(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 February 2003 (13.02.2003)

PCT

(10) International Publication Number
WO 03/011723 A1

(51) International Patent Classification[7]: B65G 47/244, 47/24, 47/252

(21) International Application Number: PCT/IB02/02687

(22) International Filing Date: 8 July 2002 (08.07.2002)

(25) Filing Language: Italian

(26) Publication Language: English

(30) Priority Data:
BO01A000435 11 July 2001 (11.07.2001) IT
BO01A000622 10 October 2001 (10.10.2001) IT

(71) Applicant *(for all designated States except US)*: **PULSAR S.R.L.** [IT/IT]; Via Serenari, 29, I-40013 Castel Maggiore (IT).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **FRANZAROLI, Massimo** [IT/IT]; Via Bachelet, 2, I-40013 Castel Maggiore (IT).

(74) Agents: **FANZINI, Valeriano** et al.; Bugnion S.p.A., Via Goito, 18, I-40126 Bologna (IT).

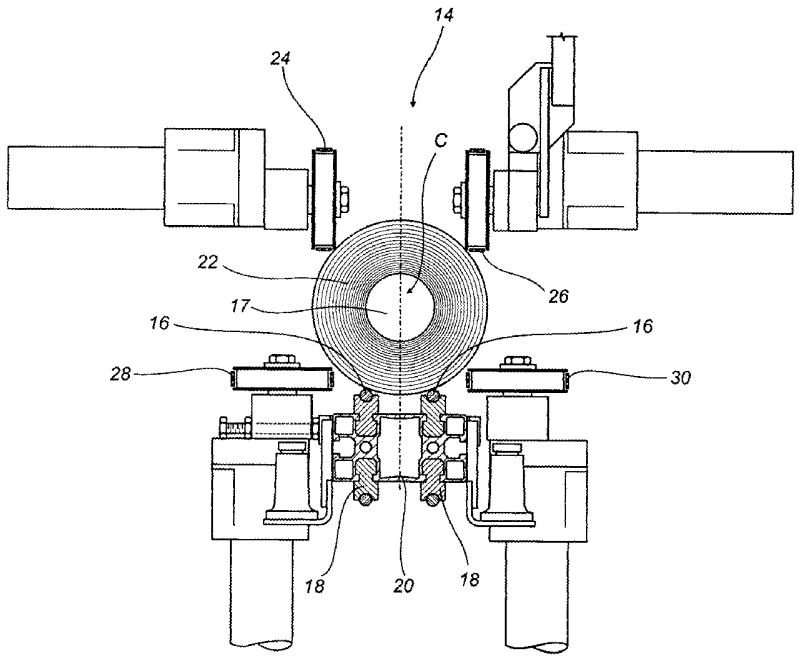
(81) Designated States *(national)*: AT, AU, BR, CA, DE, ES, FI, GB, IN, MX, NO, NZ, PL, PT, SE, US, ZA.

(84) Designated States *(regional)*: European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND DEVICE FOR ALIGNING ARTICLES AND MEANS FOR DETECTING THE POSITION OF THE ARTICLES



(57) Abstract: The invention relates to a method and device for aligning rolls (22) in a feed system (10). The rolls (22) are spaced at regular intervals so as to enable incorrectly positioned rolls (22) to be turned to the correct feed position, when necessary, while they are moving forward. The correct position of each roll (22) is identified by detecting (S1, S2) the longitudinal hole (17) through the centre of the roll (22).

WO 03/011723 A1

Method and device for aligning articles and means for detecting the position of the articles

Technical Field

The present invention addresses a method and device used to align articles, especially rolls, as they move along a feed line.

The aligning method and device according to the invention are used preferably, but not exclusively, on conveyor lines along which these articles are transported or in a machine which processes the rolls.

Background Art

Machinery for the packaging of rolls, especially toilet paper rolls, has to deal with the problem of misaligned rolls.

The rolls are normally fed along the conveyor lines lengthways, with their longitudinal axes aligned in the direction of feed, that is to say, in the same direction as the conveyors themselves extend.

This arrangement allows the rolls to be correctly fed into the packaging machines that wrap them, usually with plastic film, in packs of various sizes.

A problem common to prior art machinery of this kind is that of rolls becoming misaligned or upturned as they move along the conveyors. Misalignment or upturning may be due to any of various reasons.

Existing packaging machines are therefore equipped with suitable sensors designed to detect the outside shape of the roll and to interact with a control system which accordingly "perceives" whether the roll is correctly positioned, that is to say, with its longitudinal axis aligned in the direction of feed, or whether it is moving along in an incorrect position. When the roll is misaligned, however, this roll detection system does not

detect the actual position of the roll and simply provides a generic incorrect position signal.

Once the sensors have detected an incorrectly positioned roll, they issue a stop signal which brings the packaging machine and the production line to a halt, resulting in considerable down time and significant losses.

To overcome this drawback, personnel is especially employed to remove or re-align incorrectly positioned rolls before these rolls are detected by the sensors. The workers are placed at the packaging machine or in the proximity of the roll position sensors and instructed to take corrective action before the incorrect position signal is issued so as to prevent the machine from stopping and avoid the consequent stoppages in production.

In other terms, manual labour is required to remove incorrectly positioned rolls from the production line or to realign them by hand on the conveyor that feeds them into the packaging machine.

Disclosure of the invention

It is provided a method for aligning articles, in particular rolls, preferably rolls of paper and the like, such as toilet paper rolls, kitchen rolls, rolls of paper, plastic or aluminium foil for household use and the like, the method being characterised in that the position of each roll is detected as it feeds forward and, if the position does not match a predetermined feed position, action is taken to move the incorrectly positioned article or roll into the required feed position.

In this way, an automatic procedure is provided to reset the rolls in the correct feed position.

Thanks to the method according to the invention, the need for supervisory personnel to check and reset the rolls to the correct position is minimised.

According to another aspect of the aligning method provided by the invention, the action to reset the article or roll to the required feed position is taken while the article or roll is being fed forward.

Thus, no significant delays are produced along the roll feed line.

Advantageously and according to another aspect of the aligning method provided by the invention, the action to reset the article or roll to the required feed position consists in turning the article or roll.

According to yet another aspect, the articles or rolls are spaced so as to enable the step of turning the article or roll to be performed.

This procedure is advantageously implemented in cases where the articles or rolls are close together or not sufficiently spaced to enable an incorrectly positioned article or roll to be effectively turned.

According to yet another aspect of the present invention, the position of each article or roll is found by detecting the position of the longitudinal hole through the centre of the article or roll.

Thus, by a simple step of detecting the position of the hole through the centre of the article or roll, it is possible to identify the position of the article or roll itself. Suitable action can then be taken to correct the position where necessary.

According to another aspect of the invention, the article or roll is moved from a vertical position to a position where its longitudinal axis is positioned lengthways relative to the feed direction by turning the article or roll in a vertical longitudinal plane.

The article or roll may also be moved from a transverse position relative to the feed direction to a longitudinal position relative to the feed direction by tipping the article or roll in a horizontal plane.

It is also provided an advantageous device for aligning articles, in particular rolls, preferably rolls of paper and the like, such as toilet paper rolls, kitchen rolls, rolls of paper, plastic or aluminium foil for household use and the like, the device being characterised in that it comprises means for feeding the rolls, means for detecting the positions of the rolls as they feed forward and control means which, if the position of each

article or roll does not match a predetermined feed position, activate corresponding means acting on the incorrectly positioned article or roll so as to move the article or roll into the required feed position.

According to another aspect of it, the invention provides a device for aligning rolls comprising means which act on each roll in such a way as to move the roll into the required feed position and which, to perform this step of realigning the roll, use at least one jet of fluid.

The use of a fluid under pressure makes it possible to act on misaligned rolls to return them to the correct feed position so as to achieve at least one of the advantageous effects listed below with reference to the third and fourth preferred embodiments of the invention.

According to another aspect of it, the invention also provides specific means for detecting the position of an article or roll in a conveyor line for these articles or rolls.

In an especially preferred embodiment, these detecting means are designed to detect the position of a hole passing through the article or roll.

The other claims relate to other advantageous aspects of the invention.

Description of the drawings

The technical characteristics and advantageous aspects of the invention are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate preferred embodiments of the invention provided merely by way of example without restricting the scope of the inventive concept, and in which:

- Figure 1 is a schematic representation of a first preferred embodiment of the device, according to the present invention, for returning rolls to the correct feed position;

- Figure 2 is a schematic cross section of the first preferred embodiment of the device, according to the present invention, for returning rolls to the correct feed position;

- Figure 3 is a schematic top plan view of the first preferred embodiment of the device, according to the present invention, for returning rolls to the correct feed position;

- Figure 4 is a schematic longitudinal view of a second preferred embodiment of the device, according to the present invention, for returning rolls to the correct feed position;

- Figure 5 is a schematic cross section showing in a second operating condition the second preferred embodiment of the device, according to the present invention, for returning rolls to the correct feed position;

- Figure 6 is a schematic representation of a situation where a roll, forming part of a plurality of rolls moving forward in the feed direction, is positioned vertically in an incorrect manner;

- Figure 7 is a schematic representation of a situation where a roll, forming part of a plurality of rolls moving forward in the feed direction, is positioned transversely in an incorrect manner;

- Figure 8 is a schematic side view of a third preferred embodiment of the device according to the present invention;

- Figure 9 is a schematic cross section of the third preferred embodiment of the device according to the present invention;

- Figure 10 is a schematic top view of the third preferred embodiment of the device according to the present invention;

- Figure 11 is a schematic side view of a fourth preferred embodiment of the device according to the present invention;

- Figure 12 is a schematic cross section of the fourth preferred embodiment of the device according to the present invention.

Description of the preferred embodiments of the invention

Figure 1 illustrates a preferred embodiment 10 of an alignment device used to return rolls to the correct feed position as they travel along a line, preferably the feed line of a packaging machine, between a conveying unit 11 upstream and conveying unit 15 downstream. The latter may be a conveyor 15 that

feeds the rolls into a machine that wraps them in packs containing a predetermined number of rolls.

The device for returning misaligned rolls to the correct feed position according to the invention comprises a first unit 12 which spaces the rolls from each other and which consists preferably of a conveyor belt travelling faster than the upstream conveyor 11 in such a way as to position the rolls at predetermined regular intervals from each other.

This conveyor belt 12 might, for example, consist of an endless conveyor belt on which the rolls are fed forward. The unit 12 may, however, be made in any suitable manner.

Alternatively, as illustrated in Figure 1, the first roll spacing unit might also consist of a pair of lateral belts 12a, 12b which contact the lateral surfaces of the rolls in such a way as to feed them forward lengthways.

In Figure 1, the numeral 14 denotes a second unit of the roll aligning device according to the invention, this second unit being designed to detect the position of the rolls and to perform the aforementioned step of returning misaligned rolls to the correct feed position.

Preferably, in the unit 14, the misaligned rolls are returned to the correct feed position by turning them.

The repositioning unit 14, as illustrated better in Figures 2 and 3, showing a first preferred embodiment of it, comprises a pair of endless belts, preferably with circular cross section, labelled 16, 16, fitted to corresponding guides 18, 18 extending along a longitudinal path and mounted on a suitably shaped metal bar 20 of the mounting frame.

The belts 16, 16 feed the rolls towards the downstream conveyor unit 15 at a predetermined speed.

The belts 16, 16 consist of thin strips or endless elements which barely impinge on the bottoms of the rolls at positions which (in a cross sectional plane) can be considered substantially as points, providing a surface that supports the rolls without hindering the turning operation, when necessary, as described in more detail below.

As clearly shown in Figure 2, when the roll 22 is in the correct position as it travels downstream, the belts 16, 16 contact it at two points located at equal angular intervals symmetrically about the vertical line through the centre of the roll.

As shown in Figure 1, upstream of the means for returning the roll to the correct position, there is a sensor, labelled S1, designed to detect the roll if it is in the vertical position.

The sensor S1 preferably comprises an optical sensor or photocell (not illustrated in the drawings) having one part located above the belts 16, 16 at a position above the highest point of the roll as it feeds forward. This upper photocell portion emits an optical signal directed downwards towards a second part S1 of the photocell or optical sensor located at a position below the roll conveyor.

When a roll is transported by the belts 16, 16 with its axis positioned along the vertical - that is to say, with the cylindrical hole 17 through the centre of it positioned vertically (as shown in Figure 6) - the optical signal emitted by the sensor S1 passes through the hole 17, thus indicating that the roll is incorrectly positioned.

This signal is used, as described in more detail below, to drive means for returning the roll to the correct position with its longitudinal axis positioned along the horizontal in the conveying direction, as shown in Figure 6.

As illustrated in Figure 1, the unit 14 further comprises sensor means S2 designed to detect the roll when its longitudinal axis "A" (or the central hole) is positioned horizontally transversely to the longitudinal direction of roll feed in the unit 14, as shown in Figure 7.

The sensor means S2 consists of a suitable optical sensor or photocell similar to the one described above, but in this case positioned at the height of the hole 17 through the centre of the roll.

Therefore, if the roll is positioned with its longitudinal axis transverse to the feed direction (as shown in Figure 7), the signal emitted by the sensor S2 passes through the hole in the

roll and the sensor issues a signal that is used, as described in more detail below, to drive means for returning the roll to the correct longitudinal position.

As illustrated in Figure 2, when the sensor S1 detects the presence of a roll positioned with its longitudinal axis along the vertical (as shown in Figure 6), it activates a pair of belts 24, 26 which travel at a speed that is higher or lower than the speed at which the circular section belts 16, 16 are transferring the rolls 22 longitudinally.

The belts 24, 26 engage the upper lateral surface of the vertically positioned misaligned roll 22 so as to impart on this surface a speed that may be higher or lower than the speed imparted by the main conveyor belts 16, 16 on the lower lateral surface of the same roll 22. This causes the roll to tip or turn through 90° - forwards or backwards - in a vertical longitudinal plane.

Since the rolls have been suitably spaced in the upstream unit 12, this tipping operation is unhindered and may be carried out without difficulty. In particular, the conveyor line can continue operating since the rolls need not be stopped.

Instead, when the presence of a misaligned roll positioned with its longitudinal axis horizontal but transverse to the feed direction (as shown in Figure 7) is detected by the sensor S2, the signal emitted by the sensor S2 activates a pair of lateral belts 28, 30 which, as shown especially in Figures 2 and 3, are positioned at the sides of the main feed belts 16, 16 and are designed to contact opposite sides of the misaligned roll.

Each of the lateral belts 28, 30 is driven at a different speed from the other in such a way that their combined action turns the transversely misaligned roll by 90° in a horizontal plane, returning it to the correct feed position with its longitudinal axis A positioned lengthways along the direction of feed.

If said sensor means S2 remain blacked out and do not detect the presence of any misaligned roll, none of the endless belts 24, 26 or 28, 30 for roll repositioning is activated and the rolls can

be transferred downstream unhindered and without any tipping or turning action being imparted on them by the belts 24, 26, 28, 30.

The device according to the invention may also comprise means, which are not illustrated in detail in the drawings, for adjusting the positions of the tipping or turning belts 24, 26 and 28, 30 to suit the different sizes of the rolls that may be processed.

There may also be other means for adjusting the positions of the roll detector sensors S1 and S2 along the conveyor line.

Figure 4 illustrates a second preferred embodiment of the means for returning the roll to the longitudinal feed position starting from a condition where the roll is positioned with its axis A, or central hole, vertical. These means comprise a pusher or interference element, labelled 124 in Figure 4, which can move between a retracted position (drawn with a continuous line) where it is clear of the roll being fed forward, to an extended position (drawn with a dashed line) where it comes into contact with the upper lateral surface of the roll 22.

When the sensor S1 detects the presence of a roll positioned vertically, the signal emitted by the sensor is applied to a pneumatic cylinder 125 which actuates the pusher 124 and which is located above the zone where the rolls pass.

The pneumatic actuator 125 thus moves the interference element 124 from a position (drawn with a continuous line) where it is clear of the roll being fed forward, to a position (drawn with a dashed line) where it comes into contact with the outer cylindrical surface of the roll at a point off-centre above the centre of gravity of the roll. This, combined with the action of the feed belts 16 on the bottom of the roll 22, causes the roll 22, whose axis A is positioned vertically, to be tipped over backwards in such a way that its axis A is positioned longitudinally in the direction of feed.

As shown in Figure 5, if a roll 22 is misaligned transversely, a second pusher or interference element 126, mounted on and driven by a corresponding pneumatic actuator 127, is moved from a withdrawn or retracted position to a forward or extended

position where it interferes with the trajectory of the roll 22 in such a way as to turn it in a horizontal plane.

When the sensor activated is sensor S2, which detects the roll when the longitudinal axis A of the roll is positioned transversely, as shown in Figure 5, the second pusher 126 is moved by the corresponding pneumatic cylinder or actuator 127, located at the sides of the zone where the rolls pass, from the retracted position (drawn with the continuous line) where it is clear of the roll, to the extended position (drawn with a dashed line) where it comes into contact with the outer cylindrical surface of the roll at a point off-centre relative to the longitudinal axis of symmetry of the feed belts 16, 16. This, combined with the action of the feed belts 16, 16 on the bottom of the roll 22, causes one end of the roll 22, whose axis A is positioned transversely, to be stopped by the pusher 126, in such a way as to turn the roll in a horizontal plane so that its axis A is positioned longitudinally in the direction of feed.

According to one aspect of the present invention, the device, in order to return the roll to the correct position, first of all spaces the rolls at regular intervals from each other. Then, if the rolls are positioned correctly, no action is taken, whereas, if the rolls are misaligned, they are returned to the correct feed position by the corresponding repositioning means.

To ensure that the aligning action is effective, the device might comprise first and second sensor means, mounted one after the other, to detect vertically misaligned rolls, and first and second sensor means, mounted one after the other, to detect transversely misaligned rolls.

Alternatively, instead of systematically spacing all the rolls on the feed line, the step of spacing the rolls might be applied only to those that are not in the correct position. For this purpose, it would be necessary to place the means for detecting roll position upstream of the spacing means and upstream of the repositioning means so that the spacing means are activated only for the rolls that have to be realigned according to the required feed position.

Roll spacing must, however, be such as to enable the tipping or turning means to correctly reposition the misaligned rolls.

Instead of the aforementioned photocells to detect the actual position of the rolls feeding forward, cameras designed to detect the shape of the roll feeding forward might also be used. Special image management software allows the position of each single roll to be traced and, in the event of a misaligned roll, indicates the type of misalignment. Where necessary, the management software activates the means used to return the misaligned rolls to the correct feed position.

The alignment device according to the present invention is controlled by an appropriate control unit (a PC or a PLC), which receives the signals from the sensor means (optical sensors or cameras) processes them and, if necessary, activates the actuating means (electric motors for driving the roll turning belts or pneumatic cylinders) used to return misaligned rolls to the correct feed position. The electronic control unit may consist of a central unit controlling the entire machine or system in which the present device is installed.

Figure 8 illustrates a third preferred embodiment of the device according to the invention, for aligning rolls on a feed line.

In this embodiment, the device 210 comprises a conveyor belt, which is labelled 212 in its entirety, and which, as shown also in Figure 9, consists of a pair of belts 214, 214, with circular cross section, forming an upper section or branch 212a that supports the bottoms of the rolls and conveys the rolls in the direction of feed indicated by the arrow A in said Figure 8.

As shown in Figure 9, the belts 214, 214 run in longitudinal channels or grooves made in supporting elements of plastic or the like, labelled 216, which are in turn mounted on a shaped metal bar, labelled 218.

The present device for aligning rolls on a feed line is preferably used on a conveyor forming part of an installation for manufacturing the rolls and comprising at least one cutting machine used to cut the rolls of predetermined length from a

longer roll or "log", and at least one wrapping machine, located downstream, used to package the rolls.

Upstream of the alignment device 210, there may be a unit for slowing down or spacing the rolls, designed to advantageously set the rolls at a predetermined distance from one another so as to allow any misaligned rolls to be easily tipped or turned to the correct feed position. This spacing unit is not illustrated in the drawings.

As shown in Figures 8 and 9, the device comprises suitable means for detecting the rolls that are not in the correct feed position.

These means for detecting the incorrect position of the roll as it feeds forward comprise appropriate sensors which, in this embodiment, are capable of detecting the incorrect feed position of a roll R" positioned vertically, as shown in Figure 8, or of a roll R′ positioned horizontally, as shown in Figure 9.

As is known, the rolls normally comprise a cylindrical tube, usually made of card, around which the material, for example paper, is wound. The roll might, for example, be a roll of toilet paper, a kitchen roll or a roll of other material for household use.

In the present device, the position of the roll as it feeds forward is identified by detecting the position of the cylindrical hole through the centre of the roll, defined by the inside surface of the tube. In Figure 10, this cylindrical hole is labelled F.

The sensors are preferably optical sensors.

In practice, there are two optical sensors 220a, 220b, illustrated in Figure 9, mounted in such a way as to direct the light beam in a direction transversal to the feed direction.

As shown in Figure 9, when a roll R′, positioned with its axis transversal, moves past the sensors 220a, 220b, the light beam passes through the hole from one optical sensor to the other and the sensors issue a corresponding signal, which is applied to the control unit of the device to drive the means that return the roll to the correct position, as described in more detail below.

Optical means consisting of a similar pair of optical elements, or of a single optical element, are mounted in such a

way as to direct a light beam in the vertical direction. Figures 8 and 9 show the element 222a, constituting the optical means of the sensor that detects the roll when it is vertically out of position. Although not specifically illustrated in the drawings, a second sensor element, operating in combination with the first sensor element 222a, might be mounted vertically aligned with the sensor 222a under the line of roll feed defined by the belts 214, 214, in a horizontal central position relative to the belts 214, 214 themselves.

As shown in Figures 8 and 9, the sensors 220a and 220b are mounted on respective vertical rods 224, supported at their bottom ends by longitudinal bars 226, which are in turn suitably connected to the aforementioned central bar 218 that mounts the belts 214, 214 forming the conveyor on which the rolls are fed. The use of the belts 214, 214 facilitates the operations of repositioning the roll to the correct position since they offer a minimal resistance to the movement of incorrectly positioned rolls.

Another pair of vertical rods 224', also supported at their bottom ends by the longitudinal bars 226, mount a crossbar 228, which is located above the conveyor belt 212 and which in turn mounts the sensors for detecting rolls that are vertically out of position.

As illustrated, the lateral metal bars 226 also support the lateral guides on which the rolls feeding forward run.

These lateral guides, which are better illustrated in Figure 10, constitute another advantageous feature of the present invention. Thus, to facilitate movement of the rolls that are out of position at the zone where these rolls have to be repositioned, these guides are further apart than the lateral guides 230 along the rest of the roll conveyor line.

In practice, as shown in Figure 10, at the zone where the rolls that are out of position have to be repositioned, there are longitudinal sections 230a, 230a, which have a wider space between them than the normal sections of the lateral guides 230, 230 to which they are joined by angled connecting portions labelled 230b in Figure 10.

Still with reference to Figure 10, the means for returning badly positioned rolls to the correct feed position advantageously comprise means for emitting a jet of fluid, in particular compressed air, that strikes the roll to be repositioned in such a way as to move it to the required feed position on the conveyor.

The use of a jet of fluid, preferably air, has the advantage of not damaging the roll to reposition it.

Thus, the third preferred embodiment of the invention illustrated in Figure 10, comprises a first element 232a for emitting the jet of compressed air through a corresponding nozzle 234.

A second element for emitting a jet of compressed air or similar fluid is labelled 232b in Figure 10.

These fluid jet emitting means direct the fluid at an angle relative to the longitudinal direction L of roll feed.

More specifically, as illustrated in Figures 8 and 10, the emitters 232a and 232b direct the jets of air in an inclined direction that has a horizontal component making a defined angle with the longitudinal direction L (see Figure 10) and a vertical component making an angle downwards relative to the horizontal or longitudinal direction L (see Figure 8).

In practice, the emitters 232a, 232b are oriented in such a way that the jets of compressed air are inclined downwards relative to the feed plane 212a defined by the conveyor belt 212, as clearly shown in Figure 8, so that the jets strike the roll at a point above the centre of gravity of the roll.

Further, the second emitter 232b acts on the side of the roll opposite that on which the first emitter 232a acts.

Also, the emitters 232a, 232b are oriented in such a way that the jets of compressed air are inclined relative to the longitudinal direction L of roll feed, as clearly shown in Figure 10, and so that the air jets strike the roll at an off-centre position relative to the midpoint of the horizontal plane defined by the roll, causing the roll to turn in a horizontal plane.

Although it is preferable to use both a first emitter 232a and a second emitter 232b to return a roll R to a position where its longitudinal axis is aligned with the direction of feed not

only in the case of rolls R" that are vertically out of position, as shown in Figure 8, but also for rolls R' that are transversely out of position, only one of these compressed air emitters might be used.

It is understood that the first and second fluid or compressed air emitters can be mounted in a manner different from the above and that there may be more than two fluid or compressed air emitters, depending on requirements and without departing from the scope of the invention.

In short, once the sensors 220a, 220b, 222a have detected on the conveyor line a roll that is out of position transversely or vertically, at least one of the air emitters is activated to send jets of air against the incorrectly positioned roll, forcing it to tip over or turn to the correct feed position.

If the roll is incorrectly positioned with its axis set transversely to the feed direction, this incorrect position having been detected by the transverse sensors 220a, 220b, a jet of air is immediately emitted by one, or preferably both, of the emitters 232a and 232b. This air jet strikes the outside surface of the roll, causing it to turn in a horizontal plane, thanks to the fact that the jets from the emitters 232a and 232b have horizontal components that are parallel but directed in opposite directions and that both make a defined angle relative to the longitudinal direction L of roll feed as illustrated in Figure 10.

This rotation in a horizontal plane is advantageously performed at a zone where the guides 230a, 230a are further apart so as not to hinder the rotational motion. The roll is kept in the horizontal position also thanks to the fact that, immediately downstream of the repositioning zone, the guide spacing is reduced to its previous size again. Thus, since the conveyor 212 continues to move while the air jets are emitted, the roll is channelled between the guides 230, 230 downstream of the repositioning zone, directing it, instead of transversely as previously, with its axis along the longitudinal feed direction L.

When the sensor 222a and the sensor associated to it (not illustrated) detect a roll that is incorrectly positioned vertically, either the emitter 232a or the emitter 232b may be

activated. The jet of compressed air from these emitters 232a, 232b strikes the top of the roll and causes it to tip forwards or backwards, depending on whether the emitter 232a or the emitter 232b was activated. Obviously, since the conveyor preferably continues to move, it is easier for the roll to be tipped over backwards.

As shown clearly in Figure 8, the sensors 222a for detecting the rolls that are incorrectly positioned vertically, are positioned, relative to the direction of roll feed, upstream of the sensors 220a, 220b for detecting the rolls that are incorrectly positioned transversely. Further, these sensors are positioned longitudinally between the first and second emitters 232a and 232b.

As illustrated, the fluid jet emitting means 232a and 232b are positioned at a height above the rolls on the conveyor and on the outside of the conveyor lane, so as to allow easy access by operators without interfering with the rolls moving forward along the conveyor.

In a preferred method according to the invention, if the first and second sensor means do not detect any rolls that are incorrectly positioned either vertically or transversely, no control signal or roll repositioning command is issued, whereas, if the first and second sensor means detect a roll that is incorrectly positioned vertically or transversely, a control signal is issued to activate corresponding means for repositioning the roll according to the correct longitudinal feed direction.

The fluid emitters need not be adjusted for a wide range of roll sizes, thus reducing the amount of time required by personnel for adjustments during changeovers.

Figures 11 and 12 illustrate a fourth preferred embodiment of the device according to the invention, for repositioning rolls on a feed line.

Figures 11 and 12, illustrate schematically how the sensors for detecting rolls that are incorrectly positioned transversely advantageously comprise, in addition to the aforementioned first sensor means 220a, 220b, second transverse position sensors,

labelled 120b, 120a, also mounted on the vertical rods 224 at a height above the first sensor means 220a, 220b.

These second sensor means are used to identify incorrect transverse positioning on the roll conveyor of large rolls whose central hole F is too high to be detected by the first sensor means 220a, 220b.

The other parts of the device in the fourth embodiment, that is to say, those for returning incorrectly positioned rolls to the correct feed position are the same as those already described with reference to the third preferred embodiment and therefore, they are not illustrated in detail in Figures 11 and 12.

With the present device, which uses jets of compressed air to realign incorrectly positioned rolls, corrective action can be taken promptly, as soon as the incorrect roll position signal is issued. That means the repositioning unit occupies a very short section of the device and advantageously reduces the overall size of the device according to the invention.

It will be understood that the invention can be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. A method for aligning articles, in particular rolls (22, R), preferably rolls of paper and the like, such as toilet paper rolls, kitchen rolls, rolls of paper, plastic or aluminium foil for household use and the like, the method being characterised in that the position of each roll (22, R) is detected as it feeds forward and, if the position of the roll (22, R) does not match a predetermined feed position, action is taken to move the incorrectly positioned article or roll (22, R) into the required feed position.

2. The method according to claim 1, characterised in that the action required to move the article or roll (22, R) to the correct feed position is taken while the article or roll (22, R) to be repositioned is moving forward.

3. The method according to either of the foregoing claims, characterised in that the action required to move the article or roll (22, R) to the correct feed position comprises a step of turning the article or roll (22, R).

4. The method according to any of the foregoing claims, characterised in that it comprises a step of spacing the articles or rolls from each other so as to enable the article or roll (22, R) to be turned to the correct position.

5. The method according to any of the foregoing claims, characterised in that the step of turning the article or roll (22, R) is carried out in a vertical plane.

6. The method according to any of the foregoing claims, characterised in that the step of turning the article or roll (22, R) is carried out in a horizontal plane.

7. The method according to any of the foregoing claims, where said article or roll (22, R) presents a central hole (17, F) open at both ends and extending lengthways, defined by the inside surface of the tube inside the article or roll (22, R), the method being characterised in that the position of the article or roll (22, R) is identified by detecting the position of said longitudinal hole (17, F).

8. The method according to any of the foregoing claims, characterised in that sensor means (S1, 222a) are provided to detect whether the hole (17, F) is positioned vertically and/or sensor means (S2, 220a, 220b, 120a, 120b) to detect whether the hole (17, F) is positioned transversely.

9. The method according to any of the foregoing claims, characterised in that first and second sensor means are provided to detect whether the hole (17, F) is positioned vertically and/or first and second sensor means to detect whether the hole (17, F) is positioned transversely.

10. The method according to claim 8 or 9, characterised in that, if the first and/or the second sensor means do not detect any article or roll (22, R) that is incorrectly positioned either vertically or transversely, no control signal or command to reposition the article or roll (22, R) is issued, whereas, if the first and second sensor means do detect an article or roll (22, R) that is incorrectly positioned vertically or transversely, a control signal is issued to activate corresponding means for repositioning the article or roll (22, R) according to the correct longitudinal feed direction.

11. A device for aligning articles, in particular rolls (22, R), preferably rolls of paper and the like, such as toilet paper rolls, kitchen rolls, rolls of paper, plastic or aluminium foil for household use and the like, the device being characterised in that it comprises means for feeding the rolls, means (S1, 222a, S2, 220a, 220b, 120a, 120b) for detecting the position of the

rolls as they feed forward and control means which, if the position of each article or roll does not match a predetermined feed position, activate corresponding means (24, 26, 28, 30, 124, 126, 232a, 232b) acting on the incorrectly positioned article or roll (22) so as to move the article or roll (22) into the required feed position.

12. The device according to claim 11, characterised in that the means (24, 26, 28, 30, 124, 126, 232a, 232b) for moving the article or roll (22) to the required feed position operate while the article or roll (22) to be repositioned moves forward on the feed means (16, 16).

13. The device according to any of the foregoing claims, characterised in that the means (S1, 222a, S2, 220a, 220b, 120a, 120b) for moving the article or roll (22) to the required feed position impart on the article or roll (22) a turning movement to the required conveying position.

14. The device according to any of the foregoing claims from 11 to 13, characterised in that it comprises means (12) for spacing the articles or rolls from each other so as to enable any incorrectly positioned article or roll (22) to be turned to the correct position.

15. The device according to any of the foregoing claims from 11 to 14, where the article or roll (22, R) presents a central hole (17, F) open at both ends and extending lengthways, in particular defined by the inside surface of the tube inside the article or roll (22, R), the device being characterised in that it comprises means (S1, 222a S2, 220a, 220b, 120a, 120b) for detecting the position of the longitudinal hole (17, F).

16. The device according to any of the foregoing claims, characterised in that it comprises sensor means (S1, 222a) to detect whether the hole (17, F) is positioned vertically and/or

sensor means (S2, 220a, 220b, 120a, 120b) to detect whether the hole (17, F) is positioned transversely.

17. The device according to any of the foregoing claims, characterised in that it comprises first and second sensor means designed to detect whether the hole (17, F) is positioned vertically and first and second sensor meand to detect whether the hole (17, F) is positioned transversely.

18. The device according to claim 16 or 17, characterised in that, if the first and second sensor means do not detect any article or roll (22) that is incorrectly positioned either vertically or transversely, no control signal or command to reposition the article or roll (22) is issued, whereas, if the first and second sensor means do detect an article or roll (22) that is incorrectly positioned vertically or transversely, a control signal is issued to activate corresponding means for repositioning the article or roll (22) according to the correct longitudinal feed direction.

19. The device according to any of the foregoing claims from 11 to 18 or according to the preamble to claim 11, characterised in that to move the article or roll (22) from a position where its axis is vertical to a position where its axis extends longitudinally, there are means (24, 26, 124, 232a, 232b) for turning the article or roll in a longitudinal vertical plane.

20. The device according to claim 19, characterised in that the means to turn the article or roll (22) in a vertical longitudinal plane comprise at least one belt (24, 26) which engages the upper surface of the article or roll (22) and imparts on this upper surface of the article or roll (22) a speed that differs from the speed imparted on the lower surface of the article or roll (22) by the main conveyor means (16, 16).

21. The device according to claim 19 or 20, characterised in that the means to turn the article or roll (22) in a vertical

longitudinal plane comprise at least one element (124) of interference with the article or roll (22) extending in a position where it engages the outer cylindrical surface of the article or roll (22) in such a way that, combined with the action of the conveyor on the bottom of the article or roll (22), it causes the article or roll (22) to be tipped over backwards.

22. The device according to any of the foregoing claims from 11 to 21 or according to the preamble to claim 11, characterised in that, to move the article or roll (22) from a position where its axis extends transversely to a position where its axis extends longitudinally, there are means (28, 30, 126, 232a, 232b) for turning the article or roll (22) in a horizontal plane.

23. The device according to claim 22, characterised in that the means to turn the article or roll (22) in a horizontal plane comprise a pair of lateral belts (28, 30), which are designed to contact opposite sides of the article or roll (22) and which are driven at different speeds in such a way as to turn the transversely positioned article or roll (22) in a horizontal plane.

24. The device according to claim 22 or 23, characterised in that the means to turn the article or roll (22) in a horizontal plane comprise at least one corresponding element (126) of interference with the article or roll (22) located at the sides of the zone where the articles or rolls pass and extending in a position where it engages the outer cylindrical surface of the article or roll (22) at a point off-centre relative to the longitudinal axis of symmetry and in such a way that, combined with the action of the conveyor on the bottom of the article or roll, it causes the article or roll to be turned in a horizontal plane.

25. The device according to any of the foregoing claims from 11 to 24, characterised in that it comprises means for conveying the rolls and consisting of narrow feed belts (16, 16) which contact the bottom of the article or roll (22).

26. The device according to any of the foregoing claims from 11 to 25 or according to the preamble to claim 11, characterised in that it comprises means (232a, 232b) acting on the article or roll (R) with at least one jet of fluid in order to reposition the article or roll (R) so it is in the required feed position.

27. The device according to claim 26, characterised in that the jet of fluid is a jet of air under pressure.

28. The device according to claim 26 or 27, characterised in that the jet of fluid is directed at and against the outer surface of the article or roll (R) to be repositioned.

29. The device according to claim 26 to 28, characterised in that the jet of fluid is directed at a part of the article or roll (R) in such a way as to tip or turn the article or roll (R).

30. The device according to any of the foregoing claims from 19 to 29, characterised in that the means for moving the article or roll (R) to the longitudinal feed position comprise means (232a, 232b) designed to emit a corresponding jet of fluid against a part of the top of the article or roll (R) in such a way as to tip the article or roll (R) in a vertical plane to a longitudinal feed position.

31. The device according to any of the foregoing claims from 21 to 30, characterised in that the means for moving the article or roll (R) to the longitudinal feed position comprise means (232a, 232b) designed to emit a corresponding jet of fluid against a part of the article or roll (R) on one side of the latter's longitudinal centre line in such a way as to turn the article or roll (R) in a horizontal plane to a longitudinal feed position.

32. The device according to any of the foregoing claims from 26 to 31, characterised in that the means for emitting the jet of fluid comprise a first emitter (232a) of fluid under pressure

which directs the fluid in a direction at an angle relative to the longitudinal direction of roll feed.

33. The device according to claim 32, characterised in that the means for emitting the jet of fluid comprise a second emitter (232b) of fluid under pressure which directs the fluid in a direction at an angle relative to the longitudinal direction of roll feed.

34. The device according to any of the foregoing claims from 26 to 33, characterised in that the means for moving the article or roll (R) to the longitudinal feed position comprise means (232a, 232b) which are designed to emit at least one corresponding jet of fluid and which are located upstream and/or downstream of the part struck by the jet of fluid on the article or roll (R) to be repositioned.

35. The device according to any of the foregoing claims from 26 to 34, characterised in that, at the zone where the article or roll (R) that is out of position has to be repositioned, the lateral guides of the articles or rolls (R) have sections (230a, 230a) that are wider apart than the sections upstream and downstream of the repositioning zone.

36. The device according to any of the foregoing claims from 26 to 35, characterised in that the emitter (232a, 232b) of fluid under pressure directs the fluid in a direction at a downward angle relative to the longitudinal direction of roll feed.

37. The device according to any of the foregoing claims from 26 to 36, characterised in that the fluid jet emitting means (232a, 232b) are positioned at a height above the rolls being conveyed.

38. The device according to any of the foregoing claims from 26 to 37, characterised in that the fluid jet emitting means (232a, 232b) are positioned at the sides of the lane in which the rolls are being conveyed.

39. Means (S1, 222a, S2, 220a, 220b, 120a, 120b) for detecting the position of an article or roll in a line for conveying the articles or rolls, said means being characterised in that they are in accordance with any of the foregoing claims.

FIG. 1

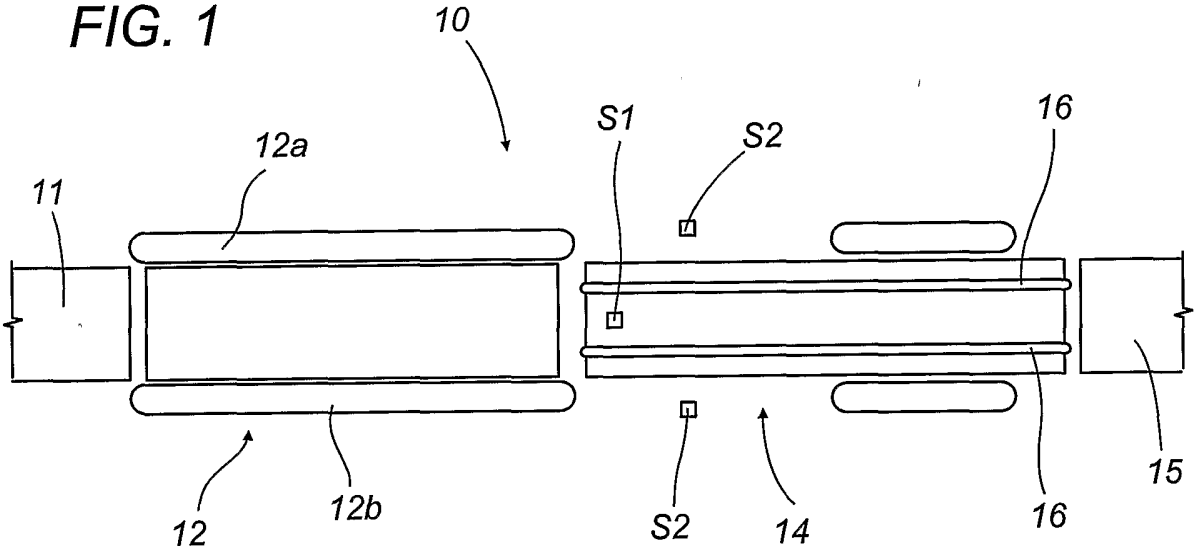
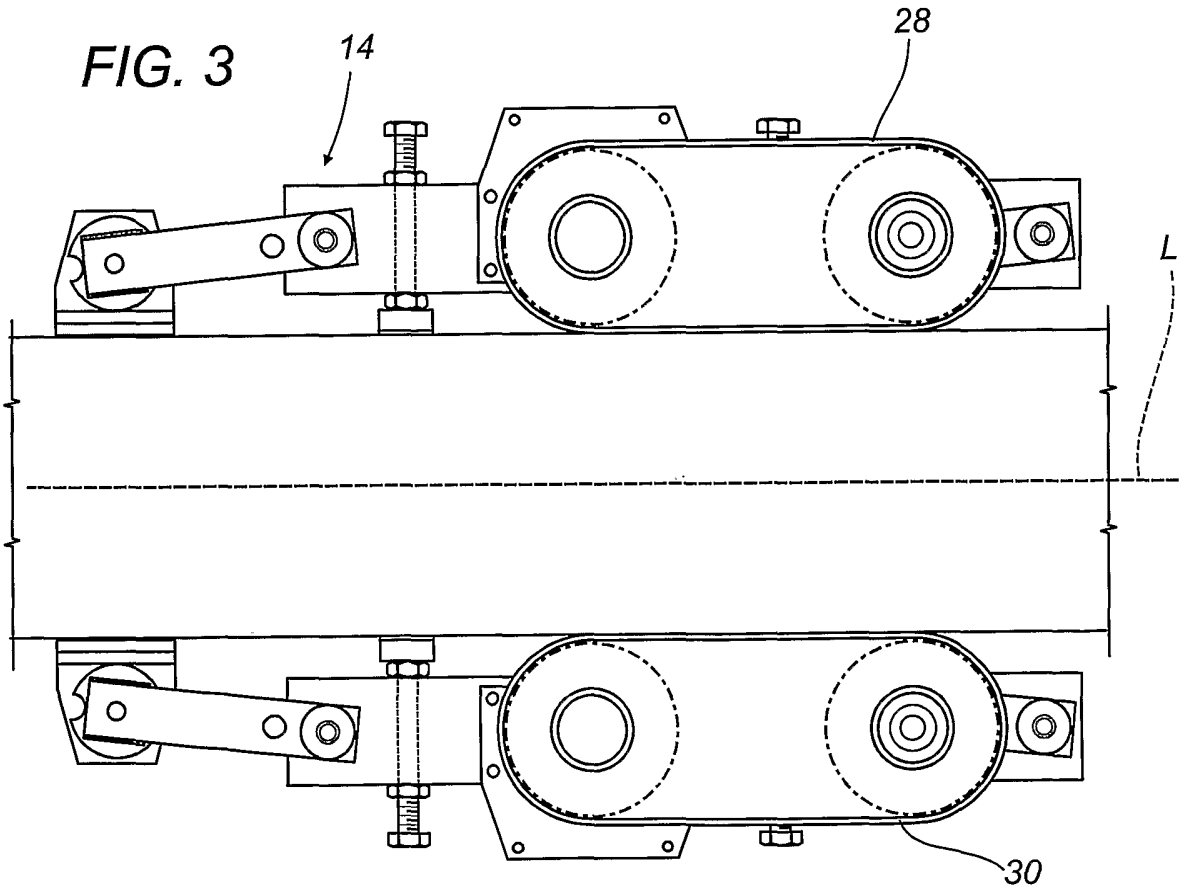


FIG. 3



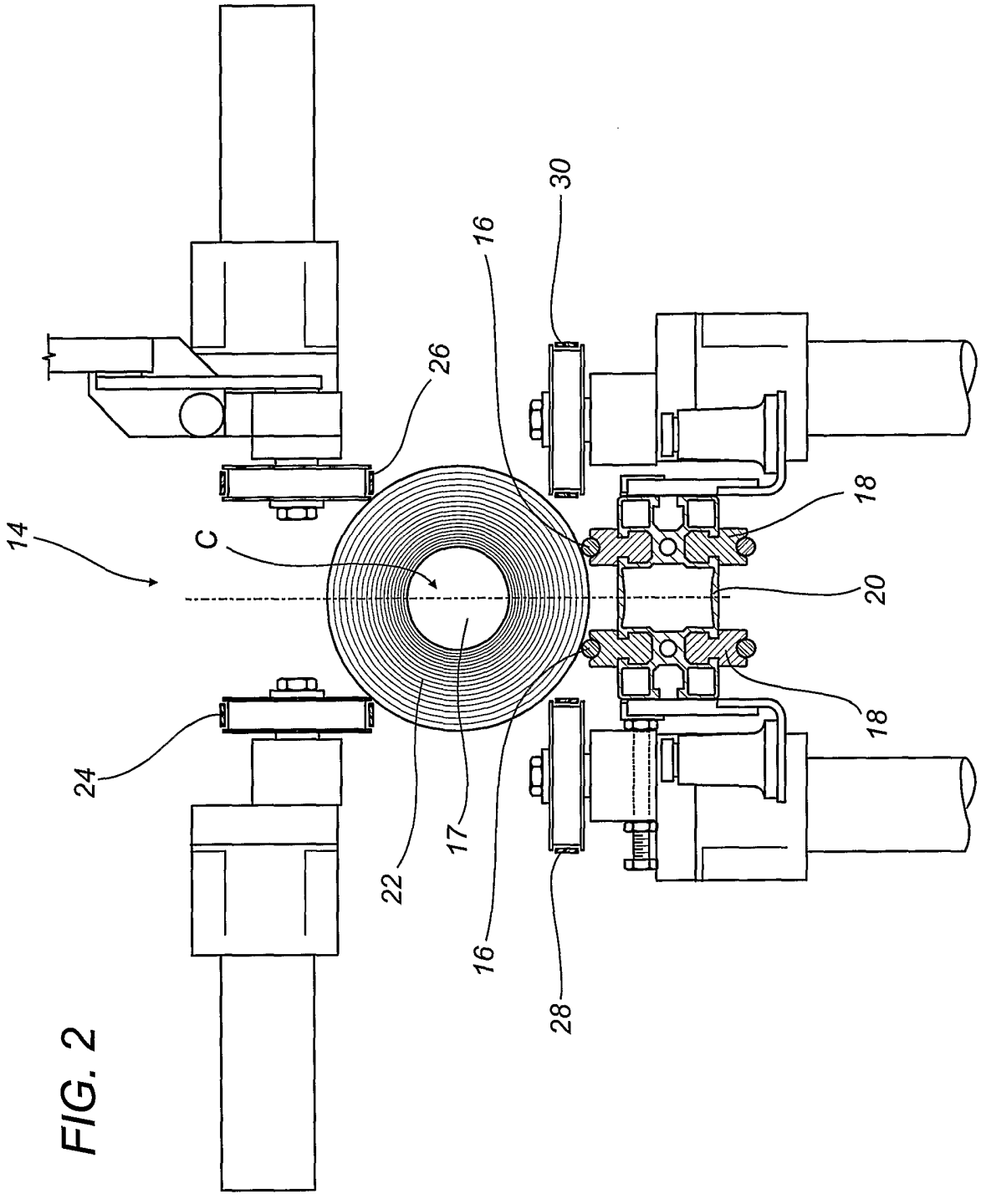


FIG. 2

FIG. 4

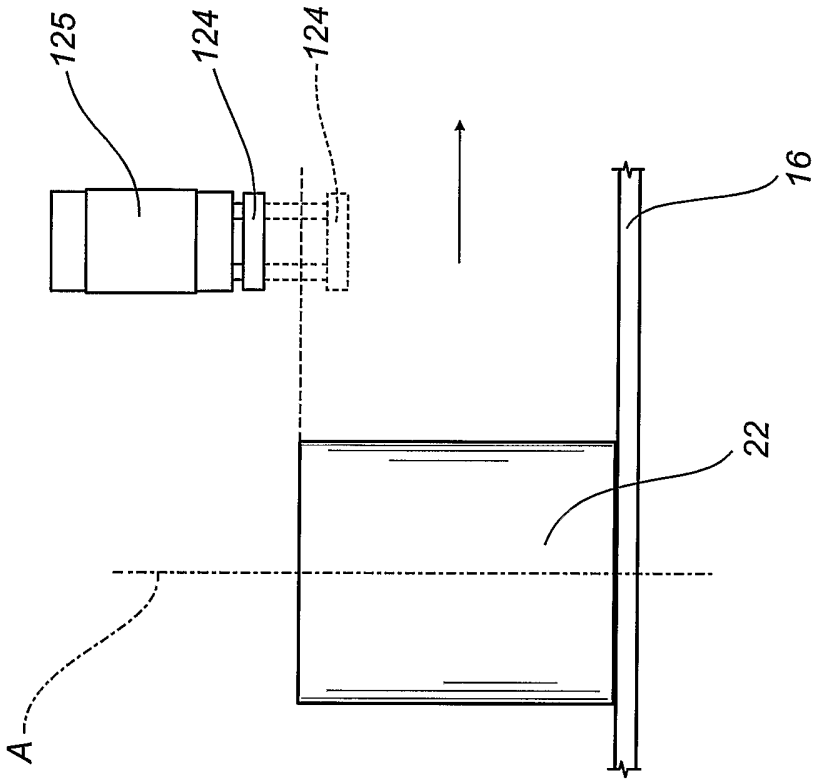
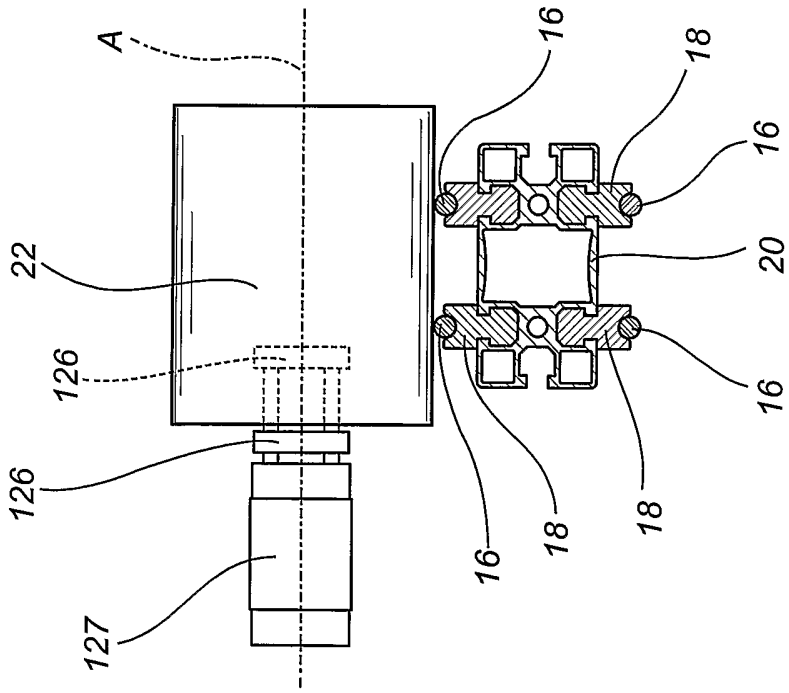


FIG. 5



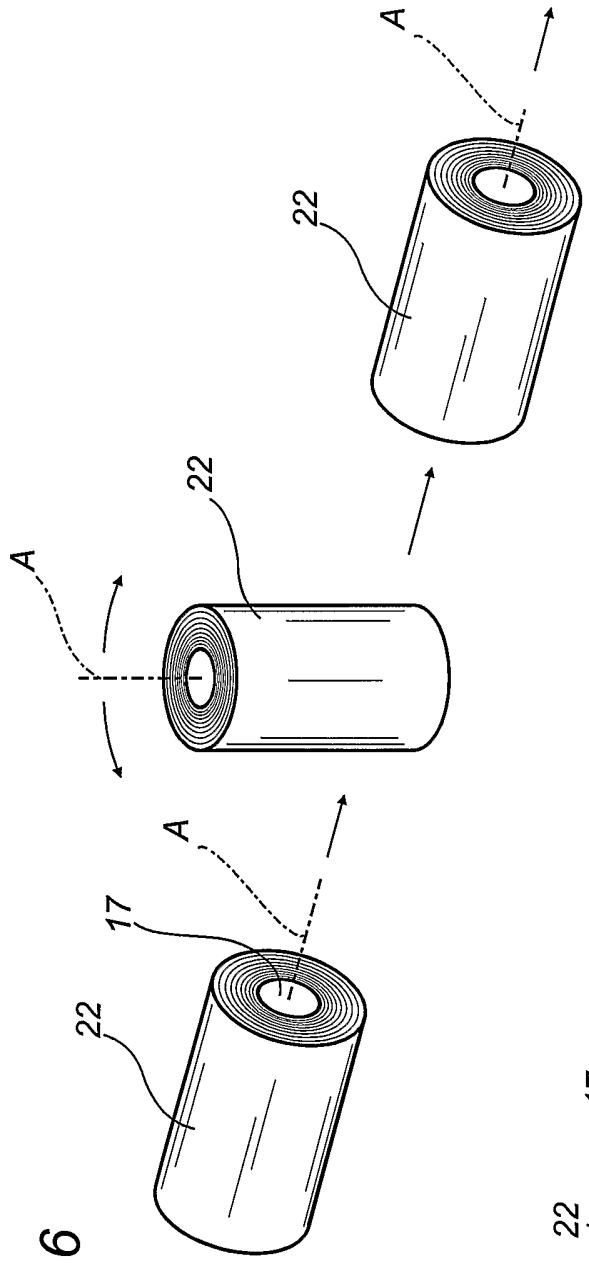


FIG. 6

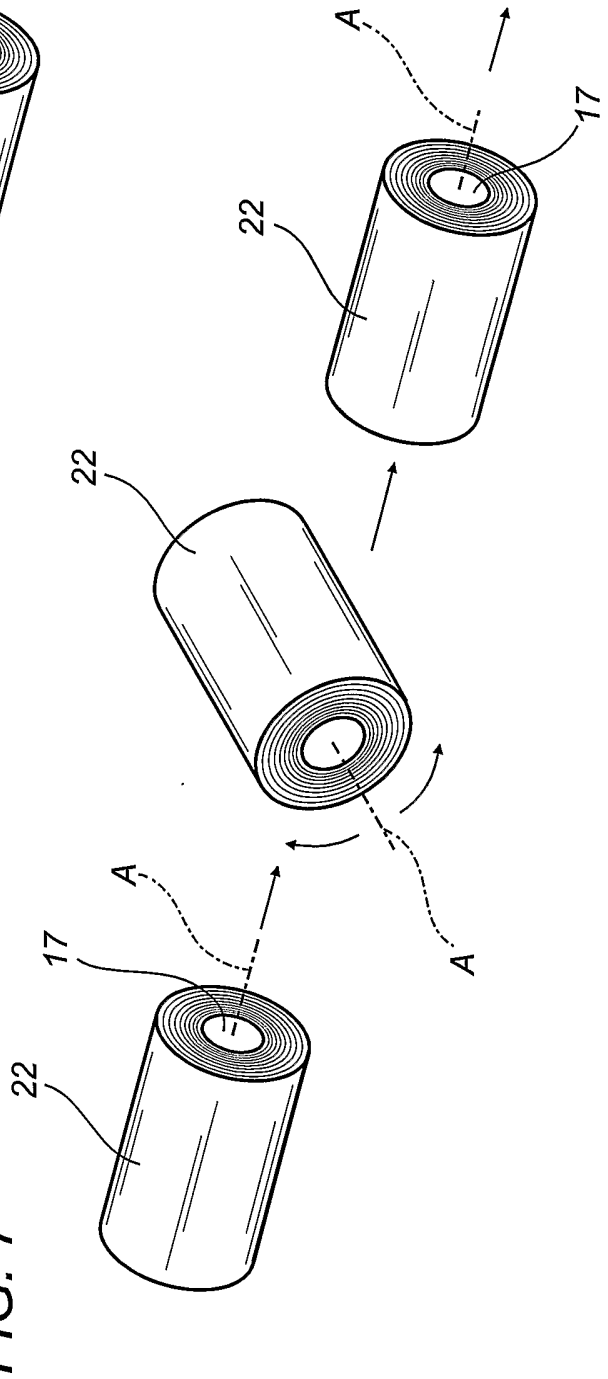


FIG. 7

FIG. 8

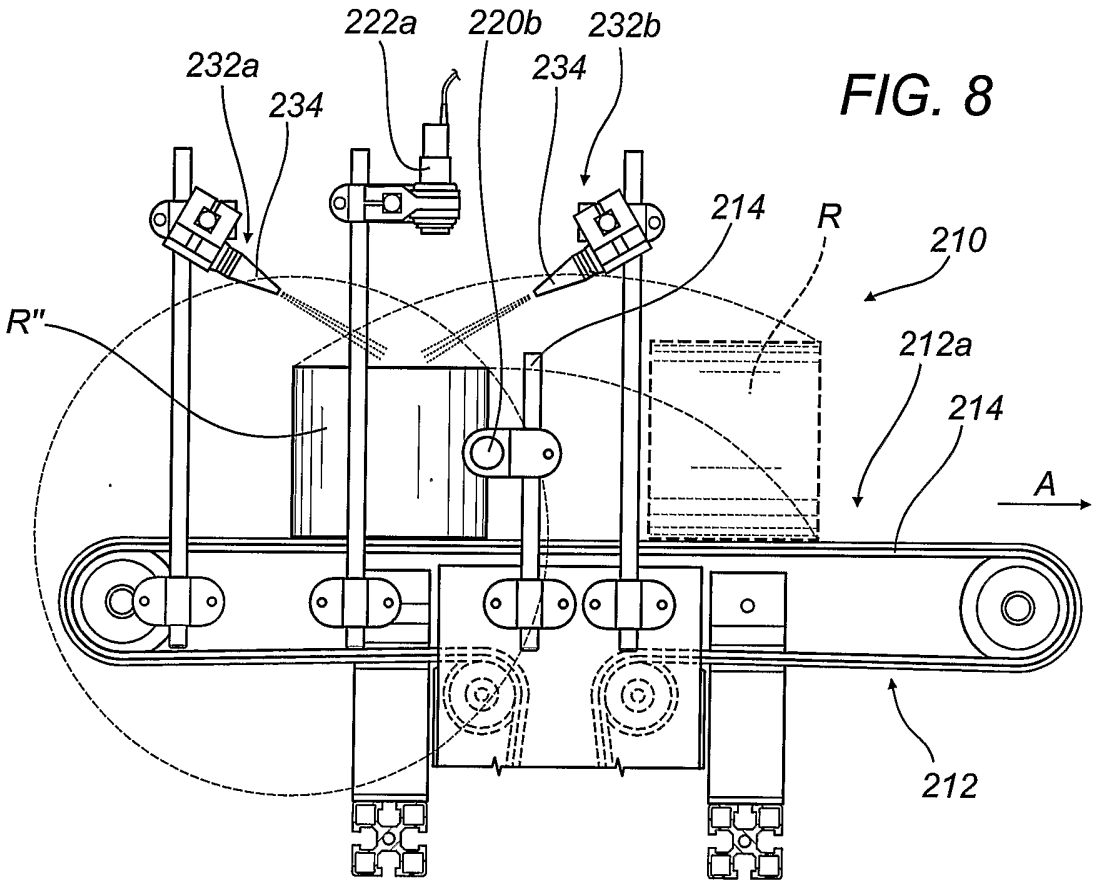
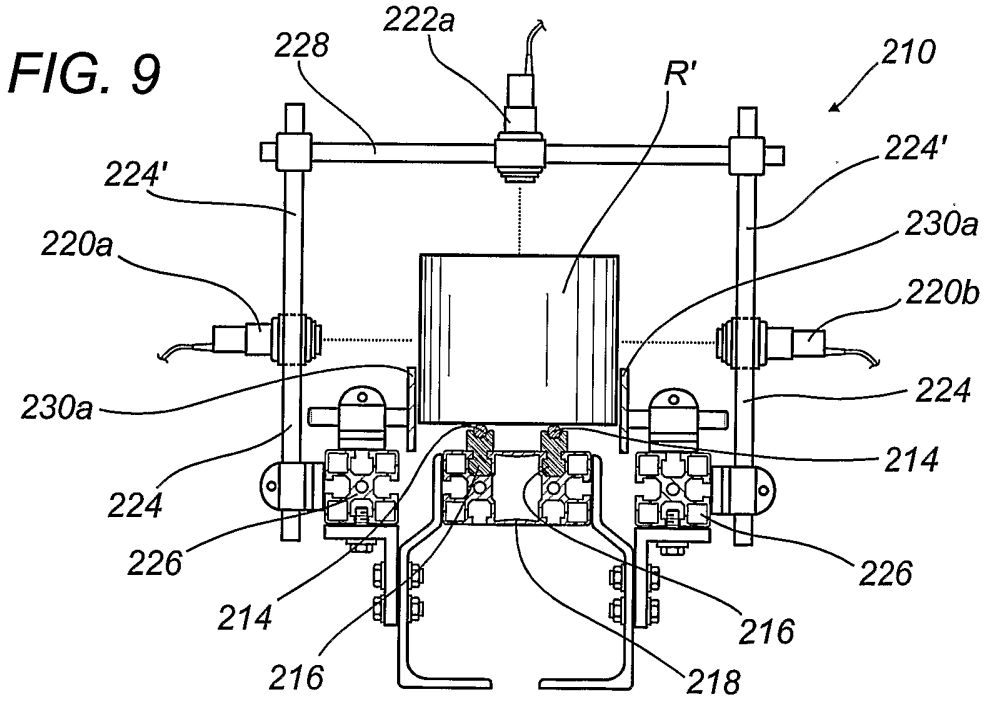

222a
220b
232b
232a
234
234
214
R
210
R"
212a
214
A
212

FIG. 9


222a
228
210
R'
224'
224'
230a
220a
220b
230a
224
214
224
226
226
214
216
216
218

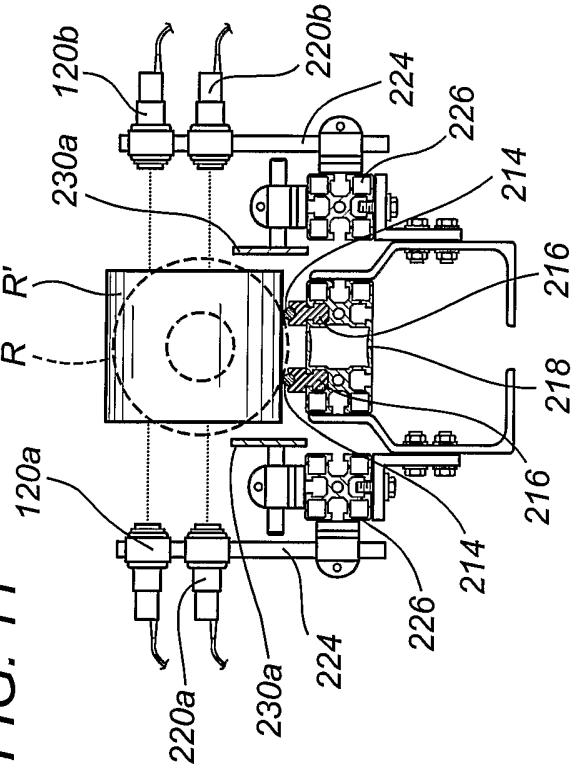


FIG. 11

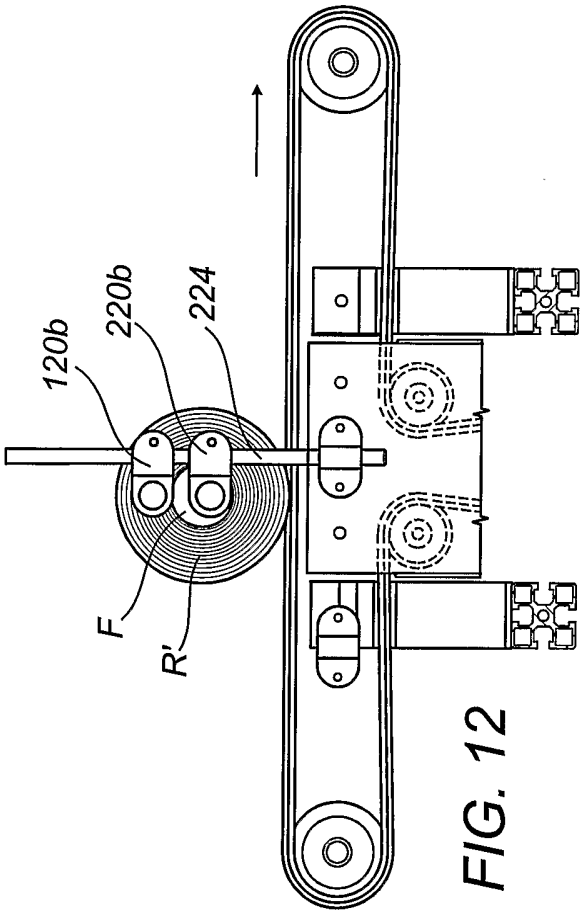


FIG. 12

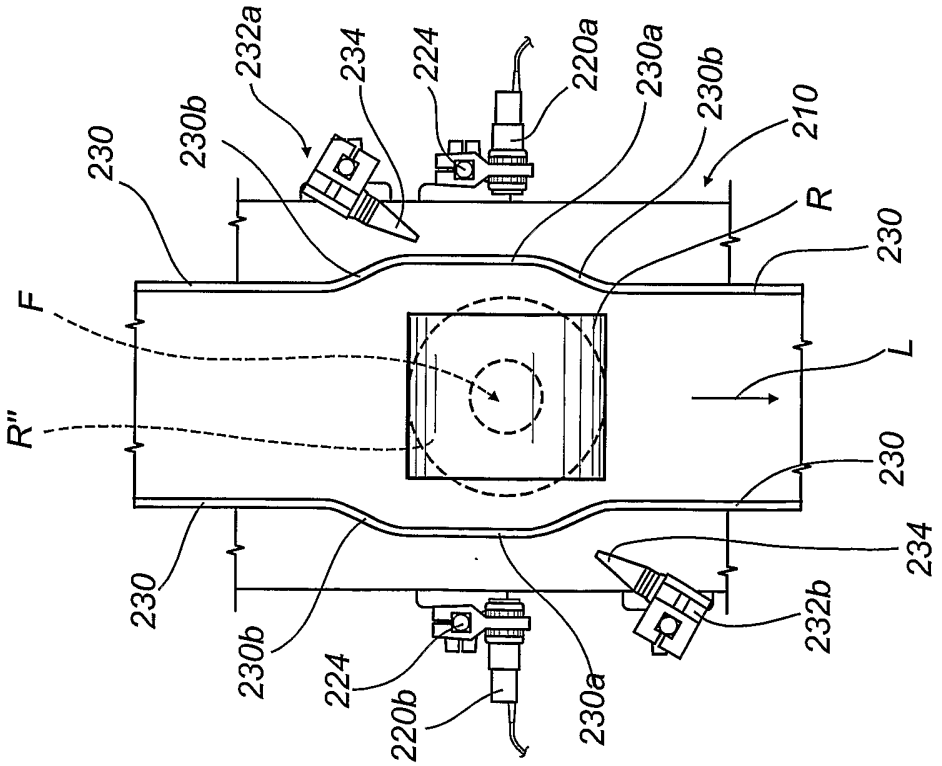


FIG. 10

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 02/02687

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65G47/244 B65G47/24 B65G47/252

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)
IPC 7 B65G B65B

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 4 782 939 A (FIELDS W GEORGE) 8 November 1988 (1988-11-08) abstract; claims; figures	1-6, 11-14 7,8,10, 15,16, 18-23, 25,39
Y A	GB 2 035 974 A (KROOSS R) 25 June 1980 (1980-06-25) abstract; claims; figures	1-6, 11-14 7,9,15, 17,22, 24,39

-/--

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

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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

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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 October 2002	30/10/2002

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, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Van Rolleghem, F

INTERNATIONAL SEARCH REPORT

Int[redacted]ial Application No
PCT/IB 02/02687

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 954 171 A (CHICK ROBERT K ET AL) 4 May 1976 (1976-05-04) abstract; claims; figures	1-3,6, 10-13, 18, 26-28, 31,39
A	US 3 967 724 A (FIJALKOWSKI BRIAN R ET AL) 6 July 1976 (1976-07-06) abstract; claims; figures	1-3,5, 10-13, 18,19
A	US 3 710 922 A (ARMSTRONG J ET AL) 16 January 1973 (1973-01-16) abstract; figures	1,9-11, 17,18
A	EP 0 700 847 A (SEIKO CO LTD) 13 March 1996 (1996-03-13) abstract; figures	1,3,4,6, 10-12, 14,17, 18,22, 35,39

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int[illegible]al Application No
PCT/IB 02/02687

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4782939 A	08-11-1988	US 4736831 A	12-04-1988
GB 2035974 A	25-06-1980	CA 1110195 A1	06-10-1981
		DE 2948897 A1	19-06-1980
		FR 2443401 A1	04-07-1980
		IT 1124091 B	07-05-1986
		JP 55080622 A	18-06-1980
US 3954171 A	04-05-1976	DE 2530886 A1	04-03-1976
		FR 2277751 A1	06-02-1976
		GB 1495181 A	14-12-1977
		IT 1039772 B	10-12-1979
		JP 1034844 C	20-02-1981
		JP 51033462 A	22-03-1976
		JP 55026087 B	10-07-1980
		NL 7508104 A	13-01-1976
		SE 415090 B	08-09-1980
		SE 7507898 A	12-01-1976
US 3967724 A	06-07-1976	AU 500996 B2	07-06-1979
		AU 8768975 A	23-06-1977
		CA 1049574 A1	27-02-1979
		GB 1498760 A	25-01-1978
US 3710922 A	16-01-1973	NONE	
EP 0700847 A	13-03-1996	JP 8127416 A	21-05-1996
		EP 0700847 A1	13-03-1996