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(54) **Device for unfolding a flat-folded tube**

(57) A device has two drive members rotatable on concentric axes of rotation (5), of which drive members a first drive member (7) is formed by first discs (11) and the second drive member (9) is formed by larger, second disc (13). The apparatus further has six guide bodies (17) which are each with a first end piece (21) at a first pivot point (25) pivotably connected to the discs (11) and are at the other end piece (23) provided with a suction cup (27) for the gripping of a flat-folded box. Between the two

end pieces, the guide members are slidable in a guide element (29) that a second pivot point (31) is pivotally connected to the second drive member.

To let the suction cups make the desired movement, the second pivot points (31) are at a greater distance from the rotational axes (5) than the first pivot points (25) the first drive body (7) is driven twice as fast as the second drive member (9).

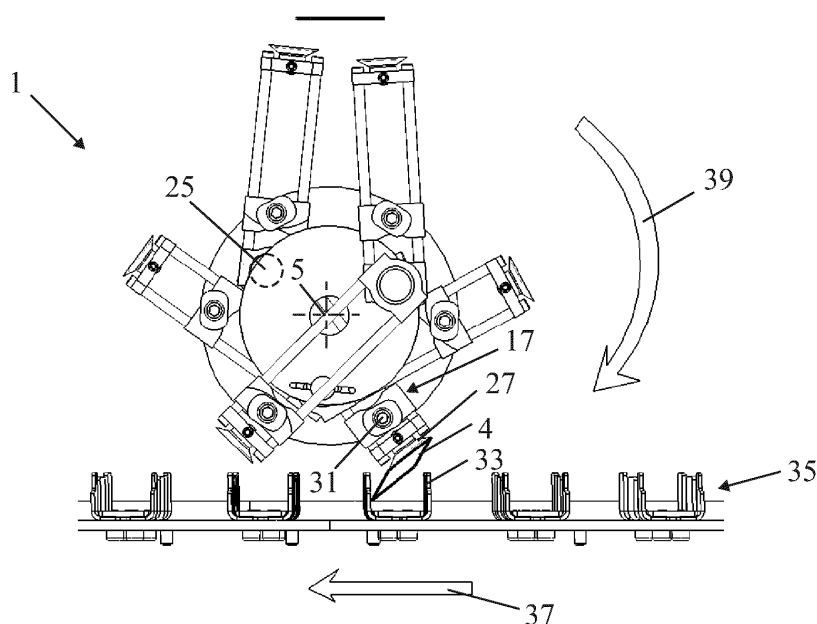


FIG. 7

Description

Field of the invention

[0001] The invention relates to a device for folding open a plate to a tube that is flat-folded to this plate, wherein the plate is gripped and moved to an output position and thereby is folded open.

State of the art

[0002] Such a device is known from DE 29 13 351 A1. In this device boxes folded into a plate are folded open by applying a folding edge of the plate against a stop and pushing against an opposite folding edge in such a way that the plate is unfolded into a tube which forms the side walls of a box. Pushing against a folding edge of the plate is done here by carriers which are pivotally connected to an endless chain which runs over two chain wheels. The plates are hereby slit one by one of a stack and pushed along a guide track to the stop by the carriers.

Summary of the invention

[0003] It is an object of the present invention to provide a device for unfolding a tube which is folded into a flat plate in which a large number of tubes can be folded in a short time and the risk of damage of the tubes is small. To this end, the device according to the invention is characterized in that the device comprises two drive members rotatable on concentric rotation shafts, as well as a guide body pivotally connected with a first end to a first of the drive members at a first pivot point is pivotally connected and the other second end is provided with gripping means and between both ends is slidable in a guide element, said guide element is pivotally connected to the second drive member at a second pivot point, wherein the second pivot point is present at a greater distance to the axes of rotation than the first pivot point, and wherein the first drive member during operation is rotated at a higher speed than the second drive member in such a way that, if the second pivot point is near the input position the first pivot point is also near the input position so that the gripping means present at the second end can take a plate from the input position above or next to the device and that if the second pivot point is at the output position the gripping means can put the plate in a holder on a transport device, wherein the speed of conveyance of the holder is smaller than the speed of movement of the second end, and by this speed difference, the plate is pressed open into a tube. By making use of rotary drive members and slidable guide bodies high movement speeds can be realized in a controlled and simple manner. With the construction of the device according to the invention the gripping of the pre-cut plate and the folding open into a tube takes place gradually so the risk of damage of the tube is small.

[0004] Preferably, during operation, the rotational

speed of the first drive member, is double or triple of that of the second drive member. If the output position is below the device, the input position is above the device in case the first drive member rotates twice as fast as the second drive body. In case the first drive member rotates three times as fast as the second drive member the input position should be located next to the device at the left or right.

[0005] A favorable embodiment of the device according to the invention is characterized in that the drive members are formed by circular discs which are present at a distance from each other, wherein the diameter of the second driving body is greater than that of the first drive member.

[0006] A further favorable embodiment of the device according to the invention is characterized in that the guide body is present between the two drive members.

[0007] Yet a further advantageous embodiment of the device according to the invention is characterized in that the guide body comprises two parallel spaced guide rods, as well as two end pieces which connect the ends of the two guide rods with each other, whereby on one of the end pieces, the first pivot point is present and the gripping means are connected to the other end piece.

[0008] Preferably, the gripping means formed by a suction cup.

[0009] In order to increase the processing number is a further embodiment of the device according to the invention is characterized in the device in addition to the guide body comprises a further guide body which with one end is pivotally connected at the first pivot point or a further first pivot point to the first drive body, and that the device in addition to said guide element comprises a further guide element that is pivotally connected at a further second pivot point to the second drive member.

[0010] Yet a further embodiment of the device according to the invention is characterized in that the further guide body is pivotally connected to the first drive body at the first pivot point, and that the further second pivot point is diametrically provided opposite the second pivot point.

Brief description of the drawings

[0011] The invention will be further elucidated below on the basis of drawings. These drawings show an embodiment of the micro gas turbine manufactured according to the method in the present invention. In the drawings:

Figure 1 shows an embodiment of the device according to the invention in a perspective view;

Figure 2 shows the apparatus in front view, short for taking from the bottom of a plate of a stack;

Figure 3 shows the apparatus during the gripping of the plate;

Figure 4 shows the apparatus shortly after the plate of the stack has been taken;

Figure 5 shows the device shortly before the unfolding of the plate;

Figure 6 shows the apparatus at the beginning of the unfolding of the plate;

Figure 7 shows the device during the folding back of the plate; and

Figure 8 shows the apparatus with almost fully open folded plate.

Detailed description of the drawings

[0012] In Figure 1, an embodiment of the device 1 according to the invention for folding open a plate 3 to a tube 4 (see Figure 8) is shown in perspective view. The device has two drive members 7 and 9 rotatable around concentric axes of rotation 5, of which a first drive member is formed by three parallel, spaced-apart concentric first discs 11 and the second drive member is formed by two parallel, spaced-apart second concentric discs 13. The axis of rotation of the first drive member is formed by a solid shaft 6, and that of the second drive member, for example, by a hollow shaft over the shaft 6, which is connected to only one of the second discs 13. The second discs 13 have a larger diameter than the first disc 11 and are located on either side of the first discs. For the sake of clarity, in the apparatus shown in Figure 1, the front second disc is omitted so that the structure behind it is more visible. The second discs 13 are connected to each other by six pins 15.

[0013] The apparatus has also six guide bodies 17, which are each formed by two parallel spaced-apart guide rods 19, and two end pieces 21 and 23 which connect the ends of the two guide rods with each other. The guide bodies 17 are each with a first one of the end pieces 21, at a first pivot point 25, pivotally connected to one of the discs 11 of the first drive member 7. At the other end piece 23 gripping means in the form of a suction cup 27 is present for gripping the flat-folded box.

[0014] Between the two end pieces 21 and 23 the guide rods 19 are slidably present in a guide element 29. These guide elements 29 are each, at a second pivot point 31, pivotally connected to the second drive member. This second pivot points 31 are formed by the pins 15. Here, the second pivot points 31 are at a greater distance from the rotational axes 5 than the first pivot points 25. The guide bodies 17 are in pairs with the first ends 21 connected to one of the first discs 11 at the same pivot point 25, wherein said end pieces 21 are located between two adjacent first discs, or between a first disk and a second disk. The guide elements 29 co-operating with said guide members are at two places diametrically opposite to each other connected to the second disks 13.

[0015] During operation, the first drive member 7 is driven twice as fast as the second drive member 9. If the second pivot point 25 is present on top near the input position of the plate (in the position shown in Figure 3, this is nearly the case), the first point of rotation 25 is also on top, so that the suction cup 27 is directed upwards

and can take away a lower plate 3 of a stack at present above the stack. In case the second pivot point 31 has made a half revolution and is down at the output position of the plate (in the position shown in Figure 8, this is nearly the case), the first pivot point 25 has made a full circle, and it is again on top. The suction cup 27 is then directed down and thus can put the plate in a holder 33 on a transport device 35. The speed of transport 37 of the holder 33 is less than the speed of movement 39 of the suction cup 27 in the lower position. Because of this speed difference, the plate 3 is transformed into a tube 4 by pushing.

[0016] In the figures 2 to 8, the device 1 is shown in front view at different stages of a cycle. Figure 2 shows the situation shortly before a plate 3 is taken from the bottom of a stack. In Figure 3 the device is shown during the gripping of the plate in which the two pivot points 25 and 31 and the rotation shafts 5 are situated in one line, and the two pivot points are located in the upper position. Figure 4 shows the situation shortly after the plate 3 is taken from the stack.

[0017] Figure 5 shows the device 1 shortly before the unfolding of the plate 3, and Figure 6 shows the situation at the start of the unfolding of the plate, in which the plate with a fold line has just contacted a holder 33 of the transport apparatus 35. In Figure 7 the situation is shown during the folding open of the plate, and in Figure 8, the situation is shown with almost fully folded open plate, in which the two pivot points 25 and 31 and the rotation axes 5 are almost present in a line again, but now with the second pivot point 31 almost in the lower position and the first pivot point 25 almost in the upper position.

[0018] Although the present invention is elucidated above on the basis of the given drawings, it should be noted that this invention is not limited whatsoever to the embodiments shown in the drawings. The invention also extends to all embodiments deviating from the embodiments shown in the drawings within the context defined by the claims. For example, the input position is not above the device but at the left or right of the device if the rotational speed of the first drive member, is not twice, but the three times of that of the second driving member.

Claims

1. Device (1) for folding open a plate (3) to a tube (4) that is flat-folded to this plate, wherein the plate is gripped and moved to an output position and thereby is folded open, which device comprises two drive members (7, 9) rotatable on concentric rotation shafts (5), as well as a guide body (17) pivotally connected with a first end to a first of the drive members (7) at a first pivot point (25) is pivotally connected and the other second end is provided with gripping means (27) and between both ends is slidable in a guide element (29), said guide element is pivotally connected to the second drive member (9) at a sec-

ond pivot point (31), wherein the second pivot point (31) is present at a greater distance to the axes of rotation (5) than the first pivot point (25), and wherein the first drive member (7) during operation is rotated at a higher speed than the second drive member (9) in such a way that, if the second pivot point (31) is near the input position the first pivot point (25) is also near the input position so that the gripping means present at the second end can take a plate (3) from the input position above or next to the device and that if the second pivot point (31) is at the output position the gripping means can put the plate (3) in a holder (33) on a transport device (35), wherein the speed of conveyance (37) of the holder is smaller than the speed of movement (39) of the second end, and by this speed difference, the plate (3) is pressed open into a tube (4).

2. Device according to claim 1, **characterized in that** during operation the speed of rotation of the first drive member (7) is double or triple of that of the second driving body (9).
3. Device according to claim 1 or 2, **characterized in that** the drive members (7, 9) are formed by circular discs (11, 13) which are present at a distance from each other, wherein the diameter of the second driving body (9) is greater than that of the first drive member (7).
4. Device according to claim 1, 2 or 3, **characterized in that** the guide body (17) is present between the two drive members (7, 9).
5. Device according to any one of the preceding claims, **characterized in that** the guide body (17) comprises two parallel spaced guide rods, as well as two end pieces (21, 23) which connect the ends of the two guide rods with each other, whereby on one of the end pieces (21), the first pivot point (25) is present and the gripping means (27) are connected to the other end piece (23).
6. Device according to any one of the preceding claims, **characterized in that** the gripping means (27) is formed by a suction cup.
7. Device according to any one of the preceding claims, **characterized in that** the device in addition to the guide body (17) comprises a further guide body which with one end is pivotally connected at the first pivot point (25) or a further first pivot point to the first drive body (7), and that the device in addition to said guide element (29) comprises a further guide element that is pivotally connected at a further second pivot point (31) to the second drive member (9).
8. Device according to claim 7, **characterized in that**

the further guide body (17) is pivotally connected to the first drive body (7) at the first pivot point (25), and that the further second pivot point (31) is diametrically provided opposite the second pivot point.

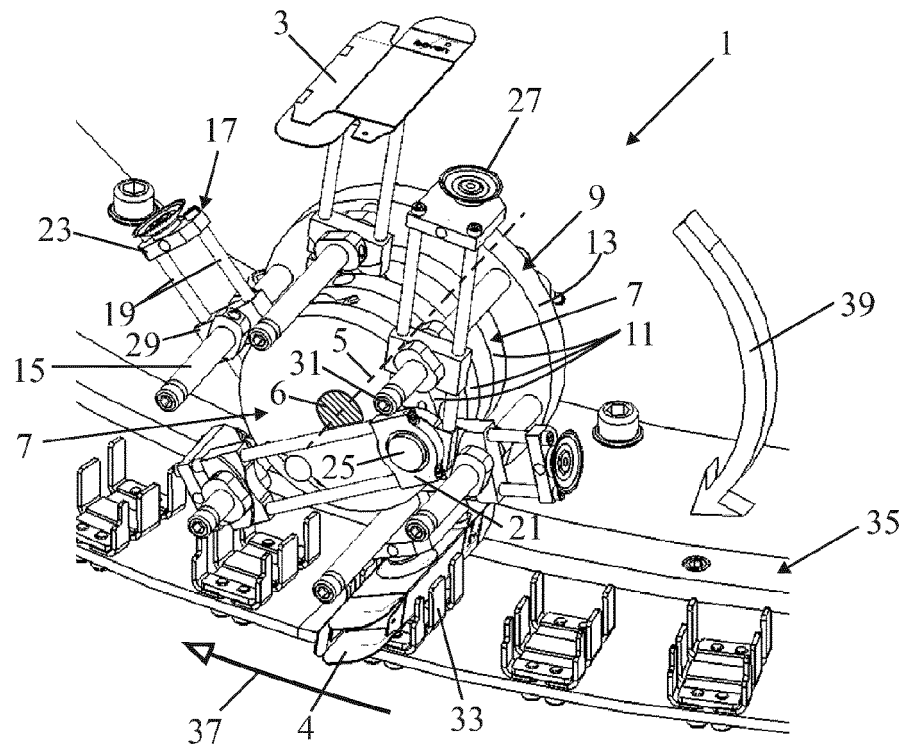


FIG. 1

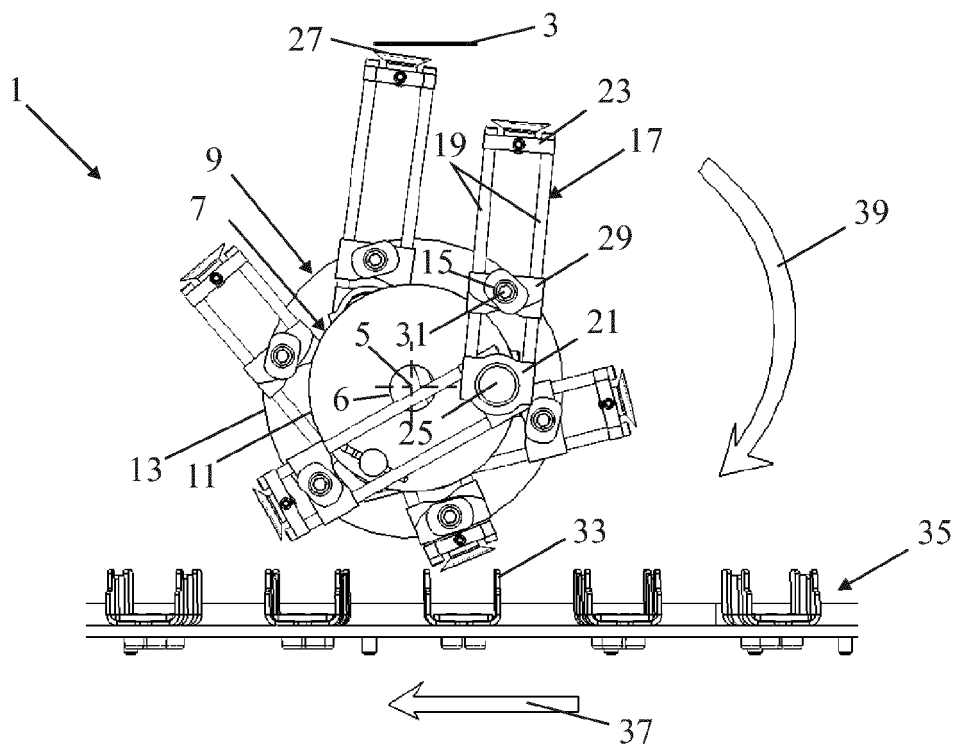


FIG. 2

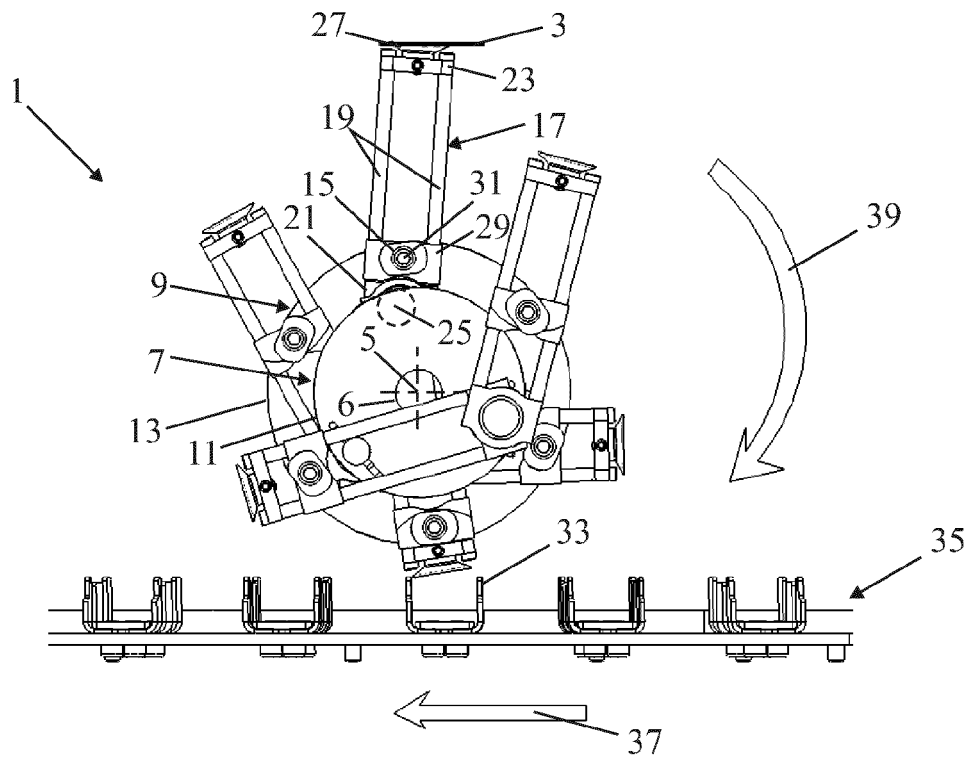


FIG. 3

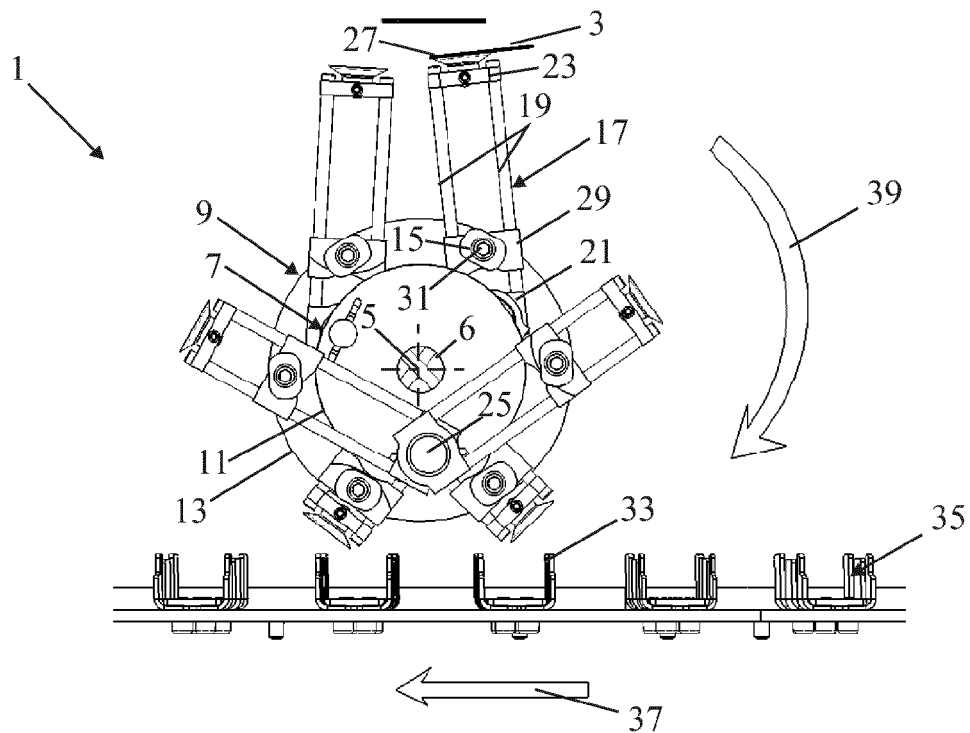


FIG. 4

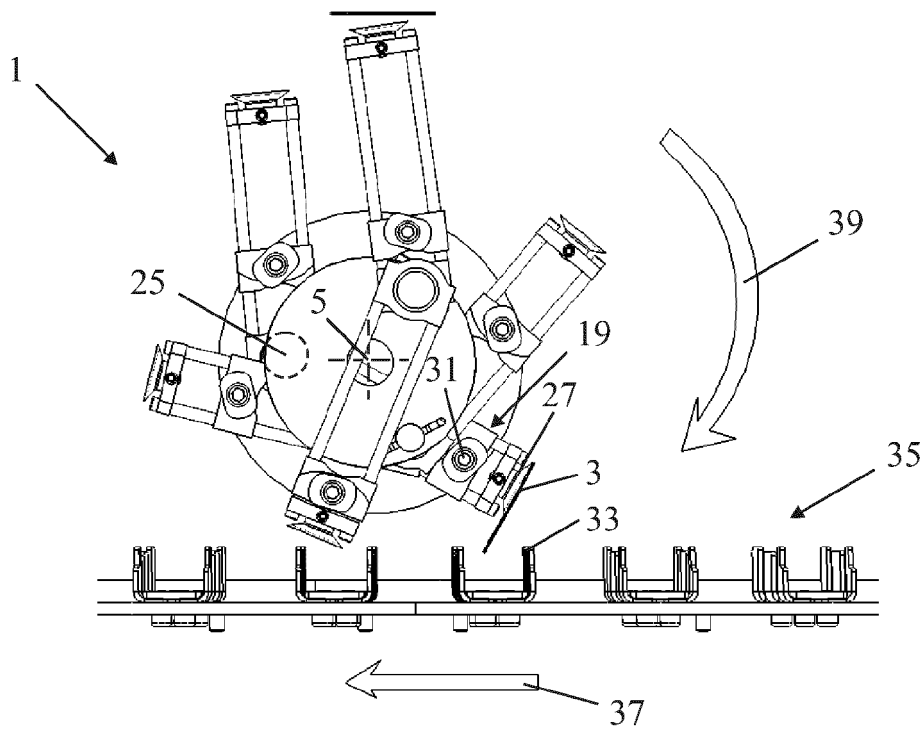


FIG. 5

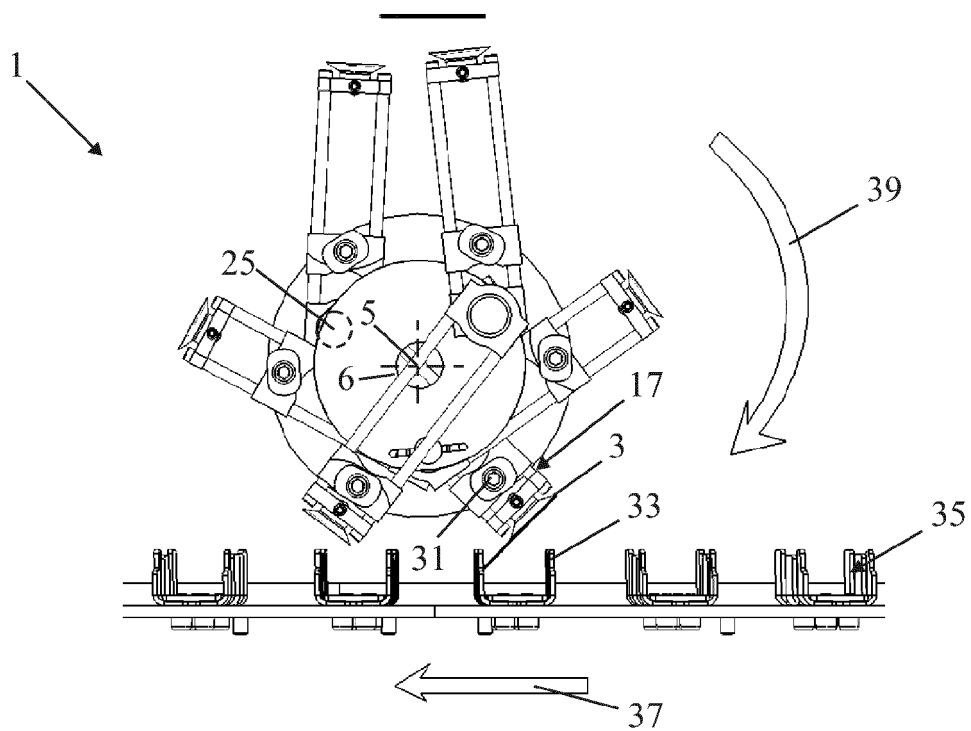


FIG. 6

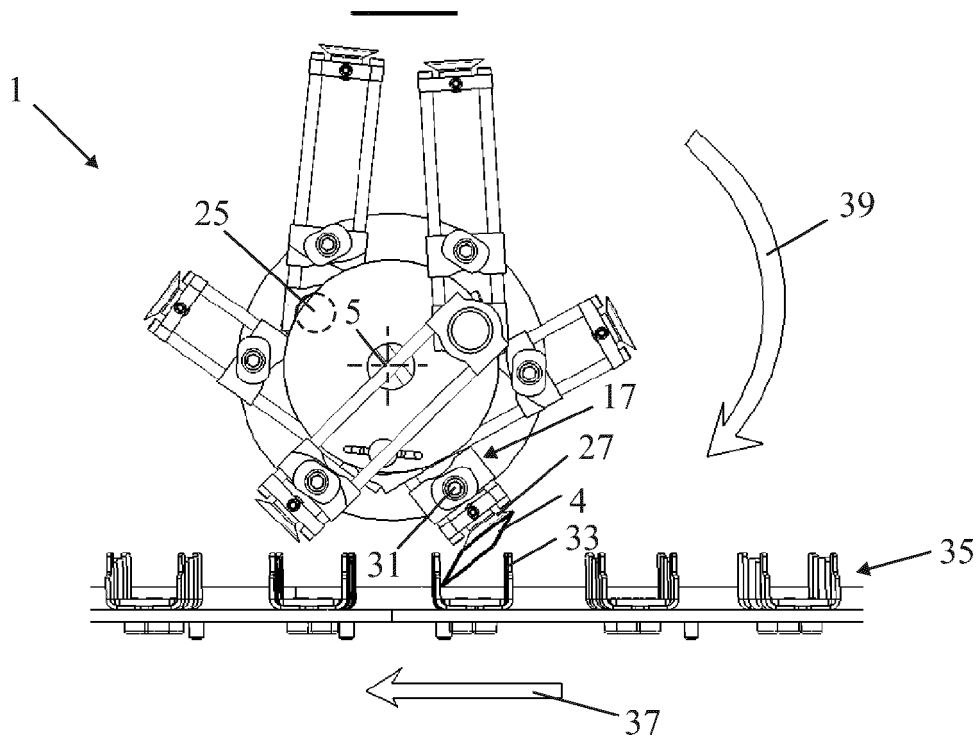


FIG. 7

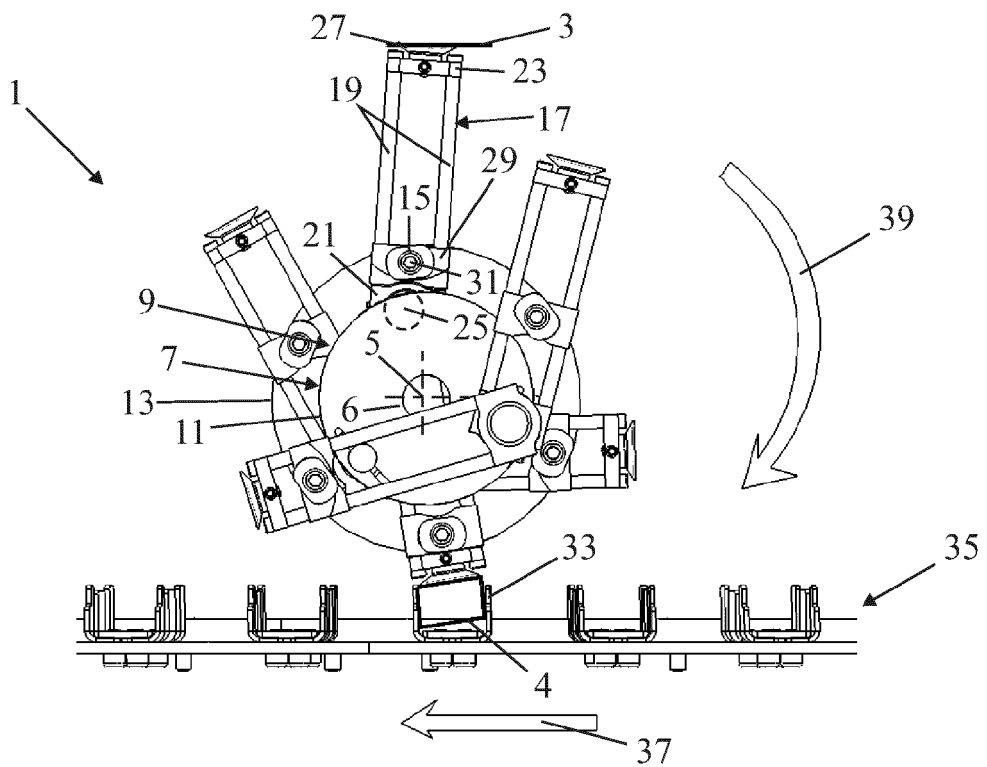


FIG. 8



EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 November 2014	Examiner Sundqvist, Stefan
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