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(54) **PACKAGE FORMING APPARATUS FOR A PACKAGING MACHINE AND PACKAGING MACHINE FOR FORMING PACKAGES FILLED WITH A POURABLE PRODUCT**

(57) There is described a package forming apparatus (10) for a packaging machine (1) configured to at least partially form a tube (4) for obtaining packages (2) from the tube (4) and provided with a number of operative devices (25) having a first operative group (26) and a second operative group (27) to at least partially form, in cooperation with one another, the tube (4). Each first operative group (26) and each second operative group (27) comprises a half-shell (28) for at least partially forming the tube (4) and a control device (29) for controlling the half-shell (28); the half-shell (28) is provided with a main forming plate (30) and two lateral forming plates (31) interposing the main forming plate (30) in between one another and is angularly movable about a first rotation axis (B). The control device (29) is configured to control the angular movement of the respective half-shell (28) and is realized to actuate the angular movement of the respective half-shell (28) about the first rotation axis (B) exclusively through the respective main forming plate (30).

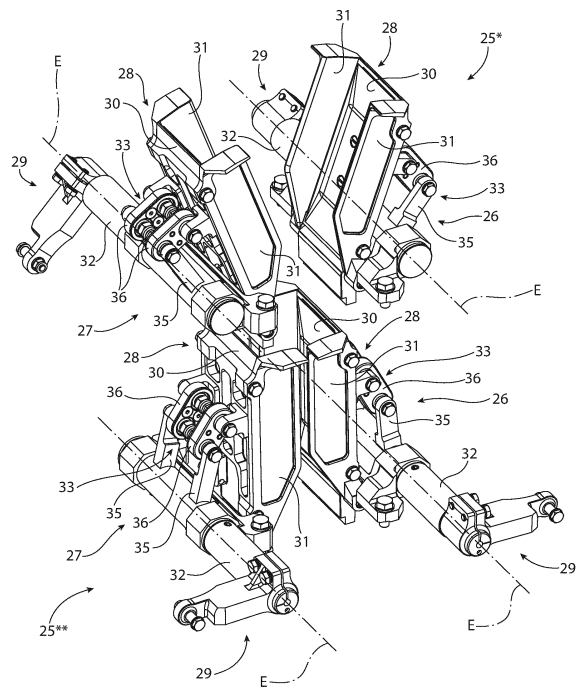


FIG. 3

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DescriptionTECHNICAL FIELD

[0001] The present invention relates to a package forming apparatus for a packaging machine for forming packages filled with a pourable product, preferentially a pourable food product.

[0002] The present invention further relates to a packaging machine for forming packages filled with a pourable product, preferentially a pourable food product.

BACKGROUND ART

[0003] As is known, many liquid or pourable food products, such as fruit juice, UHT (ultra-high-temperature treated) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

[0004] A typical example is the parallelepiped-shaped package for liquid or pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by sealing and folding laminated strip packaging material. The packaging material has a multilayer structure comprising a base layer, e.g. of paper, covered on both sides with layers of heat-seal plastic material, e.g. polyethylene. In the case of aseptic packages for long-storage products, such as UHT milk, the packaging material also comprises a layer of oxygen-barrier material (an oxygen-barrier layer), e.g. an aluminum foil, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material forming the inner face of the package eventually contacting the food product.

[0005] Packages of this sort are normally produced on fully automatic packaging machines, which advance a web of packaging material through a sterilization apparatus for sterilizing the web of packaging material at a sterilization station and to an isolation chamber (a closed and sterile environment) in which the sterilized web of packaging material is maintained and advanced. During advancement of the web of packaging material through the isolation chamber, the web of packaging material is folded and sealed longitudinally at a tube forming station to form a tube having a longitudinal seam portion, the tube being further fed along a vertical advancing direction.

[0006] For completing the forming operations, the tube is filled with a pourable product, in particular a pourable food product, and is transversally sealed and subsequently cut along equally spaced transversal cross sections within a package forming apparatus of the packaging machine during advancement along the vertical advancing direction.

[0007] Pillow packages are so obtained, each pillow package has a longitudinal sealing band, a top transversal sealing band and a bottom transversal sealing band.

[0008] A typical packaging machine comprises a conveying device for advancing the web of packaging ma-

terial, the sterilization apparatus for sterilizing the web of packaging material prior to its formation into the tube, a tube forming and sealing device configured to form the tube from the advancing web of packaging material and to longitudinally seal the tube, a filling device for filling the tube with the pourable product and the package forming apparatus adapted to form, transversally seal and cut individual packages from the tube of packaging material.

[0009] The package forming apparatus comprises at least one operative device, typically two operative devices, each having at least a first operative group and a second operative group configured to at least partially form and to transversally seal and cut in cooperation the, in use, advancing tube.

[0010] Each first operative group and each second operative group comprises a respective half-shell configured to at least partially form the tube and a control device for controlling the half-shell. Each half-shell comprises a respective main forming plate and two lateral forming plates, which, in use, are brought in contact with the tube so as to at least partially form the tube. Typically, the control device is configured to control the angular movement of the respective half-shell and is realized to actuate the angular movement of the respective half-shell so that the respective half-shell is brought in contact with the tube.

[0011] Even though the known package forming apparatuses and/or packaging machines work satisfactorily well, a desire is felt in the sector to further improve and simplify the known package forming apparatuses and/or the known packaging machines.

DISCLOSURE OF INVENTION

[0012] It is therefore an object of the present invention to provide a package forming apparatus for a packaging machine for forming packages filled with a pourable product addressing the drawbacks described above and, in particular, being easy and economical to be manufactured.

[0013] A further object of the present invention is to provide a packaging machine for forming packages filled with a pourable product addressing the drawbacks described above and, in particular, being easy and economical to be manufactured.

[0014] According to the invention there are provided a package forming apparatus for a packaging machine for forming packages filled with a pourable product and a packaging machine for forming packages filled with a pourable product according to the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

- figure 1 is a schematic view of a packaging machine

- having a package forming apparatus according to the present invention, with parts removed for clarity;
- figure 2 is a schematic perspective view of a detail of the package forming apparatus of Figure 1, with parts removed for clarity;
 - figure 3 is a perspective view of two operative devices of the package forming apparatus of Figure 1, with parts removed for clarity;
 - figure 4 is a lateral view of the two operative devices of figure 3, with parts removed for clarity;
 - figure 5 is a perspective back view of a detail of one operative device of figure 3, with parts removed for clarity; and
 - figure 6 is a perspective front view of the detail of figure 5, with parts removed for clarity.

BEST MODES FOR CARRYING OUT THE INVENTION

[0016] Number 1 indicates as a whole a packaging machine for producing sealed packages 2 of a pourable product, in particular a pourable food product, such as milk, milk drinks, yoghurt, yoghurt drinks, fruit juice, wine, tomato sauce, emulsions, beverages containing pulp, salt, sugar, etc.

[0017] In more detail, packaging machine 1 may be configured to produce packages 2 from a multilayer packaging material. Preferentially, a multilayer packaging material having heat seal properties (i.e. portions of the multilayer packaging material can be sealed to one another).

In further detail, the multilayer packaging material may comprise at least one layer of fibrous material, such as e.g. paper or cardboard, and at least two layers of heat-seal plastic material, e.g. polyethylene, interposing the layer of fibrous material in between one another. Preferentially, one of these two layers of heat-seal plastic material may define the inner face of packages 2 contacting the pourable product. Moreover, the multilayer packaging material may also comprise a layer of gas- and light-barrier material, e.g. aluminum foil or ethylene vinyl alcohol (EVOH) film, preferentially being arranged between one of the layers of the heat-seal plastic material and the layer of fibrous material. Preferentially, the packaging material may also comprise a further layer of heat-seal plastic material being interposed between the layer of gas- and light-barrier material and the layer of fibrous material.

[0018] In further detail, the multilayer packaging material may be provided in the form of a web 3.

[0019] Furthermore, packaging machine 1 is configured to produce packages 2 by forming a tube 4 from the web 3, longitudinally sealing the tube 4, filling the tube 4 with the pourable product and to transversally seal, and preferentially transversally cut the tube 4.

[0020] According to some possible non-limiting embodiments, each package 2 extends along a longitudinal axis A and comprises at least a first transversal sealing

band 5, and preferentially also a second transversal sealing band arranged at opposite ends of the package 2.

[0021] Moreover, each package 2 also comprises a longitudinal seam portion 6. Preferentially, each first transversal sealing band 5 and/or each second transversal sealing band are transversal (preferentially perpendicular) to the respective longitudinal seam portion 6.

[0022] With particular reference to figure 1, packaging machine 1 comprises a package forming apparatus 10 configured to at least partially form the tube 4, preferentially to also transversally seal and/or to transversally cut the tube 4, for obtaining the packages 2.

[0023] Moreover, packaging machine 1 comprises:

- a conveying device 11 configured to advance the web 3 along a web conveying path P, preferentially to a tube forming station, at which, in use, the web 3 is formed into the tube 4, and configured to advance the tube 4 along a tube conveying path Q;
- a tube forming and sealing device 12 configured to form the tube 4 from the advancing web 3 and to longitudinally seal the tube 4; and
- a filling device 13 for filling the tube 4 with the pourable product.

[0024] In further detail, the packaging machine 1 comprises an isolation chamber 14, preferentially delimiting an inner environment 15 from an outer environment 16. Preferentially, inner environment 15 is a sterile (aseptic) environment, preferably containing a controlled atmosphere. Preferentially, the tube forming and sealing device 12 is at least partially arranged within the isolation chamber 14, in particular within the inner environment 15, and is configured to fold and longitudinally seal the tube 4 within the isolation chamber 14, in particular within the inner environment 15.

[0025] Moreover, the packaging machine 1 comprises a sterilization unit configured to sterilize the advancing web 3, preferentially the sterilization unit is arranged upstream of the tube forming and sealing device 12 along the web conveying path P.

[0026] The conveying device 11 is configured to advance the tube 4 (even when partially formed) along the tube conveying path Q, preferentially from the tube forming and sealing device 12 to and/or at least partially within the package forming apparatus 10.

[0027] The tube forming and sealing device 12 comprises at least two forming ring assemblies 17, preferentially arranged within the isolation chamber 14, even more preferentially arranged within the inner environment 15, configured to gradually fold in cooperation with one another the web 3 into the tube 4, preferentially by overlapping opposite longitudinal edges of the web 3 with one another. Thereby, in use, the seam portion 6 is formed.

[0028] Additionally, the tube forming and sealing device 12 comprises a sealing head 18, preferentially ar-

ranged within the isolation chamber 14, even more preferentially within the inner environment 15, and, configured to longitudinally seal the tube 4, preferentially along the longitudinal seam portion 6.

[0029] Preferentially, the filling device 13 comprises a filling pipe 19 configured to direct the pourable product into the tube 4. Preferentially, the filling pipe 19 is at least partially placed within the tube 4 for feeding, in use, the pourable product into the tube 4.

[0030] With particular reference to Figures 2 to 5, the package forming apparatus 10 comprises a number of operative devices 25 (only partially shown to the extent necessary for the comprehension of the present invention). Preferably, the package forming apparatus 10 comprises two operative devices 25. A first operative device is indicated with 25* in figures 3 and 4 and a second operative device is indicated with 25** in figures 3 and 4. In figures 3 and 4 the first operative device 25* is arranged in an upper position (i.e. is positioned above the second operative device 25** along an advancement direction of the tube 4) and the second operative device 25** is arranged in a lower position (i.e. is positioned below the first operative device 25* along the advancement direction of the tube 4).

[0031] Each operative device 25 is configured to at least partially form, and preferentially to transversally seal and/or transversally cut the tube 4.

[0032] The package forming apparatus 10 is configured to control each operative device 25 such to at least partially form the tube 4 between two spaced transversal cross sections. Additionally, the package forming apparatus 10 transversally seals and transversally cuts the tube 4 along the equally spaced transversal cross sections, more preferentially thereby forming the respective first transversal sealing bands 5 and/or the respective second transversal sealing bands.

[0033] Each operative device 25 comprises a first operative group 26 and a second operative group 27 configured to cooperate with one another so as to at least partially form, and preferentially so as to transversally seal and/or transversally cut, the tube 4.

[0034] In particular, each first operative group 26 and the respective second operative group 27 are movable with respect to one another. Preferentially, each first operative group 26 and the respective second operative group 27 can be moved towards and away from one another.

[0035] Each operative device 25 is controllable between an active configuration, in which the first operative group 26 and the second operative group 27 are approached to one another for at least partially forming, and preferentially transversally sealing and/or transversally cutting, the tube 4 and a rest configuration, in which the first operative group 26 and the second operative group 27 are withdrawn from one another, and preferentially from tube 4 (i.e. the first operative group 26 and the second operative group 27 are arranged at a distance from one another and are not in contact with the tube 4).

[0036] The package forming apparatus 10 comprises a conveying unit (not shown) configured to advance each first operative group 26 and each second operative group 27 along a respective first advancement path and a respective second advancement path, respectively. Each first advancement path and each second advancement path comprises an operative portion along which each first operative group 26 and the respective second operative group 27 advance, in use, in a direction of advancement of the tube 4, and a return portion along which each first operative group 26 and the respective second operative group 27 advance, in use, in a direction opposite to the direction of advancement of the tube 4 so as to bring each first operative group 26 and the respective second operative group 27 back to the respective operative portion.

[0037] Each operative device 25 is controlled from the respective rest configuration to the respective active configuration during advancement of the respective first operative group 26 and the respective second operative group 27 along the respective operative portion.

[0038] With particular reference to figures 3 to 6, each first operative group 26 and each second operative group 27 comprise a respective half-shell 28 for at least partially forming the tube 4 and a respective control device 29 for controlling the respective half-shell 28.

[0039] The two half-shells 28 of each operative device 25 are configured to at least partially form the tube 4 in cooperation with one another, more preferentially with the respective operative device 25 being controlled in the respective active configuration. The two half-shells 28 of each operative device 25 are moved towards one another and withdrawn from one another with operative device 25 being controlled in the active configuration and the rest configuration, respectively.

[0040] Each half-shell 28 comprises two lateral forming plates 31 and a main forming plate 30 interposed between the lateral forming plates 31. Advantageously, each half-shell 28 is substantially C-shaped.

[0041] Advantageously, each half-shell 28 is monolithic. In other words, each lateral forming plate 31 is connected in a non-releasable manner to the respective main forming plate 30. The lateral forming plates 31 are not movable with respect to the main forming plate 30.

[0042] Each half-shell 28 is angularly movable about a (first) rotation axis B and between a first angular position and a second angular position. In particular, each half-shell 28 is positioned in the first angular position and the second angular position with the respective operative device 25 being in the rest configuration and the active configuration, respectively.

[0043] Each half-shell 28 is realized to engage the tube 4 when being in the second angular position.

[0044] Each control device 29 is configured to control, in use, an angular movement of the respective half-shell 28 between the first angular position and the second angular position for moving, in use, the half-shell 28 towards and away from the tube 4.

[0045] Each control device 29 comprises a shaft 32 rotatable about a (second) rotation axis E, preferentially parallel to the rotation axis B.

[0046] Each shaft 32 is operatively coupled exclusively to the respective main forming plate 30. In other words, the shaft 32 is not operatively coupled to the respective lateral forming plates 31. The shaft 32 is coupled to the main forming plate 30 such that the angular position of the respective half-shell 28 about the rotation axis B is determined in dependence of the angular position of the shaft 32 about the rotation axis E.

[0047] Figures 3 and 4 show a condition in which each shaft 32 of the control device 29 of the first operative device 25* is in an angular position about the respective rotation axis E such that the respective half-shell 28 is in the first angular position and a condition in which each shaft 32 of the control device 29 of the second operative device 25** is in an angular position about the respective rotation axis E such that the respective half shell 28 is in the second angular position.

[0048] In other words, figures 3 and 4 show a configuration of the half-shells 28 in which the respective first operative device 25* is in the rest configuration and a configuration of the half-shells 28 in which the respective second operative device 25** is in the active configuration.

[0049] Each shaft 32 is configured to rotate about the respective rotation axis E so as to move the respective half-shell 28 between the respective first angular position and the respective second angular position.

[0050] In further detail, each shaft 32 is rotatable in a first rotation direction so as to move the half-shell 28 from the first angular position to the second angular position and is rotatable in a second rotation direction (opposed to the first rotation direction) so as to move the half-shell 28 from the second angular position to the first angular position.

[0051] Each control device 29 comprises a lever mechanism 33 coupled to the shaft 32 and the half-shell 28. More in detail, the lever mechanism 33 is coupled to the shaft 32 and the main forming plate 30. The lever mechanism 33 is coupled exclusively to the shaft 32 and the main forming plate 30. Even more in detail, the lever mechanism 33 is not coupled to the lateral forming plates 31. Control devices 29 do not comprise any lever mechanism coupled to the lateral forming plates 31.

[0052] The lever mechanism 33 is configured to actuate an angular movement of the respective main forming plate 30, in dependence of the angular movement of the respective shaft 32.

[0053] More specifically, the lever mechanism 33 comprises at least one coupling element 35, preferentially two coupling elements 35 spaced apart from one another and, fixed to the shaft 32 and at least one coupling bar 36, preferentially two coupling bars 36, hinged to one respective coupling element 35 and the respective main forming plate 30.

[0054] Even more specifically, each coupling bar 36 is

hinged to the respective coupling element 35 about a (first) hinge axis R and is hinged to the respective main forming plate 30 about a (second) hinge axis H.

[0055] Preferentially, each hinge axis R and the respective hinge axis H are parallel to one another.

[0056] Advantageously, each hinge axis R and the respective hinge axis H are parallel to the respective rotation axis B and/or the respective rotation axis E.

[0057] According to some preferred non-limiting embodiments, package forming apparatus may comprise an actuating device configured to control operation of each control device 29 so as to control the angular position of the respective half-shells 28.

[0058] Preferentially, the actuating device is configured to control the angular position of shafts 32.

[0059] Even more preferentially, the actuating device may be configured to control the respective angular position of shafts 32 in dependence of the respective position of the respective first operative group 26 and the respective second operative group 27 along the respective first advancement path and/or second advancement path.

[0060] With particular reference to figure 2, each operative device 25 comprises a sealing element 55 and a respective counter-sealing element 56 configured to transversally seal in cooperation with one another the tube 4. Advantageously, one of the first operative group 26 and the respective second operative group 27 comprises the sealing element 55 and the other one of the first operative group 26 and the respective second operative group 27 comprises the counter-sealing element 56.

[0061] Additionally, each operative device 25 comprises at least one cutting element configured to transversally cut the tube 4, preferentially after sealing of the tube 4 by means of the respective sealing element 55 and the respective counter-sealing element 56.

[0062] In use, packaging machine 1 produces packages 2 filled with the pourable product. In more detail, the conveying device 11 advances the web 3 along the web advancement path P. The tube forming and sealing device 12 forms the tube 4 from the advancing web 3 and longitudinally seals the tube 4. Additionally, the filling device 13 fills the tube 4 with the pourable product and the package forming apparatus 10 forms, transversally seals and transversally cuts the tube 4 so as to obtain packages 2.

[0063] In further detail, during operation of the package forming apparatus 10, the operative devices 25 at least partially form, and preferentially transversally seal and transversally cut, the tube 4.

[0064] During operation, each operative device 25 is cyclically controlled between the respective rest configuration and the respective active configuration.

[0065] Preferentially, the respective first operative groups 26 and the respective second operative groups 27 advance along the respective advancement paths and are cyclically moved towards and away from one another so as to at least partially form, transversally seal and cut

the tube 4 for forming packages 2.

[0066] The partial forming of the tube 4 is controlled by the respective half-shells 28. In order to partially form the tube 4, the half shells 28 are moved from the respective first angular position to the respective second angular position, preferentially by controlling the angular position of the respective shaft 32.

LIST OF REFERENCE NUMERALS

[0067]

1	packaging machine
2	packages
3	web of packaging material
4	Tube
5	sealing band
6	longitudinal seam portion
10	package forming apparatus
11	conveying device
12	tube forming and sealing device
13	filling device
14	isolation chamber
15	inner environment
16	outer environment
17	forming ring assembly
18	sealing head
19	filling pipe
25	operative device
25*	first operative device
25**	second operative device
26	first operative group
27	second operative group
28	half-shell
29	control device
30	main forming plate
31	lateral forming plate
32	shaft
33	lever mechanism
35	coupling element
36	coupling bar
P	web conveying path
Q	tube conveying path
B	rotation axis
E	rotation axis
R	hinge axis
H	hinge axis

Claims

1. - Package forming apparatus (10) for a packaging machine (1) configured to at least partially form a tube (4) for obtaining packages (2) from the tube (4) and comprising a number of operative devices (25), each operative device (25) having a first operative group (26) and a second operative group (27) configured to at least partially form, in cooperation with one another, the tube (4) for forming the packages

(2);

- wherein each first operative group (26) and each second operative group (27) comprises a half-shell (28) for at least partially forming the tube (4) and a control device (29) for controlling the half-shell (28);

- wherein the half-shell (28) comprises a main forming plate (30) and two lateral forming plates (31) interposing the main forming plate (30) in between one another and is angularly movable about a first rotation axis (B), between a first angular position and a second angular position; and

- wherein the control device (29) is configured to control the angular movement of the respective half-shell (28) about the first rotation axis (B) and is realized to actuate the angular movement of the respective half-shell (28) about the first rotation axis (B) exclusively through the respective main forming plate (30).

2. - Package forming apparatus according to claim 1, wherein each control device (29) comprises a shaft (32) rotatable about a second rotation axis (E) and operatively coupled exclusively to the respective main forming plate (30), wherein the angular position of each half-shell (28) about the first rotation axis (B) is determined in dependence of the angular position of the respective shaft (32) about the second rotation axis (E).

3. - Package forming apparatus according to claim 2, wherein each shaft (32) is configured to rotate about the second rotation axis (E) so as to move the respective half shell (28) between the respective first angular position and the respective second angular position.

4. - Package forming apparatus according to claim 3, wherein each control device (29) comprises a lever mechanism (33) coupled exclusively to the shaft (32) and the respective main forming plate (30) and configured to actuate an angular movement of the respective half-shell (28) in dependence of an angular movement of the respective shaft (32) about the second rotation axis (E).

5. - Package forming apparatus according to claim 4, wherein each lever mechanism (33) comprises a coupling element (35) fixed to the respective shaft (32) and a coupling bar (36) hinged to the coupling element (35) and the respective main forming plate (30).

6. - Package forming apparatus according to claim 5, wherein each coupling bar (36) is hinged to the respective coupling element (35) about a first hinge

axis (R) and is hinged to the respective main forming plate (30) about a second hinge axis (H).

7. - Package forming apparatus according to claim 6, wherein the first hinge axis (R) and the second hinge axis (H) are parallel to one another and/or to the first rotation axis (B). 5
8. - Package forming apparatus according to any one of the preceding claims, wherein each lateral forming plate (31) is connected in a non-movable manner to the respective main forming plate (30). 10
9. - Packaging machine (1) for forming packages (2) of a pourable product from an advancing tube (4) formed and longitudinally sealed from a web of packaging material (3) comprising a package forming apparatus (10) according to any one of the preceding claims. 15

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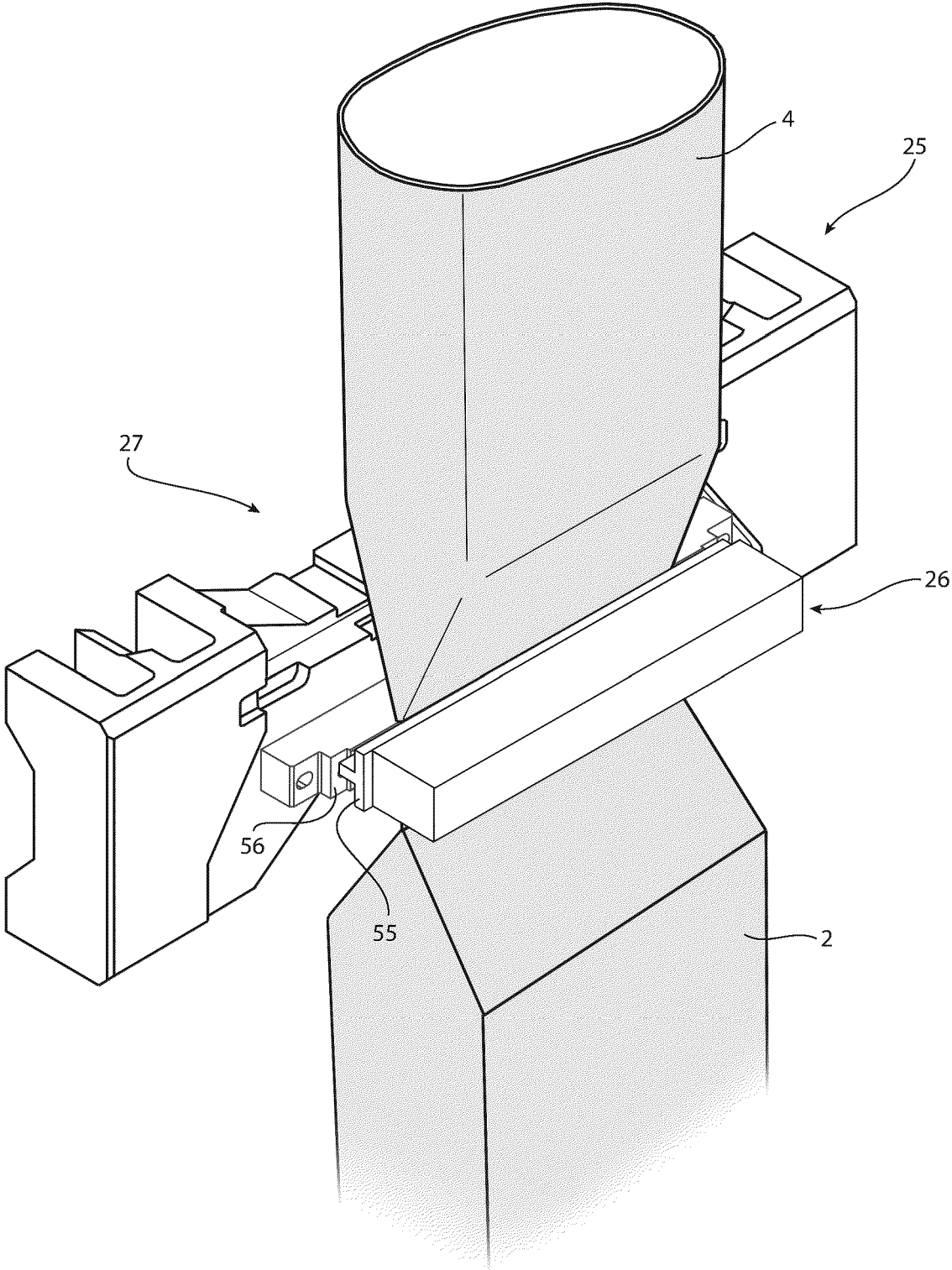


FIG. 2

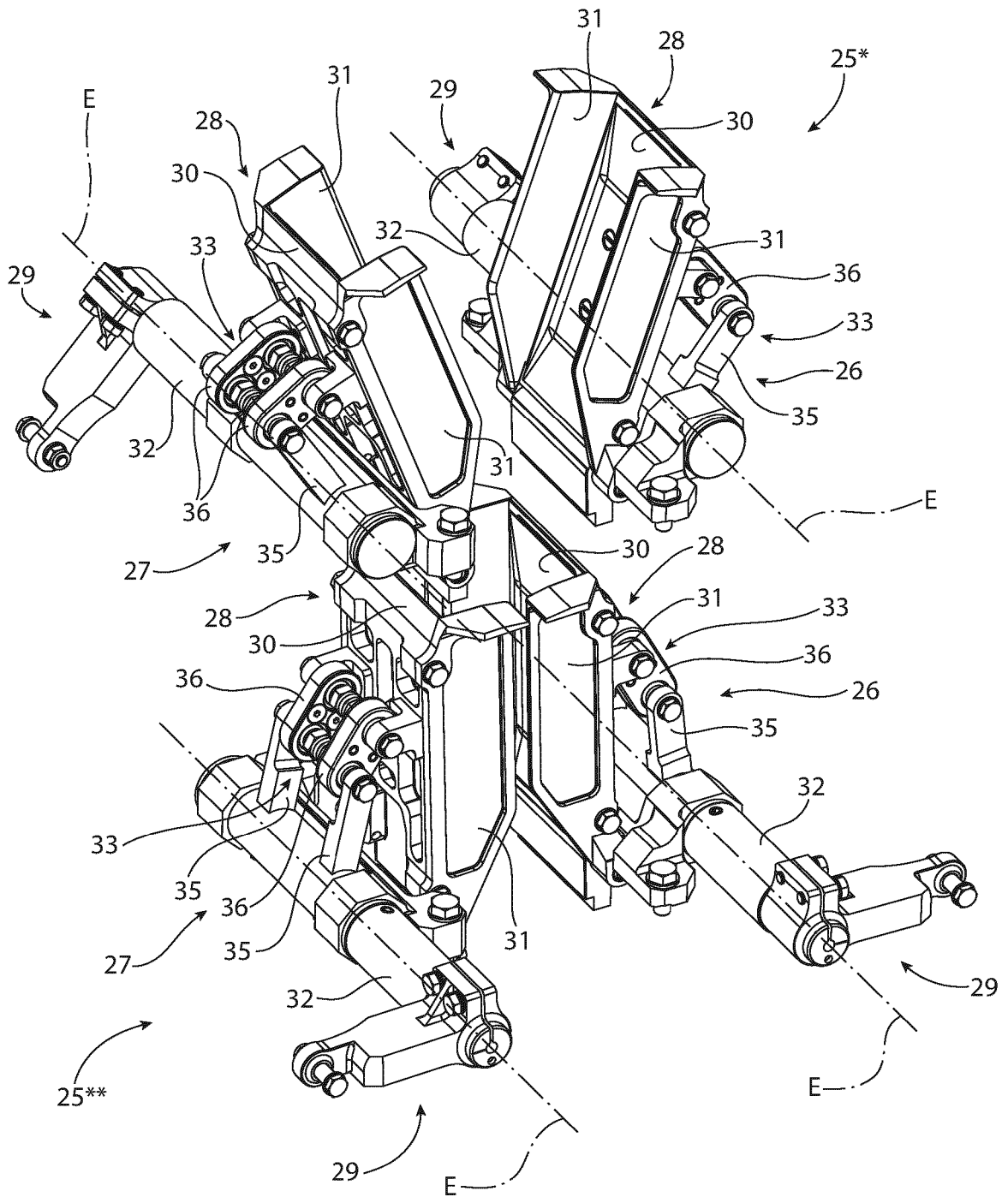


FIG. 3

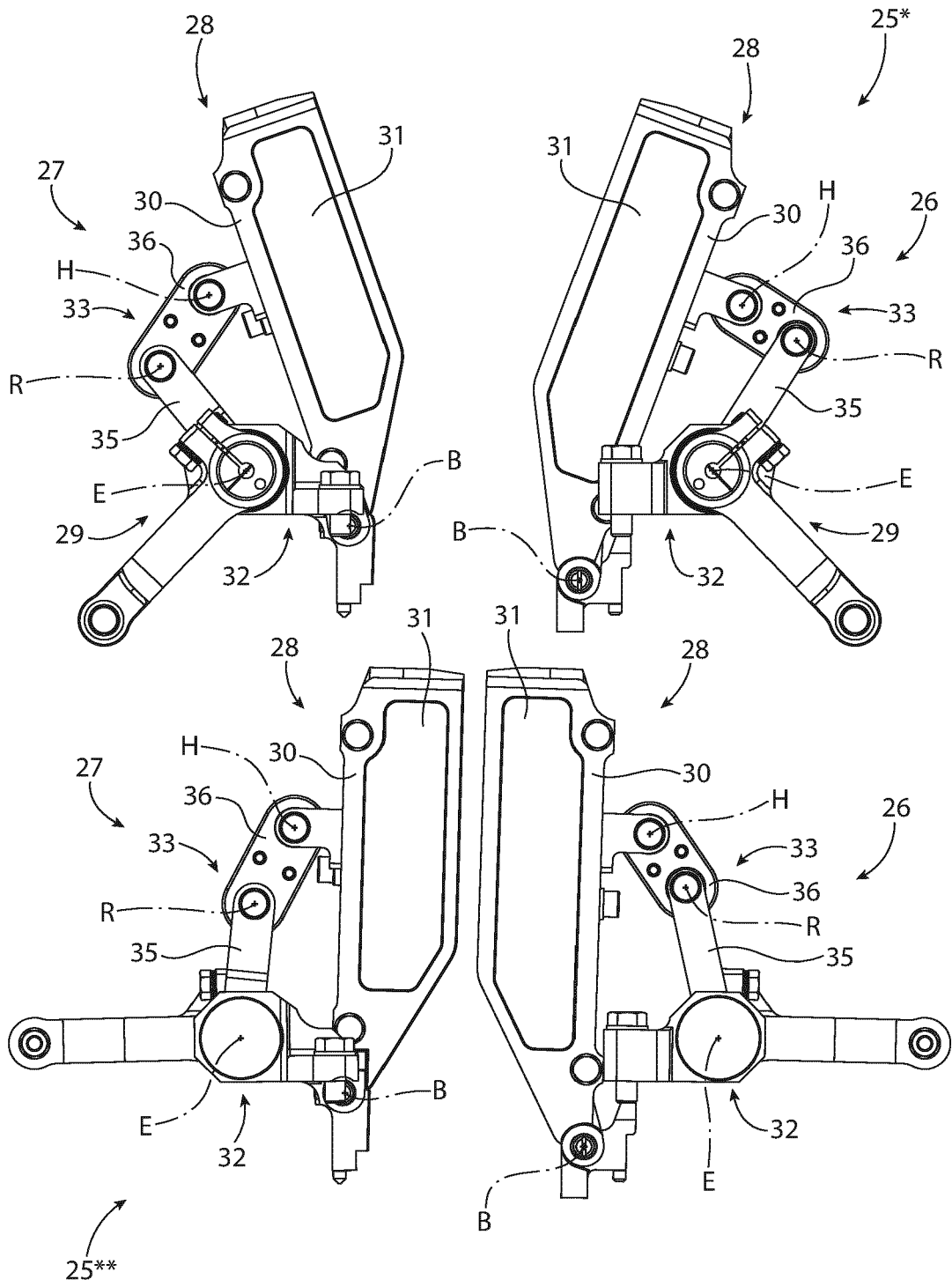


FIG. 4

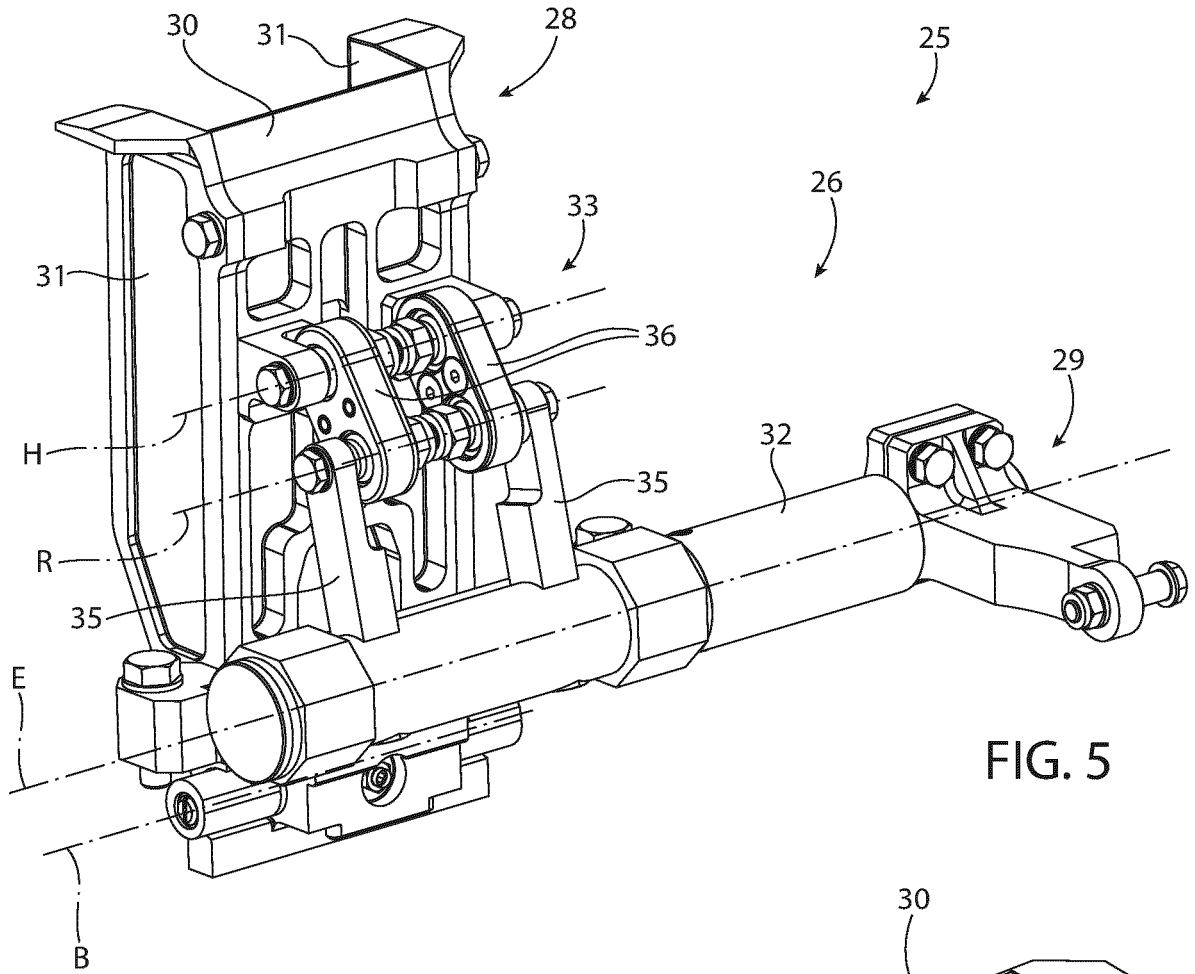


FIG. 5

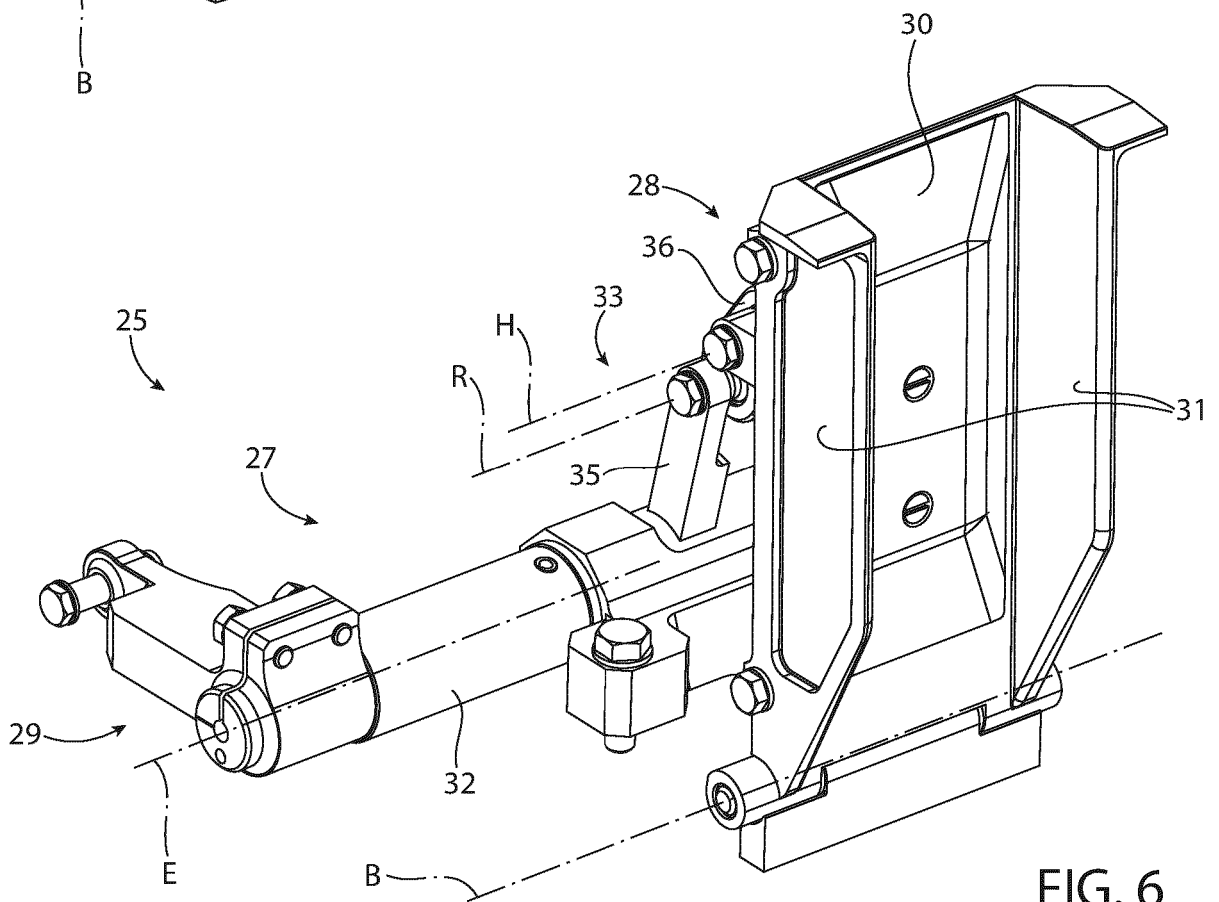


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

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15

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 351 478 A1 (TETRA LAVAL HOLDINGS & FINANCE [CH]) 25 July 2018 (2018-07-25) * figures 1-3 * * paragraphs [0048] - [0053], [0055], [0062] * -----	1-4, 8, 9	INV. B65B9/20 B65B65/02 ADD. B65B61/24
X	EP 3 318 383 A1 (GD SPA [IT]) 9 May 2018 (2018-05-09) * figures 4-7 * * paragraphs [0007], [0019] * -----	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 March 2025	Examiner Schmitt, Michel
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