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(71) Applicant: **CIDAN Machinery Sweden AB**
533 21 Götene (SE)

(72) Inventor: **Persson, Johan**
546 32 Karlsborg (SE)

(74) Representative: **Ehrner & Delmar Patentbyrå AB**
Drottninggatan 33, plan 4
111 51 Stockholm (SE)

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(54) **A FOLDING MACHINE FOR FOLDING SHEET SHAPED MATERIAL**

(57) The invention relates to a folding machine for folding sheet shaped material. The folding machine (100) comprises a first beam (102) arranged to support sheet shaped material (200) during a folding operation; a second beam (104) arranged to clamp the sheet shaped material (200) against the first beam (102) during the folding operation; and a folding beam (106) arranged to rotate around an axis of rotation (R) during the folding

operation so as to fold the sheet shaped material (200) against the first beam (102) or the second beam (104). The folding machine (100) further comprises a first eccentric (130) coupled to the folding beam (106) and arranged to change a location of the axis of rotation (R) of the folding beam (106). Thereby, the axis of rotation (R) can be adapted to different thickness of sheet shaped material resulting in improved folding.

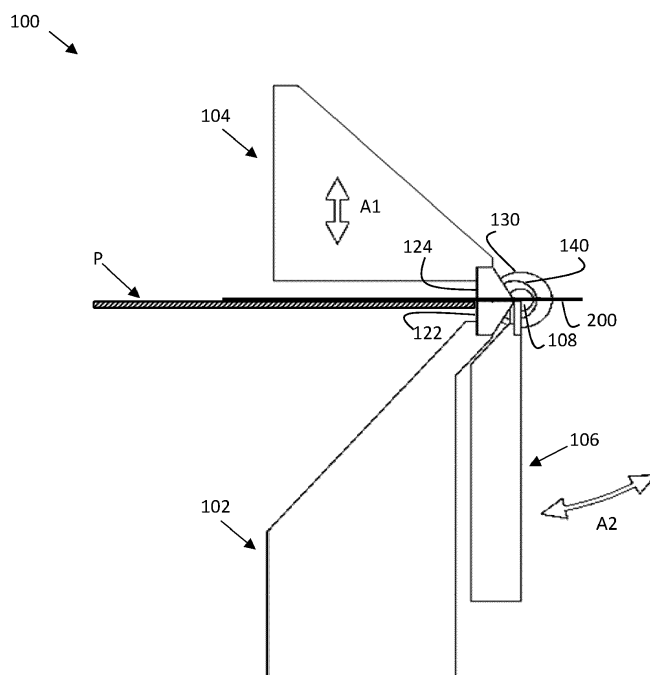


Fig. 1

Description

Technical Field

[0001] The invention relates to a folding machine for folding sheet shaped material.

Background

[0002] Folding machines are known in the art and can be of many different types.

[0003] One type of folding machines is arranged to fold or bend sheet metal in a folding operation. Sheet metal is fed into the folding machine so as to being supported on a stationary lower beam. Thereafter, an upper beam, also known as clamping beam, clamps the sheet metal against the lower beam. Finally, a folding beam folds the sheet metal against a folding tool of the upper beam in the folding operation so as to produce folded sheet metal.

[0004] To adapt to different thickness of sheet metal the folding beam can in some machines be vertically lowered in relation to the lower beam. Thereby, the folding radius can be increased during the folding operation.

Summary

[0005] An objective of embodiments of the invention is to provide a solution which mitigates or solves the drawbacks and problems of conventional solutions.

[0006] The above and further objectives are solved by the subject matter of the independent claims. Further advantageous embodiments of the invention can be found in the dependent claims.

[0007] According to an aspect of the invention, the above mentioned and other objectives are achieved with a folding machine for folding sheet shaped material, the folding machine comprising:

- a first beam arranged to support sheet shaped material during a folding operation;
- a second beam arranged to clamp the sheet shaped material against the first beam during the folding operation;
- a folding beam arranged to rotate around an axis of rotation during the folding operation so as to fold the sheet shaped material against the first beam or the second beam; **characterised in** that further comprising
- a first eccentric coupled to the folding beam and arranged to change a location of the axis of rotation of the folding beam.

[0008] Sheet shaped material will hereafter also be denoted simply as sheet. Any material that has the shape of a sheet and can be folded in a folding machine can be sheet shaped material in this discourse. Non-limiting examples of such material are metal, plastic and composite material.

[0009] An advantage of the present folding machine is that the axis of rotation can be adapted to different thickness of sheet. Thereby, better folding result is achieved compared to conventional solutions since the folding radius is adapted to the different thickness and can be held constant during the folding operation.

[0010] In an implementation form of the folding machine, the first eccentric is arranged to change the location of the axis of rotation in relation to the first beam.

[0011] In an implementation form of the folding machine, the first eccentric is arranged to change the location of the axis of rotation in relation to the first beam in a direction which is perpendicular to a plane of the first beam, wherein the plane of the first beam is arranged to support the sheet shaped material during the folding operation.

[0012] In an implementation form of the folding machine, the first eccentric is arranged to change the location of the axis of rotation so that the axis of rotation is aligned with a folding tool of the second beam.

[0013] Being aligned with can also mean that the axis of rotation is in level with the folding tool and/or located adjacent to the folding tool.

[0014] In an implementation form of the folding machine, the folding machine comprises a first actuator arranged to rotate the first eccentric so as to change the location of the axis of rotation.

[0015] In an implementation form of the folding machine, the folding machine comprises a second eccentric coupled to the folding beam, wherein the second eccentric is arranged to change a location of the folding beam in relation to the first beam so as to adapt to a thickness of the sheet shaped material during the folding operation.

[0016] An advantage with this implementation form is that both the location of the axis of rotation and the location of the folding beam can be adapted to different thickness thereby providing improved folding.

[0017] In an implementation form of the folding machine, the second eccentric is arranged to change the location of the folding beam in relation to the first beam in a direction which is perpendicular to a plane of the first beam, wherein the plane of the first beam is arranged to support the sheet shaped material during the folding operation.

[0018] In an implementation form of the folding machine, the second eccentric is arranged to change the location of the folding beam so that a folding tool of the folding beam is aligned with a folding tool of the first beam.

[0019] Being aligned with can also mean that the folding tool of the folding beam is in level with the folding tool of the first beam and/or located adjacent to the folding tool of the first beam.

[0020] In an implementation form of the folding machine, the folding machine comprises a second actuator

arranged to rotate the second eccentric so as to change the location of the folding beam.

[0021] In an implementation form of the folding machine, second eccentric is rotatably arranged inside the first eccentric, or vice versa.

[0022] An advantage with this implementation form is that a very compact solution is provided. Also, no mechanism is need for adjusting the location of the folding beam arranged on the folding beam or adjacent to the folding beam.

[0023] In an implementation form of the folding machine, the first eccentric and/or the second eccentric is coupled to the folding beam by means of a supporting shaft extending in parallel to the axis of rotation.

[0024] In an implementation form of the folding machine, a centre axis of the supporting shaft is arranged with an offset in relation to the axis of rotation.

[0025] In an implementation form of the folding machine, the supporting shaft extends through the first eccentric and/or the second eccentric and being journalled and supported herein.

[0026] In an implementation form of the folding machine, the supporting shaft is attached to the folding beam by means of a supporting arm extending perpendicularly from the supporting shaft and parallel to an extension of a main body of the folding beam.

[0027] In an implementation form of the folding machine, the supporting shaft is attached to the folding beam via coupling means.

[0028] Further applications and advantages of the embodiments of the invention will be apparent from the following detailed description.

Brief Description of the Drawings

[0029] The appended drawings are intended to clarify and explain different embodiments of the invention, in which:

- Fig. 1 shows a side view of a part of a folding machine according to an embodiment of the invention;
- Fig. 2 shows an exploding view in perspective of a part of a folding machine according to an embodiment of the invention;
- Fig. 3 illustrates the axis of rotation R for a folding beam according to an embodiment of the invention;
- Fig. 4 illustrates a detail of a folding machine according to an embodiment of the invention;
- Fig. 5 illustrates a folding operation according to an embodiment of the invention when a folding machine only comprises a second eccentric;
- Fig. 6 illustrates a folding operation according to an embodiment of the invention when a folding machine comprises a first eccentric; and
- Fig. 7 illustrates a folding operation according to an embodiment of the invention when a folding machine comprises a first eccentric and a second eccentric.

Detailed Description

[0030] Fig. 1 shows a side view of a part of a folding machine 100 according to an embodiment of the invention. The folding machine 100 comprises a first beam 102 arranged to support a sheet 200 during a folding operation. In this particular example, the first beam 102 act as a lower beam and hence comprises a plane P which supports the sheet 200 during the folding operation. The folding machine 100 further comprises a second beam 104 arranged to clamp the sheet 200 against the first beam 102 during the folding operation. In this respect the second beam 104 is arranged to be moved against and away from the first beam 102 which is illustrated with arrow A1. Hence, in this example the second beam 104 act as an upper beam and is arranged to be vertically lowered and raised relative to the first beam 102. The second beam 104 is arranged to be raised when the sheet to be folded is feed into the folding machine 100 and thereafter lowered so as to clamp the sheet 200 against the first beam 102 for the folding operation. Hence, the second beam 104 can also be denoted as a clamping beam and is considered to be in a clamping mode when clamping the sheet 200 against the first beam 102.

[0031] The folding machine 100 further comprises a folding beam 106, in this particular example arranged adjacent to the first beam 102 and in which its folding tool 122 is in level or aligned with the plane P of the first beam 102. The folding beam 106 is arranged to rotate around an axis of rotation R (see Fig. 3 and 4) during the folding operation so as to fold the sheet 200 against the second beam 104, or more particularly against the folding tool 124 of the second beam 104. The rotation of the folding beam 106 is illustrated with arrow A2 in Fig. 1. However, the folding beam 106 can also be arranged to rotate around the axis of rotation R during the folding operation so as to fold the sheet 200 against the folding tool 122 of the first beam 102 instead of the second beam 104. In such a case the folding beam 106 can be moved to the other side of the sheet 200 and thereby located adjacent to the second beam 104 before the folding operation. This type of folding machines that are arranged to fold from two opposite sides are sometimes called up and down folding machine or double folding machine.

[0032] The folding machine 100 according to the invention further comprises a first eccentric 130 which is mechanically coupled to the folding beam 106 and is arranged to change a location of the axis of rotation R of the folding beam 106. Thereby, the axis of rotation R can be adapted to different thickness of the sheet 200 by changing the folding radius. It is known that different thickness of sheet requires different folding radius for optimal folding results.

[0033] In embodiments, the first eccentric 130 is arranged to change the location of the axis of rotation R in relation to the first beam 102, and more particularly to change the location of the axis of rotation R in relation to the first beam 102 in a direction which is perpendicular

to the plane P of the first beam 102. In the example shown in Fig. 1 this direction is the vertical direction if the plane P is horizontal. In embodiments, the first eccentric 130 is arranged to change the location of the axis of rotation R so that the axis of rotation R is aligned or in level with the tip of the second beam 104 when the second beam 104 is in the clamping mode. This also means that the axis of rotation R is aligned with the folding tool 124 of the second beam 104 since the folding tool 124 is arranged at the tip.

[0034] It is further noted that the folding machine 100 in Fig. 1 also comprises a second eccentric 140, but it should be realized that the present folding machine 100 does not need to comprise a second eccentric 130 which will be apparent from the following disclosure. However, in embodiments the folding machine 100 comprises both first 130 and second 140 eccentric. Fig. 2 shows an exploded view in perspective of a folding machine 100 according to an embodiment of the invention comprising two eccentrics, i.e. a first 130 and a second 140 eccentric. The view herein shown is a partial view of the folding machine 100, i.e. a part of the folding beam 106 together with a first side frame 114 of the folding machine 100 and an arrangement comprising a first eccentric 130 and a second eccentric 140 coupled to a first end of the folding beam 106 by mechanical means.

[0035] The first 130 and second 140 eccentric are arranged to be rotated by its associated actuators, i.e. first 132 and second 142 actuator, respectively. The actuator arms can e.g. be bolted to its respective eccentrics. It is realized by the skilled person that many different types of actuators can be used for rotating the actuators herein. The actuators can be controlled by control logic which is arranged to control the rotation of the eccentrics, e.g. rotational direction, rotational speed, synchronization of the rotation, etc. Further, also other solutions for rotating the eccentrics can be implemented, such as mechanical arrangements operated by hand, arrangements using spring force, etc.

[0036] In embodiments, the second eccentric 140 is mechanically coupled to the folding beam 106 and arranged to change a location of the folding beam 106 in relation to the first beam 102 so as to adapt to a thickness of the sheet 200 during the folding operation. This can be performed by changing the location of the folding beam 106 in relation to the first beam 102 in a direction which is perpendicular to the plane P of the first beam 102. As previously mentioned and illustrated in Fig. 1 said plane P of the first beam 102 is arranged to support the sheet 200 during the folding operation. More specifically, the changing of the location of the folding beam 106 can mean that a folding tool 112 of the folding beam 106 as shown in Fig. 2 is aligned with the plane P of the first beam 102.

[0037] Furthermore, the second eccentric 140 is in Fig. 2 rotatably arranged inside the first eccentric 130 resulting in a compact solution minimizing space needed for accommodation of said eccentrics. Also, no mechanism

is need for adjusting the location of the folding beam arranged on the folding beam or adjacent to the folding beam. The revers case is also possible which implies that the first eccentric 130 instead is arranged inside the second eccentric 140. This embodiment is not shown in the Figs.

[0038] As also shown in Fig. 2, the first 130 and second 140 eccentric are coupled to the folding beam 106 by means of a supporting shaft 108 which extends through the first 130 and second 140 eccentric and hence is journaled inside and supported by the first 130 and second 140 eccentric. For robustness the supporting shaft 108 can also extend through a bearing 150 arranged between the coupling means 116 and the eccentrics and possibly attached at the first side frame 114 as shown in Fig. 2. The supporting shaft 108 is arranged parallel to the axis of rotation R but offset from the axis of rotation R with a distance. A supporting arm 110 is attached to a first end of the supporting shaft 108 via coupling means 116 and extends from the supporting shaft 108 perpendicular to the extension of the supporting shaft 108. The coupling means 116 has in this non-limiting example a cylindric shape (other shapes are also possible) and the supporting shaft 108 is asymmetrically attached to the coupling means 116. i.e. offset from the center of the cylindrically shaped coupling means 116. The symmetrical center of the cylinder herein defines the axis of rotation R in this example. Moreover, the second end of the supporting shaft 108 extends through a bracket 126 for the second actuator and is connected to a driving mechanism of a driving device (not shown), in this case a driving sprocket 128. When the driving sprocket 128 is rotated the supporting shaft 108 will accordingly also rotate and so will the folding arm 106 in the folding operation. It is realized that many different solutions can be employed for driving the supporting shaft and indirectly the folding beam 106 in the folding operation.

[0039] Moreover, Fig. 2 also discloses a housing 118 for the supporting arm 110. The housing 118 is directly attached to the main body 120 of the folding beam 106, e.g. by welding or bolting. There are two main cases regarding the housing 118 and the supporting arm 110 which now will be described.

[0040] In one case, the supporting arm 110 is slidably arranged inside the housing 118 but can be locked/secured into different positions within the housing 118. The locking can e.g. be done with the use of bolts arranged in the housing 118 and is manually performed by an operator of the folding machine 100. This means that the location of the folding beam 106 can be adjusted by the supporting arm 110 taking different positions in the housing 118. Thereby, the folding beam 106 can be adapted to different thickness of the sheet. Hence, this arrangement can e.g. be combined with the first eccentric 130 without the use of the second eccentric 140. However, this arrangement has a certain drawback that it takes time to adjust the location of the folding beam 106. Also, a locking mechanism is needed for locking the supporting

arm 110 in different positions in the housing 118.

[0041] In another case, the supporting arm 110 is rigidly attached to the housing 118 or directly attached to the main body which in the latter case means that no housing is needed at all (not shown). Combined with a second eccentric 140 the change of location of the folding beam 106 can be performed fully automatically and in a very short time period.

[0042] The folding machine 100 can comprise a second side frame (not shown) opposite to the first side frame 114 and a corresponding arrangement of eccentrics and actuators on an opposite second end of the folding beam 106 at which the folding beam 106 is supported (not shown). The arrangement of eccentrics and actuators coupled to the first and second ends, respectively, of the folding beam 106 can be synchronized so as to rotate in a synchronized manner.

[0043] Fig. 3 illustrates how the location of the axis of rotation R is changed due to rotation of the first eccentric 130. The cross illustrates the axis of rotation R and the location can be vertically raised or lowered depending on the thickness of sheet 200. Since the first beam 102 in this case is stationary, the axis of rotation R is raised when the thickness is increased and is accordingly lowered when the thickness is decreased. By raising the axis of rotation R the folding radius is increased and by lowering the axis of rotation R the folding radius is decreased.

[0044] Fig. 4 shows a side view of a section of the folding machine 100. It is noted that the axis of rotation R (i.e. the large cross) is centered in the cylindrical shaped coupling means 116 (see Fig. 2). It is further noted that the center axis of the supporting shaft 108 (i.e. the small cross) is arranged with an offset in relation to the axis of rotation R. Due to this offset and since the supporting shaft is arranged inside the first 130 and second 140 eccentric both the location of the axis of rotation R and the location of the folding beam 106 can be adjusted so as to adapt to different thickness of the sheet when both eccentrics are rotated. In a non-limiting example, the offset can e.g. be approximately 12mm for sheet thickness in the interval 0 - 5 mm. Also, the main body 120 and the folding tool 112 of the folding beam 106 is illustrated and the supporting shaft 108 is attached to the folding beam 106 by means of a supporting arm 110 that extends perpendicularly from the supporting shaft 108 and parallel to an extension of the main body 120.

[0045] Fig. 5 illustrates a conventional solution when the folding beam 106 can be adapted to different thickness of the sheet 200 but when the location of the axis of rotation R cannot be changed.

[0046] In step I in Fig. 5, the folding machine 100 is set to a first thickness of the sheet 200. The folding beam 106 is in step I more or less aligned with a folding tool 122 of the first beam 102 and the location of the axis of rotation R (i.e. the cross) is also located more or less at the tip of the second beam 104, i.e. aligned with a folding tool 124 of the second beam 104.

[0047] In step II in Fig. 5, the folding beam 106 is low-

ered to adapt to a second thickness which is larger than the first thickness. This is performed by lowering the folding beam 106, illustrated with arrow a1, by rotating the second eccentric 140 clockwise, illustrated with arrow A1. The lowering of the folding beam 106 is needed so as to increase the folding radius.

[0048] In step III in Fig. 5, the second beam 104 is raised so as to accommodate the thicker sheet which is illustrated with the upwards directed arrow A2. Raising and lowering of the second beam 104 can be performed by means of a raising and lowering device not shown in the Figs.

[0049] In step IV in Fig. 5, the supporting shaft 108 together with the coupling means 116 rotates the folding beam 106 anticlockwise (arrow A3) so as to fold sheet (not shown). However, since the axis of rotation R is no longer aligned with or adjacent to the folding tool 124 of the second beam 104, the folding result will not be optimal since e.g. the folding radius will not be held constant during the folding operation.

[0050] Fig. 6 instead illustrates a folding operation when a folding machine comprises a first eccentric 130 arranged to change the location of the axis of rotation R according to an embodiment of the invention.

[0051] In step I in Fig. 6, the folding machine 100 is set to a first thickness of the sheet 200. Hence, the folding beam 106 is in step I aligned with a folding tool 122 of the first beam 102 and the location of the axis of rotation R (i.e. the cross) is aligned with a folding tool 124 of the second beam 104.

[0052] In step II in Fig. 6, the axis of rotation R is raised (arrow a1) by rotating the first eccentric 130 (arrow A1) clockwise so as to adapt to a second thickness larger than the first thickness.

[0053] In step III in Fig. 6, the second beam 104 is raised (arrow A2) to accommodate the thicker sheet before clamping. Also, the folding beam 106 is lowered (arrow A3) to adapt to the second thickness. However, since this embodiment does not comprise a second eccentric 140 other means is used for lowering and raising the folding beam 106 as previously explained.

[0054] In step IV in Fig. 6, the supporting shaft 108 together with coupling means 116 rotates (arrow A4) the folding beam 106 anti-clockwise around the axis of rotation R so as to fold the sheet 200. Since the axis of rotation R is aligned with or adjacent to the folding tool 124 of the second beam 104, the folding result will be optimal since e.g. the folding radius can be held more or less constant during the folding operation.

[0055] Fig. 7 illustrates a folding operation when a folding machine comprises both a first eccentric 130 and a second eccentric 140 according to an embodiment of the invention.

[0056] In step I in Fig. 7, the folding machine 100 is set to a first thickness of sheet 200. Hence, the folding beam 106 is in step I aligned with a folding tool 122 of the first beam 102 and the location of the axis of rotation R (i.e. the cross) is aligned with a folding tool 124 of the second

beam 104.

[0057] In step II in Fig. 7, the axis of rotation R is raised (arrow a1) by rotating the first eccentric 130 (arrow A1) clockwise so as to adapt to a second thickness larger than the first thickness.

[0058] In step III in Fig. 7, the location of the folding beam 106 is lowered (arrow a2) to adapt to the second thickness by rotating the second eccentric 140 clockwise (arrow A2). It is to be noted that the rotation of the first 130 and second 140 eccentric can be performed sequentially as illustrated in Fig. 7 but can also be performed at the same time in a synchronised manner, e.g. depending on how the first and second actuators are controlled by control logic.

[0059] In step IV in Fig. 7, the second beam 104 is raised (arrow A3) to accommodate the thicker sheet before clamping.

[0060] In step V in Fig. 7, the supporting shaft 108 together with coupling means 116 rotates (arrow A4) the folding beam 106 anticlockwise around the axis of rotation R so as to fold the sheet. At the same time the second eccentric 140 (arrow A5) and the supporting shaft 108 rotate anticlockwise in a controlled manner so that the folding radius is more or less held constant during the folding operation. One solution is to lock the supporting shaft 108 with the second eccentric 140 during the rotation which means that the supporting shaft 108 and the second eccentric 140 will rotate synchronously with each other in the first eccentric 130. Since the axis of rotation R is aligned with the folding tool 124 of the second beam 104 and the folding tool 112 of the folding beam 106 is aligned with the folding tool 122 of the first beam 102, the folding result will be optimal.

[0061] Finally, it should be understood that the invention is not limited to the embodiments described above, but also relates to and incorporates all embodiments within the scope of the appended independent claims.

Claims

1. A folding machine (100) for folding sheet shaped material, the folding machine (100) comprising:

a first beam (102) arranged to support sheet shaped material (200) during a folding operation;

a second beam (104) arranged to clamp the sheet shaped material (200) against the first beam (102) during the folding operation;

a folding beam (106) arranged to rotate around an axis of rotation (R) during the folding operation so as to fold the sheet shaped material (200) against the first beam (102) or the second beam (104); **characterised in that** further comprising a first eccentric (130) coupled to the folding beam (106) and arranged to change a location of the axis of rotation (R) of the folding beam

(106).

2. The folding machine (100) according to claim 1, wherein the first eccentric (130) is arranged to change the location of the axis of rotation (R) in relation to the first beam (102).
3. The folding machine (100) according to claim 2, wherein the first eccentric (130) is arranged to change the location of the axis of rotation (R) in relation to the first beam (102) in a direction which is perpendicular to a plane (P) of the first beam (102), wherein the plane (P) of the first beam (102) is arranged to support the sheet shaped material (200) during the folding operation.
4. The folding machine (100) according to claim 3, wherein the first eccentric (130) is arranged to change the location of the axis of rotation (R) so that the axis of rotation (R) is aligned with a folding tool (124) of the second beam (104).
5. The folding machine (100) according to any one of the preceding claims, comprising a first actuator (132) arranged to rotate the first eccentric (130) so as to change the location of the axis of rotation (R).
6. The folding machine (100) according to any one of the preceding claims, comprising a second eccentric (140) coupled to the folding beam (106), wherein the second eccentric (140) is arranged to change a location of the folding beam (106) in relation to the first beam (102) so as to adapt to a thickness of the sheet shaped material (200) during the folding operation.
7. The folding machine (100) according to claim 6, wherein the second eccentric (140) is arranged to change the location of the folding beam (106) in relation to the first beam (102) in a direction which is perpendicular to a plane (P) of the first beam (102), wherein the plane (P) of the first beam (102) is arranged to support the sheet shaped material (200) during the folding operation.
8. The folding machine (100) according to claim 7, wherein the second eccentric (140) is arranged to change the location of the folding beam (106) so that a folding tool (112) of the folding beam (106) is aligned with a folding tool (122) of the first beam (102).
9. The folding machine (100) according to any one of claims 6 to 8, comprising a second actuator (142) arranged to rotate the second eccentric (140) so as to change the location of the folding beam (106).
10. The folding machine (100) according to any one of

claims 6 to 9, wherein the second eccentric (140) is rotatably arranged inside the first eccentric (130), or vice versa.

11. The folding machine (100) according to any one of the preceding claims, wherein the first eccentric (130) and/or the second eccentric (140) is coupled to the folding beam (106) by means of a supporting shaft (108) extending in parallel to the axis of rotation (R). 5 10
12. The folding machine (100) according to claim 11, wherein a centre axis of the supporting shaft (108) is arranged with an offset in relation to the axis of rotation (R). 15
13. The folding machine (100) according to claim 11 or 12, wherein the supporting shaft (108) extends through the first eccentric (130) and/or the second eccentric (140) and being journalled and supported herein. 20
14. The folding machine (100) according to claim 12 or 13, wherein the supporting shaft (108) is attached to the folding beam (106) by means of a supporting arm (110) extending perpendicularly from the supporting shaft (108) and parallel to an extension of a main body (120) of the folding beam (106). 25
15. The folding machine (100) according to claim 14, wherein the supporting shaft (108) is attached to the folding beam (106) via coupling means (116). 30

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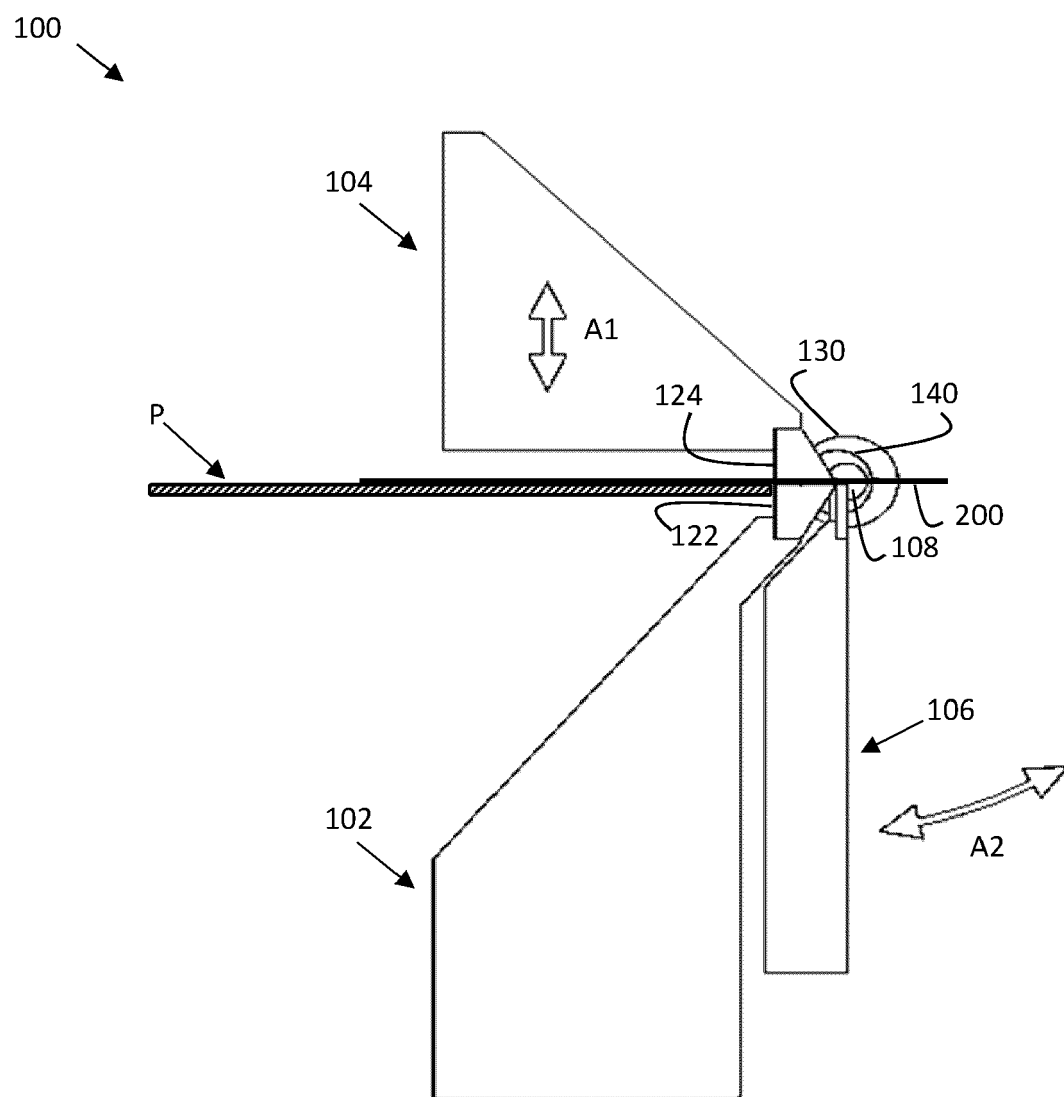


Fig. 1

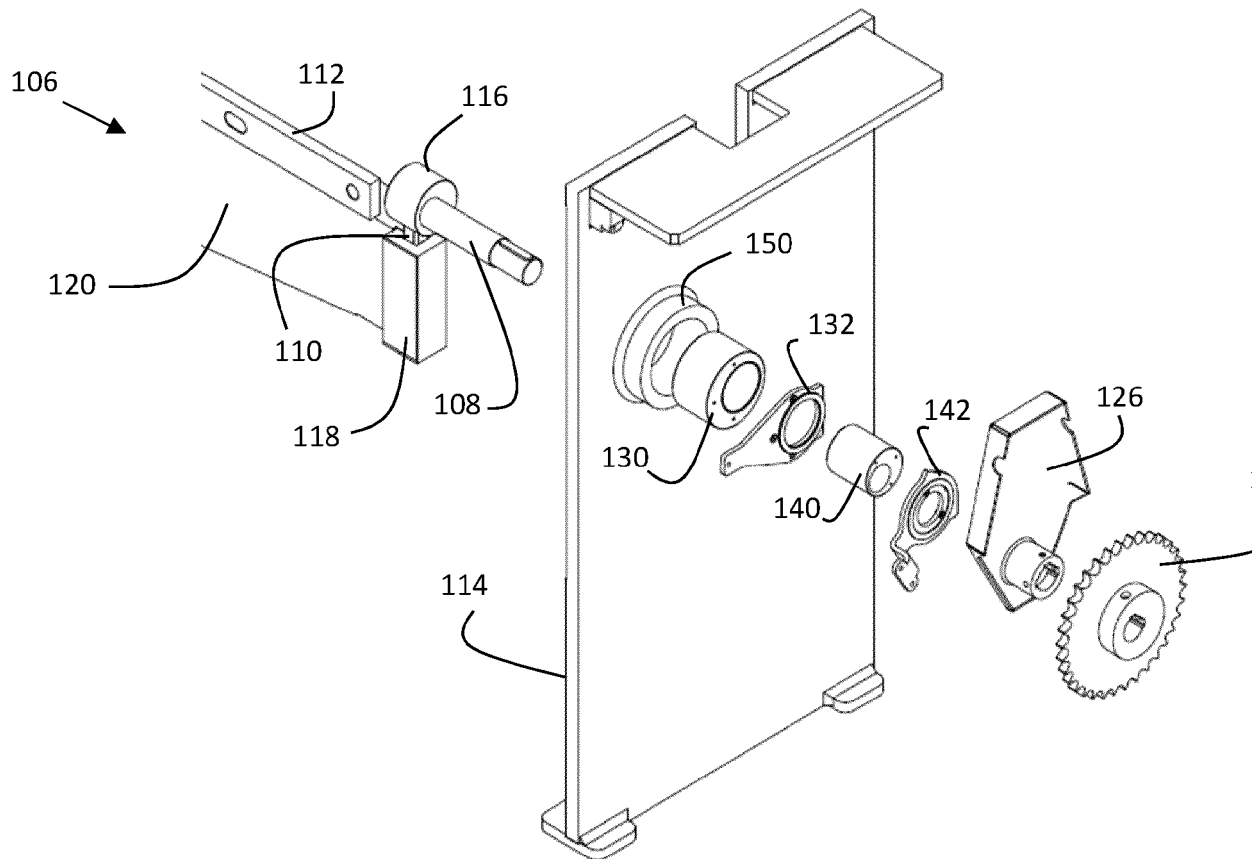


Fig. 2

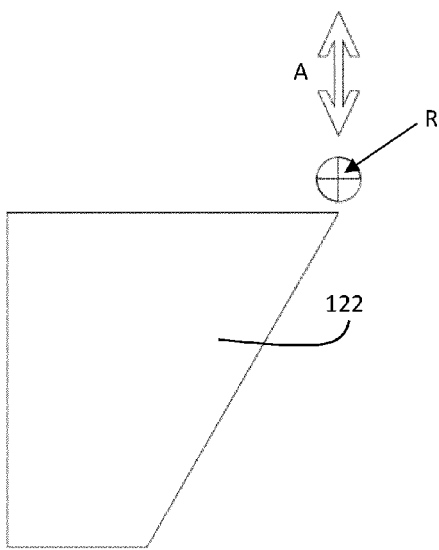


Fig. 3

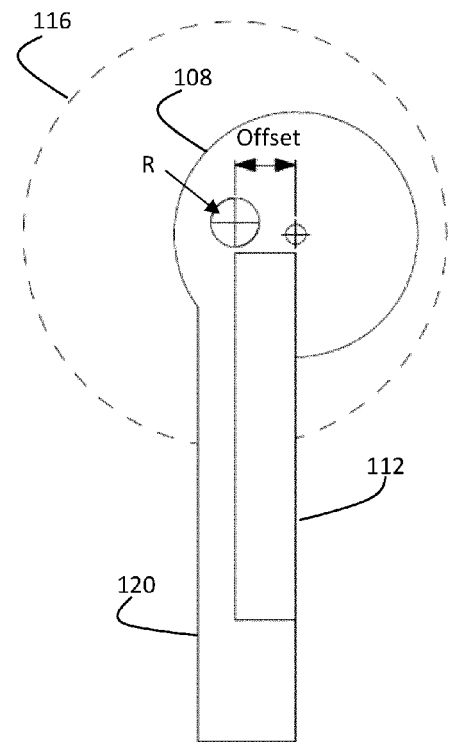


Fig. 4

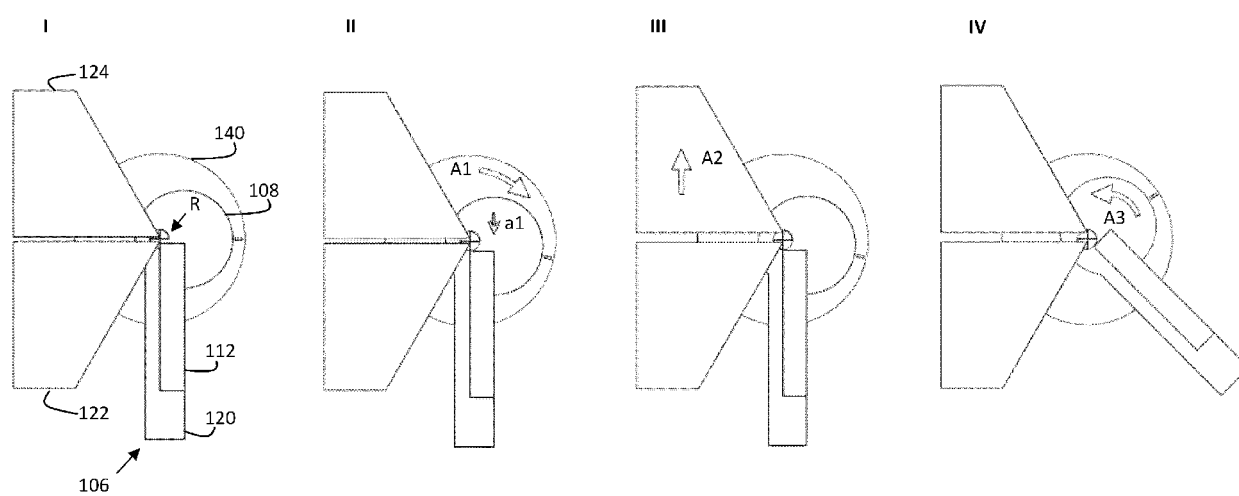


Fig. 5

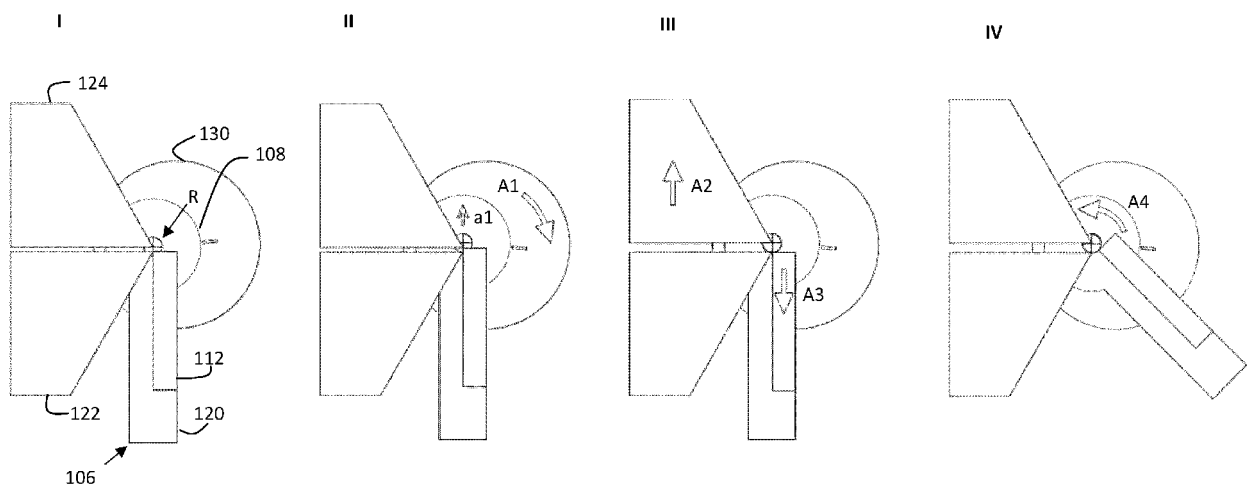


Fig. 6

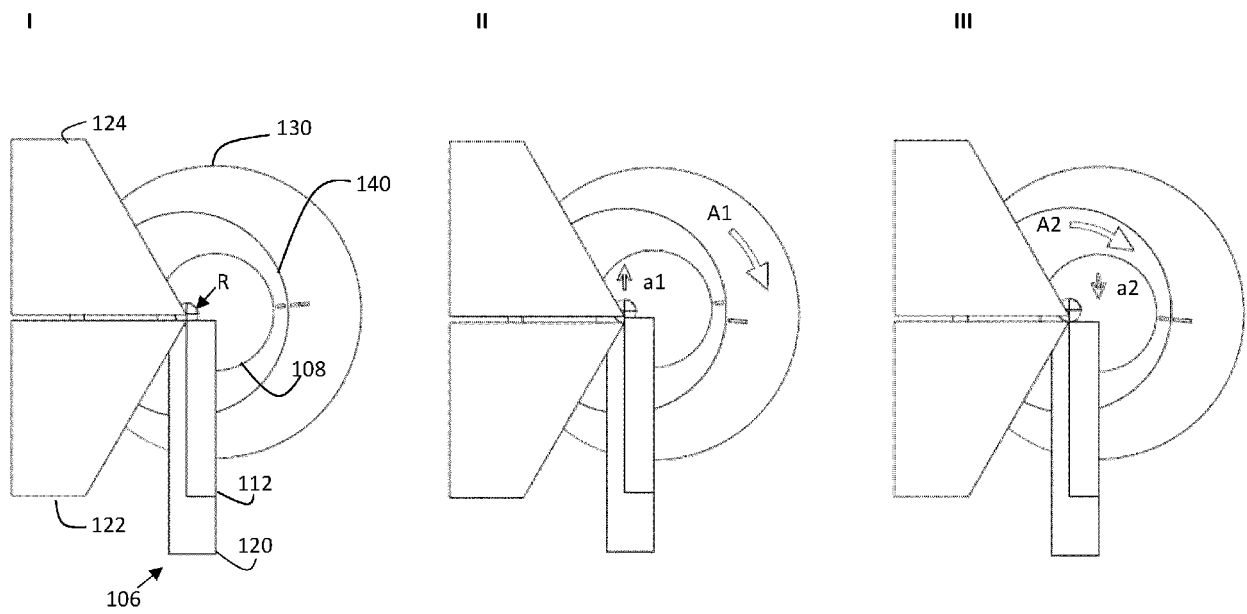


Fig. 7

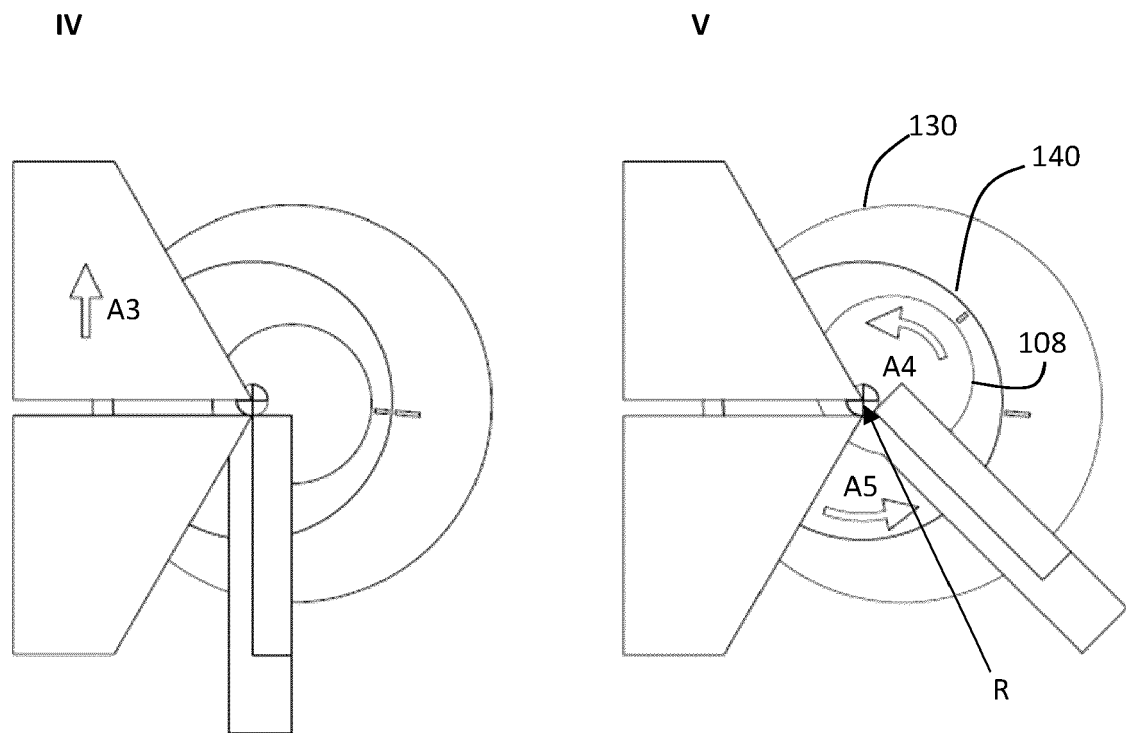


Fig. 7



EUROPEAN SEARCH REPORT

 Application Number
EP 20 20 0597

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 5 842 369 A (KUTSCHKER WOLFGANG [DE]) 1 December 1998 (1998-12-01) * claims 1-3, 7 * * column 2, lines 11-18, 24-53 * * figures 2-5 *	1-9, 11-15 10	INV. B21D5/04
X A	EP 1 649 946 A1 (HANS SCHROEDER MASCHINEBAU GMB [DE]) 26 April 2006 (2006-04-26) * claim 1 * * paragraph [0013] * * figures 1-4 *	1 2-15	
X A	US 2014/090442 A1 (KUNZE WOLFGANG [AT] ET AL) 3 April 2014 (2014-04-03) * claims 1, 2, 7-9, 13-15 * * figures 1, 2 *	1 2-15	
X A	JP H08 117868 A (AMADA CO LTD) 14 May 1996 (1996-05-14) * claim 1 * * figures 3-5, 7 *	1 2-15	TECHNICAL FIELDS SEARCHED (IPC)
X A	WO 98/01244 A1 (JEANDEAUD JEAN CLAUDE [FR]) 15 January 1998 (1998-01-15) * claim 1 * * figures 1, 2, 4, 5 *	1 2-15	B21D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 February 2021	Examiner Stanic, Franjo
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5842369 A	01-12-1998	AT 183119 T	15-08-1999
		CA 2228599 A1	20-02-1997
		DE 19529126 A1	13-02-1997
		DK 0843605 T3	06-03-2000
		EP 0843605 A1	27-05-1998
		ES 2136997 T3	01-12-1999
		JP H11510434 A	14-09-1999
		US 5842369 A	01-12-1998
		WO 9705973 A1	20-02-1997

EP 1649946 A1	26-04-2006	NONE	

US 2014090442 A1	03-04-2014	BR 102013024261 A2	31-05-2016
		CA 2826530 A1	24-03-2014
		CN 103658252 A	26-03-2014
		DK 2711102 T3	13-07-2015
		EP 2711102 A1	26-03-2014
		ES 2541603 T3	22-07-2015
		JP 6250994 B2	20-12-2017
		JP 2014065079 A	17-04-2014
		KR 20140040053 A	02-04-2014
		MY 157042 A	15-04-2016
		PL 2711102 T3	30-09-2015
		RU 2013142513 A	27-03-2015
		US 2014090442 A1	03-04-2014

JP H08117868 A	14-05-1996	JP 3295250 B2	24-06-2002
		JP H08117868 A	14-05-1996

WO 9801244 A1	15-01-1998	AT 195447 T	15-09-2000
		DE 69702860 T2	01-03-2001
		EP 0918580 A1	02-06-1999
		FR 2750625 A1	09-01-1998
		WO 9801244 A1	15-01-1998
