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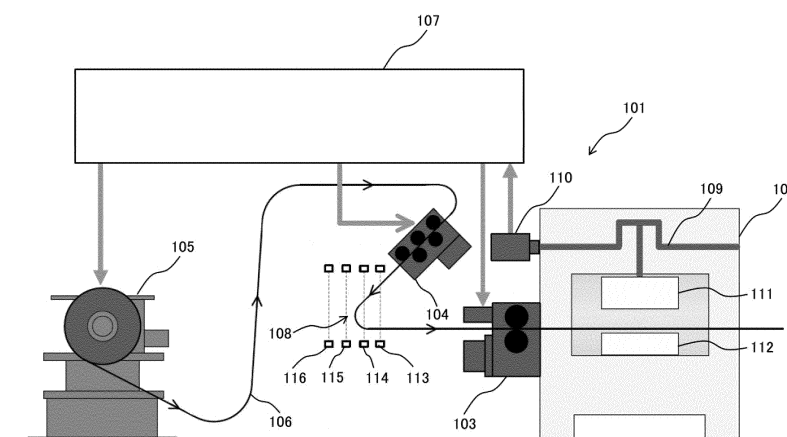
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(54) **MACHINING LINE SYSTEM**

(57) Provided is a machining line system comprising a plate material supply device capable of supplying a plate material so as to improve production efficiency. This machining line system 101 comprises: a machining device 102 which machines a plate material 100; a plate material feeding device 103 which intermittently conveys the plate material 106 to the machining device 102; and

a plate material supply device 104 which supplies the plate material 106 from an uncoiler 105 to the plate material feeding device 103, wherein the plate material supply device 104 is configured to be capable of changing the speed of supplying the plate material 106 to the plate material feeding device 103 according to steps of the machining device 102 for the plate material 106.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a machining line system in which a plate material feeding device which intermittently transports a plate material to a processing device is provided with a plate material supplying device capable of supplying the plate material in a way that improves the production efficiency.

BACKGROUND ART

[0002] When a plate material feeding device transports a plate material such as a coil material to a processing device such as a press device, the transportation operation by the plate material feeding device is performed intermittently such that advancing and stopping of the plate material is repeated in synchronization with processing at the processing device. The inertial force caused due to advancing and stopping the plate material acts on the plate material, so that the plate material is vibrated, or a phenomenon of waving called fluttering occurs. The occurrence of the fluttering mentioned above not only exerts an excessive burden on the plate material feeding device but also causes bending and scratches on the plate material. Hence, it is necessary to provide a buffer section called a looper. As a technique to mitigate fluttering of the plate material, there has been known a plate material supplying device having a looper in the form of a letter U, a letter S, or the like as a buffer section. Such a plate material supplying device causes less fluttering than in the case without a looper in the form of a letter U, a letter S, or the like. However, fluttering occurs when the plate material is transported at high speed; hence, increasing the transportation speed of the plate material is limited. Thus, there is a problem that the processing performance cannot be fully exerted, while high-speed processing is required.

[0003] Patent literature 1 discloses a coil material supplying device including: a pair of feed rollers located near a plate material feeding device for a press device and provided with a servo motor for feeding a coil material while forming a loop; a position sensor for detecting the degree of the loop of the coil material; and a control device which controls the servo motor in accordance with signals from the position sensor to control the amount of the coil material fed by the feed rollers. Patent literature 2 discloses a coil material supplying device for supplying a coil material to a plate material feeding device for a press device, including: a coil material supplying portion; a position sensor located downstream of this coil material supplying portion and configured to detect the degree of the loop of the coil material; a control device which controls a servo motor in accordance with signals from the position sensor to control the amount of the coil material fed by feeding rollers; and a stand which holds the coil material supplying portion such that the mounting angle

of the coil material supplying portion is adjustable so as to change the angle of the material being supplied in accordance with a condition. Patent literature 3 discloses a coil material supplying device including: a leveler portion configured to correct and feed a coil material; an exit guide portion located at a portion where the loop of the coil material is formed at an exit of the leveler portion; and upper guide portions located at a portion where the loop of the coil material is formed, one of the upper guide portions being located at an exit of the leveler portion, the other being located at a horizontal orientation transition portion for the loop, in which a sensor is provided at a portion where the loop is formed to control the loop so that the roundness of the loop is optimum.

CITATION LIST

PATENT LITERATURE

[0004]

PATENT LITERATURE 1: JP-U-H6-5716

PATENT LITERATURE 2: JP-A-2004-142876

PATENT LITERATURE 3: JP-A-2011-104650

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] Machining line systems including a processing device such as a press device, even in the cases of using a coil material supplying device disclosed in patent literatures 1 to 3 as a plate material supplying device which supplies a plate material to a plate material feeding device, still have a problem that in the case in which the plate material feeding device intermittently transports a plate material to the processing device at high speed, the inertial force caused by advancing and stopping the plate material causes vibration in the plate material and makes it more likely to causes fluttering, and this makes it impossible to improve the production efficiency of the machining line system.

[0006] Hence, an object of the present invention to solve the above problem is to provide a machining line system including a plate material supplying device which is capable of supplying the plate material to the plate material feeding device in such a way as to improve the production efficiency by mitigating the effects of the inertial force caused by the plate material feeding device advancing and stopping the plate material and also by preventing the occurrence of fluttering.

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 supplying device which supplies the plate material from an uncoiler to the plate material feeding device, and the plate material supplying device is configured to change a speed at which the plate material is supplied to the plate material feeding device 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 include a step of moving the plate material and a step of processing the plate material, and a speed at which the plate material in the plate material supplying device is supplied in the moving step is higher than a speed at which the plate material in the plate material supplying device is supplied in the processing step.

[0009] According to a specific example of the present invention, in the machining line system, the plate material supplying device is configured to change a speed at which the plate material is supplied to the plate material feeding device in accordance with a speed at which the plate material feeding device transports the plate material to the processing device.

[0010] According to a specific example of the present invention, in the machining line system, the plate material supplying device is configured to increase a speed at which the plate material is supplied to the plate material feeding device at a start of transport of the plate material by the plate material feeding device, and to decrease a speed at which the plate material is supplied to the plate material feeding device at a stop 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 supplying device is configured to change a speed at which the plate material is supplied to the plate material feeding device such that an amount of the plate material supplied from the plate material supplying device to the plate material feeding device is substantially the same as an amount of the plate material transported from the plate material feeding device to the processing device during one cycle of the steps of the processing device.

[0012] According to a specific example of the present invention, in the machining line system, the plate material supplying device constantly supplies the plate material to the plate material feeding device.

[0013] According to a specific example of the present invention, in the machining line system, when the plate material feeding device does not transport the plate material to the processing device, the plate material supplying device supplies the plate material to the plate material feeding device.

[0014] According to a specific example of the present invention, in the machining line system, a speed at which the plate material supplying device supplies the plate material to the plate material feeding device is different from a speed at which the plate material feeding device transports the plate material to the processing device.

[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, 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 supplying device is configured to change a speed at which the plate material is supplied to the plate material feeding device in accordance with the output signal from the sensor.

ADVANTAGEOUS EFFECTS OF INVENTION

[0017] The present invention enables the machining line system to process a plate material at high speed 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 processing device, a plate material feeding device, and a plate material supplying 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 processing device, the plate material feeding device, and the plate material supplying device in the machining line system in FIG. 1.

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. As illustrated in 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 106 such as a coil material, a plate material feeding device (feeder) 103 which intermittently transports the plate material 106 to the processing device 102, and a plate material supplying device (stock controller) 104 which supplies the plate ma-

terial 106 from an uncoiler 105 to the plate material feeding device 103. The machining line system 101 includes a control device 107 to control the processing device 102, the plate material feeding device 103, and the plate material supplying 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 perform control such that the plate material 106 is intermittently transported to the processing device 102 by making the pair of rollers hold the plate material 106 or making the pair of rollers apart to release the plate material 106. However, the plate material feeding device 103 is not limited to this configuration. The plate material supplying device 104 is configured to correct and flatten the plate material 106 uncoiled from the uncoiler 105 and may include two or more rollers for holding and transporting the plate material 106, a motor which rotationally drives at least one of the two or more rollers, and a control device which controls the motor to control the amount of the plate material 106 to be supplied to the plate material feeding device 103 by the two or more rollers. The two or more rollers may be connected by a connection device such as a timing belt or gears. However, the plate material supplying device 104 is not limited to this configuration. Note that the control device for the plate material feeding device 103 and the control device for the plate material supplying device 104 may be integrated in the control device 107.

[0022] A space 108 is provided between the plate material supplying device 104 and the plate material feeding device 103, and the plate material 106 can pause in the space 108 in accordance with intermittent transportation by the plate material feeding device 103 to the processing device 102. The space 108 is for the plate material 106 to play. When the plate material supplying device 104 is supplying the plate material 106 to the plate material feeding device 103, the plate material 106 is transported so as to form a loop as illustrated in FIG. 1 in the space 108. The operation of the plate material feeding device 103 to transport the plate material 106 is performed intermittently such that advancing and stopping of the plate material 106 is repeated in synchronization with the processing at the processing device 102. When the plate material feeding device 103 stops transporting the plate material 106 to the processing device 102, and the plate material supplying device 104 continues supplying the plate material 106 to the plate material feeding device 103, the plate material 106 pauses in the space 108, and the loop formed by the plate material 106 gradually moves to the left in the space 108 illustrated in FIG. 1 in accordance with the time during which transportation of the plate material by the plate material feeding device 103 is stopped. When the plate material feeding device 103 resumes transporting the plate material 106 to the processing device 102, the loop formed by the plate material 106 gradually moves to the right in the space 108

illustrated in FIG. 1. The space 108 provided as described above enables adjustment of the amount of the plate material to be transported to the processing device 102 by the plate material feeding device 103; however, in a loop without a guide for guiding the plate material 106, the inertial force caused due to the plate material feeding device 103 advancing and stopping the plate material 106 tends to vibrate the plate material 106 and cause fluttering.

[0023] The plate material supplying device 104 is capable of changing the speed at which the plate material 106 is supplied to the plate material feeding device 103 in accordance with the steps of the processing device 102 for the plate material 106. The steps of the processing device 102 includes a step of the plate material feeding device 103 moving the plate material 106 in accordance with a target length and a step of processing the incoming plate material 106. The plate material supplying device 104 is capable of changing the speed at which the plate material 106 is supplied to the plate material feeding device 103 when the step of moving the plate material 106 is changed to the step of processing the plate material 106, and when the step of processing the plate material 106 is changed to the step of moving the plate material 106. For example, in the case in which the processing device 102 is a press device, the press device may include a crankshaft 109, an upper die 111, a lower die 112, a motor which rotationally drives the crankshaft 109, and a control device which controls the motor. After the step of moving the plate material 106, the control device for the press device, in the step of performing press working on the plate material 106, may control the motor to rotationally drive the crankshaft 109 having an eccentric cam or the like and thereby move the upper die 111 engaged with the eccentric cam or the like vertically upward and downward to perform press working on the incoming plate material 106 by cooperation of the upper die 111 and the lower die 112. After the step of performing press working on the plate material 106, the plate material feeding device 103 may move the plate material 106 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 107. When the step of moving the plate material 106 is changed to the step of performing press working on the plate material 106, and when the step of performing press working on the plate material 106 is changed to the step of moving the plate material 106, the control device for the plate material supplying device 104 can change the rotation speed of the output shaft of the motor, and by changing the rotation speed of the output shaft of the motor, change the rotation speed of the two or more rollers holding the plate material 106 to change the speed at which the plate material 106 is supplied to the plate material feeding device 103.

[0024] The plate material supplying device 104 is capable of making the speed at which the plate material

106 is supplied to the plate material feeding device 103 in the step of moving the plate material 106 higher than the speed at which the plate material 106 is supplied to the plate material feeding device 103 in the step of processing the plate material 106. 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 supplying 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 111 and the lower die 112. The angles (°) shown in FIG. 2A indicate the rotation angles of the crankshaft 109, and the rotation of the crankshaft 109 from 270° via 0° to 90° corresponds to the step of the plate material feeding device 103 moving the plate material 106 in accordance with a target length. The rotation of the crankshaft 109 from 90° via 180° to 270° corresponds to the state in which transportation of the plate material 106 to the processing device 102 by the plate material feeding device 103 is stopped. The rotation of the crankshaft 109 near 180° corresponds to the step of processing the incoming plate material 106. In the rotation of the crankshaft 109 from 270° via 0° to 90°, in other words, in the step of the plate material feeding device 103 moving the plate material 106, the plate material supplying device 104 supplies the plate material 106 to the plate material feeding device 103 at a first speed which is constant. In the rotation of the crankshaft 109 from 90° via 180° to 270°, in other words, in the section including the step of processing the plate material 106, the plate material supplying device 104 supplies the plate material 106 to the plate material feeding device 103 at a second speed which is constant. The first speed is set to be higher than the second speed because the first speed corresponds to the speed in the step of the plate material feeding device 103 moving the plate material 106.

[0025] 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 supplying 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 111 and the lower die 112. The angles (°) shown in FIG. 2B indicate the rotation angles of the crankshaft 109, and the rotation of the crankshaft 109 from 240° via 0° to 120° corresponds to the step of the plate material feeding device 103 moving the plate material 106 in accordance with a target length. The rotation of the crankshaft 109 from 120° via 180° to 240° corresponds to the state in which transportation of the plate material 106 to the processing device 102 by the plate material feeding device 103 is stopped. The rotation of the crankshaft 109

near 180° corresponds to the step of processing the incoming plate material 106. In comparison between FIG. 2A and FIG. 2B, the rotation angle of the crankshaft 109 in the step of the plate material feeding device 103 moving the plate material 106 in FIG. 2A is 180°, while that in FIG. 2B is 240°. If the amount of the plate material 106 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 106 than the one in FIG. 2A. In the case in which the rotation angle of the crankshaft 109 during the step of the plate material feeding device 103 moving the plate material 106 is set to be 120°, the plate material feeding device 103 can transport a smaller amount of the plate material 106 than the one in FIG. 2A. As described above, the amount of the plate material 106 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 109 so that the amount of transportation matches the die used in the press device.

[0026] Note that the crankshaft 109 can be rotated at high speed or low speed in accordance with the rotation angle. For example, in FIG. 2A, a configuration is possible in which the crankshaft 109 is rotated at high speed during the rotation from 270° via 0° to 90° to shorten the time during which the plate material 106 is transported to the processing device 102, so that a small amount of the plate material 106 is transported to the processing device 102. Alternatively, a configuration is possible in which the crankshaft 109 is rotated at low speed during the rotation from 270° via 0° to 90° to lengthen the time during which the plate material 106 is transported to the processing device 102, so that a large amount of the plate material 106 is transported to the processing device 102.

[0027] The plate material supplying device 104 is capable of changing the speed at which the plate material 106 is supplied to the plate material feeding device 103 in accordance with the speed at which the plate material feeding device 103 transports the plate material 106 to the processing device 102. Since the operation of the plate material feeding device 103 to transport the plate material 106 is performed intermittently such that advancing and stopping of the plate material 106 is repeated in synchronization with the processing at the processing device 102, if the plate material supplying device 104, while the plate material feeding device 103 is not transporting the plate material 106 to the processing device 102, continues supplying the plate material at the same speed as when the plate material feeding device 103 is transporting the plate material 106 to the processing device 102, the inertial force caused due to the plate material feeding device 103 advancing and stopping the plate material 106 can cause fluttering. Hence, the plate material supplying device 104 may change the speed at which the plate material 106 is supplied to the plate material feeding device 103 so that it is synchronized with the speed at which the plate material feeding device 103 transports the plate material 106 to the processing device

102. As illustrated in FIGS. 2A and 2B, when the plate material feeding device 103 is not supplying the plate material 106 to the processing device 102, the plate material supplying device 104 may decrease the amount of the plate material 106 supplied to the plate material feeding device 103 by making the speed at which the plate material 106 is supplied to the plate material feeding device 103 lower than when the plate material feeding device 103 is transporting the plate material 106 to the processing device 102. With this operation, it is possible to adjust the amount of the plate material 106 pausing in the space 108 and thereby prevent the occurrence of fluttering.

[0028] As illustrated in FIGS. 2A and 2B, when the plate material feeding device 103 stops transporting the plate material 106 to the processing device 102, the plate material supplying device 104 may change the speed so that the speed at which the plate material 106 is supplied to the plate material feeding device 103 is lower. Then, when the plate material feeding device 103 resumes transporting the plate material 106 to the processing device 102, the plate material supplying device 104 may change the speed so that the speed at which the plate material 106 is supplied to the plate material feeding device 103 is higher. In one cycle of the steps of the processing device 102, the plate material supplying device 104 may change the speed at which the plate material 106 is supplied to the plate material feeding device 103 such that the amount of the plate material 106 supplied from the plate material supplying device 104 to the plate material feeding device 103 is substantially the same as the amount of the plate material 106 transported from the plate material feeding device 103 to the processing device 102. With this operation, it is possible to adjust the amount of the plate material 106 pausing in the space 108 and thereby further prevent the occurrence of fluttering.

[0029] The plate material supplying device 104 is capable of supplying the plate material 106 to the plate material feeding device 103 at a desired speed; however, if the plate material supplying device 104 performs such an operation as intermittently supplying the plate material 106 to the plate material feeding device 103 as the plate material feeding device 103 does, it can cause fluttering between the plate material supplying device 104 and the uncoiler 105. To prevent the occurrence of this fluttering, the plate material supplying device 104 may supply the plate material 106 constantly to the plate material feeding device 103. Even when the plate material feeding device 103 is not transporting the plate material 106 to the processing device 102, the plate material supplying device 104 may supply the plate material 106 to the plate material feeding device 103.

[0030] As illustrated in FIGS. 2A and 2B, the speed at which the plate material supplying device 104 supplies the plate material 106 to the plate material feeding device 103 does not have to be the same as the speed at which the plate material feeding device 103 transports the plate

material 106 to the processing device 102, and it may be different regardless of the steps of the processing device 102. The speed at which the plate material supplying device 104 supplies the plate material 106 and the speed at which the plate material feeding device 103 transports the plate material 106 may be set so that the occurrence of fluttering can be prevented, depending on conditions such as the material, thickness, transportation length of the plate material 106.

[0031] 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 110 such as an encoder to detect the rotation angle of the crankshaft 109. The angle detector 110 detects the rotation angle of the crankshaft 109 as illustrated in FIGS. 2A and 2B. Then, the output signal of the rotation angle detected by the angle detector 110 is transmitted to the control device 107. This operation enables the control device 107 to recognize the steps of the processing device 102. For example, as illustrated in FIG. 2A, if the rotation angle of the crankshaft 109 is in the range from 270° via 0° to 90°, the control device 107 can realize that the current process is in the step of the plate material feeding device 103 moving the plate material 106 in accordance with a target length. If the rotation angle of the crankshaft 109 is near 180°, the control device 107 can realize that the current process is in the step of processing the incoming plate material 106. When the control device 107 realizes that the rotation angle of the crankshaft 109 is at 90°, the control device 107 makes the plate material feeding device 103 stop transporting the plate material 106 to the processing device 102. When the control device 107 realizes that the rotation angle of the crankshaft 109 is at 270°, the control device 107 makes the plate material feeding device 103 resume transporting the plate material 106 to the processing device 102 and transport the plate material 106 to the processing device 102 at a constant speed. As described above, the control device 107 can make the plate material feeding device 103 intermittently transport the plate material 106 to the processing device 102 in accordance with output signals from the angle detector 110.

[0032] When the control device 107 realizes that the rotation angle of the crankshaft 109 is in the range from 270° via 0° to 90°, in other words, when the control device 107 realizes that the current process is in the step of the plate material feeding device 103 moving the plate material 106 in accordance with the target length, the control device 107 makes the plate material supplying device 104 supply the plate material 106 to the plate material feeding device 103 at a first speed. When the control device 107 realizes that the rotation angle of the crankshaft 109 is in the range from 90° via 180° to 270°, in other words, when the control device 107 realizes that the range in which the rotation angle is positioned includes the step of processing the plate material 106, the

control device 107 makes the plate material supplying device 104 supply the plate material 106 to the plate material feeding device 103 at a second speed. When the control device 107 realizes that the rotation angle of the crankshaft 109 is at 90°, the control device 107 makes the plate material supplying device 104 change the speed at which the plate material 106 is supplied to the plate material feeding device 103 from the first speed to the second speed. When the control device 107 realizes that the rotation angle of the crankshaft 109 is at 270°, the control device 107 makes the plate material supplying device 104 change the speed at which the plate material 106 is supplied to the plate material feeding device 103 from the second speed to the first speed. As described above, in accordance with output signals from the angle detector 110, the control device 107 is capable of making the plate material supplying device 104 change the speed at which the plate material 106 is supplied to the plate material feeding device 103.

[0033] The machining line system 101 may include a lower limit sensor 113 for detecting the lower limit to the loop of the plate material 106 formed in the space 108, a lower sensor 114 for detecting a lower position of the loop of the plate material 106, an upper sensor 115 for detecting an upper position of the loop of the plate material 106, and an upper limit sensor 116 for detecting the upper limit to the loop of the plate material 106. The control device 107 is capable of realizing the state of the loop of the plate material 106 in accordance with the output signals from the sensors 113 to 116, and in accordance with the state of the loop of the plate material 106, the control device 107 is capable of changing the operational states of the processing device 102, the plate material feeding device 103, and the plate material supplying device 104, such as stopping the operation, so that the control device 107 can prevent the occurrence of fluttering.

[0034] Use of the machining line system 101 of the present invention described above enables the plate material supplying device 104 to mitigate effects of the inertial force caused due to the plate material feeding device 103 advancing and stopping the plate material 106 and to supply the plate material 106 to the plate material feeding device 103 which intermittently transports the plate material 106 to the processing device 102 such as a press device in a way in which the occurrence of fluttering is prevented, and vibration of the plate material 106 is reduced, and that supports higher speed processing such as press working. Then, the processing device 102 such as a press device performs processing such as press working on the plate material 106 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, home appliances, and the like.

[0035] 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

[0036]

101	machining line system
102	processing device
103	plate material feeding device
104	plate material supplying device
105	uncoiler
106	plate material
107	control device
108	space
109	crankshaft
110	angle detector
111	upper die
112	lower die
113	lower limit sensor
114	lower sensor
115	upper sensor
116	upper limit sensor

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 supplying device which supplies the plate material from an uncoiler to the plate material feeding device, wherein the plate material supplying device is configured to change a speed at which the plate material is supplied to the plate material feeding device in accordance with steps of the processing device for the plate material.

2. The machining line system according to claim 1, wherein the steps include a step of moving the plate material and a step of processing the plate material, and a speed at which the plate material in the plate material supplying device is supplied in the moving step is higher than a speed at which the plate material in the plate material supplying device is supplied in the processing step.

3. The machining line system according to claim 1 or

2, wherein the plate material supplying device is configured to change a speed at which the plate material is supplied to the plate material feeding device in accordance with a speed at which the plate material feeding device transports the plate material to the processing device. 5

4. The machining line system according to any one of claims 1 to 3, wherein the plate material supplying device is configured to increase a speed at which the plate material is supplied to the plate material feeding device at a start of transport of the plate material by the plate material feeding device, and to decrease a speed at which the plate material is supplied to the plate material feeding device at a stop of transport of the plate material by the plate material feeding device. 10 15
5. The machining line system according to any one of claims 1 to 4, wherein the plate material supplying device is configured to change a speed at which the plate material is supplied to the plate material feeding device such that an amount of the plate material supplied from the plate material supplying device to the plate material feeding device is substantially the same as an amount of the plate material transported from the plate material feeding device to the processing device during one cycle of the steps. 20 25
6. The machining line system according to any one of claims 1 to 5, wherein the plate material supplying device constantly supplies the plate material to the plate material feeding device. 30
7. The machining line system according to any one of claims 1 to 6, wherein when the plate material feeding device does not transport the plate material to the processing device, the plate material supplying device supplies the plate material to the plate material feeding device. 35 40
8. The machining line system according to any one of claims 1 to 7, wherein a speed at which the plate material supplying device supplies the plate material to the plate material feeding device is different from a speed at which the plate material feeding device transports the plate material to the processing device. 45
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, 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. 50 55
10. The machining line system according to claim 9, wherein the plate material supplying device is con-

figured to change a speed at which the plate material is supplied to the plate material feeding device in accordance with the output signal from the sensor.

FIG. 1

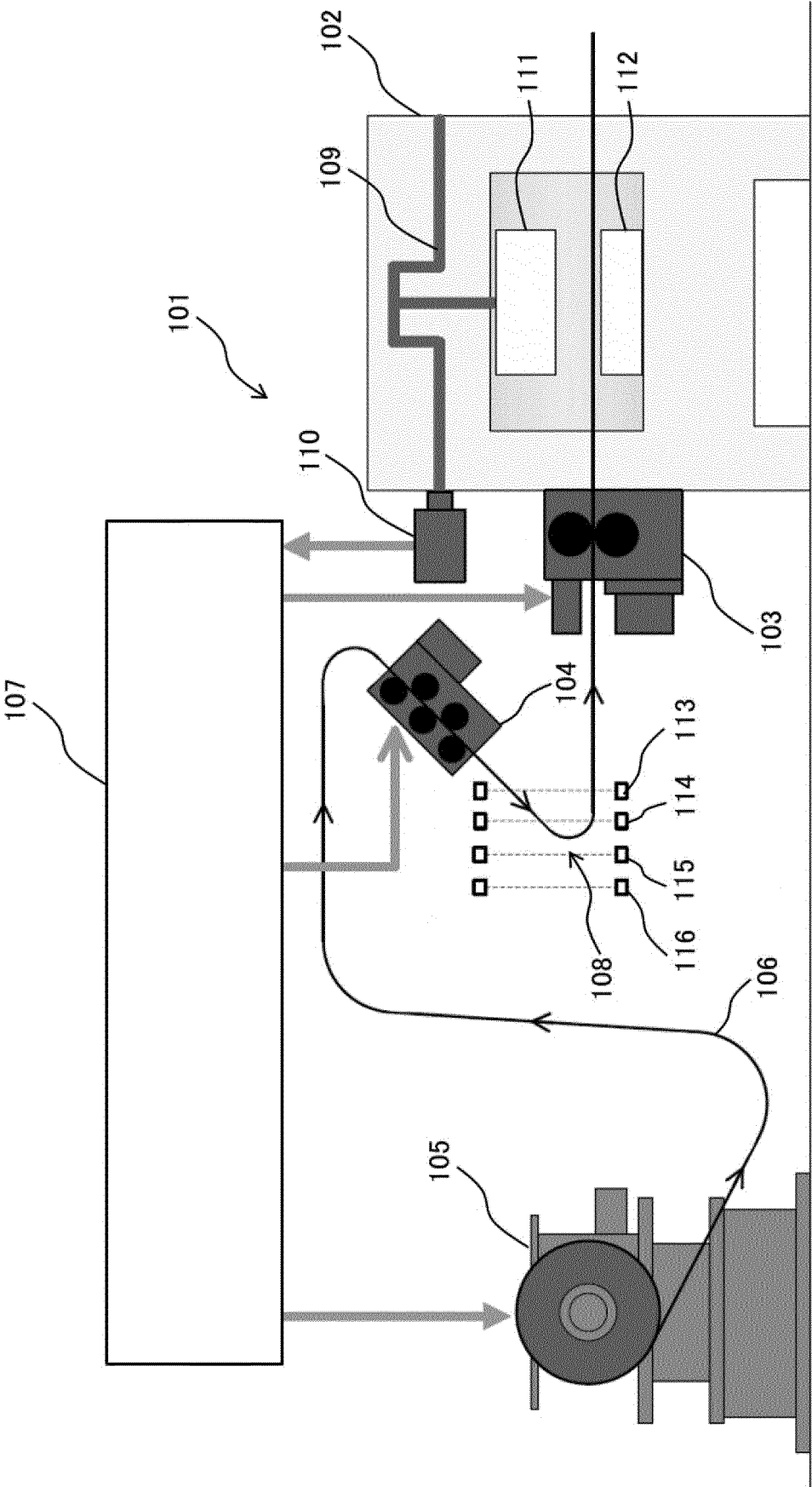
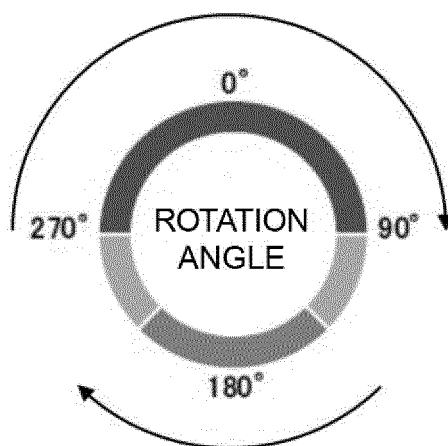
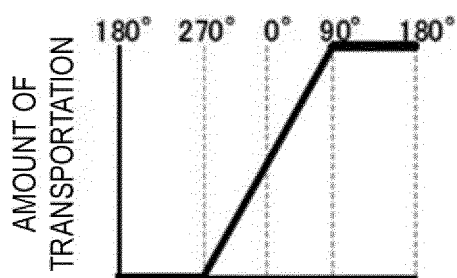


FIG. 2A

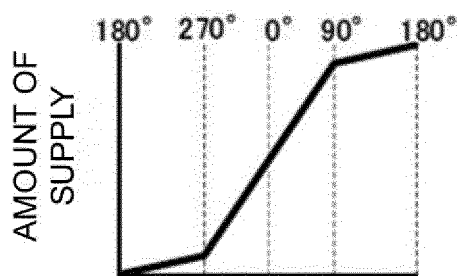
DIE A
STEP OF MOVING PLATE MATERIAL



STEP OF PROCESSING PLATE MATERIAL
PROCESSING DEVICE



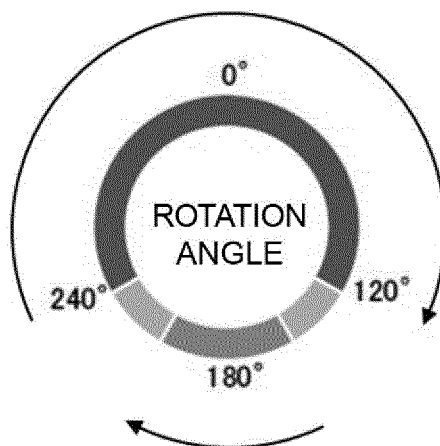
ROTATION ANGLE
PLATE MATERIAL FEEDING DEVICE



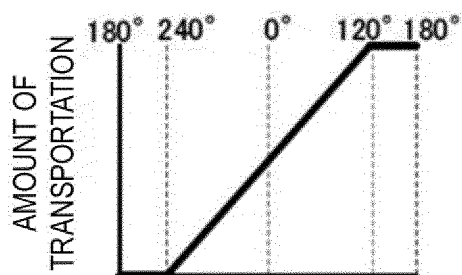
ROTATION ANGLE
PLATE MATERIAL SUPPLYING DEVICE

FIG. 2B

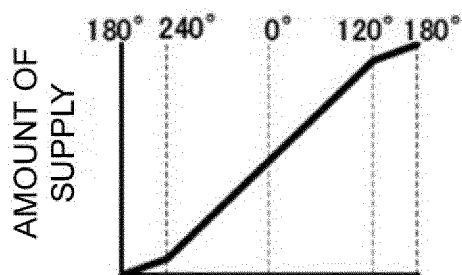
DIE B
STEP OF MOVING PLATE MATERIAL



STEP OF PROCESSING PLATE MATERIAL
PROCESSING DEVICE



ROTATION ANGLE
PLATE MATERIAL FEEDING DEVICE



ROTATION ANGLE
PLATE MATERIAL SUPPLYING DEVICE

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/035132

A. CLASSIFICATION OF SUBJECT MATTER

B21C 49/00(2006.01)i; **B21D 43/02**(2006.01)i; **B65H 23/192**(2006.01)i
FI: B21D43/02 E; B21C49/00 C; B65H23/192

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)

B21C49/00; B21D43/02; B65H23/192

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.
X	JP 2007-118050 A (KOMATSU LTD.) 17 May 2007 (2007-05-17) paragraphs [0024]-[0032], fig. 1-2	1, 3, 6-7, 9-10
A	JP 9-253741 A (ASAHI SEIKI KOGYO KK) 30 September 1997 (1997-09-30) entire text, all drawings	1-10
A	JP 2017-159325 A (KOMATSU SANKI KK) 14 September 2017 (2017-09-14) entire text, all drawings	1-10
A	JP 62-148041 A (FUTABA CORP.) 02 July 1987 (1987-07-02) entire text, all drawings	1-10
A	JP 2003-181575 A (NIPPON RELIANCE KK) 02 July 2003 (2003-07-02) entire text, all drawings	1-10
A	JP 2000-190040 A (HONDA MOTOR CO., LTD.) 11 July 2000 (2000-07-11) entire text, all drawings	1-10

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"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
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

07 December 2021

Date of mailing of the international search report

14 December 2021

Name and mailing address of the ISA/JP

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Authorized officer

Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/035132

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2007-118050 A	17 May 2007	(Family: none)	
JP 9-253741 A	30 September 1997	(Family: none)	
JP 2017-159325 A	14 September 2017	US 2018/0369895 A1 entire text, all drawings CN 108290203 A	
JP 62-148041 A	02 July 1987	(Family: none)	
JP 2003-181575 A	02 July 2003	(Family: none)	
JP 2000-190040 A	11 July 2000	(Family: none)	

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

REFERENCES CITED IN THE DESCRIPTION

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- JP 2004142876 A [0004]
- JP 2011104650 A [0004]