

19



Octrooi centrum  
Nederland

11

2014635

12

## A OCTROOIAANVRAAG

21

Aanvraagnummer: **2014635**

51

Int. Cl.:  
**B29D 30/00** (2006.01) **B25J 5/06** (2016.01)

22

Aanvraag ingediend: **14/04/2015**

41

Aanvraag ingeschreven:  
**17/10/2016**

71

Aanvrager(s):  
**VMI Holland B.V. te Epe.**

43

Aanvraag gepubliceerd:  
**12/01/2017**

72

Uitvinder(s):  
**Anthonius Maria Hendrina de Boer te Baarn.  
Gerardus Johannes Catharina van Laar te  
Scherpenzeel.**

74

Gemachtigde:  
**ir. F.A. Geurts c.s. te Den Haag.**

54

**Gripper, gripper assembly and method for gripping a tire component.**

57

The invention relates to a gripper and a method for gripping a tire component, wherein the gripper comprises a gripping element with a gripping face to engage and retain the tire component through suction, wherein the gripping face comprises a plurality of sections, wherein the gripper for each section comprises a vacuum channel and a valve that is placed between the vacuum channel of the respective section and a vacuum source, wherein each valve is individually operable to an open position and a closed position, wherein the gripping face in use has a suction area formed by the sections of which the respective valves are in the open position, wherein the suction area is adjustable by selectively operating the plurality of valves to the open positions and the closed positions.

NLP196863A

5 Gripper, gripper assembly and method for gripping a tire  
component

10 BACKGROUND

The invention relates to a gripper, a gripper assembly and a method for gripping a tire component, in particular a tire component for forming a body ply or a  
15 breaker ply.

Grippers for gripping tire components are known in different sizes and shapes and with different gripping techniques to optimally grip tire components of different sizes and shapes. In particular the length of subsequently  
20 handled tire components may vary considerably, for example when building two breaker plies out of alternately shorter and longer tire components. The known grippers have to be interchanged for each tire component that either has a different size or a different shape compared to the  
25 previously handled tire component. In particular for grippers operating with suction, it is important to ensure that the right gripper is selected for each tire component such that the area of the selected gripper sufficiently matches the tire component, otherwise air leakage will  
30 prevent the buildup of sufficient underpressure to retain the tire component. The interchanging of grippers is time consuming.

It is an object of the present invention to provide a gripper, a gripper assembly and a method for  
35 gripping a tire component, wherein the flexibility of the gripper can be improved.

## SUMMARY OF THE INVENTION

According to a first aspect, the invention provides a gripper for gripping a tire component, in particular a tire component for forming a body ply or a breaker ply, wherein the gripper comprises a gripping element with a gripping face that is arranged to engage and retain the tire component through suction, wherein the gripping face comprises a plurality of sections, wherein the gripper for each section comprises a vacuum channel that debouches at the respective section in the gripping face for retaining the tire component to the respective section and a valve that is placed between the vacuum channel of the respective section and a vacuum source, wherein each valve is individually operable to an open position in which the valve is arranged to connect the vacuum channel of the respective section in fluid communication to the vacuum source and a closed position in which the valve is arranged to disconnect the vacuum channel of the respective section from the vacuum source, wherein the gripping face in use has a suction area formed by the sections of which the respective valves are in the open position, wherein the suction area is adjustable by selectively operating the plurality of valves to the open positions and the closed positions.

Thus, the suction area of the gripper can be adjusted, within the boundaries of the gripping face, to match or substantially match the shape and/or size of the tire component, without having to interchange the gripper for another gripper. This can greatly improve the flexibility of the gripper.

In an embodiment the sections form an activatable area of the gripping face, wherein the suction area is adjustable to a full mode in which the suction area extends across the entire activatable area and a partial mode in which the suction area extends across only a part of the activatable area. Adjusting the suction area to only a part

of the activatable area, in accordance with the surface area of the tire component to be gripped, can prevent air leakage at the sections which are not covered by the tire component during gripping.

5           In an embodiment each section is directly adjacent to another one of the sections so as to allow the formation of the suction area from a single chain of adjacent sections. The tire component can thus be securely, reliably and/or uniformly retained to the gripping face.

10           In an embodiment the suction area is adjustable to match or substantially match the surface area of the tire component to be gripped. The tire component can thus be optimally engaged by and retained to the gripping face.

          In an embodiment the tire component has a  
15 parallelogram or rhomboid contour with two pairs of parallel sides, wherein the gripping face has a parallelogram or rhomboid contour with two pairs of parallel sides for retaining the tire component on the gripping face with each pair of parallel sides of the tire component extending  
20 parallel or substantially parallel to one of the pairs of the parallel sides of the gripping face. Thus, the gripping face can be optimized for gripping and retaining a tire component with a specific parallelogram or rhomboid shape. Although the contour is fixed, the suction area can still be  
25 adjusted within said contour, again improving the flexibility of the gripper.

          In an embodiment the sections extend in a first direction parallel to one of the pairs of parallel sides of the gripping face. The sections can thus securely, reliably  
30 and/or uniformly retain to the tire component to the gripping face in the first direction across the gripping face.

          In an embodiment the sections are adjacent to each other in a second direction parallel to the other of the  
35 pairs of parallel sides of the gripping face. The suction area can thus be adjusted by varying the number of activated adjacent sections in the second direction in accordance with

the dimension of the tire component in said second direction.

In an embodiment the sections cover the entire or substantially the entire gripping face in the first  
5 direction.

In an embodiment the sections cover the entire or substantially the entire gripping face in the second direction. The sections can thus securely, reliably and/or uniformly retain to the tire component to the gripping face  
10 across the entire gripping face in the first direction.

According to a second aspect, the invention provides a gripper assembly comprising the aforementioned gripper, wherein the gripper assembly further comprises a configuration tool, wherein the gripper and the  
15 configuration tool are positionable with respect to each other in a configuration position for operating the valves, wherein the gripper for each valve is provided with an operational member that is operationally connected to the respective valve to operate the respective valve to the open  
20 position and the closed position, wherein the configuration tool is provided with a plurality of configuration members which in the configuration position are arranged to interact with the operational members to control the respective valves to their open positions and their closed positions.

25 The configuration tool can quickly configure the gripper without human intervention. The configuration tool can further prevent that human operators have to enter the potentially hazardous area of the gripper assembly to control the valves manually.

30 In an embodiment each operational member is movable in a push direction and a pull direction opposite to the push direction to operate the respective valve to the open position and the closed position, wherein the configuration members are arranged to push and pull the  
35 operational members to control the respective valves to their open positions and their closed positions. Pushing and pulling are relatively simple operations, which can be

easily performed by simple tools, such as the configuration tool.

In an embodiment each operational member comprises a stem that is operationally connected to the valve in the push direction and a knob that is fixedly attached to the stem in the pull direction, wherein the configuration members are fingers which are arranged to mesh with, interact with or engage the knobs of the operational members for moving said operational members in the push direction or the pull direction. The fingers can be easily maintained as they do not have moving parts. The fingers can furthermore be inserted into tight spaces, e.g. in a meshing interaction between the stems of adjacent operational members.

In an embodiment the operational members are spaced apart in or parallel to an index direction over a constant interval, wherein the configuration members are spaced apart over the same constant interval. The configuration members can thus mesh with the operational members at any interval along the index direction.

In an embodiment one of the gripper and the configuration tool is positionable with respect to the other of the gripper and the configuration tool in various index positions along the index direction, wherein the index positions are spaced apart at the same constant interval as the operational members and the configuration members, wherein the configuration members are arranged to mesh with, interact with or engage a different amount of the operational members for each index position along the index direction. Thus, by positioning the gripper and the configuration tool with respect to each other in a selected index position, different numbers of operational members can be engaged, allowing for the control of only a part of the plurality of valves, and thus allowing for the sections in only a part of the activatable area to be connected to the vacuum source to form the suction area or to be disconnected from the vacuum source to not form part of the suction area.

In an embodiment the configuration members, when

meshing with, interacting with or engaging two or more of the operational members, are arranged for meshing with, interacting with or engaging a closed group of two or more adjacent operational members in or parallel to the index  
5 direction. Thus, a closed group of two or more adjacent sections can be either connected to or disconnected from the vacuum source.

In an embodiment the gripper assembly further comprises a manipulator, preferably in the form of a robot,  
10 that is coupled to the gripper for positioning the gripper with respect to the tire component. The manipulator can control the relative position of the gripper with respect to the tire component and/or the configuration tool.

In an embodiment the gripper comprises a valve  
15 block that is mounted to the gripping element and that holds the valves in fluid communication with the vacuum channels, wherein the gripper assembly comprises at least one alternative gripping element for engaging and retaining an alternative tire component of a different size and/or shape  
20 through suction, wherein the valve block is detachable from the gripping element and mountable to the at least one alternative gripping element. Thus, the gripping elements themselves can be designed to be less complex, to require less maintenance and/or to be lower in costs. The complex,  
25 high-maintenance and/or expensive part of the gripping elements can be attached to any of the gripping elements.

In an embodiment the gripper is provided with a coupling element that is fixedly attached to the valve block, wherein the manipulator is arranged to engage the  
30 gripper at the coupling element. The complex, high-maintenance and/or expensive part of the gripping elements can be retained on the manipulator for use in combination with another one of the gripping elements.

In an embodiment the configuration tool is  
35 arranged to be stationary, wherein the manipulator is arranged for moving the gripper into proximity of the stationary configuration tool, such that the configuration

tool is in the configuration position with respect to the gripper, wherein the manipulator is further arranged for moving the gripper with respect to the stationary configuration tool such that the configuration members  
5 interact with the operational members to control the respective valves to their open positions and their closed positions. By holding the configuration tool stationary, the complexity of the configuration tool can be further reduced. The manipulator can simply move the gripper into and out of  
10 the configuration position.

In an embodiment the gripper assembly further comprises a blocking tool that is movable with respect to the operational members between a release position and a blocking position for allowing or blocking, respectively,  
15 movement of the operational members in the push direction and the pull direction. The blocking tool can reliably secure the operational members against movement in the push direction and the pull direction before and after the configuration has taken place, so ensure that the  
20 configuration does not accidentally change during the gripping of the tire component.

In an embodiment the operational members are movable in the push direction and the pull direction between a pushed down position and a pulled up position,  
25 respectively, which are spaced apart by an intermediate space, wherein the blocking tool comprises a plurality of blocking members which in the blocking position extend into the intermediate space between the respective pushed down positions and the respective pulled positions to block  
30 movement in the pull direction of any of the operational members which are in the pushed down position and to block movement in the push direction of any of the operational members which are in the pulled up position. The blocking tool can thus simultaneously block the operational members  
35 regardless of whether they are positioned in the pushed down position or the pulled up position.

In an embodiment the configuration tool is



provided with a displacement member that is arranged to displace the blocking tool from the blocking position into the release position when the configuration tool is in the configuration position with respect to the gripper. The displacement member can automatically move the blocking tool into the release position so that in the configuration position, the operational members are automatically freely movable in the push direction and the pull direction.

In an embodiment the blocking tool is provided with an abutment member, wherein the displacement member is arranged to abut the blocking tool at the abutment member to displace the blocking tool through abutment. The abutment member can be arranged abut the configuration tool at a position that does not hinder the operation of the configuration tool, the operational members and/or the blocking tool.

In an embodiment the gripper is provided with a biasing element for biasing the blocking tool into the blocking position, wherein the displacement member is arranged for displacing the blocking tool against the bias into the release position. Thus, the blocking tool will automatically return to the blocking position when the abutment between the blocking tool and the configuration tool in the configuration position is terminated.

In an embodiment the blocking tool is provided on the gripper and is movable with respect to the operational members between the release position and the blocking position. The blocking tool can thus be moved together with the gripper to ensure that the configuration remains fixed during the gripping of the tire component.

According to a third aspect, the invention provides a method for gripping a tire component, in particular a tire component for forming a body ply or a breaker ply, with the aforementioned gripper, wherein the method comprises the step of adjusting the suction area by selectively operating the plurality of valves to the open positions and the closed positions.

Thus, the suction area of the gripper can be adjusted, within the boundaries of the gripping face, to match or substantially match the shape and/or size of the tire component, without having to interchange the gripper  
5 for another gripper. This can greatly improve the flexibility of the gripper.

In an embodiment the sections form an activatable area of the gripping face, wherein the method comprises the step of adjusting the suction area to a full mode in which  
10 the suction area extends across the entire activatable area and a partial mode in which the suction area only extends across only a part of the activatable area. Adjusting the suction area to only a part of the activatable area, in accordance with the surface area of the tire component to be  
15 gripped, can prevent air leakage at the sections which are not covered by the tire component during gripping.

In an embodiment the suction area is formed by a single chain of adjacent sections. The tire component can thus be securely, reliably and/or uniformly retained to the  
20 gripping face.

In an embodiment the suction area is adjusted to match or substantially match the surface area of the tire component to be gripped. The tire component can thus be optimally engaged by and retained to the gripping face.

25 In an embodiment the step of adjusting the suction area to a specific configuration comprises the configuration steps of simultaneously operating all of the valves to the open position or the closed position and subsequently simultaneously operating a selection of the valves to the  
30 open position or the closed position in accordance with the specific configuration of the suction area. In this manner, all valve positions are reset and/or known to the operator, and the configuration tool can be used to set only a group of valves to another position.

35 In an embodiment the gripper comprises a valve block that is mounted to the gripping element and that holds the valves in fluid communication with the vacuum channels,

wherein the gripper assembly comprises at least one alternative gripping element for engaging and retaining an alternative tire component of a different size and/or shape through suction, wherein the method comprises the step of  
5 detaching the valve block from the gripping element and mounting the valve block to the at least one alternative gripping element. Thus, the gripping elements themselves can be designed to be less complex, to require less maintenance and/or to be lower in costs. The complex, high-maintenance  
10 and/or expensive part of the gripping elements can be attached to any of the gripping elements.

The various aspects and features described and shown in the specification can be applied, individually, wherever possible. These individual aspects, in particular  
15 the aspects and features described in the attached dependent claims, can be made subject of divisional patent applications.

## 20 BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be elucidated on the basis of an exemplary embodiment shown in the attached schematic drawings, in which:

25 figure 1 shows an isometric view of a gripper assembly according to the invention, comprising a gripper and a configuration tool for configuring said gripper;

figure 2 shows an isometric view of gripper and the configuration tool of figure 1;

30 figure 3 shows a top view of the gripper and the configuration tool according to figure 2;

figures 4A and 4B show a bottom view of the gripper according to figure 2;

figure 5 shows a front view of the gripper  
35 according to figure 2;

figure 6 shows an isometric view of the configuration tool according to figure 1;

figures 7A and 7B show isometric views of the steps of the gripper interacting with the configuration tool in a single configuration; and

figures 8A and 8B show top views of the gripper  
5 interacting with the configuration tool in two different configurations.

#### DETAILED DESCRIPTION OF THE INVENTION

10 Figure 1 shows a gripper assembly 1 according to the invention, for gripping a tire component 9, in particular a cord reinforced tire component 9 for forming a breaker ply or a body ply of a tire. Such tire components 9 are cut off from a continuous strip of cord-reinforced  
15 rubber material under a cutting angle or breaker angle to obtain a body of rubber material 90 with a characteristic parallelogram or rhomboid surface area 91 of the tire component 9, having a contour formed by a first pair 92 and a second pair 93 of parallel sides with oblique angles A  
20 between the directly adjacent sides.

As shown in figure 1, the gripper assembly 1 comprises a gripper 2 with a gripping element 3 for engaging and retaining the tire component 9 through suction, underpressure or a partial vacuum, a manifold block or  
25 vacuum block 4 for controlling the vacuum and a coupling element 5. The gripper assembly 1 is further provided with a manipulator 6 which is arranged to be coupled to the gripper 2 at the coupling element 5 for controlling the positioning of the gripper 2, for example for positioning the gripper 2  
30 above the tire component 9 for gripping and/or for moving the gripper 2 between stations of a tire building machine (not shown) after gripping of the tire component 9 to transfer said tire component 9 between said stations. The gripper assembly 1 optionally comprises a storage rack or  
35 magazine 7 for holding a plurality of alternative gripping elements 103, 203, 303, 403 for gripping alternative tire components of different sizes and/or shapes (not shown).

Finally, the gripper assembly 1 comprises a configuration tool 8 for configuring the gripper 2. The gripper assembly 1 according to the invention will be described in more detail hereafter.

5           As shown in figures 2, 3, 4A and 4B, the gripping element 3 comprises a planar or plate-like body 30 having a parallelogram or rhomboid gripping face 31 with a contour formed by a first pair 32 and a second pair 33 of parallel sides. The first pair 32 of parallel sides defines a first  
10 direction B parallel to said first pair 32 of parallel sides. The second pair 33 of parallel sides defines a second direction C parallel to said first pair 32 of parallel sides. The adjacent sides of the pairs 32, 33 of parallel sides are placed under oblique angles A, equal or  
15 substantially equal to the oblique angles A between the pairs 92, 93 of parallel sides of the tire component 9. The gripping face 31 in use faces towards the body 90 of the tire component 9 and is aligned with each of its pairs 32, 33 of parallel sides aligned or parallel to a respective one  
20 of the pairs 92, 93 of parallel sides of the tire component 9. When fully aligned, the gripping element 3 is brought into contact with the tire component 9 and the gripping face 31 is arranged to engage and retain the surface area 91 of the tire component 9 through suction, underpressure or the  
25 partial vacuum.

          To obtain the partial vacuum, the gripping face 31 is divided into a plurality of sections 34 extending in the first direction B, parallel to the first pair 32 of parallel sides. The sections 34 are adjacent to each other in the  
30 second direction C parallel to the second pair 33 of parallel sides. The sections 34 can be individually activated to engage and retain a corresponding part of the surface area 91 of the tire component 9. The sections 34 form an activatable area 35 of the gripping face 31 that  
35 covers the entire or substantially the entire gripping face 31. The combination of sections 34 which are activated simultaneously form an activated area or a suction area 36

of the gripping face 31. In a full mode, as shown in figure 4B, all sections 34 are activated simultaneously, such that the suction area 36 extends across the entire activatable area 35. In a partial mode, as shown in figure 4A, only a group of sections 34 is activated so that the suction area 36 extends across only a part of the activatable area 35. Each section 34 is directly adjacent to another one of the sections 34 so as to allow the formation of a suction area 35 from a chain or a single chain of adjacent sections 34 and/or with a closed or single area within the activatable area 35.

As shown in figures 4A, 4B and 5, for each section 34, the gripping element 3 is provided with a vacuum channel 37 that individually debouches into the respective section 34 via a plurality of suction holes 38. In this example, the vacuum channels 37 are integrated into the body 30 of the gripping element 3. The suction holes 38 are evenly distributed in the first direction B along the length of the respective section 34.

As shown in figure 5, the vacuum block 4 is detachably or removably mounted to the gripping element 3 at the side opposite to the gripping face 31. The vacuum block 4 is provided with a housing 40 and a plurality of valves 41 contained in said housing 40. The vacuum block 4 is operationally connected to a vacuum source (not shown) via a flexible hose or pipe 42. The vacuum block 4 can be operationally connected to and disconnected from the vacuum source by a main valve (not shown) to effectuate the retaining and release of the tire component 9 to and from the gripping face 31. When the vacuum block 4 is mounted to the gripping element 3, each valve 41 is aligned above and connected in sealed and/or fluid communication to a respective one of the vacuum channel 37. The valves 41 are placed between their respective vacuum channels 37 and the vacuum source. Thus, by selectively operating the valves 41, the vacuum channels 37 can be individually connected to and disconnected from the vacuum source and the sections 34

associated with each of the vacuum channels 37 can be individually and/or selectively activated.

As best seen in figure 2, the gripper 2 for each valve 41 (as shown in figure 5) is provided with an operational member 43 that is operationally connected to the respective valve 41 and that is movable between a pulled up position F and a pushed down position G to switch or operate the respective valve 42 to or between an open position and a closed position, respectively. The valves 41 and their associated operational members 43 are spaced apart in or parallel to an index direction I over a constant interval. In figure 2, the operational members 43 are alternately placed in a first row in the pushed down position G and in a second row in the pulled up position F. Typically, before or during configuration of the gripper 2, all operational members 43 are either moved to the pulled up position F or the pushed down position G, after which the operational members 43 are selectively moved to the pulled up position F or the pushed down position G in accordance with a set configuration.

In this exemplary embodiment, the operational member 43 is movable in a push direction P and a pull direction Q opposite to the push direction P to operate the respective valve 41 (as shown in figure 5) to the open position and the closed position, respectively. The push direction P and the pull direction Q are orthogonal or perpendicular to the body 30 of the gripping element 3, wherein the operational members 43 are pushed towards the closed position F in the push direction P towards the gripping element 3 and pulled towards the open position E in the pull direction Q away from the gripping element 3. The operational member 43 comprises a stem 44 that is operationally connected to the valve 41 in the push direction P and a knob 45 that is fixedly attached to the stem 44 in the pull direction Q. The stem 44 is slidably received in the housing 40 of the vacuum block 4. The knobs 45 are shaped to be easily engaged by the configuration

member 8 in a manner that will be described hereafter.

As shown in figures 2, 3 and 5, the gripper 2 is provided with a blocking tool 46 that is movable with respect to the operational members 43 between a blocking position X, as shown in figure 7A, and a release position R, as shown in figure 7B, for blocking or allowing, respectively, movement of the operational members 43 in the push direction P and the pull direction Q. As best seen in figure 5, the operational members 43 in the pushed down position G and the pulled up position F are spaced apart by or moved through an intermediate space H.

The blocking tool 46 in the blocking position X extends into the intermediate space between the respective pushed down positions F and the respective pulled up positions E to block movement in the pull direction P of any of the operational members 43 which are in the pushed down position G and to block movement in the push direction P of any of the operational members 43 which are in the pulled up position F. Specifically, the blocking tool 46 is provided with a base 47 and a plurality of blocking members 48 extending from the base 47 and meshing between the operational members 43. The base 47 is arranged to move over or underneath the knobs 45 of the operational members 43 that are in the row closest to the base 47, while the distal ends of the blocking members 48 with respect to the base 47 are arranged to move over or underneath the knobs 45 of the operational members 43 in the row that is further away from the base 47. In this exemplary embodiment, the blocking tool 46 is slidably received on the vacuum block 4, e.g. in this case with the use of slots in the base 47 which are slidably with respect to bolts mounted in the vacuum block 4. The blocking tool 46 is further provided with an abutment member 49, e.g. in the form of a bracket, for moving or displacing the blocking tool 46 between the blocking position X and the release position R through abutment with an external tool, e.g. the configuration tool 8. The blocking tool 46 is biased to move into the blocking position X by one or more



biasing elements, e.g. a spring (not shown).

As shown in figures 1 and 2, the manipulator 6 is arranged to engage the gripping element 3 at the coupling element 5, which in this example is detachably or removably mounted to the gripping element 3 together with or via the vacuum block 4. Preferably, the coupling element 5 is fixedly attached to the valve block 4, e.g. via the connection plate 50 as shown in figure 2. This allows for the easy removal of the valve block 4 and the coupling element 5 with the use of the manipulator 6 and the placement of said valve block 4 and the coupling element 5 on one of the alternative gripping elements 103, 203, 403 with the use of the manipulator 6.

As shown in figure 1, the manipulator 6 is arranged for engaging the gripper 2 at the coupling element 5 and for moving the gripping element 3 between a configuration position at or near the configuration tool 8, the magazine 7 for interchanging gripping elements 3, 103, 203, 303, 403 and one or more stations and/or a building drum of a tire building machine (not shown) for picking up, transferring and placing of the tire component 9 within said tire building machine. Preferably, the manipulator 6 is arranged for manipulating the position of the gripping element 3 in three dimensions and/or with respect to three Cartesian axes. Most preferably, the manipulator 6 is a robot, e.g. a robot with six degrees of freedom (6DoF).

The magazine 7 comprises a frame 70 with several mountings 71 for temporarily storing the gripping elements 3, 103, 203, 403 received from the manipulator 6. The alternative gripping elements 103, 203, 303, 403 are held by the frame 70 in an orientation such that the manipulator 6 can reach and engage each the alternative gripping elements 103, 203, 303, 403. The alternative gripping elements 103, 203, 303, 403 differ from the gripping element 3 as shown in figure 2 in size and/or the angle A between the adjacent sides. The number of vacuum channels and their mutual spacing in the alternative gripping elements 103, 203, 303,

403 is identical to the gripping element 3, thus allowing for the same vacuum block 4 to be universally attachable to each of the alternative gripping elements 103, 203, 303, 403 and to universally connect the valves 41 (as shown in figure 5) in sealed and/or fluid communication with the respective vacuum channels in the alternative gripping elements 103, 203, 303, 403. When interchanging one gripping element 3 for an alternative gripping element 103, 203, 303, 403, the coupling element 5 and the valve block 4 are detached from the gripping element 3 and are retained on the manipulator 6. Only the gripping element 3 is released and placed by the manipulator 6 on the mounting 71 at the frame 70. The coupling element 5 and valve block 4 are subsequently reattached to one of the alternative gripping elements 103, 203, 303, 403 which is then ready for operation.

As shown in figure 6, the configuration tool 8 comprises a base 80 and a plurality of configuration members 81 extending from said base 80 in an engagement direction E towards the operational members 43 when the gripper 2 is in the configuration position at or near the configuration tool 8. The configuration members 81 are arranged to interact with the operational members 43 to control the respective valves 41 (as shown in figure 5) to their open positions and their closed positions. In particular, the configuration members 81 are arranged to push and pull the operational members 43 in the push direction P and the pull direction Q, respectively, between the pushed down position G and the pulled up position F to control the respective valves 41 to their open positions and their closed positions, respectively. In this exemplary embodiment, the configuration members 81 are fingers 82 which are arranged to mesh with, interact with or engage the knobs 45 of the operational members 43 for moving said operational members 43 in the push direction P or the pull direction Q. The fingers 82 are spaced apart over the same constant interval as the operational members 43 in the index direction I. The configuration tool 8 is provided with a displacement member

83 standing up from the base 80. The displacement member 83 is arranged to abut the abutment member 49 of the blocking tool 46 in the engagement direction E to displace the blocking tool 46 in a displacement direction D from the blocking position X into the release position R when the configuration tool 8 is in the configuration position with respect to the gripper 2, as shown in figure 7B.

The steps of configuring the gripper 2 for engaging and retaining a particular tire component 9 are described in more detail hereafter with reference to figures 7A and 7B and figures 8A and 8B.

During the steps of the configuration, as shown in figures 7A and 7B, the configuration tool 8 is held stationary in the configuration position, while the gripper 2, including the gripping element 3, is moved and/or positioned by the manipulator 6 into the configuration position at or near the configuration tool 8. Alternatively, the configuration tool 8 may be moved towards the gripper 2, in which case the gripper 2 is held stationary in the configuration position during the configuration. In said configuration position, as shown in figure 7A, the fingers 82 of the configuration tool 8 are aligned in the engagement direction E with respect to the gripper 2 so as to mesh between the operational members 43. Subsequently, the manipulator 6 moves the displacement member 83 into abutment with the abutment member 49 in the engagement direction E. After the initial abutment the manipulator 6 moves the gripper 2 further in the engagement direction E so that the displacement member 83 actually displaces the blocking tool 46 via the abutment member 49 from the blocking position X into the release position R, as shown in figure 7B. Now the knobs 45 of the operational members 43 are no longer blocked by the blocking tool 46 and the operational members 43 can be freely moved by the configuration tool 8 in the push direction P and the pull direction Q.

Prior to or as a first step of the configuration, all operational members 43 are moved into the same position,

either the pulled up position F or the pushed down position G. This preparatory step is substantially the same as the steps of the actual configuration. Reference is therefore made to the description of the configuration steps below.

5               With the movement of the gripper 2 in the engagement direction E, the configuration members 81 are brought in a position either above the knobs 45 of the operational members 43 that are in the pulled up position F or below the knobs 45 of the operational members 43 that are  
10 in the pushed down position G. When extending underneath the knobs 45, the fingers 82 are arranged to mesh with and/or extend between the stems 44 of the operational members 43. The fingers 82 are spaced apart to allow accommodation of the stems 44 between the fingers 82, while being  
15 sufficiently close to each other for abutting the knob 45 in the pull direction Q. The fingers 82 furthermore extend in the engagement direction beyond the first row up to and alongside the stems 43 of the operational members 43 in the second row. With the configuration members 81 in a position  
20 for interacting with the operational members 43, the manipulator 6 moves the gripper 2 relative to the configuration tool 8 in the push direction P or the pull direction Q so that the engaged operational members 43 are moved by the stationary configuration tool 8 in either the  
25 pull direction Q or the push direction P, respectively.

              The number of operational members 43 which are engaged and moved by the configuration tool 8 defines the number of sections 34 of the gripping element 3 which are activated to form the suction area 36, which can be the full  
30 activatable area 35 in the full mode or only a part of the activatable area 35 in the partial mode. The number of operational members 43 which are engaged by the configuration tool 8 can be adjusted by moving the gripper 2 along or parallel to the index direction I into an index  
35 position in accordance with the number of operational members 43 that are to be engaged. The gripper 2 is positionable with respect to the configuration tool 8 in a

plurality of index positions which are spaced apart over the same or constant interval as the configuration members 81 and the operational members 43. For each index position along the index direction I, the configuration members 81 of the configuration tool 8 are arranged to interact or to mesh with, interact with or engage a different number of the operational members 43. The farther an index position is offset with respect to the center of the gripper 2, the less operational members 43 are engaged. Because the interval between the configuration members 81 and the operational members 43 is the same, the configuration members 81 will always engage a compact, serried or closed group of directly adjacent operational members 43, such that a compact, serried or closed group or chain of directly adjacent sections 34 is activated. In the example of figure 8B, the gripper 2 is offset with respect to the configuration tool 8 along the index direction I into an index position in which the last four operational members 43 are not engaged by the configuration tool 8 and thus remain in the their initial position. The operational members 43 that are engaged are moved simultaneously by the configuration tool 8 into either the pulled up position F or the pushed down position G to open or close, respectively, the corresponding valves 41 (as shown in figure 5).

As shown in figures 8A and 8B, the displacement member 83 is sufficiently long in the index direction I to abut the abutment member 49 in at least half of the index positions along the index direction I.

Thus, by selectively engaging a number of the operational members 43 with the configuration tool 8, the suction area 36 can be adjusted to substantially match or correspond to the surface area 91 of the tire component 9, for securely engaging and retaining the tire component 9 at the gripping face 31. In particular, the length of the suction area 36 in the first direction A can be adjusted to match the length of the tire component 9 in said direction. The length of subsequently handled tire components 9 may

vary, for example when building breaker plies out of alternately shorter and longer tire components 9.

The alternative gripping elements 103, 203, 303, 403 are held ready for use in the magazine 5, within the  
5 range of the manipulator 6. The alternative gripping elements 103, 203, 303, 403 are functionally similar, equivalent or identical to the gripping element 3 and only differ from the gripping element 3 in the length of the  
10 pairs of parallel sides and/or the oblique angle of the directly adjacent sides. Thus, alternative tire components (not shown) which are cut at different lengths, widths and/or at different cutting angles, can be reliably gripped by a suitably shaped or dimensioned one of the alternative  
15 gripping elements 103, 203, 303, 403. Typically, a tire manufacturer only has a limited range of tire components, thus, requiring only a limited amount of alternative gripping elements 103, 203, 303, 403.

It is to be understood that the above description is included to illustrate the operation of the preferred  
20 embodiments and is not meant to limit the scope of the invention. From the above discussion, many variations will be apparent to one skilled in the art that would yet be encompassed by the scope of the present invention.

For example, multiple gripper assemblies as the  
25 gripper assembly 1 as shown in figure 1 may be used to transfer tire components 9 to different production lines, e.g. for the production of breaker plies with different sizes or shapes. In such a situation, the configuration tools 8 of both gripper assemblies 1 may be integrated into  
30 one configuration tool (not shown), which is placed within range of both manipulators 6 to simultaneously or alternately configure the grippers 2 of each of the gripper assemblies 1.

In summary, the invention relates to a gripper and  
35 a method for gripping a tire component, wherein the gripper comprises a gripping element with a gripping face to engage and retain the tire component through suction, wherein the

gripping face comprises a plurality of sections, wherein the gripper for each section comprises a vacuum channel and a valve that is placed between the vacuum channel of the respective section and a vacuum source, wherein each valve  
5 is individually operable to an open position and a closed position, wherein the gripping face in use has a suction area formed by the sections of which the respective valves are in the open position, wherein the suction area is adjustable by selectively operating the plurality of valves  
10 to the open positions and the closed positions.

C O N C L U S I E S

1. Grijper voor het grijpen van een bandcomponent, in het bijzonder een bandcomponent voor het vormen van een body ply of een breaker ply, waarbij de grijper een grijpelement omvat met een grijpvlak dat is ingericht voor het aangrijpen op en het vasthouden van de bandcomponent door zuiging, waarbij het grijpvlak een meervoud van secties omvat, waarbij de grijper voor elke sectie een vacuümkanaal omvat dat uitmondt bij de respectievelijke sectie in het grijpvlak voor het vasthouden van de bandcomponent aan de respectievelijke sectie en een klep die geplaatst is tussen het vacuümkanaal van de respectievelijke sectie en een vacuümbron, waarbij elke klep individueel bedienbaar is naar een open positie waarin de klep is ingericht teneinde het vacuümkanaal van de respectievelijke sectie in vloeiende verbinding te verbinden met de vacuümbron en een gesloten positie waarin de klep is ingericht teneinde het vacuümkanaal van de respectievelijke sectie van de vacuümbron af te sluiten, waarbij het grijpvlak in gebruik een zuiggebied heeft dat gevormd wordt door de secties waarvan de respectievelijke kleppen in de open positie zijn, waarbij het zuiggebied instelbaar is door het selectief bedienen van het meervoud van kleppen naar de open posities en de gesloten posities.

2. Grijper volgens conclusie 1, waarbij de secties een activeerbaar gebied vormen van het grijpvlak, waarbij het zuiggebied instelbaar is naar een volledige modus waarin het zuiggebied zich uitstrekt over het gehele activeerbare gebied en een gedeeltelijke modus waarin het zuiggebied zich over slechts een gedeelte van het activeerbare gebied uitstrekt.

3. Grijper volgens conclusie 2, waarbij elke sectie direct naastgelegen aan een andere van de secties is



teneinde het vormen van het zuiggebied uit een enkele aaneenschakeling van naastgelegen secties toe te laten.

4. Grijper volgens één der voorgaande conclusies, waarbij het zuiggebied instelbaar is teneinde  
5 overeen te komen met of in hoofdzaak overeen te komen met het oppervlaktegebied van de aan te grijpen bandcomponent.

5. Grijper volgens één der voorgaande conclusies, waarbij de bandcomponent een parallellogram of romboïde contour heeft met twee paren van evenwijdige  
10 zijden, waarbij het grijpvlak een parallellogram of romboïde contour heeft met twee paren van evenwijdige zijden voor het vasthouden van de bandcomponent op het grijpoppervlak met elk paar van de evenwijdige zijden van de bandcomponent die zich evenwijdig of in hoofdzaak  
15 evenwijdig uitstrekken aan één van de paren van de evenwijdige zijden van het grijpvlak.

6. Grijper volgens conclusie 5, waarbij de secties zich uitstrekken in een eerste richting evenwijdig aan één van de paren van parallelle zijden van het  
20 grijpvlak.

7. Grijper volgens conclusie 6, waarbij de secties naast elkaar gelegen zijn in een tweede richting evenwijdig aan de andere van het paar van parallelle zijden van het grijpvlak.

25 8. Grijper volgens één der conclusies 5-7, waarbij de secties het volledige of in hoofdzaak het volledige grijpvlak in de eerste richting bestrijken.

9. Grijper volgens één der conclusies 5-8, waarbij de secties het gehele of in hoofdzaak het gehele  
30 grijpvlak in de tweede richting bestrijken.

10. Grijpsamenstel omvattend de grijper volgens één der voorgaande conclusies, waarbij het grijpsamenstel verder een configuratiegereedschap omvat, waarbij de grijper en het configuratiegereedschap positioneerbaar zijn  
35 ten opzichte van elkaar in een configuratiepositie voor het bedienen van de kleppen, waarbij de grijper voor elke klep is voorzien van een bedieningsdeel dat operationeel

verbonden is met de respectievelijke klep teneinde de respectievelijke klep te bedienen naar de open positie en de gesloten positie, waarbij het configuratiegereedschap is voorzien van een meervoud van configuratiedelen welke in de  
5 configuratiepositie zijn ingericht teneinde samen te werken met de bedieningsdelen teneinde de respectievelijke kleppen te regelen naar hun open posities en hun gesloten posities.

11. Grijpsamenstel volgens conclusie 10, waarbij elk bedieningsdeel beweegbaar is in een drukrichting en een  
10 trekrichting tegengesteld aan de drukrichting teneinde de respectievelijke klep te bedienen naar de open positie en de gesloten positie, waarbij de configuratiedelen zijn ingericht teneinde de bedieningsdelen te drukken of te trekken teneinde de respectievelijke kleppen te regelen  
15 naar hun open posities en hun gesloten posities.

12. Grijpsamenstel volgens conclusie 11, waarbij elk bedieningsdeel een steel omvat die operationeel verbonden is met de klep in de drukrichting en een knop die vast verbonden is met de steel in de trekrichting, waarbij  
20 de configuratiedelen vingers zijn welke zijn ingericht teneinde aan te grijpen tussen, samen te werken met of aan te grijpen op de knoppen van de bedieningsdelen voor het bewegen van de bedieningsdelen in de drukrichting of de trekrichting.

25 13. Grijpsamenstel volgens één der conclusies 10-12, waarbij de bedieningsdelen op afstand van elkaar gelegen zijn in of evenwijdig aan een indexrichting over een constante interval, waarbij de configuratiedelen op afstand van elkaar gelegen zijn over dezelfde constante  
30 interval.

14. Grijpsamenstel volgens conclusie 13, waarbij één van de grijper en het configuratiegereedschap positioneerbaar is ten opzichte van de andere van de grijper en het configuratiegereedschap in verschillende  
35 indexposities langs de indexrichting, waarbij de indexposities op afstand van elkaar gelegen zijn op dezelfde constante interval als de bedieningsdelen en de

configuratiedelen, waarbij de configuratiedelen zijn ingericht teneinde aan te grijpen tussen, samen te werken met of aan te grijpen op een verschillend aantal van de bedieningsdelen voor elke indexpositie langs de  
5 indexrichting.

15. Grijsamenstel volgens conclusie 13 of 14, waarbij de configuratiedelen, wanneer deze aangrijpen tussen, samenwerken met of aangrijpen op twee of meer van de bedieningsdelen, zijn ingericht voor het aangrijpen  
10 tussen, samenwerken met of aangrijpen op een gesloten groep van twee of meer naast elkaar gelegen bedieningsdelen in of evenwijdig aan de indexrichting.

16. Grijsamenstel volgens één der conclusies 10-15, waarbij het grijsamenstel verder een manipulator  
15 omvat, bij voorkeur in de vorm van een robot, die gekoppeld is met de grijper voor het positioneren van de grijper ten opzichte van de bandcomponent.

17. Grijsamenstel volgens één der conclusies 10-16, waarbij de grijper een kleppenblok omvat dat gemonteerd  
20 is op het grijpelement en dat de kleppen in vloeiende verbinding houdt met de vacuümkanalen, waarbij het grijsamenstel ten minste één alternatief grijpelement omvat voor het aangrijpen op en het vasthouden van een alternatieve bandcomponent van een andere afmeting en/of  
25 vorm door zuiging, waarbij het kleppenblok losmaakbaar is van het grijpelement en bevestigbaar is aan het ten minste ene alternatieve grijpelement.

18. Grijsamenstel volgens conclusies 16 en 17, waarbij de grijper is voorzien van een koppellement dat  
30 vast verbonden is met het kleppenblok, waarbij de manipulator is ingericht teneinde de grijper aan te grijpen bij het koppellement.

19. Grijsamenstel volgens conclusie 16, waarbij het configuratiegereedschap is ingericht teneinde  
35 stationair te zijn, waarbij de manipulator is ingericht voor het bewegen van de grijper tot in nabijheid van het stationaire configuratiegereedschap, zodanig dat het

configuratiegereedschap in de configuratiepositie is ten opzichte van de grijper, waarbij de manipulator verder is ingericht voor het bewegen van de grijper ten opzichte van het stationaire configuratiegereedschap zodanig dat de  
5 configuratiedelen samenwerken met de bedieningsdelen teneinde de respectievelijke kleppen te regelen naar hun open posities en hun gesloten posities.

20. Grijsamenstel volgens één der conclusies 11-19, waarbij het grijsamenstel verder een  
10 blokkeergereedschap omvat dat beweegbaar is ten opzichte van de bedieningsdelen tussen een vrijgeefpositie en een blokkeerpositie voor het respectievelijk toelaten of blokkeren van beweging van de bedieningsdelen in de drukrichting en de trekrichting.

15 21. Grijsamenstel volgens conclusie 20, waarbij de bedieningsdelen beweegbaar zijn in de drukrichting en de trekrichting tussen respectievelijk een naar beneden gedrukte positie en een naar boven getrokken positie, welke op afstand van elkaar gelegen zijn door een tussengelegen  
20 ruimte, waarbij het blokkeergereedschap een meervoud van blokkeerdelen omvat welke zich in de blokkeerpositie uitstrekken tot in de tussengelegen ruimte tussen de respectievelijke naar beneden gedrukte posities en de respectievelijke naar boven getrokken posities teneinde  
25 beweging in de trekrichting te blokkeren van elk van de bedieningsdelen welke in de naar beneden gedrukte positie zijn en teneinde beweging te blokkeren in de trekrichting van elk bedieningsdeel dat in de naar boven getrokken positie is.

30 22. Grijsamenstel volgens conclusie 20 of 21, waarbij het configuratiegereedschap is voorzien van een verplaatsingsdeel dat is ingericht teneinde het blokkeergereedschap te verplaatsen vanuit de blokkeerpositie tot in de vrijgavepositie wanneer het  
35 configuratiegereedschap in de configuratiepositie is ten opzichte van de grijper.

23. Grijper volgens conclusie 22, waarbij het

blokkeergereedschap is voorzien van een aanslagdeel, waarbij het verplaatsingsdeel is ingericht teneinde tegen het blokkeergereedschap aan te liggen bij het aanslagdeel teneinde het blokkeergereedschap te verplaatsen door  
5 aanligging.

24. Grijpsamenstel volgens één der conclusies 22 of 23, waarbij de grijper is voorzien van een voorbelastelement voor het voorbelasten van het blokkeergereedschap tot in de blokkeerpositie, waarbij het  
10 verplaatsingsdeel is ingericht voor het verplaatsen van het blokkeergereedschap tegen de voorbelasting in tot in de vrijgavepositie.

25. Grijpsamenstel volgens één der conclusies 20-24, waarbij het blokkeergereedschap is verschaft op de  
15 grijper en beweegbaar is ten opzichte van de bedieningsdelen tussen de vrijgavepositie en de blokkeerpositie.

26. Werkwijze voor het grijpen van een bandcomponent, in het bijzonder een bandcomponent voor het  
20 vormen van een body ply of een breaker ply, met een grijper volgens conclusie 1, waarbij de werkwijze de stap omvat van het aanpassen van het zuiggebied door het selectief bedienen van het meervoud van kleppen naar de open posities en de gesloten posities.

25 27. Werkwijze volgens conclusie 26, waarbij de secties een activeerbaar gebied van het grijpvlak vormen, waarbij de werkwijze de stap omvat van het aanpassen van het zuiggebied naar een volledige modus waarin het zuiggebied zich over het volledig activeerbare gebied  
30 uitstrekt en een gedeeltelijke modus waarin het zuiggebied zich over slechts een gedeelte van het activeerbare gebied uitstrekt.

28. Werkwijze volgen conclusie 26 of 27, waarbij het zuiggebied gevormd wordt door een enkele  
35 aaneenschakeling van naast elkaar gelegen secties.

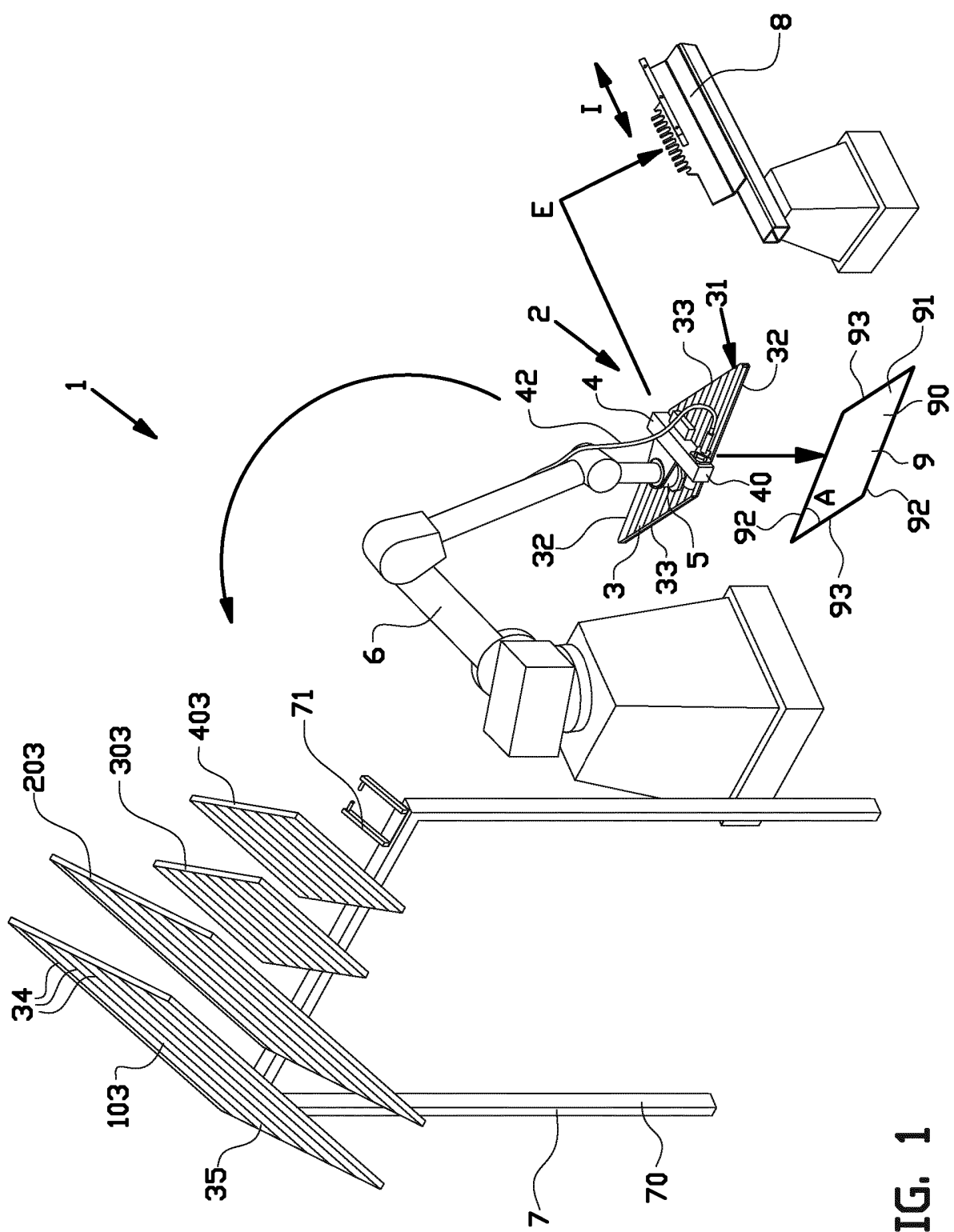
29. Werkwijze volgens één der conclusies 26-28, waarbij het zuiggebied ingesteld wordt teneinde overeen te

komen met of in hoofdzaak overeen te komen met het oppervlaktegebied van de aan te grijpen bandcomponent.

30. Werkwijze volgens één der conclusies 26-29, waarbij de stap van het instellen van het zuiggebied naar  
5 een specifieke configuratie de configuratiestappen omvat van het gelijktijdig bedienen van alle kleppen naar de open positie of de gesloten positie en het vervolgens gelijktijdig bedienen van een selectie van de kleppen naar de open positie of de gesloten positie overeenkomstig met  
10 de specifieke configuratie van het zuiggebied.

31. Werkwijze volgens één der conclusies 26-30, waarbij de grijper een kleppenblok omvat dat gemonteerd is op het grijpelement en dat de kleppen in vloeiende verbinding met de vacuümkanalen houdt, waarbij het  
15 grijpsamenstel ten minste één alternatief grijpelement omvat voor het aangrijpen en vasthouden van een alternatieve bandcomponent met een andere afmeting en/of vorm door zuiging, waarbij de werkwijze de stap omvat van het losmaken van het kleppenblok van het grijpelement en  
20 het bevestigen van het kleppenblok aan het ten minste ene alternatieve grijpelement.

-o-o-o-o-o-o-o-o-



# 151

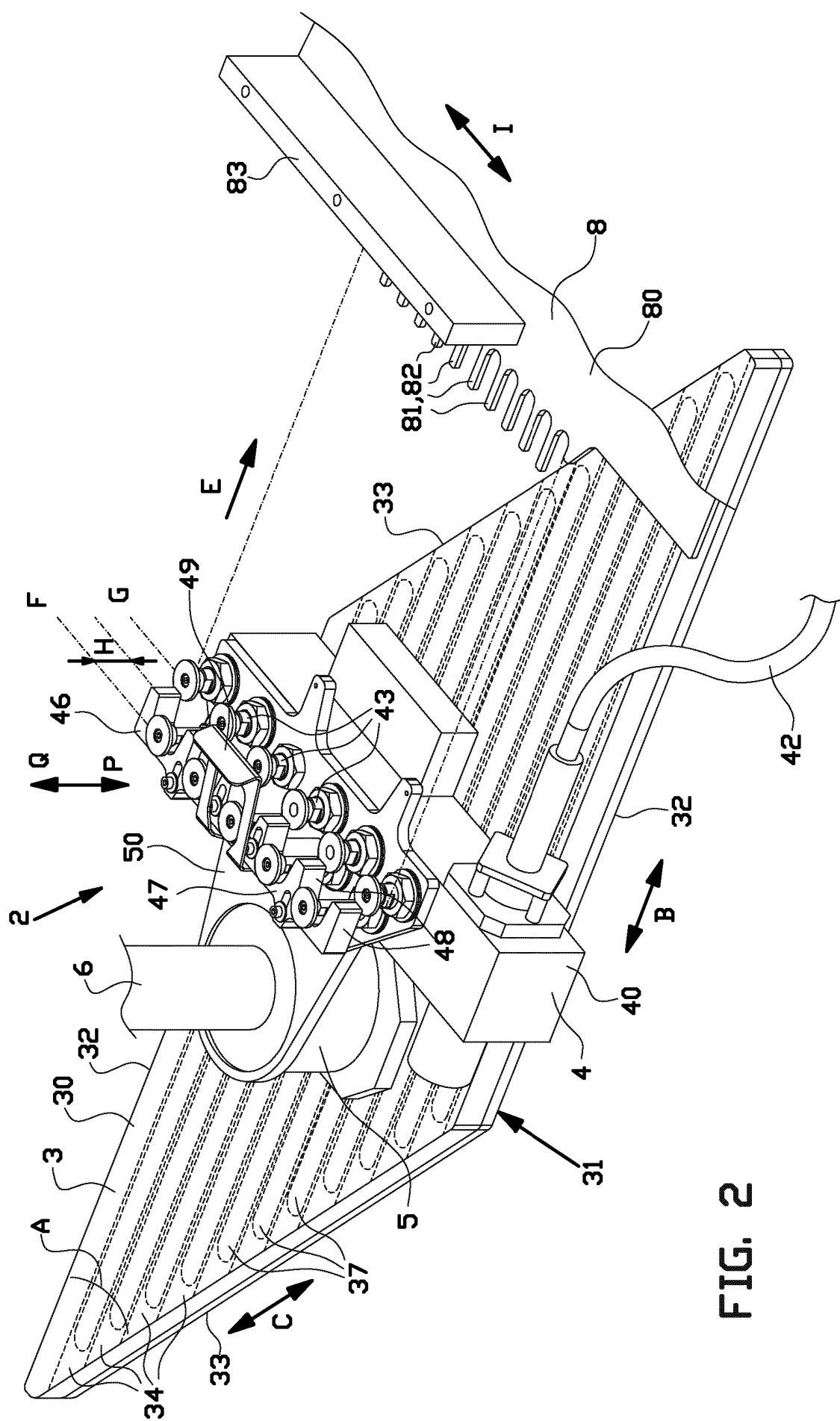
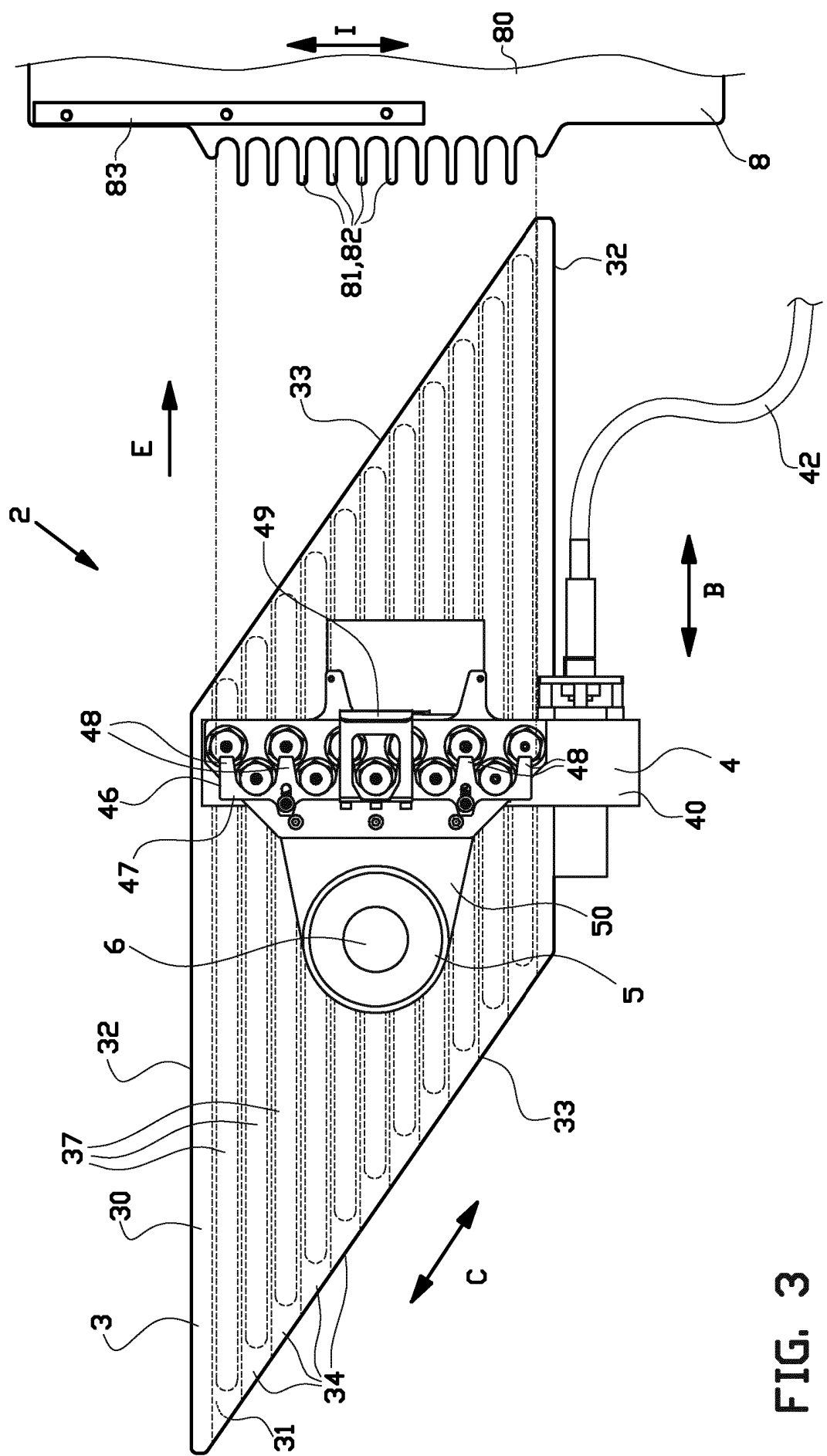


FIG. 2





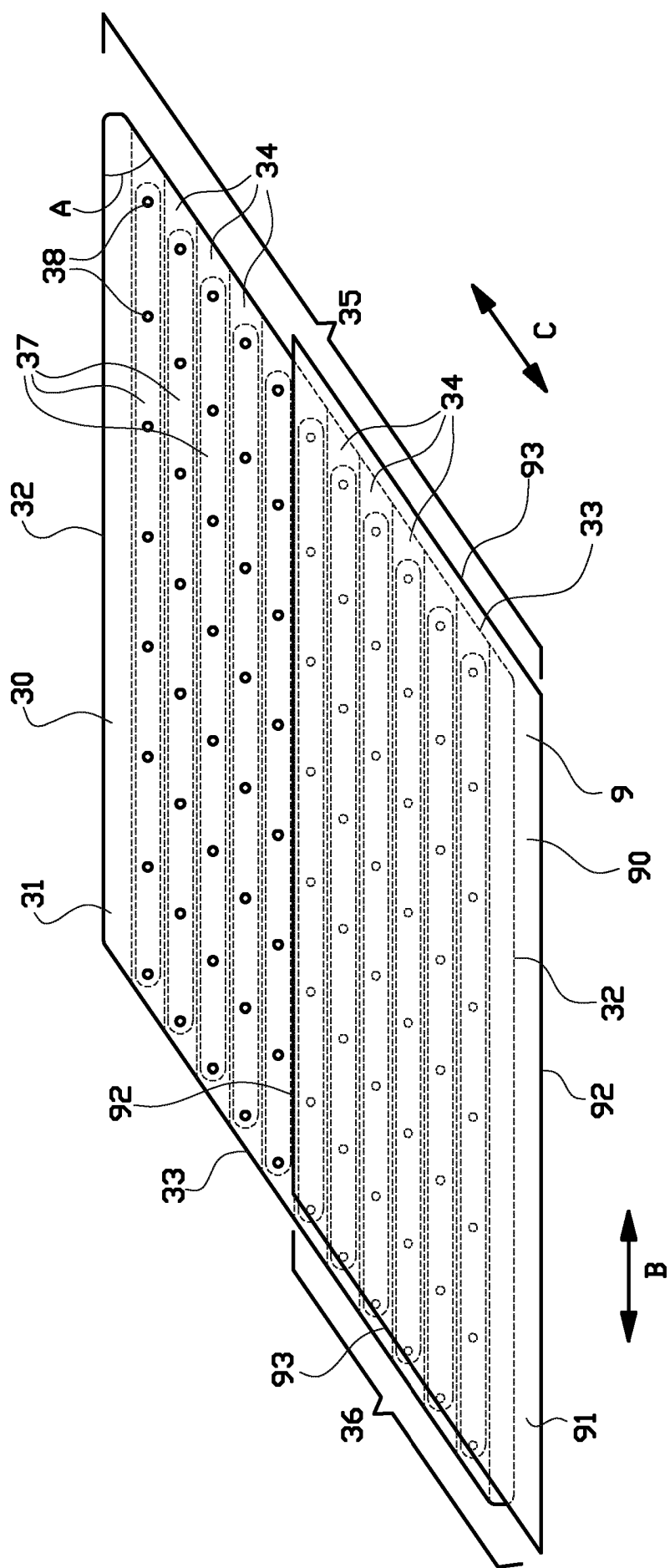


FIG. 4A

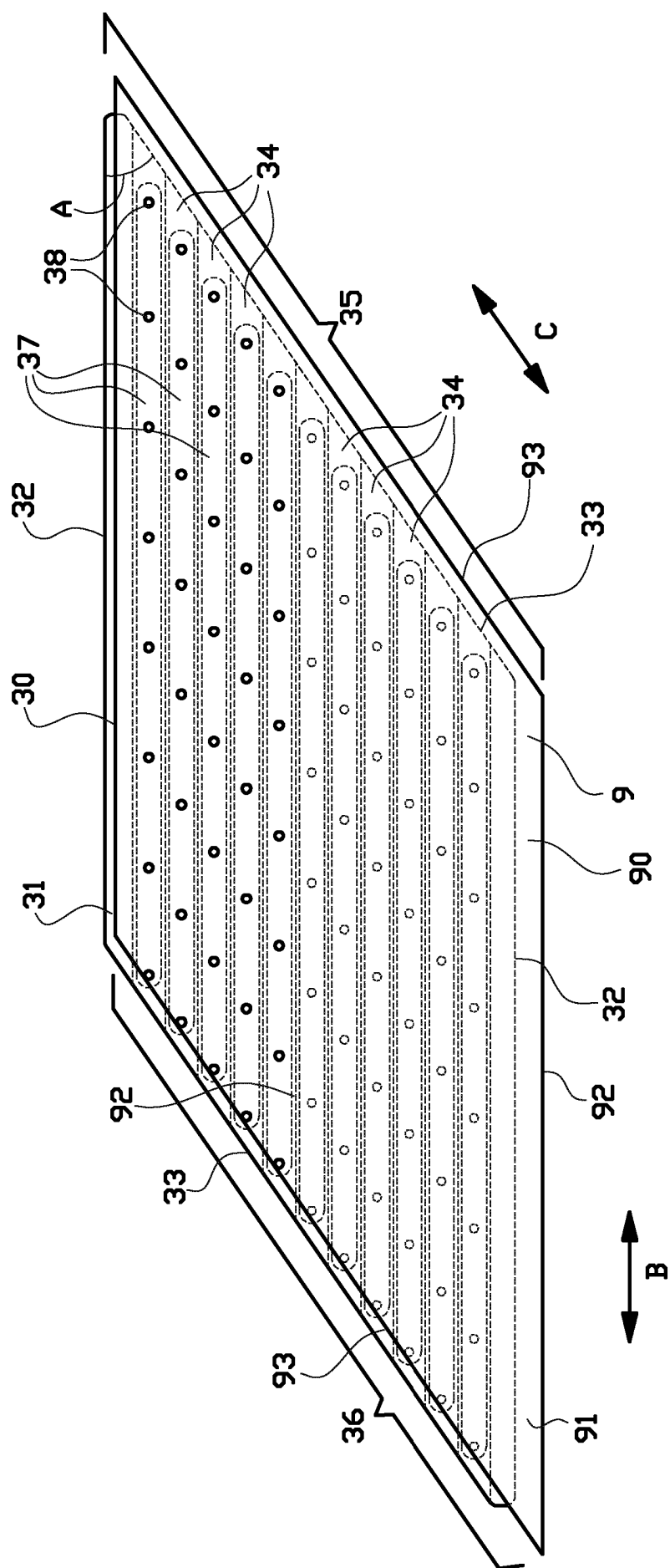


FIG. 4B

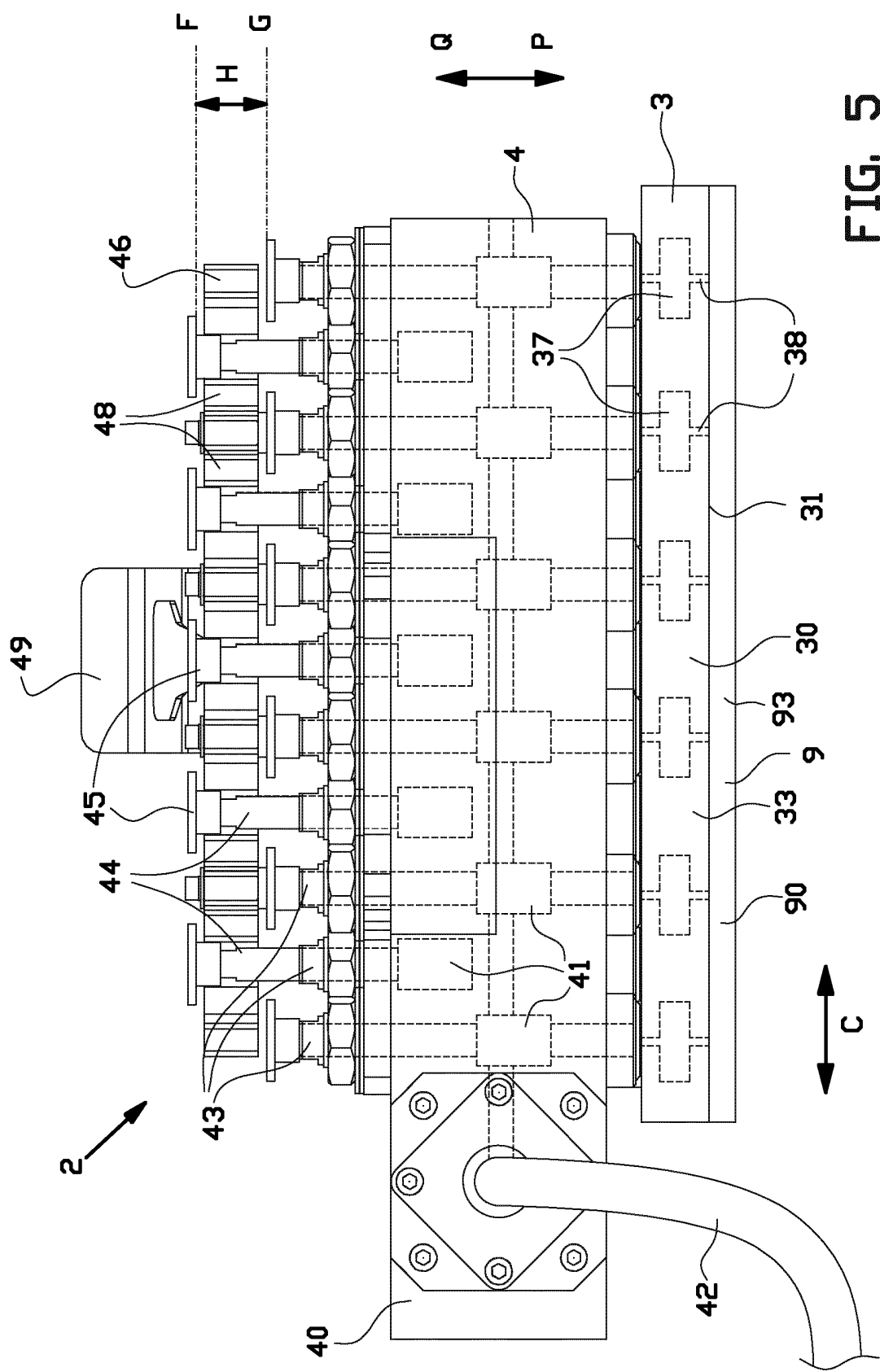


FIG. 5

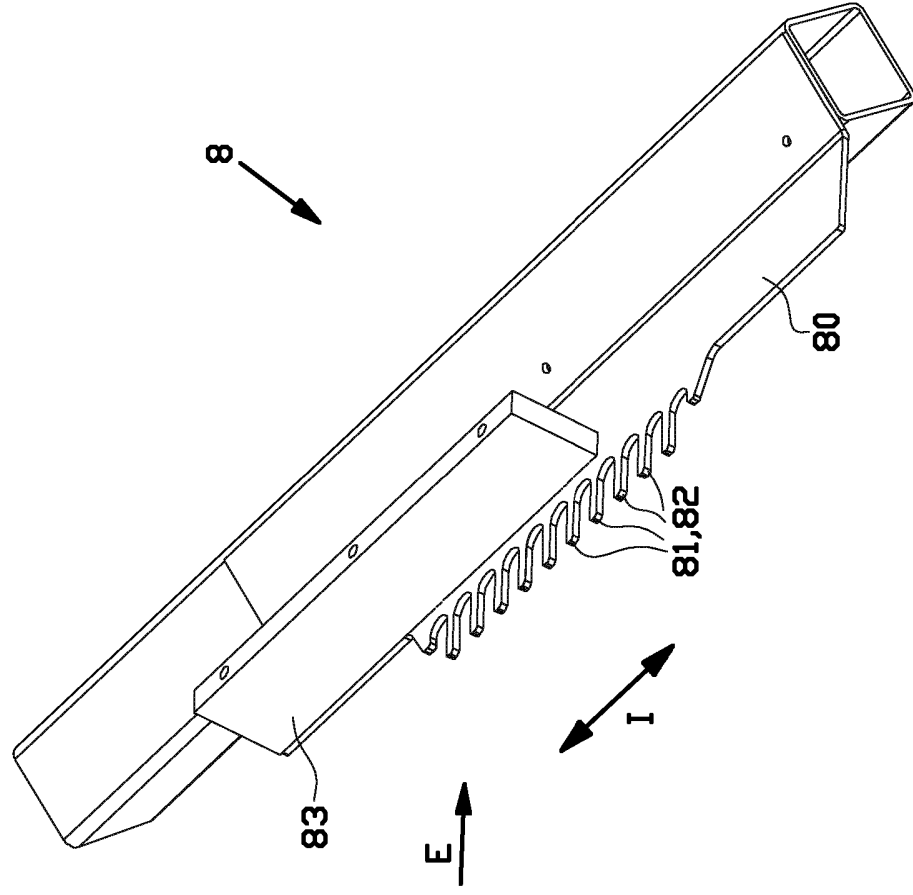


FIG. 6

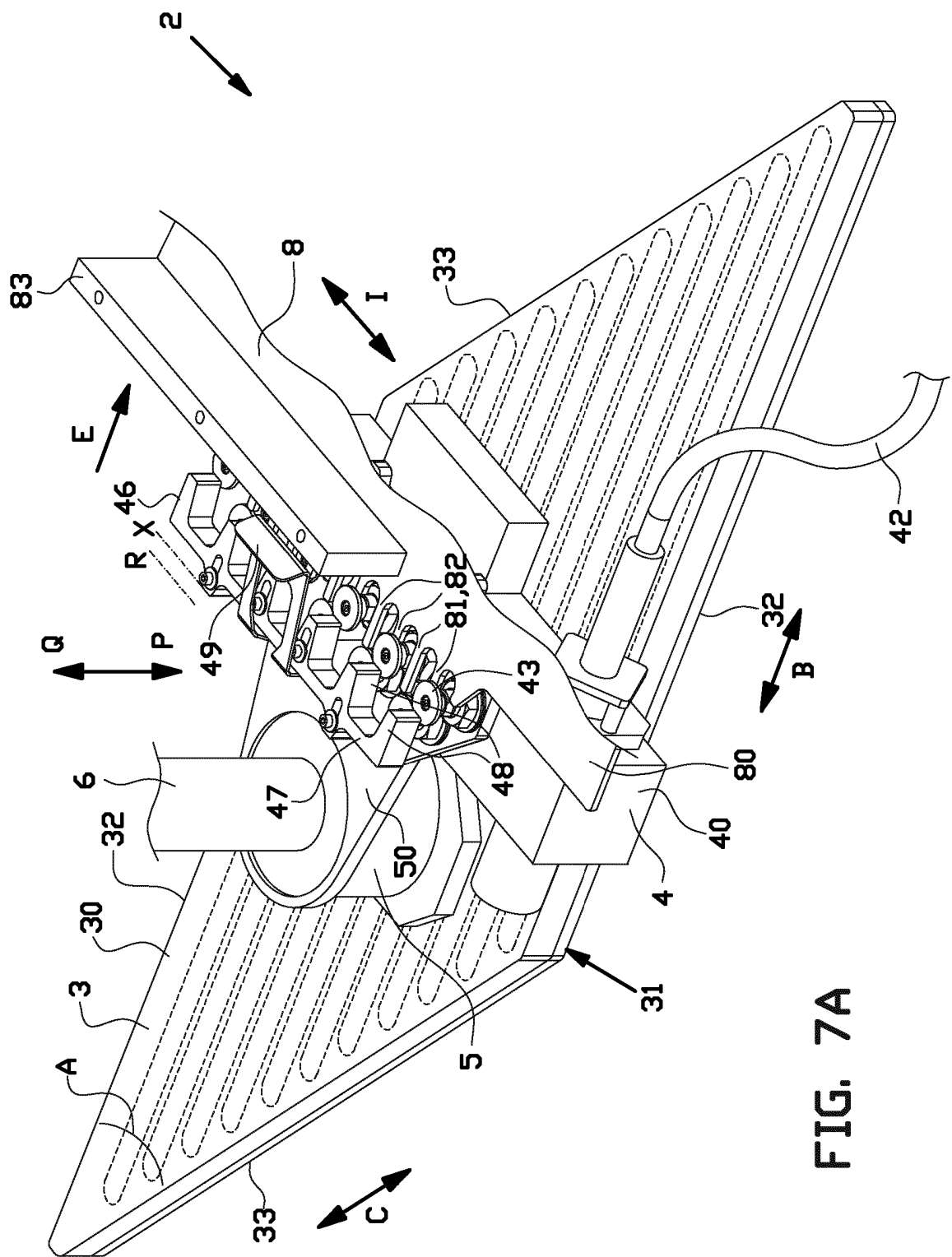


FIG. 7A

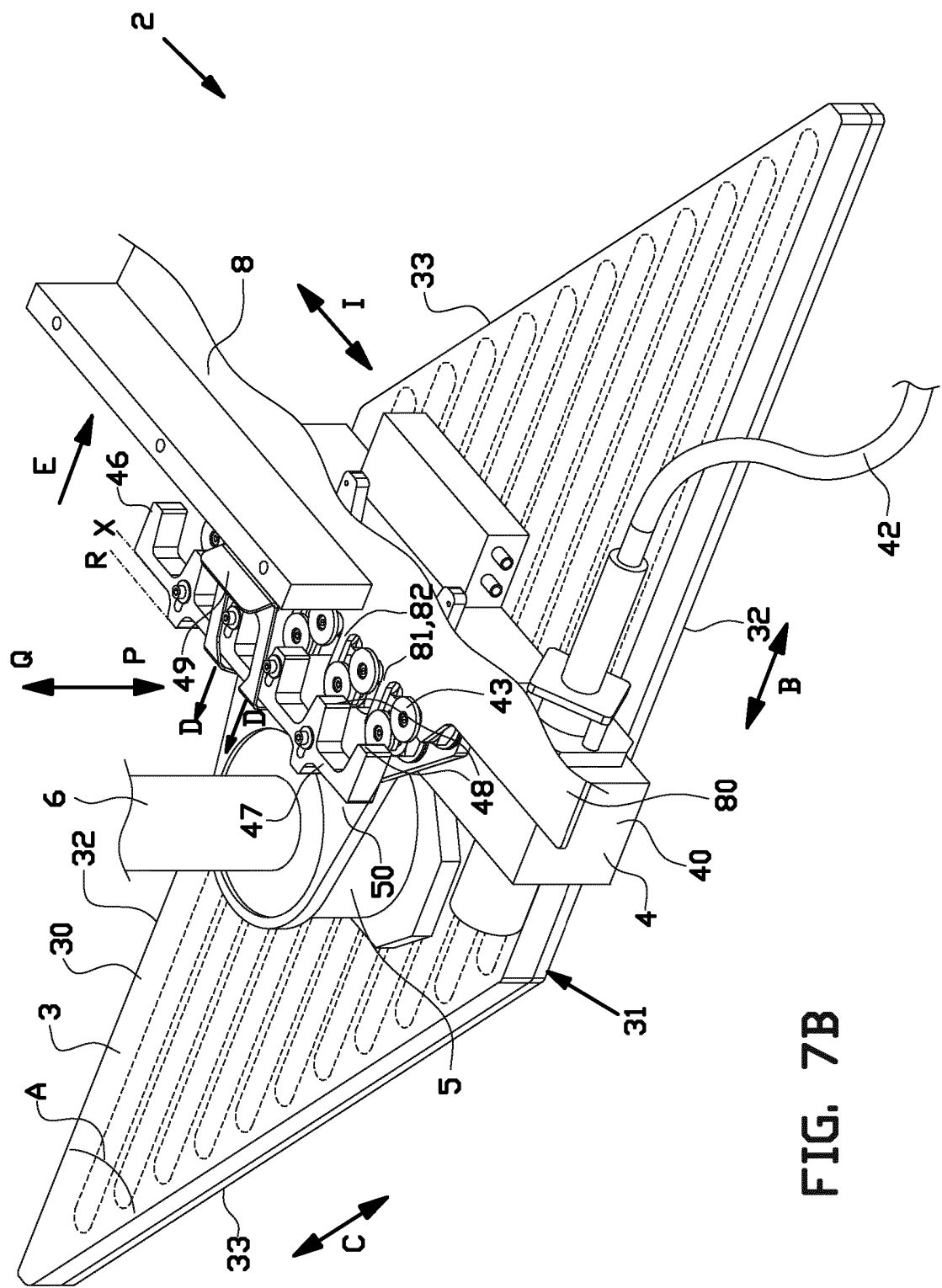
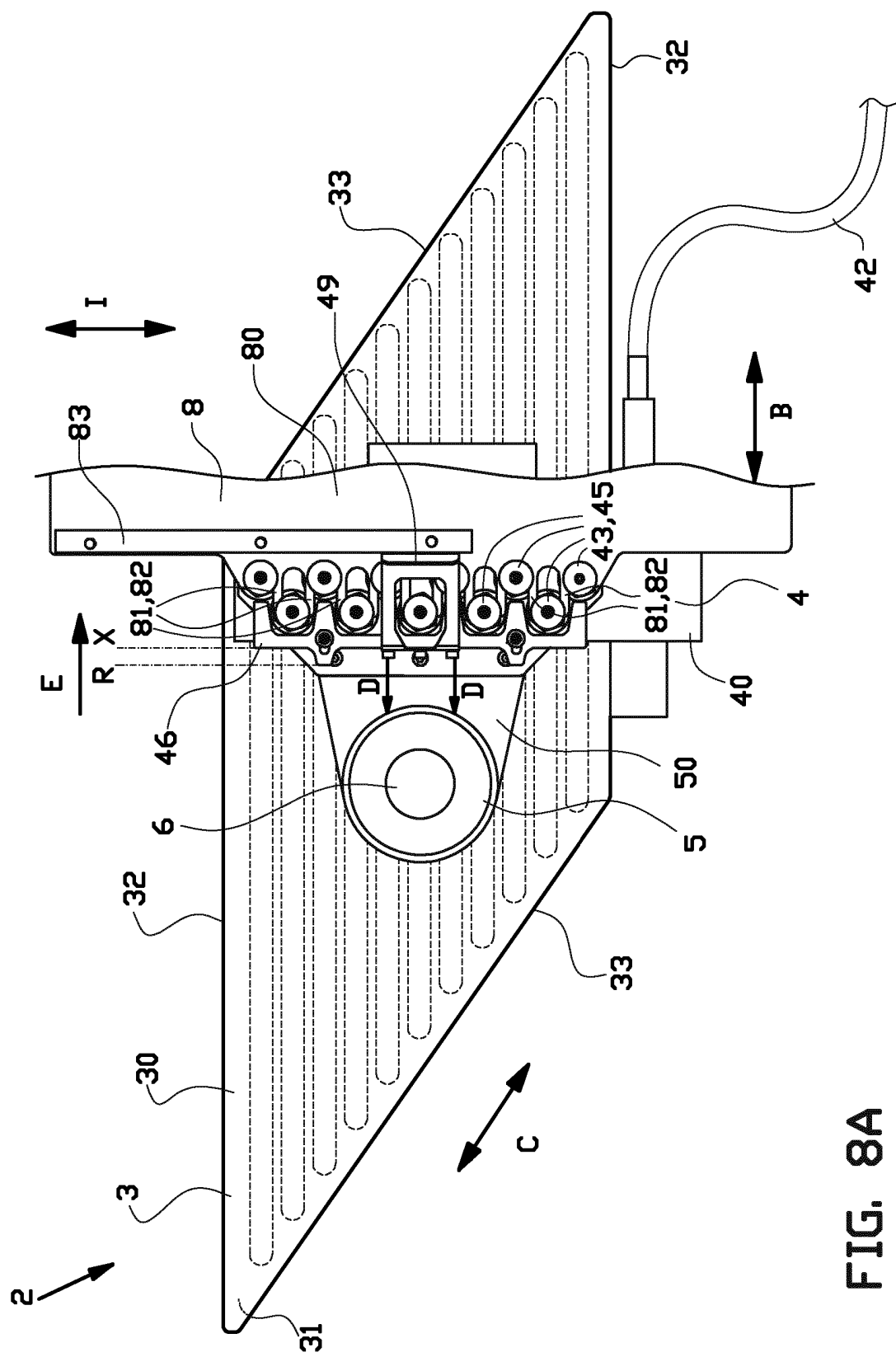
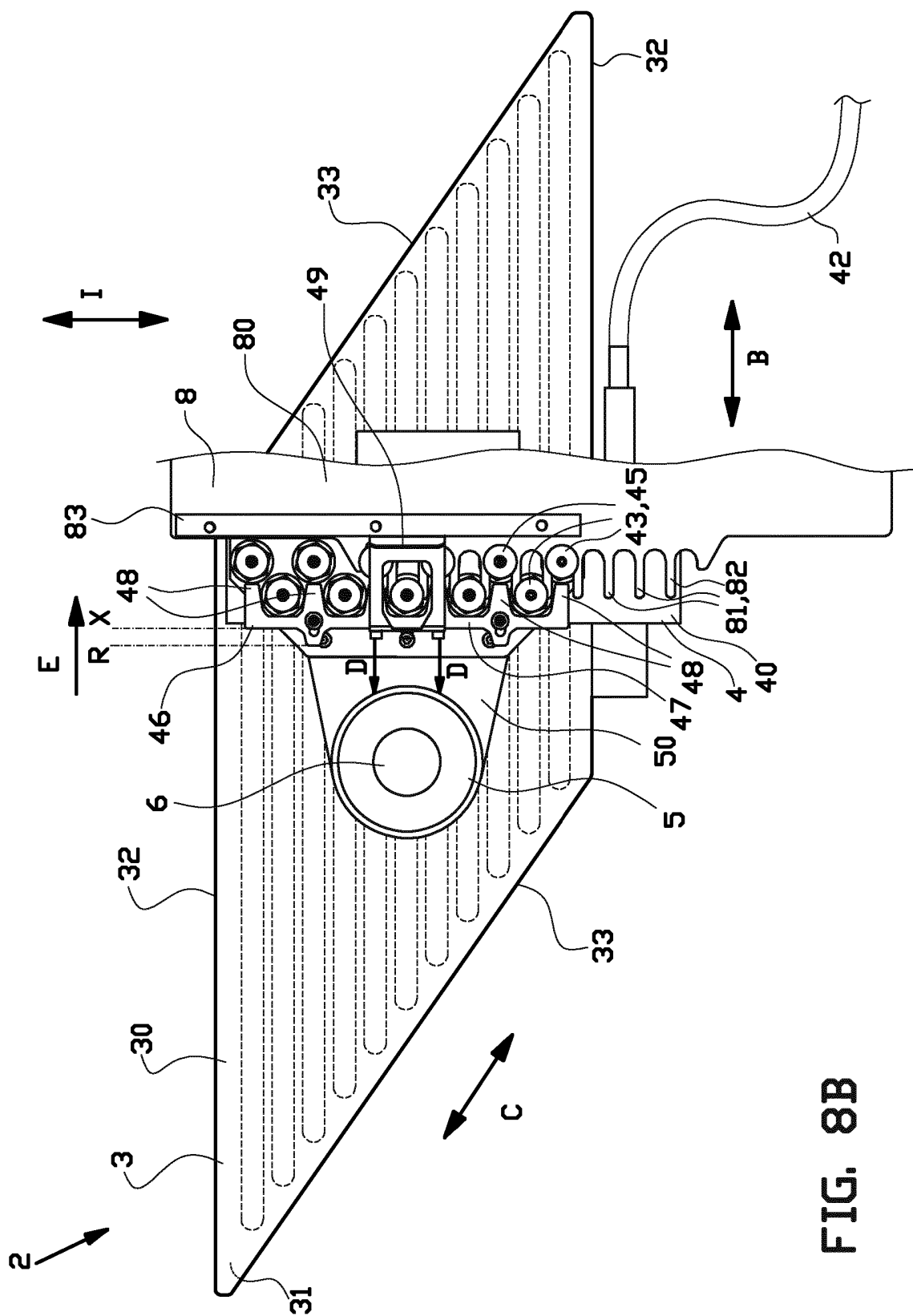


FIG. 7B







## A B S T R A C T

The invention relates to a gripper and a method for gripping a tire component, wherein the gripper comprises a gripping element with a gripping face to engage and retain the tire component through suction, wherein the gripping  
5 face comprises a plurality of sections, wherein the gripper for each section comprises a vacuum channel and a valve that is placed between the vacuum channel of the respective section and a vacuum source, wherein each valve is individually operable to an open position and a closed  
10 position, wherein the gripping face in use has a suction area formed by the sections of which the respective valves are in the open position, wherein the suction area is adjustable by selectively operating the plurality of valves to the open positions and the closed positions.

## SAMENWERKINGSVERDRAG (PCT)

### RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

|                                                                                                                                         |  |                                                                                                                          |  |
|-----------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------|--|
| IDENTIFICATIE VAN DE NATIONALE AANVRAGE                                                                                                 |  | KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE                                                                           |  |
|                                                                                                                                         |  | NLP196863A                                                                                                               |  |
| Nederlands aanvraag nr.                                                                                                                 |  | Indieningsdatum                                                                                                          |  |
| 2014635                                                                                                                                 |  | 14-04-2015                                                                                                               |  |
|                                                                                                                                         |  | Ingevoerd voorrangsdatum                                                                                                 |  |
|                                                                                                                                         |  |                                                                                                                          |  |
| Aanvrager (Naam)                                                                                                                        |  |                                                                                                                          |  |
| VMI Holland B.V.                                                                                                                        |  |                                                                                                                          |  |
| Datum van het verzoek voor een onderzoek van internationaal type                                                                        |  | Door de instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. |  |
| 27-06-2015                                                                                                                              |  | SN64404                                                                                                                  |  |
| I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)                |  |                                                                                                                          |  |
| Volgens de internationale classificatie (IPC)                                                                                           |  |                                                                                                                          |  |
| B29D30/00;B25J5/06                                                                                                                      |  |                                                                                                                          |  |
| II. ONDERZOCHETE GEBIEDEN VAN DE TECHNIEK                                                                                               |  |                                                                                                                          |  |
| Onderzochte minimumdocumentatie                                                                                                         |  |                                                                                                                          |  |
| Classificatiesysteem                                                                                                                    |  | Classificatiesymbolen                                                                                                    |  |
| IPC                                                                                                                                     |  | B29D;B25J                                                                                                                |  |
| Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen |  |                                                                                                                          |  |
|                                                                                                                                         |  |                                                                                                                          |  |
| III. <input type="checkbox"/> GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES (opmerkingen op aanvullingstblad)                        |  |                                                                                                                          |  |
| IV. <input type="checkbox"/> GEBREK AAN EENHEID VAN UITVINDING (opmerkingen op aanvullingstblad)                                        |  |                                                                                                                          |  |

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek

NL 2014635

**A. CLASSIFICATIE VAN HET ONDERWERP**

INV. B29030/00 B25J15/06  
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

**B. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK**

Onderzochte minimum documentatie (klassificatie gevolgd door classificatiesymbolen)

B290 B25J

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)

EPO-Internal

**C. VAN BELANGS GEACHTE DOCUMENTEN**

| Categorie * | Geaciteerde documenten, eventueel met aanduiding van specifiek van belang zijnde passages | Van belang voor conclusie n° |
|-------------|-------------------------------------------------------------------------------------------|------------------------------|
| X           | US 5 609 377 A (TANAKA HIROHISA [JP])<br>11 maart 1997 (1997-03-11)                       | 1-9,<br>26-31                |
| A           | * kolom 3, regel 47 - kolom 6, regel 57;<br>figuren 1-3 *                                 | 10-25                        |
| X           | JP H05 146983 A (TOYO COMMUNICATION EQUIP)<br>15 juni 1993 (1993-06-15)                   | 1-4,<br>26-31                |
|             | * samenvatting; figuren 1-4 *                                                             |                              |
| X           | US 2013/129464 A1 (REGAN PATRICK CONALL<br>[TW] ET AL) 23 mei 2013 (2013-05-23)           | 1-4,6-9,<br>26-31            |
| A           | * alinea [0056] - alinea [0096]; figuren<br>16-22 *                                       | 5,10-25                      |
| X           | WO 2012/172484 A2 (GALLUCCI GIUSEPPE [IT])<br>20 december 2012 (2012-12-20)               | 1-4,26                       |
| A           | * bladzijde 3, regel 15 - bladzijde 7,<br>regel 15; figuren 1-7 *                         | 5-25,<br>27-31               |
|             | -----<br>-/-                                                                              |                              |

☒ Verdere documenten worden vermeld in het vervolg van vak C.

☒ Leden van dezelfde octroofamilie zijn vermeld in een bijlage

**\* Speciale categorieën van aangehaalde documenten**

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"C" in de octrooiaanvraag vermeld

"E" eerdere octroop(aanvraag), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermeldde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorafgedatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorafgedatum gepubliceerde literatuur die niet bezwaarlijk is voor de octrooiaanvraag, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geaciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"Z" lid van dezelfde octroofamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid

23 december 2015

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

Naam en adres van de instantie

European Patent Office, P.O. Box 5818, Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040,  
Fax: (+31-70) 340-3016

De bevoegde ambtenaar

Fregosi, Alberto

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek

NL 2014635

**C (Verzoek) VAN BELANG GEACHTE DOCUMENTEN**

| Categorie * | Geachte documenten, eventueel met aanduiding van specifiek van belang zijnde passages                                              | Van belang voor<br>conclusie nr. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| X           | US 2010/068012 A1 (PETIJEAN YANNICK [FR])<br>18 maart 2010 (2010-03-18)                                                            | 1-4,26                           |
| A           | * alinea [0013] - alinea [0054]; figuren<br>1-6 *                                                                                  | 5-25,<br>27-31                   |
| X           | US 2004/094979 A1 (DAMHUIS EDUARD<br>HENDRIKUS JOHAN [BE])<br>20 mei 2004 (2004-05-20)                                             | 1-4,26                           |
| A           | * alinea [0004] - alinea [0058]; figuren<br>1-13B *                                                                                | 5-25,<br>27-31                   |
| X           | US 2008/080962 A1 (HOLTMEIER GERHARD [DE])<br>3 april 2008 (2008-04-03)                                                            | 1-9,<br>26-31                    |
| A           | * alinea [0029] - alinea [0042]; figuren<br>1,2 *                                                                                  | 10-25                            |
| A           | US 5 131 971 A (ELIA GERARDO P [US] ET AL)<br>21 juli 1992 (1992-07-21)<br>* kolom 3, regel 8 - kolom 5, regel 8;<br>figuren 1-5 * | 1-31                             |

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**  
Informatie over leden van dezelfde oestroofamilie

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek  
NL 2014635

| In het rapport<br>genoemd oestroegestaft | Datum van<br>publicatie | Overeenkomstig(e)<br>geschrift(en) | Datum van<br>publicatie                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------|-------------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| US 5609377                               | A                       | 11-03-1997                         | DE 69423704 D1 04-05-2000<br>DE 69423704 T2 20-07-2000<br>EP 0657373 A2 14-06-1995<br>JP H07157117 A 20-06-1995<br>US 5609377 A 11-03-1997                                                                                                                                                                                                                                                                                                                                                                                            |
| JP H05146983                             | A                       | 15-06-1993                         | GEEN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| US 2013129464                            | A1                      | 23-05-2013                         | CN 104010781 A 27-08-2014<br>EP 2780138 A1 24-09-2014<br>KR 20140102692 A 22-08-2014<br>TW 201341133 A 16-10-2013<br>US 2013129464 A1 23-05-2013<br>WO 2013074952 A1 23-05-2013                                                                                                                                                                                                                                                                                                                                                       |
| WO 2012172484                            | A2                      | 20-12-2012                         | CN 103796809 A 14-05-2014<br>EP 2720838 A2 23-04-2014<br>US 2014165806 A1 19-06-2014<br>WO 2012172484 A2 20-12-2012                                                                                                                                                                                                                                                                                                                                                                                                                   |
| US 2010068012                            | A1                      | 18-03-2010                         | AT 455704 T 15-02-2010<br>AT 548269 T 15-03-2012<br>BR PI0719290 A2 29-04-2014<br>BR PI0719521 A2 27-05-2014<br>CN 101557991 A 14-10-2009<br>CN 101631721 A 20-01-2010<br>EP 2084059 A1 05-08-2009<br>EP 2089280 A1 19-08-2009<br>ES 2338940 T3 13-05-2010<br>ES 2384061 T3 29-06-2012<br>FR 2907100 A1 18-04-2008<br>JP 2010505711 A 25-02-2010<br>JP 2010505713 A 25-02-2010<br>PT 2084059 E 15-04-2010<br>US 2010043357 A1 25-02-2010<br>US 2010068012 A1 18-03-2010<br>WO 2008043912 A1 17-04-2008<br>WO 2008043914 A1 17-04-2008 |
| US 2004094979                            | A1                      | 20-05-2004                         | AU 2003290810 A1 15-06-2004<br>US 2004094979 A1 20-05-2004<br>WO 2004046092 A2 03-06-2004                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| US 2008080962                            | A1                      | 03-04-2008                         | DE 102006046624 A1 03-04-2008<br>EP 1905709 A2 02-04-2008<br>US 2008080962 A1 03-04-2008                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| US 5131971                               | A                       | 21-07-1992                         | BR 9200060 A 20-04-1993<br>CA 2057971 A1 15-07-1992<br>DE 69211365 D1 18-07-1996<br>DE 69211365 T2 06-02-1997<br>EP 0495604 A2 22-07-1992<br>ES 2092024 T3 16-11-1996<br>JP 2793406 B2 03-09-1998<br>JP H0584851 A 06-04-1993<br>US 5131971 A 21-07-1992                                                                                                                                                                                                                                                                              |

## WRITTEN OPINION

|                                                                       |                                            |                                |                              |
|-----------------------------------------------------------------------|--------------------------------------------|--------------------------------|------------------------------|
| File No.<br>SN64404                                                   | Filing date (day/month/year)<br>14.04.2015 | Priority date (day/month/year) | Application No.<br>NL2014635 |
| International Patent Classification (IPC)<br>INV. B29D30/00 B25J15/06 |                                            |                                |                              |
| Applicant<br>VMI Holland B.V.                                         |                                            |                                |                              |

This opinion contains indications relating to the following items:

- ☒ Box No. I      Basis of the opinion
- ☐ Box No. II      Priority
- ☐ Box No. III      Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV      Lack of unity of invention
- ☒ Box No. V      Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI      Certain documents cited
- ☐ Box No. VII      Certain defects in the application
- ☐ Box No. VIII      Certain observations on the application

|  |                              |
|--|------------------------------|
|  | Examiner<br>Fregosi, Alberto |
|--|------------------------------|

## WRITTEN OPINION

Application number  
NL2014635

---

### Box No. I Basis of this opinion

---

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:
    - ☐ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material:
    - ☐ on paper
    - ☐ in electronic form
  - c. time of filing/furnishing:
    - ☐ contained in the application as filed.
    - ☐ filed together with the application in electronic form.
    - ☐ furnished subsequently for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

---

### Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

---

#### 1. Statement

|                          |             |            |
|--------------------------|-------------|------------|
| Novelty                  | Yes: Claims | 10-25      |
|                          | No: Claims  | 1-9, 26-31 |
| Inventive step           | Yes: Claims | 10-25      |
|                          | No: Claims  | 1-9, 26-31 |
| Industrial applicability | Yes: Claims | 1-31       |
|                          | No: Claims  |            |

#### 2. Citations and explanations

**see separate sheet**



**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. State of the Art**

Reference is made to the following documents:

- D1: US 5609377 - A;
- D2: JPH 05146983 - A;
- D3: US 2013/0129464 - A;
- D4: WO 2012/172484 - A;
- D5: US 2010/0068012 - A;
- D6: US 2004/0094979 - A;
- D7: US 2008/0080962 - A;
- D8: US 5131971 - A.

**2. Claims 1 - 9, 26 - 31 - Lack of Novelty and/or of Inventive Step**

2.1 Claim 1 relates to a gripper (1) for gripping a tire component (9), in particular a tire component for forming a body ply or a breaker ply, wherein the gripper comprises:

(a) - a gripping element (3) with a gripping face (31) that is arranged to engage and retain the tire component through suction, wherein the gripping face (31) comprises:

(a1) - a plurality of sections (34), wherein the gripper for each section comprises:

(a1.1) - a vacuum channel (37) that debouches at the respective section in the gripping face for retaining the tire component to the respective section and

(a1.2) - a valve (41) that is placed between the vacuum channel of the respective section and a vacuum source, wherein each valve is individually operable to an open position in which the valve is arranged to connect the vacuum channel of the

respective section in fluid communication to the vacuum source and a closed position in which the valve is arranged to disconnect the vacuum channel of the respective section from the vacuum source.

(b) - wherein the gripping face in use has a suction area formed by the sections of which the respective valves are in the open position.

(c) - wherein the suction area is adjustable by selectively operating the plurality of valves to the open positions and the closed positions.

2.2 Document **D1** (US 5609377 - A) discloses (the signs in parentheses referring to this document) such a gripper suitable for gripping a tire component, the gripper comprising the combination of the above mentioned features (a) to (c); namely:

- feature (a) is represented by chuck frame (1) and sub-frame (2);
- features (a1) and (a1.1) are represented by suction cups (11), (12), (13), and air hoses (52a), (54a), (56a);
- feature (a1.2) is represented by valves (37), (39a), (39b);
- features (b) and (c) are disclosed in the passages of **D1** between column 4, line 43 and column 6, line 46 in combination with figures 1 - 3.

Claim 1 is therefore not novel.

2.3 It is pointed out that also documents **D2** to **D7** appear to be, singularly, novelty-destroying for claim 1.

2.4 Since the content of independent method claim 26 merely relates to the use of the apparatus defined in claim 1, the same arguments apply, "mutatis mutandis", also to demonstrate the lack of novelty of claim 26 vis-à-vis of documents **D1** to **D7**.

2.5 The dependent claims 2 to 9 and 27 to 31 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of novelty and/or inventive step, since these features appear to be either disclosed or suggested in the available prior art or are simply considered as part of the common knowledge of the person skilled in the art of manipulating objects.

3. Claims 10 - 25 - Novelty and Inventive Step

3.1 Claim 10 relates to a gripper assembly comprising the gripper as defined in claim 1, wherein the gripper assembly further comprises:

(d) - a configuration tool,

(e) - wherein the gripper and the configuration tool are positionable with respect to each other in a configuration position for operating the valves,

(f) - wherein the gripper for each valve is provided with an operational member that is operationally connected to the respective valve to operate the respective valve to the open position and the closed position,

(g) - wherein the configuration tool is provided with a plurality of configuration members which in the configuration position are arranged to interact with the operational members to control the respective valves to their open positions and their closed positions.

3.2 None of the available prior art documents discloses such a gripper assembly comprising the combination of features (a) to (g).

Claim 10 is therefore novel.

3.3 The technical effect achieved by the gripper assembly according to claim 10 is to allow a quick configuration of the gripper without human intervention and furthermore to prevent that human operators have to enter the potentially hazardous area of the gripper assembly to control the valves manually.

3.4 Said specific technical effect has not been acknowledged in the available prior art; furthermore, the combination of features according to claim 10 is neither known from, nor readily derivable from the available prior art.

The claim is therefore considered as involving an inventive step.

3.5 The claims 11 to 25, as directly or indirectly dependent on claim 10, as such, are also regarded as novel and inventive.