



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

(43) Date of publication:
19.09.2018 Bulletin 2018/38

(51) Int Cl.:
B21D 53/88 (2006.01) **B21D 22/02** (2006.01)
B21D 28/06 (2006.01)

(21) Application number: **15908333.6**

(86) International application number:
PCT/JP2015/081987

(22) Date of filing: **13.11.2015**

(87) International publication number:
WO 2017/081816 (18.05.2017 Gazette 2017/20)

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

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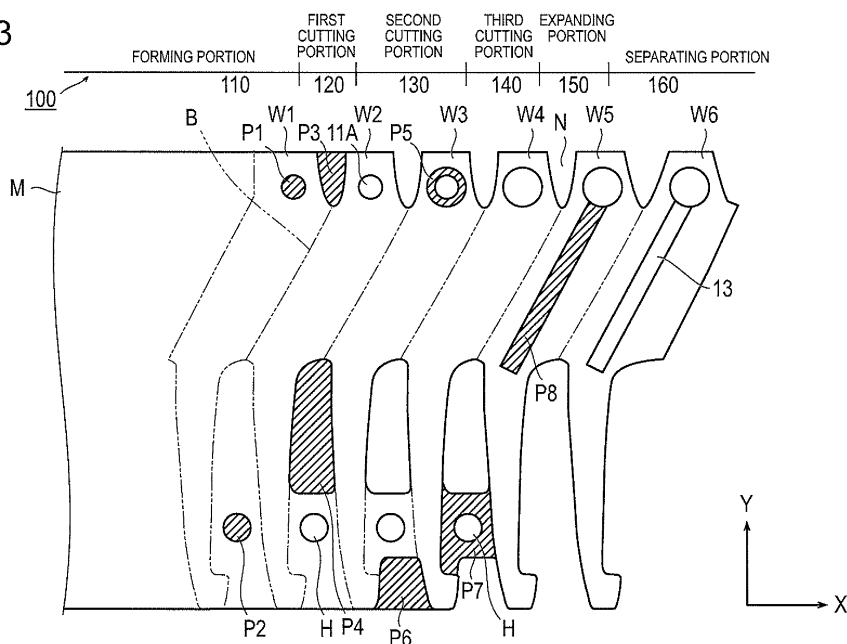
(54) **METHOD AND DEVICE FOR MANUFACTURING VEHICLE ARM COMPONENT**

(57) [Problem] To provide a vehicle arm component manufacturing method whereby the yield of a material can be further improved.

[Solution] The present invention has: an expanding step (S05) for expanding the X-direction width of a workpiece from a first width (X1) to a second width (X2) by

pressing, in the Z direction, a portion (P8) to be applied with pressure, said portion being provided within the surface of the workpiece (W); and a separating step (S06) for cutting down, from a material (M) to be machined, the workpiece the X-direction width of which has been expanded to the first width.

FIG.3



Description

TECHNICAL FIELD

[0001] The present invention relates to a manufacturing method and a manufacturing apparatus for a vehicular arm component.

BACKGROUND ART

[0002] As a manufacturing method for a vehicular arm component, for example, Patent Literature 1 described below discloses a method of manufacturing a vehicular arm component by progressive press working. A progressive press working method is a method in which a long-shaped processed material is intermittently fed at a constant pitch in a feed direction and is simultaneously pressed in a plurality of positions in the feed direction.

[0003] In addition, Patent Literature 2 described below discloses the progressive press working method in which a feed bridge width, which is a separation distance between workpiece portions that are contiguously adjacent in a feed direction, is zero. This method enables an increase in material yield since the feed bridge width is zero.

Citation List

Patent Literatures

[0004]

Patent Literature 1: JP 2010-86052 A

Patent Literature 2: JP H08-19823 A

SUMMARY OF INVENTION

Technical Problem

[0005] For a manufacturing method for a vehicular arm component, the progressive press working method disclosed in Patent Literature 2 described above requires a further increase in material yield.

[0006] The present invention has been made in view of the above circumstances, and it is an object of the present invention to provide a manufacturing method and a manufacturing apparatus for a vehicular arm component that enables a further increase in material yield for a manufacturing method and a manufacturing apparatus for a vehicular arm component for manufacturing a vehicular arm component by a progressive press working method in which the feed bridge width is set to zero.

Solution to Problem

[0007] A manufacturing method for a vehicular arm component according to the present invention to solve the above object is a manufacturing method for a vehic-

ular arm component for manufacturing by a progressive press working method in which a long-shaped processed material for which a blank layout is set such that a feed bridge width, which is a separation distance between workpieces that are contiguously adjacent in a feed direction, is zero is intermittently fed at a constant pitch in the feed direction and is simultaneously pressed in a plurality of positions in the feed direction, the manufacturing method for a vehicular arm component including: an expanding process of pressing a pressurized portion provided in a plane of the workpiece in a thickness direction to expand a width of the workpiece in the feed direction; and a separating process of cutting off the workpiece having an expanded width in the feed direction from the processed material.

[0008] Furthermore, a manufacturing apparatus for a vehicular arm component according to the present invention to solve the above object is a manufacturing apparatus for a vehicular arm component for manufacturing by a progressive press working method in which a long-shaped processed material for which a blank layout is set such that a feed bridge width, which is a separation distance between workpieces that are contiguously adjacent in a feed direction, is zero is intermittently fed at a constant pitch in the feed direction and is simultaneously pressed in a plurality of positions in the feed direction, the manufacturing apparatus for a vehicular arm component including: an expanding portion configured to press a pressurized portion provided in a plane of the workpiece in a thickness direction to expand a width of the workpiece in the feed direction; and a separating portion configured to cut off the workpiece having an expanded width in the feed direction from the processed material.

Advantageous Effects of Invention

[0009] With the aforementioned manufacturing method and manufacturing apparatus for a vehicular arm component, an expanding portion enables expansion to a desired width in an expanding process. Thus, as compared with the case where the width in a feed direction is preset to a desired width, the material yield can be increased further. Hence, a manufacturing method and a manufacturing apparatus for a vehicular arm component that can further increase the material yield can be provided.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

FIG. 1 is a schematic side view illustrating an example of a brake pedal device according to an embodiment of the present invention.

FIG. 2 is a perspective view illustrating a brake pedal according to the present embodiment.

FIG. 3 is a view illustrating a manufacturing appara-

tus for a brake pedal and a processed material that is fed progressively.

FIG. 4 is a plan view illustrating a processed material, which has been pressed in a plurality of positions in an X direction.

FIG. 5 is a view illustrating a state in which an expanding portion presses a pressurized portion.

FIG. 6 is a schematic cross-sectional view along an X direction illustrating a manufacturing apparatus for a brake pedal.

FIG. 7 is a schematic cross-sectional view along a Y direction illustrating an expanding portion of a manufacturing apparatus for a brake pedal.

FIG. 8 is a flowchart of a manufacturing method for a brake pedal according to the present embodiment.

FIG. 9 is a view for describing an example.

FIG. 10 is a graph illustrating a relationship between a pressing force and an amount of expansion.

FIG. 11 is a graph illustrating a relationship between a pressing force and an amount of reduction in thickness.

FIG. 12 is a graph illustrating a relationship between an amount of reduction in thickness and an amount of expansion.

DESCRIPTION OF EMBODIMENTS

[0011] An embodiment of the present invention is described with reference to the drawings. In the description of the drawings, like elements are designated with like reference numerals, and a redundant description is omitted. The dimensional ratio in the drawings is exaggerated for the sake of convenience of description and differs from the actual ratio. Herein, "workpiece W" indicates a portion for one of brake pedals 4 which are manufactured continuously in a processed material M.

[0012] FIG. 1 is a schematic side view illustrating an example of a brake pedal device according to an embodiment of the present invention. FIG. 2 is a perspective view illustrating a brake pedal 4 according to the present embodiment.

[0013] Examples of the vehicular arm component according to the present embodiment include the brake pedal 4 for use in a brake pedal device. As illustrated in FIG. 1, the brake pedal device generally includes a bracket 2 attached to a dash panel 1, the brake pedal 4 rotatably mounted on a support shaft 3 provided on the bracket 2, a pin 5 extending through an upper part of the brake pedal 4, a rod 6 having one end coupled to the pin 5 and another end coupled to a Master vac (not illustrated), and a foot plate 7 attached to a lower portion of the brake pedal 4.

[0014] As illustrated in FIG. 2, the brake pedal 4 includes a hole 11 into which the support shaft 3 is inserted, a clevis hole 12 into which the pin 5 is inserted, and a recess 13 formed by pressing in an expanding process S05 to be described later.

[0015] Next, a manufacturing apparatus 100 and a

manufacturing method for a vehicular arm component according to the present embodiment are described. Here, the manufacturing apparatus 100 and the manufacturing method for, as an example of the vehicular arm component, the brake pedal 4 are described. The brake pedal 4, when described briefly, is manufactured by a progressive press working method in which a long-shaped processed material M for which a blank layout is set such that the feed bridge width, which is a separation distance between workpieces W1 to W6 that are contiguously adjacent in an X direction (feed direction), is zero is intermittently fed at a constant pitch in the X direction and is simultaneously pressed in a plurality of positions in the X direction. The detailed description is given below.

[0016] FIG. 3 is a view illustrating the manufacturing apparatus 100 for the brake pedal 4 and the processed material M that is fed progressively. FIG. 4 is a plan view illustrating the processed material M, which has been pressed in a plurality of positions in the X direction. FIG. 5 is a view illustrating a state in which an expanding portion 150 presses a pressurized portion P8. FIG. 6 is a schematic cross-sectional view along the X direction illustrating the manufacturing apparatus 100 for the brake pedal 4. FIG. 7 is a schematic cross-sectional view along the Y direction (perpendicular direction) illustrating the expanding portion 150 of the manufacturing apparatus 100 for the brake pedal 4. FIG. 8 is a flowchart of a manufacturing method for the brake pedal 4 according to the present embodiment.

[0017] As illustrated in FIG. 3, it is preferable that the Y-directional length of the processed material M be the same as the length of a Y-directional component of the brake pedal 4.

[0018] First, a configuration of the manufacturing apparatus 100 for the brake pedal 4 is described.

[0019] The manufacturing apparatus 100 for the brake pedal 4 includes a forming portion 110, a first cutting portion 120, a second cutting portion 130, a third cutting portion 140, the expanding portion 150, and a separating portion 160. Each portion is formed of one press working device.

[0020] As illustrated in FIGS. 3 and 4, the forming portion 110 forms, in a position P1 that is on one side (upper side in FIG. 3) of the workpiece W1 in the Y direction (perpendicular direction) and where the hole 11 into which the support shaft 3 is inserted is formed, a precursor hole 11A, which is smaller than the hole 11, and forms a positioning hole H in a position P2 that is on another side (lower side in FIG. 3) in the Y direction. The forming portion 110 is, for example, a publicly known piercing die for hole making.

[0021] The first cutting portion 120 cuts out a first end P3 at one end (upper end in FIG. 3) of a boundary portion B between the adjacent workpieces W1, W2 in the Y direction to form a notched portion N, and cuts out a first unnecessary portion P4 that is provided on the side of the positioning hole H facing the notched portion N and follows the shape of the brake pedal 4. The first cutting

portion 120 includes a publicly known notching die for cutting out the first end P3 to form the notched portion N, and a publicly known piercing die for cutting out the first unnecessary portion P4. As illustrated in FIG. 4, it is preferable that the notched portion N be formed to be longer in the Y direction than in the X direction.

[0022] The second cutting portion 130 forms the hole 11 in a vicinity P5 of the position where the precursor hole 11A is formed by the forming portion 110 and cuts out a second end P6 that is provided at another end (lower end in FIG. 3) in the Y direction and follows the shape of the brake pedal 4. The second cutting portion 130 includes a publicly known piercing die for forming the hole 11 and a publicly known notching die for cutting out the second end P6.

[0023] The third cutting portion 140 cuts out a second unnecessary portion P7 that surrounds the positioning hole H, is provided between the first unnecessary portion P4 and the second end P6, and follows the shape of the brake pedal 4. The third cutting portion 140 is, for example, a publicly known notching die.

[0024] As illustrated in FIG. 5, the expanding portion 150 presses the pressurized portion P8 provided in the plane of the workpiece W5 from both sides in the Z direction (thickness direction) to expand the X-directional width of the workpiece W5. Pressing from both sides in the Z direction shifts the center of gravity to the center in the thickness direction. As illustrated in FIG. 5, the expanding portion 150 includes an upper expanding portion 151 and a lower expanding portion 152. When the expanding portion 150 presses the pressurized portion P8, as illustrated in FIG. 4, the X-directional width of the workpiece W5 is expanded from a first width X1 to a second width X2. The pressurized portion P8 is extended such that both ends of the pressurized portion P8 exceed a width L1 extending along the Y direction of the boundary portion B when viewed from the X direction. In addition, the pressurized portion P8 is formed along a direction crossing the X direction. In addition, the recess 13 is formed on the portion where the pressurized portion P8 is pressed. As described above, because the pressurized portion P8 is extended long in the Y direction, when the pressurized portion P8 is pressurized, the X-directional width of the brake pedal 4 can be expanded substantially uniformly along the Y direction in line with the shape of the pressurized portion P8.

[0025] The separating portion 160 cuts off the workpiece W6 having an expanded X-directional width from the processed material M. The separating portion 160 is, for example, a publicly known notching die.

[0026] A configuration of the manufacturing apparatus 100 for the brake pedal 4 is described below in more detail with reference to FIGS. 6 and 7.

[0027] As illustrated in FIG. 6, the manufacturing apparatus 100 for the brake pedal 4 includes an upper die 100U and a lower die 100L.

[0028] The upper die 100U includes a movable portion 101U, an upper die support plate 102U, and six upper

die plates 103U, 104U, 105U, 106U, 107U, 108U.

[0029] The lower die 100L includes a stationary portion 101L, a lower die support plate 102L, and six lower die plates 103L, 104L, 105L, 106L, 107L, 108L.

5 **[0030]** The movable portion 101U is provided on the uppermost side of the upper die 100U. The movable portion 101U is configured to be movable in an up-and-down direction of FIG. 6 (see the arrow in FIG. 6).

10 **[0031]** The upper die support plate 102U is fixedly provided on a lower side of the movable portion 101U.

[0032] The six upper die plates 103U, 104U, 105U, 106U, 107U, 108U are separated from one another by a predetermined distance in the X direction and are fixedly provided on a lower side of the upper die support plate 102U.

15 **[0033]** The forming portion 110 is fixed to a lower side of the upper die plate 103U. The first cutting portion 120 is fixed to a lower side of the upper die plate 104U. The second cutting portion 130 is fixed to a lower side of the upper die plate 105U. The third cutting portion 140 is fixed to a lower side of the upper die plate 106U. The expanding portion 150 is fixed to a lower side of the upper die plate 107U. The separating portion 160 is fixed to a lower side of the upper die plate 108U.

20 **[0034]** The upper die plate 106U to which the third cutting portion 140 is fixed and the upper die plate 107U to which the expanding portion 150 (upper expanding portion 151) is fixed are coupled by a biasing member 109A. In addition, the upper die plate 107U to which the expanding portion 150 (upper expanding portion 151) is fixed and the upper die plate 108U to which the separating portion 160 is fixed are coupled by a biasing member 109B.

25 **[0035]** The stationary portion 101L is provided on the lowermost side of the lower die 100L.

30 **[0036]** The lower die support plate 102L is fixedly provided on an upper side of the stationary portion 101L.

[0037] The six lower die plates 103L, 104L, 105L, 106L, 107L, 108L are separated from one another by a predetermined distance in the X direction and are fixedly provided on an upper side of the lower die support plate 102L.

35 **[0038]** The forming portion 110 is fixed to an upper side of the lower die plate 103L. The first cutting portion 120 is fixed to an upper side of the lower die plate 104L. The second cutting portion 130 is fixed to an upper side of the lower die plate 105L. The third cutting portion 140 is fixed to an upper side of the lower die plate 106L. The expanding portion 150 is fixed to an upper side of the lower die plate 107L. The separating portion 160 is fixed to an upper side of the lower die plate 108L.

40 **[0039]** The lower die plate 106L to which the third cutting portion 140 is fixed and the lower die plate 107L to which the expanding portion 150 (lower expanding portion 152) is fixed are coupled by a biasing member 109C. In addition, the lower die plate 107L to which the expanding portion 150 (lower expanding portion 152) is fixed and the lower die plate 108L to which the separating por-

tion 160 is fixed are coupled by a biasing member 109D.

[0040] The biasing members 109A, 109B, 109C, 109D adjust the position of pressing to perform positioning depending on the expansion of the X-directional width of the workpiece W5 by the expanding portion 150.

[0041] In addition, as illustrated in FIG. 7, guide pins 111U extending downward in FIG. 7 are fixedly provided on the upper die plate 107U. In addition, through-holes 111L through which the guide pins 111U are inserted are formed on the lower die plate 107L. The guide pins 111U are inserted into the through-holes 111L to correct the positions of the upper die 100U and the lower die 100L.

[0042] In addition, as illustrated in FIG. 7, a locator pin 112U is provided on the upper expanding portion 151. The locator pin 112U is inserted into the hole 11 of the workpiece W5 to correct the positions of the upper die plate 107U, the lower die plate 107L, and the workpiece W5.

[0043] As with the upper die plate 107U, guide pins are provided on the upper die plates 103U, 104U, 105U, 106U, 108U. In addition, as with the expanding portion 150, locator pins are provided on the forming portion 110, the first cutting portion 120, the second cutting portion 130, the third cutting portion 140, and the separating portion 160.

[0044] Next, a procedure of manufacturing the brake pedal 4 according to the present embodiment is described with reference to FIG. 8.

[0045] The manufacturing method for the brake pedal 4 according to the present embodiment includes a forming process S01, a first cutting process S02, a second cutting process S03, a third cutting process S04, an expanding process S05, and a separating process S06. The processes are simultaneously performed by the upper die 100U and the lower die 100L.

[0046] First, in the forming process S01, by the forming portion 110, in the position P1 that in on one side of the workpiece W1 in the Y direction and where the hole 11 into which the support shaft 3 is inserted is formed, the precursor hole 11A, which is smaller than the hole 11, is formed, and the positioning hole H is formed in the position P2 that is on the other side in the Y direction.

[0047] Next, in the first cutting process S02, by the first cutting portion 120, the first end P3 at one end of the boundary portion B between the adjacent workpieces W1, W2 in the Y direction is cut out to form the notched portion N, and the first unnecessary portion P4 that is provided on the side of the positioning hole H facing the notched portion N and follows the shape of the brake pedal 4 is cut out.

[0048] Next, in the second cutting process S03, by the second cutting portion 130, the hole 11 is formed in the vicinity P5 of the position where the precursor hole 11A is formed by the forming portion 110, and the second end P6 that is provided at the other end in the Y direction and follows the shape of the brake pedal 4 is cut out.

[0049] Next, in the third cutting process S04, by the third cutting portion 140, the second unnecessary portion

P7 that surrounds the positioning hole H, is provided between the first unnecessary portion P4 and the second end P6, and follows the shape of the brake pedal 4 is cut out.

[0050] Next, in the expanding process S05, by the expanding portion 150, the pressurized portion P8 provided in the plane of the workpiece W5 is pressed from both sides in the Z direction to expand the X-directional width of the workpiece W5. In the expanding process S05, it is preferable that the workpiece W5 be pressed in a position different from that of the clevis hole 12. When the workpiece W5 is thus pressed in a position different from that of the clevis hole, the thickness of a portion where the clevis hole 12 that becomes a highly stressed portion during pedal operation is formed is not reduced, and therefore the brake pedal 4 having increased reliability can be provided.

[0051] Next, in the separating process S06, by the separating portion 160, the workpiece W6 having an expanded X-directional width is cut off from the processed material M.

[0052] In the expanding process S05, the X-directional width of the workpiece W5 is expanded. The upper die 100U and the lower die 100L are provided with the biasing members 109A, 109B, 109C, 109D. Therefore, depending on the expansion of the X-directional width of the workpiece W5, the upper die plates 106U, 107U, 108U and the lower die plates 106L, 107L, 108L are moved by the biasing members 109A, 109B, 109C, 109D so that the locator pins 112U are inserted into the holes 11.

[0053] The brake pedal 4 is manufactured by the series of procedures described above.

[0054] As described above, the manufacturing method for the brake pedal 4 according to the present embodiment is a manufacturing method for the brake pedal 4 for manufacturing by a progressive press working method in which the long-shaped processed material M for which the blank layout is set such that the feed bridge width, which is a separation distance between the workpieces W that are contiguously adjacent in the X direction, is zero is intermittently fed at a constant pitch in the X direction and is simultaneously pressed in a plurality of positions in the X direction. The manufacturing method for the brake pedal 4 includes the expanding process S05 of pressing the pressurized portion P8 provided in the plane of the workpiece W5 in the Z direction to expand the X-directional width of the workpiece W5 and the separating process S06 of cutting off the workpiece W6 having an expanded X-directional width from the processed material M. By this manufacturing method, in the expanding process S05, the workpiece W5 is expanded to a desired width. Thus, as compared with the case where the X-directional width is preset to a desired width, the material yield can be increased further. Thus, the manufacturing method for the brake pedal 4 that can further increase the material yield can be provided.

[0055] In addition, the position of pressing is adjusted to perform positioning depending on the expansion of the

X-directional width of the workpiece W5 in the expanding process S05. Therefore, the press working can be performed precisely.

[0056] In addition, the pressurized portion P8 is pressurized from both sides in the Z direction in the expanding process S05. Therefore, the center of gravity can be shifted to the center in the thickness direction, and the workpiece W5 can be further expanded in the X direction.

[0057] In addition, the Y-directional length of the processed material M is the same as the length of the Y-directional component of the brake pedal 4. Therefore, the material yield can be increased further.

[0058] In addition, the manufacturing method further includes, prior to the expanding process S05, the forming process S01 of forming, in the position P1 that is on one side of the workpiece W1 in the Y direction and where the hole 11 into which the support shaft 3 is inserted is formed, the precursor hole 11A, which is smaller than the hole 11, and forming the positioning hole H in the position P2 that is on the other side in the Y direction, the first cutting process S02 of cutting out the first end P3 at one end of the boundary portion B between the adjacent workpieces W1, W2 in the Y direction to form the notched portion N and cutting out the first unnecessary portion P4 that is provided on the side of the positioning hole H facing the notched portion N and follows the shape of the brake pedal 4, the second cutting process S03 of forming the hole 11 in the vicinity P5 of the position where the precursor hole 11A is formed in the forming process S01 and cutting out the second end P6 that is provided at the other end in the Y direction and follows the shape of the brake pedal 4, and the third cutting process S04 of cutting out the second unnecessary portion P7 that surrounds the positioning hole H, is provided between the first unnecessary portion P4 and the second end P6, and follows the shape of the brake pedal 4. Therefore, the brake pedal 4 can be manufactured more reliably.

[0059] In addition, the pressurized portion P8 is extended such that both ends of the pressurized portion P8 in the Y direction exceed the width L1 extending along the Y direction of the boundary portion B when viewed from the X direction. Therefore, when the pressurized portion P8 is pressurized, the X-directional width of the brake pedal 4 can be expanded substantially uniformly along the Y direction in line with the shape of the pressurized portion P8.

[0060] In addition, the notched portion N is formed to be longer in the Y direction than in the X direction. Therefore, in the expanding process S05, the effect of extension in the X direction is increased with respect to the pressurized portion P8, enabling easier expansion in the X direction.

[0061] In addition, the pressurized portion P8 is formed along a direction crossing the X direction. Therefore, the X-directional width of the brake pedal 4 can be expanded substantially uniformly along the Y direction in line with the shape of the pressurized portion P8.

[0062] In addition, as described above, the manufacturing apparatus 100 for the brake pedal 4 according to the present embodiment is the manufacturing apparatus 100 for the brake pedal 4 for manufacturing by a progressive press working method in which the long-shaped processed material M for which the blank layout is set such that the feed bridge width, which is a separation distance between the workpieces W that are contiguously adjacent in the X direction, is zero is intermittently fed at a constant pitch in the X direction and is simultaneously pressed in a plurality of positions in the X direction. The manufacturing apparatus 100 includes the expanding portion 150 for pressing the pressurized portion P8 provided in the plane of the workpiece W5 in the Z direction to expand the X-directional width of the workpiece W5, and the separating portion 160 for cutting off the workpiece W6 having an expanded X-directional width from the processed material M. With this manufacturing apparatus, the workpiece W5 can be expanded to a desired width by the expanding portion 150. Thus, as compared with the case where the width in the X direction is preset to a desired width, the material yield can be increased further. Thus, the manufacturing apparatus 100 for the brake pedal 4 that can further increase the material yield can be provided.

[0063] In addition, the manufacturing apparatus 100 further includes the biasing members 109A, 109B, 109C, 109D that adjust the position of pressing to perform positioning depending on the expansion of the X-directional width of the workpiece W5 by the expanding portion 150. Thus, the press working can be performed precisely.

[0064] In addition, the expanding portion 150 presses the pressurized portion P8 from both sides in the Z direction. Thus, the center of gravity can be shifted to the center in the thickness direction, and the workpiece W5 can be further expanded in the X direction.

[0065] In addition, the manufacturing apparatus 100 further includes the forming portion 110 for forming, in the position P1 that is on one side of the workpiece W1 in the Y direction and where the hole 11 into which the support shaft 3 is inserted is formed, the precursor hole 11A, which is smaller than the hole 11, and forming the positioning hole H in the position P2 that is on the other side in the Y direction, the first cutting portion 120 for cutting out the first end P3 at one end of the boundary portion B between the adjacent workpieces W1, W2 in the Y direction to form the notched portion N and cutting out the first unnecessary portion P4 that is provided on the side of the positioning hole H facing the notched portion N and follows the shape of the brake pedal 4, the second cutting portion 130 for forming the hole 11 in the vicinity P5 of the position where the precursor hole 11A is formed by the forming portion 110 and cutting out the second end P6 that is provided at the other end in the Y direction and follows the shape of the brake pedal 4, and the third cutting portion 140 for cutting out the second unnecessary portion P7 that surrounds the positioning hole H, is provided between the first unnecessary portion

P4 and the second end P6, and follows the shape of the brake pedal 4. Thus, the brake pedal 4 can be manufactured more reliably.

[0066] In addition, the pressurized portion P8 is extended such that both ends of the pressurized portion P8 in the Y direction exceed the width L1 extending along the Y direction of the boundary portion B when viewed from the X direction. Thus, the X-directional width of the brake pedal 4 can be expanded substantially uniformly along the Y direction in line with the shape of the pressurized portion P8.

[0067] In addition, the notched portion N is formed to be longer in the Y direction than in the X direction. Therefore, in the expanding process S05, the effect of extension in the X direction is increased with respect to the pressurized portion P8, enabling easier expansion in the X direction.

[0068] In addition, the pressurized portion P8 is formed along a direction crossing the X direction. Therefore, the X-directional width of the brake pedal 4 can be expanded substantially uniformly along the Y direction in line with the shape of the pressurized portion P8.

[0069] The present invention is not limited to the aforementioned embodiment, but various changes may be made within the scope of the claims.

[0070] For example, the aforementioned embodiment includes the forming process S01, the first cutting process S02, the second cutting process S03, and the third cutting process S04, but may not include these processes.

[0071] In addition, according to the aforementioned embodiment, the Y-directional length of the processed material M is the same as the length of the Y-directional component of the brake pedal 4. However, the present invention is not limited thereto. The Y-directional length of the processed material M may be configured to be longer than the length of the Y-directional component of the brake pedal 4.

[0072] In addition, according to the aforementioned embodiment, the pressurized portion P8 is provided between the hole 11 and the first unnecessary portion P4 when viewed from the X direction. However, the present invention is not limited thereto. The pressurized portion P8 may be formed in any position in the plane of the workpiece W5.

[0073] In addition, according to the aforementioned embodiment, the notched portion N is formed to be longer in the Y direction than in the X direction. However, the present invention is not limited thereto. The notched portion N may be formed to be longer in the X direction than in the Y direction.

[0074] In addition, according to the aforementioned embodiment, the pressurized portion P8 is formed along a direction crossing the X direction. However, the present invention is not limited thereto. The pressurized portion P8 may be formed in any direction in the plane of the workpiece W5.

[0075] In addition, in the aforementioned embodiment,

the brake pedal 4 is indicated as an example of the vehicular arm component, but the present invention may similarly be applied to any vehicular component having a long arm shape, e.g., a clutch pedal arm, and may also be applied to a clutch pedal arm or a suspension arm.

<Example>

[0076] The present invention is described below in more detail in conjunction with an example. However, the present invention is not limited thereto.

[0077] With regard to a processed material having a thickness of 7 mm an X-directional width of 280 mm, and a tensile strength of 440 MPa, as illustrated in FIG. 9, pressing was performed over an area of 15 mm × 110 mm in the area of the pressurized portion P8. FIG. 10 is a graph illustrating a relationship between a pressing force and an amount of expansion of the X-directional width. FIG. 11 is a graph illustrating a relationship between a pressing force and an amount of reduction in thickness. FIG. 12 is a graph illustrating a relationship between an amount of reduction in thickness and an amount of expansion of the X-directional width.

[0078] As illustrated in FIG. 10, the processed material was pressed with a force of 200 t and expanded about 1.7 mm. In addition, the processed material was pressed with a force of 300 t and expanded about 4.1 mm. In addition, the processed material was pressed with a force of 400 t and expanded about 4.3 mm.

[0079] In addition, as illustrated in FIG. 11, the processed material was pressed with a force of 200 t, so that the thickness was reduced about 0.8 mm. In addition, the processed material was pressed with a force of 300 t, so that the thickness was reduced about 1.7 mm. In addition, the processed material was pressed with a force of 400 t, so that the thickness was reduced about 1.8 mm.

[0080] In addition, as illustrated in FIG. 12, as the thickness was reduced about 0.8 mm, the width was expanded about 1.7 mm. In addition, as the thickness was reduced about 1.7 mm, the width was expanded about 4.1 mm. In addition, as the thickness was reduced about 1.8 mm, the width was expanded about 4.3 mm.

[0081] According to the above example, pressing was found to provide a predetermined amount of extension.

Reference Signs List

[0082]

- 2: bracket
- 3: support shaft
- 4: brake pedal (vehicular arm component)
- 5: pin
- 6: rod
- 11: hole
- 11A: precursor hole
- 100: manufacturing apparatus for brake pedal
- 109A, 109B, 109C, 109D: biasing member

110: forming portion
 120: first cutting portion
 130: second cutting portion
 140: third cutting portion
 150: expanding portion
 160: separating portion
 B: boundary portion of workpiece
 H: positioning hole
 M: processed material
 N: notched portion
 P1: position where hole is formed
 P2: position on another side in Y direction
 P3: first end
 P4: first unnecessary portion
 P5: vicinity of position where precursor hole is formed
 P6: second end
 P7: second unnecessary portion
 P8: pressurized portion
 S01: forming process
 S02: first cutting process
 S03: second cutting process
 S04: third cutting process
 S05: expanding process
 S06: separating process
 W: workpiece

Claims

1. A manufacturing method for a vehicular arm component for manufacturing by a progressive press working method in which a long-shaped processed material for which a blank layout is set such that a feed bridge width, which is a separation distance between workpieces that are contiguously adjacent in a feed direction, is zero is intermittently fed at a constant pitch in the feed direction and is simultaneously pressed in a plurality of positions in the feed direction, the manufacturing method for a vehicular arm component comprising:

an expanding process of pressing a pressurized portion provided in a plane of the workpiece in a thickness direction to expand a width of the workpiece in the feed direction; and

a separating process of cutting off the workpiece having an expanded width in the feed direction from the processed material.
2. The manufacturing method for a vehicular arm component according to claim 1, wherein a position of pressing is adjusted to perform positioning depending on expansion of the width of the workpiece in the feed direction in the expanding process.
3. The manufacturing method for a vehicular arm component according to claim 1 or 2, wherein the pres-

surized portion is pressurized from both sides in the thickness direction in the expanding process.

4. The manufacturing method for a vehicular arm component according to any one of claims 1 to 3, wherein a length of the processed material in a perpendicular direction perpendicular to the feed direction is the same as a length of a component of the vehicular arm component in the perpendicular direction.
5. The manufacturing method for a vehicular arm component according to claim 4, further comprising, prior to the expanding process:

a forming process of forming, in a position that is on one side of the workpiece in the perpendicular direction and where a hole into which a support shaft for supporting the vehicular arm component to a bracket is inserted is formed, a precursor hole, which is smaller than the hole, and forming a positioning hole in a position that is on another side in the perpendicular direction; a first cutting process of cutting out a first end at one end of a boundary portion between the adjacent workpieces in the perpendicular direction to form a notched portion and cutting out a first unnecessary portion that is provided on a side of the positioning hole facing the notched portion and follows a shape of the vehicular arm component;

a second cutting process of forming the hole in a vicinity of a position where the precursor hole is formed in the forming process and cutting out a second end that is provided at another end in the perpendicular direction and follows a shape of the vehicular arm component; and

a third cutting process of cutting out a second unnecessary portion that surrounds the positioning hole, is provided between the first unnecessary portion and the second end, and follows a shape of the vehicular arm component.

6. The manufacturing method for a vehicular arm component according to claim 5, wherein the pressurized portion is extended such that both ends of the pressurized portion in the perpendicular direction exceed a width extending along the perpendicular direction of the boundary portion when viewed from the feed direction.
7. The manufacturing method for a vehicular arm component according to claim 5 or 6, wherein the notched portion is formed to be longer in the perpendicular direction than in the feed direction.
8. The manufacturing method for a vehicular arm component according to any one of claims 1 to 7, wherein the pressurized portion is formed along a direction

crossing the feed direction.

9. A manufacturing apparatus for a vehicular arm component for manufacturing by a progressive press working method in which a long-shaped processed material for which a blank layout is set such that a feed bridge width, which is a separation distance between workpieces that are contiguously adjacent in a feed direction, is zero is intermittently fed at a constant pitch in the feed direction and is simultaneously pressed in a plurality of positions in the feed direction, the manufacturing apparatus for a vehicular arm component comprising:

an expanding portion configured to press a pressurized portion provided in a plane of the workpiece in a thickness direction to expand a width of the workpiece in the feed direction; and
a separating portion configured to cut off the workpiece having an expanded width in the feed direction from the processed material.

10. The manufacturing apparatus for a vehicular arm component according to claim 9, further comprising a biasing member configured to adjust a position of pressing to perform positioning depending on expansion of the width of the workpiece in the feed direction in the expanding portion.
11. The manufacturing apparatus for a vehicular arm component according to claim 10, wherein the expanding portion presses the pressurized portion from both sides in the thickness direction.
12. The manufacturing apparatus for a vehicular arm component according to claim 10 or 11, further comprising:

a forming portion configured to form, in a position that is on one side of the workpiece in a perpendicular direction perpendicular to the feed direction and where a hole into which a support shaft for supporting the vehicular arm component to a bracket is inserted is formed, a precursor hole, which is smaller than the hole, and form a positioning hole in a position that is on another side in the perpendicular direction;

a first cutting portion configured to cut out a first end at one end of a boundary portion between the adjacent workpieces in the perpendicular direction to form a notched portion and cut out a first unnecessary portion that is provided on a side of the positioning hole facing the notched portion and follows a shape of the vehicular arm component;

a second cutting portion configured to form the hole in a vicinity of a position where the precursor hole is formed by the forming portion and cut out

a second end that is provided at another end in the perpendicular direction and follows a shape of the vehicular arm component; and
a third cutting portion configured to cut out a second unnecessary portion that surrounds the positioning hole, is provided between the first unnecessary portion and the second end, and follows a shape of the vehicular arm component.

13. The manufacturing apparatus for a vehicular arm component according to claim 12, wherein the pressurized portion is extended such that both ends of the pressurized portion in the perpendicular direction exceed a width extending along the perpendicular direction of the boundary portion when viewed from the feed direction.
14. The manufacturing apparatus for a vehicular arm component according to claim 12 or 13, wherein the notched portion is formed to be longer in the perpendicular direction than in the feed direction.
15. The manufacturing apparatus for a vehicular arm component according to any one of claims 9 to 14, wherein the pressurized portion is formed along a direction crossing the feed direction.

FIG.1

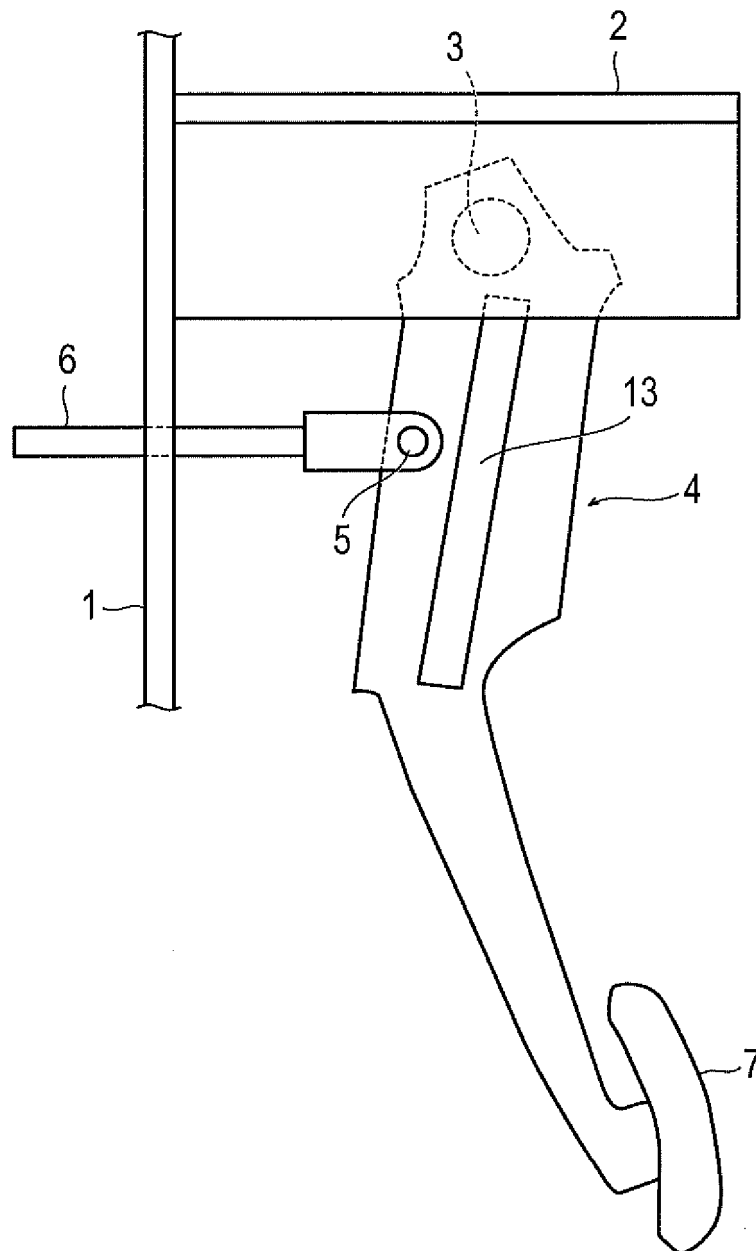


FIG.2

4

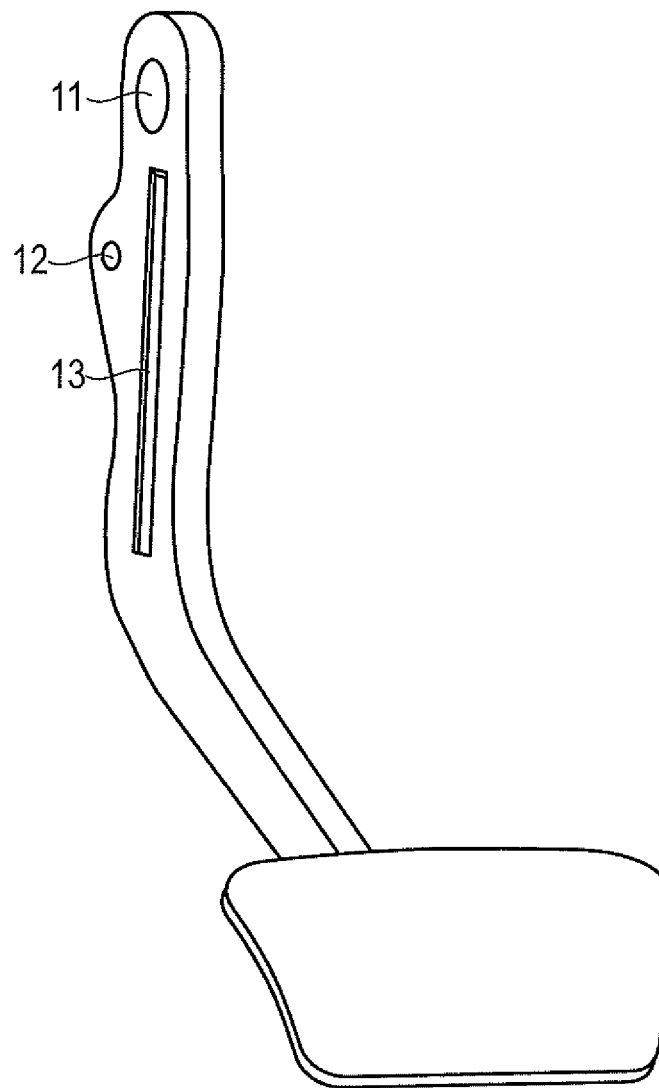
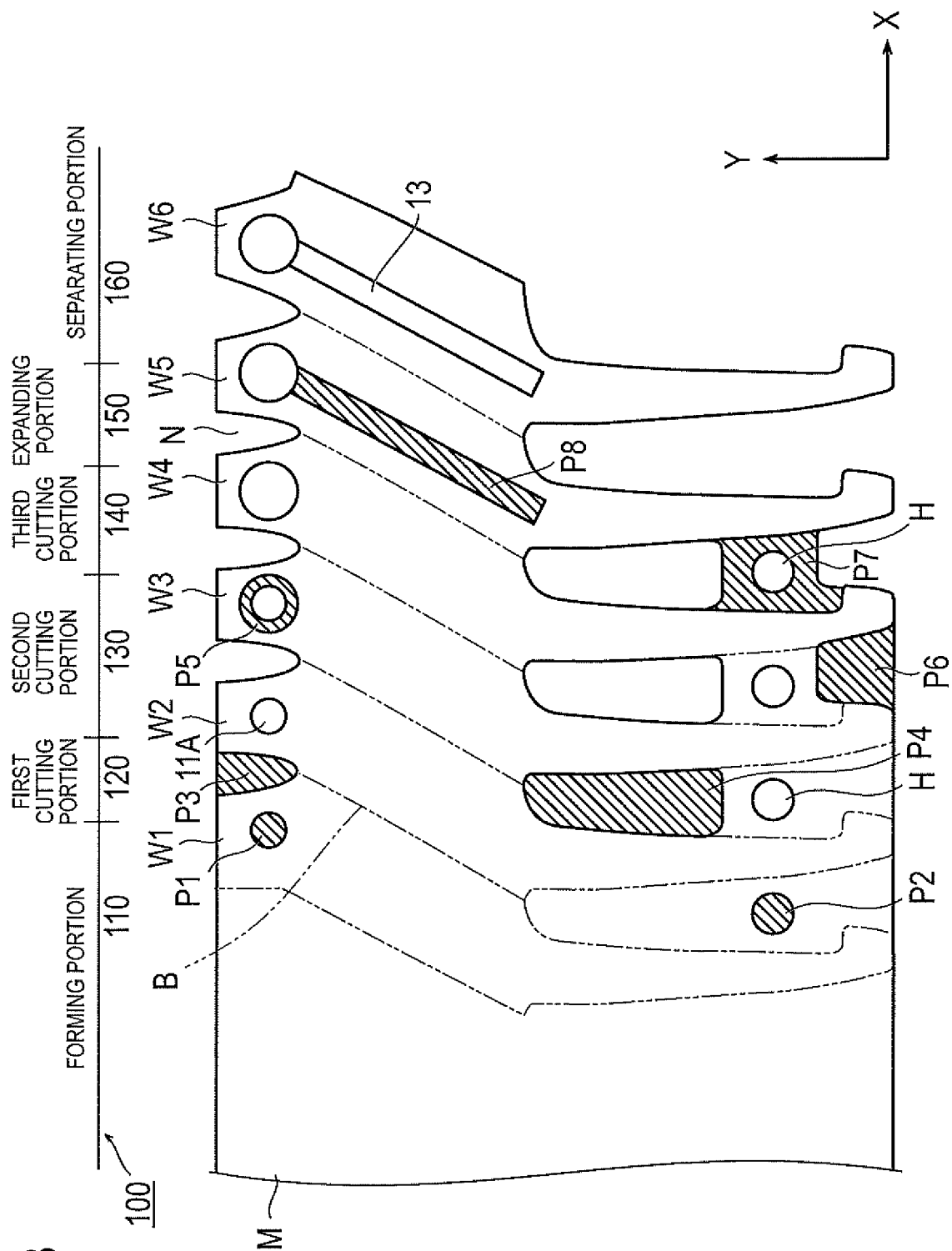


FIG.3



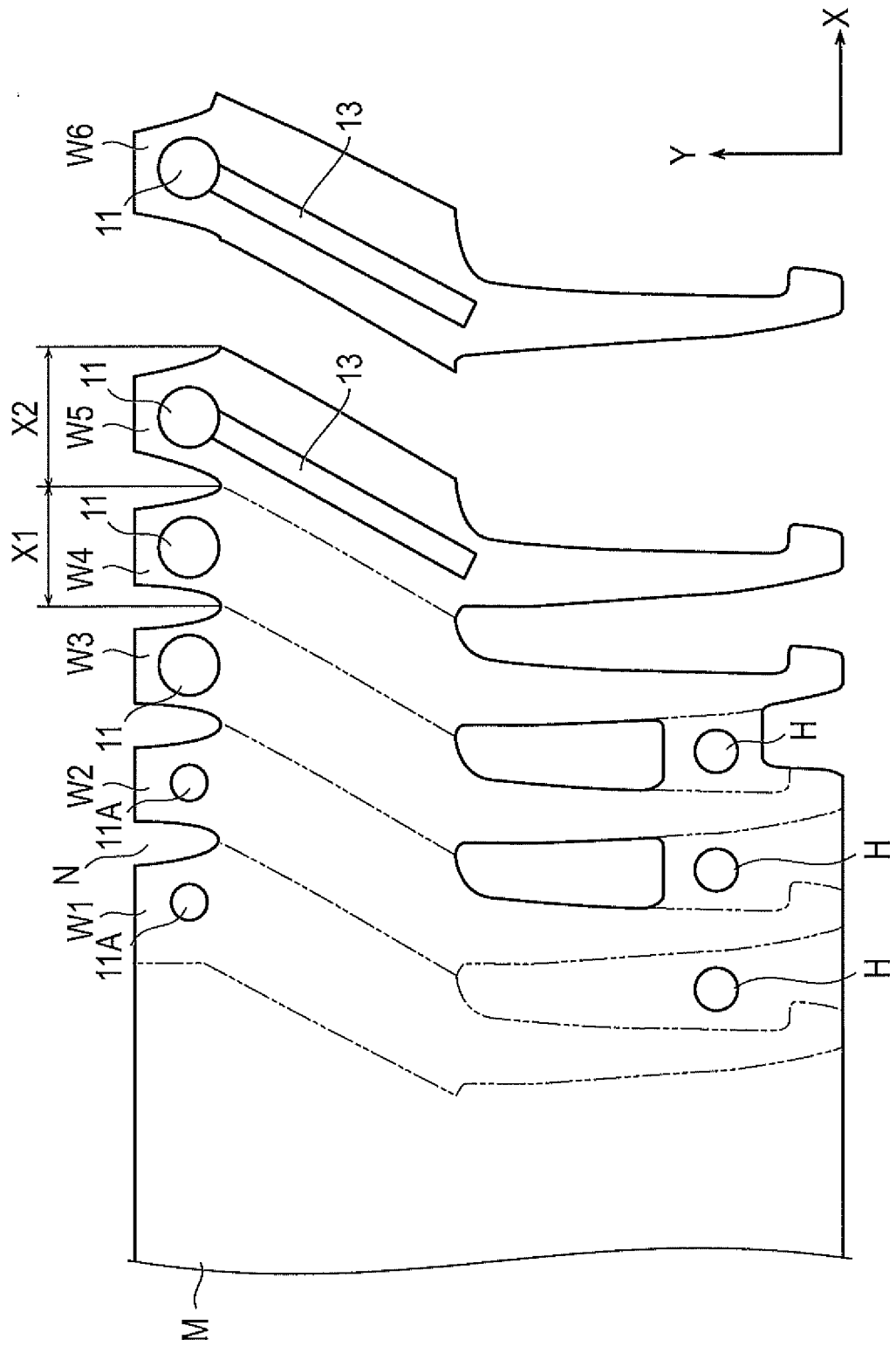


FIG. 4

FIG.5 (A)

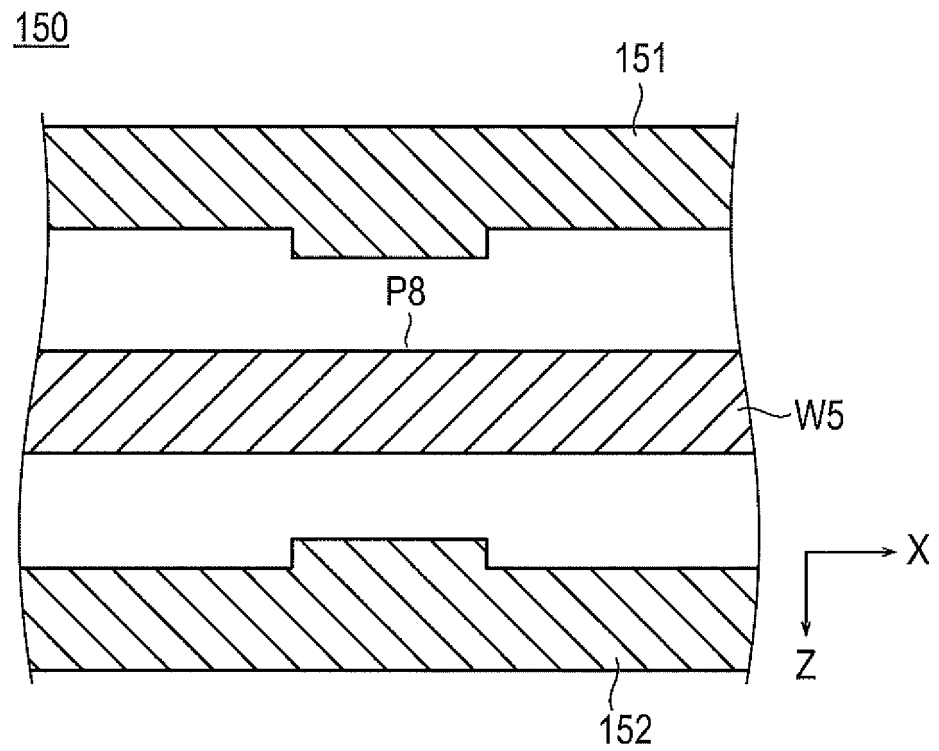


FIG.5 (B)

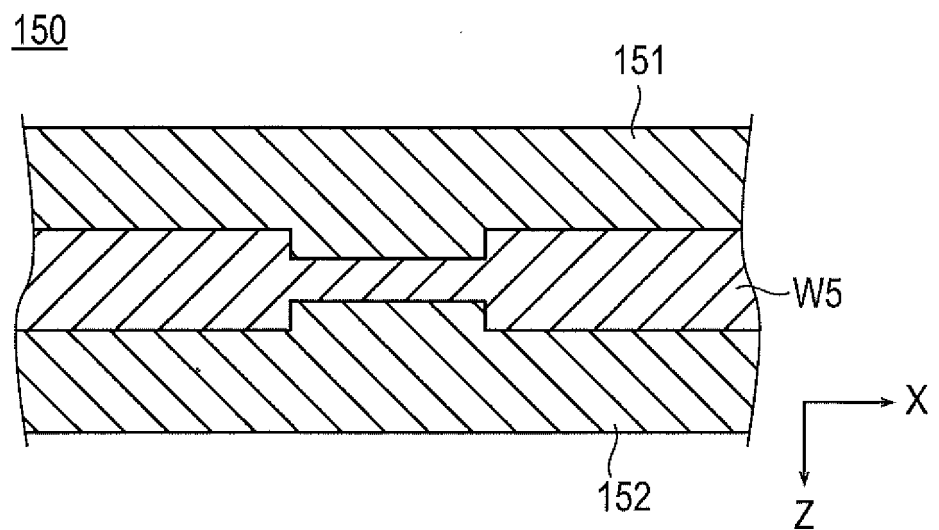


FIG.6

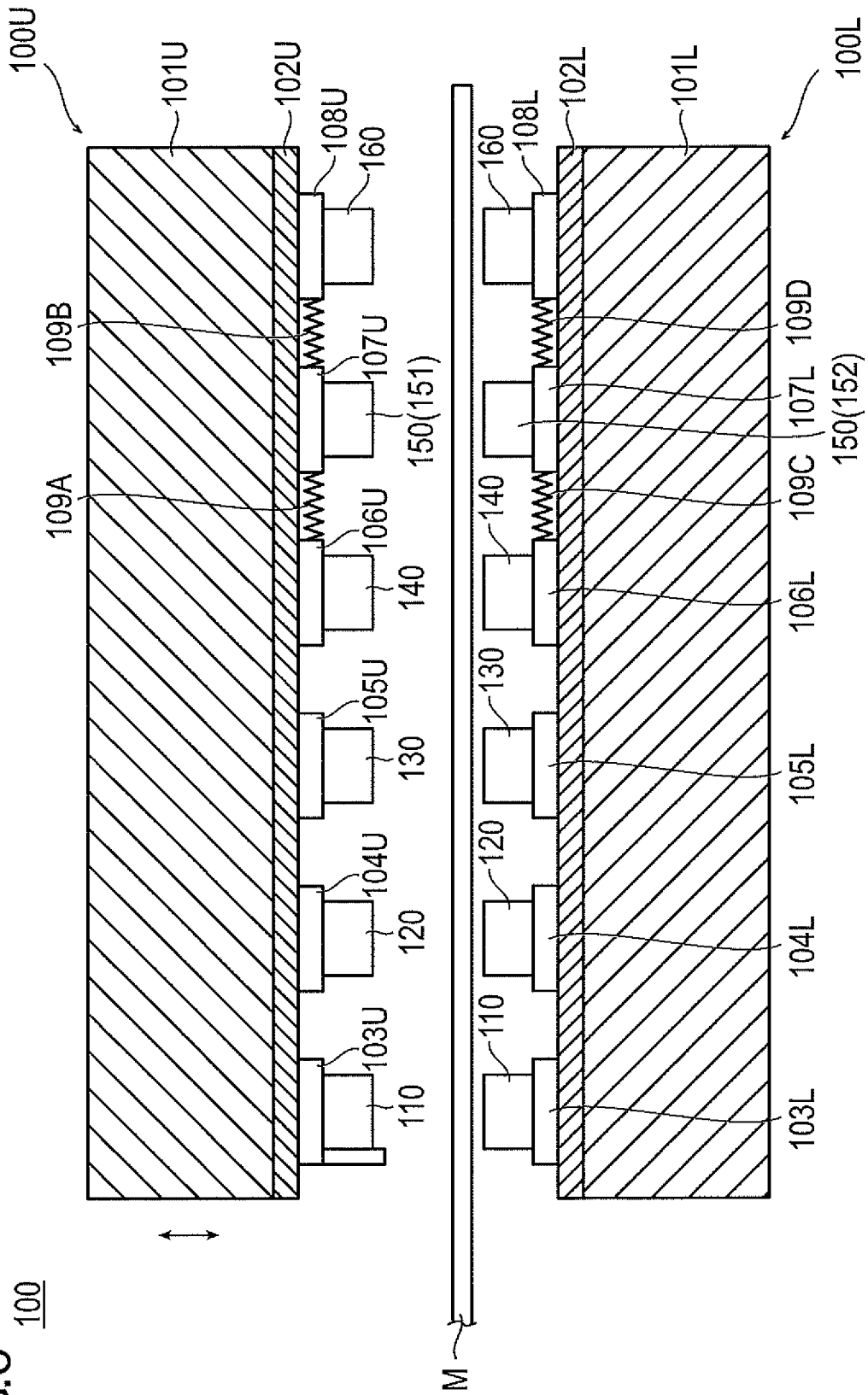


FIG.7

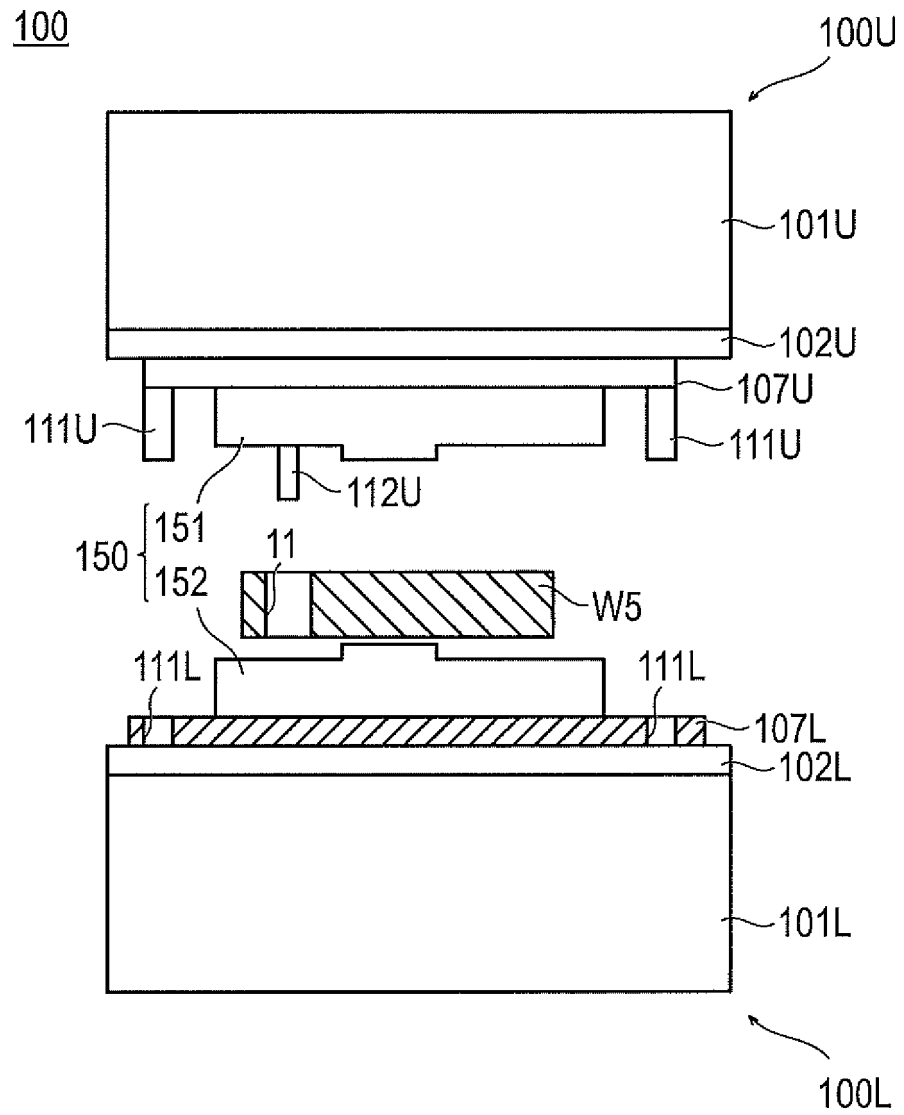


FIG.8

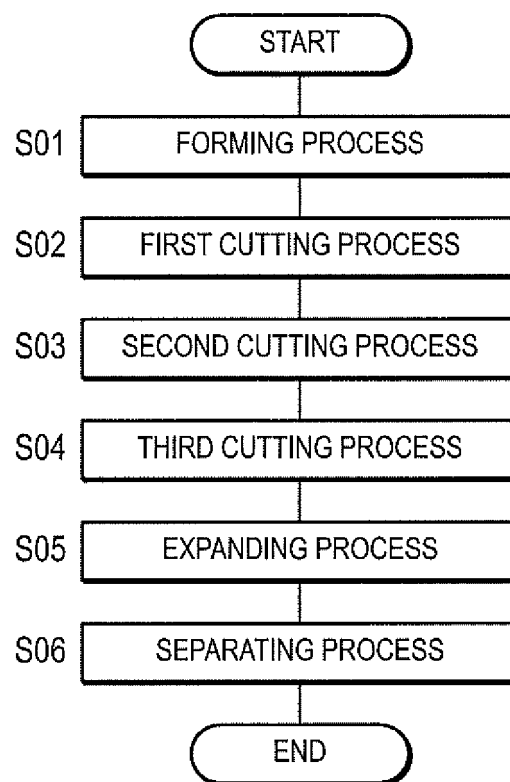


FIG.9

4

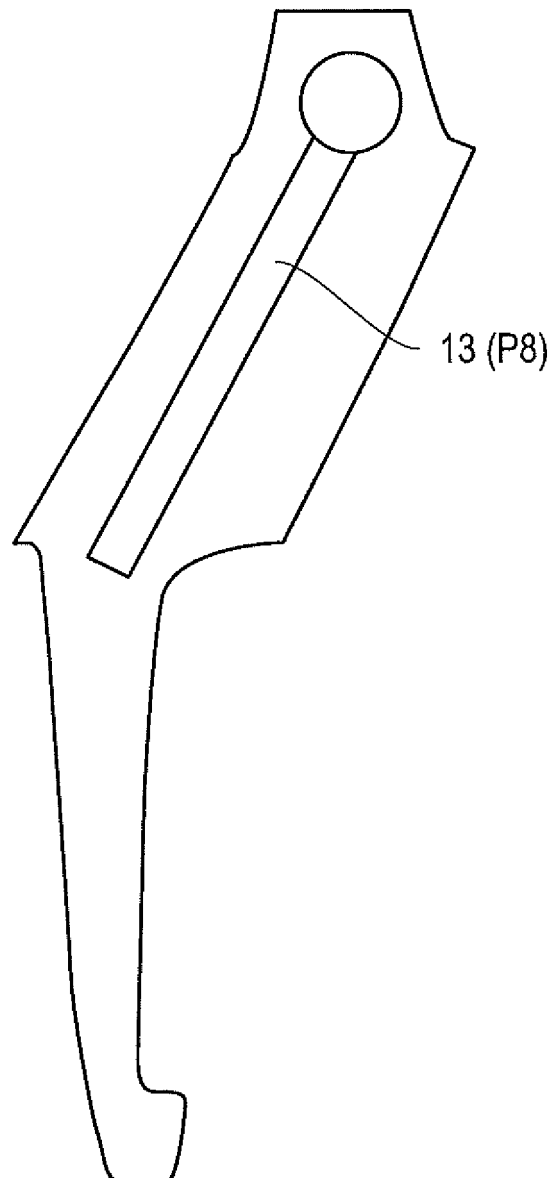


FIG.10

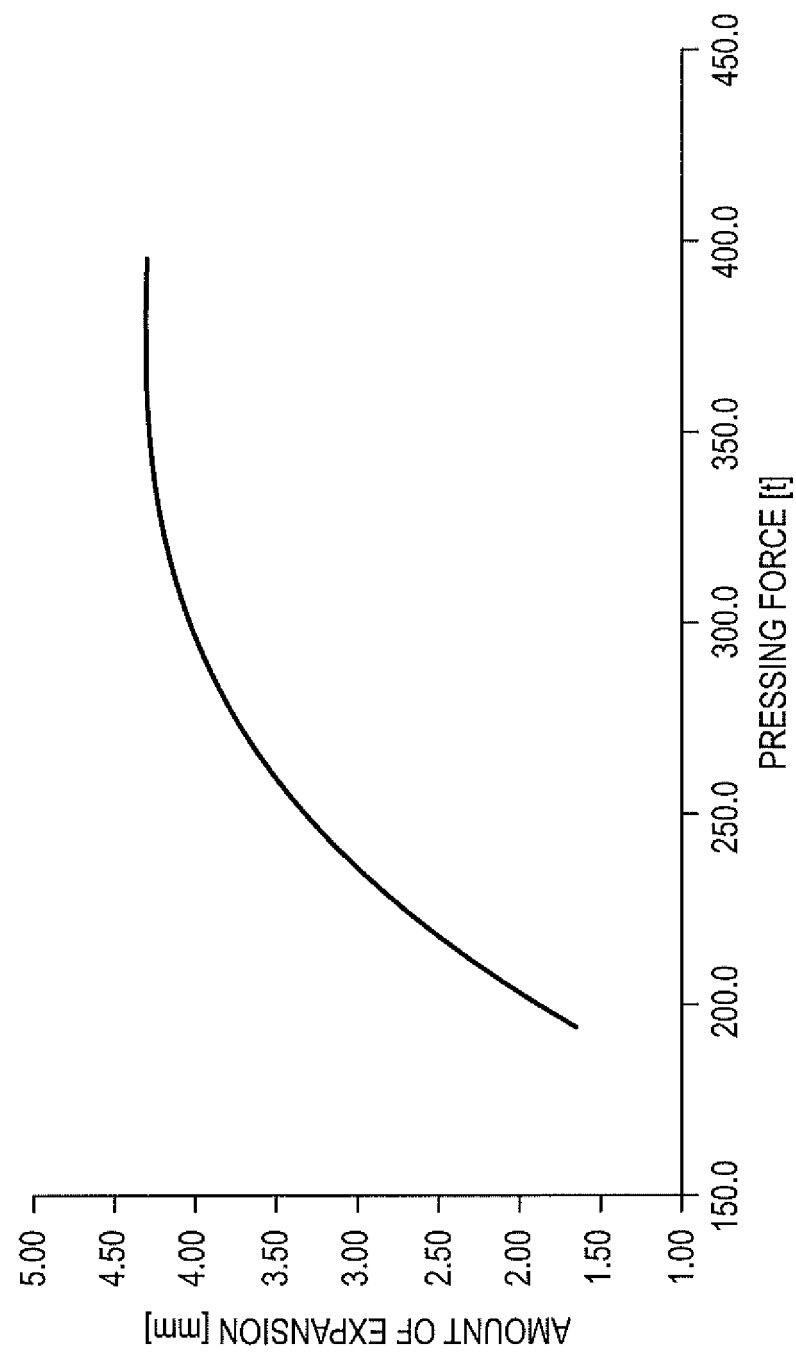


FIG.11

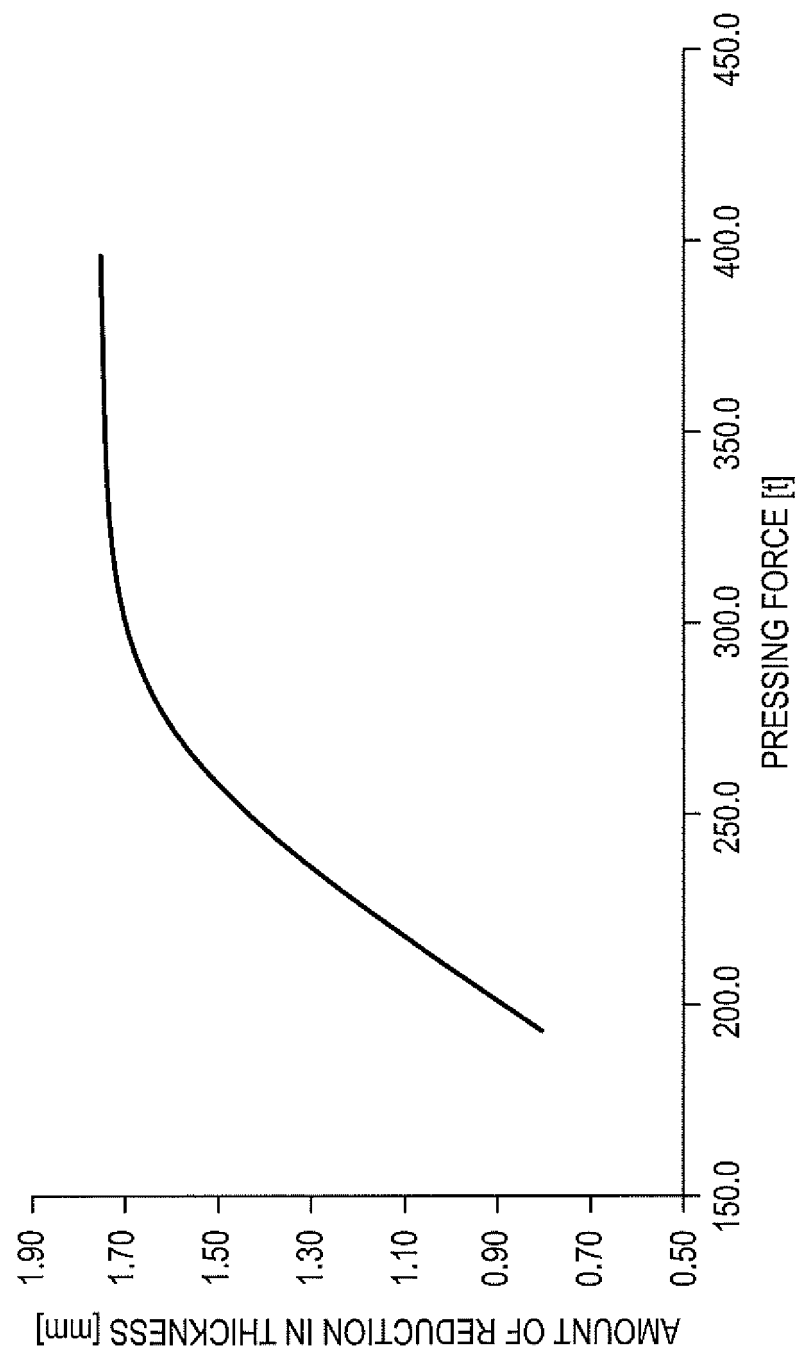
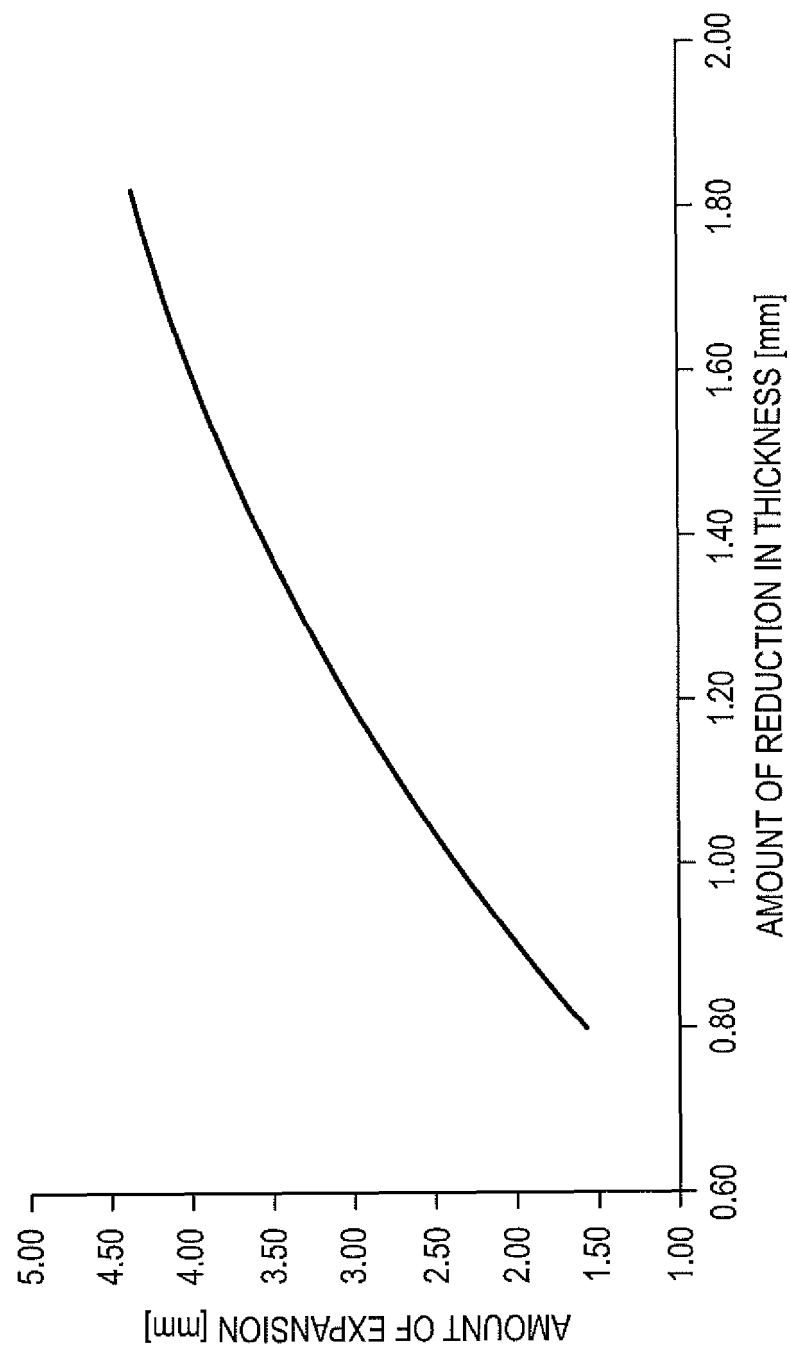


FIG.12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/081987

A. CLASSIFICATION OF SUBJECT MATTER

B21D53/88(2006.01)i, B21D22/02(2006.01)i, B21D28/06(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B21D53/88, B21D22/02, B21D28/06, B60T7/04

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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 2004-503273 A (Tegometall International AG), 05 February 2004 (05.02.2004), figures & WO 2001/095764 A1 figures & US 2002/0134900 A1 & EP 1292204 A & DE 200010499 U1	1-15
A	JP 59-232631 A (Mitsubishi Electric Corp.), 27 December 1984 (27.12.1984), page 2, lower left column, lines 6 to 17; fig. 4 to 6 (Family: none)	1-15

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

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Date of the actual completion of the international search
18 February 2016 (18.02.16)Date of mailing of the international search report
01 March 2016 (01.03.16)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/081987

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2015-11511 A (Mitsubishi Motors Corp.), 19 January 2015 (19.01.2015), fig. 1 (Family: none)	1-15
A	JP 7-236930 A (Fuji Kiko Co., Ltd.), 12 September 1995 (12.09.1995), fig. 6 to 7, 9 (Family: none)	1-15

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010086052 A [0004]
- JP H0819823 A [0004]