(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 November 2022 (10.11.2022)

WIPO | PCT

(10) International Publication Number
WO 2022/235248 A1

(51) International Patent Classification:
B65G 47/22 (2006.01) *B65G 47/00* (2006.01)

(21) International Application Number:
PCT/TR2022/050401

(22) International Filing Date:
03 May 2022 (03.05.2022)

(25) Filing Language: Turkish

(26) Publication Language: English

(30) Priority Data:
2021 007540 03 May 2021 (03.05.2021) TR

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

(54) Title: WORKPIECE TILTING MECHANISM

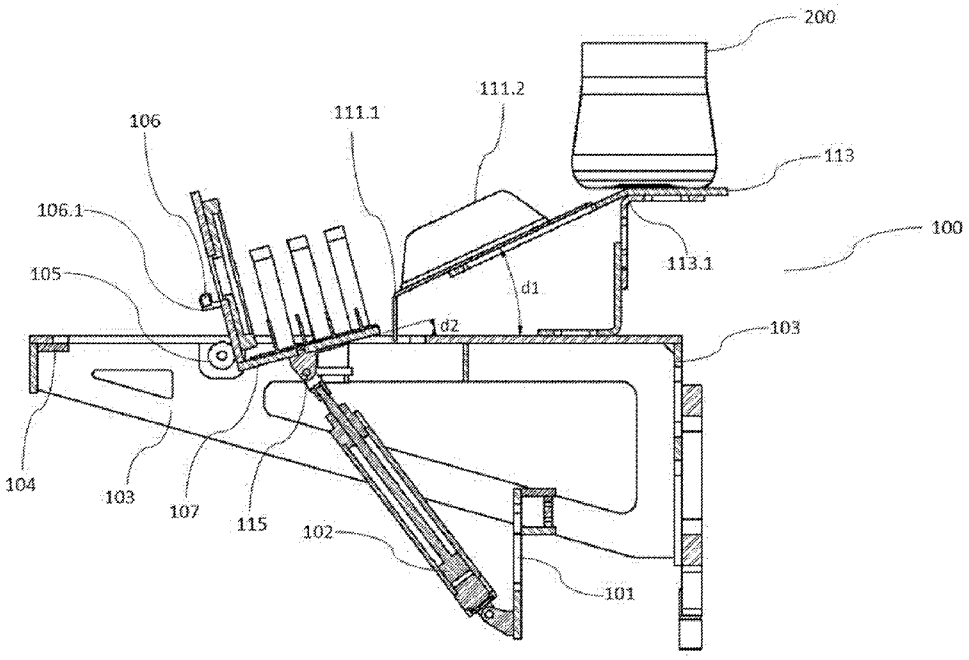

Figure 1

(57) Abstract: The invention relates to a tilting mechanism that allows the position of the workpiece to be rotated 180° in cases where it is necessary to switch between production stages and change the position of the workpiece.

[Continued on next page]

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TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

WORKPIECE TILTING MECHANISM

Technical Field

The invention relates to a workpiece tilting mechanism used to change the position of a workpiece by 180° when there is a necessity to transfer the workpiece between production stages and change its position.

The present invention specifically relates to a workpiece tilting mechanism that allows the workpiece to come to the tipping point under the influence of its own weight, actuate the piston when the photosensitive sensor detects the workpiece, and tilt the workpiece 180° with a single piston movement in casse there is a necessity to transfer the workpiece between production stages and change its position.

Prior Art

In cases where it is necessary to switch between the production stages, the position of the workpiece must be changed in cases where various surfaces of the workpiece need to be processed.

At the present time, two different robotic arm application is used to change the position of the workpiece. In one of these methods, end effector in the shape of a “Y” is used to grasp the workpiece by vacuuming it and rotate across the joint and returns the workpiece to the production line. In the other known method, the workpiece is rotated 180° and returned to the production line with the help of a robotic arm with the capability of 180° motion that grabs the workpiece by vacuum.

In the method of robotic arms, ensuring simultaneous operation of the robotic arm with the production line is a complex mechanical problem. In addition, there is a risk of leakage in the system which can result in the workpiece moving away from the station thus creating risk of potential work accidents and production disruptions.

In patent No. CN102357764A, a tilting mechanism that allows 180° turning of the steel plate is mentioned.

In patent No. CN102672405A, a workpiece positioning machine is mentioned.

In the mentioned documents, a workpiece is tilted over with the push of a piston and the second piston meets the fallen part. Therefore tilting cannot be achieved by a single piston motion and installation and maintenance of the system is difficult.

In patent No. CN105036000A, a stone plate tilting machine is mentioned. Tilting machine mentioned in the document consist of two parallel plates and the workpiece is transferred from one plate to the other. Therefore a well-built drive system is necessary for coordination of the cylinders and tilting operation cannot be achieved by a single pneumatic piston.

Invention topics that are mentioned above are designed to turn over the heavy pieces. These systems are heavy as a structure and not modular. Besides, systems in these documents are hydraulic systems.

As a result, it was required to come up with the solution subject to the present invention that allows to switch between the production stages and change the position of the workpiece, to make the workpiece comes to the tipping point with the effect of its own weight, the photosensitive sensor to detect the coming of the part, activates the piston, and the workpiece tilts 180° with a single piston movement, at the same time compared to the hydraulic system a modular tilting mechanism solution that is easy to install and maintain, more reliable in terms of occupational safety and can be transferred to another production line.

Objectives and Brief Description of the Invention

The aim of the present invention is to introduce a tilting mechanism that allows the position of the workpiece to be rotated by 180° in cases where it is necessary to switch between the production stages and change the position of the workpiece.

Another aim of the present invention is to prevent the structural complexity by enabling the workpiece to come to the tilting point by the effect of its own weight thus activating the piston when the photosensitive sensor detects the workpiece and with a single piston movement tilting the workpiece by 180°.

Another aim of the present invention is to use a pneumatic system instead of a hydraulic system to provide a more reliable tilting mechanism in terms of work safety and to reduce the cost of the system.

Another aim of the present invention is to present a light tilting mechanism which made it easier to transfer to another production line thus making it modular.

In order to achieve the mentioned objectives, the invention is a tilting mechanism comprising main body plate forming main body and front body sheet for allowing the position of the workpiece to be rotated 180°, wherein it comprises

- connection sheet that enables the assembly of the tilting mechanism to a machine body where it will be used,
- slip sheet,
- tilting plate,
- damping element, which prevents the rim of the workpiece from being crushed by absorbing the impact,
- 2. support bracket which helps the tilting plate to keep the angle it makes with the main body plate when the tilting plate is in its normal position,
- piston that pushes the tilting plate,
- piston-body connector that provides the piston-body connection,
- sensor and sensor connection sheet detecting that the workpiece is coming from the tilting plate.

The tilting mechanism also comprises a hinge that facilitates the positioning of the mechanism in the machine and provides convenience in interventions such as mold replacement and maintenance.

In the mechanism of the invention, the sensor is preferably a photosensitive sensor.

Also, it is preferred that the damping element, is made of polyurethane material.

In the preferred embodiment of the invention, the angle d1 between the tilting plate and the main body plate is between 20°-30°, preferably 25°.

When the tilting plate is in its normal position, the angle d2 between the tilting plate and the main body plate is between 12°-20° preferably 15°.

The invention is also operation method of a workpiece tilting mechanism and it comprises the following steps,

- the workpiece, which has completed one of the production stages, comes to the front body sheet,
- the workpiece moves on the front body sheet until its center of gravity passes the bent point of the front body sheet,
- the base of the workpiece settles on the slip sheet,
- the workpiece moves along the slip sheet,

- the center of gravity of the workpiece passes the bent point of the slip sheet and the workpiece rotates over this point,
- the workpiece tilts onto the tilting plate by turning on the bent point of the slip sheet.
- the workpiece coming to the tilting plate collides with the damping element with the effect of tilting,
- the sensor detects the workpiece that came to the tilting plate, and activates the piston,
- the piston pushes the tilting plate and the tilting plate rotates on the hinge,
- with the forward movement of the piston, the tilting plate (109) turns on the hinge and becomes parallel with the main body plate and the workpiece completes its tilting of 180°.

Brief Description of the Figures

In Figure 1; the side view of the workpiece tilting mechanism and its components is given.

In Figure 2; the top view of the workpiece tilting mechanism and its components is given.

In Figure 3; the arrival of the workpiece on the bent point of the front sheet and the initial view of the sliding motion is given.

In Figure 4; the view of the workpiece on the slip sheet is given.

In Figure 5; the view of the workpiece that starts to tilt over the bent point of the slip sheet is given.

In Figure 6; the view of the workpiece tilting over the tilting table is given.

In Figure 7; the view of the piston, which started to push the tilting table, started to rotate the tilting table, is given.

In Figure 8; the view of the workpiece when it has completed its 180° tilting movement is given.

Reference Numbers

100. The workpiece tilting mechanism
101. Piston-body connector
102. Piston
103. Body sheets
104. Support bracket
105. Support bracket hinge
106. Sensor

106.1. Sensor connection sheet

107. Support bracket

108. Main body plate

109. Tilting plate

109.1 Tilting plate side barrier

110. Damping element

111. Slip sheet

111.1 Slip sheet bent point

111.2 Slip sheet barrier

112. Hinge

113. Front body sheet

113.1 Front body sheet bent point

114. Connection sheet

115. Support bracket-piston connection point

200. Workpiece

d1. Angle between slip sheet and main body plate

d2. In the normal position of the tilting plate, the angle between the tilting plate and the main body plate

Detailed Description of the Invention

The invention is the tilting mechanism (100) that allows the position of the workpiece (200) to be rotated 180° in cases where it is necessary to switch between production stages and change the position of the workpiece (200), wherein it composed of the following elements

- connection sheet (114) that enables the assembly of the workpiece (200) to the machine body where tilting mechanism (100) will be used,
- body sheets (103),
- main body plate (108),
- front body sheet (113),
- slip sheet (111),
- tilting plate (109),
- damping element (110) which prevents the rim of the workpiece (200) from being crushed by absorbing the impact,

- 1. support bracket (104),
- 2. support bracket (107) which helps the tilting plate (109) to keep the angle it makes with the main body plate (108) when the tilting plate (109) is in its normal position,
- hinge (112), which facilitates the positioning of the mechanism on the machine and the interventions such as mold changing and maintenance,
- piston (102) that pushes the tilting plate (109),
- piston-body connector (101) providing piston-body connection,
- sensor (106) and sensor connection sheet (106.1) detecting that the workpiece (200) is coming to the tilting plate (109).

The invention is a tilting mechanism (100) that allows the position of the workpiece (200) to be rotated 180° in cases where it is necessary to switch between the production stages and change the position of the workpiece (200), and it performs this process with the steps mentioned below.

The workpiece (200), which has finished one of the production stages, comes to the front body sheet (113) as shown in Figures 1 and 2. The workpiece (200) can proceed on the front body sheet (113) with different mechanisms such as a conveyor, robotic arm or a gripper end system. When the center of gravity of the workpiece (200) passes the bent point (113.1) of the front body sheet (113), it turns over the bent point (113.1) of the front body sheet (113) and leads to the slip sheet (111) as seen in Figure 3. The base of the workpiece (200) rests on the slip sheet (111) as shown in Figure 4. The slip sheet (111) mentioned here consists of a metal sheet body bent down from the bent point (111.1) and two side barriers (111.2) adapted to prevent the workpiece (200) from leaving the production line on both sides of this body. The angle d1 between the main body plate (108) and the slip sheet (111) is between 20°-30°, preferably 25°.

As seen in Figure 5, the workpiece (200) moves along the slip sheet (111) and the workpiece (200) rotates on bent point (111.1) when the center of gravity of the workpiece (200) passes the bent point (111.1) of the slip sheet (111).

As can be seen in Figure 6, the workpiece (200) rotates on the bent point (111.1) of the slip sheet (111) and is tilted over onto the tilting table (109). The tilting plate (109) consists of two sheets welded at an angle of 90° to each other, arc-shaped side barriers (109.1), tilting plate (109) on which the workpiece (200) will rest, workpiece (200) resting sheets, and damping element (110).

When the tilting plate (109) is in its normal position, there is an angle d2 of 12°-20°, preferably 15°, between the tilting plate (109) and the main body plate (108), and it maintains this position thanks to the 2nd support bracket (107). Thanks to the barriers (109.1) located on the tilting plate (109), the workpiece (200) cannot move away from the station and the movements of the

workpiece (200) that may hinder the production are prevented. The damping element (110) located on the tilting plate (109), on the other hand, prevents the rim of the workpiece (200) from being crushed by absorbing the impact caused by rotation.

As shown in Figure 7, the workpiece (200) coming to the tilting plate (109) hits the damping element (110) with the effect of the tilting. The sensor (106), which senses that the workpiece (200) has come to the tilting plate (109), activates the piston (102) connected to the body with the piston-body connector (101). The piston (102), which is connected to the tilting plate (109) from the support bracket-piston connector (115), starts to push the tilting table (109) and therefore starts to rotate the tilting plate (109) on the hinge (105).

As seen in Figure 8, with the forward movement of the piston (102), the tilting plate (109) rotates on the hinge (105) and comes to a parallel position with the main body plate (108). This position is maintained by the 2nd support bracket (107). With the tilting plate (109) in parallel with the main body plate (108), the workpiece (200) will have completed its 180° tilting and will be ready to be transferred to the next production stage.

CLAIMS

1. The invention is a tilting mechanism (100) comprising main body plate (108) forming main body and front body sheet (113) characterized in that for allowing the position of a workpiece (200) to be rotated 180° it comprises
   - connection sheet (114) that enables the assembly of the tilting mechanism (100) to a machine body where it will be used,
   - slip sheet (111),
   - tilting plate (109),
   - damping element (110), which prevents the rim of the workpiece (200) from being crushed by absorbing the impact,
   - 2. support bracket (107) which helps the tilting plate (109) to keep the angle it makes with the main body plate (108) when the tilting plate (109) is in its normal position,
   - piston (102) that pushes the tilting plate (109),
   - piston-body connector (101) that provides the piston-body connection,
   - sensor (106) and sensor connection sheet (106.1) detecting that the workpiece (200) is coming from the tilting plate (109).

2. The tilting mechanism (100) according to Claim 1 characterized in that it comprises a hinge (112) that facilitates the positioning of the mechanism in the machine and provides convenience in interventions such as mold replacement and maintenance.

3. The tilting mechanism (100) according to Claims 1 and 2 characterized in that the sensor (106) is a photosensitive sensor.

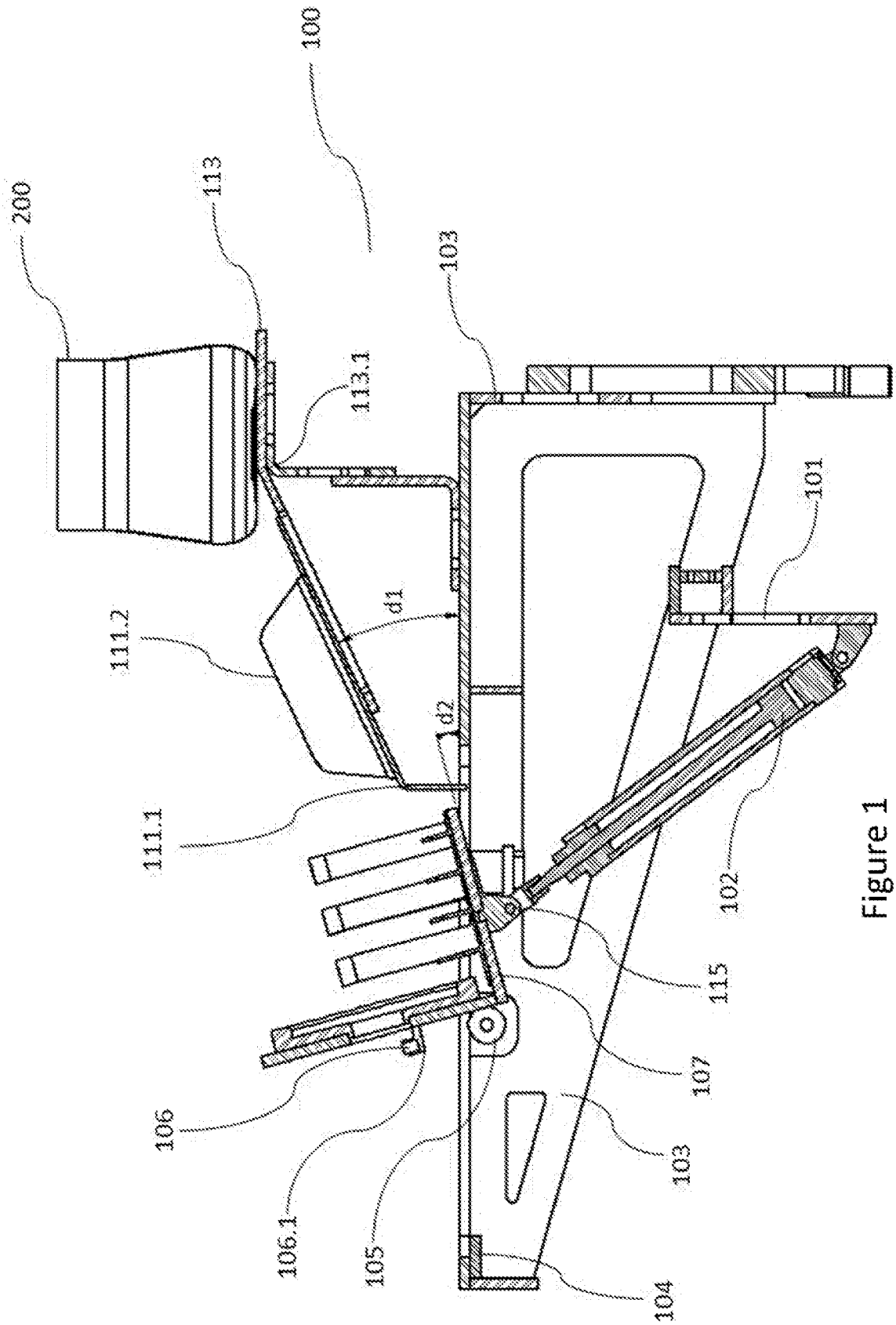
4. The tilting mechanism (100) according to Claims 1 to 3 characterized in that the damping element (110) is preferably made of polyurethane material.

5. The tilting mechanism (100) according to Claims 1 to 4 characterized in that the angle (d1) between slip sheet (111) and main body plate (108) is between 20°-30° preferably 25°.

6. The tilting mechanism (100) according to Claims 1 to 5 characterized in that when the tilting plate (109) is in its normal position, the angle (d2) between the tilting plate (109) and the main body plate (108) is between 12°-20°, preferably 15°.

7. The operation method of a workpiece tilting mechanism (100) characterized in that it comprises the following steps;

- the workpiece (200), which has completed one of the production stages, comes to the front body sheet (113),
- the workpiece (200) moves on the front body sheet (113) until its center of gravity passes the bent point (113.1) of the front body sheet (113),
- the base of the workpiece (200) settles on the slip sheet (111),
- the workpiece (200) moves along the slip sheet (111),
- the center of gravity of the workpiece (200) passes the bent point (111.1) of the slip sheet (111) and the workpiece (200) rotates over this point (111.1),
- the workpiece (200) tilts onto the tilting plate (109) by turning on the bent point (111.1) of the slip sheet (111).
- the workpiece (200) coming to the tilting plate (109) collides with the damping element (110) with the effect of tilting,
- the sensor (106) detects the workpiece (200) that came to the tilting plate (109), and activates the piston (102),
- the piston (102) pushes the tilting plate (109) and the tilting plate (109) rotates on the hinge (105),
- with the forward movement of the piston (102), the tilting plate (109) turns on the hinge (105) and becomes parallel with the main body plate (108) and the workpiece completes its tilting of 180°.


100
200
113
103
113.1
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104

Figure 1

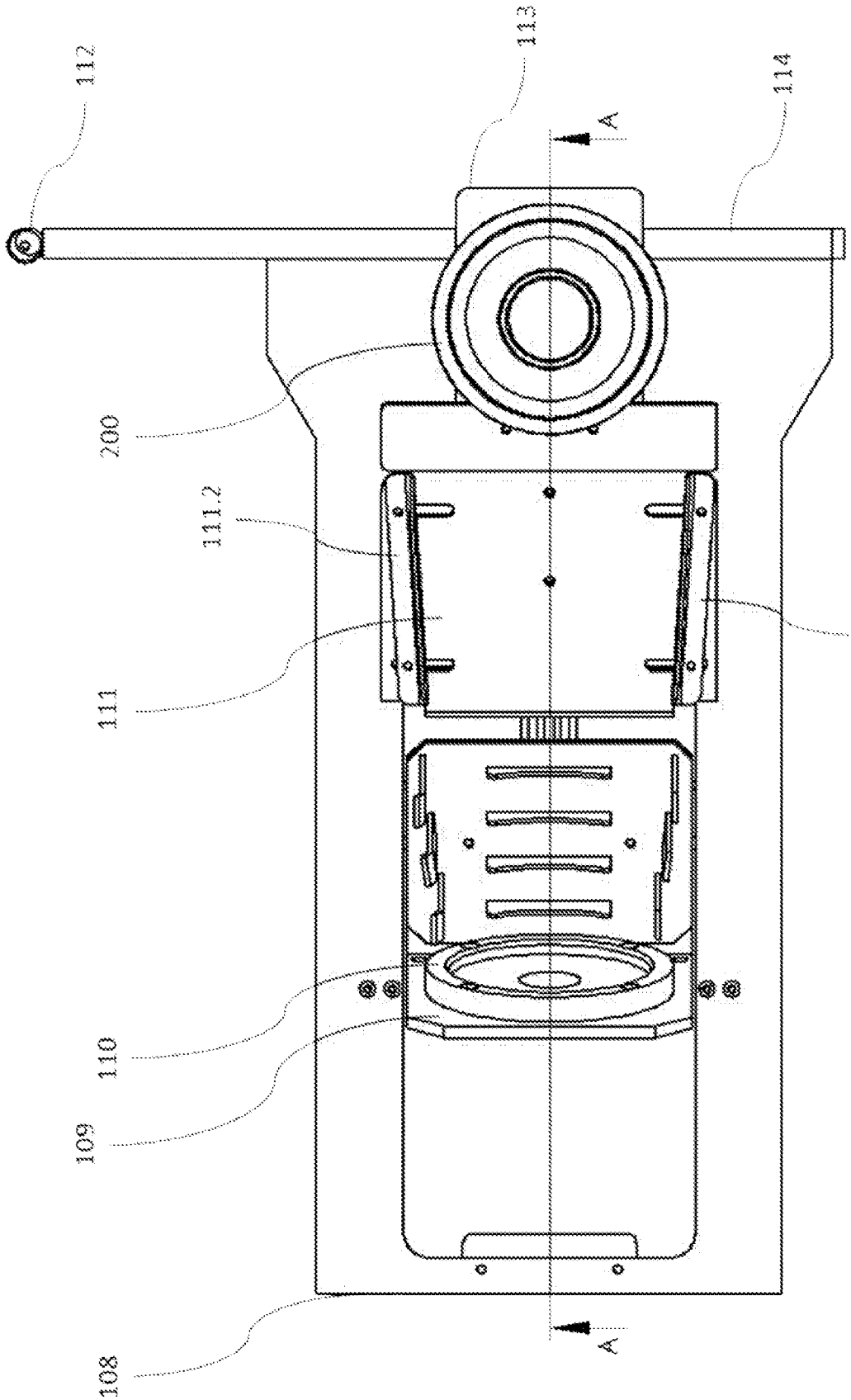

Figure 2

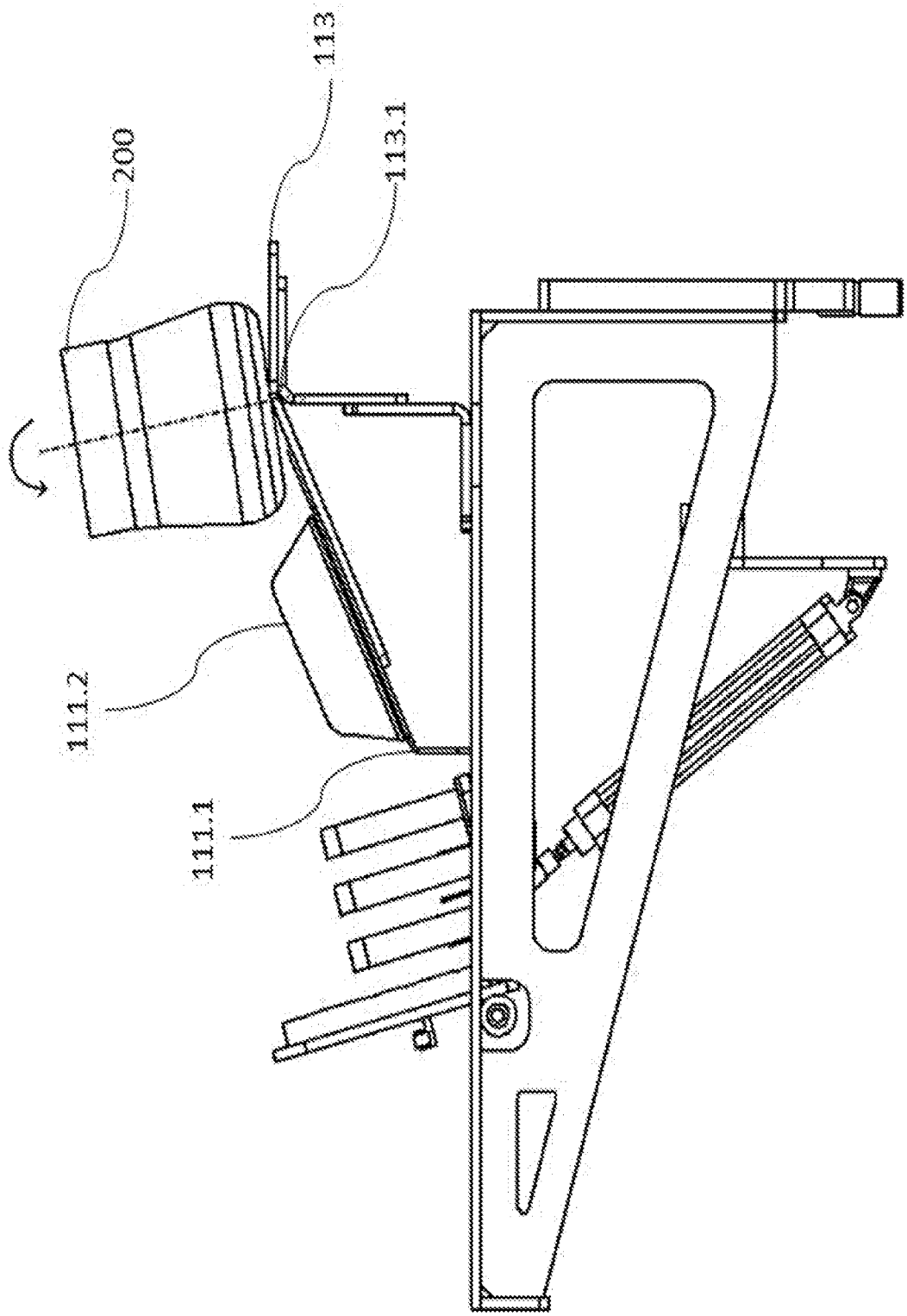

Figure 3

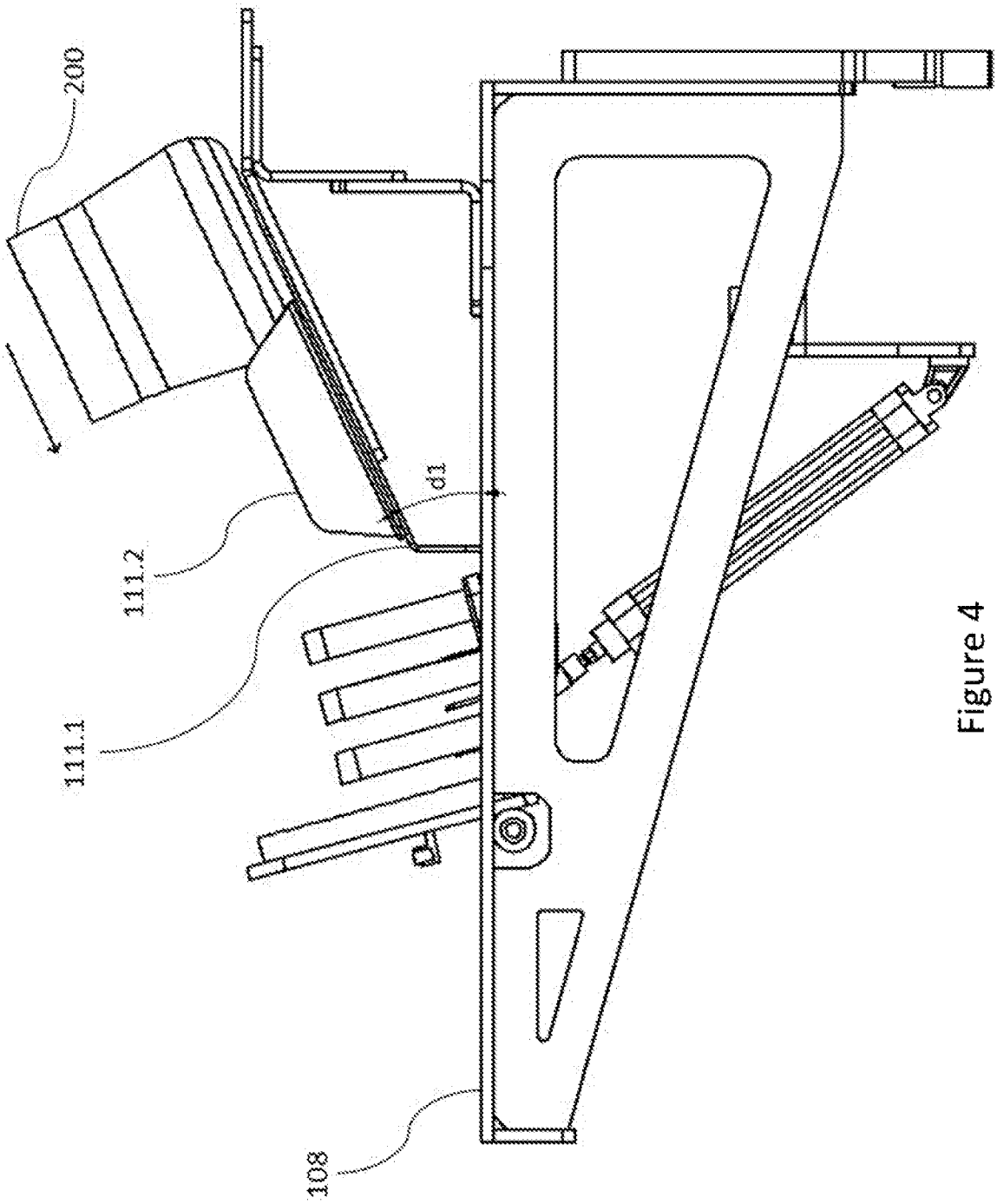

Figure 4

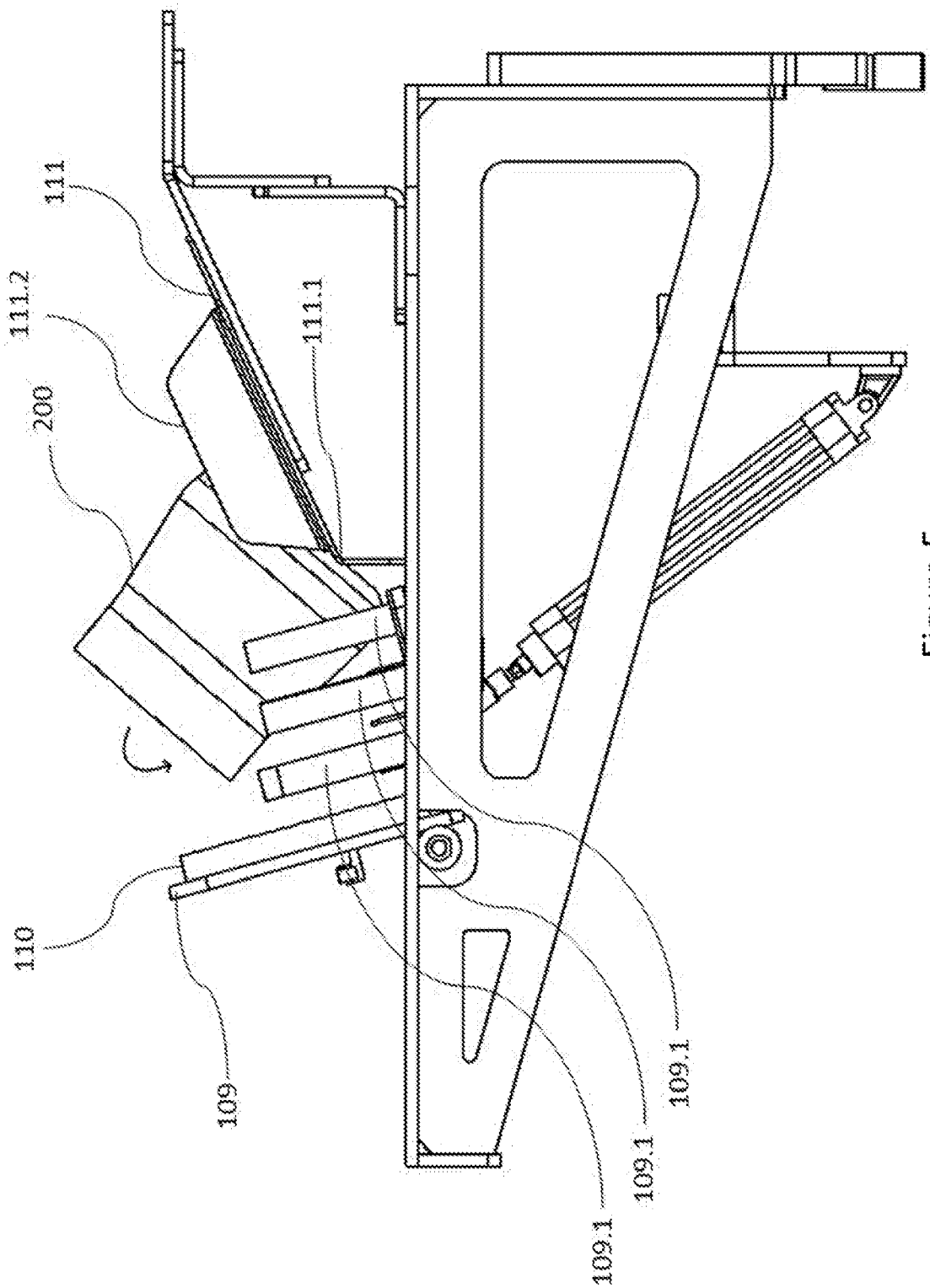

Figure 5

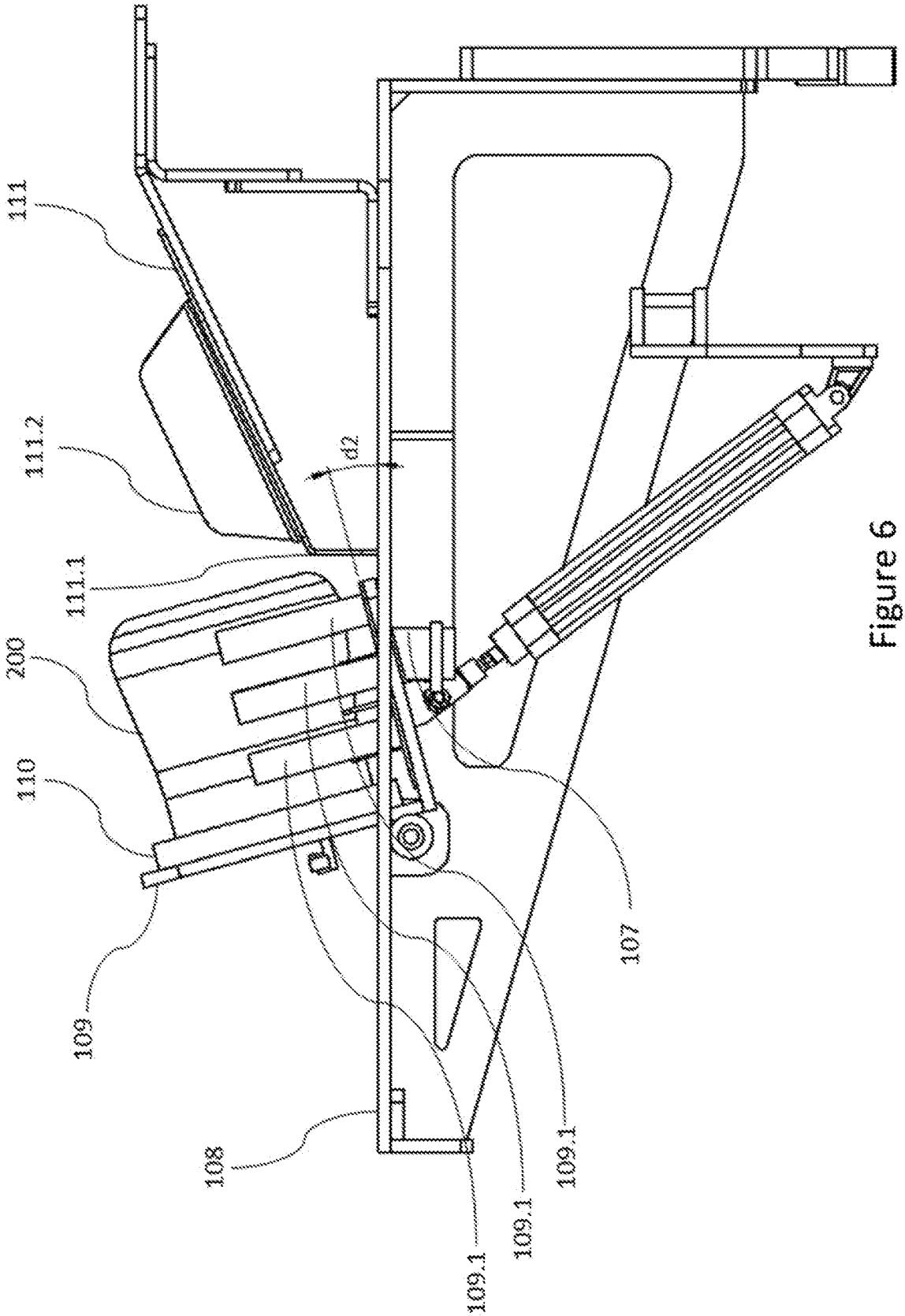

Figure 6

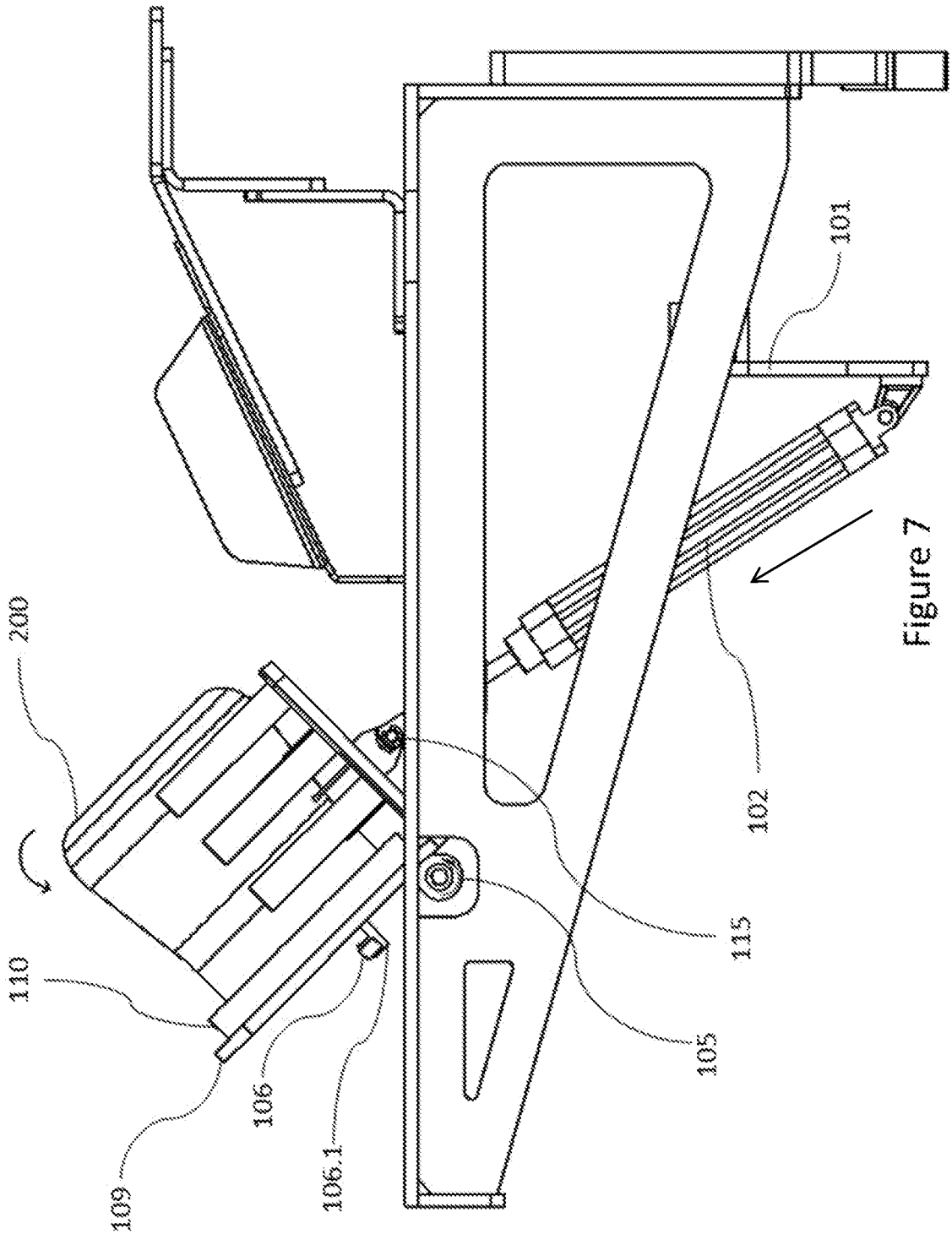

Figure 7

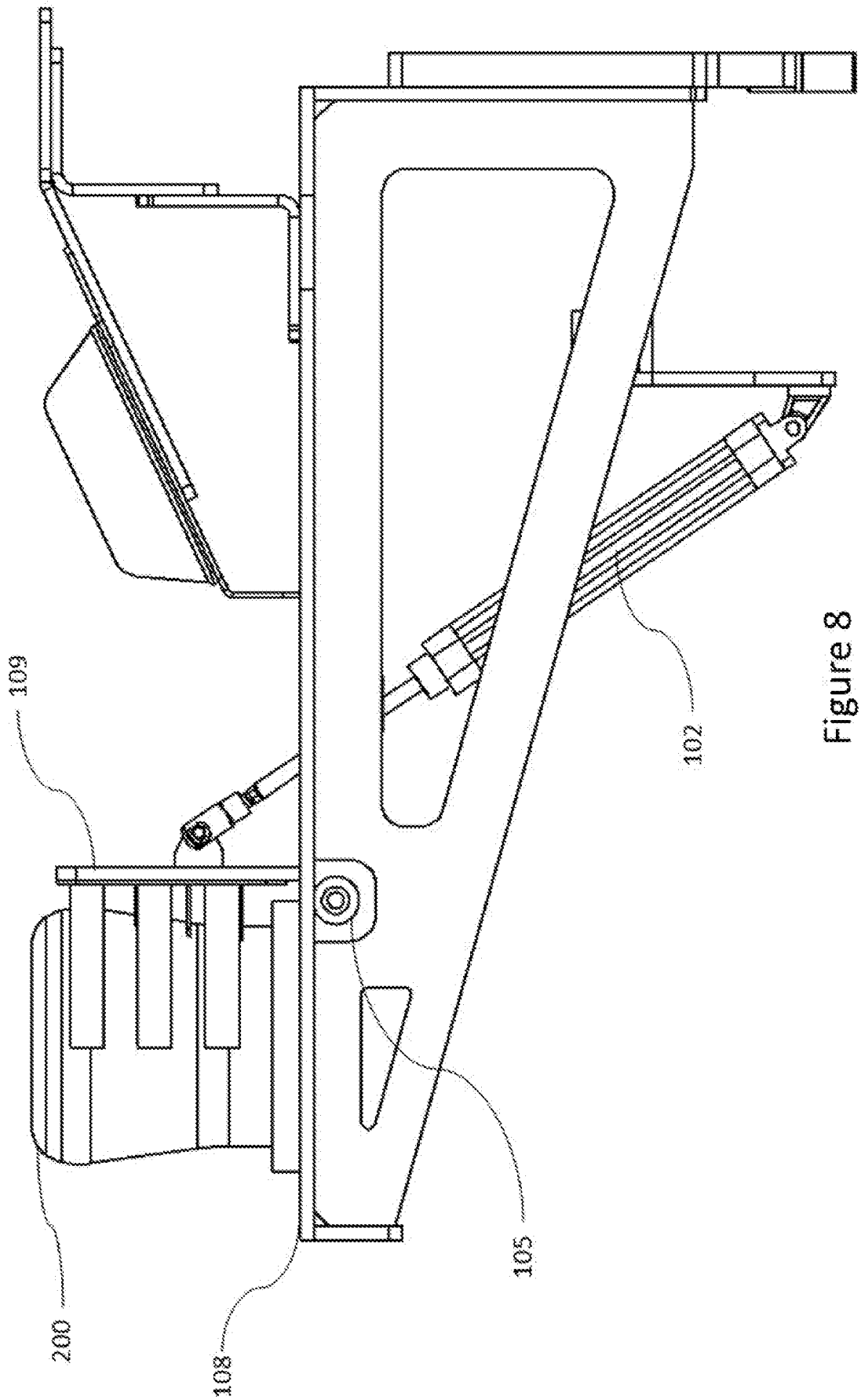

Figure 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/TR2022/050401

A. CLASSIFICATION OF SUBJECT MATTER

B65G 47/22 (2006.01)i; B65G 47/00 (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)

B65G

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

Turkpatent database

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

EPO Abstract & Fulltext databases, Search terms used: process, method, system ,work piece, position, change, machine, sensor, hold, rotate, plate, mechanism, tilt, conveyor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 201841432U U (XUGONG GROUP ENGINEERING MACHINERY CO LTD CONSTRUCTION MACHINERY BRANCH) 25 May 2011 (2011-05-25) Abstract, Figure 1, Claim 1	1-7
A	CN 201988985U U (NANTONG JUNENG FORGING ENGINE CO LTD) 28 September 2011 (2011-09-28) Abstract, Figure 1, Claim 1	1-7
A	CN 201172151Y Y (LUOYANG CIMC LINYU AUTOMOBILE [CN]) 31 December 2008 (2008-12-31) Abstract, Figure 1, Claim 1	1-7

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

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 July 2022	**22 July 2022**

Name and mailing address of the ISA/TR	Authorized officer
Turkish Patent and Trademark Office (Turkpatent) **Hipodrom Caddesi No. 13** **06560 Yenimahalle** **Ankara** **Turkey** Telephone No. **+903123031000** Facsimile No. **+903123031220**	**Senay DEMIRKAN DELICE** Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/TR2022/050401

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	201841432U	U	25 May 2011	CN	201841432U	U	25 May 2011
CN	201988985U	U	28 September 2011	CN	201988985U	U	28 September 2011
CN	201172151Y	Y	31 December 2008	CN	201172151Y	Y	31 December 2008