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(54) **Singulator device for postal objects with anti-slide function**

(57) A singulator device for flat rectangular postal objects comprising: a resting surface (12,13) for the packs of postal objects; a motor-driven belt withdrawing device (19); a drawing system (15), which displaces the packs towards a plane gripping portion of said motor-driven belt withdrawing device (19) designed to withdraw individually a postal object that constitutes a front end face of the pack, displacing it in a direction transverse to the direction of drawing. The motor-driven belt withdrawing device (19) is coupled to a separator device (40), which moves

between at least two positions, of which: a resting position, in which the separator device (40) does not interfere with the belt withdrawing device (19) and with the postal object during withdrawal from the pack by the withdrawing device (19); and an activation position, in which a mobile portion of the separator device extends beyond the plane gripping portion towards the pack of objects to come into contact with a rear portion of the postal object during withdrawal, moving it away from the belt withdrawing device (19) and preventing sliding of the rear portion on the belt.

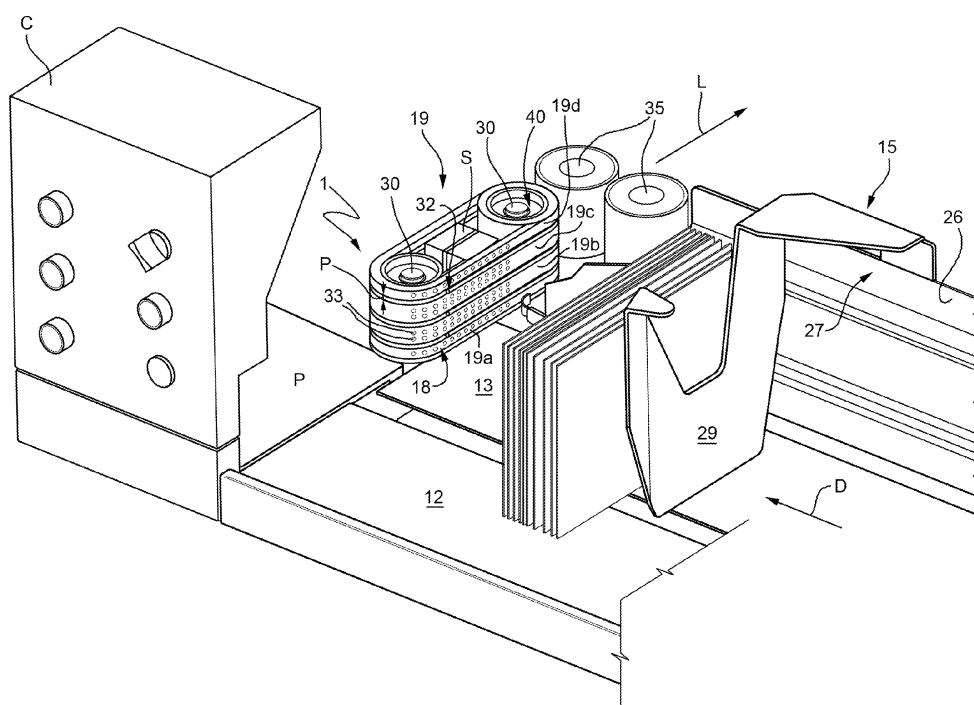


FIG. 1

Description

[0001] The present invention relates to a singulator device for postal objects with anti-slide function.

[0002] As is known, a singulator device receives at input groups of flat rectangular postal objects grouped together in packs and feeds at output singulated postal objects, i.e., postal objects physically separated from one another.

[0003] For example, the documents Nos. US-4,634,328 (Mail Singulation System), WO91/15416 (Flat mail Singulation Apparatus), US 4,171,130 (Control of withdrawal of flat items individually from a stack) and DE101 40 497 describe singulator devices for postal objects.

[0004] Typically, the packs of postal objects, which have an approximately parallelepipedal shape, slide along a horizontal resting surface under the thrust of a drawing system that displaces the packs towards a singulator system designed to withdraw in sequence and individually the postal objects that form a front end face of the pack. Typically, the packs move in a rectilinear direction D of advance.

[0005] The singulator system, for example, can comprise a motor-driven withdrawing belt, which forms a vertical plane gripping portion associated to a suction device; the postal object that forms the front face of the pack comes to bear upon the plane gripping portion that moves individually the postal object withdrawn in a direction L transverse to the direction of advance, separating it from the pack.

[0006] The spatial separation between the postal objects singulated in sequence in the direction L is obtained by controlling the speed of the withdrawing belt and following with an optical barrier of emitter/receiver sensors the leading and trailing edges of each moving object in such a way that the trailing edge of one postal object 7 is spaced in the direction L with respect to the leading edge of the object that follows it by a constant gap g.

[0007] The aim of said control is to create a flow of singulated postal objects separated from one another by a constant gap g, which moves at a controlled speed.

[0008] An optical barrier of a known type comprises n emitter/receiver sensors C (C0, C1, C2, ..., Cn) arranged aligned in a rectilinear direction parallel to the direction L, and the optical paths between emitters/receivers C (C0, C1, C2, ..., Cn) are interrupted by the edges of the postal object that moves in the direction L. The sensor C0 (first sensor) is closest to the withdrawal area, whereas the sensor Cn (last sensor) is furthest from the withdrawal area and located in a part of the conveying system where the speed of the objects in motion is constant and already equal to the steady running speed V.

[0009] The process of withdrawal can comprise three steps, namely:

step 1: waiting for obscuration of the last sensor Cn of the barrier. In this step, the motor-driven withdraw-

ing belt moves with an acceleration ramp that is maintained until the last sensor Cn is obscured. Following upon obscuration of the last sensor Cn (the leading edge of the postal object has reached said sensor) the withdrawing belt is stopped with controlled deceleration ramp; the postal object 7 now moves with practically constant speed V, its leading portion (edge) being already taken up by a pair of pinch rollers, which send it towards a conveying system set downstream, thus moving away from the pack of postal objects. The postal object subsequent to the one withdrawn, which forms the end face of the pack, is now stationary. All the sensors of the barrier have optical paths interrupted by the receding postal object or by the stationary postal object.

Step 2: Waiting for formation of a gap in the barrier.

When the trailing edge of the receding postal object is physically separated from the leading edge of the stationary postal object, a gap is created, which enables passage of a signal between at least one emitter/receiver Ci (lighting-up of sensor Ci). The withdrawing belt is still kept stationary and computation of a time T_{COR} is triggered, which enables a recession of the trailing edge of the postal object that is moving with respect to the leading edge of the stationary postal object, which enables creation of a preset gap between the postal objects. The time T_{COR} is calculated on the basis of the position of the sensor Ci lit up and on the basis of the speed V of the receding postal object.

Step 3: restart. Once the time T_{COR} has expired, the withdrawing belt is activated, and the operations previously described are repeated, thus creating a flow of postal objects separated from one another with a constant gap g.

[0010] As mentioned above, in the course of the first step the postal object is conveyed (at constant speed V) by the pinch rollers, whilst the withdrawing belt is decelerated until it stops altogether; for this reason, a rear portion of the postal object slides on the stationary belt, which, as is known, has a high coefficient of friction (both static and dynamic).

[0011] Sliding of the object on the belt can damage the postal object and/or can bring about opening of the postal object itself in the case where this is provided with closing flaps. These harmful effects are particularly evident in the case of longer formats, for example in the case of the well-known C4 format or above.

[0012] The aim of the present invention is to provide a singulator device for postal objects that will solve the problems of the known art, preventing sliding of the rear portion of the postal object on the stationary belt.

[0013] The above aim is achieved by the present invention in so far as it regards a singulator device for flat rectangular postal objects comprising a resting surface

for the packs of postal objects, a motor-driven belt withdrawing device, and a drawing system that displaces the packs towards a plane gripping portion of said motor-driven belt withdrawing device designed to withdraw individually a postal object that constitutes a front end face of the pack, displacing it in a direction transverse to the direction of drawing and loosening it from the pack, the singulator device being characterized in that said motor-driven belt withdrawing device is coupled to a separator device, which moves between at least two positions, of which: a resting position, in which the separator device does not interfere with the belt withdrawing device and with the postal object during withdrawal from the pack by the withdrawing device; and an activation position, in which a mobile portion of the withdrawing device extends beyond the plane gripping portion towards the pack of objects to come into contact with a rear portion of the postal object during withdrawal, moving it away from the belt withdrawing device and preventing sliding of the rear portion on the belt or sliding-off of a band for closing the postal object, in particular a newspaper.

[0014] The invention will now be illustrated with particular reference to the attached drawings, which illustrate a preferred non-limiting embodiment thereof and in which:

- Figures 1 and 2 illustrate, in front and rear perspective view, a singulator device built according to the present invention;
- Figure 3 illustrates, in perspective view, at an enlarged scale and partially in cross section, a singulator device built according to the present invention and set in a first operating position;
- Figure 4 illustrates, in perspective view, at an enlarged scale, and partially in cross section, a singulator device built according to the present invention and set in a second operating position; and
- Figure 5 illustrates operation of the device according to the invention.

[0015] In Figures 1 and 2 designated as a whole by 1 is a singulator device for postal objects 7.

[0016] The postal objects 7 of a flat type have a rectangular shape and are characterized by a major side L and by a minor side 1. The singulator device 1 is configured for receiving at input groups of flat rectangular postal objects grouped together in packs P (Figure 1) and feed at output singulated postal objects 7, i.e., postal objects physically separated from one another.

[0017] The device 1 comprises:

- a singulator system 10;
- a plane rectangular resting wall 12 for the packs of postal objects, sliding on which is a motor-driven plane belt 13; and
- a drawing system 15 (built according to known techniques), which displaces the packs P along the belt 13 parallel to a direction of advance D towards the

singulator system 10, which is set at one end of the plane rectangular resting wall 12.

[0018] The singulator system 10 is designed to withdraw individually the postal objects that form a front end face of the pack; in particular, as will be clarified herein-after, the postal object 7 forming the front face of the pack comes to bear upon a plane gripping portion 18 (Figure 2) of a motor-driven belt withdrawing device 19, which moves the postal object 7 in a direction of unloading L transverse to the direction of advance D, separating it from the pack P.

[0019] The drawing system 15 further comprises a slide 27 (represented partially), which slides under the thrust of a motor device (not illustrated) along a rectilinear guide 26 parallel to the direction of advance D and carried by the wall 12.

[0020] The slide 27 comprises a U-shaped plane pusher element (messer knife) 29 having plane of lie transverse to the direction of advance D and perpendicular to the resting wall 12 and to the belt 13.

[0021] The pusher element 29 is designed to come to bear upon a rear face of a pack P of postal objects 7 resting on the top surface of the belt 13 for moving the front face of the pack P towards the singulation system 10.

[0022] The device 1 comprises an electronic control unit C (illustrated schematically in Figure 1) which controls, amongst other things, the motion of the slide 27 and of the pusher element 29, which move from a first end of the wall 12 (not illustrated) towards a second end of the wall 12 in the proximity of which the singulation system 10 is located. In this way, the packs P of postal objects resting on the resting wall 12 are pushed by the pusher element (messer knife) 29 and by the belt 13, which co-operates synchronously with the knife 29 (i.e., they are moved by the same mechanism), towards the singulation system 10 and advance in the direction of advance D.

[0023] The motor-driven belt withdrawing device 19 extends between a pair of motor-driven pulleys 30, which have axes perpendicular to the wall 12; in this way, the motor-driven belt withdrawing device 19 defines a pair of plane portions, one of which faces the pusher element 29 to provide the plane gripping portion 18.

[0024] In greater detail, the motor-driven belt withdrawing device 19 comprises four belts 19a, 19b, 19c and 19d separated from one another, carried by the pulleys 30 and each separated from the adjacent one/ones by a preset axial pitch P. The belts 19a, 19b, 19c and 19d are typically made of natural (or synthetic) rubber with a high coefficient of friction, for example, 0.6-0.8.

[0025] In this way, between adjacent belts 19a/19b, 19b/19c and 19c/19d a rectangular window 32 opens. In particular - in the example of embodiment described - three rectangular windows 32 are present parallel to one another and arranged at different heights (Figures 1 and 2).

[0026] Each withdrawing belt 19a, 19b, 19c and 19d has a plurality of circular through holes 33, which communicate with a suction system S (of a known type - illustrated partially) set in the space delimited towards the outside by the belts 19a, 19b, 19c and 19d that extend between the two pulleys 30.

[0027] The plane gripping portion 18 is then provided by a plane portion of the belts 19a, 19b, 19c and 19d that lies in a plane that is perpendicular to the wall 12; on the plane gripping portion 18 three rectangular windows 32 open. The direction of advance D is moreover perpendicular to the plane of the plane gripping portion 18.

[0028] An end postal object of the pack P comes into contact with the plane gripping portion of the belts 19a, 19b, 19c and 19d, to which it attaches thanks to the action of suction exerted by the holes 31 and to the action of friction exerted by the rubber that forms the belts 19a, 19b, 19c and 19d. The motion of the withdrawing belt 19 enables displacement of the postal object attached to the belts 19a, 19b, 19c and 19d with respect to the adjacent postal object, thus separating the postal object from the pack and feeding it along an unloading path that extends in the direction of unloading L.

[0029] The postal object 7 slides along the unloading path until it sets itself between a pair of motor-driven pinch rollers 35 set up against one another, which have axes perpendicular to the wall 12 and are designed to send the postal object (that sets itself between the two pinch rollers 35) towards a conveying system 36 of a known type that moves the postal object at a constant speed V.

[0030] The motor-driven pinch rollers 35 are provided with an outer surface coated with rubber with a high coefficient of friction and turn at constant speed. The speed of rotation is very high, such as to guarantee on the tangent to the point of contact a speed of the postal object equal to the speed V of the conveying system 36.

[0031] According to the present invention, the motor-driven belt withdrawing device 19 is coupled to a separator device 40, which moves between at least two positions, of which:

- a resting position (Figure 3), in which the separator device 40 does not interfere with the belt withdrawing device 19 and with the postal object during withdrawal from the pack by the withdrawing device 19; and
- an activation position (Figure 4), in which the separator device has a mobile portion that extends beyond the plane gripping portion towards the pack of objects and comes into contact with a rear portion of the postal object during withdrawal, moving it away from the belt withdrawing device 19.

[0032] In particular, the mobile portion of the separator device, in the example of embodiment illustrated, comprises three elongated bars 42, each of which is housed - in the resting position - in the space delimited between adjacent belts 19a/19b, 19b/19c, and 19c/19d and does not project beyond the gripping surface. The bars 42 are

rectilinear, parallel to one another and have a preferably circular cross section. Preferably, the bars 42 are made of steel having minimum coefficient of dynamic friction, in the region of 0.05-0.25.

[0033] The bars 42 are designed to set themselves - in the activation position - in a plane parallel to that of the plane gripping portion, projecting towards the outside of the belts 19a, 19b, 19c and 19d after having traversed the respective windows 32.

[0034] The reversible motion of the bars 42 from the resting position to the activation position (and vice versa) through the windows 32 occurs under the thrust of an electromagnetic actuator 45 (Figure 2) controlled by the electronic unit and having an output member (not illustrated) that is linearly mobile with reversible motion and supports the bars 42.

[0035] A barrier of n emitter/receiver sensors C (CO, C1, C2, ..., Cn - not illustrated for simplicity) is set aligned in a rectilinear direction parallel to the direction L, and the optical paths between emitters and receivers C (CO, C1, C2, ..., Cn) are interrupted by the edges of the postal object that moves in the direction L. The sensor CO (first sensor) is closest to the withdrawal area, whereas the sensor Cn (last sensor) is furthest from the withdrawal area and positioned slightly downstream with respect to the point of tangency of the pinch rollers 35.

[0036] The various operations of the device 1 carried out under the control of the electronic unit are illustrated with the aid of the flowchart of Figure 5.

[0037] Initially, with the postal object already accelerated by the withdrawing belt at the speed V, in block 100 a check is made to verify whether the last sensor Cn has detected the presence of a postal object 7. The detection typically occurs following upon interruption of the optical path existing between emitter and receiver of the sensor Cn.

[0038] If the presence is not detected, block 100 is followed by a block 110 that keeps in rotation the belts 19a, 19b, 19c and 19d at the speed V. From block 110 the flow returns to block 100. In this step, the separator device 40 is set in a resting position.

[0039] In this way, the motor-driven belts 19a, 19b, 19c and 19d proceed with their motion at constant speed V withdrawing the postal object that forms the front face of the pack.

[0040] Otherwise (i.e., if the last sensor Cn has detected the presence of a postal object 7 in so far as the postal object has moved away from the pack following upon its withdrawal) block 100 is followed both by a block 120, in which a command is issued for blocking the belts 19a, 19b, 19c and 19d, and by a block 125, in which a command is issued for activation of the anti-slide device.

[0041] In this way, following upon obscuration of the last sensor Cn, the withdrawing belt is stopped with a controlled deceleration ramp; the postal object 7 previously withdrawn from the pack moves at constant speed V drawn by the pair of pinch rollers 35, which send it towards the conveying system 34. The postal object sub-

sequent to the one withdrawn, which forms now the end face of the pack, is stationary. All the sensors of the first and second barriers have optical paths interrupted by the receding postal object or by the stationary postal object.

[0042] In addition, setting of the separator device 40 in the activation position brings about recession of the trailing edge of the postal object 7 from the belts 19a, 19b, 19c and 19d. Typically, operation of block 125, controlled practically together with operation of block 120, is activated when the leading edge of the postal object 7 is gripped between the pinch rollers 35 to prevent the trailing edge of the postal object withdrawn by the pinch rollers 35 from sliding on the belts 19a, 19b, 19c and 19d that are decelerating and then come to a stop.

[0043] Blocks 120 and 125 are followed by a block 130, where the control unit sets itself waiting for the following logic condition:

- at least one first sensor C_i detects the absence of a postal object.

[0044] Said condition corresponds to the creation of a gap between the trailing edge of the receding postal object and the leading edge of the stationary postal object.

[0045] In other words, a gap is created, which enables passage of a signal between at least one emitter and at least one receiver of the sensor C_i .

[0046] Block 130 is followed by a block 135, in which a command is issued for return of the anti-slide device into a resting position in order to enable gripping by the belts 19a, 19b, 19c and 19d on the next postal object to be withdrawn (the bars 42 in the extracted position - device 40 activated - would not enable gripping by the belts on the postal object).

[0047] The withdrawing belt is still kept stationary, and there is moreover triggered (block 140 parallel to block 135) computation of a correction time T_{COR} (by means of algorithms known and hence not illustrated - the correction time T_{COR} is calculated on the basis of the position of the sensor lit up C_i and on the basis of the speed V of the receding postal object), said correction time T_{COR} enabling a recession of the trailing edge of the postal object that is moving with respect to the leading edge of the stationary postal object, which enables creation of a pre-set gap between the postal objects being separated.

[0048] From block 160 the flow returns to block 100, and the belts 19a, 19b, 19c and 19d (and consequently the subsequent postal object withdrawn from the pack P) undergo a step of acceleration that brings their speed from 0 to V in the time T_{RAMP} .

[0049] In this way, the operations previously described are repeated, thus creating a flow of postal objects separated from one another with a constant gap g without the rear portion of the receding postal object possibly sliding on the motor-driven belt withdrawing device 19.

[0050] Added to the advantages of the present invention is the possibility of processing particular postal objects such as, for example, folded newspapers with a

transverse paper band. The effect of the anti-slide device 42 is also to prevent sliding-off of the paper band from the newspaper precisely because sliding of the band on the belts is prevented during deceleration or when the belts are stationary.

Claims

1. A singulator device for flat rectangular postal objects, comprising:

- a resting surface (12, 13) for the packs of postal objects;
- a motor-driven belt withdrawing device (19); and
- a drawing system (15), which displaces the packs towards a plane gripping portion of said motor-driven belt withdrawing device (19) designed to withdraw individually a postal object that constitutes a front end face of the pack, displacing it in a direction transverse to the direction of drawing and loosening it from the pack,

said singulator device being **characterized in that** said motor-driven belt withdrawing device (19) is coupled to a separator device (40), which moves between at least two positions, of which:

- a resting position, in which the separator device (40) does not interfere with the belt withdrawing device (19) and with the postal object during withdrawal from the pack by the withdrawing device (19); and
- an activation position, in which a mobile portion of the withdrawing device extends beyond the plane gripping portion towards the pack of objects to come into contact with a rear portion of the postal object during withdrawal, moving it away from the belt withdrawing device (19) and preventing sliding of the rear portion on the belt or sliding-off of a band for closing the postal object, in particular a newspaper.

2. The device according to Claim 1, wherein said motor-driven belt withdrawing device (19) comprises at least one pair of adjacent belts carried by end pulleys (30) and separated axially, with respect to one another, by a pre-set axial pitch (P) for defining an elongated window that opens between the two adjacent belts;

said mobile portion of the separator device comprising an elongated element (42) which is housed - in the resting position - in the space delimited between adjacent belts (19a/19b, 19b/19c and 19c/19d) and does not project beyond the surface of the plane gripping portion;

said elongated element (42) is designed to set itself

- in the activation position - in a plane parallel to that of the plane gripping portion, projecting towards the outside of the belts (19a, 19b, 19c and 19d) after having traversed the respective window (32).

of pinch-rollers, which are designed to send the postal object towards a conveying system.

3. The device according to Claim 2, wherein said elongated element is a bar that has a substantially circular cross section.

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4. The device according to Claim 2 or Claim 3, wherein said elongated element is made of metal material, preferably steel, and has a coefficient of dynamic and static friction decidedly lower than the coefficient of friction of the rubber of the belts (19a, 19b, 19c and 19d).

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5. The device according to Claim 2, Claim 3, or Claim 4, wherein said elongated element has a coefficient of friction in the region of 0.05-0.25.

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6. The device according to Claim 1, wherein the motor-driven belt withdrawing device (19) comprises four belts (19a, 19b, 19c and 19d) separated from one another, carried by end pulleys (30) and each set at a distance from the adjacent one/ones by a preset axial pitch (P); pairs of adjacent belts (19a/19b, 19b/19c and 19c/19d) delimiting major sides of three rectangular windows (32) parallel to one another and arranged at different heights;

the mobile portion of said separator device comprising three elongated bars (42), each of which is housed - in the resting position - in the space delimited between adjacent belts (19a/19b, 19b/19c and 19c/19d) and does not project beyond the gripping surface;

said bars (42) are designed to set themselves - in the activation position - in a plane parallel to that of the plane gripping portion projecting towards the outside of the belts (19a, 19b, 19c and 19d) after having traversed the respective windows (32);

the separator device comprising an electromagnetic actuator (45) having an output member that is linearly mobile with reversible motion and supports the bars (42).

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7. The device according to Claim 1, wherein control means are provided, designed to govern arrangement (125) of said belt withdrawing device between the resting position and the activation position when a leading edge of the receding postal object reaches a pre-set position with respect to the motor-driven belt withdrawing device.

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8. The device according to Claim 1, wherein control means are provided, designed to govern arrangement of said belt withdrawing device from the resting position to the activation position when a leading edge of the postal object is inserted between a pair

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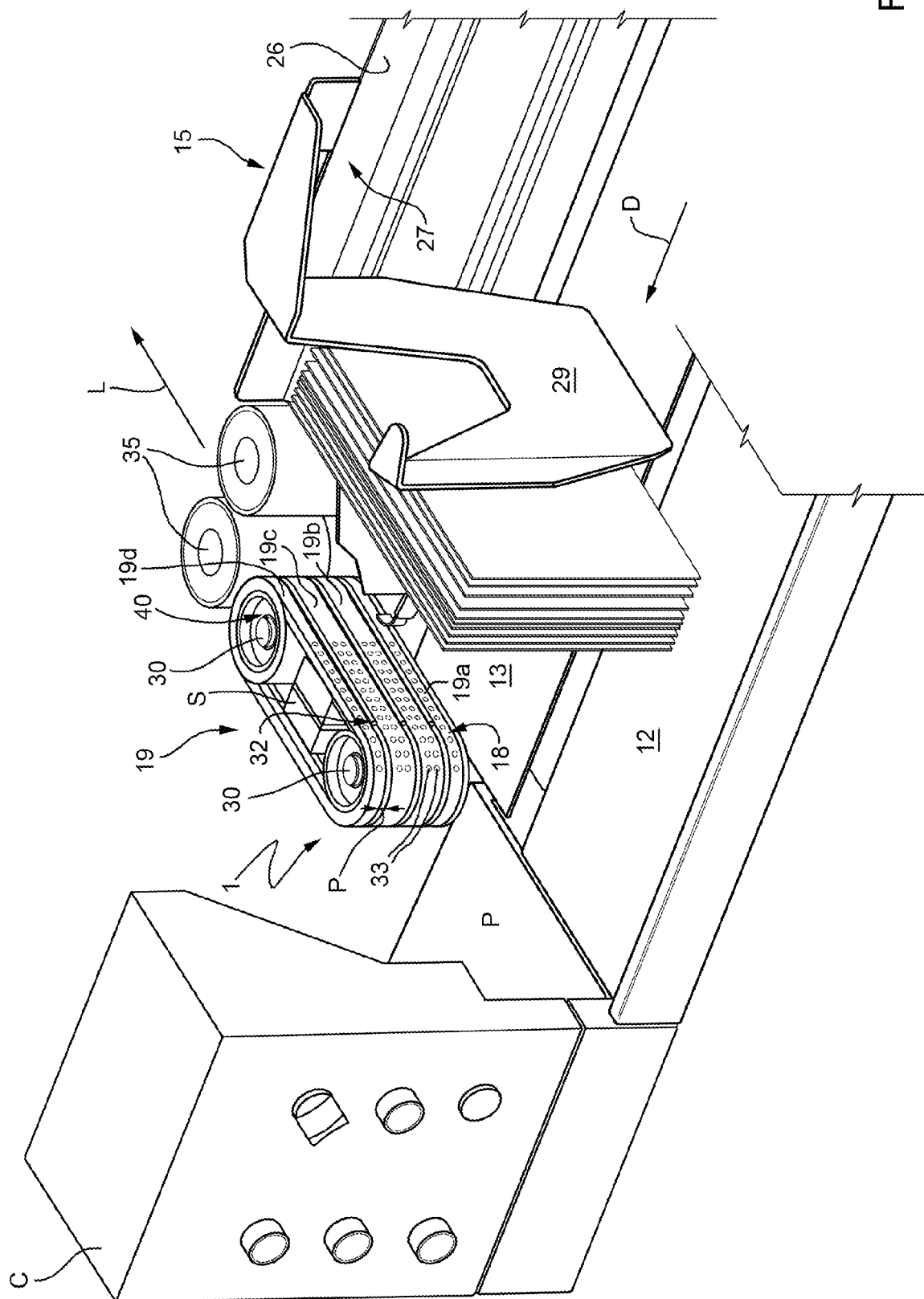


FIG. 1

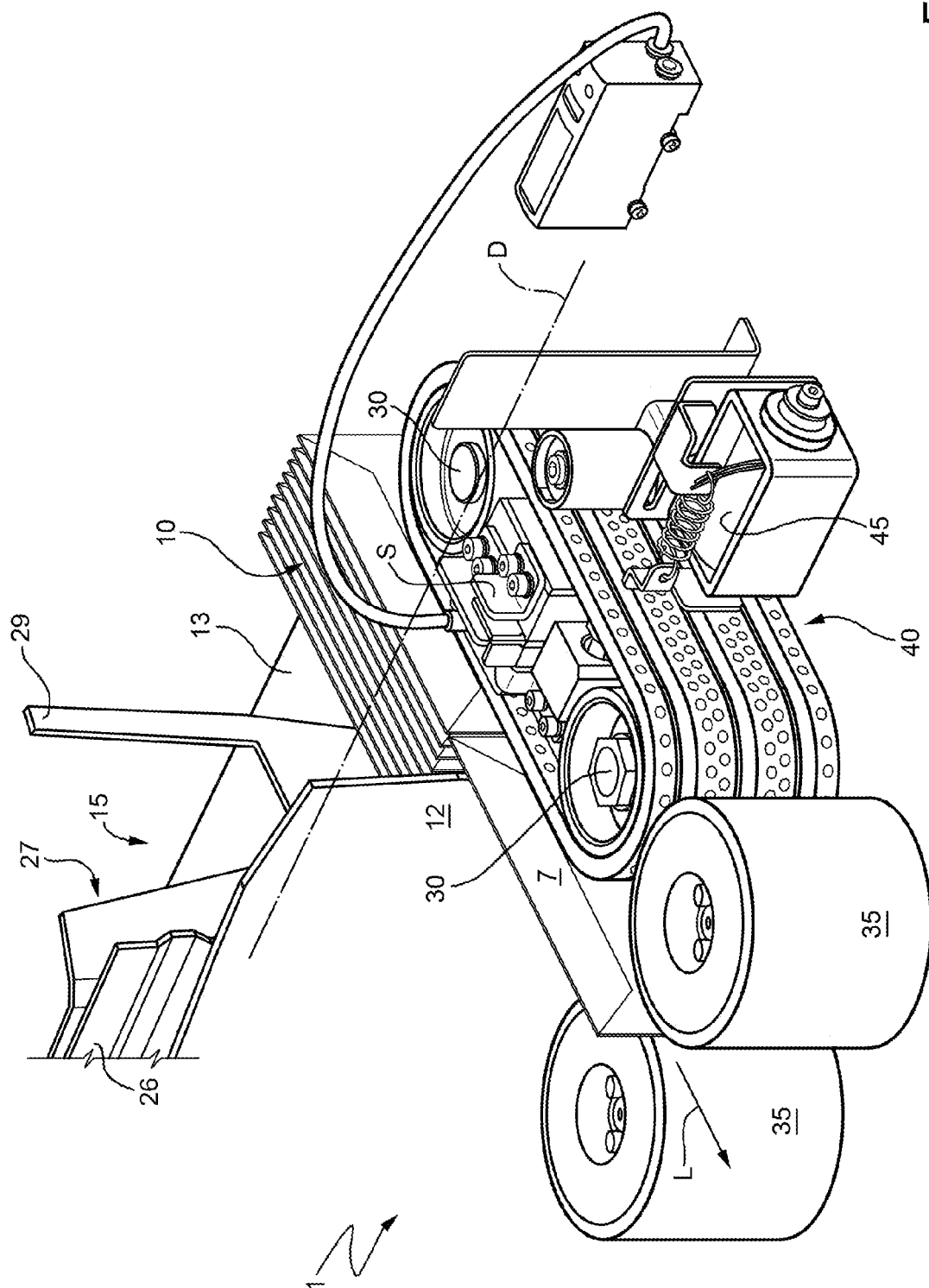


FIG. 2

FIG. 4

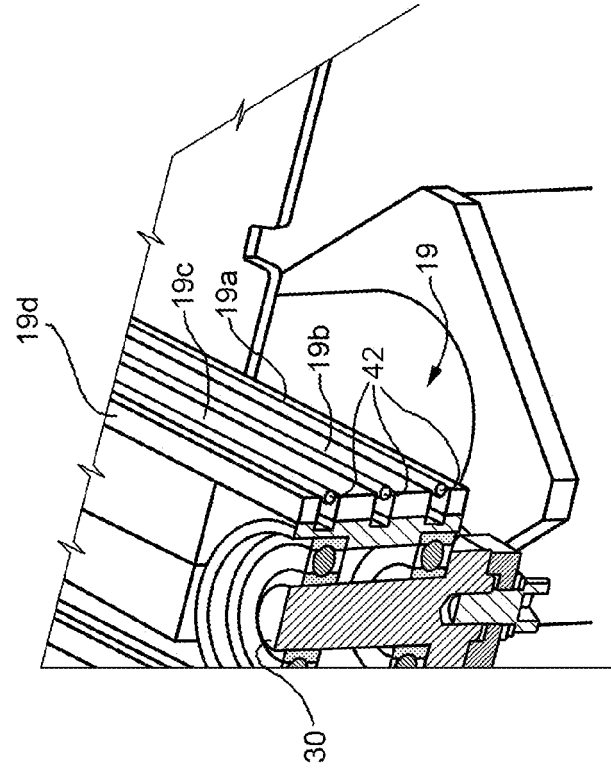
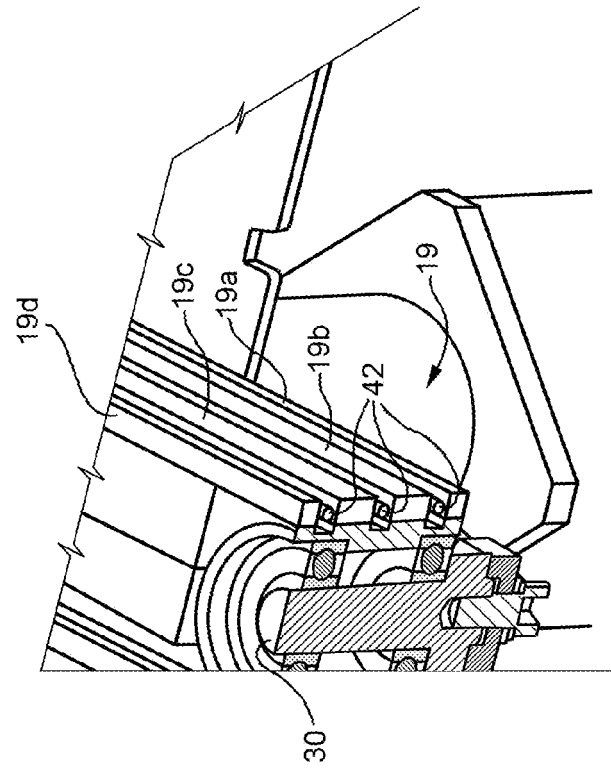


FIG. 3



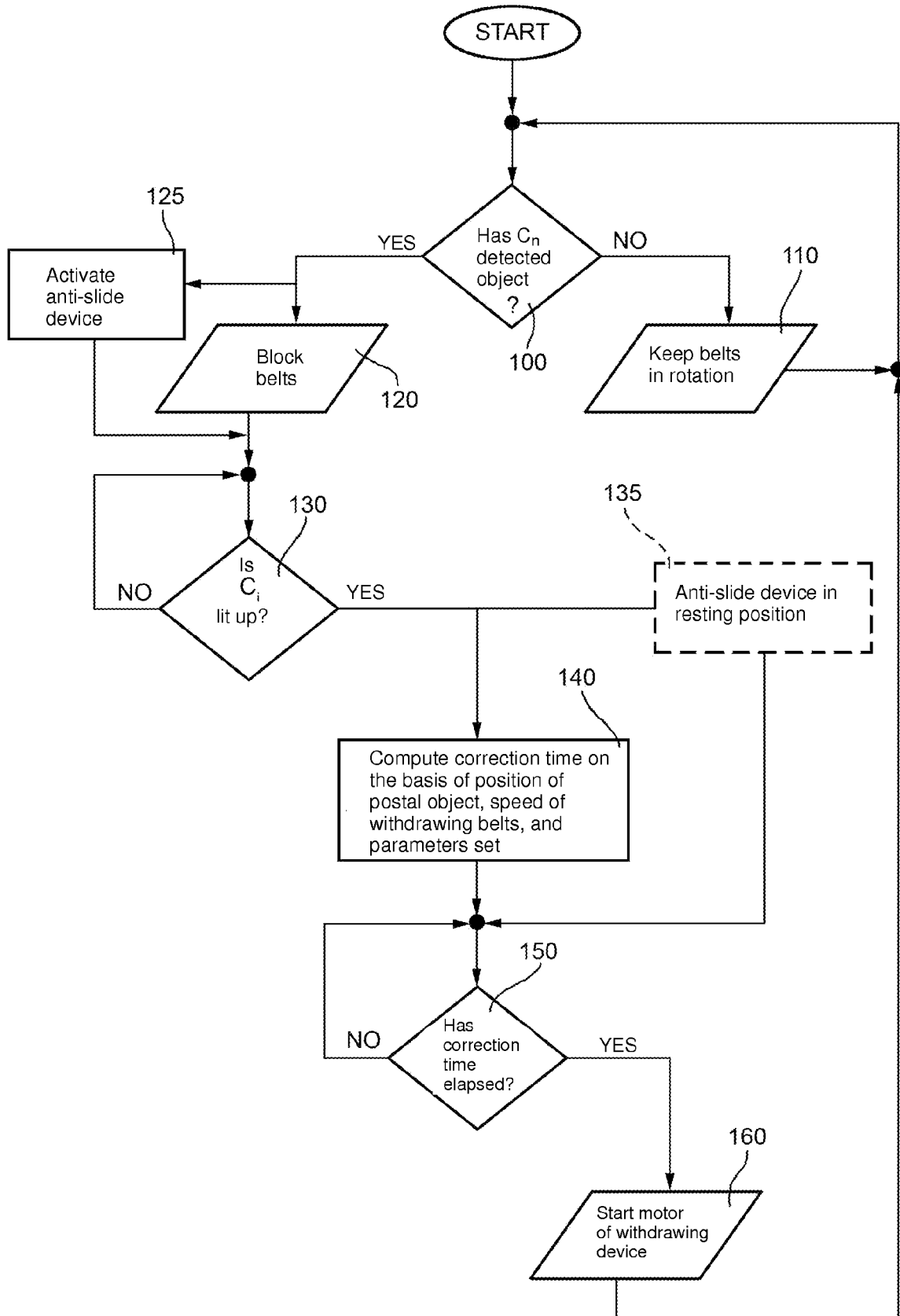


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 10 42 5245

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 101 40 497 C1 (SIEMENS DEMATIC AG [DE]) 13 March 2003 (2003-03-13)	1	INV. B07C1/04 B65H3/04
A	* paragraphs [0020] - [0028]; figure 1 *	2-8	
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	* pages 24,26-28; figure 6B *		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B07C B65H
1	Place of search Munich	Date of completion of the search 24 January 2011	Examiner Golombek, Gregor
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 42 5245

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The members are as contained in the European Patent Office EDP file on
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24-01-2011

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