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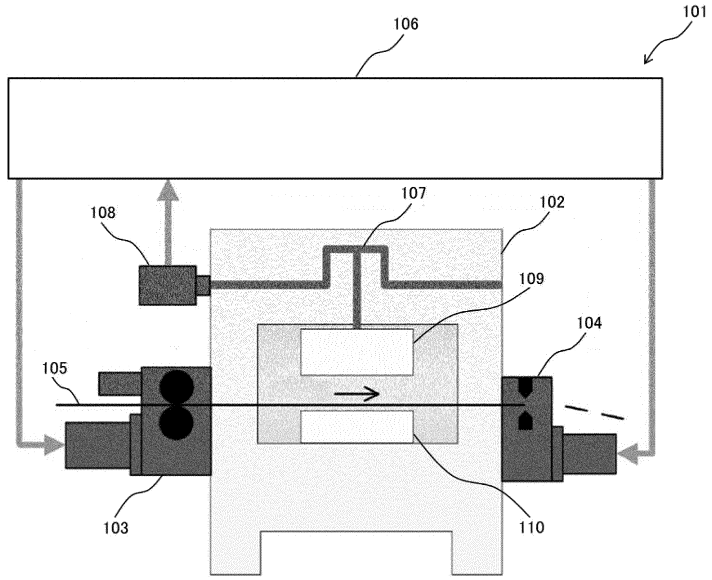
(54) **MACHINING LINE SYSTEM**

(57) Provided is a machining line system equipped with a plate material cutting device capable of cutting a plate material that has been machined by a machining device, so as to improve production efficiency. A machining line system 101 comprises: a machining device 102 for machining a plate material 105, a plate material feeding device 103 for intermittently transporting the plate material 105 to the machining device 102, and a plate material cutting device 104 provided with a cutter for cutting the plate material 105 machined by the machining device 102. The plate material cutting device 104 is configured so as to be able to drive the cutter in accordance with a process carried out by the machining device 102 on the plate material 105.

FIG. 1



EP 4 201 550 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a machining line system including a plate material cutting device capable of cutting a plate material processed in a processing device in such a way as to improve the production efficiency.

BACKGROUND ART

[0002] Patent literature 1 discloses a punch press machine including: an uncoiler which rotates, holding a strip steel plate wound in a roll; a press device having a pair of punching dies which form steel plate parts in a specified shape by punching the strip steel plate; a feeding device which sequentially feeds the strip steel plate uncoiled from the uncoiler into between the pair of punching dies at specified feeding intervals; and a slack forming device located upstream of the press device in the feed direction and configured to make a slack of the strip steel plate when feeding of the feeding device is stopped, in which a scrap cutter is located downstream of the press device in the feed direction, the scrap cutter being configured to cut and collect scrap metal left after punching the strip steel plate to form core steel plate parts.

[0003] Patent literature 2 discloses an amorphous core manufacturing apparatus including: a reel on which a plurality of amorphous sheet materials are wound; a sheet separating device that unifies the amorphous sheet materials drawn out from a plurality of reels into one amorphous sheet material and separates the unified amorphous sheet material into respective sheet materials; a cutting device that again unifies the amorphous sheet materials that passed through the sheet separating device into one amorphous sheet material and cuts the unified amorphous sheet material into sections of predetermined lengths; and a measuring device that laminates the amorphous sheet material sections cut by the cutting device by the number corresponding to one core and measures weight of the laminated sheet material sections, in which a control device controls the rotation of the reel of the uncoiler device, the amount of the sheet material fed to the cutting device, the motor for cutting, the timing at which a clamp cylinder pulls the cut sheet material, and the like.

CITATION LIST

PATENT LITERATURE

[0004]

PATENT LITERATURE 1: JP-A-2014-104500
PATENT LITERATURE 2: JP-A-2012-231028

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] Since the scrap cutter according to patent literature 1 and the cutting device according to patent literature 2 are devices for simply cutting scrap metal left after punching a strip steel plate to form core steel plate parts or for simply cutting unified amorphous sheet materials, they have a problem that it is impossible to drive the scrap cutter or the cutting device in accordance with the steps of the press device or the measuring device, and that it is thus impossible to improve the production efficiency.

[0006] Hence, an object of the present invention to solve the above problem is to provide a machining line system including a plate material cutting device capable of cutting a plate material processed in a processing device at appropriate timing in such a way as to improve the production efficiency.

SOLUTION TO PROBLEM

[0007] According to an aspect of the present invention, a machining line system includes: a processing device which processes a plate material; a plate material feeding device which intermittently transports the plate material to the processing device; and a plate material cutting device including a cutter which cuts the plate material processed in the processing device, and the plate material cutting device is configured to drive the cutter in accordance with steps of the processing device for the plate material.

[0008] According to a specific example of the present invention, in the machining line system, the steps of the processing device for the plate material include a step of moving the plate material and a step of processing the plate material, and the plate material cutting device is configured to drive the cutter in accordance with the processing step.

[0009] According to a specific example of the present invention, in the machining line system, the plate material cutting device is configured to drive the cutter in accordance with the intermittent transport of the plate material by the plate material feeding device.

[0010] According to a specific example of the present invention, in the machining line system, the plate material cutting device is configured to start driving the cutter to cut the plate material processed at a stop of transport of the plate material by the plate material feeding device, and to stop driving the cutter at a start of transport of the plate material by the plate material feeding device.

[0011] According to a specific example of the present invention, in the machining line system, the plate material cutting device further includes a drive unit for driving the cutter, the drive unit includes a shaft rotatable about a rotation axis, and a mechanism for reciprocating the cutter in one direction along with rotation of the shaft about the rotation axis, and the shaft is configured to rotate in accordance with the steps of the processing device for the plate material.

[0012] According to a specific example of the present invention, in the machining line system, the shaft is configured to change a rotation speed in accordance with the steps of the processing device for the plate material.

[0013] According to a specific example of the present invention, in the machining line system, the shaft is configured to change a rotation speed in accordance with a rotation angle of the shaft.

[0014] According to a specific example of the present invention, in the machining line system, the shaft is configured to change a rotation speed so as to rotate about the rotation axis by one round during one cycle of the steps of the processing device for the plate material.

[0015] According to a specific example of the present invention, in the machining line system, the processing device includes a sensor for detecting the steps of the processing device for the plate material, and the plate material feeding device is configured to intermittently transport the plate material to the processing device in accordance with an output signal from the sensor.

[0016] According to a specific example of the present invention, in the machining line system, the plate material cutting device is configured to drive the cutter in accordance with the output signal from the sensor.

ADVANTAGEOUS EFFECTS OF INVENTION

[0017] The present invention enables a machining line system to cut a processed plate material at appropriate timing and to improve the production efficiency.

[0018] Other objects, features, and advantages of the present invention will become apparent from the following description of the embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

[FIG. 1] FIG. 1 is a schematic diagram illustrating a machining line system which is an embodiment of the present invention.

[FIG. 2A] FIG. 2A is a diagram illustrating an example of the relationship between the operations of a plate material feeding device, a processing device, and a plate material cutting device in the machining line system in FIG. 1.

[FIG. 2B] FIG. 2B is a diagram illustrating another example of the relationship between the operations of the plate material feeding device, the processing device, and the plate material cutting device in the machining line system in FIG. 1.

[FIG. 3A] FIG. 3A is a perspective view of the plate material cutting device of the machining line system in FIG. 1 part of which is illustrated to be transparent.

[FIG. 3B] FIG. 3B is a partial cross-sectional side view of the plate material cutting device in FIG. 3A.

[FIG. 3C] FIG. 3C is a cross-sectional front view of the plate material cutting device in FIG. 3A.

DESCRIPTION OF EMBODIMENTS

[0020] Embodiments according to the present invention will be described with reference to the drawings. However, the present invention is not limited to those embodiments.

[0021] A machining line system 101, which is an embodiment of the present invention, will be described with reference to FIG. 1. The machining line system 101 includes a processing device 102 such as a press device which performs processing such as press working on a plate material 105 such as a coil material, a plate material feeding device (feeder) 103 which intermittently transports the plate material 105 from an uncoiler to the processing device 102, and a plate material cutting device 104 including a cutter which cuts the plate material 105 processed in the processing device 102. The plate material 105 may be uncoiled from the uncoiler and supplied to the plate material feeding device 103 via a plate material supplying device (stock controller) which corrects and flattens the plate material 105. The machining line system 101 includes a control device 106 to control the processing device 102, the plate material feeding device 103, and the plate material cutting device 104. The plate material feeding device 103 may include a pair of rollers, a motor which rotationally drives at least one of the paired rollers, and a control device which controls the motor. The control device for the plate material feeding device 103 may control intermittent transport of the plate material 105 to the processing device 102 by making the pair of rollers hold the plate material 105 or making the pair of rollers apart to release the plate material 105. However, the plate material feeding device 103 is not limited to this configuration. Note that the control device for the plate material feeding device 103 may be integrated in the control device 106.

[0022] The plate material cutting device 104 is capable of driving the cutter in accordance with the steps of the processing device 102 for the plate material 105. The steps of the processing device 102 include a step of the plate material feeding device 103 moving the plate material 105 in accordance with a target length and a step of processing the incoming plate material 105. The plate material cutting device 104 is capable of driving the cutter in accordance with the step of processing the plate material 105 during the time from when the step of moving the plate material 105 finishes, via the step of processing the plate material 105, by when the step of processing the plate material 105 starts again. For example, in the case in which the processing device 102 is a press device, the press device may include a crankshaft 107, an upper die 109, a lower die 110, a motor which rotationally drives the crankshaft 107, and a control device which controls the motor. After the step of moving the plate material 105, the control device for the press device, in the step of performing press working on the plate material 105, may control the motor to rotationally drive the crankshaft 107 having an eccentric cam or the like and thereby move the upper die 109 engaged with the eccentric cam or the like vertically upward and downward to perform press working on the incoming plate material 105 by cooperation of the upper die 109 and the lower die 110. After the step of performing press working on the plate material 105, the plate material feeding device 103 may move the plate material 105 again in accordance with the target length. However, the processing device 102 is not limited to this configuration. Note that the control device for the processing device 102 may be integrated in the control device 106. The plate material cutting device 104 is capable of driving the cutter in accordance with the step of performing press working on the plate material 105 during the time from when the step of moving the plate material 105 finishes, via the step of performing press working on the plate material 105, by when the step of performing press working on the plate material 105 starts again.

[0023] The operation of the plate material feeding device 103 to transport the plate material 105 is performed intermittently such that advancing and stopping of the plate material 105 is repeated in synchronization with the processing at the processing device 102. The plate material cutting device 104 is capable of driving the cutter in accordance with the intermittent transportation of the plate material 105 by the plate material feeding device 103. FIG. 2A illustrates an example of the relationship between the operations of the processing device 102, the plate material feeding device 103, and the plate material cutting device 104 in one cycle of the steps of the processing device 102. Specifically, FIG. 2A illustrates an example of the relationship between the operations for the case in which the processing device 102 is a press device, and a die A is used as an example of the upper die 109 and the lower die 110. The angles (°) shown in FIG. 2A indicate the rotation angles of the crankshaft 107, and the rotation of the crankshaft 107 from 270° via 0° to 90° corresponds to the step of the plate material feeding device 103 moving the plate material 105 in accordance with a target length. The rotation of the crankshaft 107 from 90° via 180° to 270° corresponds to the state in which transportation of the plate material 105 to the processing device 102 by the plate material feeding device 103 is stopped. The rotation of the crankshaft 107 near 180° corresponds to the step of processing the incoming plate material 105. In the rotation of the crankshaft 107 from 270° via 0° to 90°, in other words, in the step of the plate material feeding device 103 moving the plate material 105, the plate material cutting device 104 is in the step of not driving the cutter. In the rotation of the crankshaft 107 from 90° via 180° to 270°, in other words, in the section including the step of processing the plate material 105, the plate material cutting device 104 is in the step of driving the cutter. When the rotation angle of the crankshaft 107 is at 90°, in other words, when the plate material feeding device 103 stops transporting the plate material 105, the plate material cutting device 104 may starts driving the cutter to cut the plate material 105 processed in the processing device 102, and when the rotation angle of the crankshaft 107 is at 270°, in other words, when the plate material feeding device 103 starts transporting the plate material 105, the plate material cutting device 104 may stop driving the cutter.

[0024] FIG. 2B illustrates another example of the relationship between the operations of the processing device 102, the plate material feeding device 103, and the plate material cutting device 104 in one cycle of the steps of the processing device 102. Specifically, FIG. 2B illustrates another example of the relationship between the operations for the case in which the processing device 102 is a press device, and a die B, which is different from the die A, is used as another example of the upper die 109 and the lower die 110. The angles (°) shown in FIG. 2B indicate the rotation angles of the crankshaft 107, and the rotation of the crankshaft 107 from 240° via 0° to 120° corresponds to the step of the plate material feeding device 103 moving the plate material 105 in accordance with a target length. The rotation of the crankshaft 107 from 120° via 180° to 240° corresponds to the state in which transportation of the plate material 105 to the processing device 102 by the plate material feeding device 103 is stopped. The rotation of the crankshaft 107 near 180° corresponds to the step of processing the incoming plate material 105. In the rotation of the crankshaft 107 from 240° via 0° to 120°, in other words, in the step of the plate material feeding device 103 moving the plate material 105, the plate material cutting device 104 is in the step of not driving the cutter. In the rotation of the crankshaft 107 from 120° via 180° to 240°, in other words, in the section including the step of processing the plate material 105, the plate material cutting device 104 is in the step of driving the cutter. When the rotation angle of the crankshaft 107 is at 120°, in other words, when the plate material feeding device 103 stops transporting the plate material 105, the plate material cutting device 104 may starts driving the cutter to cut the plate material 105 processed in the processing device 102, and when the rotation angle of the crankshaft 107 is at 240°, in other words, when the plate material feeding device 103 starts transporting the plate material 105, the plate material cutting device 104 may stop driving the cutter.

[0025] In comparison between FIG. 2A and FIG. 2B, the rotation angle of the crankshaft 107 in the step of the plate material feeding device 103 moving the plate material 105 in FIG. 2A is 180°, while that in FIG. 2B is 240°. If the amount of the plate material 105 transported by the plate material feeding device 103 per unit time is the same, the plate material feeding device 103 in FIG. 2B can transport a larger amount of the plate material 105 than the one in FIG. 2A. The rotation angle of the crankshaft 107 in the section including the step of processing the plate material 105 in FIG. 2A is 180°, while that in FIG. 2B is 120°. In the step of the plate material feeding device 103 moving the plate material 105 (in the case of FIG. 2A, in the range of 180° in the rotation angle of the crankshaft 107; in the case of FIG. 2B, in the range of 240° in the rotation angle of the crankshaft 107), the plate material cutting device 104 is in the step of not driving the cutter. In the section including the step of processing the plate material 105 (in the case of FIG. 2A, in the range of 180° in the rotation angle of the crankshaft 107; in the case of FIG. 2B, in the range of 120° in the rotation angle of the crankshaft 107), the plate material cutting device 104 is in the step of driving the cutter. In the case in which the rotation angle of the crankshaft 107 during the step of the plate material feeding device 103 moving the plate material 105 is set to be 120°, the plate material feeding device 103 can transport a smaller amount of the plate material 105 than the one in FIG. 2A. In this case, in the step of the plate material feeding device 103 moving the plate material 105, in other words, in the range of 120° in the rotation angle of the crankshaft 107, the plate material cutting device 104 is in the step of not driving the cutter. In the section including the step of processing the plate material 105, in other words, in the range of 240° in the rotation angle of the crankshaft 107, the plate material cutting device 104 is in the step of driving the cutter. As described above, the amount of the plate material 105 to be transported to the processing device 102 by the plate material feeding device 103 can be adjusted in accordance with the rotation angle of the crankshaft 107 so that the amount of transportation matches the die used in the press device. In addition, with the plate material cutting device 104, it is possible to cut the plate material 105 processed in the processing device 102.

[0026] Note that the crankshaft 107 can be rotated at high speed or low speed in accordance with the rotation angle. For example, a configuration is possible in which the crankshaft 107 is rotated at high speed during the rotation from 270° via 0° to 90° in FIG. 2A to shorten the time for transporting the plate material 105 to the processing device 102 and thereby to transport a small amount of the plate material 105 to the processing device 102 and in which in contrast, the crankshaft 107 is rotated at low speed during the rotation from 90° via 180° to 270°, during which the plate material cutting device 104 drives the cutter to cut the plate material 105 processed in the processing device 102. Alternatively, a configuration is possible in which the crankshaft 107 is rotated at low speed during the rotation from 270° via 0° to 90° to lengthen the time for transporting the plate material 105 to the processing device 102 and thereby to transport a large amount of the plate material 105 to the processing device 102 and in which in contrast, the crankshaft 107 is rotated at high speed during the rotation from 90° via 180° to 270°, during which the plate material cutting device 104 drives the cutter to cut the plate material 105 processed in the processing device 102.

[0027] As illustrated in FIGS. 3A to 3C, the plate material cutting device 104 may include a housing 201, the cutter which is housed in the housing 201, a drive unit a part of which is housed in the housing 201 and configured to drive the cutter, and a control device which controls the drive unit. The drive unit may include a shaft 202 rotatable about a rotation axis 203, a first motor 204 connected to one end of the shaft 202, and a mechanism to reciprocate the cutter in one direction along with the rotation of the shaft 202 about the rotation axis 203. The drive unit may further include a second motor 209 connected to the other end of the shaft 202 to reduce the torsion of the shaft 202. The cutter may be a scrap cutter including a first cutting blade 205 fixed to the housing 201 and a second cutting blade 206 configured to work with the first cutting blade 205 to cut the plate material 105. The mechanism may include a cam 207 fixed to the shaft 202. The cam 207 rotates along with the rotation of the shaft 202 about the rotation axis 203, and the rotation of the cam 207 reciprocates the second cutting blade 206 relative to the first cutting blade 205. When the second cutting blade 206 approaches the first cutting blade 205, and the first cutting blade 205 and the second cutting blade 206 are engaged, the engagement cuts the plate material 105 transported from the outside via a reception opening 208 which the housing 201 has. The cam 207 may be a plate cam having a special curved outline, a planar cam having a special groove, or the like and may be, for example, a disk cam having an eccentric disc, a triangular cam, or the like. The cam 207 may have a shape that enables reciprocation of the second cutting blade 206 required from the rotation of the shaft 202 about the rotation axis 203. However, the plate material cutting device 104 is not limited to this configuration. Note that the control device for the plate material cutting device 104 may be integrated in the control device 106.

[0028] The shaft 202 can rotate in accordance with the steps of the processing device 102 for the plate material 105. The shaft 202 can rotate in accordance with the step of processing the plate material 105 during the time from when the step of moving the plate material 105 finishes, via the step of processing the plate material 105, by when the step of processing the plate material 105 starts again. The control device for the plate material cutting device 104 may control the first motor 204, in accordance with the step of processing the plate material 105, to rotationally drive the shaft 202 to which the cam 207 is fixed, thereby reciprocating the second cutting blade 206 engaged with the cam 207 in the direction toward the first cutting blade 205, so that the engagement between the first cutting blade 205 and the second cutting blade 206 cuts the plate material 105 processed in the processing device 102.

[0029] The shaft 202 can change the rotation speed in accordance with the step of the processing device 102 for the plate material 105. The shaft 202 may change the rotation speed such that the rotation speed increases after the step of moving the plate material 105 finishes and that the rotation speed decreases after the step of processing the plate material 105 is passed through and the step of processing the plate material 105 starts again. The shaft 202 may stop its rotation during the step of moving the plate material 105 and may start rotating after the step of moving the plate material 105 finishes. In addition, the shaft 202 can change the rotation speed in accordance with the rotation angle of the shaft 202. A configuration is possible in which the shaft 202 rotates at low rotation speed in a range of a specified rotation angle in the step of moving the plate material 105 and in which the shaft 202 rotates at high rotation speed in another range of a specified rotation angle in the step of processing the plate material 105. The shaft 202 can change the rotation speed such that the shaft 202 rotates about the rotation axis 203 once during one cycle of the steps of the processing device 102 for the plate material 105. Also in the case in which the shaft 202 rotates at low rotation speed in a range of a specified rotation angle in the step of moving the plate material 105 and in which the shaft 202 rotates at high rotation speed in another range of a specified rotation angle in the step of processing the plate material 105, the shaft 202 may change the rotation speed such that the time taken for the shaft 202 to rotate about the rotation axis 203 once is equal to the time taken for one cycle of the steps of the processing device 102 for the plate material 105. Alternatively, the shaft 202 may change the rotation speed such that the shaft 202 rotates about the rotation axis 203 once during an integral multiple of one cycle of the steps of the processing device 102 for the plate material 105. In this case, the cam 207 may have a shape having as many vertexes as the number of the integral multiple. For example, in the case in which the shaft 202 rotates about the rotation axis 203 once during three cycles of the steps of the processing device 102 for the plate material 105, the cam 207 may be a triangular cam. When a portion near one of the vertexes of the cam 207 is engaged with the second cutting blade 206, the first cutting blade 205 and the second cutting blade 206 are engaged, and the engagement cuts the plate material 105 processed in the processing device 102.

[0030] The processing device 102 may include a sensor for detecting the steps of the processing device 102. For example, in the case in which the processing device 102 is a press device, the processing device 102 may include, as a sensor, an angle detector 108 such as an encoder to detect the rotation angle of the crankshaft 107. The angle detector 108 detects the rotation angle of the crankshaft 107 as illustrated in FIGS. 2A and 2B. Then, the output signal indicating the rotation angle detected by the angle detector 108 is transmitted to the control device 106. With this operation, the control device 106 can recognize the step of the processing device 102. For example, as illustrated in FIG. 2A, if the rotation angle of the crankshaft 107 is in the range from 270° via 0° to 90°, the control device 106 can realize that the current process is in the step of the plate material feeding device 103 moving the plate material 105 in accordance with a target length. If the rotation angle of the crankshaft 107 is near 180°, the control device 106 can realize that the current process is in the step of processing the incoming plate material 105. When the control device 106 realizes that the rotation angle of the crankshaft 107 is at 90°, the control device 106 makes the plate material feeding device 103 stop transporting the plate material 105 to the processing device 102. When the control device 106 realizes that the rotation angle of the crankshaft 107 is at 270°, the control device 106 makes the plate material feeding device 103 resume transporting the plate material 105 to the processing device 102 and transport the plate material 105 to the processing device 102 at a constant speed. As described above, the control device 106 can make the plate material feeding device 103 intermittently transport the plate material 105 to the processing device 102 in accordance with output signals from the angle detector 108.

[0031] When the control device 106 realizes that the rotation angle of the crankshaft 107 is in the range from 270° via 0° to 90°, in other words, in the step of the plate material feeding device 103 moving the plate material 105 in accordance with the target length, the control device 106 makes the plate material cutting device 104 stop driving the cutter. When the control device 106 realizes that the rotation angle of the crankshaft 107 is in the range from 90° via 180° to 270°, in other words, in the section including the step of processing the plate material 105, the control device 106 makes the plate material cutting device 104 drive the cutter. When the control device 106 realizes that the rotation angle of the crankshaft 107 is at 90°, the control device 106 makes the plate material cutting device 104 start driving the cutter to cut the plate material 105 processed in the processing device 102. When the control device 106 realizes that the rotation angle of the crankshaft 107 is at 270°, the control device 106 makes the plate material cutting device 104 finish driving the cutter. As described above, the control device 106 can make the plate material cutting device 104 drive the cutter in accordance with output signals from the angle detector 108 to cut the plate material 105 processed in the processing device 102.

[0032] With the use of the machining line system 101 according to the present invention as described above, the processing device 102 such as a press device performs processing such as press working on the plate material 105 intermittently transported with high accuracy from the plate material feeding device 103, so that the processing device 102 can manufacture small parts to be used in information-related equipment such as mobile phones and personal computers or to manufacture structural parts such as components for automobiles, industrial motor parts, and home appliances. Then, the plate material cutting device 104 can cut the plate material 105 subjected to processing such as press working in the processing device 102 such as a press device at appropriate timing, and this improves the production efficiency.

[0033] It should be further understood by those skilled in the art that although the foregoing description has been made on embodiments of the present invention, the present invention is not limited thereto and various changes and modifications may be made without departing from the principle of the present invention and the scope of the appended claims.

REFERENCE SIGNS LIST

[0034]

101	machining line system
102	processing device
103	plate material feeding device
104	plate material cutting device
105	plate material
106	control device
107	crankshaft
108	angle detector
109	upper die
110	lower die
201	housing
202	shaft
203	rotation axis
204	first motor
205	first cutting blade
206	second cutting blade
207	cam
208	reception opening
209	second motor

Claims

1. A machining line system comprising:

a processing device which processes a plate material;
a plate material feeding device which intermittently transports the plate material to the processing device; and
a plate material cutting device comprising a cutter which cuts the plate material processed in the processing device, wherein
the plate material cutting device is configured to drive the cutter in accordance with steps of the processing device for the plate material.

2. The machining line system according to claim 1, wherein the steps of the processing device for the plate material include a step of moving the plate material and a step of processing the plate material, and the plate material cutting device is configured to drive the cutter in accordance with the processing step.

3. The machining line system according to claim 1 or 2, wherein the plate material cutting device is configured to drive the cutter in accordance with the intermittent transport of the plate material by the plate material feeding device.

4. The machining line system according to claim 3, wherein the plate material cutting device is configured to start driving the cutter to cut the plate material processed at a stop of transport of the plate material by the plate material feeding device, and to stop driving the cutter at a start of transport of the plate material by the plate material feeding device.

5. The machining line system according to any one of claims 1 to 4, wherein the plate material cutting device further comprises a drive unit for driving the cutter, the drive unit comprises a shaft rotatable about a rotation axis, and a mechanism for reciprocating the cutter in one direction along with rotation of the shaft about the rotation axis, and the shaft is configured to rotate in accordance with the steps of the processing device for the plate material.

6. The machining line system according to claim 5, wherein the shaft is configured to change a rotation speed in accordance with the steps of the processing device for the plate material.

7. The machining line system according to claim 5 or 6, wherein the shaft is configured to change a rotation speed in accordance with a rotation angle of the shaft.

8. The machining line system according to any one of claims 5 to 7, wherein the shaft is configured to change a rotation speed so as to rotate about the rotation axis by one round during one cycle of the steps of the processing device for the plate material.

9. The machining line system according to any one of claims 1 to 8, wherein the processing device comprises a sensor for detecting the steps of the processing device for the plate material, and the plate material feeding device is configured to intermittently transport the plate material to the processing device in accordance with an output signal from the sensor.

10. The machining line system according to claim 9, wherein the plate material cutting device is configured to drive the cutter in accordance with the output signal from the sensor.

FIG. 1

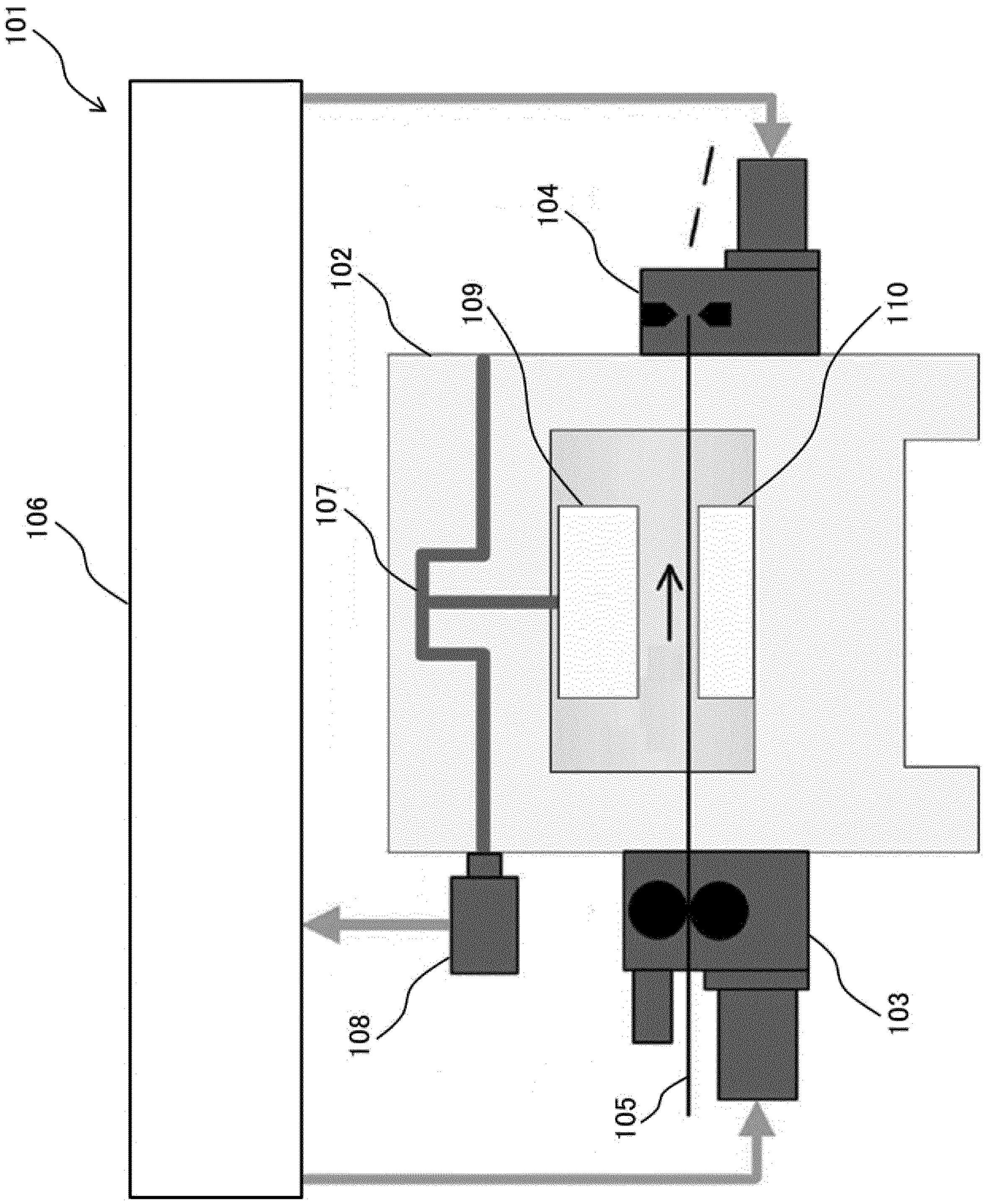


FIG. 2A

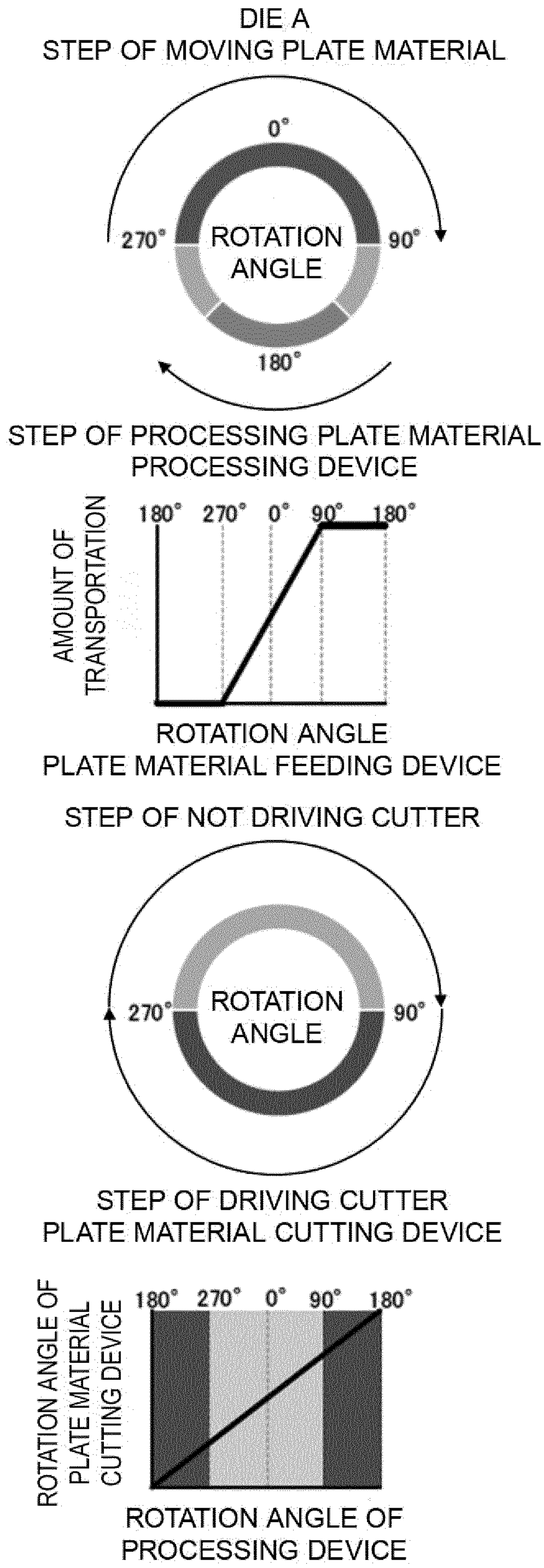

DIE A
STEP OF MOVING PLATE MATERIAL
0°
270°
ROTATION ANGLE
90°
180°
STEP OF PROCESSING PLATE MATERIAL
PROCESSING DEVICE
AMOUNT OF TRANSPORTATION
180° 270° 0° 90° 180°
ROTATION ANGLE
PLATE MATERIAL FEEDING DEVICE
STEP OF NOT DRIVING CUTTER
270°
ROTATION ANGLE
90°
STEP OF DRIVING CUTTER
PLATE MATERIAL CUTTING DEVICE
ROTATION ANGLE OF PLATE MATERIAL CUTTING DEVICE
180° 270° 0° 90° 180°
ROTATION ANGLE OF PROCESSING DEVICE

FIG. 2B

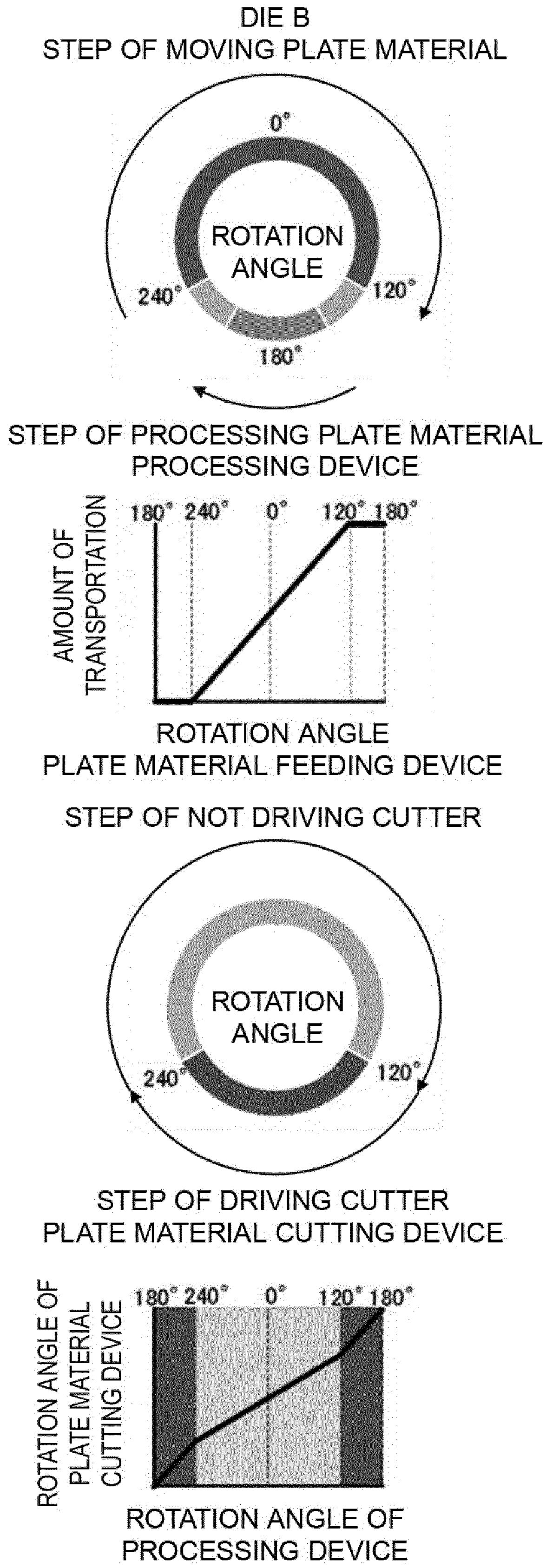

DIE B
STEP OF MOVING PLATE MATERIAL
0°
ROTATION ANGLE
240°
120°
180°
STEP OF PROCESSING PLATE MATERIAL
PROCESSING DEVICE
AMOUNT OF TRANSPORTATION
180° 240° 0° 120° 180°
ROTATION ANGLE
PLATE MATERIAL FEEDING DEVICE
STEP OF NOT DRIVING CUTTER
ROTATION ANGLE
240°
120°
STEP OF DRIVING CUTTER
PLATE MATERIAL CUTTING DEVICE
ROTATION ANGLE OF PLATE MATERIAL CUTTING DEVICE
180° 240° 0° 120° 180°
ROTATION ANGLE OF PROCESSING DEVICE

FIG. 3A

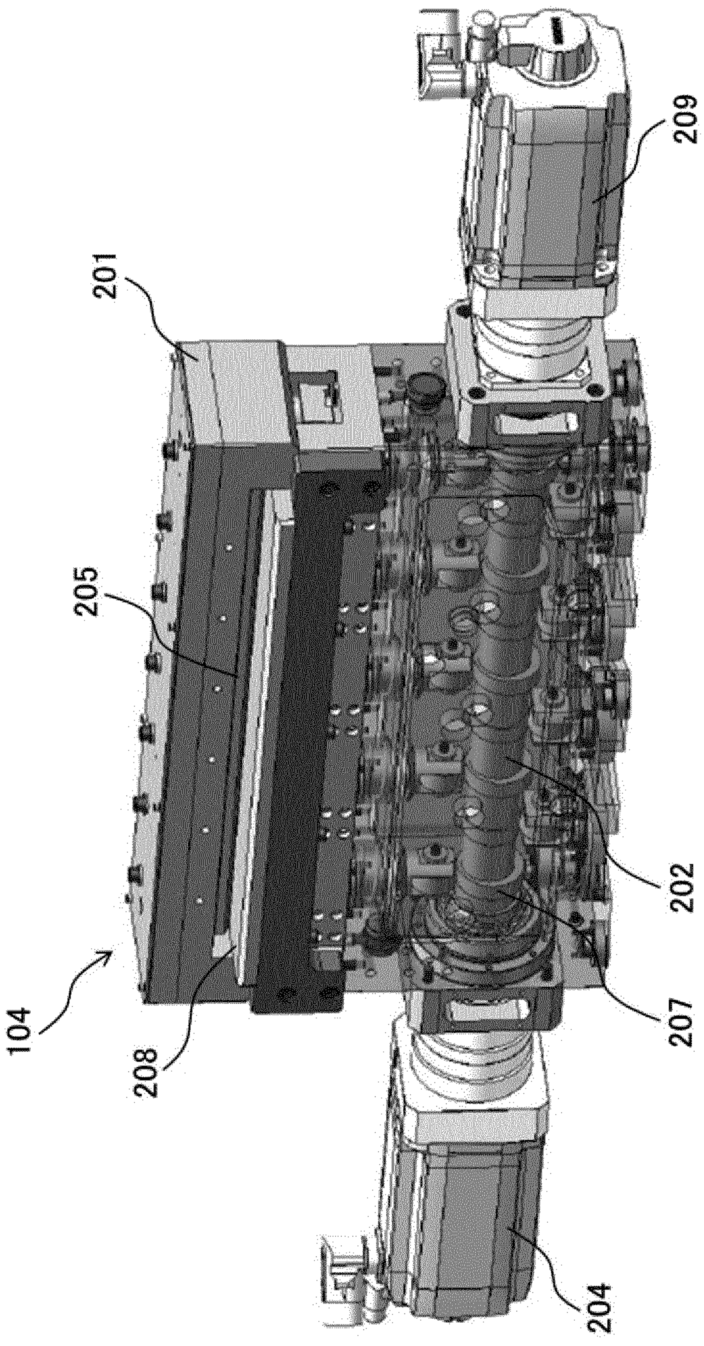


FIG. 3B

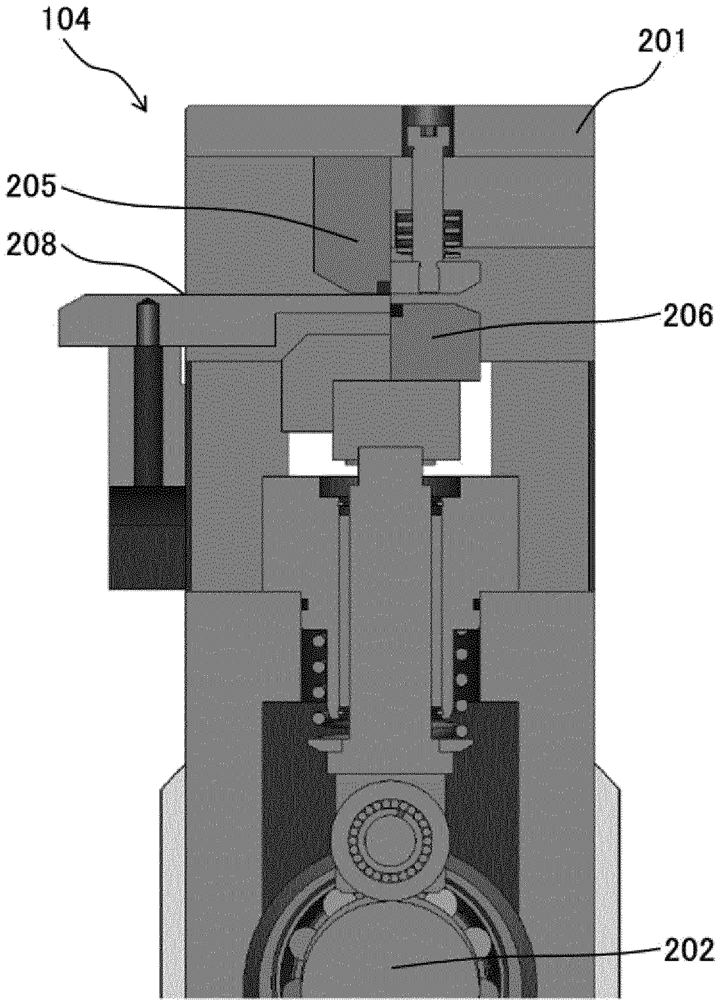
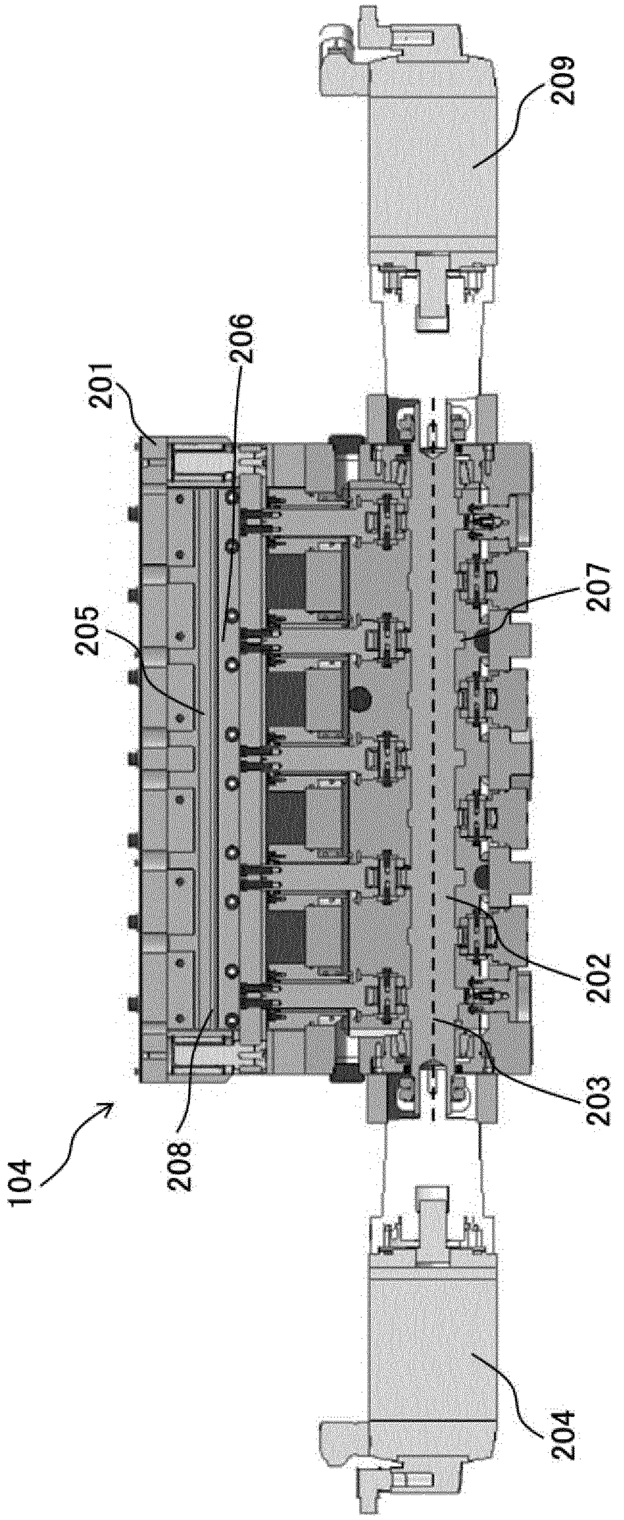


FIG. 3C



INTERNATIONAL SEARCH REPORT

International application No. **PCT/JP2021/035134**

A. CLASSIFICATION OF SUBJECT MATTER

B21D 43/02(2006.01)i; ***B21D 43/28***(2006.01)i
FI: B21D43/02 E; B21D43/28

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)

B21D43/02; B21D43/28

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2021
Registered utility model specifications of Japan 1996-2021
Published registered utility model applications of Japan 1994-2021

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2020-127956 A (JFE METAL PRODUCTS & ENGINEERING INC.) 27 August 2020 (2020-08-27)	1-10
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 152893/1984 (Laid-open No. 67938/1986) (TOYOTA MOTOR CO., LTD.) 09 May 1986 (1986-05-09)	1-10
A	JP 47-8945 Y1 (AIDA ENGINEERING LTD.) 05 April 1972 (1972-04-05)	1-10

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

* Special categories of cited documents:
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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
18 October 2021	**02 November 2021**

Name and mailing address of the ISA/JP	Authorized officer
Japan Patent Office (ISA/JP) **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/035134

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2020-127956 A	27 August 2020	(Family: none)	
JP 61-67938 U1	09 May 1986	(Family: none)	
JP 47-8945 Y1	05 April 1972	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2014104500 A **[0004]**
- JP 2012231028 A **[0004]**