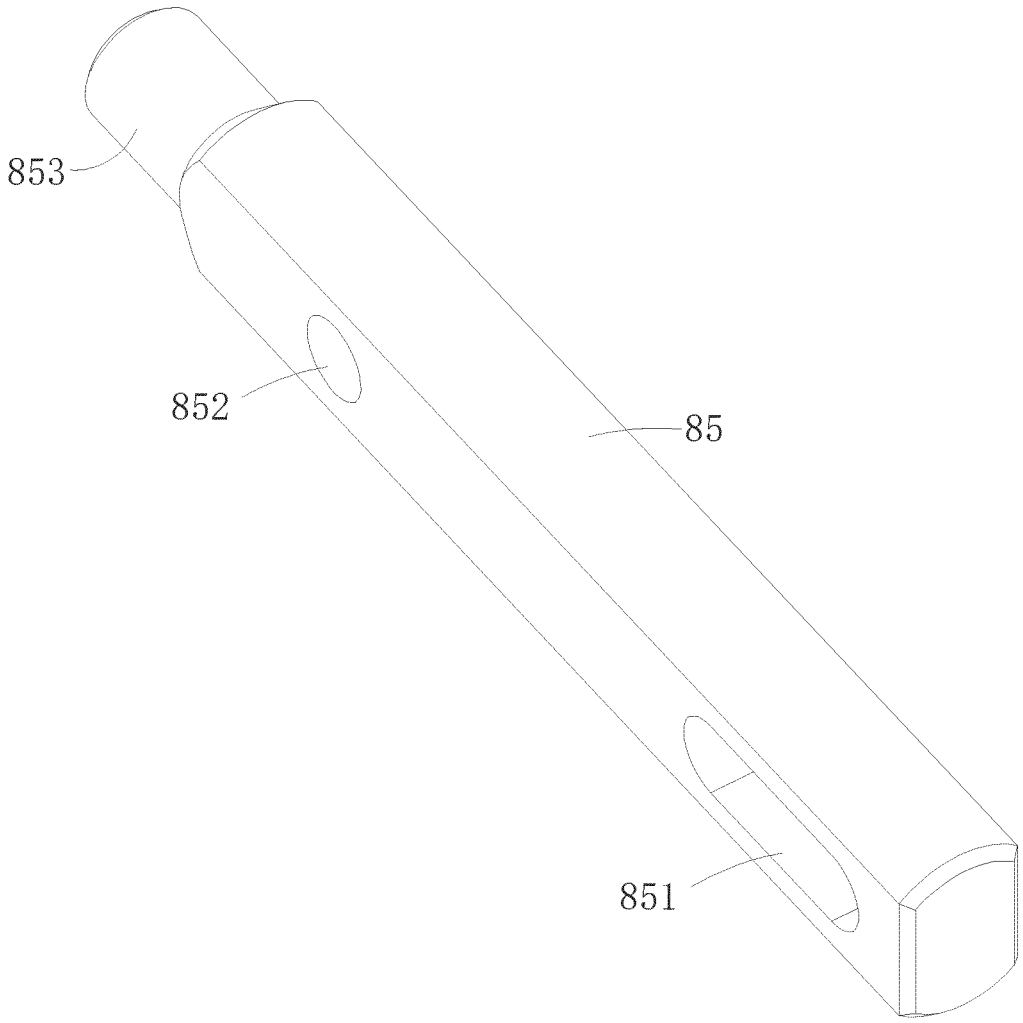


FIG.6

## INTERNATIONAL SEARCH REPORT

International application No.
**PCT/CN2021/138070**

**A. CLASSIFICATION OF SUBJECT MATTER**

B26D 7/26(2006.01)i; B26F 1/40(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

B26D7, B26F1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNTXT, DWPI, CNKI: 刀模, 刀模库, 刀库, 刀架, 叠放, 存放, 同步带, 传动带, 皮带, 链条, 链轮, mold, die, belt, chain, up, down, lift, storag+, stock+, rack+, liberary+

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
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| A | CN 204640345 U (RUIAN ZHONGTAI TECHNOLOGY EQUIPMENT CO., LTD.) 16 September 2015 (2015-09-16)<br>entire document | 1-7 |

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| **26 January 2022** | **14 February 2022** |
| Name and mailing address of the ISA/CN<br>**China National Intellectual Property Administration (ISA/CN)**<br>**No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China**<br>Facsimile No. **(86-10)62019451** | Authorized officer<br><br>Telephone No. |

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/138070

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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**Information on patent family members**

International application No.
**PCT/CN2021/138070**

| Patent document cited in search report | Publication date (day/month/year) | Patent family member(s) | Publication date (day/month/year) |
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