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

(11) EP 1 939 122 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.07.2008 Bulletin 2008/27

(51) Int Cl.:
B65H 3/52 *(2006.01)* ***B65H 3/06*** *(2006.01)*

(21) Application number: **06077330.6**

(22) Date of filing: **28.12.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(71) Applicant: **Neopost Technologies**
92220 Bagneux (FR)

(72) Inventors:
- **Remeijnse, Jan Jacobus Peter**
  7943 JS Meppel (NL)
- **Munneke, Christiaan Antoon**
  9203 EE Drachten (NL)

(74) Representative: **van Loon, C.J.J. et al**
c/o VEREENIGDE
Johan de Wittlaan 7
2517 JR Den Haag (NL)

(54) Method and apparatus to control and calibrate the distance between a conveyor roller and a friction retainer in an apparatus for separating sheets from a stack

(57) In an apparatus for separating sheets from a stack (2), the relative positions of a conveyor roller (5) and a separating surface (9) are adjusted by bringing a single specimen of the sheets to be separated in the separating area (4), activating a drive (11, 24) for driving rotation of the conveyor roller (5), and carrying out at least once an adjustment cycle. The adjustment cycle includes measuring a variable dependent on resistance encountered by the drive (11, 24), checking the measured resistance against a predetermined criterion; and, if the measured value of this variable does not meet the predetermined criterion, operating the adjustment structure (10) to adjust at least the position of the conveyor roller relative to the separating surface or the position of the separating surface (9) relative to the conveyor roller (5) and restarting the adjustment cycle until the measured resistance meets the predetermined criterion.

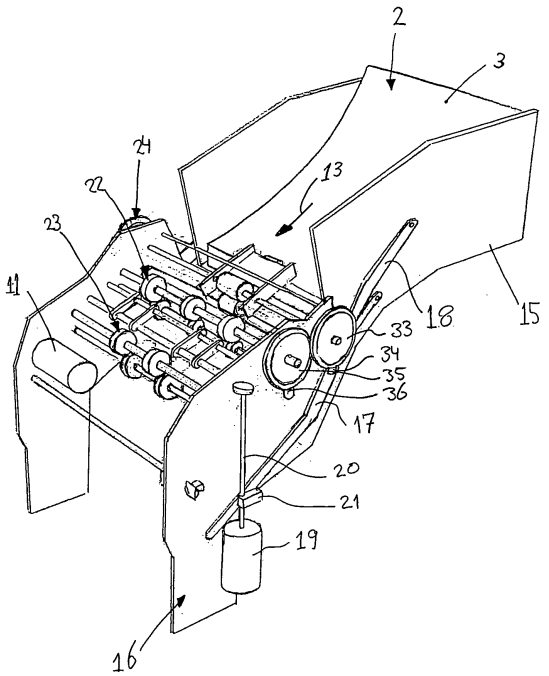

FIGURE 1

EP 1 939 122 A1

Description

TECHNICAL FIELD AND BACKGROUND ART

[0001] The invention relates to a method for adjusting an apparatus for separating sheets, such as paper or plastic sheets or envelopes, from a stack and to such an apparatus. In such apparatuses sheets from a top or bottom end of a stack are fed into a separating area where each time a sheet is separated and from where the separated sheet is fed individually. For separating the sheets, several principles of operation are known, such as friction separation and gap separation.

[0002] In friction separation, a sheet is individually separated from other sheets having been fed to the separating area because friction between on the one hand a surface urging an outer one of the sheets in transport direction and friction between a separating surface restraining next sheets from being entrained by the outer sheet and the next sheets in contact with the separating surface are higher than the friction between the outer sheet and the next sheet or sheets. Separation based on this principle does generally not require any adjustment by an operator to properties of the sheets to be separated, but is relatively sensitive to the condition of the surfaces contacting the sheets and of the properties of the surfaces of the sheets and is less suitable for processing relatively thick sheets and for separating items that each are constituted by two or more sheets, such as brochures.

[0003] In gap separation, a gap between conveyor and separating surfaces facing the separating area from opposite sides is set such, that only one sheet or set of sheets at a time can pass through the gap. When two or more sheets are fed to the separating area at the same time, the next sheets are restrained by the separating surface from being entrained by the outer sheet or set of sheets, since the next sheet or sheets do not fit between the conveyor and separating surfaces together with the outer sheet or set of sheets. Thus, only the outer sheet is transported in the transport direction and thereby separated from the others. This enables to separate sheets or sets of sheets reliably with little, if any, significant influence of the properties of the surfaces facing the separating area or of the surfaces of the sheets to be separated. However, the gap needs to be adjusted by an operator by adjusting the positions relative to each other of the surfaces facing the separating area from opposite sides, to the thickness of the type of sheets or of the sets of sheets to be separated from the stack. To adjust the relative positions of the surfaces facing the separating area from different sides, the operator may for instance initially set the relative positions such that a specimen of the sheets to be separated can easily be brought into the separating area and subsequently adjust the position of one of the surfaces towards the separating area until the operator senses slight amount of friction between the sheet and the surfaces facing the separating area. This is a cumbersome procedure and the adjustment depends on the experience and feeling of the operator.

SUMMARY OF THE INVENTION

[0004] It is an object of the invention to provide a solution for adjusting the adjustable relative positions of a conveyor and a separating surface facing a separating area in an apparatus for separating sheets from a stack, which does not rely on the experience on the part of the operator operating the apparatus.

[0005] According to the present invention, this object is achieved by providing a method according to claim 1. The invention may also be embodied in a separating apparatus according to claim 9, which is specifically adapted for use in this method.

[0006] By using the measured value of the variable dependent on resistance encountered by the drive as a measure for determining whether at least the position of the conveyor roller relative to the separating surface or the position of the separating surface relative to the conveyor roller needs to be adjusted or adjusted further, it can be determined reliably and accurately and in a simple manner without relying on the experience of the operator, whether the separating apparatus needs to be adjusted or adjusted further.

[0007] Particular embodiments of the invention are set forth in the dependent claims. Further aspects, effects and details of the invention are set forth in the detailed description with reference to examples of which some are shown in the schematic drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a perspective view of an example of an apparatus according to the invention;
Fig. 2 is an enlarged perspective view of a portion of the apparatus shown in Fig. 1 including a conveyor roller and a separating surface;
Fig. 3 is a perspective view of a portion of the apparatus shown in Figs. 1 and 2 including the portion shown in Fig. 2, with a sheet between the conveyor roller and the separating surface; and
Fig. 4 is a perspective view of a portion of a version of an apparatus according to Figs. 1-3 that is additionally equipped with a gripper.

MODES FOR CARRYING OUT THE INVENTION

[0009] The invention is first discussed with reference to an example of an apparatus according to the invention shown in Figs. 1-3. The apparatus has a hopper tray 15 for holding a stack 2 of sheets. The hopper tray 15 is suspended relative to a main frame 16 via two pairs of bars 17, 18 that are each pivotably linked to the frame 16 and to the hopper tray 15. For lifting and lowering the hopper tray 15, a motor 19 is mounted to the frame 16.

A threaded drive shaft 20 coupled to the motor 19 engages a nut 21 that is mounted to one of the bars 17. A feeding roller 1 is positioned and arranged for feeding sheets 3 from a stack 2 in a transport direction, indicated by an arrow 13, to a separating area 4, after the hopper tray 15 has been lifted to a position in which an uppermost sheet 3 of the stack is near the feeding roller 1. The feeding roller 1 is rotatably suspended in a rocker arm 25 which is suspended pivotably about a shaft 7 and coupled to a solenoid 26 for bringing the feeding roller 1 selectively in and out of contact with the uppermost sheet 3 of the stack 2.

[0010] Downstream in transport direction 13 of the feeding roller 1, a conveyor roller 5 and a separating surface 9 are arranged. The conveyor roller 5 has a circumferential surface 6 extending around its axis of rotation 7. The separating surface is provided in the form of a circumferential surface of a separating roller 8. Portions of the circumferential surface 6 of the conveyor roller 5 and of the separating surface 9 face the separating area 4 from opposite sides and in essentially opposite directions. Downstream of the separating area 4, two sets of transport rollers 22, 23 are arranged for transporting sheets that are being separated away from the stack 2.

[0011] A motor 11 is coupled to the conveyor roller 5 via a drive train 24 for driving rotation of the conveyor roller 5 about its axis of rotation 7 in a sense of rotation for transporting a sheet 3 in contact with its circumferential surface 6 in the transport direction 13. The drive train 24 is also coupled for driving the separating roller 8 in a sense of rotation for urging a sheet in the separating area 4 that is in contact with the circumferential surface 9 of the separating roller in a direction opposite to the transport direction 13. Moreover, the drive train 24 is coupled to the transport roller sets 22, 23 for driving these sets of rollers.

[0012] For the separation to function reliably, the relative positions of the conveyor roller 5 and the separating surface 9 are critical. In the present example, the correct distance between the conveyor roller 5 and the separating surface 9 depends inter alia on the thickness and the surface properties of the sheets to be separated. A too small distance will cause that the delivery of sheets is unreliable and the sheets mat become damaged. If the distance is too large, more than one sheet or set of sheets may be delivered at a time and the delivery of sheets may become unreliable.

[0013] For adjusting the position of the separating surface 9 relative to the conveyor roller 5, an adjustment structure 10 is provided. According to the present example, the adjustment structure 10 includes a DC-motor 27, a schematically shown control system 12 coupled to the motor, a drive shaft 28 and a pulse disk 29 coupled to the motor 27, a pulse detector 30 and a separating roller carrier 31 having a threaded bore which engages a threaded end 32 of the drive shaft 28.

[0014] For measuring rotation of the conveyor roller 5, a measuring unit is provided, which includes a pulse disk 33 rotationally fixed to the shaft 7 (and thus also relative to the conveyor roller 5 and a pulse detector 34 mounted along the periphery of the pulse disk 33 and connected to the control system 12. For measuring rotation of the set of transport rollers 22, a pulse disk 35 is rotationally fixed to one of the shafts of that set of rollers 22 for co-rotation with the transport rollers on that shaft and a pulse detector 36 is mounted along the periphery of the pulse disk 35 and also connected to the control system 12. The signals sent by the pulse detectors 34, 36 to the control system 12 may represent just the detection of pulses, but may also represent angular movement or the rotational velocity of the respective pulse disk 33, 35. Instead of by pulse disks and counters, the rotation of the conveyor roller and of the transport rollers may also be monitored by monitoring commands sent to a stepper motor or commands sent to a brushless DC motor.

[0015] The control system 12 is arranged for controlling the motor 11 and the drive train 24 for driving the conveyor roller 5 and the transport roller sets 22, 23 and the motor 27 for adjusting the distance between the separating surface 9 and the conveyor roller, before separation of sheets from the stack 2 is started or continued, to carry out a procedure as is described below.

[0016] First, the separating surface 9 is retracted far enough to allow reliable entry of a sheet or a set of mutually connected sheets 3 into the separating area 4. Then, a single specimen 3 of the sheets or sets of sheets in the stack 2 to be separated is brought into the separating area 4, either by hand or by placing a single sheet or set of sheets in the hopper tray 15 and entering a command that causes the control system 12 to control the motor 11 and the drive train 24 such that the feeding roller 1 engages the sheet or set of sheets 3 and advances it in the transport direction 13 into a position extending into the separating area 4.

[0017] Then, the control system 12 controls the motor 11 and the drive train for driving the rotation of the conveyor roller 5, while the sheet 3 is held stationary and thereby refrained from being displaced by the conveyor roller 5. As the conveyor roller 5 rotates, the pulse detector sends information representative of rotation of the conveyor roller 5 to the control system 12. This rotation is dependent on resistance encountered by the drive 11, 24, because the motor 11 will be slowed down by the encountered resistance.

[0018] It is noted that instead of rotation or rotational velocity, also other variables dependent on resistance encountered by the drive could be measured and checked against a criterion, such as a change in velocity, the current required to achieve a certain rotational velocity or the torque exerted to achieve a certain rotational velocity.

[0019] Next, the control system 12 compares the received value representative of rotation of the conveyor roller 5 with a predetermined criterion in the form of a value range for the rotation of the conveyor roller 5 that would have been obtained if the resistance encountered,

mainly caused by friction between the conveyor roller and the sheet 3, would have been within a predetermined range.

[0020] If the received value representative of rotation of the conveyor roller 5 is outside the predetermined range, a next adjustment cycle is started after the adjustment motor 27 has been controlled to adjust (preferably reduce) the position of the separating surface 9 relative to the conveyor roller 5. If the received value representative of rotation of the conveyor roller 5 is inside the predetermined range, the adjustment procedure is completed and terminated by removing the test sheet 3 from the separating area 4. A warning signal is generated, for example in the form of an audio signal or a visual signal on a display, if none of the measured variables obtained throughout an available range of the adjustment structure 10 meets the predetermined criterion.

[0021] It is noted that a sheet 3 may also be inserted after the drive 11 for rotation of the conveyor roller 5 is activated. Also, the adjustment cycle may be a continuous process in which the conveyor roller 5 is rotated and the variable dependent on the encountered resistance is continuously or repeatedly measured while adjusting the position of the separating surface 9.

[0022] If the adjustment structure and control system operates fast enough, it is possible to carry out an adjustment cycle during the transportation of the sheet through the separating area instead of while holding the sheet or set of sheets stationary. In that case, the resistance encountered by the drive driving the conveyor roller depends mainly on the friction between the test sheet and the separating surface.

[0023] In particular if the conveyor roller 5 is set to run at high speeds, it is advantageous to hold the test sheet 3 stationary in the separating area 4 while carrying out the adjustment cycle. The sheet 3 can be held stationary by hand or by a grip of the separating apparatus. In Fig. 4, a version of the separating apparatus shown in Figs. 1-3 is shown that is equipped with a grip 14 for holding the test sheet 3 stationary in the separating area 4. The grip 14 is rotationally fixed to a shaft 37 of which rotation indicated by an arrow 38 can be operated by a solenoid 39 under control of the control system 12. Before the sheet 3 has been brought in the position extending in the separating area 4, the grip 14 was in a raised position pivoted away from the path to be followed by the sheet as it is passed into the position extending into the separating area 4. In Fig. 4, the grip 14 is shown in an activated position in which it is lowered and engages the sheet 3. After the adjustment procedure has been completed, the grip 14 is pivoted away from the sheet 3 again under control of the control system 12.

[0024] The criterion against which the variable dependent on the resistance encountered by the drive is checked may be selected such that the relative positions of the conveyor roller and the separating surface at which the variable meets the criterion is such that these positions are suitable for and retained for operation. However, it is also possible, to provide that the criterion against which the variable dependent on the resistance encountered by the drive is checked is selected such that the relative positions of the conveyor roller and the separating surface at which the variable meets the criterion is such that these positions are too far apart or too close together for operation. In that case, after the variable representative of the resistance encountered by the drive has been found to meet the criterion, the relative positions of the conveyor roller and the separating surface are adjusted further by a margin. This margin may be a fixed value or related to the relative positions of the conveyor roller and the separating surface.

[0025] Such a difference between the relative positions of the conveyor roller and separating surface when the criterion is met and the desired relative positions of the conveyor roller and separating surface during operation can be advantageous for a more accurate detection of a resistance encountered by the drive that meets the predetermined criterion.

[0026] For instance, a difference between the torque delivered to a conveyor roller driven in unloaded condition and the torque delivered to a conveyor roller driven while pressed against a sheet may only be measurable reliably if the distance between the conveyor roller and the separating surface is smaller than the distance between the conveyor roller and the separating surface in operating condition. By first adjusting the apparatus until the measured difference meets the predetermined criterion and subsequently retracting the conveyor roller and/or the separating surface by a predetermined distance, the relative positions of the conveyor roller and the separating surface can reliably be set to a setting at which the resistance encountered by the drive is not accurately measurable.

[0027] The control system 12 has a memory 40 for storing a setting value representing the position of the separating surface 9 relative to the conveyor roller 5. After adjusting the position of the separating surface 9 relative to the conveyor roller 5, the setting value representing the position to which the separating surface 9 has been adjusted can be stored in the memory 40 as a job setting, for instance in combination with other job settings. When, at a later time, after the sheets of a stack have been separated, the sheets of a next stack of sheets of the same type are to be separated, the need of an adjustment cycle can be avoided by operating the control system 12 to directly adjust the position of the separating surface 9 to the position represented by the setting value stored in the memory 40 for the sheets of that type.

[0028] In use, the thickness of the circumferential surface 6 of the conveyor roller 5 and the separating surface 9 of the separating roller 8 may wear. Due to such wear, the actual relative position of the separating surface 9 relative to the section of the circumferential surface 6 of the conveyor roller 5 that faces the separating area 4 when adjusted in accordance with a given setting value may change. Moreover, changes in temperature and

ageing of the material of the rollers 5, 8 may affect the position to which the separating surface needs to be adjusted for reliable operation, in particular, it may be required to position the separating surface 9 differently to exert the same normal force onto a sheet 3 extending in the separating area 4. Hence, in time, the optimal position of the conveyor roller 5 and the separating surface 9 may deviate from the stored position of the adjustment structure 10.

[0029] To compensate for such effects, the control system 12 is arranged for use in a calibration cycle to determine a reference position of the separating surface 9 relative to the conveyor roller 5. The reference position is established by, prior to bringing a single specimen of the sheets to be separated in the separating area 4, carrying out at least once a calibration cycle.

[0030] A first step of the calibration cycle is to measure the variable dependent on resistance encountered by the drive 11, 24 driving rotation of the conveyor roller 5. Instead, a variable dependent on a contact force pressing the conveyor roller and the separating surface against each other may be measured. An advantage of measuring a variable dependent on the contact force pressing the conveyor roller and the separating surface against each other is, that such a measurement does not require the conveyor roller to be driven so that rubbing of the conveyor roller over the separating surface can be avoided. The contact pressure may for instance be measured by measuring the torque exerted by a drive of the adjustment structure while the adjustment structure is controlled for moving the separating surface to the conveyor roller. When the separating surface touches the conveyor roller, the torque exerted by the drive of the adjustment structure will increase. When the exerted torque reaches a predetermined value, the reference position has been reached and the drive is stopped or uncoupled or a slip coupling will slip.

[0031] Next, the measured value of the variable dependent on resistance encountered by the drive 11, 24 or, where applicable, the variable dependent on a contact force pressing the conveyor roller and the separating surface against each other is checked against a predetermined criterion. If the measured value meets the predetermined criterion, a value representing the current position of the separating surface 9 relative to the conveyor roller 5 is stored as a reference position in a memory. If the measured value does not meet the predetermined criterion, the adjustment structure 10 is operated to adjust or to further adjust the position of the separating surface 9 relative to the conveyor roller 5 and to restart the calibration cycle.

[0032] By carrying out the calibration cycle prior to the adjustment of the position of the separating surface 9, the operating position of the separating surface 9 can thereafter be determined as a value relative to a reference position in which the separating surface 9 is in contact with the conveyor roller 5 with an, at least to a certain extent, predetermined contact pressure. Thereby, the value representing the operating position of the separating surface is made independent of manufacturing tolerances and wear of the conveyor roller and the separating surface 9. If a job is to be carried out by the separating apparatus for which a value representing the operating position of the separating surface 9 is stored, the position of the separating surface 9 can be adjusted very accurately without the need of an adjustment cycle involving the presence of a test sheet 3 in the separating area by carrying out the calibration cycle once or more, until a new reference position has been found and subsequently adjusting the position of the separating surface to a position relative to the reference position in accordance with the stored value representing the operating position of the separating surface 9.

[0033] When the circumferential surface 6 of the conveyor roller 5 and/or the separating area 9 are worn too far, the separating surface 9 cannot reach a reference position in which the resistance encountered by the drive 11, 24 or the contact pressure between the conveyor roller and the separating surface meets the predetermined criterion. The control system 12 is arranged for generating a signal for warning the operator that the conveyor roller 5 and/or the separating surface 9 is/are worn too far. For example by causing a warning to be shown on a display. Alternatively or additionally, the control system 12 may be arranged to cause such a warning signal to be generated if a reference position is reached, but is located outside a predetermined range.

[0034] From the foregoing, it will be clear to the skilled person that within the framework of invention as set forth in the claims also many variations other than the examples described above are conceivable. For instance, the conveyor roller(s) and the separating surface(s) may be positioned in positions that are mutually staggered in transport direction and/or perpendicularly to the transport direction, so that the sheets are to some extent flexed when engaged by the conveyor roller(s) and the separating surface(s) and the bending stiffness of the sheets influences the normal forces and thus the frictional forces exerted thereon.

[0035] Also, the separating surface may also be provided in the form of one or more stationary surfaces instead of as a circumferential surface of a roller or the roller may be suspended stationary and optionally be rotatable manually to bring a fresh surface section in a position facing the separating area, if the surface section presently facing the separating area is worn out.

[0036] Furthermore, instead of as a feeder for feeding sheets from an upper end of a stack, an apparatus and method according to the invention may also be applied in a so-called bottom feeder in which sheets are fed from a bottom end of a stack, or the sheets may be fed from either end of a stack that is oriented so as to have an essentially horizontal stacking direction.

[0037] The control system may be arranged to only signal to an operator that the adjustment structure must be operated to adjust the position of the conveyor roller

and/or of the separating surface, either manually or by activating a drive displacing the conveyor roller and/or the separating surface.

[0038] Instead of for adjusting the position of the separating surface relative to the conveyor roller by displacing that surface, or in addition thereto, the adjustment structure may also be arranged for adjusting the position of the separating surface relative to the conveyor roller by displacing the conveyor roller. Thus, the relative positions of the separating surface and of the conveyor roller may be adjusted by displacing the separating surface and/or the conveyor roller.

[0039] Furthermore, the adjustment structure may be arranged for manually driven adjustment, for instance by turning a thumb wheel. To indicate to an operator how to adjust the position of the separating surface relative to the conveyor roller, the control system 12 may then be arranged to cause the operator to be signaled in which direction to turn the wheel and whether a setting suitable for operation has been reached.

Claims

1. A method for adjusting an apparatus for separating sheets, such as paper or plastic sheets or envelopes, from a stack (2), the apparatus comprising:

a feed roller for feeding sheets from the stack (2) in a transport direction to a separating area (4);
a conveyor roller (5) having a circumferential surface (6) extending around an axis of rotation (7) of the roller;
a separating surface (9),
wherein the circumferential surface (6) of the conveyor roller (5) and the separating surface (9) face the separating area from opposite sides;
a drive (11, 24) for driving rotation of the conveyor roller (5) about its axis of rotation (7) in a sense of rotation for transporting a sheet in contact with the circumferential surface (6) in said transport direction;
an adjustment structure (10) for adjusting at least the position of the conveyor roller relative to the separating surface or the position of the separating surface (9) relative to the conveyor roller (5);
said method comprising:

bringing a single specimen of the sheets to be separated in the separating area (4), activating the drive (11, 24) for driving rotation of the conveyor roller (5), and carrying out at least once an adjustment cycle comprising:

a) measuring a variable dependent on resistance encountered by the drive (11, 24) driving rotation of the conveyor roller (5);
b) checking the measured value of the variable dependent on resistance encountered by the drive (11, 24) against a predetermined criterion; and
c) if the measured value of the variable dependent on resistance encountered by the drive (11, 24) does not meet the predetermined criterion, operating the adjustment structure (10) to adjust at least the position of the conveyor roller relative to the separating surface or the position of the separating surface (9) relative to the conveyor roller (5) and restarting the adjustment cycle.

2. A method according to claim 1, wherein, at least prior to bringing a single specimen of the sheets to be separated in the separating area (4), at least once a calibration cycle is carried out, said calibration cycle comprising:

a) measuring at least the variable dependent on resistance encountered by the drive (11, 24) driving rotation of the conveyor roller (5), or measuring a variable dependent on a contact force pressing the conveyor roller and the separating surface against each other (10);
b) checking the measured value of the variable dependent on resistance encountered by the drive (11, 24) or of the variable dependent on the contact force pressing the conveyor roller and the separating surface against each other (10) against a predetermined criterion; and
c) if the measured value meets the predetermined criterion, storing at least the position of the conveyor roller relative to the separating surface or of the separating surface (9) relative to the conveyor roller (5) as a reference position in a memory, or, if the measured value does not meet the predetermined criterion, operating the adjustment structure (10) to adjust at least the position of the conveyor roller relative to the separating surface or the position of the separating surface (9) relative to the conveyor roller (5) and restarting the calibration cycle.

3. A method according to claim 2, further comprising, subsequent to the at least one adjustment cycle and the at least one calibration cycle:

determining at least the position of the conveyor roller relative to the separating surface or the position of the separating surface (9) relative to the conveyor roller (5) relative to the stored reference position; and

storing the determined position relative to the stored reference position in a memory.

4. A method according to claim 2 or 3, wherein said variable dependent on a contact force pressing the conveyor roller (5) and the separating surface (9) against each other is obtained by measuring a torque exerted by a drive driving the adjustments structure (10).

5. A method according to any one of the preceding claims, wherein a warning signal is generated if none of the measured variables obtained throughout an available range of adjustment structure (10) meets the predetermined criterion.

6. A method according to any one of the preceding claims, wherein the specimen of the sheets to be separated is held stationary in the separating area (4) while measuring the value of said variable dependent on resistance encountered by the drive (11, 24).

7. A method according to any one of the preceding claims, wherein said variable dependent on resistance encountered by the drive (11, 24) is a measure for the rotational velocity speed of the conveyor roller (5).

8. A method according to any one of the preceding claims, further comprising, after the at least one adjustment cycle, operating the adjustment structure (10) to adjust at least the position of the conveyor roller relative to the separating surface or the position of the separating surface (9) relative to the conveyor roller (5) by a predetermined distance to an operating position.

9. An apparatus for separating sheets, such as paper or plastic sheets or envelopes, from a stack (2), the apparatus comprising:

a feed roller for feeding sheets from the stack (2) in a transport direction to a separating area (4);
a conveyor roller (5) having a circumferential surface (6) extending around an axis of rotation (7) of the roller;
a separating surface (9);
wherein the circumferential surface (6) of the conveyor roller (5) and the separating surface (9) face the separating area (4) in essentially opposite directions;
a drive (11, 24) for driving rotation of the conveyor roller (5) about its axis of rotation (7) in a sense of rotation for transporting a sheet in contact with the circumferential surface (6) in said transport direction;
an adjustment structure (10) for adjusting at least the position of the conveyor roller (5) relative to the separating surface or the position of the separating surface (9) relative to the conveyor roller (5);
a measuring unit (33, 34) for measuring a variable dependent on resistance encountered by the drive (11, 24) driving rotation of the conveyor roller (5);
a control system for controlling the adjustment structure (10) and the drive (11, 24) connected to the measuring unit (33, 34) for receiving the measured value or values, said control system being arranged for carrying out at a method comprising at least one adjustment cycle, comprising:

a) activating the drive (11, 24) for driving the rotation of the conveyor roller (5);
b) receiving, from the measuring unit (33, 34), a variable dependent on resistance encountered by the drive (11, 24);
c) checking the received value dependent on resistance encountered by the drive (11, 24) against a predetermined criterion; and
d) if the received value dependent on resistance encountered by the drive (11, 24) does not meet the predetermined criterion, restarting the adjustment cycle for a next cycle after the position of the conveyor roller (5) relative to the separating surface or the position of the separating surface (9) relative to the conveyor roller (5) has been readjusted.

10. An apparatus according to claim 9, further comprising a grip (14) for holding a specimen of the sheets (3) to be separated stationary in a position in which a portion of the sheet (3) is in the separating area (4).

11. An apparatus according to claim 10 or 11, wherein the apparatus comprises a drive (27, 28) for driving the adjustment structure (10).

12. An apparatus according to claim 11, wherein the control system (12) is arranged and connected for controlling the drive (27, 28) driving the adjustment structure (10).

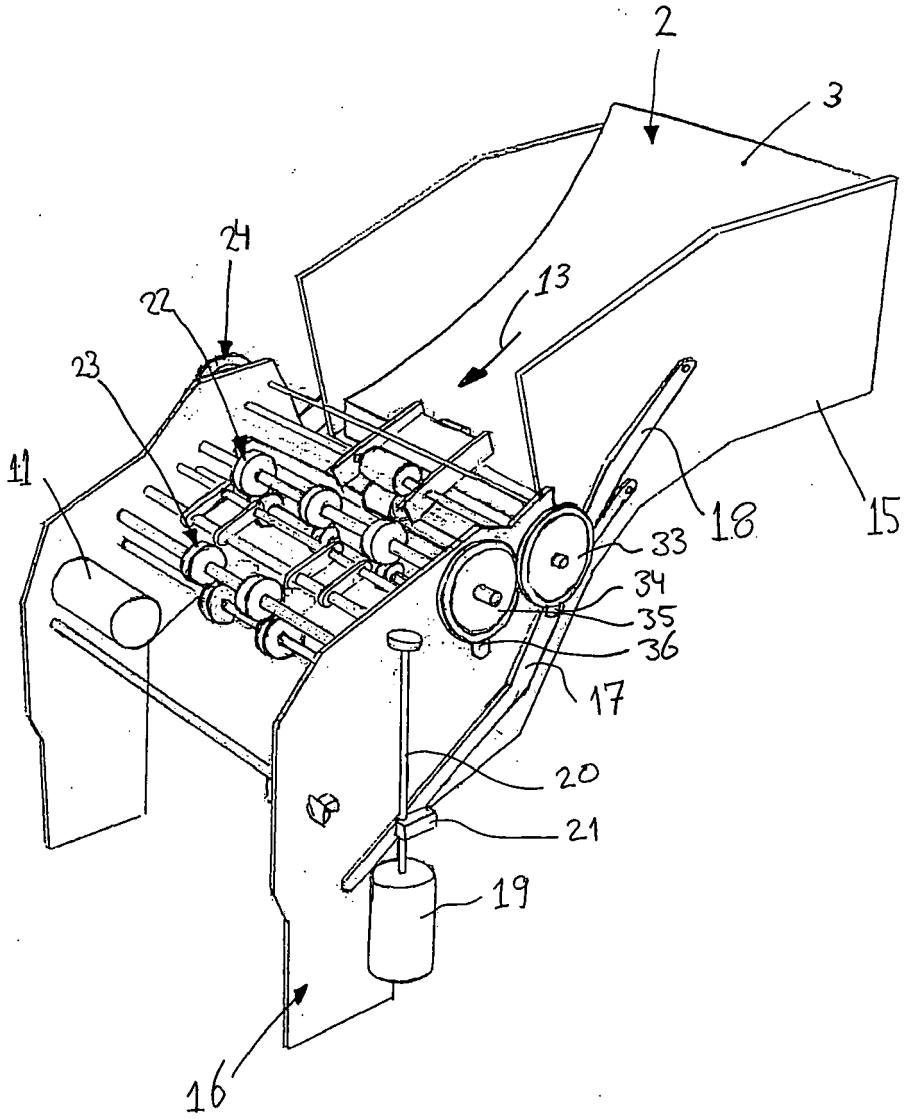

FIGURE 1

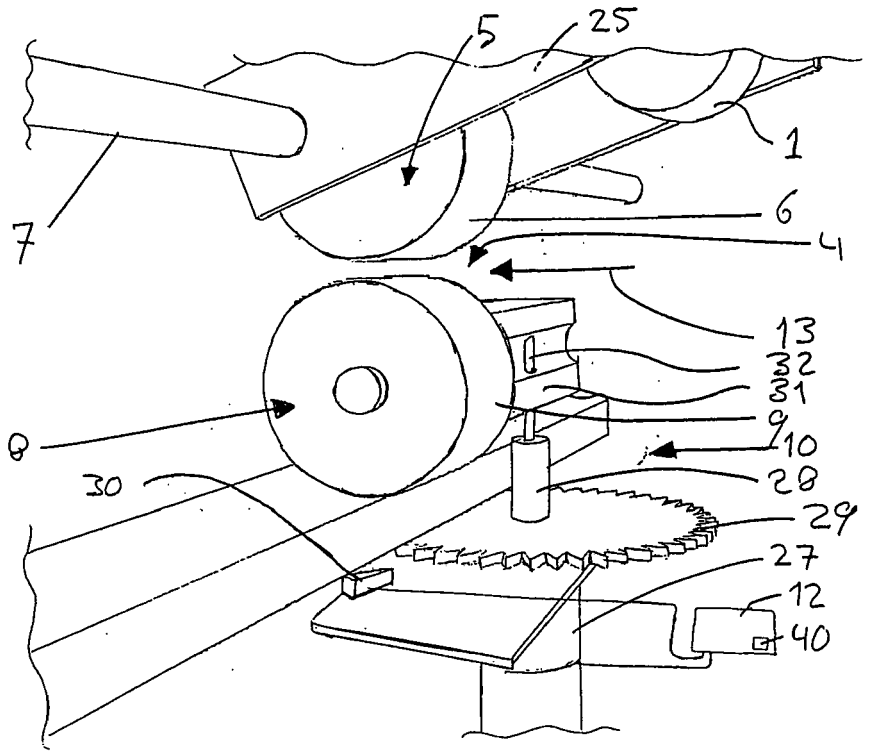

FIGURE 2

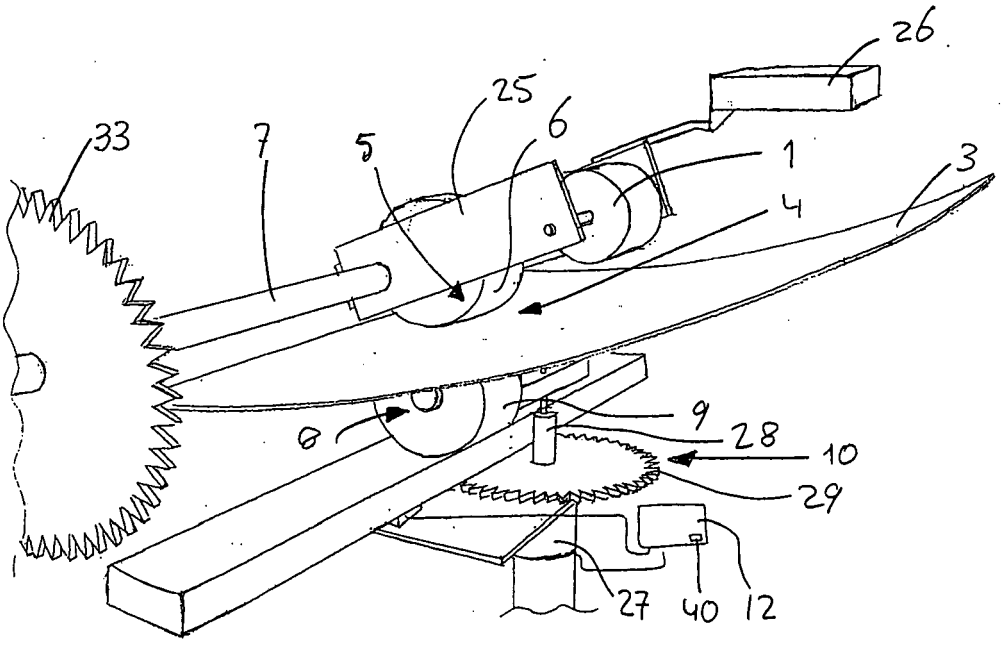

FIGURE 3

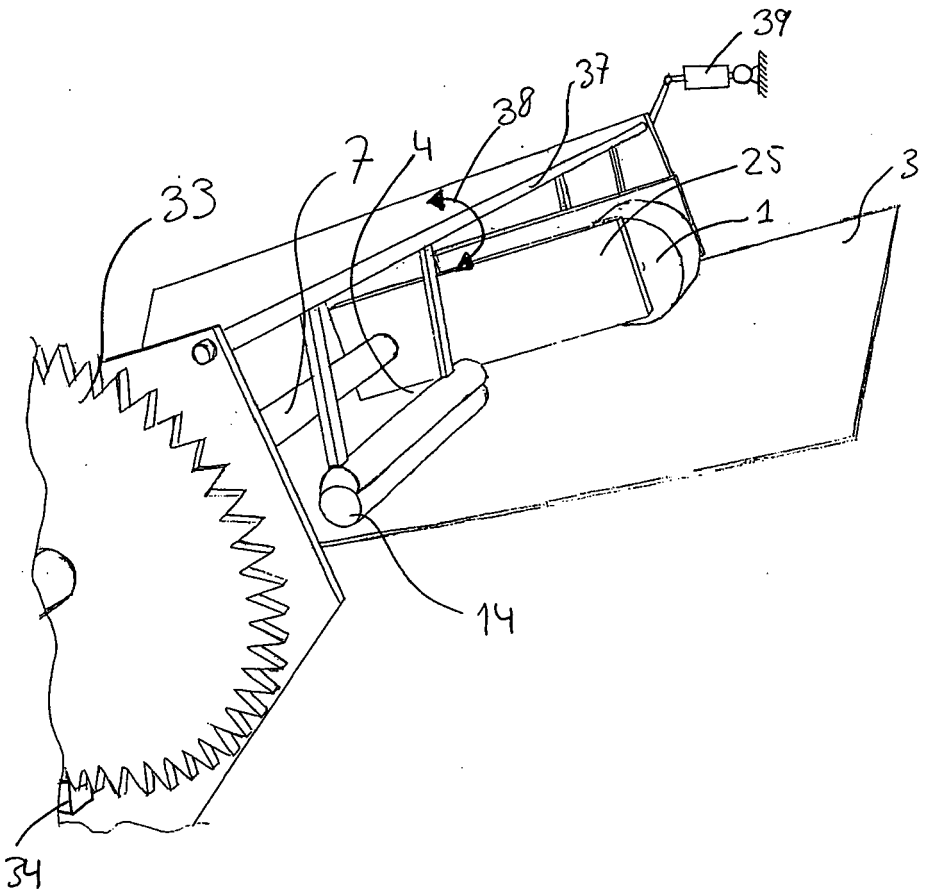

FIGURE 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 07 7330

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	JP 04 197936 A (OKI ELECTRIC IND CO LTD) 17 July 1992 (1992-07-17) * abstract; figures 1-7 *	1,8,9, 11,12	INV. B65H3/52 B65H3/06
Y	JP 62 171849 A (CANON KK) 28 July 1987 (1987-07-28) * abstract; figures 1,2 *	1,4,5, 7-9	
Y	US 5 678 817 A (SAITO YOSHIHIRO [JP] ET AL) 21 October 1997 (1997-10-21) * column 10, line 3 - line 45; figures 2-5 *	1,4,5, 7-9	
Y	JP 04 333432 A (NIPPON ELECTRIC CO) 20 November 1992 (1992-11-20) * abstract; figures 1-3 *	1,9	
Y	JP 55 111337 A (FUJITSU LTD) 27 August 1980 (1980-08-27) * abstract; figures 2,4 *	1,9	
A	US 4 603 848 A (MARKGRAF WILHELM [DE] ET AL) 5 August 1986 (1986-08-05) * column 2, line 10 - line 21; figures 5,6 * * column 7, line 38 - column 8, line 16 *	1,6,9,10	TECHNICAL FIELDS SEARCHED (IPC) B65H
X	US 5 172 900 A (UNO KAZUO [JP] ET AL) 22 December 1992 (1992-12-22) * the whole document *	1,9	
A	GB 2 156 788 A (LAUREL BANK MACHINE CO) 16 October 1985 (1985-10-16) * page 2, line 33 - line 107; figure 2 *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 May 2007	Uhlig, Robert

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 07 7330

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

04-05-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 4197936 A	17-07-1992	JP 2636497 B2	30-07-1997
JP 62171849 A	28-07-1987	NONE	
US 5678817 A	21-10-1997	JP 3197163 B2	13-08-2001
		JP 8085641 A	02-04-1996
JP 4333432 A	20-11-1992	NONE	
JP 55111337 A	27-08-1980	NONE	
US 4603848 A	05-08-1986	DE 3412574 C1	10-10-1985
		EP 0157343 A2	09-10-1985
		JP 60228340 A	13-11-1985
US 5172900 A	22-12-1992	JP 4012947 A	17-01-1992
GB 2156788 A	16-10-1985	DE 3511345 A1	17-10-1985
		JP 1597192 C	28-01-1991
		JP 2020536 B	09-05-1990
		JP 60213642 A	25-10-1985
		US 4605217 A	12-08-1986

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82