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

(11) **EP 4 458 483 A1**

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

(43) Date of publication:
06.11.2024 Bulletin 2024/45

(21) Application number: **22915521.3**

(22) Date of filing: **31.10.2022**

(51) International Patent Classification (IPC):
B21D 5/01 *(2006.01)* ***B21D 5/04*** *(2006.01)*
B21D 43/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B21D 5/01; B21D 5/04; B21D 43/00

(86) International application number:
PCT/JP2022/040648

(87) International publication number:
WO 2023/127288 (06.07.2023 Gazette 2023/27)

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

(30) Priority: **29.12.2021 JP 2021215350**

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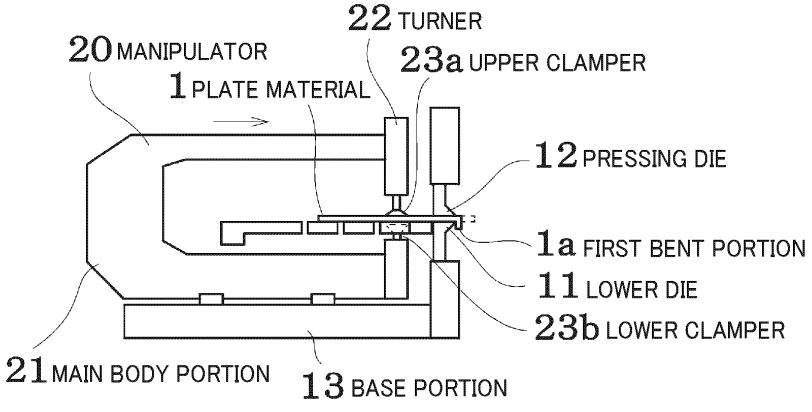
(54) **PLATE MATERIAL BENDING DEVICE**

(57) An object is to provide a bending device for a plate material that can apply a bending process to an end portion of a plate material even when the plate material has a bent end portion that is directed downward. A bending device for a plate material includes: a table for placing a plate material; manipulator clamping the plate material and being controlled so as to move forward, move backward, and turn; and a bending machine for bending process end portions of the plate material, the table having a plurality of divided tables, at least one or more of the plurality of divided tables being capable of being lowered to a position lower than upper surfaces of the other divided tables.

FIG.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a bending device for bending a plate material, particularly to a bending device that is suitable for performing a bending process while directing downward an end portion of a plate material conveyed onto a table.

BACKGROUND ART

[0002] A bending machine for a plate material has been publicly known that is also referred to as a panel bender or the like and can perform ironing bending for a plate material while holding the plate material between a lower die and a pressing die and directing the plate material downward or upward by a blade (Patent Document 1).

[0003] In this case, the plate material is conveyed to and placed on a table disposed on a front side of the bending machine, and this plate material is clamped by a manipulator and is thereby supplied to or discharged from the bending machine.

[0004] In this case, there has been a technical problem that when a bent end portion directed downward is formed in one end portion of the plate material and an attempt to perform a bending process for another end portion of the plate material is made by clamping and turning the plate material by the manipulator, a distal end of the one end portion for which the bending process is performed earlier interferes with an upper surface of the table.

RELATED-ART DOCUMENT

PATENT DOCUMENT

[0005] Patent Document 1: JP-A-2000-33590

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0006] An object of the invention is to provide a bending device for a plate material that can apply a bending process to an end portion of a plate material even when the plate material has a bent portion that is directed downward.

SOLUTION TO PROBLEM

[0007] A bending device for a plate material according to the invention includes: a table for placing a plate material; a manipulator clamping the plate material and being controlled so as to move forward, move backward, and turn; and a bending machine for bending end portions of the plate material, the table having a plurality of divided tables, at least one or more of the plurality of divided tables being capable of being lowered to a position lower than upper surfaces of the other divided tables.

[0008] Here, the bending machine may perform a bending process by a blade while holding the end portion of the plate material between a lower die and a pressing die, and a bending machine may perform the bending process downward or upward, and so forth. An object of the invention is to cause the end portion that is bent earlier and directed downward not to interfere with the table when at least a downward bending process has been performed and the bending process is thereafter performed for the other end portion. Accordingly, the bending machine may hold the plate material between a lower die and a pressing die and perform the bending process while directing downward an end portion of the plate material.

[0009] Consequently, a bending method for a plate material according to the invention is a bending method using the bending device for a plate material according to claim 2, the bending method including: supplying the one end portion of the plate material to the bending machine by clamping the plate material by the manipulator; bending the one end portion of the plate material downward at the same time as or after the plate material supplied to the bending machine is held between the lower die and the pressing die; clamping, raising and turning the plate material having a bent end portion directed downward by the manipulator; lowering one of the divided tables facing to the bent end portion of the plate material to a position at which the one of divided tables does not interfere with the bent end portion of the plate material when the other end portion of the plate material is supplied to the bending machine; and performing, subsequently bending the other end portion of the plate material downward.

ADVANTAGEOUS EFFECTS OF INVENTION

[0010] When a bent portion that is directed downward is formed in one end portion of a plate material placed on a table and an attempt is made to turn the plate material as it is, because this downward bent portion interferes with a lower die or the like, the plate material is raised by a manipulator, is temporarily taken out from a bending machine to a table on a front side, and is then turned.

[0011] In the invention, when a bending process is performed while one end portion is directed downward, the plate material is clamped, raised, and turned by the manipulator, and the bending process is thereafter performed for the other end portion, because an upper surface of one of divided tables that is facing to a bent portion, for which a downward bending process is performed earlier, can be lowered to a position lower than upper surfaces of the other divided tables, one bent portion that is processed earlier does not interfere with the table, and the bending process for the other end portion can successively be performed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 illustrates a state where a bending process is performed for one end portion of a plate material.
FIG. 2 illustrates a state where the plate material is raised and turned.
FIG. 3 illustrates a state where one bent portion of the plate material is placed on tables while the one bent portion is positioned on a lower side.
FIG. 4 illustrates a state where the bending process is performed for another end portion of the plate material.
FIG. 5 is a plan view of the tables.
FIG. 6 illustrates an example of a shape of the plate material that is formed by the bending process.

DESCRIPTION OF EMBODIMENTS

[0013] A bending device and a bending method for a plate material according to the invention will hereinafter be described based on drawings.

[0014] FIG. 5 illustrates a plan schematic diagram of the bending device, and FIG. 1 to FIG. 4 illustrate a flow of a bending process for a plate material.

[0015] As illustrated in FIG. 5, tables 14a to 14d are disposed on a front side of a bending machine 30 such as a bender machine, and a manipulator 20 is controlled so as to move forward and backward along central portions of the tables 14a to 14d.

[0016] Note that an example is raised where the bending device has a side table 15 for conveying the plate material onto and/or out from the tables disposed on the front side of the bending machine 30.

[0017] As illustrated in FIG. 1, a plate material 1 is held between a lower die 11 and a pressing die 12, and an upward or downward bending process is performed for the plate material 1 by a blade by using the bending machine 30 that is not illustrated in FIG. 1.

[0018] FIG. 1 illustrates an example where the downward bending process is performed for one end portion of the plate material 1 and a first bent portion 1a is thereby formed.

[0019] The plate material 1 is in a state where the plate material 1 that are mounted on the manipulator 20 is placed on the tables and clamped between an upper clamper 23a and a lower clamper 23b.

[0020] In the present embodiment, an example is raised where a C-type manipulator is used and where a main body portion 21 is controlled so as to move forward and backward along a base portion 13 and the manipulator 20 has a turner 22 formed with a turning mechanism in a distal end portion of an upper arm.

[0021] When the first bent portion 1a is formed in one end portion of the plate material, the pressing die 12 is next raised as illustrated in FIG. 2, and the plate material is raised while being stuck to and retained by the upper clamper 23a and is drawn from the bending machine side to the front side.

[0022] In this case, the plate material may be raised, drawn to the front side, and turned while being held between the upper clamper 23a and the lower clamper 23b.

[0023] Accordingly, the plate material can be turned without the first bent portion 1a interfering with the bending machine or an upper surface of each of the tables.

[0024] FIG. 3 illustrates a state where the plate material is turned by 180° and the other end portion of the plate material is supplied to the bending machine side.

[0025] The tables are divided into a plurality of divided tables (14a to 14e) such as a first divided table 14a, a second divided table 14b, a third divided table 14c, 14d, 14e, ..., and for example, as illustrated in FIG. 4, an upper surface of the second divided table 14b is lowered to a position lower than upper surfaces of the other divided tables, so that first bent portion 1a does not interfere with the upper surface of the second divided table 14b.

[0026] Each of the divided tables is independent from the other divided tables and is controlled so as to be lowered and raised by a cylinder or the like that is not illustrated.

[0027] Accordingly, the divided table facing upper bent portion can be lowered in accordance with a size of the plate material.

[0028] Accordingly, as illustrated in FIG. 4, a second bent portion 1b can be shaped on a distal end side of the other end portion of the plate material.

[0029] By using the bending device according to the invention, when the plate material 1 has bent portions 1c and 1d directed to its upper side as illustrated in FIG. 6, for example, the bent portions 1a, 1b, and so forth that are inversely bent to the lower side can be shaped.

INDUSTRIAL APPLICABILITY

[0030] As for a bending device for a plate material according to the invention, because a bent portion for which a bending process is performed earlier can be prevented from interfering with a table when the bending process is performed for both sides of a plate material, flexibility of the bending process for the plate material is high.

[0031] Consequently, the bending device can widely be used as a bending device that can handle a complicated bending process for a plate material.

REFERENCE SIGN LIST

[0032]

1	plate material
1a	first bent portion
1b	second bent portion
11	lower die
12	pressing die
13	base portion
14a	first divided table

14b second divided table
20 manipulator
21 main body portion
22 turner
23a upper clamper
23b lower clamper
30 bending machine

Claims

1. A bending device for a plate material, the bending device comprising:

a table for placing a plate material;
a manipulator clamping the plate material and being controlled so as to move forward, move backward, and turn; and
a bending machine for bending end portions of the plate material,
the table having a plurality of divided tables,
at least one or more of the plurality of divided tables being capable of being lowered to a position lower than upper surfaces of the other divided tables.

2. The bending device for a plate material according to claim 1, wherein
the bending machine holds the plate material between a lower die and a pressing die and bend one end portion of the plate material downward.

3. A bending method for a plate material, the bending method using the bending device for a plate material according to claim 2, the bending method comprising:

supplying the one end portion of the plate material to the bending machine by clamping the plate material by the manipulator;
bending the one end portion of the plate material downward at the same time as or after the plate material supplied to the bending machine is held between the lower die and the pressing die;
clamping, raising and turning the plate material having a bent end portion directed downward by the manipulator;
lowering one of the divided tables facing to the one end portion of the plate material to a position at which the one of the divided tables does not interfere with the bent end portion of the plate material when the other end portion of the plate material is supplied to the bending machine; and
subsequently bending the other end portion of the plate material downward.

FIG.1

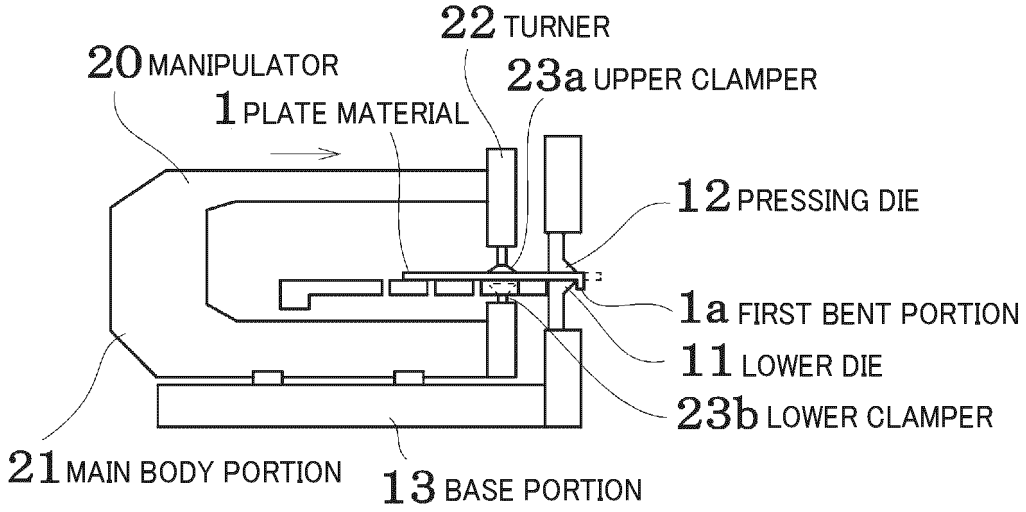

22 TURNER
20 MANIPULATOR
23a UPPER CLAMPER
1 PLATE MATERIAL
12 PRESSING DIE
1a FIRST BENT PORTION
11 LOWER DIE
23b LOWER CLAMPER
21 MAIN BODY PORTION
13 BASE PORTION

FIG.2

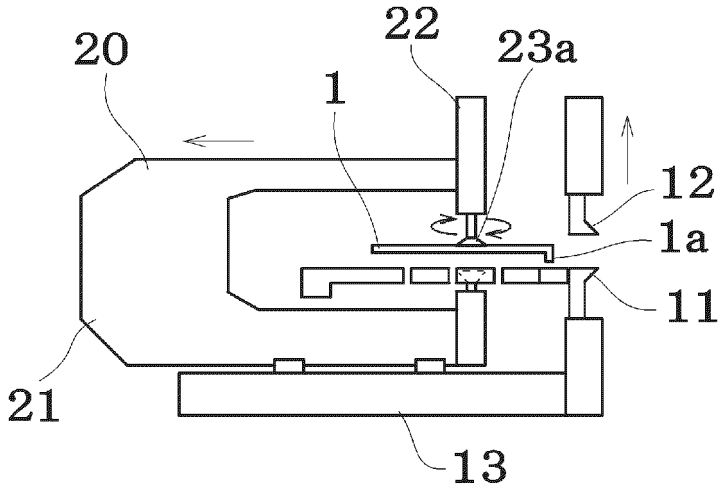

22
20
23a
1
12
1a
11
21
13

FIG.3

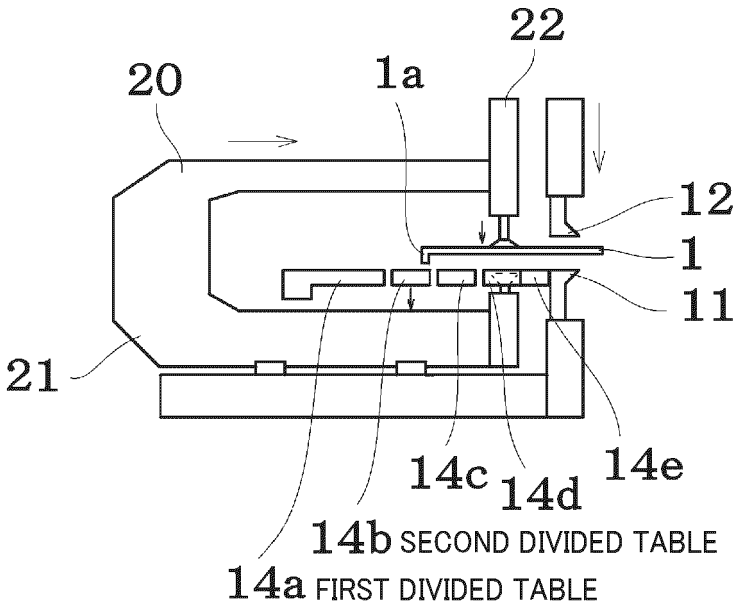

22
20
1a
12
1
11
21
14c
14d
14e
14b SECOND DIVIDED TABLE
14a FIRST DIVIDED TABLE

FIG.4

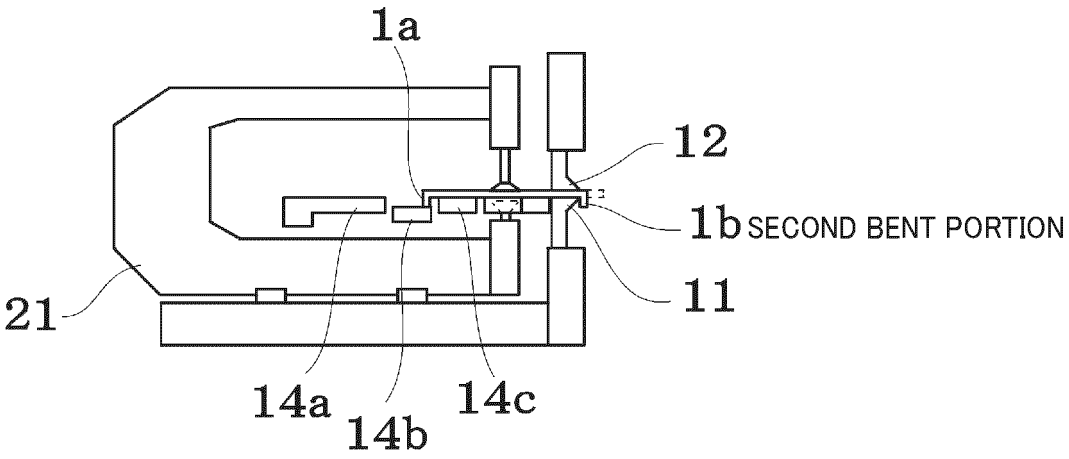

1a
12
1b SECOND BENT PORTION
11
21
14a
14b
14c

FIG.5

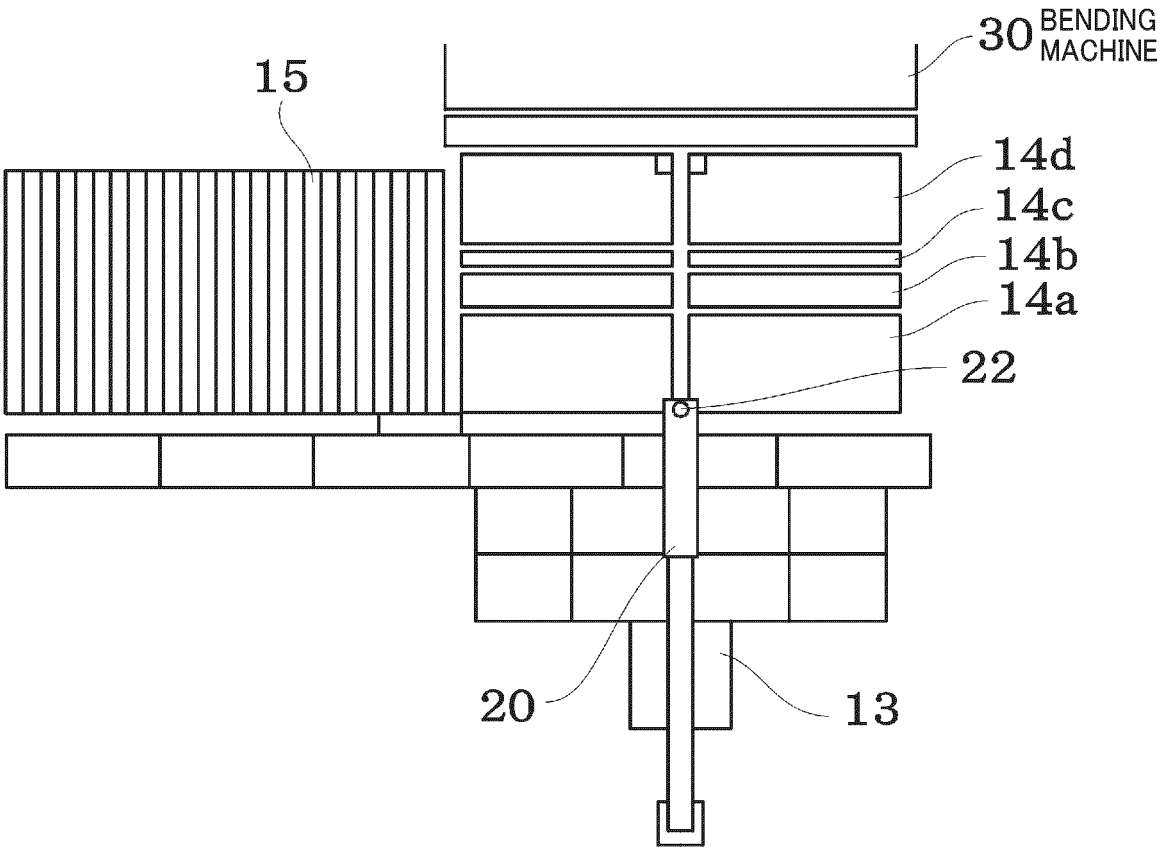
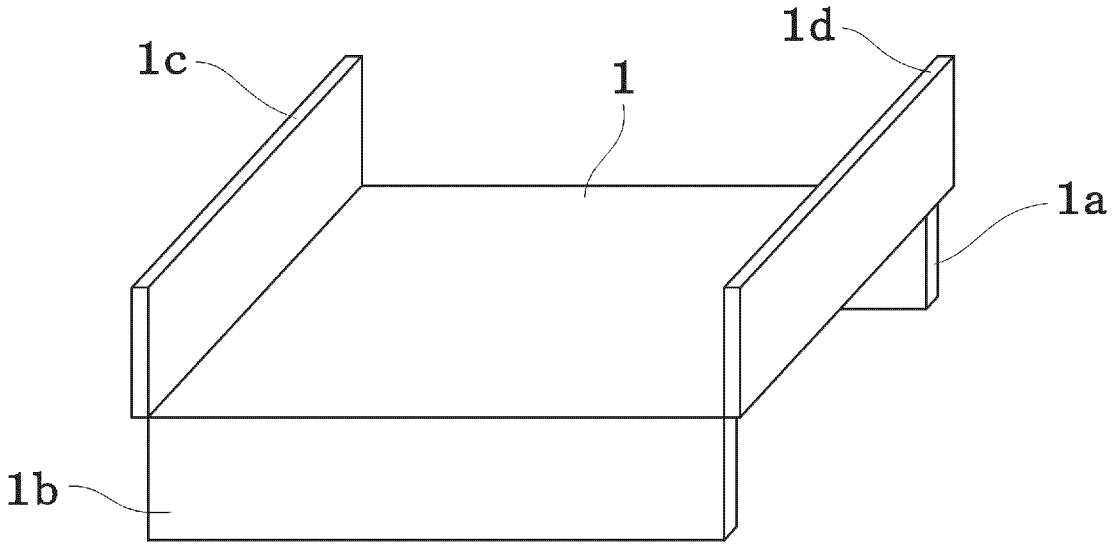


FIG.6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/040648

A. CLASSIFICATION OF SUBJECT MATTER

B21D 5/01(2006.01)i; ***B21D 5/04***(2006.01)i; ***B21D 43/00***(2006.01)i
FI: B21D5/04 J; B21D5/01 G; B21D5/01 X; B21D43/00 P; B21D43/00 S

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)

B21D5/01; B21D5/02;B21D5/04; B21D43/00

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 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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 2001-79614 A (AMADA CO., LTD.) 27 March 2001 (2001-03-27) paragraphs [0019]-[0064], fig. 1-12	1-2
A		3
A	JP 2000-237822 A (AMADA CO., LTD.) 05 September 2000 (2000-09-05) paragraphs [0010]-[0034], fig. 1-6	1-3
A	JP 2005-40829 A (AMADA CO., LTD.) 17 February 2005 (2005-02-17) paragraphs [0015]-[0044], fig. 1-3	1-3
A	WO 2019/171561 A1 (KYOWA MACHINE TECHNOLOGY CO., LTD.) 12 September 2019 (2019-09-12) paragraphs [0011]-[0016], fig. 1-3	1-3
A	JP 2000-280025 A (AMADA CO., LTD.) 10 October 2000 (2000-10-10) paragraphs [0010]-[0020], fig. 1-5	1-3

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"P" document published prior to the international filing date but later than the priority date claimed
"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
"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
"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
23 December 2022	**10 January 2023**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/040648

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2001-79614 A	27 March 2001	(Family: none)	
JP 2000-237822 A	05 September 2000	(Family: none)	
JP 2005-40829 A	17 February 2005	(Family: none)	
WO 2019/171561 A1	12 September 2019	EP 3763453 A1 paragraphs [0019]-[0043], fig. 1-10	
JP 2000-280025 A	10 October 2000	(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 2000033590 A **[0005]**