



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.02.2017 Bulletin 2017/08

(51) Int Cl.:
B21C 37/08 (2006.01) B21D 53/30 (2006.01)

(21) Application number: **15461554.6**

(22) Date of filing: **19.08.2015**

(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

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(54) **APPARATUS FOR FORMING AUTOMATIVE WHEEL RIM BLANKS**

(57) Apparatus for forming wheel rim blanks comprising:

- a coiling station (A) for coiling blanks (20) of strip material into the form of a cylinder with the longitudinal edges (20b', 20c') of the coiled blank (20') defining a longitudinal gap, and
- a flattening press (B) for flattening longitudinal edge portions (20b', 20c') on the coiled blank (20'), wherein the flattening press includes a gripper (50) for clamping the coiled blank (20'), said gripper comprising two pair of jaws (51, 52; 53, 54), each pair of jaws (51, 52; 53, 54) being adapted to engage opposite side edges (20b1, 20b2; 20c1, 20c2) of the coiled blank (20') near to a re-

spective longitudinal edge portion (20b', 20c') of the coiled blank (20'),

wherein each pair of jaws (51, 52; 53, 54) is carried by a respective movable clamp assembly (61, 63), wherein said gripper comprises a clamping drive for moving the jaws (51, 52; 53, 54) of the respective clamp assembly (61, 63) toward each other to clamp the respective longitudinal edge portion (20b', 20c') of the coiled blank (20'), and an aligning drive for moving the clamp assemblies (61, 63) in longitudinal direction to align the longitudinal edge portions (20b', 20c') of the coiled blank (20') to each other.

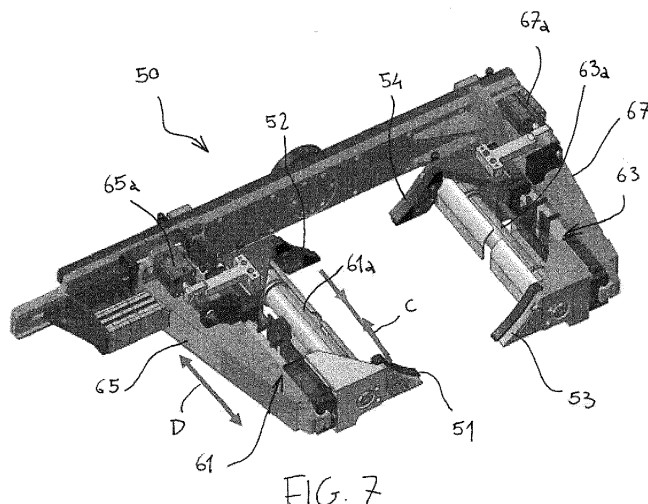


FIG. 7

Description

[0001] The present invention relates generally to the forming of cylindrical wheel rim blanks from blanks of strip material. As used herein and in the appended claims, the term "forming" includes the coiling of the initial blanks and the conditioning of the longitudinal edges of the coiled blanks in preparation for the welding thereof to form a closed cylinder.

[0002] It has been observed that the quality of welding is dependent on the quality of preparation of the blanks; in particular, it is dependent on the quality of cutting and coiling of the blanks, as well as on the geometry and uniformity of the gap between longitudinal edges of the coiled blank. Furthermore, care is to be taken to prevent the cut edges from being damaged during the forming process. With all the more reason, this applies to high-strength steels that are inherently difficult to weld.

[0003] One object of the present invention is to provide a forming apparatus that allows for a better preparation of the rim blanks, and consequently facilitates the welding thereof to form a closed cylinder.

[0004] This object is achieved according to the invention by an apparatus for forming wheel rim blanks comprising:

- a coiling station for coiling blanks of strip material into the form of a cylinder with the longitudinal edges of the coiled blank defining a longitudinal gap, and
- a flattening press for flattening longitudinal edge portions on the coiled blank, wherein said flattening press includes a gripper for clamping the coiled blank, said gripper comprising two pair of jaws, each pair of jaws being adapted to engage opposite side edges of the coiled blank near to a respective longitudinal edge portion of the coiled blank,

wherein each pair of jaws is carried by a respective movable clamp assembly, and wherein said gripper comprises a clamping drive for moving the jaws of the respective clamp assembly toward each other to clamp the respective longitudinal edge portion of the coiled blank, and an aligning drive for moving the clamp assemblies in longitudinal direction to align the longitudinal edge portions of the coiled blank to each other.

[0005] In the apparatus according to the invention, it is obtained that the clamping movement and the aligning movement are configured as separate movements. This allows for adjusting the parallelism between the longitudinal edge portions of the coiled blank and, as a consequence, better welding joints can be obtained.

[0006] Preferred embodiments of the invention are defined in the dependent claims, which are to be understood as forming an integral part of the present description.

[0007] Further characteristic features and advantages of the apparatus according to the invention will become clear from the following detailed description of an embodiment of the invention provided with reference to the

accompanying drawings and provided purely by way of a non-limiting example in which:

- Figure 1 is a schematic plan view showing a coiling station and a flattening press of an apparatus according to the invention,
- Figure 2 is a perspective view showing an entry portion of the coiling station shown in figure 1,
- Figure 3 is a schematic perspective view showing introducing rollers of the coiling station of Figure 2,
- Figure 4 is a schematic perspective view showing coiling rollers of the coiling station of Figure 2,
- Figure 5 is a perspective view showing a detail of the coiling rollers of Figure 4,
- Figure 6 is a schematic elevation view showing the flattening press shown in Figure 1,
- Figure 7 is a perspective view showing a gripper of the flattening press of Figure 6 and
- Figures 8a-8c are schematic plan views showing different operating positions of the gripper of Figure 7.

[0008] Referring first to Fig. 1, there are shown a coiling station A and a flattening press B of an apparatus for converting flat metal blanks into cylindrical rim blanks having welded seams where the edges of the flat blank are brought together to form the cylinder. The flat blanks that are fed into the apparatus are pre-cut to exactly the size required to form rim blanks having a preselected diameter and axial length. The flat blanks are fed into the apparatus along a feed table 12 leading into the coiling station A where the flat blank is coiled to form a cylindrical blank.

[0009] The coiling station A is shown in more detail in Figs. 2-5. Figs. 2 and 3 show that the coiling station A comprises a pair of upper and lower introducing rollers 13, 14 which are overlapped to each other. The two rollers 13, 14 are all driven in the direction indicated by the arrows in Fig. 3. The upper roller 13 is journaled to a fixed frame of the coiling station A. The lower roller 14 is journaled to a vertically adjustable fork support 15, which is driven by a fluidic actuator 16, such as for example a pneumatic cylinder. The introducing rollers 13, 14 are configured for catching a flat blank 20 of strip material and introducing it into the coiling station A. The fluidic actuator 16 associated to the lower introducing roller 14 is configured to urge the lower introducing roller 14 against the upper introducing roller 13 to catch the blank 20 of strip material between the introducing rollers 13, 14 when an intermediate portion 20a of the blank 20 is passing between them. On the other hand, the fluidic actuator 16 is configured to take the lower introducing roller 14 away from the upper introducing roller 13 to release the catch on the blank 20 of strip material when a front edge portion 20b or a rear edge portion 20c of the blank 20 is passing between the introducing rollers 13, 14. In this way, a reduced pressure is exerted by the introducing rollers 13, 14 on the flat blank 20 when the front edge portion 20b or rear edge portion 20b thereof

is passing between them. This can prevent the cut edges 20a, 20b from being hurt by a too high pressure exerted by the introducing rollers 13, 14.

[0010] Figs. 4 and 5 show that the coiling station A further comprises a triangular coiling arrangement including a top roller 31 and a pair of bottom rollers 32, 33. The three rollers 31-33 are all driven in the direction indicated by the arrows in Fig. 4. The two bottom rollers 32, 33 press the incoming blank upwardly against the top roller 31 with the upper surface of the second bottom roller 33 extending over the level of the lower introducing roller 14 so that it bends or coils the metal blank upwardly around the top roller 31.

[0011] The radius of curvature of the coiled blank formed at the coiling station is controlled by the vertical position of the bottom rollers 32, 33. A respective adjusting device 32a, 32b; 33a, 33b is associated to each of opposite ends of the bottom rollers 32, 33. Each adjusting device 32a, 32b; 33a, 33b comprises a vertically movable rod 34a, 34b; 35a, 35b which is translationally integral with the respective end of the respective bottom roller 32, 33, and a rotatable control member 36a, 36b; 37a, 37b for adjusting vertical position of the rod 34a, 34b; 35a, 35b. For each bottom roller 32, 33 the control members 36a, 36b; 37a, 37b of the adjusting devices 32a, 32b; 33a, 33b associated to the opposite ends of the bottom roller 32, 33 are connected to be rotationally integral with each other. Fig. 5 shows that connection between the control members 36a, 36b; 37a, 37b of opposite adjusting devices 32a, 32b; 33a, 33b can be obtained by means of connection members 36, 37, such as for example flanged shafts. The mechanical link between opposite control members prevents the respective adjustment devices from becoming misaligned during adjustment operation. Therefore, the operator can adjust the level only of the bottom rollers. As a consequence, the coiling rollers stay parallel and the quality of coiling is stable.

[0012] With reference to Fig. 1, the flattening press B is located adjacent the coiling station A so that the coiled blanks can be transferred directly from the coiling station to the press in the direction of the axis of the coiled blanks. The purpose of the flattening press is to make the longitudinal edge portions of the coiled blank symmetrical and bring them into precise alignment with each other to ensure the production of a good weld seam. An inherent result of the coiling operation is the production of asymmetrical longitudinal edge portions, i.e., a slight bend or kink is formed near the front edge of the blank, and the rear edge has an increasing radius of curvature. The flattening press removes these irregularities and produces perfectly symmetrical longitudinal edge portions so as to facilitate the subsequent welding thereof.

[0013] With reference to Figs. 6, 7 and 8a-c, the flattening press B conventionally comprises opposite dies 41, 42 which are driven against each other to flatten longitudinal edge portions 20b', 20c' on the coiled blank 20'. Here, the prime symbols (') indicate that the flat blank 20

has been converted into the cylindrical coiled blank 20' after the coiling process. The flattening press includes a gripper 50 for clamping the coiled blank 20' during the flattening process. The gripper 50 comprises two pair of jaws 51, 52; 53, 54. Each pair of jaws 51, 52; 53, 54 is adapted to engage opposite side edges 20b1, 20b2; 20c1, 20c2 of the coiled blank 20' near to a respective longitudinal edge portion 20b', 20c' of the coiled blank 20'.

[0014] Each pair of jaws 51, 52; 53, 54 is carried by a respective clamp assembly 61, 63. The gripper 50 comprises a clamping drive for moving the jaws 51, 52; 53, 54 of the respective clamp assembly 61, 63 toward each other to clamp the respective longitudinal edge portion 20b', 20c' of the coiled blank 20'. The movement directions of the jaws 51, 52; 53, 54 are indicated by the arrows C in Fig. 7. The clamping drive can comprise a respective fluidic deformable actuator 61a, 63a installed on each clamp assembly 61, 63, wherein the deformable actuator includes a hollow deformable cylinder which increases in diameter and contracts in length when filled with fluid. Such a deformable actuator can be for example the so-called "Fluidic muscle" produced by Festo AG & CO KG.

[0015] The gripper 50 further comprises an aligning drive for moving the clamp assemblies 61, 63 in longitudinal direction to align the longitudinal edge portions 20b', 20c' of the coiled blank 20' to each other. For this purpose, each clamp assembly 61, 63 is mounted for translation on a respective support arm 65, 67 of a support frame of the gripper 50. The movement directions of the clamp assemblies 61, 63 are indicated by the arrows D in Fig. 7. The aligning drive can comprise a respective fluidic cylinder actuator 65a, 67a, such as a pneumatic cylinder, installed on each support arm 65, 67. In operation, the fluidic actuators 65a, 67a are depressurized to allow free longitudinal movement of the clamp assemblies 61, 63 when the jaws 51, 52; 53, 54 of the respective clamp assembly 61, 63 are moving toward each other to clamp the respective longitudinal edge portions 20b', 20c' of the coiled blank 20'.

[0016] Therefore, the gripper 50 is provided with a floating mechanism which aligns itself to the current position of the coiled blank 20' before actuating the alignment of the longitudinal edges 20b', 20c'.

[0017] First, when the coiled blank 20' is positioned on the flattening press B, the deformable actuators 61a, 63a of the gripper 50 are used to clamp the coiled blank 20' (Figs. 8a-8b). It is important that, although jaws 51, 52; 53, 54 are brought together (clamped) the respective clamp assemblies 61, 63 are free to move as cylinder actuator 65a, 67a are not pressurized. At this stage, the gripper 50 align itself to the position of the coiled blank 20', so if any defect - misalignment - is created in the coiling process it will be repeated at this movement stage by the gripper 50. Then the dies 41, 42 are driven against each other to flatten the longitudinal edge portions 20b', 20c' of the coiled blank 20'.

[0018] After flattening press B releases the coiled blank 20', the cylinder actuators 65a, 67a are pressurized to

align the clamp assemblies 61, 63 and thus longitudinal edge portions 20b', 20c' of the coiled blank 20' against respective mechanical stops 68, 69 (one of which is regulated by an operator to adjust alignment).

[0019] In view of the above, as the clamping and aligning movements are separated parallel longitudinal edges 20b', 20c' can be obtained after their position is found by the system. This is opposite to conventional grippers performing both actions in one motion, which can lead to imprecisions.

Claims

1. Apparatus for forming wheel rim blanks comprising:
 - a coiling station (A) for coiling blanks (20) of strip material into the form of a cylinder with the longitudinal edges (20b', 20c') of the coiled blank (20') defining a longitudinal gap, and
 - a flattening press (B) for flattening longitudinal edge portions (20b', 20c') on the coiled blank (20'), wherein said flattening press includes a gripper (50) for clamping the coiled blank (20'), said gripper comprising two pair of jaws (51, 52; 53, 54), each pair of jaws (51, 52; 53, 54) being adapted to engage opposite side edges (20b1, 20b2; 20c1, 20c2) of the coiled blank (20') near to a respective longitudinal edge portion (20b', 20c') of the coiled blank (20'), said apparatus being **characterized in that** each pair of jaws (51, 52; 53, 54) is carried by a respective movable clamp assembly (61, 63), wherein said gripper comprises a clamping drive for moving the jaws (51, 52; 53, 54) of the respective clamp assembly (61, 63) toward each other to clamp the respective longitudinal edge portion (20b', 20c') of the coiled blank (20'), and an aligning drive for moving the clamp assemblies (61, 63) in longitudinal direction to align the longitudinal edge portions (20b', 20c') of the coiled blank (20') to each other.
2. Apparatus according to claim 1, wherein the aligning drive is configured to allow free longitudinal movement of the clamp assemblies (61, 63) when the respective jaws (51, 52; 53, 54) are moving toward each other to clamp the respective longitudinal edge portions (20b', 20c') of the coiled blank (20').
3. Apparatus according to claim 2, wherein the aligning drive comprises a respective fluidic cylinder actuator (65a, 67a) associated to each clamp assembly (61, 63), said fluidic actuator being depressurized when the jaws (51, 52; 53, 54) of the respective clamp assembly (61, 63) are moving toward each other to clamp the respective longitudinal edge portions (20b', 20c') of the coiled blank (20c').
4. Apparatus according to any of the preceding claims, wherein the aligning drive comprises a mechanical stop (68, 69) associated to each clamp assembly (61, 63), said mechanical stops defining adjustable aligning positions for the clamp assemblies (61, 63).
5. Apparatus according to any of the preceding claims, wherein the clamping drive comprises a respective fluidic deformable actuator (61a, 63a) associated to each clamp assembly (61, 63), the deformable actuator (61a, 63a) including a hollow deformable cylinder which increases in diameter and contracts in length when filled with fluid.
6. Apparatus according to any of the preceding claims, wherein the coiling station (A) comprises a pair of introducing rollers (13, 14) which are overlapped to each other for catching a blank (20) of strip material and introducing it into the coiling station (A), and a fluidic actuator (16) associated to one of the introducing rollers (14) and configured to urge the associated introducing roller (14) against the other introducing roller (13) to catch the blank (20) of strip material between the introducing rollers (13, 14) when an intermediate portion (20a) of the blank (20) is passing between them, and to take the associated introducing roller (14) away from the other introducing roller (13) to release the catch on the blank (20) of strip material when a front edge portion (20b) or a rear edge portion (20c) of the blank (20) is passing between the introducing rollers (13, 14).
7. Apparatus according to any of the preceding claims, wherein the coiling station (A) comprises a triangular coiling arrangement including a top roller (31) and a pair of bottom rollers (32, 33), and a respective adjusting device (32a, 32b; 33a, 33b) associated to each of opposite ends of the bottom rollers (32, 33), each adjusting device (32a, 32b; 33a, 33b) comprising a vertically movable rod (34a, 34b; 35a, 35b) which is translationally integral with the respective end of the respective bottom roller (32, 33), and a rotatable control member (36a, 36b; 37a, 37b) for adjusting vertical position of the rod (34a, 34b; 35a, 35b), and wherein for each bottom roller (32, 33) the control members (36a, 36b; 37a, 37b) of the adjusting devices (32a, 32b; 33a, 33b) associated to the opposite ends of the bottom roller (32, 33) are connected to be rotationally integral with each other.

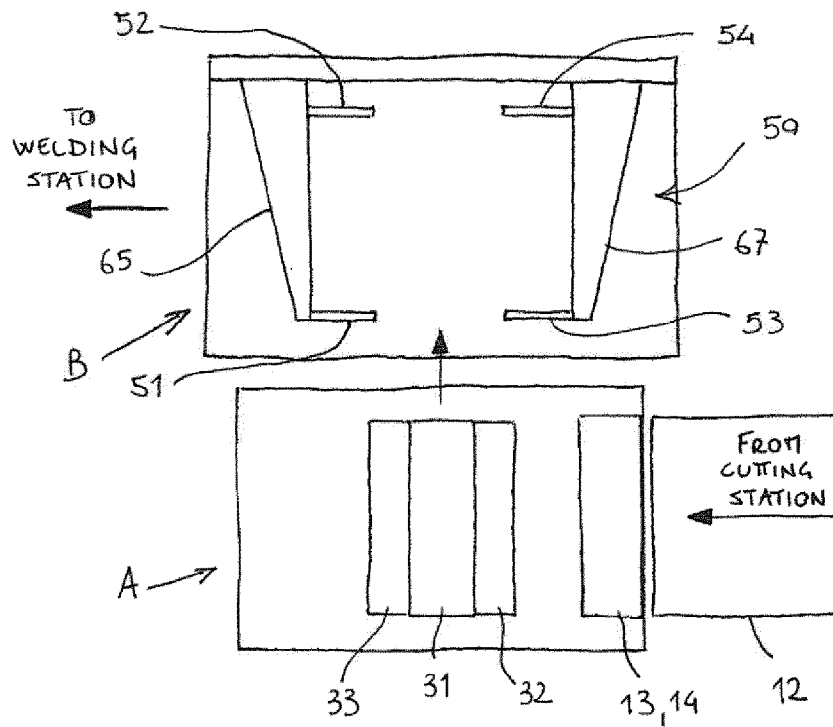


FIG. 1

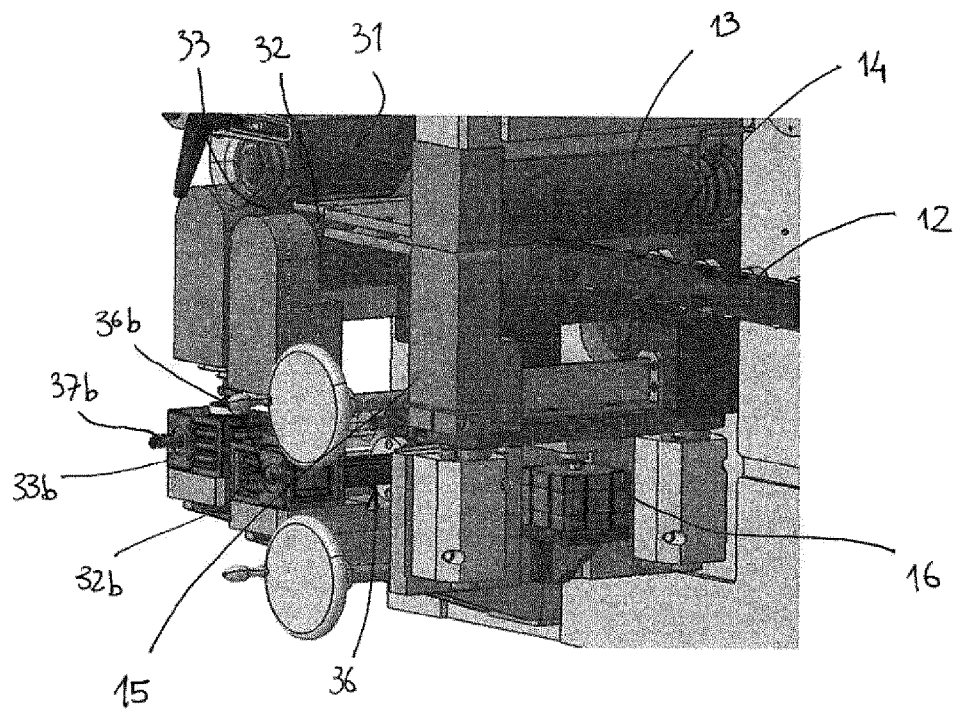


FIG. 2

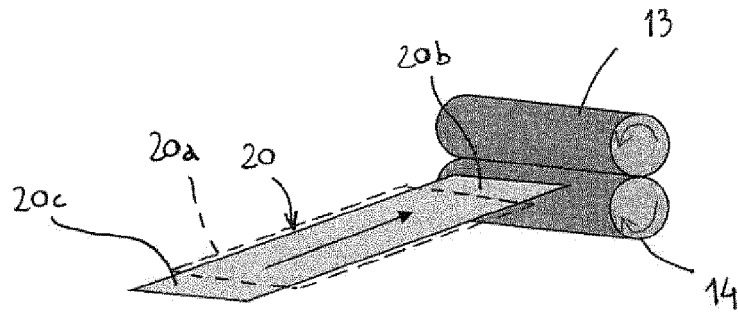


FIG. 3

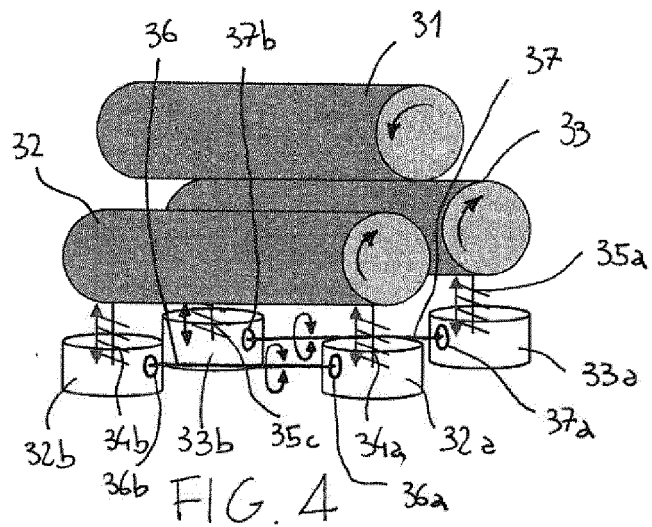


FIG. 4

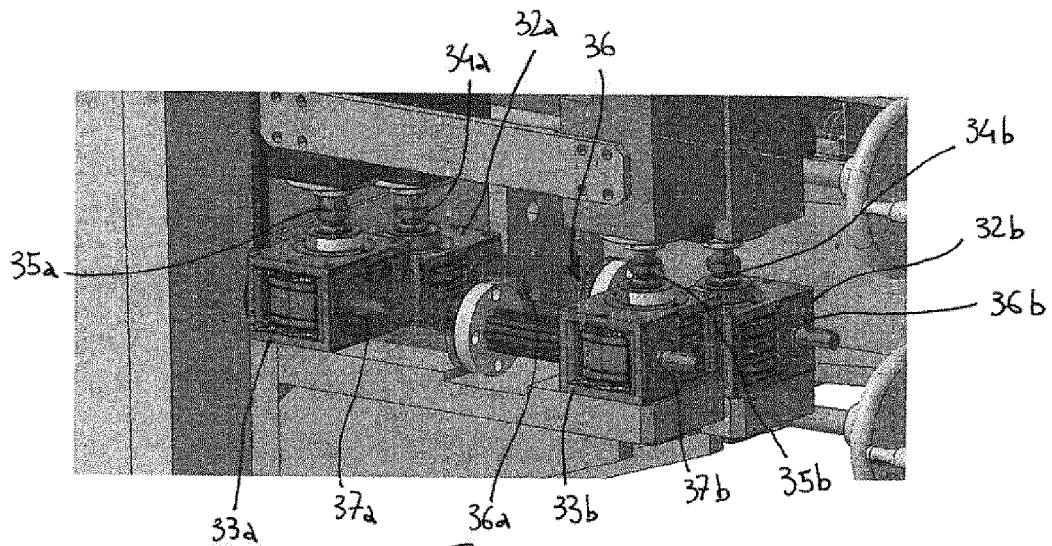


FIG. 5

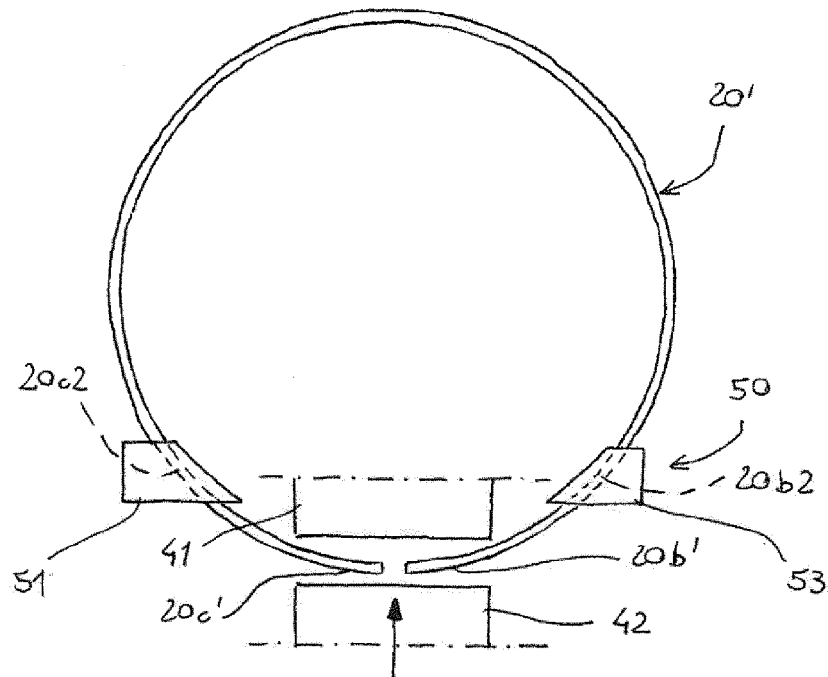


FIG. 6

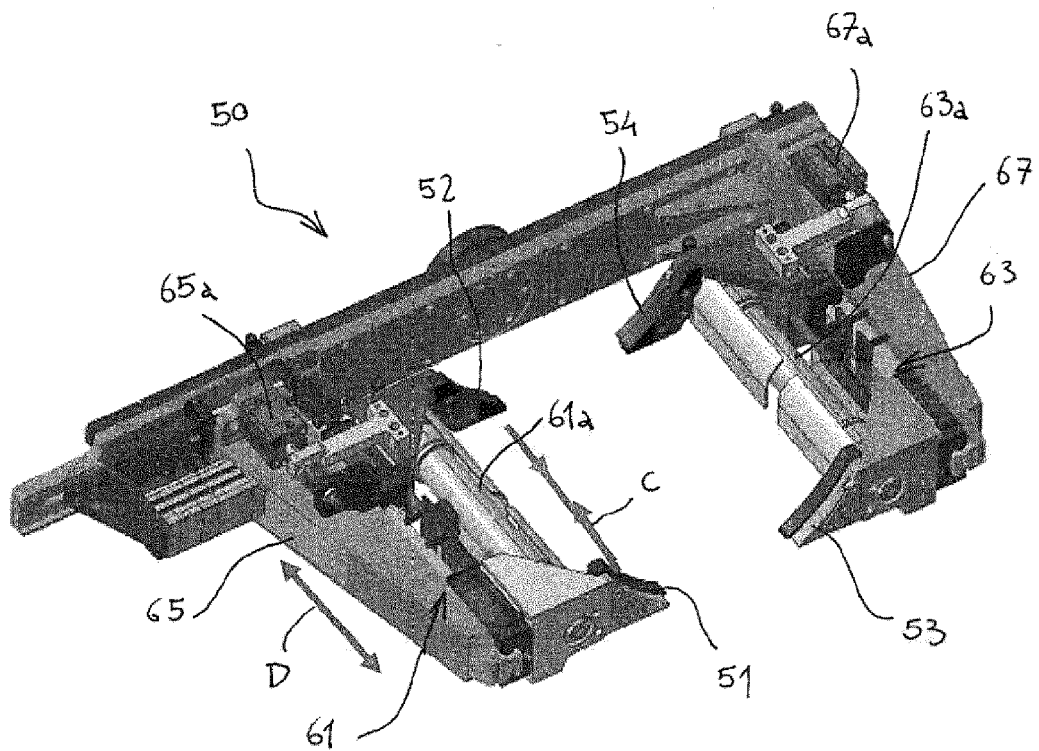


FIG. 7

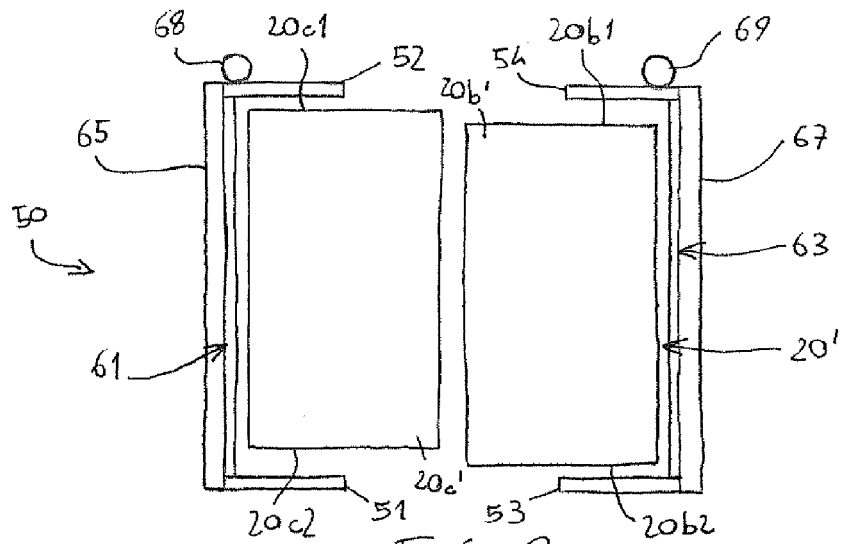


FIG. 8a

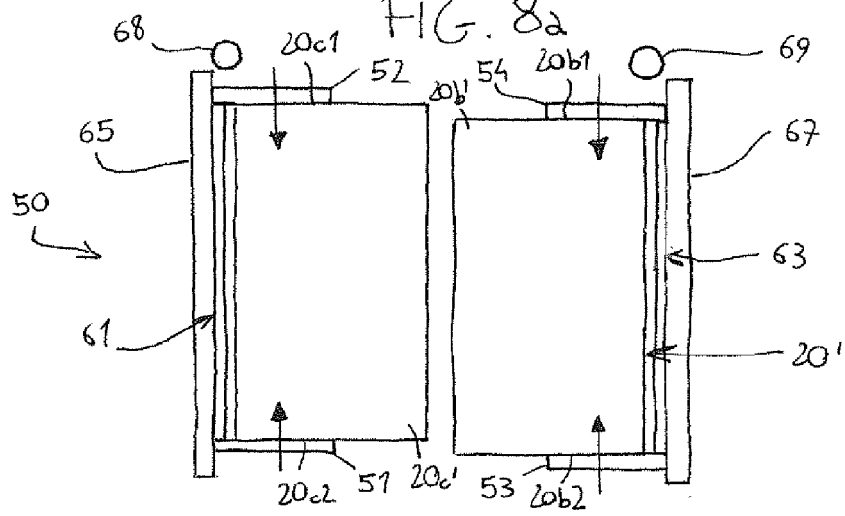


FIG. 8b

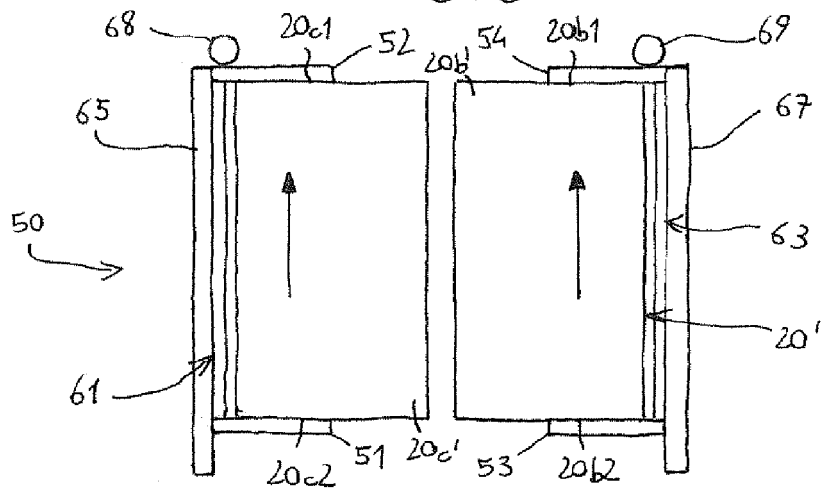


FIG. 8c



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Application Number
EP 15 46 1554

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Place of search Munich		Date of completion of the search 29 January 2016	Examiner Vinci, Vincenzo
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