(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 009 384 A2**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.04.2016 Bulletin 2016/16

(51) Int Cl.:
B65H 20/24 *(2006.01)* ***B65H 23/04*** *(2006.01)*

(21) Application number: **15184202.8**

(22) Date of filing: **08.09.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

(30) Priority: **11.09.2014 IT MI20141574**

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(54) TENSIONING DEVICE FOR A PLASTIC FILM IN A PASTA PACKAGING MACHINE

(57) A tensioning device (1) for a film (2) intended for the formation of bags in a packaging machine (100) is described. The device (1) is placed between a reel (5) of said film (2), wound on a motor-driven axis (6), and a film drive (3), adapted to pull the film (2), while unrolling it from said reel (5), and lead it towards a bag formation unit. The device (1) comprises a take-up (7) rotating around a rotation axis (9) which is parallel to said motor-driven axis (6) of the reel (5) and adapted to wrap therein a portion of the film (2) unrolled from the film reel (5), means (8) for detecting the working position of the take-up (7), and control means configured to start or stop the motor-driven axis (6) of the reel (5) as a function of the detected working position of the take-up (7). (Fig. 1)

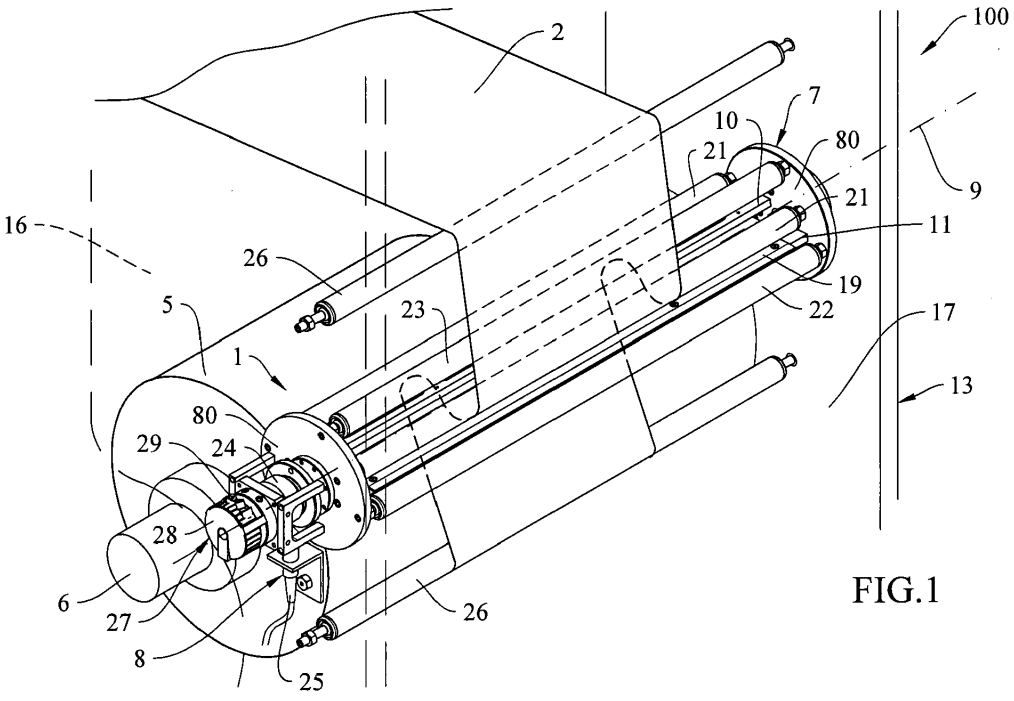

FIG.1

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Description

[0001] The present invention relates to a tensioning device for a plastic film in a pasta packaging machine.

[0002] Vertical flow pasta packaging machines are known, in which pasta is introduced into a bag being formed. The bag consists of a flexible plastic material film, the side edges of which are progressively folded, arranged side-by-side and then heat-sealed to each other by means of a longitudinal heat sealing unit to form a tubular package. The operation of closing such a package is completed by a transversal heat sealing unit which performs the transversal heat sealing of the tubular package before and after the operation of introducing the pasta into the bag being formed.

[0003] In these machines there is a film drive adapted to pull physically the plastic material film, which is unrolled from a reel on a motor-driven axis, running through a path of rollers which leads to the aforesaid heat sealing units belonging to a bag formation unit. The film drive typically consists of rubberized tracks moved by appropriate motors and configured to define the running speed of the film through the path along the packaging machine and thus the packaging speed of the machine itself.

[0004] The film required by the bag formation unit must be appropriately tensioned by a constant force for the correct operation of the packaging machine. For this reason, the packaging machine is designed so that the motor which rotates the reel axis is synchronized with the film drive track motors.

[0005] However, especially during the steps of stopping and starting the machine, such a condition of synchronism between motor-driven reel axis and film drive cannot be satisfied. In particular, during the step of stopping the machine, in which the film drive stops and no longer pulls the film, the reel which is unrolling the film may stop after a given time and, as a consequence, there may be film in excess which is not tensioned. Conversely, during the step of starting the packaging machine, in which the film drive is actuated and starts to pull the film, the film reel may restart with a given delay and, as a consequence, an overtensioning of the film may occur, leading to a breakage thereof.

[0006] In view of the above problems and of the aforesaid background art, it is the object of the present invention to suggest a short-pasta packaging machine which ensures the optimal tensioning of the plastic material film which will form the packages in all conditions.

[0007] According to the invention, such an object is achieved by a tensioning device for a flexible plastic material film intended for the formation of bags in a packaging machine, said device being placed between a reel of said film, wound on a motor-driven axis, and a film drive, adapted to pull the film while unrolling it from said reel, in order to lead it to a bag formation unit, said tensioning device being characterized in that it comprises:

a take-up rotating around a rotation axis, which is parallel to said motor-driven axis of the reel and adapted to wrap therein a portion of the film unrolled from the reel,

means for detecting the working position of the take-up, and

control means configured to start or stop the motor-driven axis of the reel, and therefore the unrolling of the film from the reel, as a function of the detected working position of the take-up.

[0008] The features of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, shown by way of example in the accompanying drawings, in which:

figure 1 shows a perspective view of a tensioning device for a flexible plastic material film according to the present invention;

figure 2 shows a front view of the tensioning device;

figure 3 shows a top view of the tensioning device in a first working position;

figure 4 shows a top view of the tensioning device in a second working position;

figure 5 shows a first section of the tensioning device taken along line V-V in figure 3;

figure 6 shows a second section of the tensioning device taken along line VI-VI in figure 4;

figure 7 shows a third section of the tensioning device taken along line VII-VII in figure 2.

[0009] Figure 1 shows a tensioning device 1 of a flexible plastic material film 2 intended to form bags in a pasta packaging machine 100, according to present invention.

[0010] For example, the packaging machine 100 is a vertical flow packaging machine for short pasta, configured to introduce a given amount of pasta into a bag being formed. The bags are formed by a bag formation unit (not shown in the figures), which substantially comprises heat sealing units, and each bag consists of the plastic material film 2, the side edges of which are progressively folded, arranged side-by-side and then longitudinally sealed to each other to form a tubular package. The operation of closing such a package is completed by the reciprocal transversal heat sealing of the tubular package before and after the operation of introducing a dose of pasta into the bag being formed.

[0011] At the bag formation unit, the packaging machine 100 includes a film drive 3 (Figs. 5, 6) comprising rubberized tracks 4 moved by first brushless motors adapted to pull physically the plastic material film 2 while unrolling it from a reel 5 wound on a motor-driven axis 6 by a second brushless motor. Said film drive 3 defines the speed at which film 2 runs into the packaging machine 100, starting from reel 5 to the bag forming unit.

[0012] The film drive 1 is arranged between said film drive 3 and said reel 5 of film 2 (Figs. 5, 6), and is configured to cooperate with the motor-driven axis 6 of reel 5 in order to keep the tensioning of film 2 always optimal

and avoid breakages caused by overtensioning or excesses of film 2, which may occur during the steps of starting and stopping the packaging machine 100, respectively.

[0013] In particular, the tensioning device 1 comprises (Figs. 1-4) a take-up 7 adapted to wrap therein a portion of the plastic material film 2 unrolled from reel 5, and detection means 8 configured to detect the position of take-up 7; said detecting means 8 are also configured to communicate the detected working position to control means (not shown in the figures) of the second motor adapted to move the axis 6 of the reel 5 of film 2. Said control means are configured to either start or stop said second motor of the axis 6 of reel 5, and thus the unrolling of film 2 therefrom, as a function of the detected working position of take-up 7.

[0014] Take-up 7 comprises two disks 80 rotating around a single rotation axis 9, which is perpendicular to the plane of the disks 80 and passing through their center O; the two disks 80 are integrally connected together by means of a first and a second bar 10, 11, which are parallel to the rotation axis 9 and are arranged so as to be symmetrically equidistant with respect to the latter (Fig. 5, 6). In particular, the bars 10, 11 both have rectangular cross-section, and preferably have slits 12 (Fig. 2) and are oriented so that the faces corresponding to the bars 10, 11 are also parallel to each other. Said first and second bars 10, 11 are fixed between the two disks 80 by means of threaded pins inserted into holes obtained in the disks 80 and locked there by means of nuts.

[0015] The rotation axis 9 of take-up 7 is perpendicular to the movement direction of film 2 along the roller path inside the packaging machine 100, and thus is also parallel to the motor-driven axis 6 of the reel 5 of film 2 (Figs. 5, 6). In particular, take-up 7 is mounted to the frame 13 of the packaging machine 100 by means of coupling elements 14 with which both disks 80 are provided. Said coupling elements 14 (Fig. 2) are fixed by means of screws to the outer faces of the disks 80 and are concentric thereto; furthermore, the coupling elements 14 are adapted to rotatably mate with respective housings 15 obtained in a first and a second vertical wall 16, 17 of the frame 13 of the packaging machine 100.

[0016] A lamina (Figs. 5, 6) is then fixed to each of the bars 10, 11, and particularly a first lamina 18 is fixed to the first bar 10 and a second lamina 19 is fixed to the second bar 11, so that there are two mutually opposite laminas 18, 19; the laminas 18, 19 are on parallel planes and equidistant from a plane P passing through the center O of the disks 80. The laminas 18, 19 thus arranged create a passage 20 through which the plastic material film 2 is introduced, which film reaches the bag formation unit from reel 5.

[0017] In order to facilitate the running of film 2 through said passage, take-up 7 further comprises a first and a second pair of idle rollers 21, 22 parallel to the rotation axis 9. Each of said first and second pairs of idle rollers 21, 22 is associated with a lamina 18, 19, and in particular the first lamina 18 is between the rollers of the first pair 21 and the second lamina 19 is between the rollers of the second pair 22, with the rollers 21, 22 arranged close to each of the two blades of the laminas 18, 19.

[0018] Finally, take-up 7 comprises a third pair of idle rollers 23, again parallel to the rotation axis 9 and symmetrically equidistant thereto; each of the rollers of said third pair of rollers 23 is on a plane which is substantially orthogonal to said plane P.

[0019] A fourth pair of rollers 26 parallel to the rotation axis 9 and both belonging to a reference plane L, is advantageously positioned over and under the take-up 7 and adapted to arrange film 2 to be inserted into take-up 7. Each of the rollers of said fourth pair of rollers 26 is fixed between said first and second walls 16, 17 of the frame 13 of the packaging machine 100 by means of threaded pins inserted into holes obtained in frame 13 and locked there by means of nuts.

[0020] As a whole, take-up 7 is configured to rotate around the rotation axis 9 between a first limit angular position, with an angle θ of about 0° between said planes L and P, and a second limit angular position, with angle θ of about 270° between said planes L and P (Figs. 5, 6). The first limit position allows film 2 to be inserted into the passage 20 between the laminas 18, 19; instead, the second limit position is the maximum rotation of take-up 7 which prevents the film 2 running on said first and second pairs of rollers 21, 22 from overlapping the film running on said third pair of rollers 23, thus ensuring a given gap.

[0021] Said means 8 (Fig. 7) for detecting the working position of take-up 7 comprise a spiral cam 24 mounted to the rotation axis 9 of take-up 7 and an analog probe 25. The spiral cam 24 is such that the plane of the spiral is perpendicular to the rotation axis 9 which centrally crosses the spiral cam 24, and is preferably mounted close to one of the two disks 80, e.g. disk 80 at said first vertical wall 16 of frame 13. On the other hand, probe 25 is fixed by means of an appropriate support to the same first vertical wall 16 of frame 13 (Fig. 2) and configured to read the distance with the spiral cam 24 and, as a response, to send a control signal to the means for controlling the motion of the motor-driven axis 6 of the reel 5 of film 2. Said control signal is indicative of a given angular position of take-up 7 with angle θ between said first and a second limit angular positions.

[0022] Said means for controlling the motion of the motor-driven axis 6 of the reel 5 of film 2 are connected to the second motor and configured to start or stop the rotation of the motor-driven axis 6, as a function of the rotation performed by the take-up 7 about the rotation axis 9. In particular, the control means are configured to start or stop the second motor of axis 6 to unroll an amount of film 2 from reel 5 as a function of the control signal received from said probe 25 and thus of the detected angular position (angle θ) of take-up 7.

[0023] Finally, the tensioning device 1 comprises adjustment means 27 (Figs. 1-4) of the tension of film 2, i.

e. for adjusting the force with which take-up 7 tends to oppose to the driving force of the film drive 3, so that film 2 is optimally tensioned according to the type of the plastic material film 2 used in the packaging process. In particular, at least one of the disks 80 is connected to a rotating pneumatic shock absorber 28, in which the pressure, which is adjustable by means of a pressure switch provided with pressure gauge (not shown in the figures) connected to a specific air inlet 29, is translated into torque offered by the take-up 7, which tends to oppose to the driving force of film 2.

[0024] Starting from reel 5 on the motor-driven axis 6, the plastic material film 2 (Figs. 5, 6) will run on said roller of said fourth pair 26 arranged in a lower position as compared to the take-up 7 to then pass through passage 20 between the laminas 18, 19, being facilitated in the running movement by said first and second pairs of idle rollers 21, 22 which are arranged by the side of each lamina 18, 19, respectively. Once passage 20 has been crossed, film 2 will run on the roller of the fourth pair 26 arranged above and will reach said film drive 3 and the bag formation unit.

[0025] During operation, in an initial step the take-up 7 is in the first limit position (angle θ of 0°) (Figs. 3, 5) so that the plastic material film 2 may be manually unrolled from reel 5, introduced between the laminas 18, 19 into the take-up 7, and led to the film drive 3 of the packaging machine 100.

[0026] The torque with which the take-up 7 will tend to oppose to the drive force defined by the film drive 3 which pulls film 2 towards the bag formation unit is then adjusted according to the type of film 2 (more or less thick) to be used in the packaging process. In particular, the inlet air pressure of the rotating pneumatic shock absorber 28 is adjusted through the pressure switch, which pressure translates into a given mechanical moment of the take-up 7 about the rotation axis 9.

[0027] With the film drive 3 not yet working, the take-up 7 goes from the first limit angular position (angle θ of 0°) (Fig. 5) to the second limit angular position (angle θ of 270°) (Fig. 6) under the bias of the torque offered by the rotating pneumatic shock absorber 28, turning counterclockwise about its rotation axis 9. Within the take-up 7, the film 2, when crossing passage 20 between the laminas 18, 19, will run firstly on only one roller of each first and second pairs of idle rollers 21, 22 and on both rollers of the third pair of idle rollers 23; after a given rotation angle θ, film 2 will then also run on the remaining rollers of the first and second pairs of idle rollers 21, 22. In essence, film 2 is rolled inside take-up 7 following a counterclockwise rotation thereof, and conversely film 2 is unrolled following a clockwise rotation.

[0028] During the step of starting the packaging machine 100, the film drive 3 starts to pull the plastic material film 2 towards the bag packaging unit. The take-up 7, which opposes only slightly to maintain the film 2 tensioned, will undergo a given clockwise rotation, equal to a given angle θ, which is detected by the analog probe 25 which monitors the distance with the spiral cam 24. In response to the detected rotation, probe 25 sends a corresponding control signal to the means for controlling the movement of the motor-driven axis 6 of reel 5 which start the second motor to unroll a given amount of film 2 from reel 5 so as to rotate the take-up 7 counterclockwise and equal the detected rotation by a given angle θ. Indeed, the film 2 unrolled from reel 5 allows the rotating pneumatic shock absorber 28 to rotate the take-up 7 counterclockwise despite the bias of the drive force of device 3.

[0029] Thereby, starting from an oscillatory movement generated by the alternation of steps in which there is a clockwise rotation, due to the drive of film 2 by the film drive 3, and steps in which there is a counterclockwise rotation, due to the unrolling of the film 2 from reel 5, the take-up 7 will be stabilized at full rate in angular position with angle θ of intermediate value between the two angles θ of 0° and 270°, corresponding to the first and second limit angular positions. For example, the full rate value may be an angle θ of 135°.

[0030] Thereby, the tensioning device 1 always maintains the optimal tensioning of film 2, while ensuring a constant reserve of film 2 inside take-up 7 so as to avoid the problems of the prior art. The overtensioning during the step of starting the packaging machine 100 is avoided by virtue of the clockwise rotation of take-up 7 which wraps the film 2 therein. During the step of stopping the film drive 3, even if the axis 6 of reel 5 stops after a given time, the take-up 7 will wrap the possible film 2 in excess, keeping the film 2 tensioned.

Claims

1. Tensioning device (1) for a film (2) of flexible plastic material for the formation of bags in a packaging machine (100), said tensioning device (1) being placed between a reel (5) of said film (2), rolled on a motor-driven axis (6), and a film drive (3), suitable to pull the film (2), unrolling it from said film reel (5), to lead it to a formation unit of the bags, said tensioning device (1) being **characterized by** comprising:

   a take-up (7) rotating around a rotation axis (9) which is parallel to said motor-driven axis (6) of the film reel (5) and suitable to wrap inside a portion of the film (2) unrolled from the film reel (5),
   detecting means (8) of the working position of the take-up (7), and
   control means configured to start or stop the motor-driven axis (6) of the film reel (5), and therefore the unrolling of the film (2) from the film reel (5), in function of the detected working position of the take-up (7).

2. Tensioning device (1) according to claim 1, **charac-**

terized in that said take-up (7) comprises two disks (80) rotating around said rotation axis (9) which is perpendicular to the plane of the disks (80) and passing for their center (O), said disks (80) being integrally connected via a first and a second bar (10, 11) which are parallel to the rotation axis (9) and symmetrically equidistant with respect to the latter.

3. Tensioning device (1) according to claim 2, **characterized in that** the take-up (7) comprises coupling elements (14) fixed to the outer faces of the disks (80) and suitable to rotatably mate with respective housings (15) formed on a first and a second wall (16, 17) of a frame (13) of the packaging machine (100).

4. Tensioning device (1) according to claim 2, **characterized in that** the take-up (7) comprises a first and a second laminas (18, 19) which are fixed on said first and second bar (10, 11) respectively, said first and second laminas (18, 19) being on parallel planes and equidistant from a plane (P) passing through the center (O) of the disks (80), and creating a passage (20) through which is introduced the film (2) that, from the film reel (5), goes to the formation unit of the bags.

5. Tensioning device (1) according to claim 4, **characterized in that** the take-up (7) comprises a first and a second pair of idle rollers (21, 22) parallel to the rotation axis (9), associated to said first and second laminas (18, 19) respectively, said first lamina (18) being comprised between the rollers of the first pair (21) and said second lamina (19) being comprised between the rollers of the second pair (22), with the rollers of said first and second pairs (21, 22) disposed in proximity of the blades of the laminas (18, 19).

6. Tensioning device (1) according to claim 4, **characterized in that** the take-up (7) comprises a third pair of idle rollers (23) which are parallel to the rotation axis (9) and symmetrically equidistant with respect to the latter, each of the rollers of said third pair of rollers (23) being comprised in a plane which is substantially orthogonal to said plane (P).

7. Tensioning device (1) according to claim 4, **characterized in that** said working position of the take-up (7) is an angular position with a given rotation angle (θ) of the take-up (7) around the rotation axis (9), said angle (θ) being the angle formed by said plane (P) and a reference plane (L).

8. Tensioning device (1) according to any of the preceding claims, **characterized in that** said detection means (8) comprise a spiral cam (24) mounted on the rotation axis (9), with the plane of the spiral which is perpendicular to the rotation axis (9), and an analog probe (25), fixed to the vertical wall (16) of the frame (13) by means of a support and configured to read the distance with the spiral cam (24) and, as a response, send a command signal to said control means for the motion of the motor-driven axis (6).

9. Tensioning device (1) according to claim 8, **characterized in that** said control signal is indicative of a given angular position of the take-up (7) with said angle (θ) comprised between a first and a second limit angular position.

10. Tensioning device (1) according to any one of the preceding claims, **characterized in that** said control means for the motion of the motor-driven axis (6) of the film reel (5) are configured to start or stop the rotation of the motor-driven axis (6), unrolling a certain amount of the film (2) from the reel (5), as a function of the command signal received by the probe (25).

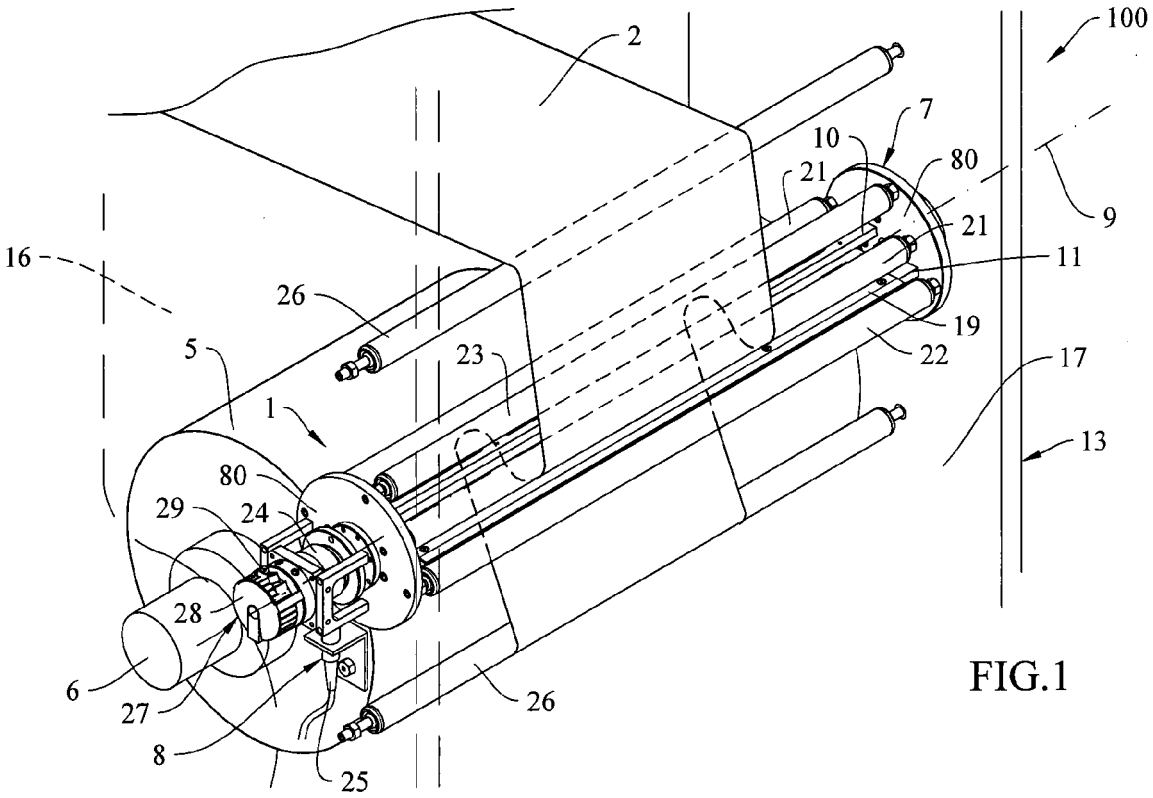

FIG.1

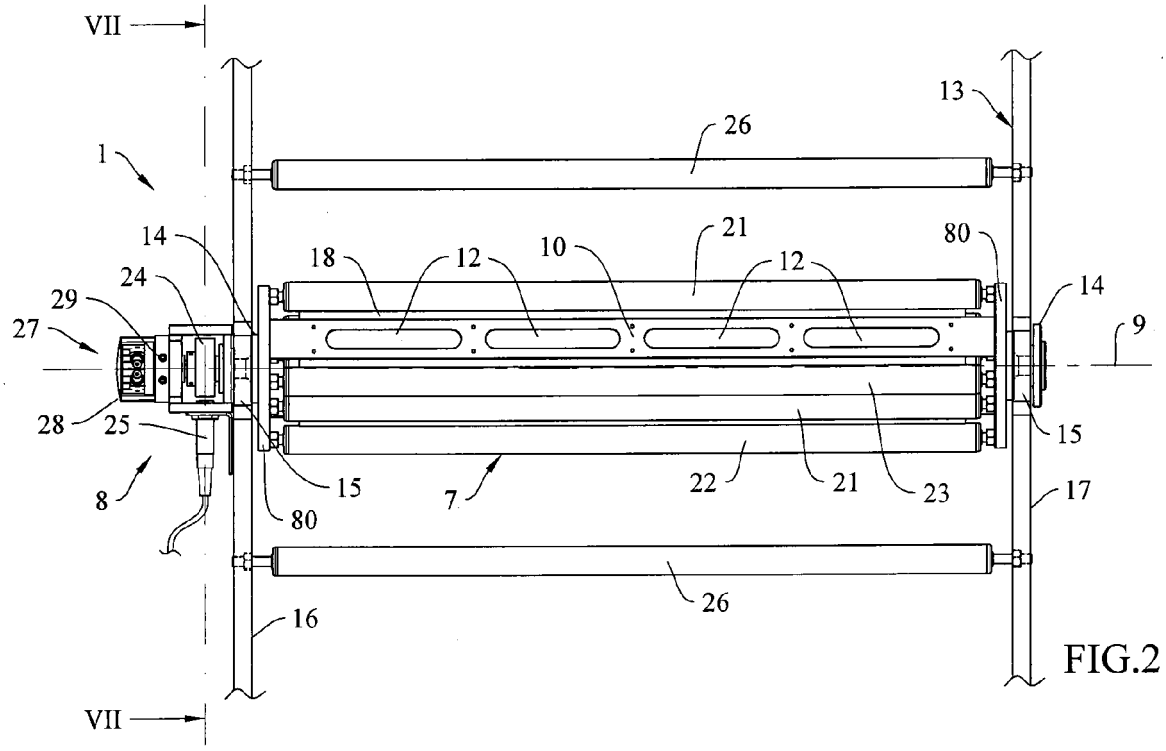
VII
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FIG.2

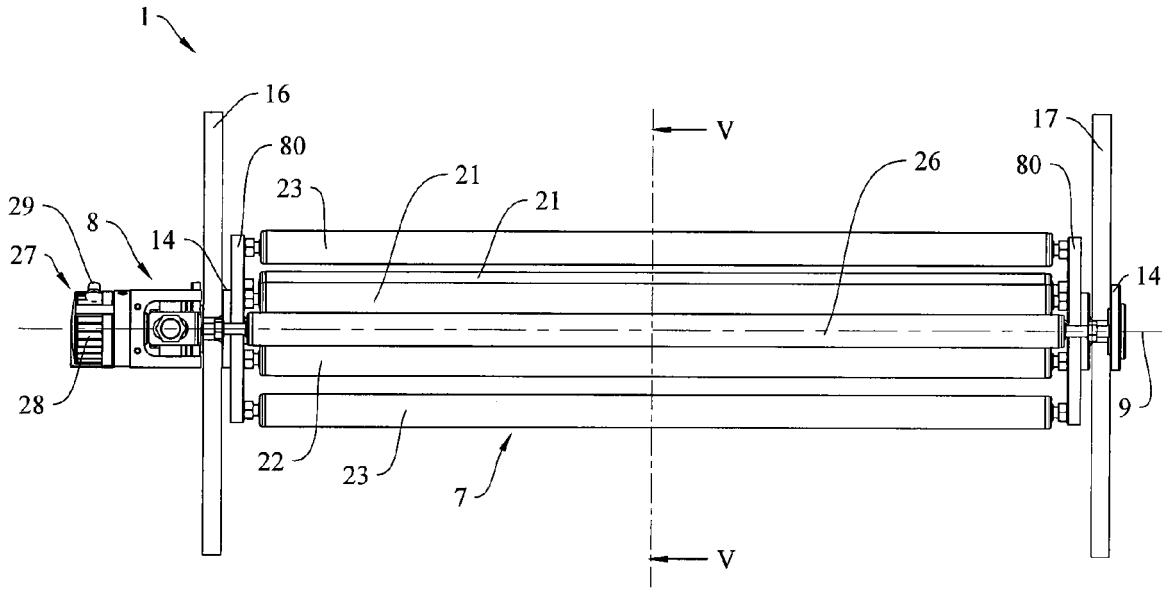

FIG.3

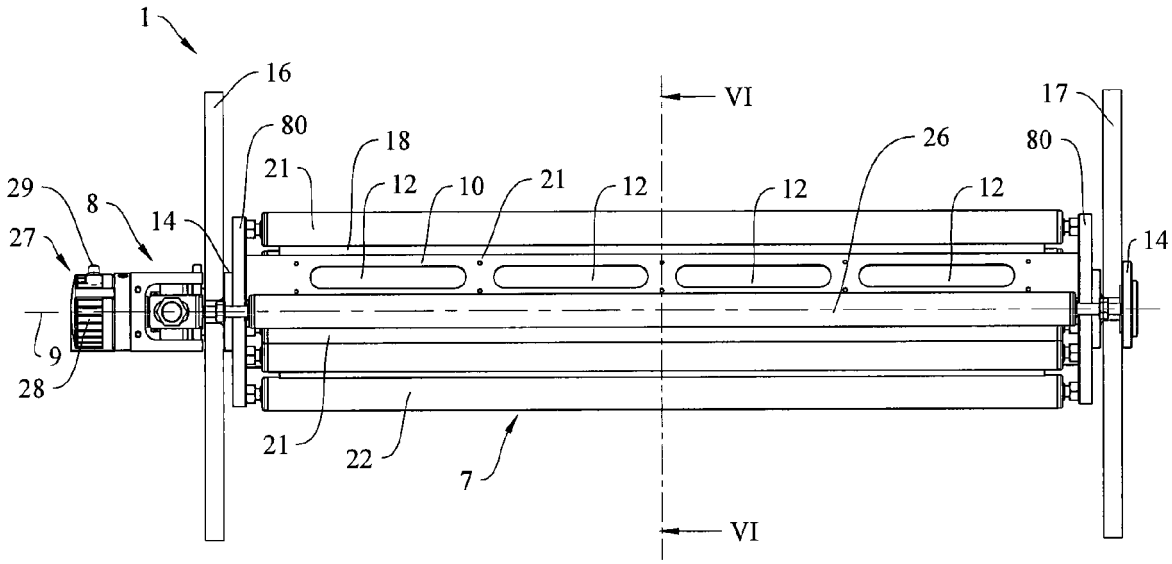

FIG.4

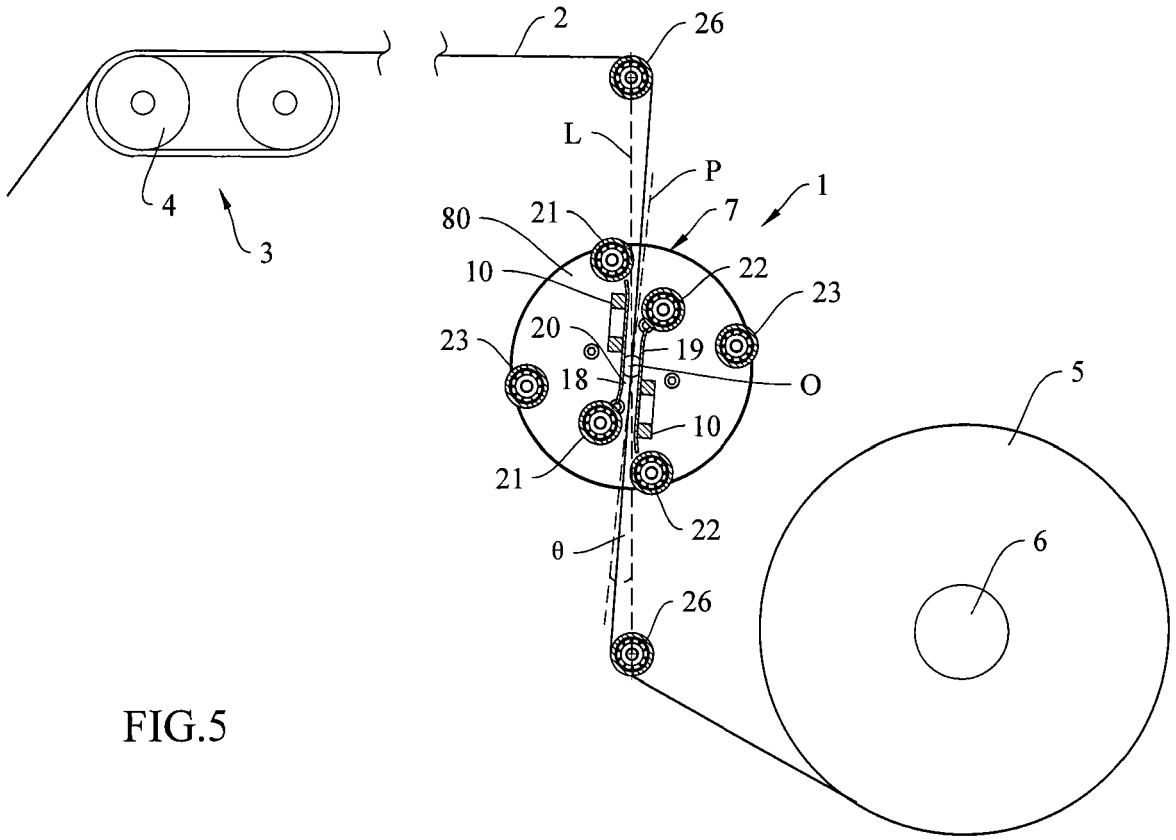

FIG.5

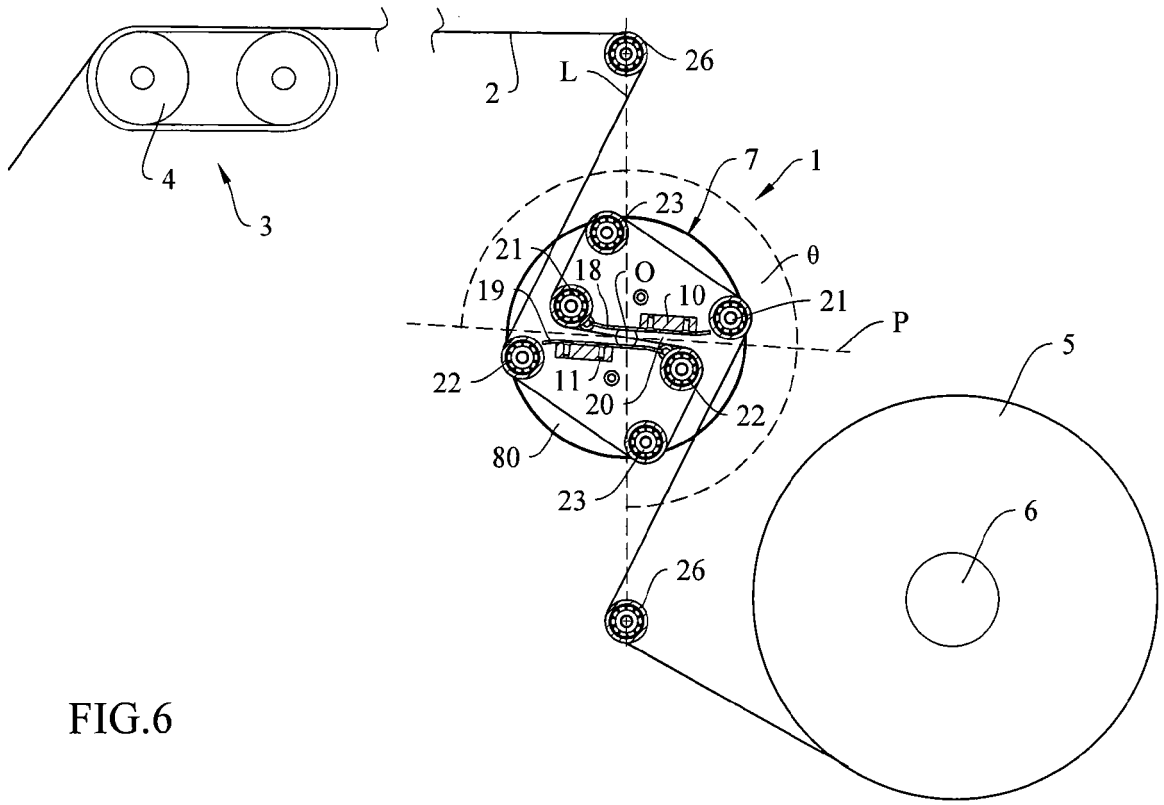

FIG.6

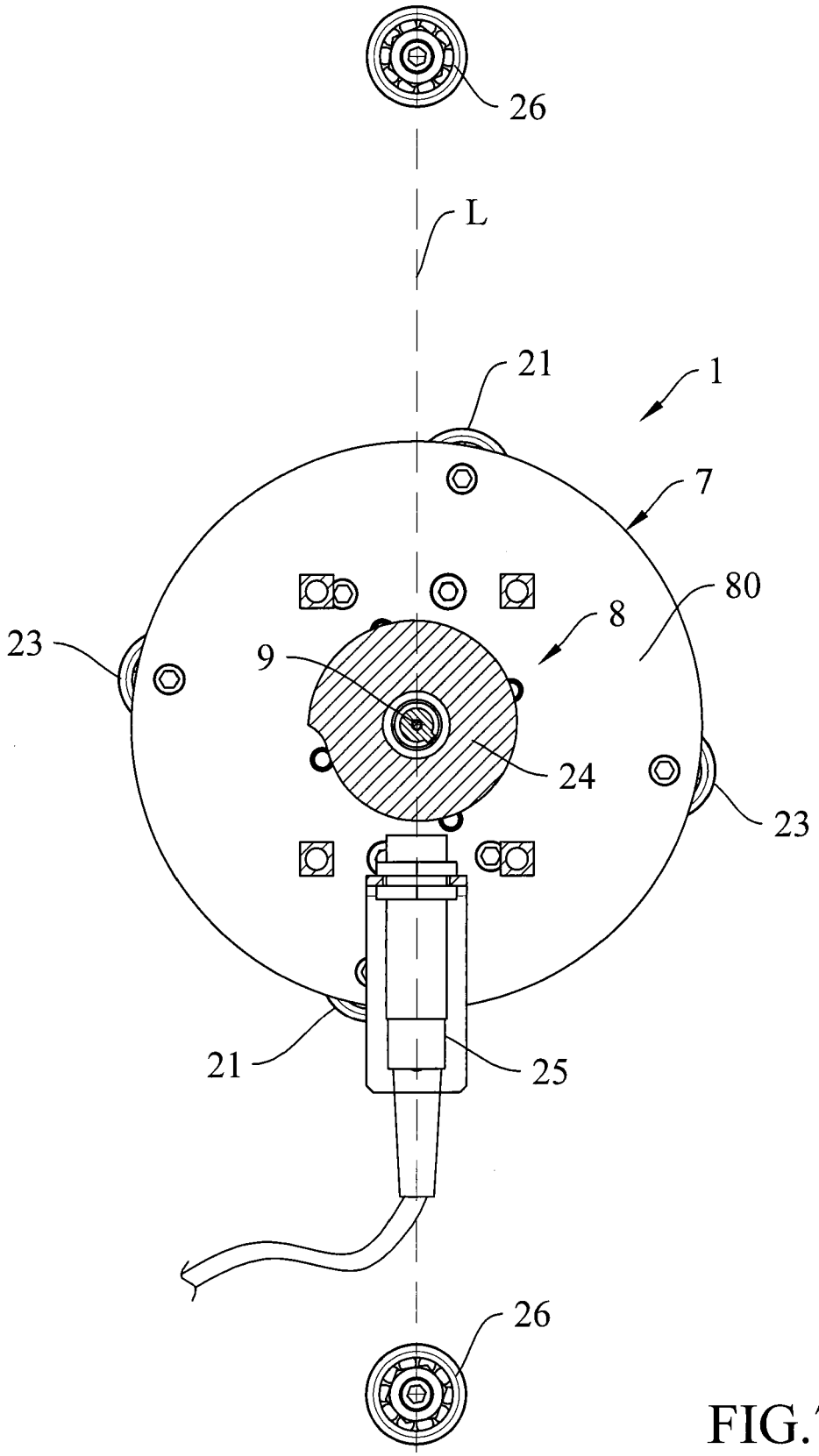

FIG.7