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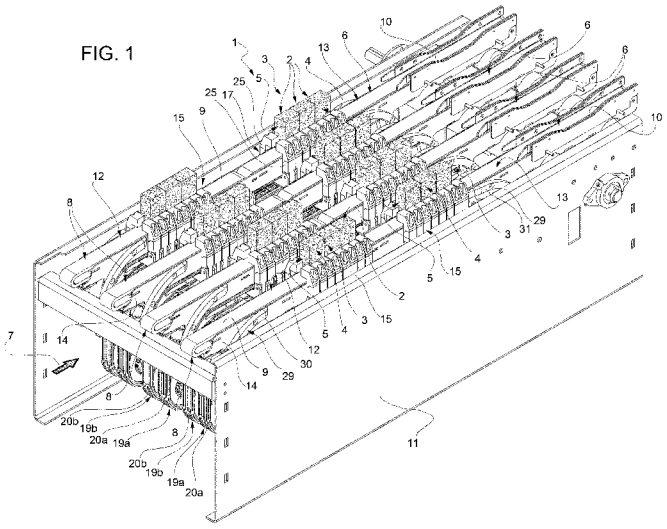
(54) Title: PACKAGE GROUPING UNIT WITH PACKAGE LINEAR SPEED REDUCTION

FIG. 1



(57) Abstract: A package grouping unit (1) for a packaging line operable to produce multipacks; the package grouping unit being provided with at least one linear conveyor (8) for feeding, in a given advancement direction (7), a 5 succession of packages (2) fed to an inlet of the linear conveyor (8) at a first speed (V1); and at least one package slowdown device (15), which is configured to group (3) the packages (2) and successively feed the groups (3) to a linear conveyor output at a second speed 10 (V2) lower than the first speed (V1); the slowdown device (15) being formed by a plurality of variable configuration sections (17), which define a seat (16) so sized to receive a package (2) group (3) and operable to move along the linear conveyor (8) and to assume, 15 depending on the position of the variable configuration sections (17) along the linear conveyor (8), a closed configuration adapted to retain the packages (2) in the seat (16) and an open configuration suitable to allow insertion and release of the packages (2) in and, 20 respectively, from the seat (16).

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PACKAGE GROUPING UNIT WITH PACKAGE LINEAR SPEED REDUCTION

Technical field

The present invention relates to a package grouping unit with package linear speed reduction.

The present invention, although suitable to be used in any multipack production line, may be used to particular advantage in the field of the food industry in a packaging line of pourable food products, such as fruit juices, milk, wine, etc., to which the the following description refers purely by way of example.

Background of Invention

As known, a packaging line of the above type comprises, in general, a packaging machine which is adapted to form the packages with the product already inside. In particular, packages are generally produced from a sheet packaging material, which is normally in the form of pre-cut blanks or a continuous strip, and which is subjected to a series of folding and longitudinal sealing operations to form a continuous tube of packaging material, which, after being filled, is welded, transversely divided and formed to take the form of individual packages.

The packages are then supplied to a grouping unit to be arranged in groups of a given number of packages

and advanced, finally, to a wrapping machine to be wrapped by a wrapping material, normally cardboard or plastic film, and to form multipacks.

Depending on the size of the multipack, the packaging line may have a single-line or a multi-line configuration. In the latter case, immediately upstream from the grouping unit there is normally arranged a divider, which is adapted to remove the packages from an output of the packaging machine and to distribute the packages, aligned with one another, in a determined number of parallel lines. The grouping unit is configured to group the packages in each line and order the groups along the respective lines to allow a transfer device to withdraw a group from each line, simultaneously, and feed the groups to the wrapping machine to be arranged in a compact configuration and wrapped to form a multipack.

Regardless of the multipack format and, therefore, of the number of lines of the grouping unit, it is known that the transfer of the packages from the packaging machine to the wrapping machine is a very critical stage for the stability and integrity of the packages. This stems from the fact that the package output linear speed from the packaging machine is normally considerably higher than the speed with which the groups are fed to the wrapping machine. It is therefore essential to slow

down the packages which are fed with high speed to the grouping unit in order to ensure that the linear speed of the groups fed to the wrapping machine and the wrapping machine input speed are equal.

Since at this stage the packages are subjected to a relatively high reduction of the advancing speed, especially in view of the high production speed of the new generation packaging machines, it is very important to reduce the linear speed of the packages in a manner as controlled and gentle as possible to avoid dropping of packages or damage thereof.

Disclosure of Invention

An object of the present invention is to provide a package grouping unit, which allows reducing the linear speed of the packages while minimizing the risks of package falling and damage and, moreover, which is relatively flexible in terms of multipack format change.

According to the present invention, there is provided a package grouping unit as claimed in claim 1 and, preferably, in any one of the claims depending directly or indirectly on claim 1.

Brief description of the drawings

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

- Figure 1 shows, in perspective view, a preferred

embodiment of the package grouping unit according to the present invention;

- Figure 2 shows a section, along a longitudinal plane, of the package grouping unit of Figure 1, with parts removed for clarity;

- Figure 3 shows the package grouping unit of Figure 2 in a different operating configuration, with parts removed for clarity;

- Figure 4 shows, with parts removed for clarity, a further section, according to a different longitudinal plane, of the package grouping unit of Figure 1;

- Figure 5 shows, in perspective view, with parts removed for clarity, a detail of Figure 4;

- Figure 6 shows, with parts removed for clarity, a detail of Figure 5;

- Figures 7 and 8 show, in perspective - partly sectioned - view and in enlarged scale, a detail of Figure 5 in respective different operating positions;

- Figures 9 and 10 show, in perspective - partly sectioned - view and in enlarged scale, two further details of Figure 5; and

- Figure 11 represents a functional diagram of the grouping unit according to the present invention.

Detailed description of preferred embodiments

Number 1 in Figure 1 indicates as a whole a grouping unit to group packages 2 in a packaging line

for the production of multipacks (not shown).

In the following, the term "multipack" is intended to mean a group of packages 2 arranged in a compact arrangement according to a determined format and kept together by an outer overwrapping formed, typically, by a film of plastic material or packaging cardboard.

Although the grouping unit 1 of the present invention is suitable for use in any packaging line for the production of multipacks, the present description refers, purely by way of example, to a packaging line for the production of aseptic packages 2 of pourable food products, such as fruit juices, milk, wine, etc.

In a packaging line of this type the grouping unit 1 is arranged normally downstream of a packaging unit (not shown), in which the packages 2, filled with the product, are formed through a (known) sequence of operating steps essentially comprising forming a continuous tube of wrapping material, filling the tube with the product, welding and transversally cutting the tube to obtain individual units, and forming the packages 2 from the individual units.

The packages 2 thus obtained are then supplied to the grouping unit 1 so as to be grouped to form groups 3 containing a number N > 1 of packages 2 aligned with each other so as to form a row of packages 2.

The multipack forming process ends in a wrapping

machine (not shown), which is arranged downstream of the grouping unit 1 and is configured to receive in succession, from the grouping unit 1, a number $M \geq 1$ of groups 3 and to wrap the M groups 3, previously grouped in a compact assembly, with a wrapping material, normally a plastic film or a cardboard, so forming a multipack.

Depending on the required format, the multipack can contain only one group 3, namely a single row of N packages, or M groups 3, namely MxN packages ordered in M rows.

In the example illustrated in the accompanying drawings and described in the following, the grouping unit 1 has a multi-line configuration for the production of multipacks with MxN packages 2, where $N > 1$ is the number of packages 2 forming each group 3, and $M > 1$ is the number of groups 3, namely the number of rows in the multipack.

The packages 2 have a generally parallelepiped shape and are bounded externally by two larger flat lateral walls 4 parallel to each other, two smaller flat lateral walls 5 parallel to each other and substantially perpendicular to the larger lateral walls 4, and two end walls substantially perpendicular to the lateral walls.

The packages 2 are fed to the grouping unit 1 through a divider (known and not illustrated), which is

adapted to remove packages 2 from an output of the packaging machine (not shown) and to feed them, at an input speed V1, to the grouping unit 1 while distributing the packages in M lines 6, which extend parallel to one another in a substantially horizontal advancement direction 7. In particular, as it will be explained below, the divider is operable to feed the lines 6 sequentially, namely from the first to the last, and cyclically, namely by repeating the sequence continuously, and releasing each time, on each line, N packages 2 before starting to feed the next line 6.

Each line 6 comprises a linear conveyor 8, which has an package feeding inlet, to which the packages 2 are advanced with the speed V1, an intermediate portion, along which packages 2 arranged in groups 3 are advanced in the advancement direction 7, and a group delivery outlet, at which the groups 3 are advanced with a speed V2 lower than the speed V1 and equal to the input speed of the wrapping machine (not shown).

In practice, as illustrated in Figures 1 and 4, each linear conveyor 8 comprises two belt conveyors 9, 10 aligned with each other in the advancement direction 7 and of which the belt conveyor 9 is operating at the speed V1, at which packages 2 are fed to the linear conveyor 8 from the divider (not shown), and the belt conveyor 10 is operating at the speed V2, at which the

groups 3 are to be feed to the wrapping machine (not shown).

In particular, each belt conveyor 9 comprises a belt looped around pulleys, one of which is a drive pulley, and which are mounted on a frame 11 of the grouping unit 1 to rotate about respective axes transverse to the advancement direction 7 and define, on the belt conveyor 9, a straight work branch 12 extending in the advancement direction 7, and a return branch extending on a vertical plane below the respective work branch 12.

Similarly, each belt conveyor 10 comprises a belt looped around pulleys, one of which is a drive pulley, and which are mounted on the frame 11 to rotate about respective axes transverse to the advancement direction 7 and define, on the belt conveyor 10, a straight work branch 13, which extends in the advancement direction 7 and is substantially coplanar and contiguous with the work branch 12, and a return branch extending on a vertical plane below the respective work branch 13.

As shown in Figure 1, work branch 12 and work branch 13 of one and the same line 6 are movable within a respective channel defined laterally by a pair of vertical plates 14 rigidly mounted on the frame 11 and extending along the entire length of the line 6. The plates 14 are bounded at their top by respective

longitudinal free edges, which are arranged at a level slightly lower than or, at most, equal to the upper surface of the work branch 12 and the work branch 13.

The belt conveyors 9 are driven by a common motor (not shown) operable to cause the respective work branches 12 to advance at the speed V1 of the packaging machine output; similarly, belt conveyors 10 are driven, independently of the conveyor belt 9, by a common motor (not shown) operable to cause the work branches 13 to advance at the speed V2 of the wrapping machine inlet.

In order to group the packages 2 into groups 3 and, at the same time, reduce the packages speed from speed V1 to speed V2, the grouping unit 1 comprises slowdown devices 15, each of which is operable to move along the respective line 6 independently of the corresponding linear conveyor 8 and is formed by a series of generally U-shaped variable configuration elements 17 arranged close to one another around the linear conveyor 8 in such a way as to define, as a whole, and with the linear conveyor 8, a movable seat 16 adapted to contain a group 3 of packages 2.

As will be clarified in more detail below, the number of slowdown devices 15 in each line 6 is variable depending on the package input speed V1, the length and the number of lines 6, and the size of the multipack, i.e. the number N of packages in each group 3.

With reference to Figures 2, 5 and 6, each slowdown device 15 is movable along a respective annular path comprising a straight work branch 18, which is parallel to the advancement direction 7, is vertically aligned to the linear conveyor 8 and extends below the work branch 12 of the belt conveyor 9 and part of the work branch 13 of the belt conveyor 10.

Each slowdown device 15 is conveyed along the annular path by an endless conveyor, preferably a chain endless conveyor 19 comprising at least one chain 20 looped around four pulleys 21, one of which is a drive pulley driven by a respective motor (not shown) independently of the drive motors of the belt conveyors 9 and 10. The pulleys 21 are mounted to the frame 11 to rotate about respective axes which are substantially horizontal and perpendicular to the advancement direction 7, and define, on the annular path, the work branch 18 and a return branch 22, which comprises a lower portion parallel to work branch 18 and two vertical intermediate portions connected to the work branch 18 and to the lower portion by respective curved portions.

In the example illustrated, the grouping unit 1 comprises, for each linear conveyor 8, four slowdown devices 15 (shown in Figure 2) and two chain endless conveyors 19 (for the sake of clarity referenced in the

drawings by the reference numerals 19a and 19b), whose chains 20 (referenced in the drawings by the reference numerals 20a and 20b) extend along identical annular paths which are arranged side by side and lie on respective vertical planes parallel to each other. Each chain endless conveyor 19a, 19b carries two slowdown devices 15 evenly spaced along the respective chain 20a, 20b and is operated by a respective motor (not shown) independent of the motor of the other chain endless conveyor 19b, 19a.

With reference to Figures 5 and 6, the variable configuration elements 17 in each slowdown device 15 are firmly connected, via respective connecting members 23, to the chain 20a or 20b of the chain endless conveyor 19a or 19b associated with the respective slowdown device 15.

In particular, each connecting member 23 is defined by an elongated element, which extends along an axis 24 perpendicular to the advancement direction 7 and over both the chain 20a and 20b.

As illustrated in Figures 6 to 10, each connecting member 23 of one and the same slowdown device 15 is rigidly connected, by means of screws or similar connecting means, to one of the chains 20, at its axial end portion facing the chain 20, while the opposite axial end portion facing the other chain 20 has a

recessed part, which defines a gap between the connecting member 23 and the chain 20 to ensure that no contact occurs between the variable configuration element 17 and the chain 20 when the variable configuration element 17 advances along its annular path.

Each variable configuration element 17 further comprises a pair of fingers 25 lying on a respective plane radial to the annular path and passing through the axis 24. The fingers 25 are hinged at the ends of the respective connecting member 23 to rotate about respective axes 26 perpendicular to the axis 24 and parallel to the advancement direction 7 and to move between a closed position, in which the fingers 25 form the seat 16, and an open position, in which the fingers 25 assume a V-configuration.

The variable configuration elements 17 are movable between the closed position and the open position independently from each other.

From the kinematic point of view, each finger 25 defines a rocker arm hinged about the axis 26 and comprising a first arm, which extends from the axis 26 to the connecting member 23, and a second arm, which is aligned and opposed to the first arm and carries, at its free end, a head 27 provided, on the side facing the other finger 25, with a projecting portion 28, whose

function will be explained in the following.

As shown in Figures 6, 7 and 8, the length of the fingers 25 is such that, along the work branch 18, the fingers 25, which are arranged externally to the plates 14, protrude beyond the upper free edge of the plates 14, and the heads 27 are arranged above the work branch 12 and the work branch 13.

As illustrated in Figures 1, 3, 5 and 8, the fingers 25 of each pair are adapted to be moved from the closed position to the open position, and viceversa, when they run through the two sections of the annular path which connect the return branch 22 to the work branch 18.

The opening of the fingers 25 is achieved by bringing them into contact with fixed cam profiles 29 carried by the frame 11 and arranged on opposite sides of the linear conveyor 8. In particular, as clearly shown in Figures 2 and 3, each line 6 comprises a first pair of cam profiles 29 arranged to cooperate with the fingers 25 when the fingers 25 move through an inlet portion of the work branch 18, and a second pair of cam profiles 29 arranged to cooperate with the fingers 25 when the fingers 25 move through an outlet portion of the work branch 18.

Each cam profile 29 in the first pair is defined by a curvilinear profile comprising an outlet portion 30

(in the direction of advance of the fingers 25 along the annular path, clockwise in the drawings), which is rigidly connected to the corresponding plate 14, extends parallel to an initial portion of the work branch 12 and, at its free end, is joined to the plate 14 by an inclined plane that allows the fingers 25 to move gradually and smoothly to the closed position from the open position. Similarly, each cam profile 29 in the second pair is defined by a curvilinear profile comprising an inlet portion 31, which is rigidly connected to the corresponding plate 14, extends parallel to an intermediate portion of the work branch 13 and, at its end free, is joined to the plate 14 by an inclined plane that allows the fingers 25 to gradually and smoothly spread apart.

As shown in Figures 7 and 8, the cam profiles 29 are arranged in such a way that, when they are engaged by a pair of fingers 25, each one of them comes into contact with a surface of the respective finger 25 facing the plate 14 and arranged between the head 27 and the axis 26. In this way, each cam profile 29 imparts to the respective fingers 25 a rotation around the axis 26 against the action of a return spring 32, which extends parallel to the axis 24 and is compressed between the first arms of the fingers 25 to impart to the fingers 25 a counter rotation about the axis 26 when the fingers 25

disengage from the cam profiles 29, and return the fingers 25 in the closed position.

As illustrated in Figures 5, 7, 9 and 10, each slowdown device 15 comprises, preferably, three types of fingers 25 which differ from each other in the shape of the head 27, which is preferably removably mounted to allow it to be replaced quickly and easily.

In particular, as illustrated in Figures 5 and 7, in each slowdown device 15 the front pair of fingers 25, i.e. the first pair of fingers 25, (in the sense of advancement along the annular path) differs from the other fingers 25 in that the respective projecting portions 28 extend one toward the other in such a way that, when the fingers 25 are arranged in the closed position and a group 3 of packages 2 is arranged inside the respective seat 16, the projecting portions 28 define, as a whole, a transverse abutment having the function of intercepting the package 2 entering in the work branch 12 and to allow the accumulation of the packages 2 and the formation of a group 3.

As shown in Figures 5 and 10, the rear pair of fingers 25, i.e. the last pair of fingers 25, (in the sense of advancement along the annular path) differs from the other fingers 25 in that, when the fingers 25 are arranged in the closed position and a group 3 of packages 2 is arranged in the seat 16, the respective

projecting portions 28 protrude toward each other so that they come into contact with the larger lateral walls 4 of one or more of the last package 2 and impart a slight lateral pressure on the respective packages 2 so as to prevent any displacement between packages 2 and maintain group 3 in a compact configuration. Preferably, in order to take account of the dimensional tolerances of the packages 2, each slowdown device 15 is provided with two or more pairs of fingers 25 of the latter type in order to guarantee in any case a sufficient gripping on the packages 2. If the last pair of fingers 25 closes right at the back of the last package 2, the projecting portions 28 of the fingers 25 protrude toward each other to such an extent to define, as a whole, a rear transverse abutment adapted to prevent the last package 2 to tip backwards.

Finally, as illustrated in Figures 5 and 9, the projecting portions 28 of the central pairs of fingers 25 are so shaped and sized as to prevent them to come into contact, when in the closed position, with larger lateral walls 4 of the packages 2 so as to leave the packages 2 free to move forwards under the thrust of the linear conveyor 8 which slides under the packages 2 and come in a compact configuration and form a group 3.

The operation of the grouping unit 1 is described below with reference to the example illustrated in the

attached Figures, in which the grouping unit 1 is of a multi-line type to produce multipacks having a 4x3 format i.e. multipacks made up of four groups 3, each of which is formed by three packages 2.

As introduction to what follows, it is to be noted that, in the case of a multi-line configuration, when the groups 3 come to the outlet of the grouping unit 1, it is necessary that the groups 3, one for each line 6, move at the speed V2 and be aligned in a direction perpendicular to the advancement direction 7 in such a way as to form a common front and to be withdrawn at the same time and fed to the wrapping machine (not shown).

The divider (not shown) is operated to supply the lines 6 cyclically and sequentially and, at each cycle, delivers on each linear conveyor 8 a number N of packages 2, in the illustrated example three packages 2.

The two chain endless conveyors 19a, 19b of one and the same line 6 are independent of each other and are controlled in such a way that, when the packages 2 are fed on the work branch 12 of the linear conveyor 8, only one of the four slowdown devices 15 in the line 6, is moved through the inlet portion of the work branch 18 at a speed V3 lower than the speed V1.

In particular, the feeding of packages 2 and the advancement of the slowdown device 15 takes place in such a way that, when the first package 2 enters the

work branch 12 at the speed V1, the front pair of fingers 25 have already spread apart and returned in their closed position or, at least, in a position close enough to define the aforementioned front transverse abutment. It follows that, since the speed of the packages 2 is greater than the speed of the fingers 25 of the slowdown device 15, the packages 2 are slowed down and, as they enter the seat 16 gradually formed by fingers 25, are pushed by linear conveyor 8 one against another to form a compact group 3.

Central fingers 25 are spread apart when they come into contact with cam profiles 29 and return to their closed position when the packages 2 are already in the seat 16. As soon as the last package 2 has entered the seat 16, the last pair(s) of fingers 25 closes against the lateral surface of the last package 2 and/or right at the back of the last package 2. Except from the fingers 25 arranged at the rear portion of the group 3, all the other fingers 25 do not touch the packages 2 and define two containment lateral shoulders movable with the group 3.

At this time, the slowdown device 15 with the group 3 is advanced, by the respective chain endless conveyor 19, along the linear conveyor 8 according to a given motion profile such that, before reaching the second pair of cam profiles 29, the speed of the slowdown

device 15 is equal to the speed V2 of the belt conveyor 10.

Once they reach the second pair of cam profiles 29, the front pair of fingers 25 and, in succession, all the other pairs of fingers 25 move gradually in the respective open position, so causing the seat 16 to be opened and allowing the packages 2 of the group 3 to come out from the seat 16 and move along the work branch 13 (Figure 5).

As shown in Figure 3, when a group 3 is released by respective slowdown device 15, a slowdown device 15 connected to the other chain endless conveyor 19 reaches the inlet of the work branch 12 and receive package 2.

While the latter slowdown device 15 is filled and transported along the linear conveyor 8 by the respective chain endless conveyor 19, the other chain endless conveyor 19 is operated according to a given independent motion profile to advance the slowdown device 15 opposite to that which has just released the group 3 towards the inlet of the work branch 12.

To put this another way, for each line 6, the inlet of the work branch 12 is reached by the slowdown devices 15 of one and the other of the chain endless conveyors 19, alternately, and the slowdown device 15 of each chain endless conveyor 19 reaches the inlet of the work branch 12 one after the other. In the case illustrated,

in which the slowdown devices 15 are two, the slowdown devices 15 of each chain endless conveyor 19 reach the inlet of the work branch 12 in an alternating manner.

In the case of a multi-line configuration as that of the example illustrated, the chain endless conveyors 19 of lines 6 are operated independently from each other according to respective motion profiles in such a way that the slowdown devices 15 reach the inlet of the respective lines 6 synchronously with the package feeding sequence of the divider (not shown) and move through the delivery outlet of the respective line 6 only when the delivery outlet of all of the lines 6 have been reached by respective slowdown devices 15 in such a way that M groups 3, each from a respective line 6, are delivered at the same time to the wrapping machine.

This result is achieved by the chain endless conveyors 19 being operated independently, which results in the speed of the slowdown devices 15 being adjustable according to a motion profile.

Figure 11 illustrates, by way of a non-limiting example, a space-time diagram representing the slowdown device motion profiles of the four lines 6 shown in Figure 1.

In general, the motion profiles of the chain endless conveying 19 are set to take account of a plurality of operating conditions, in particular the

speed V1 and the speed V2, the number N of packages in each group 3, the number of lines 6, the length of each line 6, the number of chain endless conveyors 19 in each line 6 and the number of slowdown devices 15 on each chain endless conveyor 19.

In the case illustrated, where each endless conveyor chain 19 carries two slowdown devices 15, if the divider is required to feed the lines 6 continuously, at least the first line 6 is necessarily to be equipped with at least two chain endless conveyor 19, each of which is to be equipped with at least one slowdown device 15. In this way, when one of the two slowdown device 15 releases the respective group 3, another slowdown device 15 is already present at the inlet of the line 6 to receive packages 2.

From the above, the advantages of the grouping unit 1 of the present invention may be readily appreciated. Firstly, the fact that the seats 16 can be opened during package receiving and delivery, and define a laterally closed pocket housing a group 3 and moving with it along the linear conveyor 8 allows package 2 to be handled in a controlled and precise manner, substantially eliminating the risk of package tipping or damage during the grouping and the speed reduction.

Furthermore, in the case of a multiline configuration, the structure of the grouping unit 1

results in a high flexibility in terms of multipack format change. In this regard, it should be noted that the grouping unit 1 is quickly adaptable to different formats by simply changing the number of active lines 6 and/or the number and the motion profiles of the chain endless conveyors 19 in each line 6.

Moreover, the slowdown devices 15 are quickly adaptable to any number of packages in each group 3. In fact, the variable configuration elements 17, i.e. the pairs of fingers 25 with the respective connecting members 23, operate as independent "sections", which may rapidly be removed from and/or moved along the chain 20 to vary their number or position in order to change the size of the seat 16.

CLAIMS

1.- Package grouping unit for a packaging line operable to produce multipacks, the package grouping unit (1) comprises at least one linear conveyor (8) operable to feed, in a given advancement direction (7), a succession of packages (2) which are fed to a conveyor inlet at a first speed (V1) and package slowdown means operable to move in the advancement direction (7) to interact with the packages (2) on the linear conveyor (8) to group the packages (2) into groups (3) each containing a given number of packages (2) aligned in the advancement direction (7), and to feed the groups (3) in succession to a conveyor output at a second speed (V2) lower than the first speed (V1); the package grouping unit (1) is characterized in that the slowdown means comprise at least one slowdown device (15) formed by variable configuration sections (17), which are aligned along the advancement direction (7) to define a seat (16) so sized to receive a group (3) of packages (2); an advancement device (19) for advancing the slowdown device (15), which is operable independently of the linear conveyor (8) to move the slowdown device (15) in the advancement direction (7) along the linear conveyor (8); the package grouping unit (1) further comprises actuating means (29) operable to vary the configuration of the variable configuration sections (17) based on the

position thereof along the linear conveyor (8) and between a closed configuration suitable to retain the packages (2) in the seat (16) and an open configuration suitable to allow insertion and release of the packages (2) in and, respectively, from the seat (16).

2.- Package grouping unit according to claim 1, wherein the linear conveyor (8) has a package feeding inlet and a group delivery outlet; and the advancement device comprise at least one endless conveyor (19), which comprises a work branch (18) extending in the advancement direction (7) from the package feeding inlet to the group delivery outlet.

3.- Package grouping unit according to claim 2, wherein the advancement device comprises a first endless conveyor (19a) and a second endless conveyor (19b) operable independently of each other and associated to the linear conveyor (8) and wherein the package grouping unit (1) comprises a first slowdown device (15) and a second slowdown device (15), the first slowdown device (15) being associated to and advanced by the first endless conveyor (19a) and the second slowdown device (15) being associated to and advanced by the second endless conveyor (19b).

4.- Package grouping unit according to claim 3, wherein each endless conveyor (19a, 19b) is equipped with at least two slowdown devices (15) evenly spaced

along the endless conveyor (19).

5.- Package grouping unit according to any one of claims 2 to 4, wherein the slowdown device (15) is arranged to protrude over the linear conveyor (8) while moving along the work branch (18) to receive the package (2) at the package feeding inlet, and is operable to move along the work branch (18) according to a given motion profile, and to release the groups (3) at the group delivery outlet.

6.- Package grouping unit according to any one of claims 2 to 5, wherein the linear conveyor (8) comprises a first branch (12), which is movable at the first speed (V1) and has the package feeding inlet; and a second branch (13), which is aligned to the first branch (12) in the advancement direction (7), is movable at the second speed (V2) and extends through the group delivery outlet.

7.- Package grouping unit according to any one of claims 2 to 6, wherein the endless conveyor (19) is operable to move the slowdown device (15) through the package feeding inlet at a third speed (V3) lower than the first speed (V1) and through the group delivery outlet at the second speed (V2).

8.- Package grouping unit according to any one of claims 2 to 7, wherein the variable configuration sections (17) are movable between the closed

configuration and the open configuration independently from each other, each variable configuration section (17) comprising a connecting member (23) to connect the variable configuration section (17) to the endless conveyor (19), and two fingers (25), which are arranged on opposite sides of the linear conveyor (8) when the fingers (25) moves along the work branch (18), and are hinged to the connecting member (23) to rotate on a plane transverse to the advancement direction (7) between the closed configuration, in which the fingers (25) define a side wall of the seat (16), and the open configuration, in which the fingers (25) are spaced apart from each other.

9.- Package grouping unit according to claim 8, wherein the actuating means (29) comprise two cam devices (29), which are arranged in a fixed position with respect to the linear conveyor (8) and wherein a first cam device (29) is arranged at the package feeding inlet and is configured to move the fingers (25) from the closed configuration to the open configuration, and the second cam device (29) is arranged at the group delivery outlet and is configured to move the fingers (25) from the closed configuration to the open configuration.

10.- Package grouping unit according to claim 8, or 9, wherein the front variable configuration section

(17), in the advancement direction (7), is so shaped as to define, in the closed configuration, a transverse abutment adapted to retain the packages (2) entering the seat (16).

11.- Package grouping unit according to claim 10, wherein at least the rear variable configuration section (17), in the advancement direction (7), protrudes, when in the closed configuration, towards the inside of the seat (16) in such a way as to grip laterally at least the last package (2) within the seat (16).

12.- Package grouping unit according to claim 10 or 11, wherein each finger (25) of the variable configuration section (17) comprises a stem portion, which is hinged to the respective connecting member (23), and a head (27), which is connected in removable manner to a free end of the stem portion, and protrudes over the linear conveyor (8) when the slowdown device (15) moves along the linear conveyor (8); the heads (27) of the front variable configuration section (17) having respective projecting portions (28) which define, as a whole, said transverse abutment.

13.- Package grouping unit according to one of claims 2 to 12, wherein the grouping unit (1) comprises a plurality of linear conveyors (8), which are adapted to receive a respective number of packages (2) in succession, according to a package feeding cyclic

sequence; at least one endless conveyor (19), carrying at least one slowdown device (15), being associated to a corresponding linear conveyor (8) and being operable independently of the other endless conveyors (19) and according to respective motion profiles in such a way that the slowdown devices (15) reach the respective package feeding inlets according to said package feeding cyclic sequence and, at the respective group delivery outlets, are aligned with each other in a direction perpendicular to the advancement direction (7).

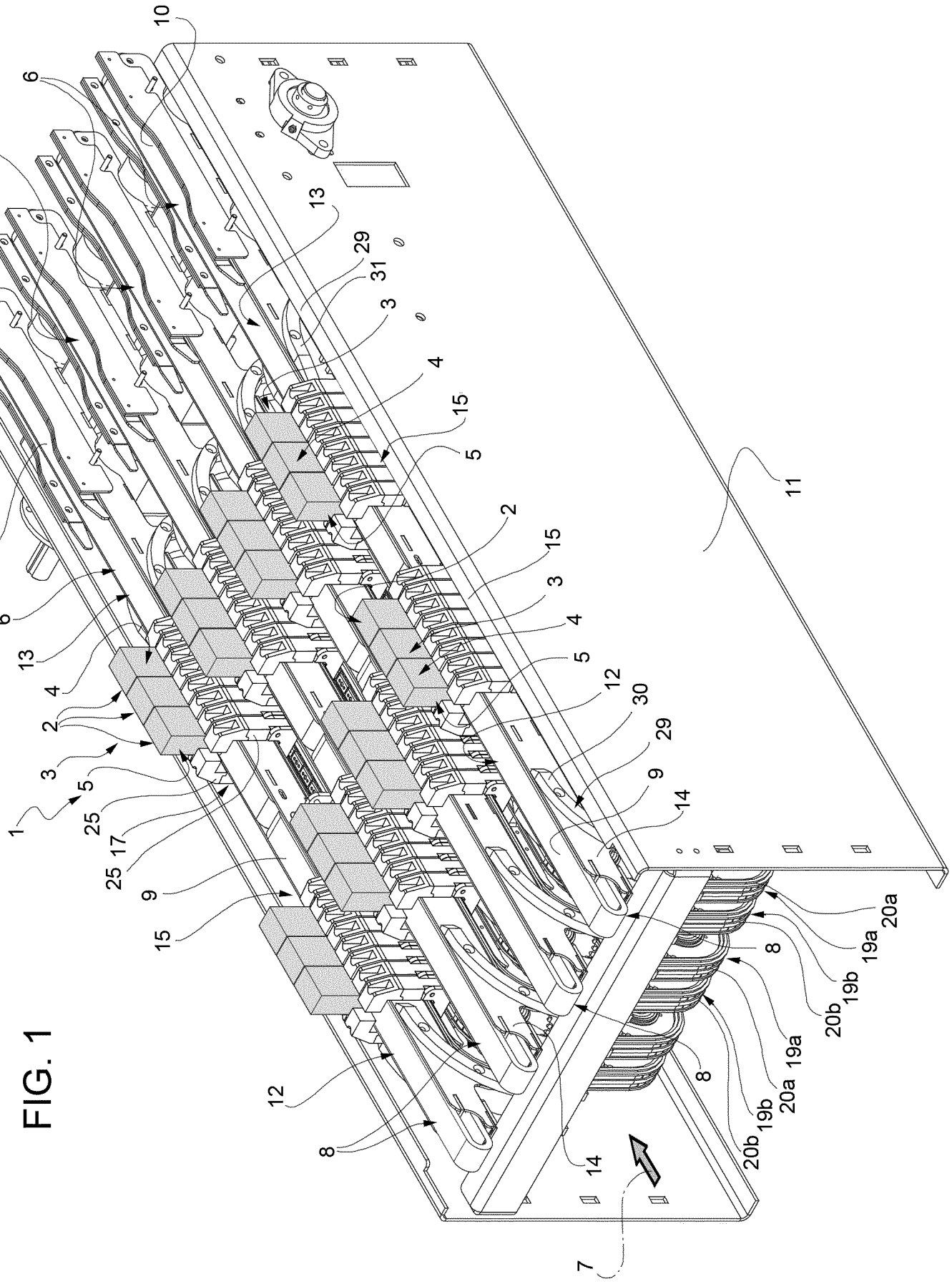
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FIG. 1

FIG. 2

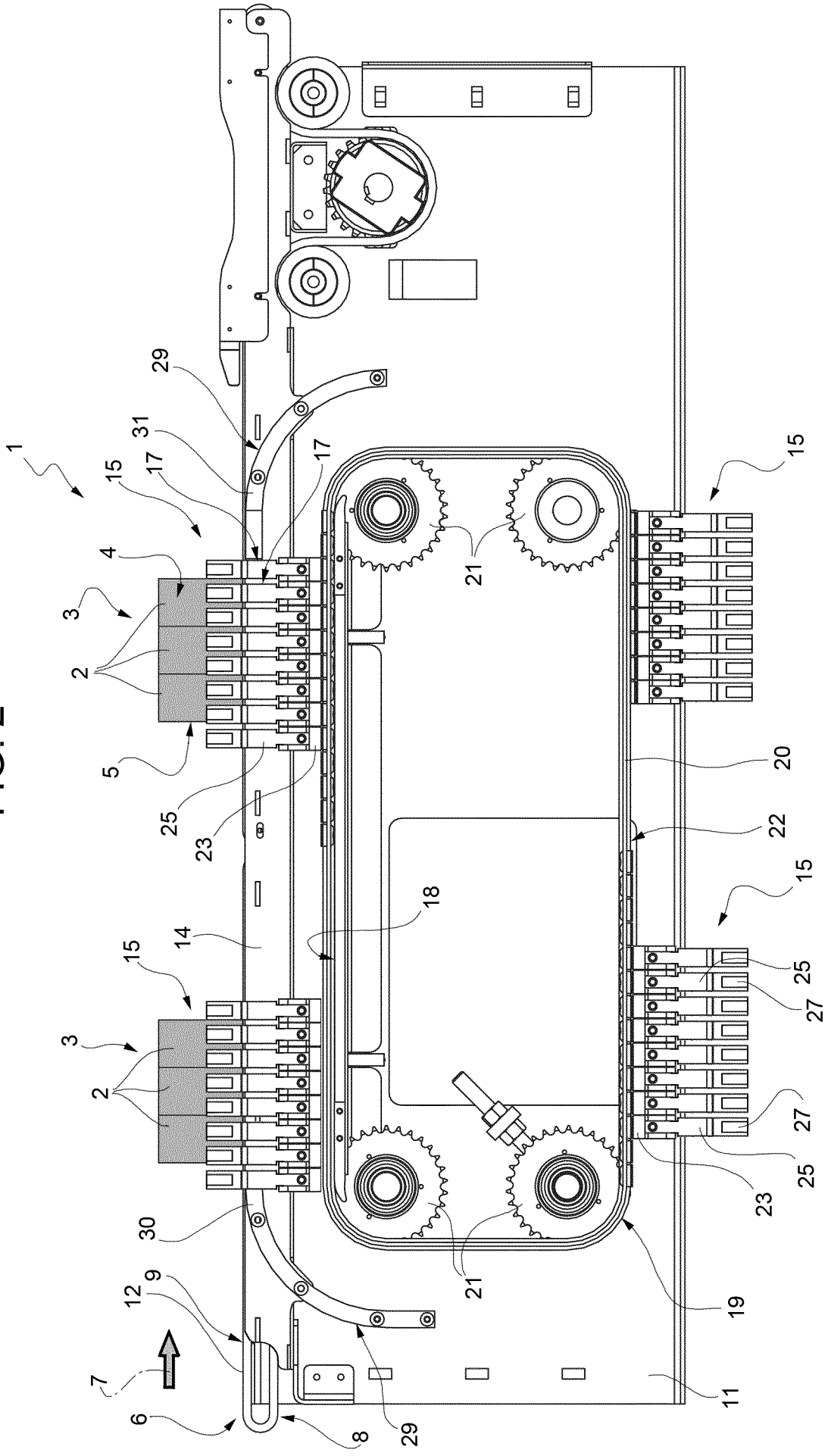


FIG. 3

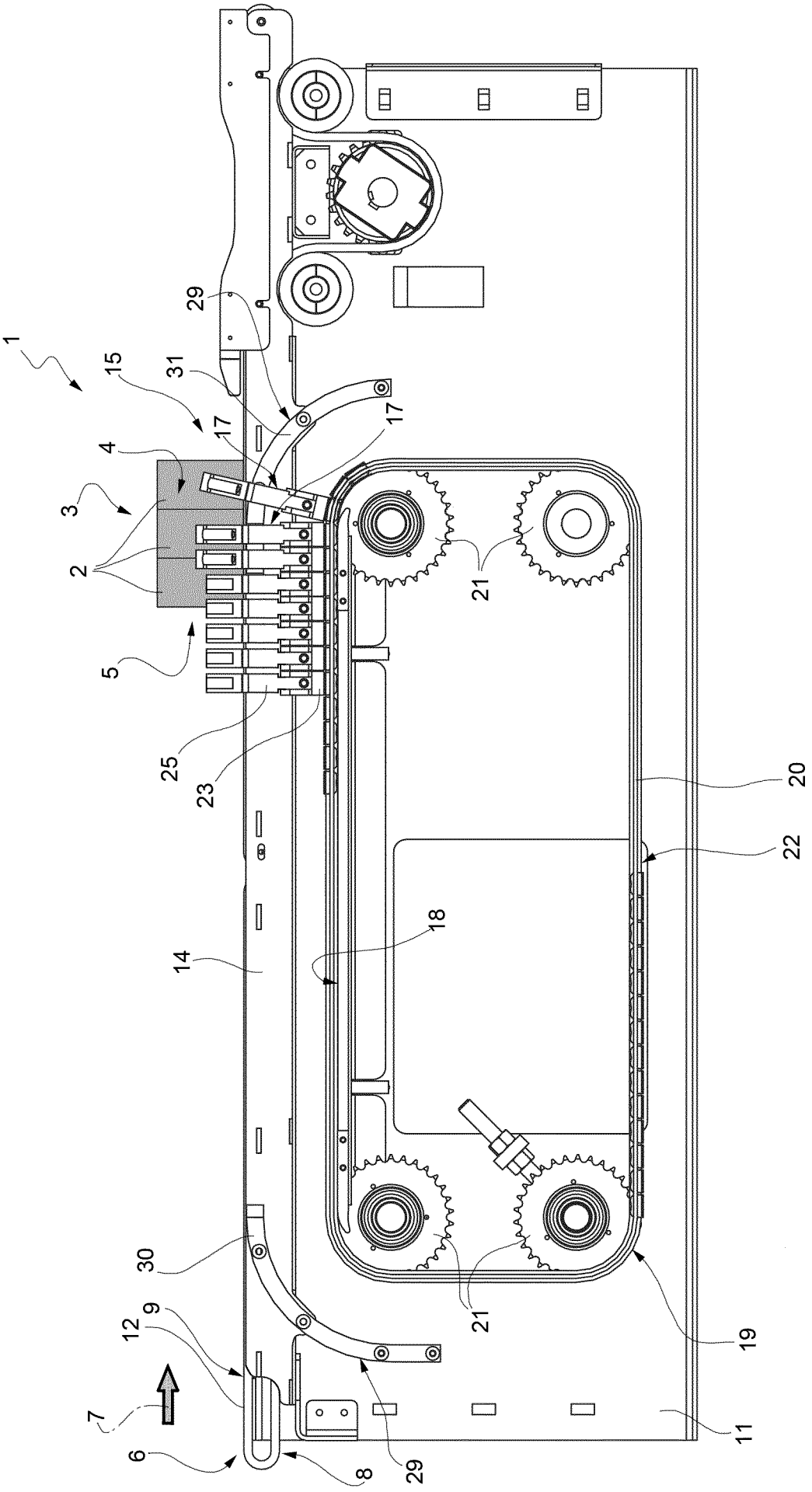


FIG. 4

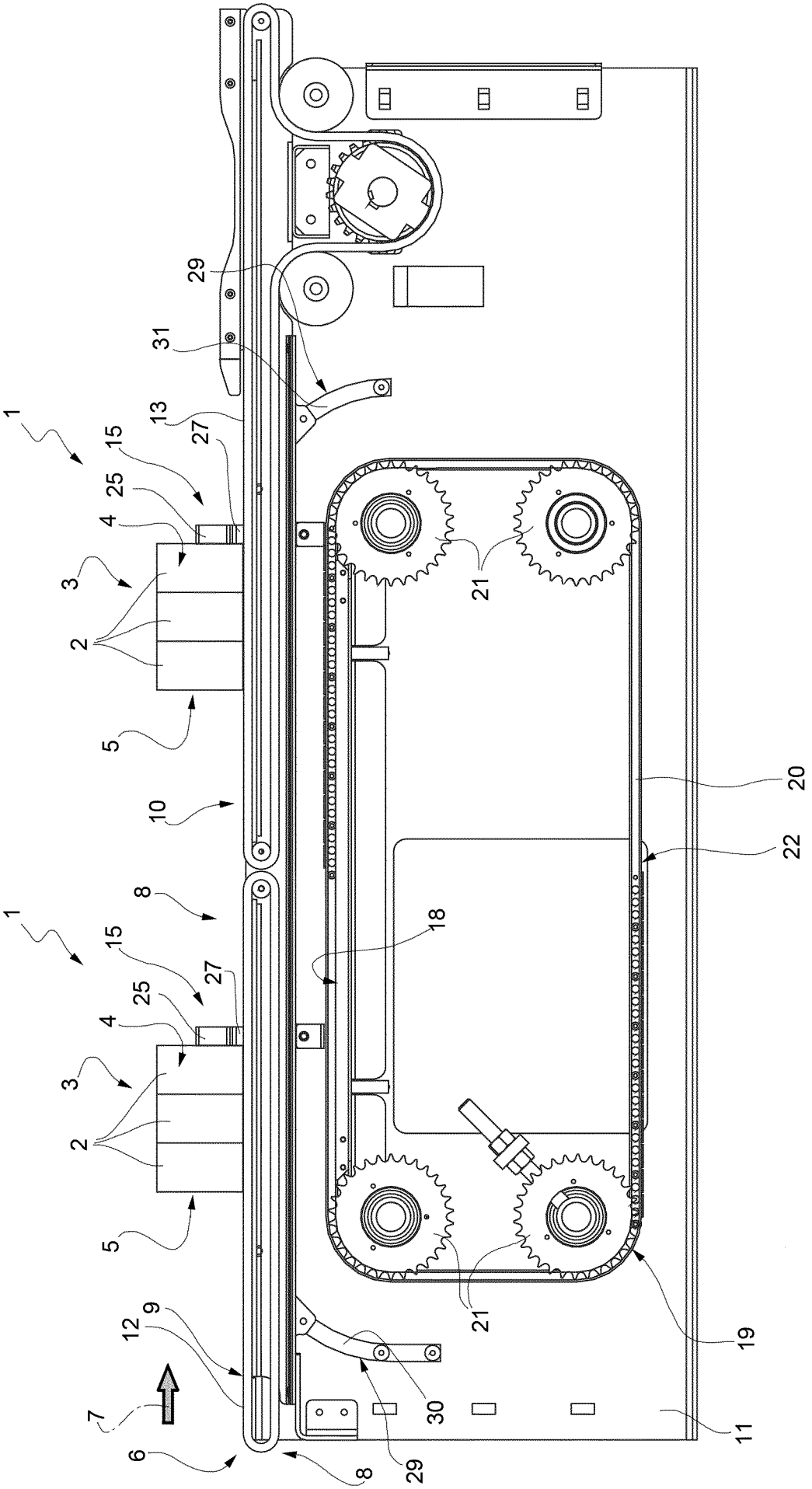
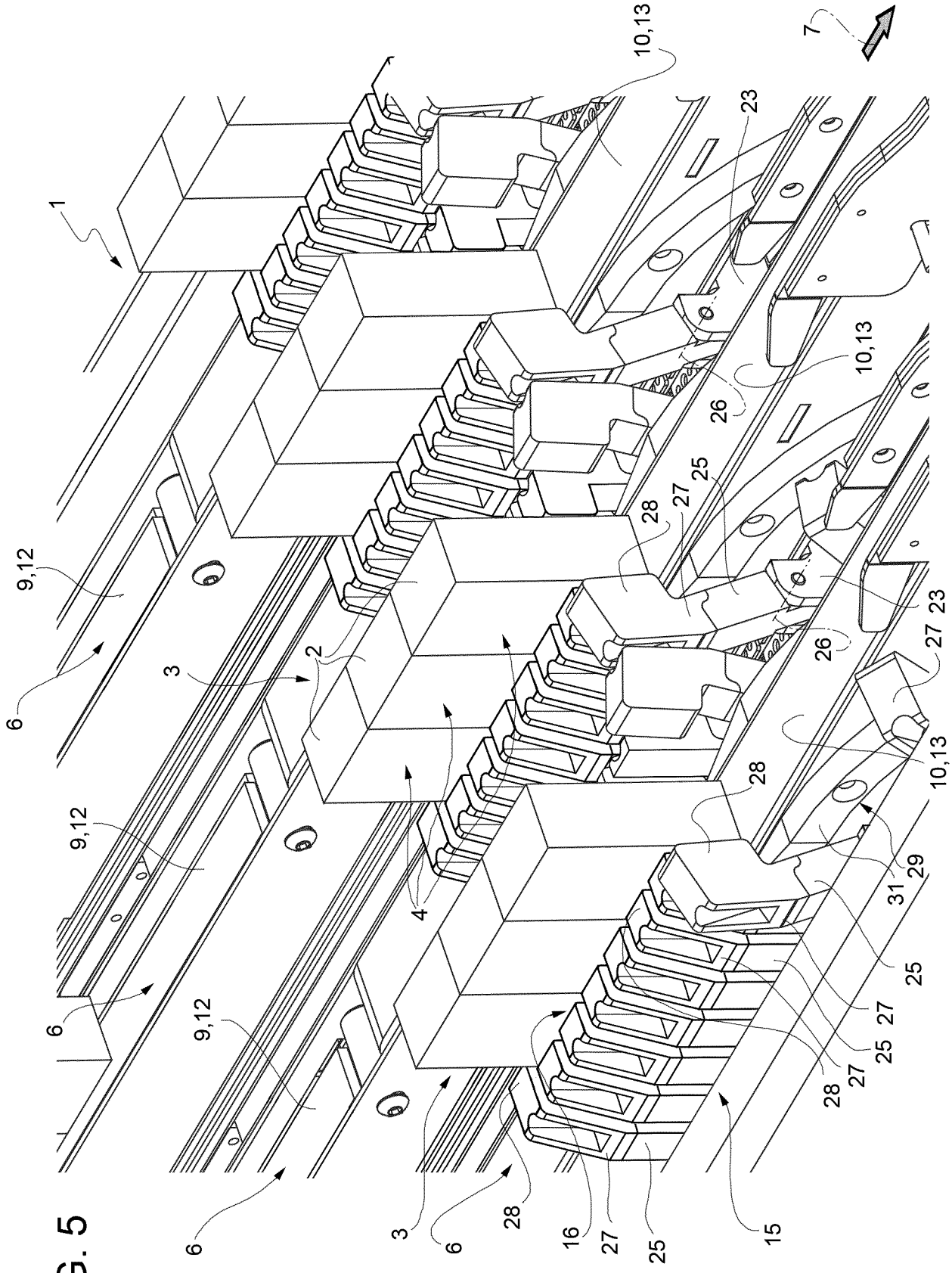


FIG. 5



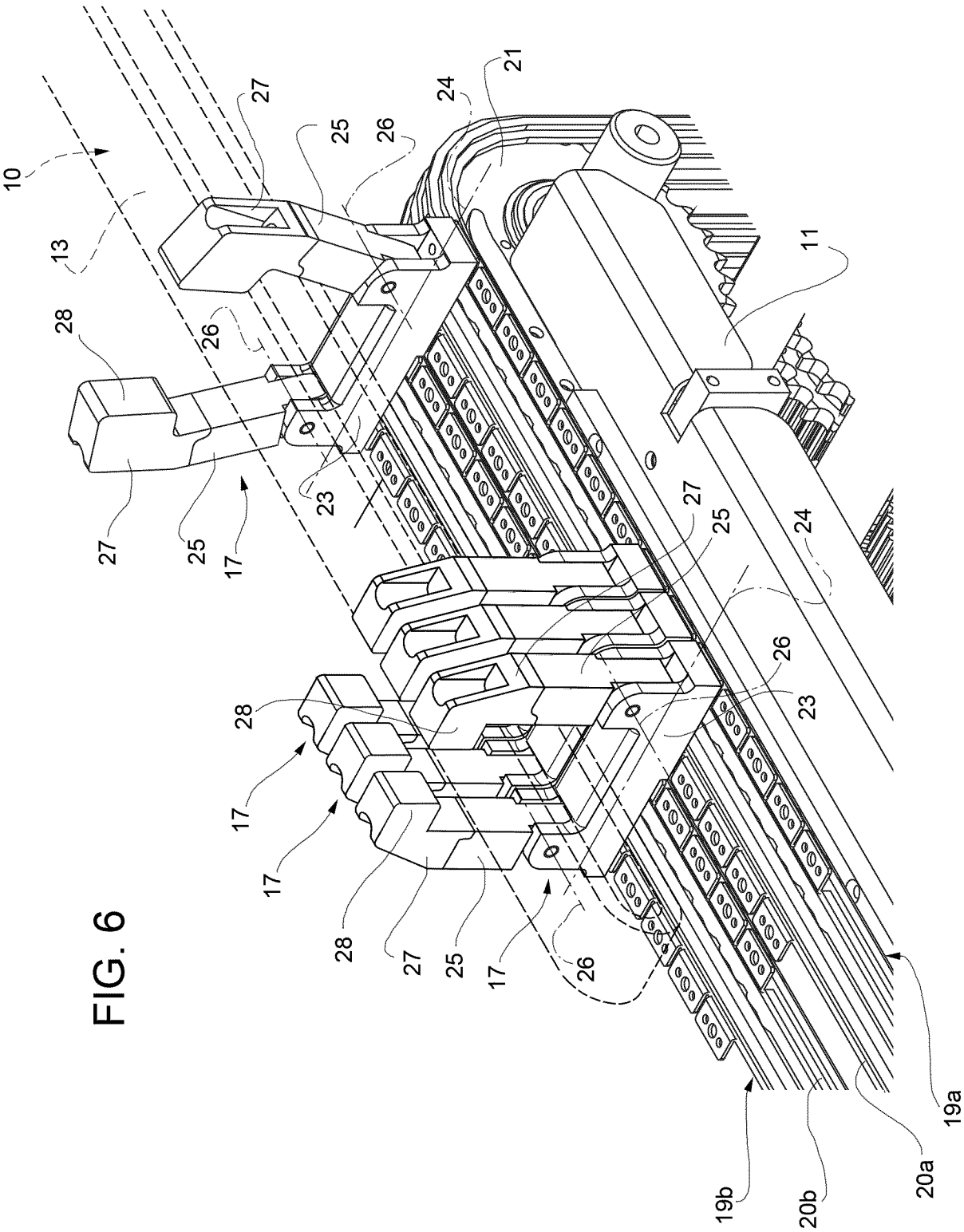

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FIG. 6

FIG. 8

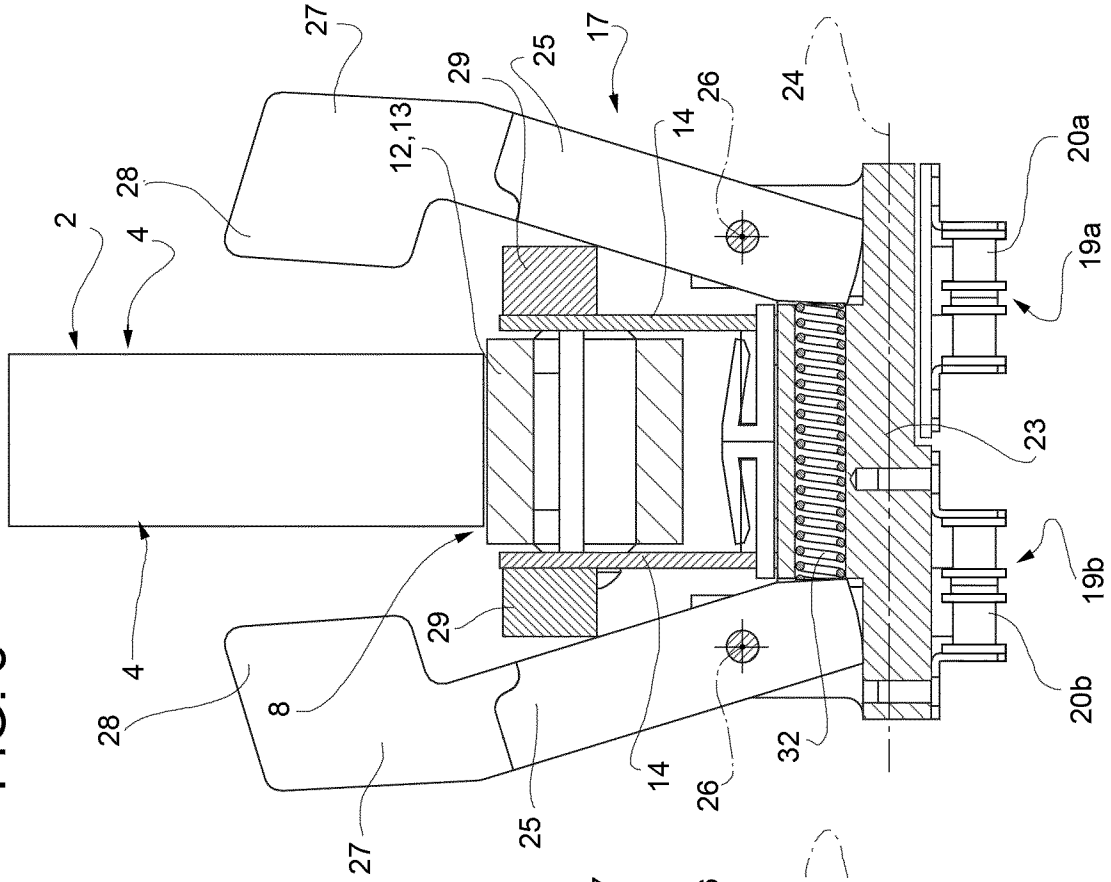
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FIG. 7

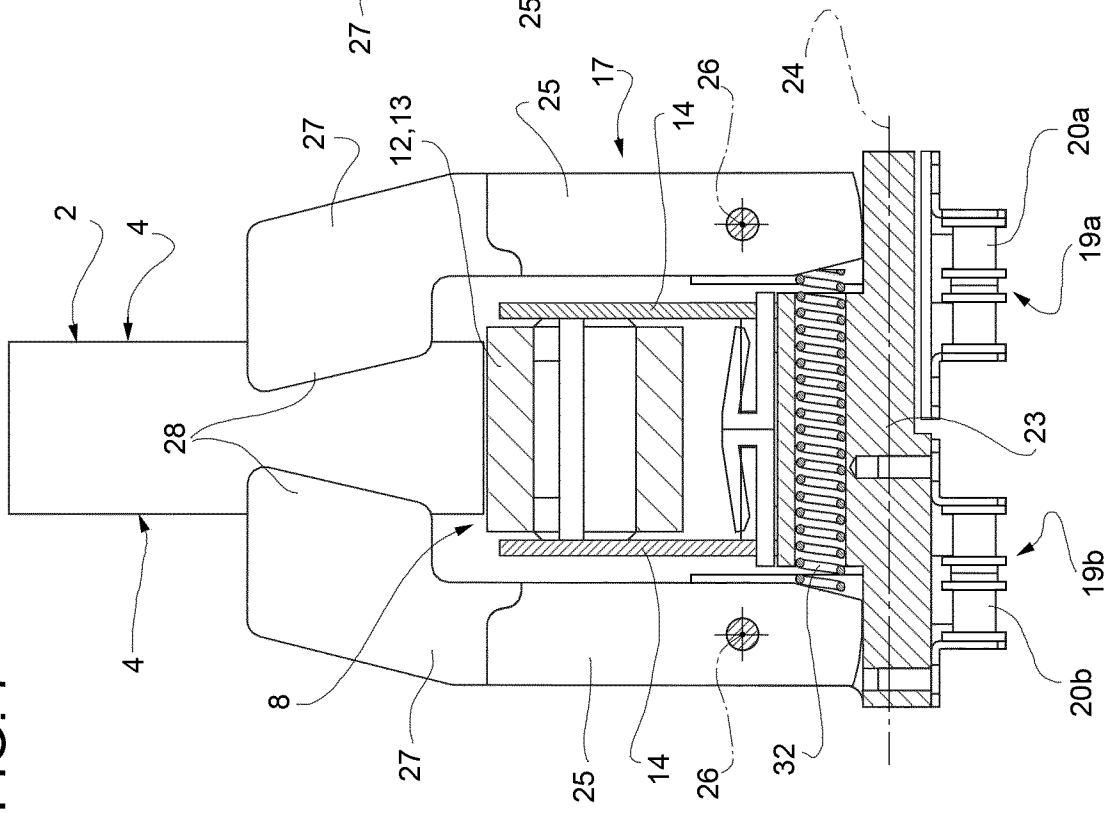
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FIG. 10

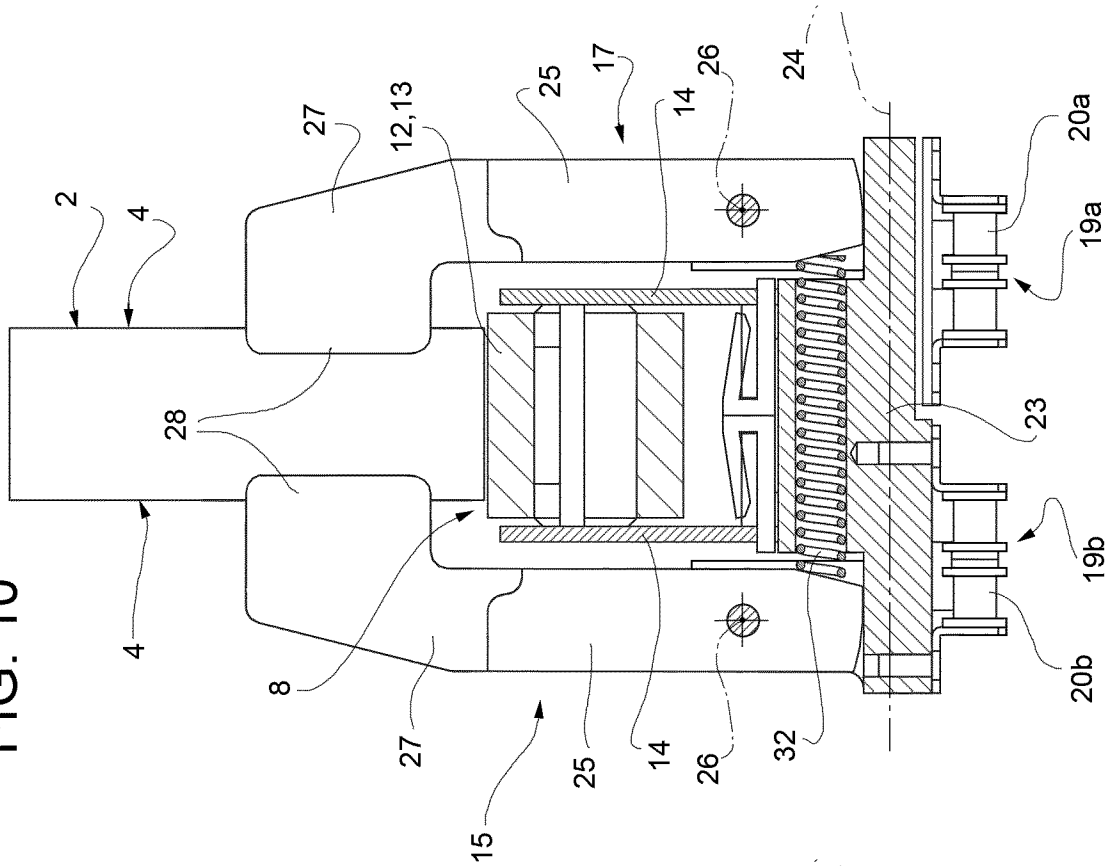
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FIG. 9

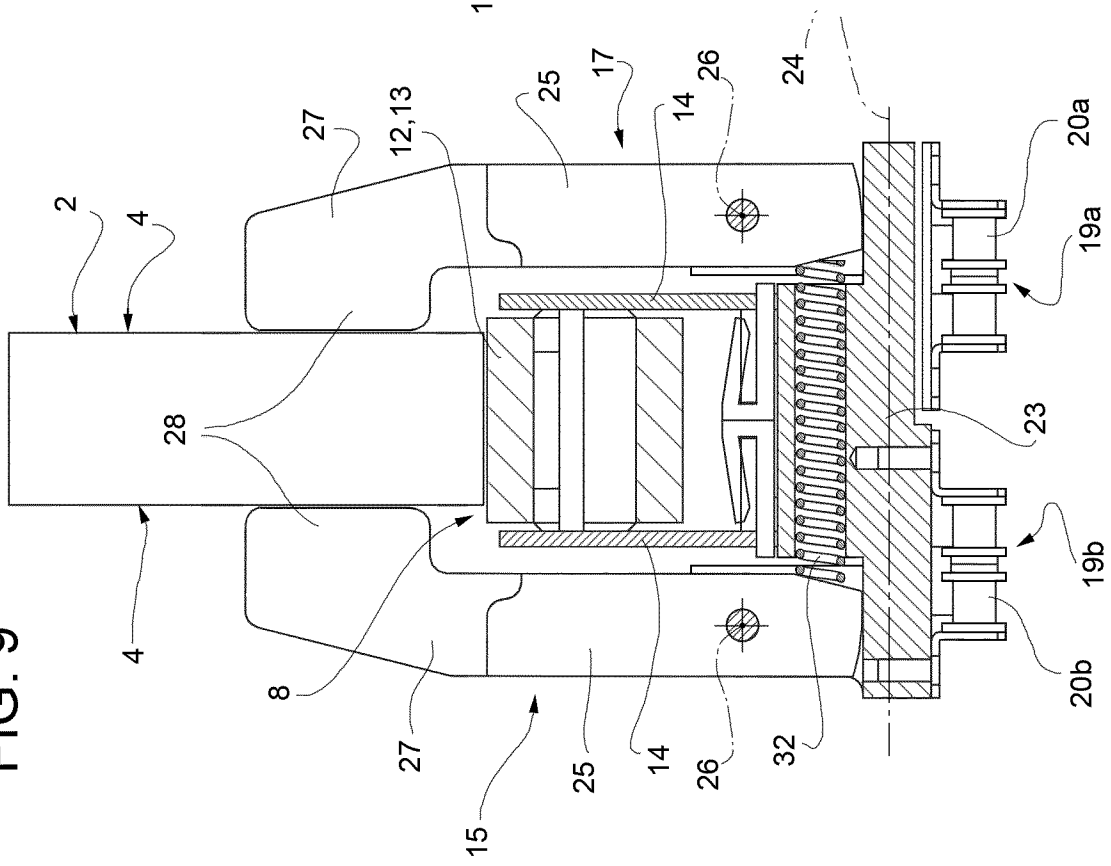
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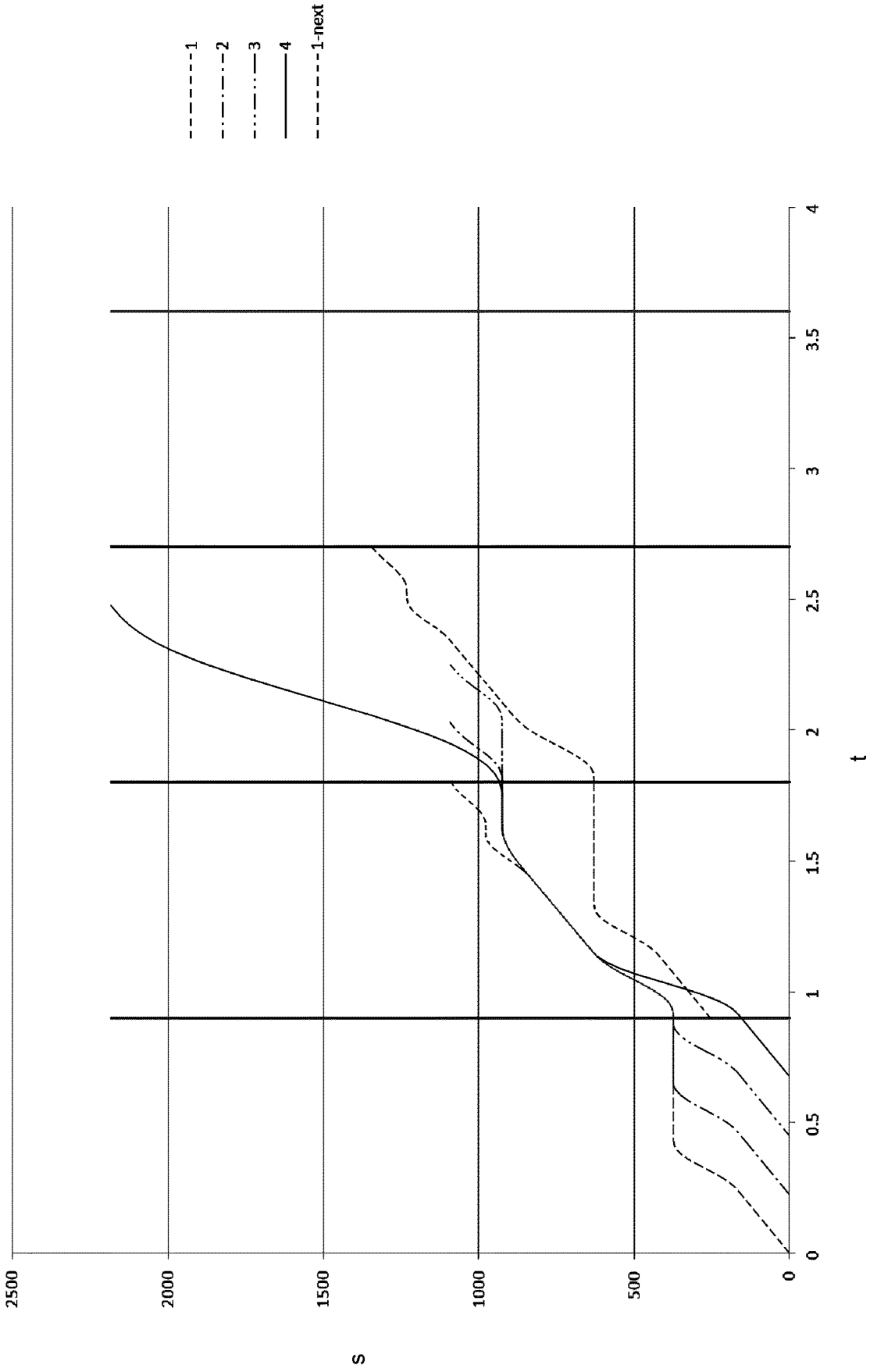
FIG. 11



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/062032

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65B35/40 B65B35/44 B65G15/40 B65B59/00 B65G47/08
B65G47/71 B65G47/84 B65G47/86
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65B B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/090581 A1 (TETRA LAVAL HOLDINGS & FINANCE [CH]) 19 June 2014 (2014-06-19)	1-5,7-13
Y	figures 1, 6, 7 page 3, lines 27-32 page 7, lines 18-26 page 9, line 5 - page 11, line 2 page 10, lines 3-10 page 13, line 20 - page 15, line 18	6
Y	US 4 577 745 A (CALVERT RODNEY K [US] ET AL) 25 March 1986 (1986-03-25) figures 2, 6 column 3, line 48 - column 4, line 21	6

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 July 2016	01/08/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schmitt, Michel

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/062032

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2015/036159 A1 (KRONES AG [DE]) 19 March 2015 (2015-03-19)	1-5,7-9, 13
Y	figure 3 page 8, lines 6-9 page 11 page 12, lines 25-31	6

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/062032

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014090581 A1	19-06-2014	CN 104781148 A	15-07-2015
		EP 2743192 A1	18-06-2014
		JP 2015536888 A	24-12-2015
		US 2015321857 A1	12-11-2015
		WO 2014090581 A1	19-06-2014
US 4577745 A	25-03-1986	NONE	
WO 2015036159 A1	19-03-2015	CN 105555683 A	04-05-2016
		DE 102013218397 A1	19-03-2015
		EP 3044136 A1	20-07-2016
		WO 2015036159 A1	19-03-2015