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(71) Applicant: **GDM S.P.A.** [IT/IT]; Via Battindarno, 91,  
40133 Bologna (IT).

(72) Inventors: **TORDINI, Federico**; Via G.B. Moroni, 1,  
24066 Pedrengo (BG) (IT). **PALLAVERA, Massimo**;  
Cascina Novella Località Zerbi, 26015 Soresina (CR) (IT).  
**ROSANI, Marco**; Via Marcel Proust, 7, 26019 Vailate (CR)  
(IT). **PIANTONI, Matteo**; Via Cà Bianca, 2/e, 24021 Al-  
bino (BG) (IT).

(74) Agent: **MACCAGNAN, Matteo et al.**; c/o STUDIO TOR-  
TA S.p.A., Via Viotti, 9, 10121 Torino (IT).

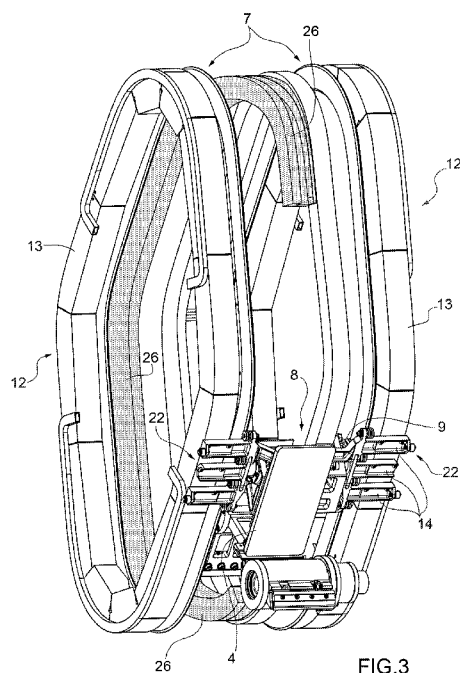
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(54) Title: UNIT TO FEED COMPONENTS IN AN AUTOMATIC MANUFACTURING MACHINE



(57) Abstract: A feeding unit (1) to feed a component (2) in an automatic manufacturing machine; the feeding unit (1) has: at least one holding head (4), which is designed to receive and hold the component (2); a conveyor (5) to cyclically move the holding head (4) along an application path (P); and a rotation station (S3), which is arranged along the feeding path (P) and in which the holding head (4) rotates relative to the equipment (8) and around a rotation axis (R1) so as to vary the orientation of the component (2). The conveyor (5) has: a closed curve guide (7), which is arranged in a fixed position along the application path (P); and an equipment (8), which supports the holding head (4) and is provided with at least one slide (9), which is coupled to the guide (7) so as to freely slide along the guide (7). An actuation system (25) is provided, which controls the rotation of the holding head (4) around the first rotation axis (R1) and has: a cam (26), which is arranged in a fixed position beside the guide (8) and along the application path (P); and a cam follower roller (27), which can be coupled to the cam (26) and is mechanically connected to the holding head (4).



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**Unit to feed components in an automatic manufacturing  
machine**

5 CROSS-REFERENCE TO RELATED APPLICATIONS

This patent application claims priority from Italian patent application no. 102018000002272 filed on 31/1/2018, the entire disclosure of which is incorporated herein by reference.

10 TECHNICAL FIELD

The invention relates to a unit to feed components in an automatic manufacturing machine.

This invention finds advantageous application in the feeding of components in an automatic manufacturing machine to  
15 manufacture hygiene absorbent articles, to which explicit reference will be made in the description below without loosing in generality.

PRIOR ART

A known manufacturing machine to manufacture hygiene  
20 absorbent articles comprises a moving line for a continuous band of impermeable material (e.g. polyethylene), along which there are arranged a plurality of operating units, which feed the band, in a continuous manner, with the base components (such as, for example, the absorbent padding or  
25 a layer of nonwoven fabric permeable to liquids) and the accessories (such as, for example, elastic bands, faeces barriers and side wings), which define the absorbent article.

Each operating unit comprises a feeding unit provided with a main drum (usually hinged so as to rotate, with a continuous motion, around a central rotation axis), which supports a plurality of sucking holding heads, each designed to receive a corresponding component, which is separated from a continuous band by means of a crosswise cut. In an input station, each sucking holding head receives a corresponding component, which is still part of the continuous band (namely, is the final end of the continuous band) and is subsequently separated from the continuous band by means of a crosswise cut made by a cutting device arranged downstream of the input station. Downstream of the cutting device, each head can be rotated by 90° so as to change the orientation of the component. Finally, in an output station, each sucking holding head releases the corresponding component.

In known feeding units, in order to convey the sucking holding heads, it is possible to use a transport system with directly operated linear electric motors, as described in patent application WO2017158572A1.

The transport system with linear electric motors described in patent application WO2017158572A1 has, for each sucking holding head, one single slide, which supports the holding head as it slides along a central guide. In particular, each slide is coupled to the guide thanks to four pair of idle wheels arranged perpendicularly to one another so as to ensure a crosswise containment of the slide relative to the

guide and allow the slide to only slide along the guide. The pairs of wheels generally must be arranged at a close distance, so as to allow the slide to also slide along the parts of the guide having a reduced bending radius, thus covering sharp bends. As a consequence, the aforesaid slides usually are small-sized.

In order to determine the rotation of each holding head (so as to change the orientation of the corresponding component), the holding head is mounted on the slide in a rotary manner, so as to rotate around a rotation axis arranged radially relative to the guide, and there is a cam actuation system to control the rotation of the holding head around the rotation axis. In particular, the cam actuation system comprises a cam, which is arranged in a fixed position beside the guide, and a cam follower roller, which can be coupled to the cam and is mechanically connected to the holding head. However, the presence of the cam can significantly interfere with the presence of the cutting device cutting the continuous band crosswise, thus forcing manufacturers to adopt complicated and expensive constructive solutions to allow the cam to coexist with the cutting device.

#### DESCRIPTION OF THE INVENTION

The object of the invention is to provide a unit to feed components in an automatic manufacturing machine, which does not suffer from the drawbacks described above and, at the same time, is easy and economic to be manufactured.

According to the invention, there is provided a unit to feed

components in an automatic manufacturing machine according to the appended claims.

The appended claims describe preferred embodiments of the invention and form an integral part of the description.

5 BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the accompanying drawings, which show some non-limiting embodiments thereof, wherein:

- 10 • figure 1 is a schematic front view of a unit to feed components of hygiene absorbent articles according to the invention;
- figure 2 is a simplified perspective view of part of the feeding unit of figure 1, wherein a movable equipment and part of a guide are highlighted
- 15 • figure 3 is a schematic perspective view of the feeding unit of figure 1;
- figure 4 is a side view of a movable equipment of the feeding unit of figure 1;
- 20 • figures 5 and 6 are an upper perspective view and a lower perspective view, respectively, of the movable equipment of figure 4;
- figure 7 is a perspective sectional view of part of the feeding unit of figure 1 by means of a plane perpendicular to the conveying direction of a movable equipment;
- 25 • figure 8 is a side view of a different embodiment of the movable equipment of figure 4;
- figures 9 and 10 are an upper perspective view and a lower

perspective view, respectively, of the movable equipment of figure 8;

- figure 11 is a schematic front view of the feeding unit of figure 1 with, highlighted, a rotary vacuum chamber connected to the movable equipments in a pneumatic manner; and
- figure 12 is a schematic view from the bottom of a different embodiment of the movable equipment of figure 4, where there is an adjustable limit stop block.

#### 10 PREFERRED EMBODIMENTS OF THE INVENTION

In figure 1, number 1 indicates, as a whole, a feeding unit 1 to feed a component 2 of a hygiene absorbent article. The feeding unit 1 is part of an automatic manufacturing machine to manufacture absorbent hygiene articles.

15 In the preferred and non-limiting embodiment shown in figure 1, each component 2 is obtained from a continuous band 3 (unwound from a reel, which is not shown herein) by means of a crosswise cut of the continuous band 3; namely, the continuous band 3 is cyclically cut crosswise so as to  
20 separate, in succession, the single components 2 from the continuous band 3. According to a different embodiment which is not shown herein, the feeding unit 1 singularly receives the components 2, which, hence, are not separated from the continuous band 3.

25 The feeding unit 1 comprises a plurality of sucking holding heads 4, which are each designed to receive and hold a corresponding component 2. Furthermore, the feeding unit 1

comprises a conveyor 5, which supports the sucking holding heads 4 and cyclically moves each sucking holding head 4 along an application path P (shown in figure 1).

The application path P goes through an input station S1, where the sucking holding head 4 receives a corresponding component 2, and through an output station S2, where the sucking holding head 4 releases the component 2 to a subsequent device 6. In figure 1, the device 6 is represented as a conveyor belt, but it is evident that the device 6 receiving the components 2 in succession in the output station S2 can be any type of device of a manufacturing machine to manufacture hygiene absorbent articles.

The conveyor 5 comprises a closed curved guide 7 (i.e. closed in a ring shape forming a circuit without a start or an end), which is arranged in a fixed position along the application path P. Furthermore, the conveyor 5 comprises a plurality of equipments 8, each supporting a respective holding head 4 and provided with three slides 9, each coupled to the guide 7 so as to freely slide along the guide 7 by means of a plurality of wheels 10, which are idle on the slide 9 and roll along respective rolling surfaces 11 of the guide 7 (as shown in figure 2). According to other embodiments which are not shown herein, each equipment 8 comprises a different number of slides 9 (for example one single slide 9, two slides 9, four slides 9...).

Finally, according to figure 3, the conveyor 5 comprises a linear electric motor 12, which moves the slides 9 carrying



the equipments 8 and, hence, the sucking holding heads 4 along the application path P. The linear electric motor 12 comprises a closed curved stator 13 (i.e. a fixed primary element), which is arranged in a fixed position along the guide 7, and a plurality of movable sliders 14 (i.e. movable secondary elements), each electro-magnetically coupled to the stator 13 so as to receive, from the stator 13, a driving force and rigidly connected to a corresponding slide 9.

The stator 13 of the linear electric motor 12 comprises a ferromagnetic armature having a series of slots housing windings designed to be run through electric currents variable in time in order to generate corresponding stator magnetic fields (which are variable in time). According to figure 6, each slider 14 of the linear electric motor 12 comprises a ferromagnetic armature in which there is arranged at least one permanent magnet 15 generating a rotor magnetic field (which is constant in time) interacting with the stator magnetic field (which is variable in time) in order to generate, on the slider 14, a driving force of electromagnetic origin. In each slide 9, the slider 14 is mounted so as to be very close to the stator 13 (approximately 1-2 millimetres away), so as to minimize the gap existing between the ferromagnetic armature of the slider 14 and the ferromagnetic armature of the stator 13.

A control device is provided, which controls the linear electric motor 12 applying a variable voltage to the windings of the stator 13. The control device preferably uses a closed

loop (i.e. feedback) control system to control the position of each slider 14 (hence, of each slide 9). As a consequence, the control device must know, in real time and with a good precision, the actual position of each slider 14 (hence, of each slide 9) along the application path P; to this aim, the control device can track the actual position of each slider 14 along the application path P by means of estimation algorithms based on electrical signals at the ends of the windings of the stator 13 or the control device can receive the detection of a dedicated sensor, which is arranged along the application path P. For example, the position sensor comprises a magnetoresistive material measuring band, which is arranged along the application path P, and, for each slider 12, a corresponding permanent magnet 15, which is arranged close to the measuring band. In other words, along the application path P there is an encoder detection device, which allows the position of each permanent magnet 15 associated with each slider 14 to be detected with precision. According to figure 3, the stator 13 of the linear electric motor 12 is parallel to the guide 7 and adjacent to the guide 7. In other words, the stator 13 of the linear electric motor 12 and the guide 7 are arranged on two parallel planes; in this way, the stator 13 of the linear electric motor 12 can be mechanically connected close to the guide 7.

According to a preferred, though non-binding embodiment, the stator 13 of the linear electric motor 12 is divided into different sectors (twelve in figure 3, but there could be

more or less of them) arranged one after the other along the guide 7. The single sectors of the stator 13 are mechanically and electrically independent of one another, namely each sector of the stator 13 is electrically powered by a control device of its own, which is exclusively dedicated to its sector (hence, is different and separate from the control devices of the other sectors); obviously, there is a central control unit, which controls the control devices in a coordinated manner so as to move the slides 9 (hence, the corresponding sucking holding heads 4) along the application path P according to a desired law of motion.

According to figure 7, the guide 7 has, on the rolling surfaces 11, a transverse profile 16 having a concavity or a convexity. The wheels 10 have, on the surface in contact with the guide 7, a transverse profile 17, which has a convexity or a concavity, which is complementary to the profile 16 (namely, when the profile 16 is convex, the corresponding profile 17 is concave and vice versa). The profile 17 generates, with the profile 16, a shape coupling between the guide 7 and the wheels 10, which prevents the slide 9 from moving crosswise relative to the guide 7. In other words, the shape coupling generated between the transverse profile 16 of the guide 7 and the transverse profile 17 of each wheel 10 prevents the slide 9 from moving along a direction T which is transverse to the guide 7, so as to also prevent the slide 9 from derailing out of the guide 7.

Advantageously, though not necessarily, the profile 16 and the profile 17 are "V"-shaped. In this way, thanks to the presence of the vertex in the "V" shape, a high precision of the application path P followed by the wheels is ensured.

5 According to a preferred, though non-limiting embodiment shown in figures 1, 2, 7, 9 and 10, each slide 9 has at least one pair of opposite wheels 10, which are coupled to a side 18 and to a side 19, respectively, of the guide 7 (which are opposite one another), thus forbidding the movement of the  
10 slide 9 relative to the guide 7 along a direction R (shown in figure 7), which is radial to the application path P. In the preferred, though non-limiting embodiment shown in figures 1, 2, 7, 9 and 10, each slide 9 has three wheels 10: two smaller wheels 10, which slide along the side 19 of the  
15 guide 7, and a larger wheel 10, which slides along the side 18 of the guide 7.

According to a preferred, though non-limiting embodiment shown in figure 2, the guide 7 comprises two tracks 20, which are parallel to one another and spaced apart from one  
20 another. As a consequence, the equipment 8 comprises two groups of opposite slides 9 (each group for each track 20) and a connection element 21, which connects the two groups of slides 9 to one another and supports the holding head 4. According to figures 4 and 8, advantageously, in each slide  
25 9 the wheels 10 of one of the slides 9 are floating relative to the corresponding slide 9 along a compensation direction C, which is transverse to the application path P. By so

doing, building and/or assembling imperfections, which unavoidably arise in the parallel arrangement and in the uniform character of the two tracks 20, can be solved.

According to a preferred, though non-limiting embodiment shown, for example, in figures 8, 9 and 10, each slide 9 is provided with three wheels 10. In particular two (smaller) wheels 10 slide on the outer rolling surface 11 of the guide 7, namely along the side 19 of the guide 7, whereas one single (larger) wheel 10 slides on the inner rolling surface 11 of the guide 7, namely along the side 18 of the guide 7. In this way, the (larger) wheel 10 sliding along the side 18 of the guide 7 forms, with the two (smaller) wheels 10 sliding along the side 19 of the guide 7, two pairs of wheels 10, one with each one of the (smaller) wheels 10 sliding along the side 19 of the guide 7.

Advantageously, though not necessarily, each equipment 8 comprises two trains 22 of slides 9, each comprising three slides 9 which slide on the same track 20 (alternatively, each train 22 of slides 9 could comprise only one/two slides 9 or four/five slides 9). Furthermore, the connection element 21 connects at least one slide 9 sliding on a track 20 and another slide 9 sliding on the other track 20 to one another. Two slides 9 sliding on the same track 20 are connected in an articulated manner by means of a fork (figure 5) or by means of a connecting rod 23 (having a fork at one of the ends and shown in figure 10), which permit a relative rotation of the two slides 9 sliding on the same track 20

along the curved segments of the guide 7.

According to a preferred embodiment, each equipment 8 comprises two trains 22 of slides 9, each comprising three slides 9, which slide on a same track 20. Furthermore, the  
5 connection element 21 connects the sole central slide 9 of a train 22 to the sole central slide 9 of the other train. According to a further preferred embodiment of the invention, the floating wheels 10 are present only on the slide 9 arranged at the centre (namely, arranged between the two  
10 side slides 9). This is due to the fact that, as far as the side slides 9 (arranged on opposite sides of the central slide 9) are concerned, the function of compensation of the parallel arrangement and of possible lacks of homogeneity between the different tracks 20 is fulfilled (enabled) by  
15 the connecting rod 23 connecting the two side slides 9 to the central slide 9.

According to a preferred, though non-limiting embodiment shown in figure 1, the feeding unit 1 comprises a rotation station S3, which is arranged along the feeding path P and  
20 where each holding head 4 makes a rotation relative to the equipment 8 and around a rotation axis R1 (shown in figures 4 and 8) in order to change the orientation of the component 2. In particular, each sucking holding head 4 is mounted in a rotary manner on the equipment 8 so as to rotate around  
25 the rotation axis R1 and there is a cam actuation system 25 to control the rotation of the sucking holding head 4 around the rotation axis R1.

According to figures 3, 4 and 8, the cam actuation system 25 comprises a cam 26 (shown in figure 3), which is arranged in a fixed position beside the guide 7 and along the application path P, and, for each holding head 4, at least one  
5 corresponding cam follower roller 27 (shown in figures 4 and 8), which is coupled to the cam 26 (namely, slides on the cam 26 so as to follow the profile of the cam 26) and is mechanically connected to the sucking holding head 4.

According to a preferred non-limiting embodiment (shown in  
10 figures 4 and 8), in each equipment 8 the cam follower roller 27 is oriented parallel to the rotation axis R1; further optimizations are possible by causing the axis R1 and the symmetry axis of the cam follower roller 27 to converge in a suitable point; furthermore, there is an operating arm 28  
15 having a first end, on which there is mounted, in a rotary manner, the roller 27, and a second end, which is angularly integral to the sucking holding head 4. In this embodiment, an end of each operating arm 28 is directly constrained to a shaft supporting the sucking holding head 4, so that the  
20 rotary movement of the operating arm 28 becomes a same rotary movement of the sucking holding head 4.

According to a further embodiment shown in figure 3, the cam 26 is interrupted along a portion of the application path P, so as to permit the introduction of stations, interfering in  
25 terms of space, along the application path P (such as, for example, a cutting station). In this embodiment, a locking device 29 (shown in figures 4 and 8) is provided, which

prevents the holding head 4 from rotating around the rotation axis R1, so as to avoid accidental rotations of the holding head 4 along the segment where the cam 26 is interrupted.

Advantageously, though not necessarily, a control device is provided, which activates the locking device 29 upstream of the portion of the application path P where the cam 26 is interrupted and deactivates the locking device 29 downstream of the portion of the application path P where the cam 26 is interrupted. In other words, the locking device 29 shifts from an active (locking) position, in which the locking device 29 prevents the holding head 4 from rotating around the rotation axis R1, to a passive (release) position, in which the locking device 29 allows the holding head 4 to freely rotate controlled by the cam 26 by means of the cam follower roller 27.

According to a possible embodiment, the locking device 29 comprises a locking pin 30, which can axially slide between an active position and a passive position. Furthermore, the control device comprises an elastic element, which pushes the locking pin 30 towards the active position, and an actuator element (not shown), which pushes the locking pin 30 towards the passive position, thus compressing the elastic element. According to a non-limiting embodiment of the invention, the locking pin 30 is made of a ferromagnetic material and the actuator element consists of a magnet (not shown), which magnetically attracts the locking pin 30 towards the passive position.



According to a further preferred embodiment shown in figure 12, the locking device 29 comprises: a system consisting of the rotary operating arm 28, which is angularly connected, in particular integrally, to the sucking holding head 4 and on which there is mounted at least one cam follower roller 27; and an adjustable limit stop block 39, which is rigidly connected to the connection element 21. Furthermore, at least one respective magnet 40 and 41 is mounted both on the operating arm 28 and on the adjustable limit stop block 39. Advantageously, though not necessarily, between the operating arm 28 and the respective magnet 40 there is a spacer 42.

Advantageously, though not necessarily, between the adjustable limit stop block 39 and the respective magnet 41 there is a spacer 43.

This configuration allows the operating arm 28 to strike (as shown in figure 12) against the adjustable limit stop block 39 and allows the operating arm 28 to be held in a fixed angular position (relative to its rotation axis R1) thanks to the attraction generated by the magnets 40 and 41 installed on the operating arm 28 and on the adjustable limit stop block 39, respectively.

In the striking position of the operating arm 28 and of the limit stop block 39, the contact usually occurs between a portion of the operating arm 28 (other than the magnet 40) and a corresponding portion of the limit stop block 39 (other than the magnet 41) and, hence, the two magnets 40 and 41

face one another and are very close to one another, but do not touch one another (so as to avoid magnetic gluing, which multiplies the magnetic attraction force, and avoid the surface wear of the two magnets 40 and 41); alternatively, 5 in the striking position of the operating arm 28 and of the limit stop block 39, the two magnets 40 and 41 could also be in contact with one another.

Furthermore, this configuration allows the magnetic attraction force generated by the magnets 40 and 41 to be 10 changed in a desired manner. In particular, this attraction force can be adjusted by changing the number or type of magnets 40 and/or 41 installed (for example, using magnets with different sizes or made of different materials) or by changing the thickness of the spacers 42 and/or 43 in order 15 to bring the magnets 40 and 41 closer or move them apart.

Advantageously, though not necessarily, the limit stop block 39 is adjustable along a circular path CP with a centre corresponding to the rotation axis R1, namely the rotation axis of the operating arm 28 (and, in particular, of the 20 holding head 4).

According to the preferred, though non-limiting embodiment shown in figure 12, the limit stop block 39 is designed so as to have a protuberance 44, namely a fixing element (for example, a bolt), which slides inside a circular recess 45 25 (arranged along the circular path P). In other words, the circular recess 45 acts like a track for the movement of the limit stop block 39. In this way, by sliding in the recess

45, the plane of the striking face of the limit stop block 39 always is parallel to the plane of the striking face of the operating arm 28. As a consequence, by adjusting the position of the limit stop block 39, it is possible to adjust  
5 the position of the operating arm 28, keeping the magnets 40 and 41 always parallel to one another, thus optimizing the generated attracting force. Furthermore, this configuration allows manufacturers to compensate possible geometric errors due to tolerances, to the processing process and/or to the  
10 assembly of the locking device 29 or of the equipment 8.

In this case, the control device is the cam 26.

In use, the operating arm 28 (hence, the holding head 4) is accompanied by the cam 26, through the cam follower roller 27, to the rest position, namely to the position to be kept  
15 during the segment of the application path P where the cam 26 is interrupted. The rest position corresponds to the striking position of the operating arm 28 and of the limit stop block 39. This position is held, in the absence of the cam, due to the attraction force generated by the magnets 40  
20 and 41, which, in the rest position, face one another. Once the cam follower roller 27 newly gets into the cam 26, the pushing action exerted by the cam 26 upon the cam follower roller 17 exceeds the attraction force between the magnets 40 and 41 and releases the operating arm 28 from the limit  
25 stop block 39, thus forcing it to assume the desired angular position, in order to then bring it back to the rest position before subsequently getting out of the cam 26.

A further advantage of this configuration lies in the absence, between the operating arm 28 and the limit stop block 39, of mechanical locks (for example movable pins), which could break during use, in particular at high speeds, thus losing the ability to lock the operating arm 28 in the  
5 desired rest position.

According to a further embodiment, the feeding unit 1 comprises a rotation station S4, which is arranged along the feeding path P (figure 1) and in which the holding head 4  
10 makes a rotation relative to the equipment 8 and around a rotation axis R2 (shown in figures 4 and 6), which is transverse to the feeding path P, so as to change the inclination of the holding head 4. In this way, the angle  $\alpha$  (shown in figure 1) existing between each holding head 4 and  
15 the guide 7 can be changed in order to allow the holding head 4 to approach the continuous band 3 in an ideal manner. In particular, the rotation around the rotation axis R2 takes place by means of a further cam actuation system 31, which is completely similar to the actuation system 25. As a  
20 consequence, the further actuation system 31 also comprises a cam follower roller 24 (shown, for example, in figures 4 and 6) and a cam (not shown), on which the cam follower roller 24 slides.

According to a preferred non-limiting embodiment, as already  
25 mentioned above and according to figure 1, in the input station S1 the holding head 4 receives a corresponding component 2 connected, without gaps, to a continuous band 3;

furthermore, there is a cutting station S5, which is arranged along the application path P downstream of the input station S1 and is provided with a cutting device 32, which cuts the continuous band 3 crosswise so as to separate the component  
5 2 held by the holding head 4 from the remaining part of the continuous band 3. In other words, when, in the input station S1, a component 2 is engaged by a corresponding sucking holding head 4, the component 2 is still part of the continuous band 3 (namely, is connected without gaps to the  
10 continuous band 3) and is separated from the continuous band 3 by means of crosswise cut in the cutting station S5 arranged downstream of the input station S1.

According to a further non-limiting embodiment, upstream of the input station S1 (hence, since the guide 7 is closed,  
15 between the output station S2 and the input station S1) there is the second rotation station S4, which allows the holding head 4 to rotate around the rotation axis R2 in order to change the angle  $\alpha$  and, hence, help the holding head approach the band 3, preventing a (sharp) end of the holding head 4  
20 from touching the band 3, damaging it, before the holding head 4 is parallel to the band 3.

According to a preferred, though non-binding embodiment, between the cutting station S5 and the output station S2 (namely, downstream of the cutting station S5 and upstream  
25 of the output station S) there is the rotation station S3, where each sucking holding head 4 rotates by  $90^\circ$  (or, alternatively, by any other angle other than  $90^\circ$ ) relative

tot he conveyor 5 and around the rotation axis R1 (shown in figure 4), which is arranged radially (namely, perpendicularly) to the application path P.

In particular, the cutting device 32 comprises: at least one  
5 blade 33 and at least one counter-blade 34, which cooperate with one another to cut the continuous band 3 crosswise; a cutting drum 35, which is arranged on a side of the application path P, supports the blade 33 and rotates around a rotation axis R3 so as to cyclically allow the blade 33 to  
10 come into contact with the continuous band 3; and a counter-drum 36, which is arranged on a side of the application path P opposite the cutting drum 35, supports the counter-blade 34 and rotates around a rotation axis R4 (parallel to the rotation axis R3) so as to cyclically allow the counter-  
15 blade 34 to come into contact with the continuous band 3 on the opposite side of the blade 33.

The number of blades 33 supported by the cutting drum 35 is completely independent of and variable relative to the number of counter-blades 34 supported by the counter-drum 36, since  
20 the control units of the aforesaid drums 35 and 36 are free to control them with different speeds, provided that the rhythm of contact with the band 3 is synchronous.

According to a preferred, though non-limiting embodiment shown in figure 11, the unit 1 comprises a drum, which is  
25 mounted so as to rotate around a rotation axis R5 and inside which there is defined a suction chamber 37 (with a preferably cylindrical shape), which is connected in a

pneumatic manner to the holding heads 4 present on the single equipments 8 by means of a flexible connection system in order to transmit a suction, namely a negative pressure relative to the room pressure, and, hence, allows the holding heads 4 to attract and hold the components 2 through suction. The flexible connection system comprises, for each equipment 8 (namely, for each holding head 4), a corresponding flexible (articulated) hose 38, in particular made of plastic, which connects the equipment 8 (carrying a corresponding holding head 4) to the suction chamber 37 in a pneumatic manner. In order to prevent the flexible hoses 38 from intertwining and breaking due to the cyclical movement of the equipments 8, the suction chamber 37 can rotate (together with the corresponding drum) around the rotation axis R5 (corresponding to the symmetry axis of the cylindrical suction chamber 37). In other words, the suction chamber 37 rotates around the rotation axis R5 in a manner which, on average, is synchronous with the sliding of the equipments 8 along the guide 7, so as to prevent the flexible hoses 38 from intertwining and breaking. In other words, the suction chamber 37 rotates around the rotation axis R5 with a rotation speed which is equal to the mean speed of the equipments 8 along a complete lap of the guide 7. Obviously, the suction chamber 37 cannot follow the movement of each equipment 8 point by point (namely, instant by instant) and, therefore, there are moments in which the suction chamber 37 is in advance or in delay relative to each equipment 8; these

cyclical variations ("*pulsations*") of the distance between the suction chamber 37 and each equipment 8 are compensated by elastic deformations of the corresponding flexible hoses 38.

5 According to an embodiment, the rotation axis R5 is arranged in the area of the centre of gravity of the guide 7 so as to minimize the extent of the cyclical variations ("*pulsations*") of the distance between the suction chamber 37 and each equipment 8. In particular, it is evident that  
10 the variation of the distance between the suction chamber 37 and the single equipment 8 is due both to a geometric factor deriving from the relationship between the shapes of the guide 7 and the suction chamber 37, respectively, and to the law of motion with which the equipments move along the guide.

15 According to a possible non-limiting embodiment, the suction chamber 37 rotates at a rotation speed that is variable in time and is equal, instant by instant, to the mean of the instantaneous speeds of the equipments 8 running along the guide 7. According to an alternative non-limiting  
20 embodiment, the suction chamber 37 rotates at a rotation speed that is constant in time and is equal to the mean speed of the equipments 8 along a complete lap of the guide 7.

The embodiments described herein can be combined with one another, without for this reason going beyond the scope of  
25 protection of the invention.

In the preferred embodiment show in the accompanying figures, the feeding unit 1 described above is used in an automatic



manufacturing machine to manufacture hygiene absorbent articles. According to other embodiments which are not shown herein, the feeding unit 1 described above can be used in other types of automatic manufacturing machines manufacturing products that are (even completely) different from hygiene absorbent articles; for example, the feeding unit 1 described above could be used in an automatic manufacturing machine for the production of food or in an automatic manufacturing machine to process products of the tobacco industry (for example, in a unit for forming groups of cigarettes).

The feeding unit 1 described above has numerous advantages. First of all, the feeding unit 1 described above can stand fast production rates, as the structure of the slides 9, which is completely symmetrical relative to a plane that is parallel to and equally spaced apart from the tracks 20 of the guide 7, determines a reduced and uniform wear of the wheels 10.

Furthermore, the feeding unit 1 described above allows the components 2 to be moved with very high speeds and accelerations (hence, with fast production rates) thanks to the fact that each movable equipment 8 can be provided with a plurality of sliders 14, which, as a whole, are capable of generating a significant driving force.

**CLAIMS**

1) A unit (1) to feed a component (2) in an automatic manufacturing machine; the feeding unit (1) comprises:

- at least one holding head (4), which is designed to receive and hold the component (2);
- a conveyor (5) to cyclically move the holding head (4) along an application path (P);
- an input station (S1), which is arranged along the application path (P) and in which the holding head (4) receives the component (2);
- an output station (S2), which is arranged along the application path (P) downstream of the input station (S1) and in which the holding head (4) releases the component (2); and
- a first rotation station (S3), which is arranged along the feeding path (P) and in which the holding head (4) rotates around a first rotation axis (R1) so as to vary the orientation of the component (2);

wherein the conveyor (5) comprises: a closed curve guide (7), which is arranged in a fixed position along the application path (P); and an equipment (8), which supports the holding head (4) and is provided with at least one slide (9), which is coupled to the guide (7) so as to freely slide along the guide (7) by means of a plurality of wheels (10), which are idle on the slide (9) and roll along respective rolling surfaces (11) of the guide (7);

wherein the holding head (4) is fitted on the equipment (8)

in a rotary manner, so as to rotate around the first rotation axis (R1); and

wherein an actuation system (25) is provided, which controls the rotation of the holding head (4) around the first rotation axis (R1) and comprises: a cam (26), which is  
5 arranged in a fixed position beside the guide (8) and along the application path (P); and a cam follower roller (27), which can be coupled to the cam (26) and is mechanically connected to the holding head (4);

10 the feeding unit (1) is **characterized in that:**

the cam (26) is interrupted along a portion of the application path (P);

a locking device (29) is provided, which prevents the holding head (4) from rotating around the first rotation axis (R1);

15 and

a control device is provided, which activates the locking device (29) upstream of the portion of the application path (P) where the cam (26) is interrupted and deactivates the locking device (29) downstream of the portion of the application path (P) where the cam (26) is interrupted.  
20

2) A feeding unit (1) according to claim 1, wherein the locking system (29) comprises a system consisting of:

a rotary operating arm (28), which connects the cam follower roller (27) to the sucking holding head (4), and

25 an adjustable limit stop block (39), in particular rigidly connected to the equipment (8).

3) A feeding unit according to claim 2, wherein the rotary

operating arm (28) is angularly connected to the sucking holding head (4).

4) A feeding unit according to claim 3, wherein the cam follower roller (27) is mounted on the rotary operating arm  
5 (28).

5) A feeding unit according to claim 2, 3 or 4, wherein a first and a second magnet (40, 41) are mounted, respectively, both on the operating arm (28) and on the adjustable limit stop block (39).

10 6) A feeding unit according to claim 5, wherein the first and the second magnet (40, 41) face one another in the portion of the application path (P) where the cam (26) is interrupted.

7) A feeding unit according to claim 5 or 6, wherein between  
15 the operating arm (28) and the respective magnet (40) there is a first spacer (42) and/or between the adjustable limit stop block (39) and the respective magnet (41) there is a second spacer (43).

8) A feeding unit according to one of the claims from 2 to  
20 7, wherein the limit stop block (39) is adjustable along a circular path (CP) with a centre corresponding to the first rotation axis (R1).

9) A feeding unit (1) according to claim 1, wherein:

the locking device (29) comprises a locking pin (30), which  
25 can axially slide between an active position and a passive position; and

the control device comprises an elastic element, which pushes

the locking pin (30) towards the active position, and an actuator element, which pushes the locking pin (30) towards the passive position, thus compressing the elastic element.

10) A feeding unit (1) according to claim 9, wherein:

5 the locking pin (30) is made of a ferromagnetic material;  
and

the actuator element consists of a magnet, which magnetically attracts the locking pin (30) towards the passive position.

11) A feeding unit (1) according to one of the claims from  
10 1 to 10 and comprising a second rotation station (S4), which is arranged along the feeding path (P) and in which the holding head (4) rotates relative to the equipment (8) and around a second rotation axis (R2), which is transverse to the feeding path (P), so as to vary the inclination of the  
15 holding head (4).

12) A feeding unit (1) according to any of the claims from 1 to 11, wherein:

in the input station (S1), the holding head (4) receives a corresponding component (2), which is connected - without  
20 gaps - to a continuous band (3); and

a cutting station (S5) is provided, which is arranged along the application path (P) downstream of the input station (S1) and is provided with a cutting device (32), which cuts the continuous band (3) crosswise, so as to separate the  
25 component (2) held by the holding head (4) from the remaining part of the continuous band (3);

13) A feeding unit (1) according to claim 12, wherein the

cutting device (32) comprises:

at least one blade (33) and at least one counter-blade (34) cooperating with one another so as to cut the continuous band (3) crosswise;

5 a cutting drum (35), which is arranged on one side of the application path (P), supports the blade (33), and rotates around a third rotation axis (R3) so as cyclically allow the blade (33) to come into contact with the continuous band (3), and

10 a counter-drum (36), which is arranged on one side of the application path (P) opposite the cutting drum (35), supports the counter-blade (34), and rotates around a fourth rotation axis (R4) so as cyclically allow the counter-blade (34) to come into contact with the continuous band (3) on the  
15 opposite side of the blade (33).

14) A feeding unit (1) according to one of the claims from 1 to 13 and comprising a linear electric motor (12), which comprises a stator (13), which is arranged in a fixed position along the guide (7), and a movable slider (14),  
20 which is electro-magnetically coupled to the stator (13) so as to receive, from the stator (13), a driving force and is rigidly connected to the slide (9).

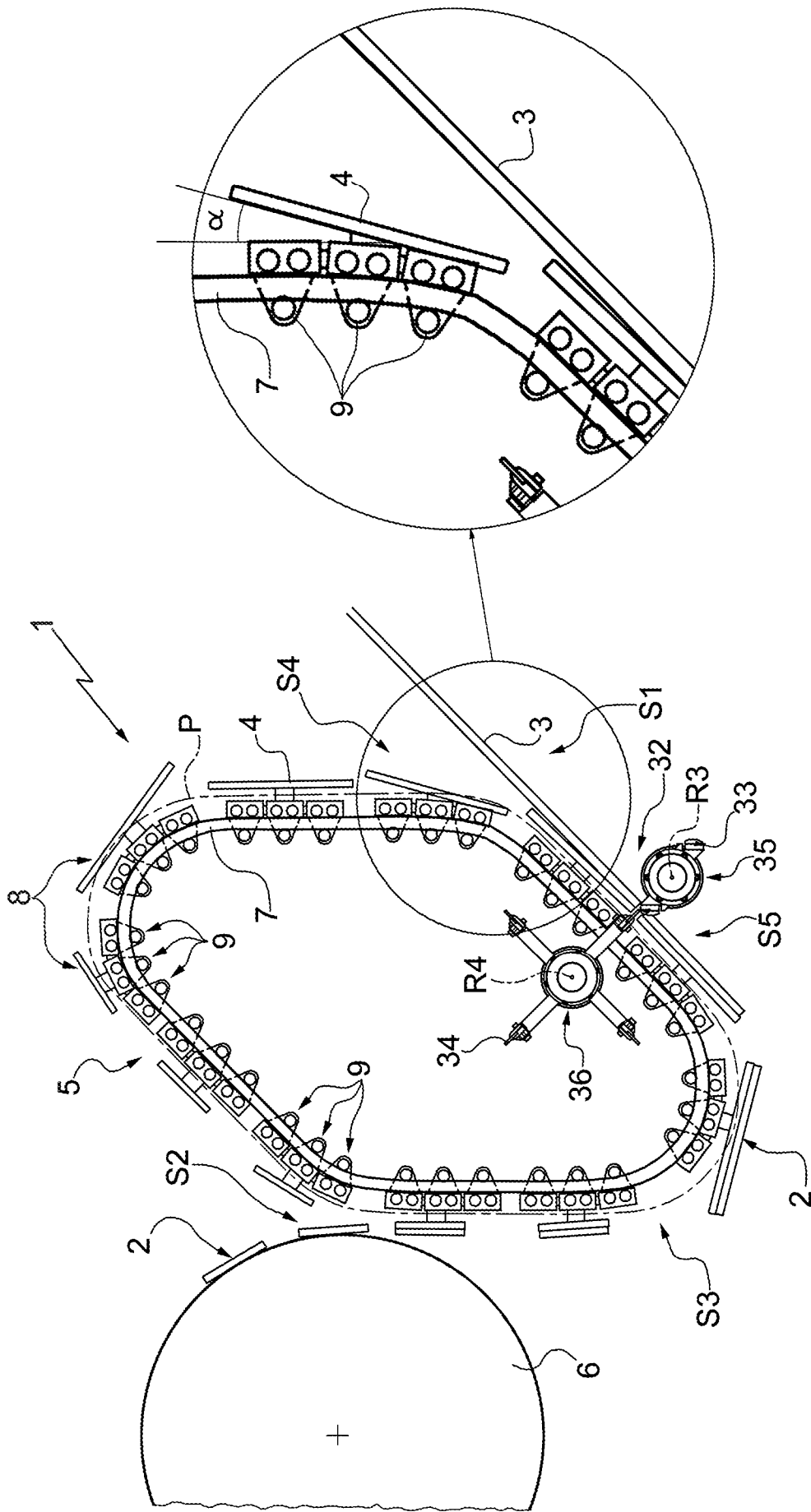


FIG.1

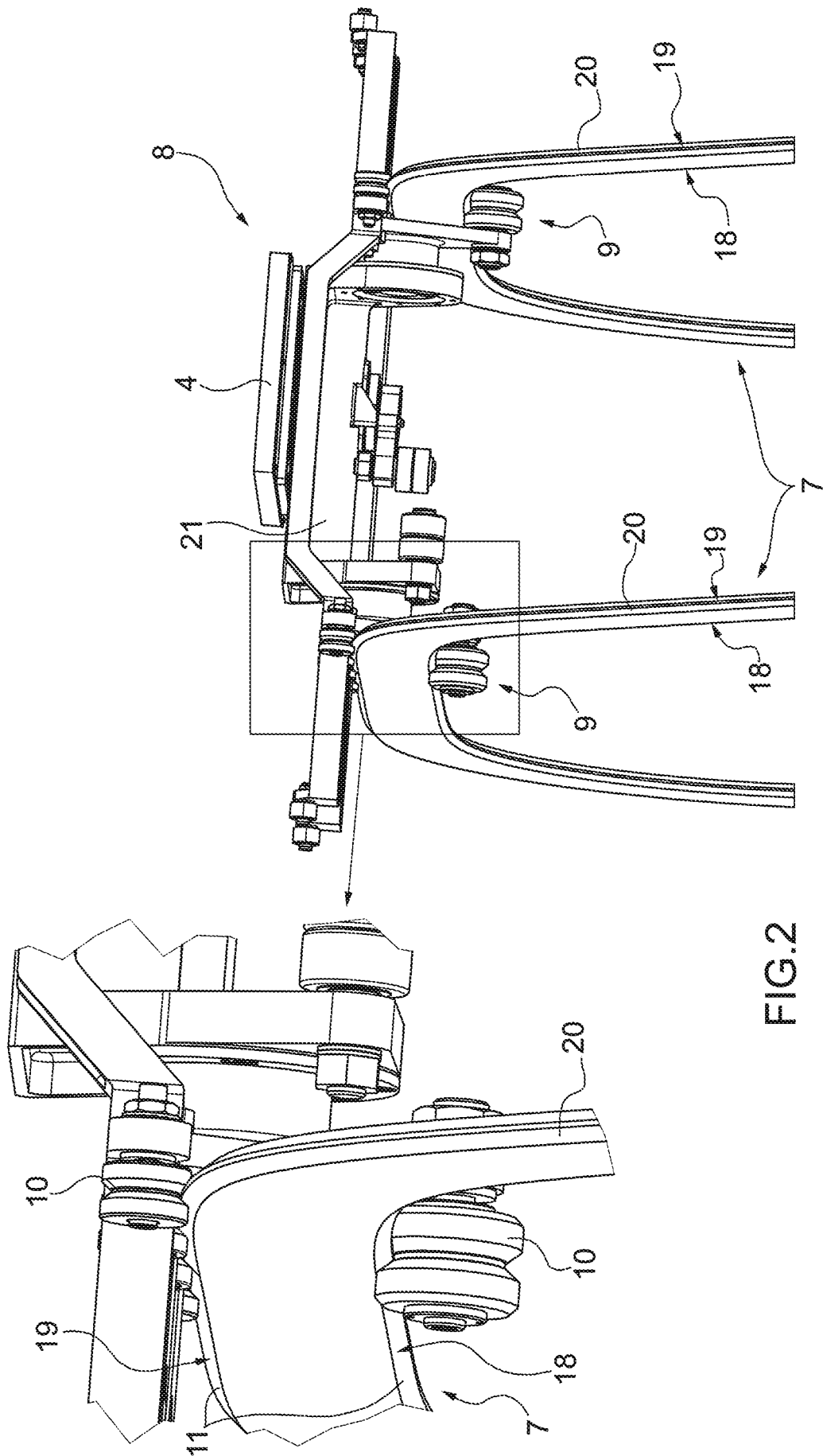


FIG.2



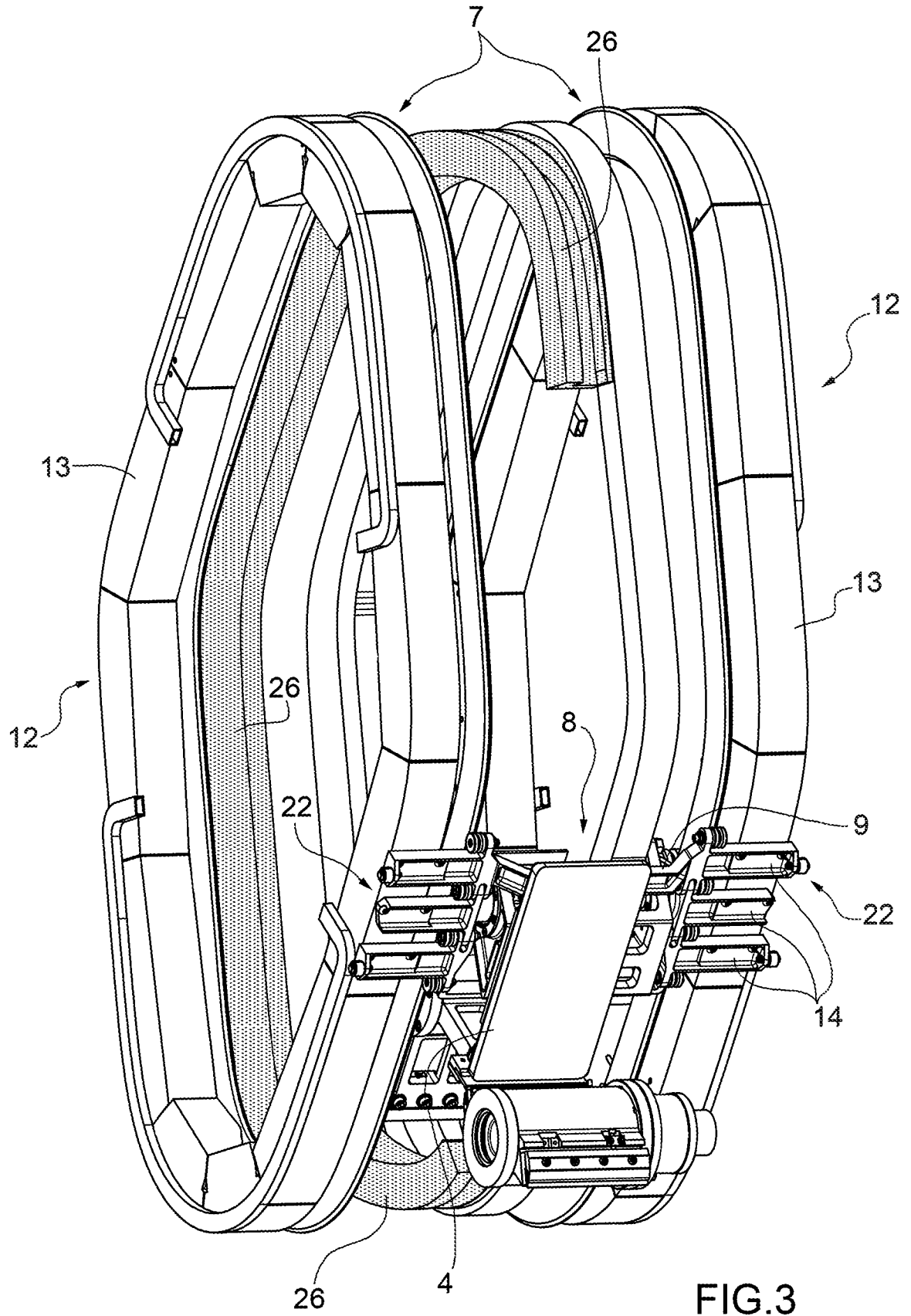


FIG.3

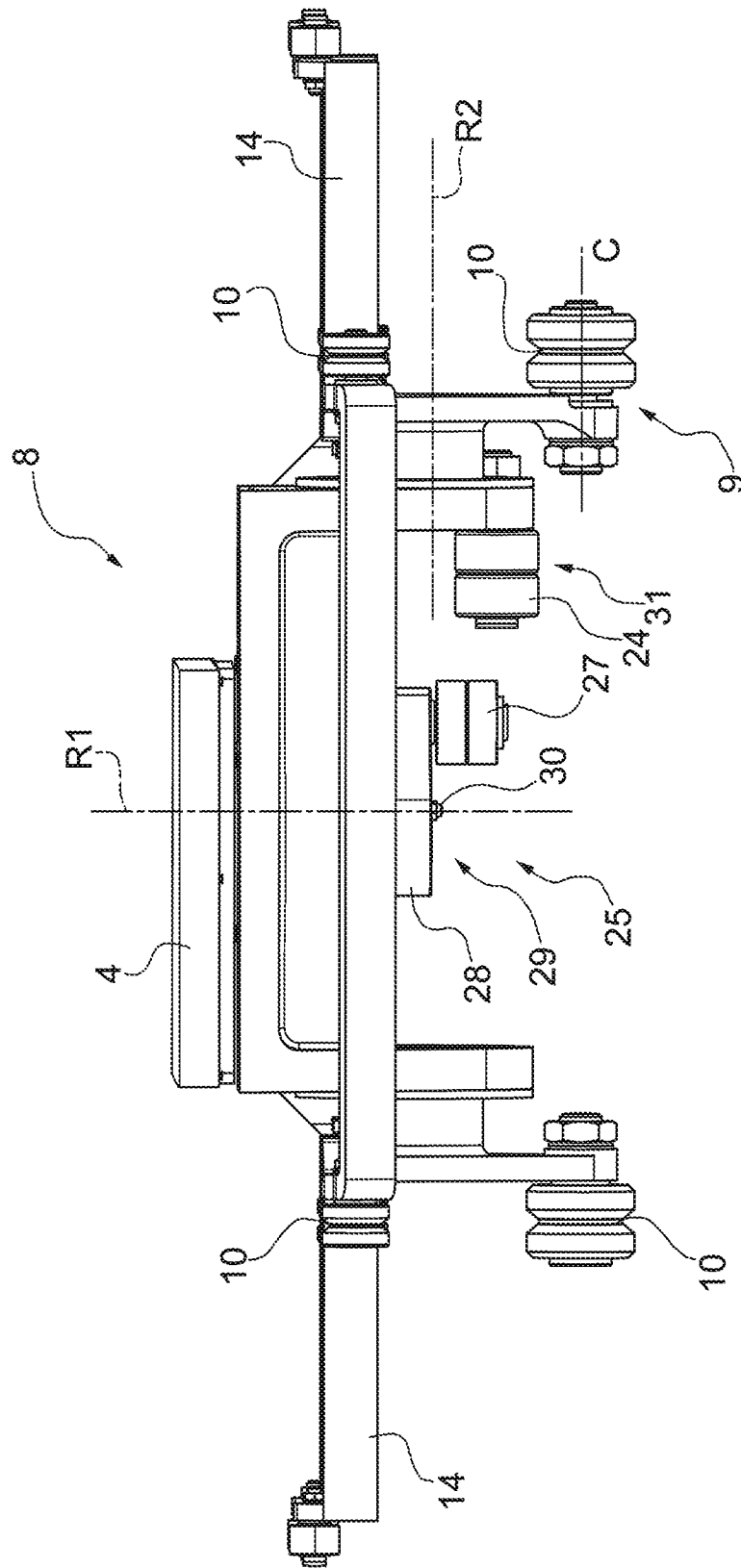


FIG.4

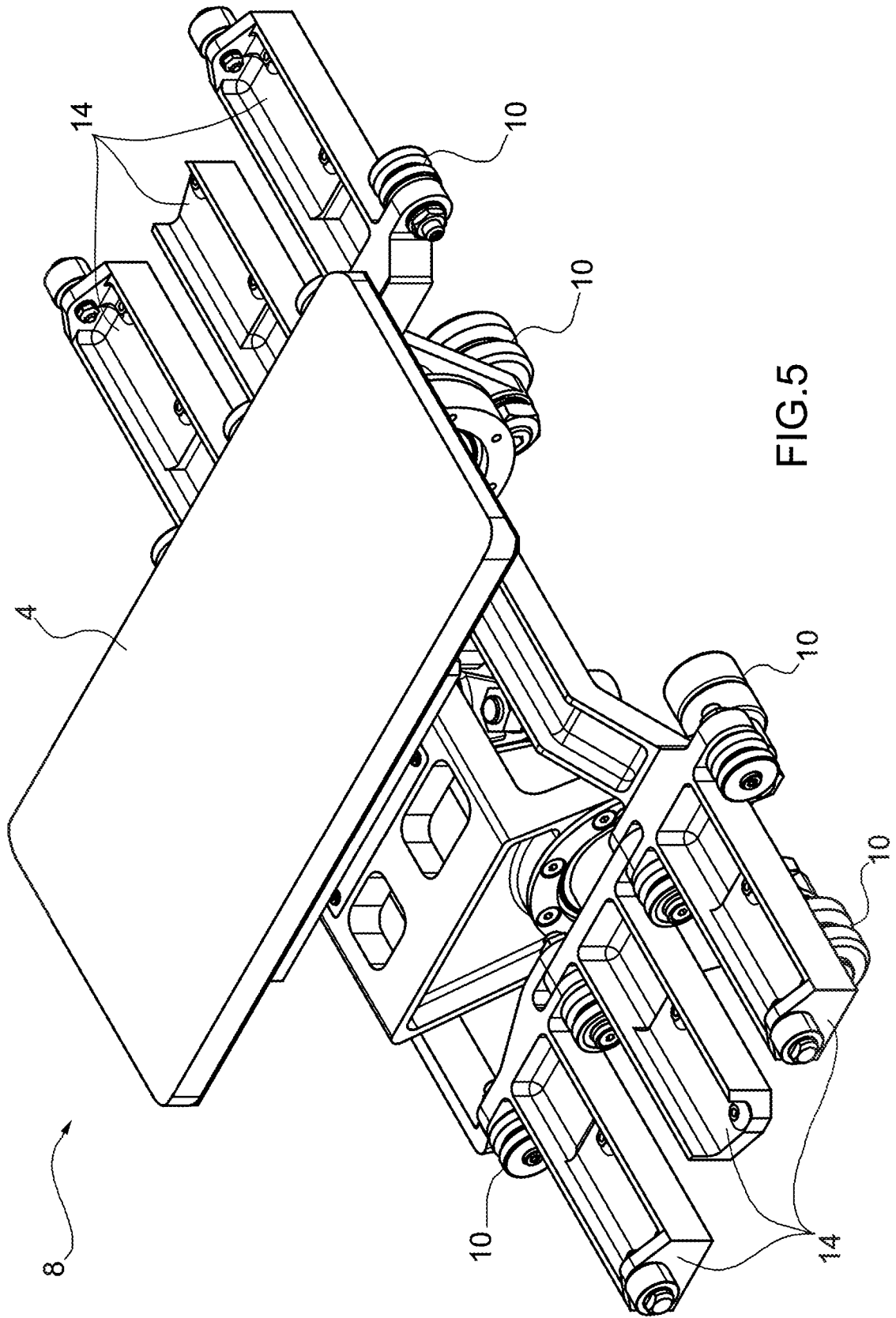


FIG.5

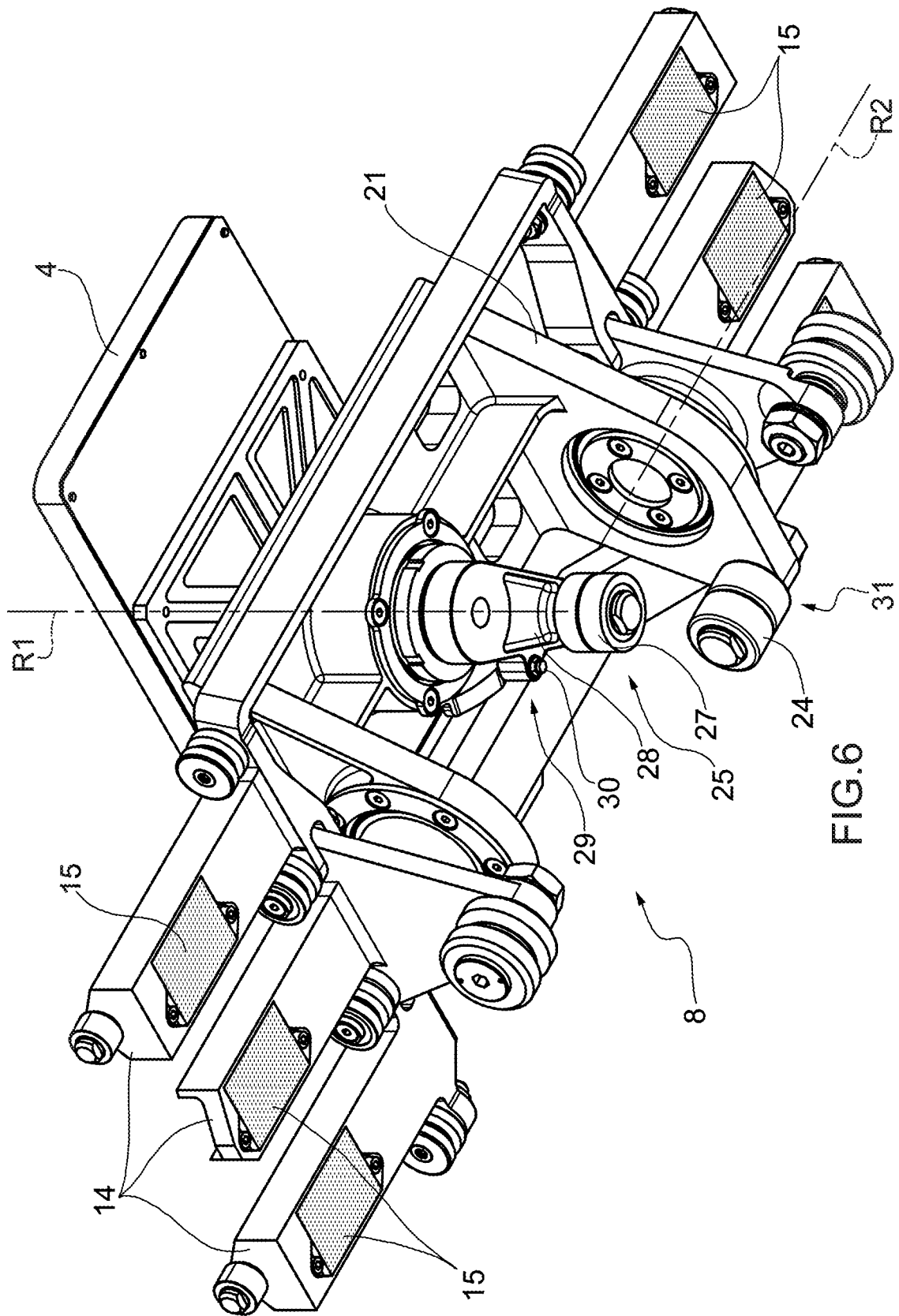
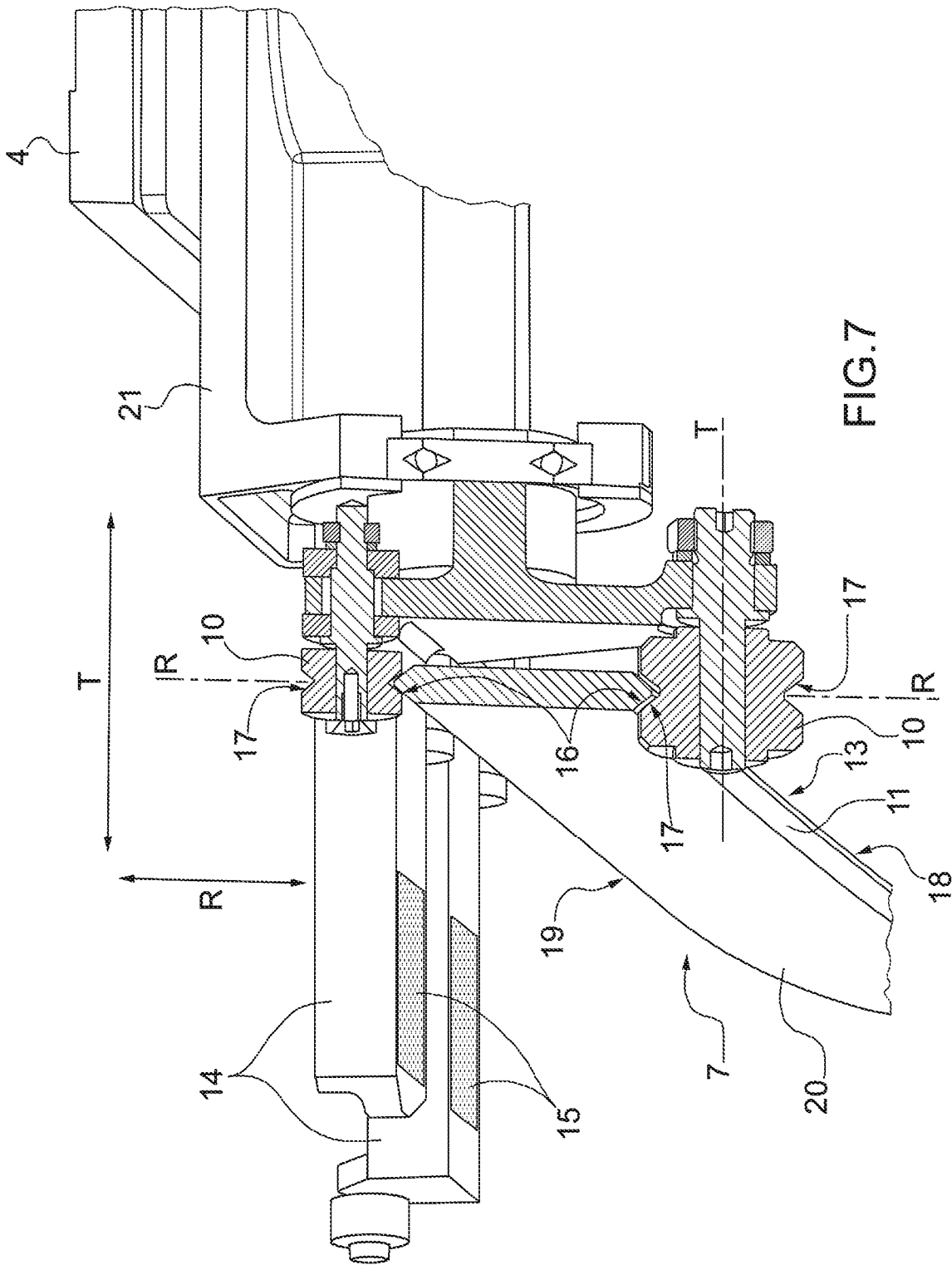


FIG. 6



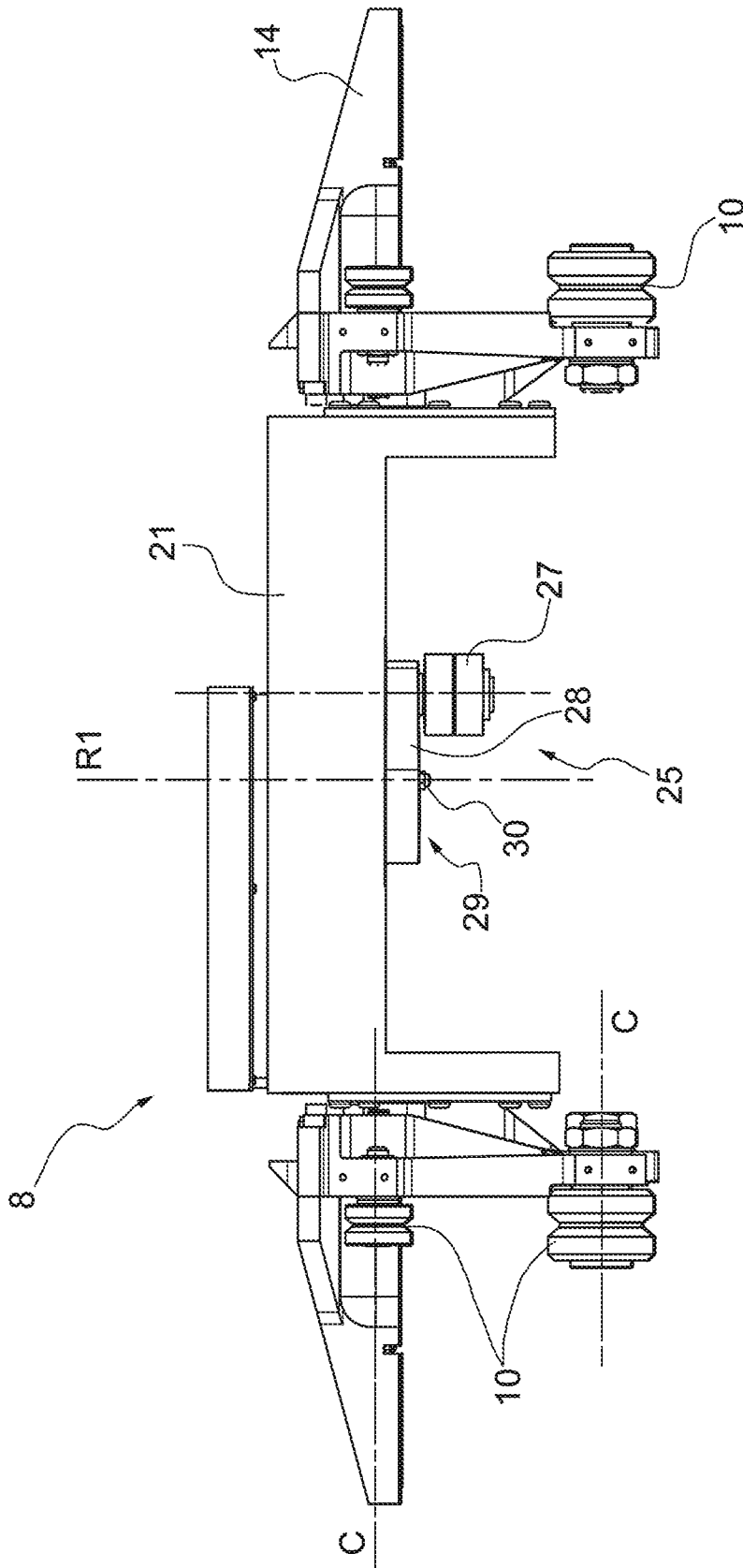


FIG. 8

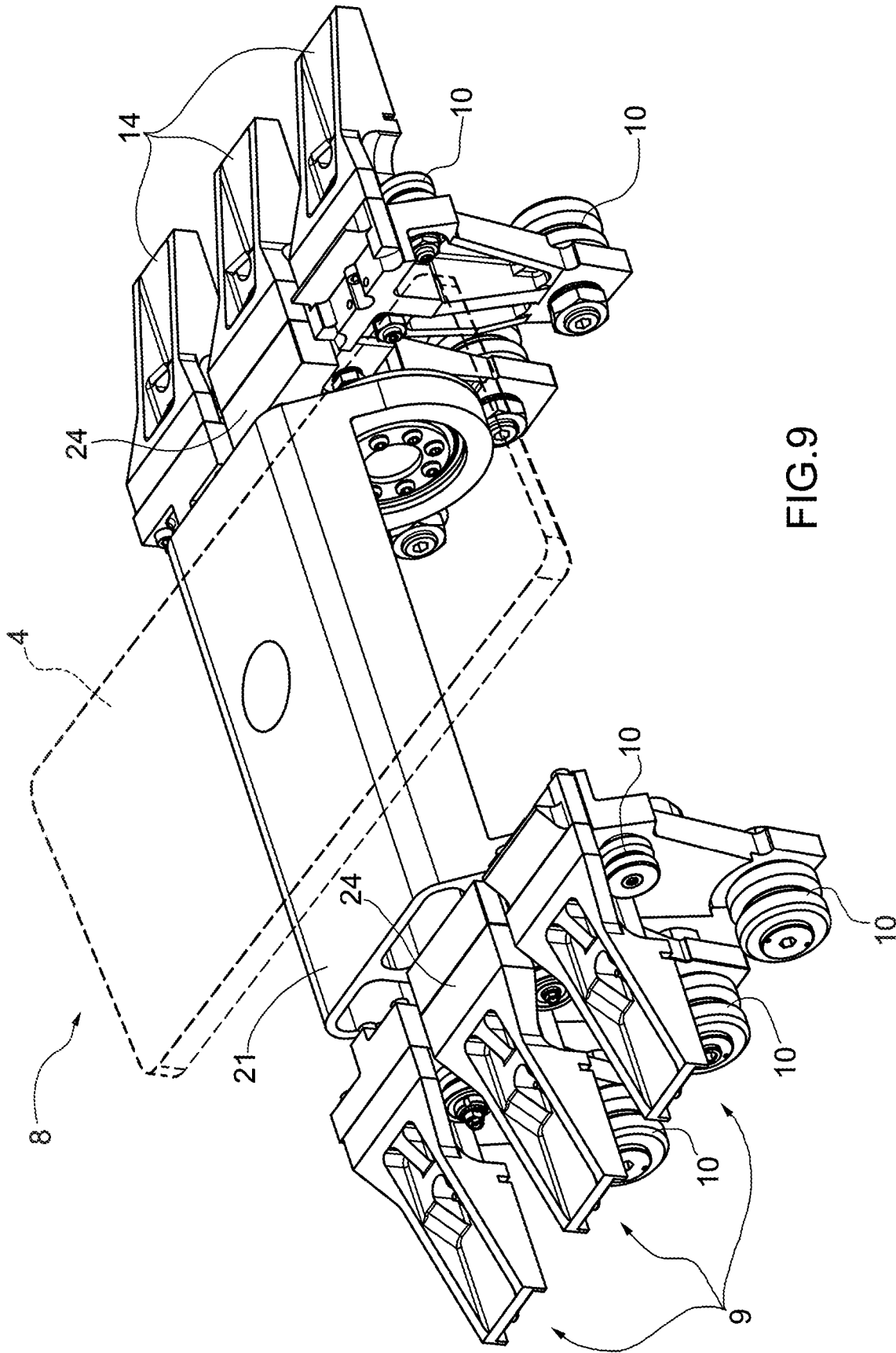


FIG.9

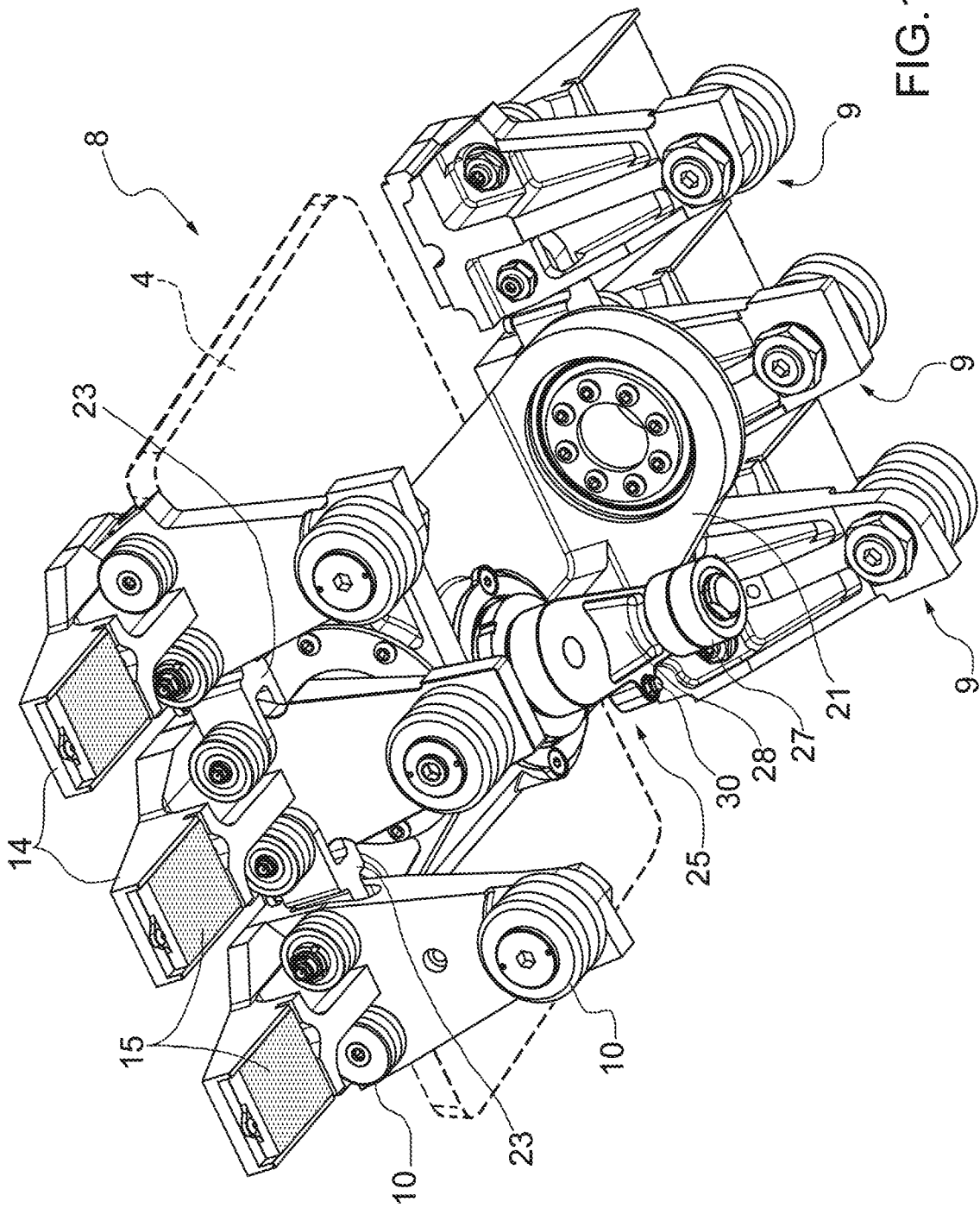


FIG.10



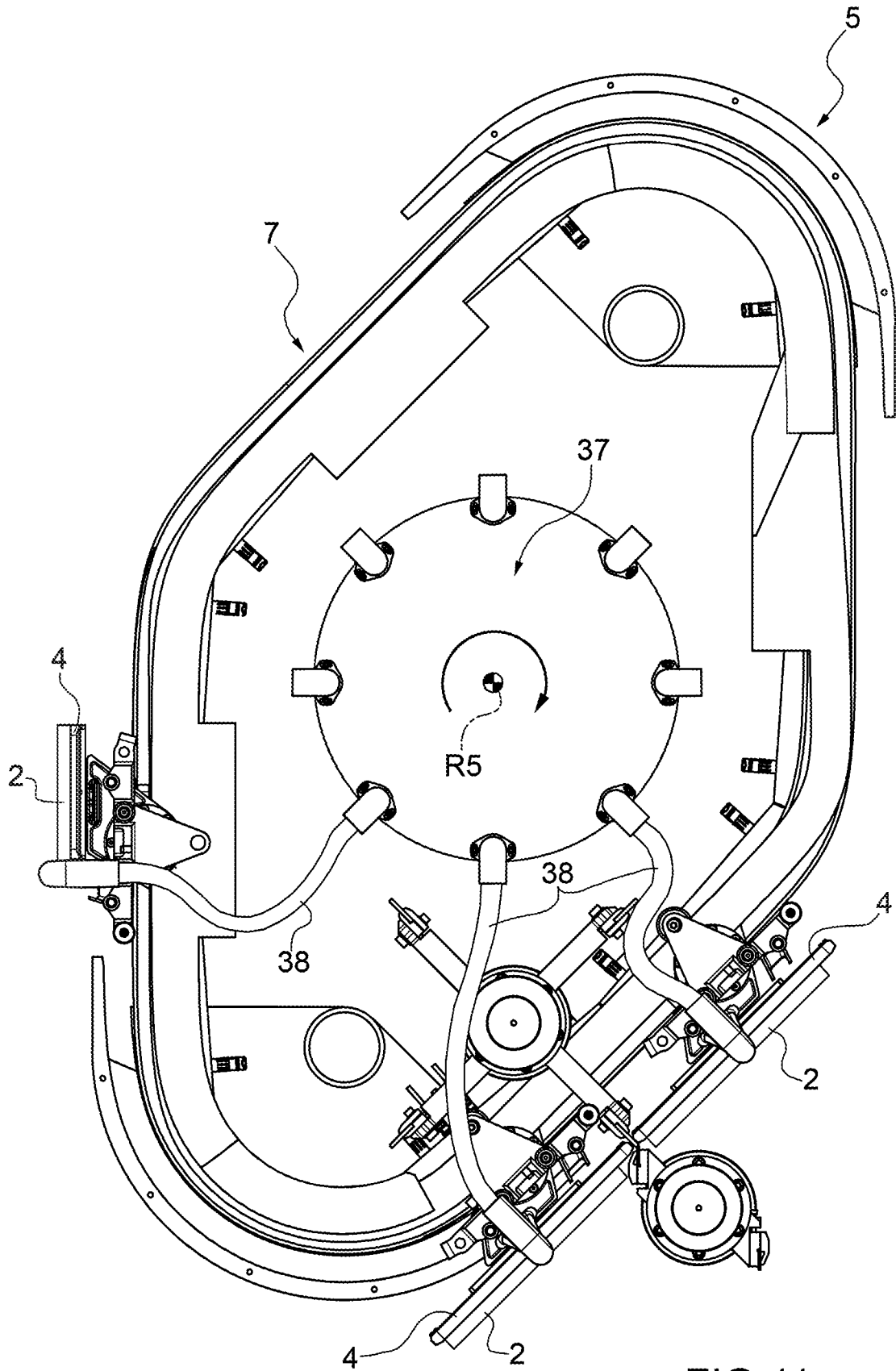


FIG.11

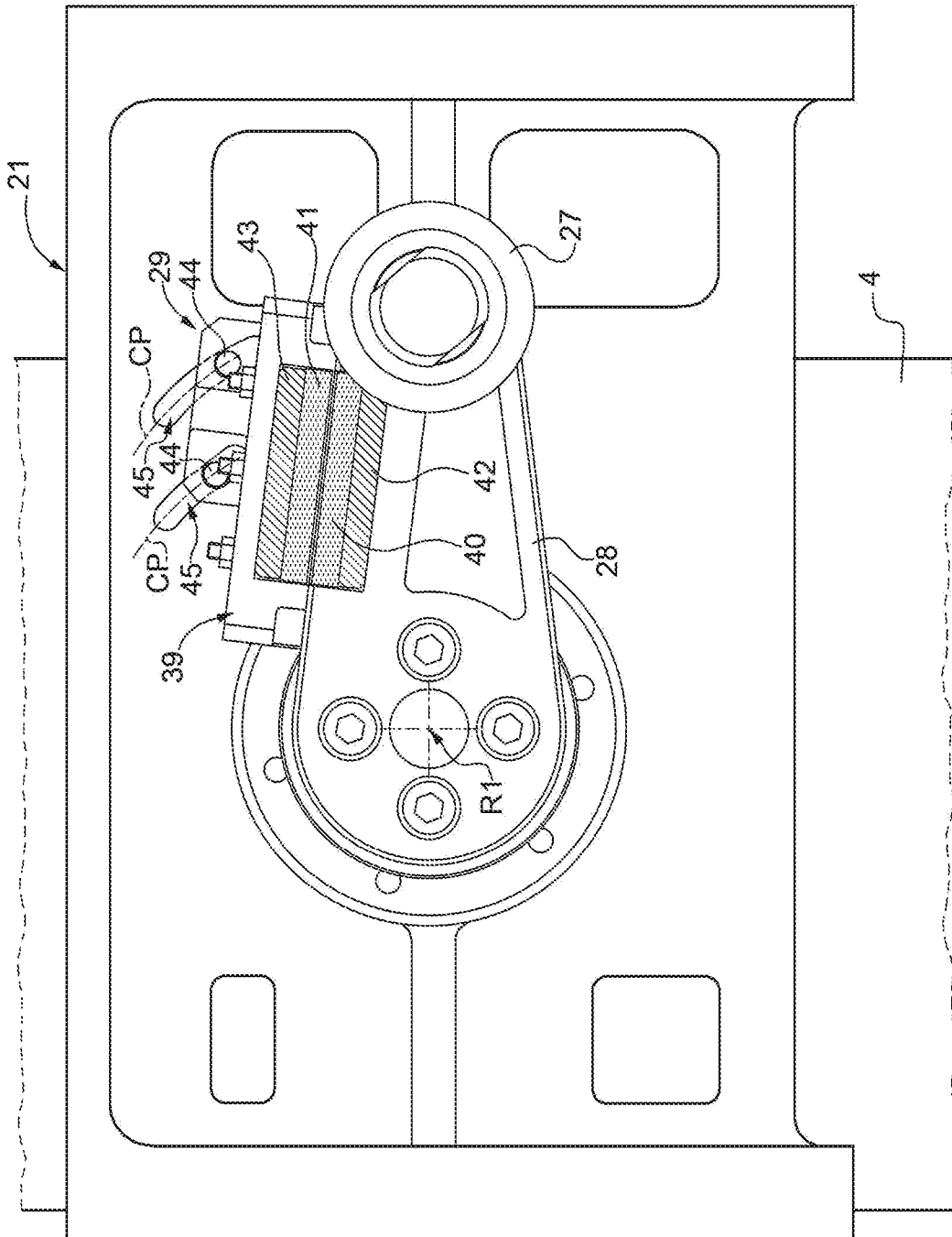


FIG.12

# INTERNATIONAL SEARCH REPORT

International application No PCT/IB2019/050780
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. A61F13/15      B65H29/24      B65G47/84 ADD.				
According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b>				
Minimum documentation searched (classification system followed by classification symbols) A61F B65H B65G				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
A	EP 3 067 172 A1 (ZUIKO CORP [JP]) 14 September 2016 (2016-09-14) abstract; figure all paragraphs [0040] - [0045] the whole document -----	1-14		
A	EP 1 162 162 A1 (ZUIKO CORP [JP]) 12 December 2001 (2001-12-12) abstract; figure all paragraphs [0034] - [0045] the whole document -----	1-14		
A	DE 28 06 058 A1 (ALCOA GMBH MASCH) 16 August 1979 (1979-08-16) abstract; figure 2 the whole document -----	1-14		
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;">                     "A" document defining the general state of the art which is not considered to be of particular relevance                      "E" earlier application or patent but published on or after the international filing date                      "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)                      "O" document referring to an oral disclosure, use, exhibition or other means                      "P" document published prior to the international filing date but later than the priority date claimed                 </td> <td style="width: 50%; border: none; vertical-align: top;">                     "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention                      "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone                      "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art                      "&amp;" document member of the same patent family                 </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
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Date of the actual completion of the international search	Date of mailing of the international search report			
29 March 2019	09/04/2019			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Piekarski, Adam			

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Information on patent family members

International application No PCT/IB2019/050780
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