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

(11) EP 1 415 552 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
08.02.2006 Bulletin 2006/06

(51) Int Cl.:
A24B 3/06 *(2006.01)*

(21) Application number: **02024626.0**

(22) Date of filing: **04.11.2002**

(54) **Apparatus and method for delaminating parcels of tobacco**

Einrichtung und Verfahren zum Lösen von Tabakballen

Appareil et procédé pour séparer des balles de tabac

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LU MC NL PT SE SK TR
Designated Extension States:
LT SI

(43) Date of publication of application:
06.05.2004 Bulletin 2004/19

(73) Proprietor: **Philip Morris Products S.A.**
2000 Neuchâtel (CH)

(72) Inventors:
- **Spry Roger**
  Hants SP11 8BW (GB)
- **Lauenstein Michael**
  2036 Cormondrèche (CH)

(74) Representative: **Gritschneder, Martin et al**
Abitz & Partner
Poschingerstrasse 6
81679 München (DE)

(56) References cited:
EP-A- 0 244 138
EP-A- 1 254 606
US-A- 4 532 946
US-A- 4 597 396

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 415 552 B1

Description

[0001] The invention relates to an apparatus and method for delaminating tobacco in the form of slices from a layered parcel of tobacco. The apparatus comprises a turnover device, a main conveyor and a rotatable tine assembly. The tobacco parcels are usually delivered to the delaminating apparatus with horizontal layering. The turnover device includes a swivel axis and tips the parcels such that the layering is vertical. The main conveyor transports the tipped parcels of tobacco to a separating location at the outlet end of the main conveyor. The tine assembly is arranged at the outlet end of the main conveyor at a distance above the main conveyor and comprises a shaft on which a plurality of tines is mounted in a star-like configuration. The shaft extends at right angles to the main conveyor and parallel to the layering of the parcel and includes a plurality of tines which are pointed and profiled to at least partly extend in the direction of rotation of the tine assembly and the tine assembly is driven at a circumferential speed greater than that of the main conveyor. The tines are adapted to enter the parcel at an entry point in a direction substantially parallel to the layering of the parcel and to accelerate a slice away from the parcel in order to separate the slice of tobacco from the parcel.

[0002] Tobacco is supplied to cigarette manufacturers in the form of parcels. These parcels are usually layered due to the tobacco leaves having been laid flat one on top of the other and subsequently compressed and will be separated into slices prior to conditioning of the tobacco in continuous conditioning cylinders. The problem with separating out these parcels is that considerable degradation of the tobacco leaves often results.

[0003] EP-A-0 244 138 discloses a tobacco delaminating apparatus as outlined above, wherein one or two rotatable tine assemblies can be provided at the separating location. One tine assembly is arranged below the layered parcel of tobacco and the other above the parcel in the embodiment with two rotatable tine assemblies. The rotatable tine assemblies may be driven at any speed greater than that of the conveyor or not driven at all. Two designs are disclosed for the tines: the tines are continuously curved in the first design and angled in the second. The tines have an inner radial part and an outer part arranged at an angle of about 45° to the radius in the second design. At least the edge portions of the tobacco lamina are deformed or crushed when separated by the tines.

[0004] European Patent Application EP 1 254 606 A1 (prior art according to Art. 54(3) EPC) relates to an apparatus and method for delaminating parcels of tobacco, wherein the axis of the tine assembly is arranged at a distance above the parcel such that the line from the axis of the tine assembly to the entry point forms an angle of between 14 and 24°, preferably about 16°, with the horizontal and by the peripheral speed of the tine assembly being about three to five times the linear speed of the main conveyor. The actual height of each parcel is measured by a vision system before the processing of the parcel and the vertical position of the tine assembly is adjusted such that this angle is achieved. The tobacco parcels are transported by a conveyor and the parcel length is measured and the speed of the conveyor and of the tine assembly are adjusted so that the last slice has the same thickness as the other slices. The tobacco parcels are delivered to the delaminating apparatus with horizontal layering and a turnover device is provided for tipping a parcel of tobacco onto the conveyor so that the layering is vertical.

[0005] The problem underlying the invention resides in how to increase the obtainable number of delaminations or slices per parcel for a given flow rate and to reduce the changeover time between one parcel and the next parcel so as to allow a more consistent tobacco flow rate.

[0006] This problem is solved according to the invention by the swivel axis of the turnover device being guided in rails such that the swivel axis can be moved to and fro in the direction of the conveyor.

[0007] The tobacco flow and moisture consistency are improved by the invention and the tobacco is better protected for subsequent processing.

[0008] The movable turnover device transports a parcel already before tipping it or during tipping into such a distance from the delamination or separation position that the parcel, when tipped by the turnover device, is already in the delamination position.

[0009] The apparatus comprises preferably a height measuring device for measuring the height (h) of a parcel when the layering of the parcel is horizontal and means for moving the turnover device in response to the measured height of a parcel. The apparatus is thus able to handle parcels of different heights (measured at right angles to the layering).

[0010] The apparatus comprises preferably a parcel follow-up device for tracking the trailing edge of a parcel and stabilizing it during delamination.

[0011] The apparatus comprises preferably a controller for controlling the turnover device such that it is withdrawn from the parcel and returned to the inlet end of the main conveyor to accept a new parcel once the tipped parcel is stabilized by the follow-up device.

[0012] The apparatus according to the invention comprises preferably a weighing device for weighing a parcel, the controller adjusting the speed of the conveyor in response to the weight of the parcel so as to acquire a predetermined flow rate.

[0013] Each tine comprises a support arm and a blade. In order to separate slices of tobacco from parcels of tobacco in such a manner as to avoid substantial degradation of the tobacco leaves, the support arm has an inner part extending radially from the shaft and an outer part extending almost tangentially, there being a smooth transition between the inner and the outer parts. The blade is mounted at the tip of the outer part. The blade

preferably has a width of 100 to 200 mm in axial direction and a height of about 50 mm in tangential direction. The blade moves vertically into the laminations at a speed, having a horizontal component coincident with the movement of the tobacco parcel. The blade is not sharp. Its tip has a radius of a few millimeters so that it is prising the tobacco rather cutting. It propagates the natural lamination. The blade facilitates the prising apart of the slices and enters the tobacco parcel, causing prising to occur. The blade may be regarded as the primary active area of the tine. The rest of the outer part is designed such that it does not interfere with the tobacco.

[0014] The tines are arranged in a star-like fashion on the shaft and look like a paddle wheel. The shaft carries preferably a plurality of such paddle wheels, with the blades of each paddle wheel being aligned with the blades of the other paddle wheels.

[0015] Tobacco parcels range from oriental bales at 25 to 100 kg through C-48 cartons at 160 to 200 kg and through to hogsheads at 400 to 450 kg. Since the material is delaminated with the laminations vertical, the structural integrity of the tobacco to be delaminated has to be taken into consideration such that the delamination range may be 25-50 mm on oriental bales, 40-80 mm on C-48 cartons and 100-200 mm on hogsheads. C-48 cartons have a dimension of 0.72 m in the direction of lamination and hogsheads have a diameter of 1.2 m so that the height of those parcels is 0.72 m and 1.2 m respectively when lying on the conveyor belt where the lamination is vertical.

[0016] Pre-packaged tobacco other than reconstituted tobacco and preblended materials are packed in C-48 cartons.

[0017] The term "bale" is used in the following to designate any one of the above-mentioned types of tobacco parcels.

[0018] The concept of rotary tines for delaminating tobacco bales has shown to be both tolerant of different tobacco materials and able to supply a continuous flow of tobacco to the next stage of the process. The full potential of the concept may be realized by considering the concept as having three sections:

- bale identification
- bale handling
- bale delamination

[0019] All three sections are controlled by the controller.

[0020] The bale identification section comprises an inlet conveyor, a static weighing device and a height measuring device. The tobacco bale is received on the inlet conveyor and is conveyed through the static weighing device and the height measuring device. The weight and height information is processed by the controller and the information provided to the bale handling section.

[0021] The bale handling section includes the main conveyor and the turnover device. In the bale handling section, the bale is transported by the main conveyor to the turnover device which is mounted on linear slides with positioning capability. The turnover device moves the bale further to a position where the trailing edge of the bale has a distance from the delamination position equal to the measured height (h) of the bale, and tips the bale. Because the height (h) measured at the bale identification section is the length after the bale is turned over, the leading edge of the turned-over bale is in the proper position for the first delamination, i.e. the delamination position. Accordingly, as the controller determines the tipping position of the turnover device in accordance with measured height (h), the tobacco bale when turned-over is already at the delamination position.

[0022] The bale delamination section includes the bale follow-up mechanism and the rotary tine assembly which is positioned at a distance greater than the bale height (h) above the outlet end of the main conveyor. In the bale delamination section, the bale is transported by the main conveyor beneath the rotary tine assembly. The follow-up mechanism tracks the basic face of the bale and moves at the same rate as the main conveyor while the bale is delaminated into slices.

[0023] Depending on the tobacco type and flow rate, different designs of tines will be used, but the fundamental requirements are similar and comply with the following:

- The bale moves towards the delamination tines with the laminations oriented vertical and normal to the direction of travel.
- The tine enters the bale with its tip vertical.
- The shape of the tines and the peripheral speed of the tine assembly permits initial movement of the tine tips when entering the bale in order to be coincident with the horizontal movement of the tobacco.
- The shape of the back of the tine following initial penetration is such that its point of contact with the bale moves in horizontal direction at about the main conveyor speed without interfering.
- The horizontal velocity component of the tine accelerates during the delamination phase up to where the separation of the slice, which started during the initial prising, is completed.
- As the rotation of the tine assembly continues, the horizontal component of the tine velocity increases up to about 3 to 5 times the horizontal velocity of the bale.
- The upper edge of the delaminated slice is contained in a pocket between adjacent tines, a leading tine and a trailing tine, until the leading tine rises sufficiently to permit the slice to be released.

- The pocket must be larger at the height of the bale than the slice to be delaminated.

[0024] As the delaminating device processes only one bale at a time, the tines are "parked" in an open pocket position during the short changeover period between two bales, permitting the new bale to be introduced into the mechanism. In the "parked" position the paddle wheel awaits the arrival of the bale with one of the tines a short distance above the separating location. This facilitates equal delamination slices to be generated and within a time interval that allows mass flow capability.

[0025] The shape, size and number of tines are selected dependent on the tobacco type, density and delamination thickness, but in all cases the pocket between the tines is able to accommodate the delaminated slice. The larger the bale, the larger the tines and the fewer tines are required.

[0026] The preceding or leading tine is used to control the release of the delaminated slice to ensure a consistent feed to the next phase of the process.

[0027] The bale is not held by the following tine during the delaminating process as the new concept has low distorting forces and allows for bale stability.

[0028] In order for optimal delamination to occur, it is preferred that certain geometric relationships are maintained for the penetration ratio, the prising ratio and the delamination ratio. The penetration ratio is the relationship between the final depth of penetration and height of the bale. It should be in the range of 15% - 50%, preferably 18% - 30%. The prising ratio is the relationship between the cumulative width of the blade tip and the bale width. It should be in the range of 20% - 50%, preferably 25% - 30%. The delamination ratio is the relationship between the delamination thickness of the bale and the height of the bale. It should be within the range of 4% - 40%, preferably 6% - 17%.

[0029] The controller adjusts the speed of the main conveyor belt and the time to process the bale to achieve the flow rate required.

[0030] Preferably, all drives in the bale handling section are variable speed with positioning devices.

[0031] The apparatus is particularly advantageous in view of its ability to delaminate the bales into small, equal-sized slices. The delaminating apparatus is immediately followed in the tobacco processing by a continuous conditioning cylinder in which the dry tobacco is heated and humidified. It is this process that protects the tobacco during subsequent processing. In order to optimize this process it is essential that small, equal-sized portions are fed into the conditioning cylinder. That low-mass flow variation enables the process to achieve low-temperature standard deviation and low-moisture standard deviation.

[0032] The apparatus is able to improve conditioning performance as the slices are typically 15% - 30% of the weight of presently generated horizontal and vertical slices, thus producing a significantly greater number of slices for a given mass throughput. This improved input control substantially reduces the incidence of pads (unconditioned tobacco) exiting the conditioning cylinder.

[0033] An embodiment of the present invention will now be described with reference to the accompanying drawings in which:

Fig. 1	is a side view of a delaminating apparatus according to one embodiment of the invention;
Fig. 2	is a plan view of the apparatus of Fig. 1;
Fig. 3	is a rear view of the apparatus of Fig. 1;
Fig. 4	is a side view of the paddle wheel;
Fig. 5	is a front view of the paddle wheel and
Figs. 6 to 14	show the sequences of the delaminating.

[0034] Referring to the drawings, the delaminating apparatus comprises a bale or tobacco parcel identification section 1, a bale handling section 2 and a bale delamination section 3. All three sections are controlled by a controller not shown in the drawings.

[0035] The bale identification section includes an inlet conveyor 12, a static weighing device 16 and a height measuring device. A number of bales or tobacco parcels 10 are delivered by transport means not shown in the drawings to the inlet end of the inlet conveyor 12 which includes a horizontal section 14. Even if the bales 10 delivered to the bale identification section 1 are of the same type, they have slightly different dimensions and weights. The weighing device 16 is, therefore, included in the section 14 of the inlet conveyor 12 and the measured weight is input into a controller not shown. The height h of the bale 10 is also measured e.g. by a vision system including a CCD camera and input into the controller.

[0036] The bales are conveyed by the inlet conveyor 12 after these measurements to the bale handling section 2. The bale handling section 2 includes a horizontal main conveyor 18 and a turnover device 22. The main conveyor 18 includes a continuous belt 20 and it forms together with the inlet conveyor 12 practically a continuous conveying surface. The main conveyor 18 can therefore take bales 10 from the inlet conveyor 12 and transport them to the bale turnover device 22.

[0037] The bale turnover device 22 comprises two first flaps 26 and two second flaps 28. The first and second flaps 26, 28 extend from a swivel axis 30 and the first flaps 26 include an angle of 90° with the second flap 28. The swivel axis 30 is mounted in slides guided in rails 23 so that the turnover device is movable by drive means to and fro in the direction of the main conveyor 18. The rails 23 are arranged beneath the upper section of the

main conveyor belt 20. In Figure 1 the first flaps extend horizontally towards the inlet end of the main conveyor 18 and slightly below the plane of the upper section of its continuous belts 20 while the second flaps 28 extend vertically upwards. In this position the bale turnover device 22 is ready to receive bales 10. Each bale 10 is comprised of substantially parallel, stacked layers of tobacco leaves. The bales are delivered to the bale identification section 1 with horizontal layering and transmitted by the inlet conveyor 12 to the main conveyor 18 and the bale turnover device 22 with such horizontal layering. As soon as the leading edge of the bale 10 touches the second flaps 28, the first and second flaps 26, 28 are swivelled clockwise (seen in Figure 1) through 90° so that the tipped or turned-over bale 10 stands on the upper section of the belts 20 of the main conveyor 18 with vertical layering.

[0038] The bales 10 are positioned one at a time by the turnover device 22 at a separating or delamination location 40 below the separating device 42. The turnover device 22 is moved during tipping along the rails 23 such that the leading edge of the bale 10, after having been tipped, is located at a separating or delamination position 40 near the outlet end of the main conveyor 18. The tipped-over bale 10 rests on the main conveyor 18 and will be conveyed further by it during the bale delamination process.

[0039] The bale delamination section 3 comprises a bale follow-up device 24 and a separating device 42. The bale follow-up device 24 includes a slide guided in rails 25 arranged at a distance slightly greater than the diagonal dimension of the largest expected bales 10 above the main conveyor 18 to ensure that the rails 25 do not interfere with the bales during their tipping movement. A pair of arms 34 is pivotally mounted on the slide and can be swivelled between an active, vertically inclined position and an inactive, horizontal position. With the arms 34 in the active, vertical position, the bale follow-up device 24 tracks the basic face or trailing edge of the tipped-over bale in order to stabilize the bale 10 when it is being transported on the main conveyor 18 through the separating device 42. The bale follow-up device 24 is moving at the same rate as the main conveyor 18. Once the bale is stabilized by the bale follow-up device 24 the turnover device 22 is withdrawn from the bale 10 and swivelled back to accept the next bale.

[0040] The separating device or tine assembly 42 comprises a shaft 44 extending substantially horizontally and at right angles to the direction of movement of the main conveyor 18. The shaft 44 is positioned at such a height above the main conveyor 18 that the bales 10 can pass on the conveyor 18 below the shaft 44.

[0041] The shaft 44 mounts a plurality of tines 46. Viewed from the side, the tines 46 are arranged in a star-like configuration with equal angular distance between the tines 46. The tines 46 have an inner part 48 extending radially from the shaft 44 and an outer part 50 extending almost tangentially, there being a smooth transition between the inner and the outer parts 48, 50. The outer parts 50 of the tines 46 extend through about 30°. A blade 49 is mounted at the tip of each tine 46. The tines 46 arranged star-like on the shaft 44 look like a paddle wheel 52. As shown in Fig. 2, shaft 44 carries three such paddle wheels 52.

[0042] When one of the bales 10 has been laid down by the turnover device 22 below the separating device 42, i.e. at the separation or delamination location, one of the blades 49 enters the bale 10 at a location 54 offset from the forward end by the intended slice thickness and proceeds in a direction substantially parallel to the layering so as to penetrate behind a first slice 56. The shaft 44 is positioned at a height above the upper side of the bale 10 such that the line from the entry point 54 to the axis of the shaft 44 forms an angle of between 18° and 21° to the horizontal. The tip of the outer part 50 of the tines 46 forms about the same angle with the circumference of the paddle wheel 52 so that they enter the bale 10 in a substantially vertical direction, i.e. a direction parallel to the layering in the bale 10.

[0043] In order to separate the slice 56 from the bale 10, the peripheral velocity of the paddle wheels 52 is about three to five times the movement velocity of the bale 10, i.e. the velocity of the main conveyor 18. This velocity ratio is important for separating the slice 56 from the rest of the bale 10. While the blade 49 accelerates the separated slice 56, the back of the tine 46 moves coincident with the front face of the rest of the bale 10 without interfering with it. The back of the tine 46 is shaped so that it follows the horizontal movement of the bale 10. This means that the point of contact between the back of the tine 46 and the front face of the bale 10 moves in horizontal direction at about the velocity of the main conveyor 18. The back of the outer part 50 and the transition between the outer part 50 and the inner part 48 of the tines 46 are shaped to meet this uniformity of velocities for a considerable time period so as to allow for the bale's stability and to avoid disturbing forces being exerted on the bale 10.

[0044] Continued rotation of the separation device or tine assembly 42 prises apart further slices 56 until the bale 10 is divided completely into a plurality of slices 56. The prised-apart slices 56 glide onto a further conveyor not shown in the drawings which conveys them to a tobacco conditioning section.

[0045] In the embodiment of Figs. 1 to 3, the tip of the tines 46 has a distance of 25 to 45 cm from the axis of the shaft 44. As mentioned above, the line from the tip of the tine 46 forms an angle a between 18° and 21° with the horizontal (Fig. 4). Consequently, the tine 46 penetrates a maximum of about 70% of its radial length into the bale 10. The position of the shaft 44 is adjustable so that it can be adapted to the vertical dimension of the bale 10. The dimension at right angles to the layering of each bale 10 is measured by a vision system 58 before delaminating the bale 10, and the vertical position of the shaft 44 is adjusted in accordance therewith. As only one

bale 10 is processed at a time, the software may be used, not only to position the tine 46 in the "parked" position and also adjust the vertical position of the shaft 44 to ensure optimal delamination, but also to adjust the tine rotation speed to ensure the desired number of delaminations required which may vary according to tobacco type. The bale height h is measured and the speed of the conveyor and of the paddle wheel are adjusted so that the last slice has the same thickness as the other slices or up to 10% less.

[0046] In order not to crush the edge portion of the slice 56 to be separated, a sufficient angular distance between successive tines 46 is provided, pockets 60 being formed between successive tines 46. The pockets 60 have, at the height of the bale 10, a dimension 1 in the direction of bale movement at least as large as the thickness of the slice 56 to be delaminated. The diameter of the hub of the shaft 44 must, of course, not be so large that it interferes with the bale 10.

[0047] The radius of the paddle wheels 52, the number of tines 46 and the number of paddle wheels 52 depend on the type of bale 10 to be delaminated.

[0048] Four typical designs of paddle wheels will be explained in the following:

1. A paddle wheel 52 with three tines 46 and a radius of 450 mm, two such paddle wheels being provided on the shaft 44, can be used for a delaminater having a capacity of about 10,000 kg/hr and up to 20,000 kg/hr. That tine assembly 42 is adapted particularly for hogsheads and C-48 cartons. The penetration depth must be greater than the slice thickness t to achieve natural delaminating.

2. A paddle 52 with four tines 46 having a radius of 400 mm has a capacity of 6,000 to 12,000 kg/hr for C-48 cartons.

3. A paddle wheel 52 with six tines and a radius of 300 mm. A tine assembly 42 with such a paddle wheel 52 has a capacity of 3,000 to 8,000 kg/hr and can be used for C-48 cartons and oriental bales. The tine penetration depth is 200 mm for C-48 cartons and 50 mm for oriental bales. Two such paddle wheels are used for oriental bales and three paddle wheels are used for C-48 cartons.

4. A paddle wheel 52 with eight tines 46 and a radius of 250 mm has a capacity of 1,000 to 5,000 kg/hr for oriental bales.

[0049] The length of the flaps 26, 28 of the turnover device 22 corresponds to the height of a C-48 carton 10 (about 0.7 meters) and the swivel axis 30 of the turnover device 22 can be moved from about that distance from the inlet end of the main conveyor 18 to about the same distance from the delamination position 40. A C-48 carton 10 can therefore be placed at the inlet end of the main conveyor 18 onto the first flaps 26 with the layering in horizontal direction, and can be tipped 90° and simulaneously moved by the turnover device 22 so that the layering is vertical and the parcel 10 is positioned with its leading edge at the delamination position 40.

[0050] When one bale 10 has been completely delaminated the arms 34 are swivelled clockwise (seen in Fig. 1) into the inactive, horizontal position where they are out of the path of the next bale which is being transported on the main conveyor 18 and tipped by the turnover device 22.

[0051] As can be seen in Figure 2 the flaps 26, 28 of the turnover device and the pair of arms 34 of the bale follow-up device 24 are arranged across the width of the main conveyor 18 such that they do not interfere with each other. In particular, the arms 34 do not hit the second flaps 28 when they are swivelled from the vertical to the horizontal position. When the arms 34 are swivelled down into the active vertical position they touch the basic face of the bale 10 at a point slightly offset from the point at which the first flaps 26 touch the basic face so that the turnover device 22 can be withdrawn after the arms 34 have touched the basic face. The flaps 26, 28 are likewise arranged such that they do not interfere with these belts 20.

[0052] A chute (not shown) may be provided at the inlet end of the main conveyor 18 for collecting loose tobacco and for directing such loose tobacco onto a collecting conveyor 62 which is arranged below the conveyor 18 and conveys the loose tobacco to the outlet end of the main conveyor 18.

[0053] A typical sequence of process steps is shown in Figs. 6 to 14: A C-48 tobacco parcel (bale) 10 is delivered to the inlet conveyor 12 of the bale identification section 1 with horizontal layering (Fig.6). The weight w and the height h of the bale 10 are measured and the bale 10 is conveyed by the inlet conveyor 12 and the main conveyor 18 of the bale handling section 2 at the inlet end of which the bale 10 is accepted by the turnover device 22 (Fig. 7). While the arms 34 of the bale follow-up device 24 are in the inactive, horizontal position, the turnover device 22 transports the bale 10 to the delaminating section 3 and tips it by 90° simultaneously (Fig. 8). It deposits the bale 10 on the main conveyor 18 such that the forward end of the bale 10 is at the delamination position 40 (Fig. 9). After the parcel 10 is tipped, the actual height H is measured and the vertical position of the shaft 44 is adjusted so that the angle α is 16°. The bale follow-up device 24 backs up the trailing side of the bale 10 and moves at the same rate as the main conveyor 18 (Fig. 10). The turnover device 22 is withdrawn from the bale 10 and returns to the inlet end of the bale handling section 2 to accept the next bale (Fig. 11).

[0054] The paddle wheel 52 is shown in the "parked" position in Figs. 8 and 9. The paddle wheel 52 is of the above-mentioned typical design No. 3 and starts rotating as soon as the forward end of the bale 10 has passed over the separating or delamination location 40 by a dis-

tance equal to the intended thickness of the slice 56 (Fig. 10). Further rotation of the paddle wheel 52 prises off the slice 56, the upper portion of the slice 56 being held in the pocket 60 between the tine 46 which separates this slice 56 and the preceding tine 46. The back part of the tine 46 is shaped such that the upper edge of the slice 56, when tipping forward, slides along the back of the tine without substantial pressure. Slice 56 is freed from the pocket 60 and the next slice is prised off with further rotation of the paddle wheel 52 (Fig. 12). Delamination is continued in this manner over the whole length of the bale 10 (Fig. 13). After removal of the last slice 56, the arms 34 of the bale follow-up device 24 are swivelled into the inactive, horizontal position (Fig. 14) so that the path is free for the next bale 10. The next bale 10 already rests on the turnover device 22 and will be tipped over and moved to the delaminating section 3. The changeover time between subsequent bales 10 is reduced, thereby allowing a more continuous operation of the subsequent conditioning step and the further tobacco treatment steps.

List of reference numbers

[0055]

1	bale identification section
2	bale handling section
3	bale delamination section
10	tobacco parcel, bale
12	inlet conveyor
14	main section
16	weighing device
18	main conveyor
20	belt
22	turnover device
23	rail
24	bale follow-up device
25	rail
26	first flaps
28	second flaps
30	swivel axis
34	pair of arms
36	layer
40	separating location, delamination position
42	separating device
44	shaft
46	tines
48	inner part
49	blade
50	outer part
52	paddle wheel
54	entry point
56	slice
58	vision system
60	pocket
62	collecting conveyor

Claims

1. Apparatus for delaminating tobacco in the form of slices (56) from a layered tobacco parcel (10), comprising:

- a main conveyor (18) for delivering a parcel (10) of tobacco to a delamination position (40);
- a turnover device (22) including a swivel axis (30) for tipping a parcel (10) of tobacco onto the main conveyor (18) so that the layering is generally at right angles to the main conveyor (18); and
- a rotatable tine assembly (52) mounted on an axis (44) extending at right angles to the main conveyor (18) and parallel to the layering of the parcel (10) and including a plurality of tines (46), the tines (46) being adapted to enter the parcel (10) at an entry point (54) in a direction substantially parallel to the layering of the parcel (10) and to accelerate a slice (56) away from the parcel (10) in order to separate the slice (56) of tobacco from the parcel (10), and the axis of the tine assembly (52) being arranged at a distance above the parcel (10) such that the line from the axis of the tine assembly (52) to the entry point (54) forms an angle of between 14 and 24° with the horizontal;

characterized

- **by** the swivel axis (30) of the turnover device (22) being guided in rails (23) such that the swivel axis can be moved to and fro in the direction of the conveyor (18).

2. Apparatus according to Claim 1, comprising a height measuring device (1) for measuring the height of a parcel when the layering of the parcel is horizontal and means for moving the turnover device (22) in response to the measured height of a parcel such that leading edge of the parcel (10), when tipped by the turnover device (22), is already in the delamination position (40).

3. Apparatus according to Claim 1 or 2, comprising a bale follow-up device (24) for tracking the trailing edge of a parcel when tipped and stabilizing it during delamination.

4. Apparatus according to Claim 3, comprising a controller for controlling the turnover device (22) such that it is withdrawn from the parcel and returned to accept the next parcel (10) once the tipped parcel is stabilized by the bale follow-up device (24).

5. Apparatus according to any one of Claims 1 to 4, comprising a weighing device (16) for weighing a

parcel, the controller adjusting the speed of the main conveyor (18) so as to achieve a predetermined tobacco flow rate.

6. Method for delaminating tobacco in the form of slices (56) from a layered tobacco parcel (10), comprising the steps of:

- delivering a parcel (10) of tobacco to a main conveyor (18), the layering of the parcel (10) being horizontal;
- tipping a parcel (10) of tobacco onto the main conveyor (18) by a turnover device (22) having a swivel axis (30) so that the layering is generally at right angles to the main conveyor (18); and
- separating the parcel (10) by a rotatable tine assembly (52) into a plurality of slices (56) the tine assembly including a plurality of tines (46), the tines (46) being adapted to enter the parcel (10) at an entry point (54) in a direction substantially parallel to the layering of the parcel (10);

characterized

- **by** guiding the parcel by moving the turnover device (22) along rails (23) in the direction of the conveyer movement before or during tipping the parcel.

7. Method according to Claim 6, comprising the steps of measuring the height of a parcel (10) when the layering of the parcel (10) is horizontal, and moving the turnover device (22) in response to the measured height of a parcel (10) such that the leading edge of the parcel (10), when tipped by the turnover device (22), is already in the delamination position (40).

8. Method according to Claim 6 or 7, comprising the step of tracking the trailing edge of the parcel (10) when tipped and stabilizing it during delamination.

9. Method according to Claim 8, comprising the step of controlling the turnover device (22) such that it is withdrawn from the parcel (10) and returned to accept the next parcel (10) once the tipped parcel is stabilized by the bale follow-up device (24).

10. Method according to any one of Claims 6 to 9, comprising the steps of weighing a parcel (10) and adjusting the speed of the main conveyor (18) so as to achieve a predetermined tobacco flow rate.

Patentansprüche

1. Vorrichtung zur Schichtentrennung von Tabak in der Form von Scheiben (56) von einem Schichtentabakballen (10), umfassend:

- einen Hauptförderer (18) zur Übergabe eines Ballens (10) von Tabak an eine Schichtentrennungsposition (40);
- ein Umstürzgerät (22), das eine Schwenkachse (30) umfasst, um einen Ballen (10) von Tabak auf den Hauptförderer (18) zu kippen, so dass sich die Schichtung im Allgemeinen unter rechtem Winkel zum Hauptförderer (18) befindet; und
- eine drehbare Zinkenanordnung (52), die auf einer Achse (44) montiert ist, die unter rechtem Winkel zum Hauptförderer (18) und parallel zur Schichtung des Ballens (10) verläuft und eine Mehrzahl von Zinken (46) umfasst, wobei die Zinken (46) angepasst sind, um an einem Eintrittspunkt (54) in einer zur Schichtung des Ballens (10) im Wesentlichen parallelen Richtung in den Ballen (10) einzudringen und um eine Scheibe (56) weg von dem Ballen (10) zu beschleunigen, um die Scheibe (56) von Tabak von dem Ballen (10) zu trennen, und wobei die Achse der Zinkenanordnung (52) in einem Abstand über dem Ballen (10) so angeordnet ist, dass die Linie von der Achse der Zinkenanordnung (52) zum Eintrittspunkt (54) einen Winkel von zwischen 14 und 24° mit der Horizontalen bildet;

dadurch gekennzeichnet, dass

- die Schwenkachse (30) des Umstürzgeräts (22) in Schienen (23) geführt wird, so dass die Schwenkachse in der Richtung des Förderers (18) hin- und herbewegt werden kann.

2. Vorrichtung nach Anspruch 1, umfassend ein Höhenmessgerät (1) zum Messen der Höhe eines Ballens, wenn die Schichtung des Ballens horizontal ist, und Einrichtungen zur Bewegung des Umstürzgeräts (22) ansprechend auf die gemessene Höhe eines Ballens, so dass sich eine Vorderkante des Ballens (10), wenn er durch das Umstürzgerät (22) gekippt ist, schon in der Schichtentrennungsposition (40) befindet.

3. Vorrichtung nach Anspruch 1 oder 2, umfassend ein Ballenfolgegerät (24), um die Hinterkante eines Ballens zu verfolgen, wenn er gekippt ist, und ihn während einer Schichtentrennung zu stabilisieren.

4. Vorrichtung nach Anspruch 3, umfassend einen Kontroller zum Steuern des Umstürzgeräts (22), so dass es von dem Ballen zurückgezogen und rückgeführt wird, um den nächsten Ballen (10) anzunehmen, sobald der gekippte Ballen durch das Ballenfolgegerät (24) stabilisiert ist.

5. Vorrichtung nach einem der Ansprüche 1 bis 4, um-

fassend ein Wägegerät (16) zum Wiegen eines Ballens, wobei der Kontroller die Geschwindigkeit des Hauptförderers (18) einstellt, um einen vorbestimmten Tabakdurchsatz zu erzielen.

6. Verfahren zur Schichtentrennung von Tabak in der Form von Scheiben (56) von einem Schichtentabakballen (10), umfassend die Schritte:

- Übergeben eines Ballens (10) von Tabak an einen Hauptförderer (18), wobei die Schichtung des Ballens (10) horizontal ist;
- Kippen eines Ballens (10) von Tabak auf den Hauptförderer (18) durch ein Umstürzgerät (22) mit einer Schwenkachse (30), so dass sich die Schichtung im Allgemeinen unter rechtem Winkel zum Hauptförderer (18) befindet; und
- Trennen des Ballens (10) durch eine drehbare Zinkenanordnung (52) in eine Mehrzahl von Scheiben (56), wobei die Zinkenanordnung eine Mehrzahl von Zinken (46) umfasst, wobei die Zinken (46) angepasst sind, um an einem Eintrittspunkt (54) in einer zur Schichtung des Ballens (10) im Wesentlichen parallelen Richtung in den Ballen (10) einzudringen;

gekennzeichnet

- **durch** Führen des Ballens, indem das Umstürzgerät (22) vor einem oder während eines Kippens des Ballens entlang Schienen (23) in der Richtung der Fördererbewegung bewegt wird.

7. Verfahren nach Anspruch 6, umfassend die Schritte: Messen der Höhe eines Ballens (10), wenn die Schichtung des Ballens (10) horizontal ist, und Bewegen des Umstürzgeräts (22) ansprechend auf die gemessene Höhe eines Ballens (10), so dass sich die Vorderkante des Ballens (10), wenn er durch das Umstürzgerät (22) gekippt ist, schon in der Schichtentrennungsposition (40) befindet.

8. Verfahren nach Anspruch 6 oder 7, umfassend den Schritt: Verfolgen der Hinterkante des Ballens (10), wenn er gekippt ist, und Stabilisieren desselben während einer Schichtentrennung.

9. Verfahren nach Anspruch 8, umfassend den Schritt: Steuern des Umstürzgeräts (22), so dass es von dem Ballen (10) zurückgezogen und rückgeführt wird, um den nächsten Ballen (10) anzunehmen, sobald der gekippte Ballen durch das Ballenfolgegerät (24) stabilisiert ist.

10. Verfahren nach einem der Ansprüche 6 bis 9, umfassend die Schritte:

Wiegen eines Ballens (10) und Einstellen der Geschwindigkeit des Hauptförderers (18), um einen vorbestimmten Tabakdurchsatz zu erzielen.

Revendications

1. Appareil pour séparer du tabac sous forme de tranches (56) à partir d'une dalle de tabac en couches (10), comprenant :

- un transporteur principal (18) pour distribuer une dalle (10) de tabac à une position de séparation (40) ;
- un dispositif de retournement (22) comprenant un axe de pivotement (30) pour incliner une dalle (10) de tabac sur le transporteur principal (18) de sorte que la disposition en couches est généralement à angle droit par rapport au transporteur principal (18) ; et
- un ensemble de dents rotatif (52) monté sur un axe (44) s'étendant à angle droit par rapport au transporteur principal (18) et parallèle à la disposition en couches de la dalle (10) et comprenant une pluralité de dents (46), les dents (46) étant adaptées pour entrer dans la dalle (10) au niveau d'un point d'entrée (54) dans une direction sensiblement parallèle à la disposition en couches de la dalle (10) et pour accélérer une tranche (56) pour l'éloigner de la dalle (10) afin de séparer la tranche (56) de tabac à partir de la dalle (10), et l'axe de l'ensemble de dent (52) étant agencé à une distance au-dessus de la dalle (10) de sorte que la ligne à partir de l'axe de l'ensemble de dents (52) jusqu'au point d'entrée (54) forme un angle compris entre 14 et 24° avec l'horizontale ;

caractérisé

- **par** l'axe de pivotement (30) du dispositif de retournement (22) étant guidé dans des rails (23) de sorte que l'axe de pivotement peut être déplacé d'avant en arrière dans la direction du transporteur (18).

2. Appareil selon la revendication 1, comprenant un dispositif de mesure de hauteur (1) pour mesurer la hauteur d'une dalle lorsque la disposition en couches de la dalle est horizontale et des moyens pour déplacer le dispositif de retournement (22) en réponse à la hauteur mesurée d'une dalle de sorte que le bord avant de la dalle (10), lorsqu'elle est inclinée par le dispositif de retournement (22), est déjà dans la position de séparation (40).

3. Appareil selon la revendication 1 ou 2, comprenant

un dispositif de suivi de balle (24) pour suivre le bord arrière d'une dalle lorsqu'elle est inclinée et la stabiliser au cours de la séparation.

4. Appareil selon la revendication 3, comprenant un dispositif de commande pour commander le dispositif de retournement (22) de sorte qu'il est retiré de la dalle et retourné pour accepter la dalle suivante (10) une fois que la dalle inclinée est stabilisée par le dispositif de suivi de balle (24).

5. Appareil selon l'une quelconque des revendications 1 à 4, comprenant un dispositif de pesage (16) pour peser une dalle, le dispositif de commande réglant la vitesse du transporteur principal (18) afin d'obtenir un débit de tabac prédéterminé.

6. Procédé pour séparer du tabac sous forme de tranches (56) à partir d'une dalle de tabac en couches (10), comprenant les étapes consistant à :

- distribuer une dalle (10) de tabac à un transporteur principal (18), la disposition en couches de la dalle (10) étant horizontale ;
- incliner une dalle (10) de tabac sur le transporteur principal (18) par l'intermédiaire d'un dispositif de retournement (22) ayant un axe de pivotement (30) de sorte que la disposition en couches est généralement à angle droit par rapport au transporteur principal (18) ; et
- séparer la dalle (10) par l'intermédiaire d'un ensemble de dents rotatif (52) en une pluralité de tranches (56) l'ensemble de dents comprenant une pluralité de dents (46), les dents (46) étant adaptées pour entrer dans la dalle (10) au niveau d'un point d'entrée (54) dans une direction sensiblement parallèle à la disposition en couches de la dalle (10) ;

caractérisé

- **par** le fait de guider la dalle en déplaçant le dispositif de retournement (22) le long de rails (23) dans la direction du mouvement de transporteur avant ou au cours de l'inclination de la dalle.

7. Procédé selon la revendication 6, comprenant les étapes consistant à mesurer la hauteur d'une dalle (10) lorsque la disposition en couches de la dalle (10) est horizontale, et déplacer le dispositif de retournement (22) en réponse à la hauteur mesurée d'une dalle (10) de sorte que le bord avant de la dalle (10), lorsqu'elle est inclinée par le dispositif de retournement (22), est déjà dans la position de séparation (40).

8. Procédé selon la revendication 6 ou 7, comprenant l'étape consistant à suivre le bord arrière de la dalle (10) lorsqu'elle est inclinée et la stabiliser au cours de la séparation.

9. Procédé selon la revendication 8, comprenant l'étape consistant à commander le dispositif de retournement (22) de sorte qu'il est retiré de la dalle (10) et retourné pour accepter la dalle suivante (10) une fois que la dalle inclinée est stabilisée par le dispositif de suivi de balle (24).

10. Procédé selon l'une quelconque des revendications 6 à 9, comprenant les étapes consistant à peser une dalle (10) et régler la vitesse du transporteur principal (18) afin d'obtenir un débit de tabac pré-déterminé.

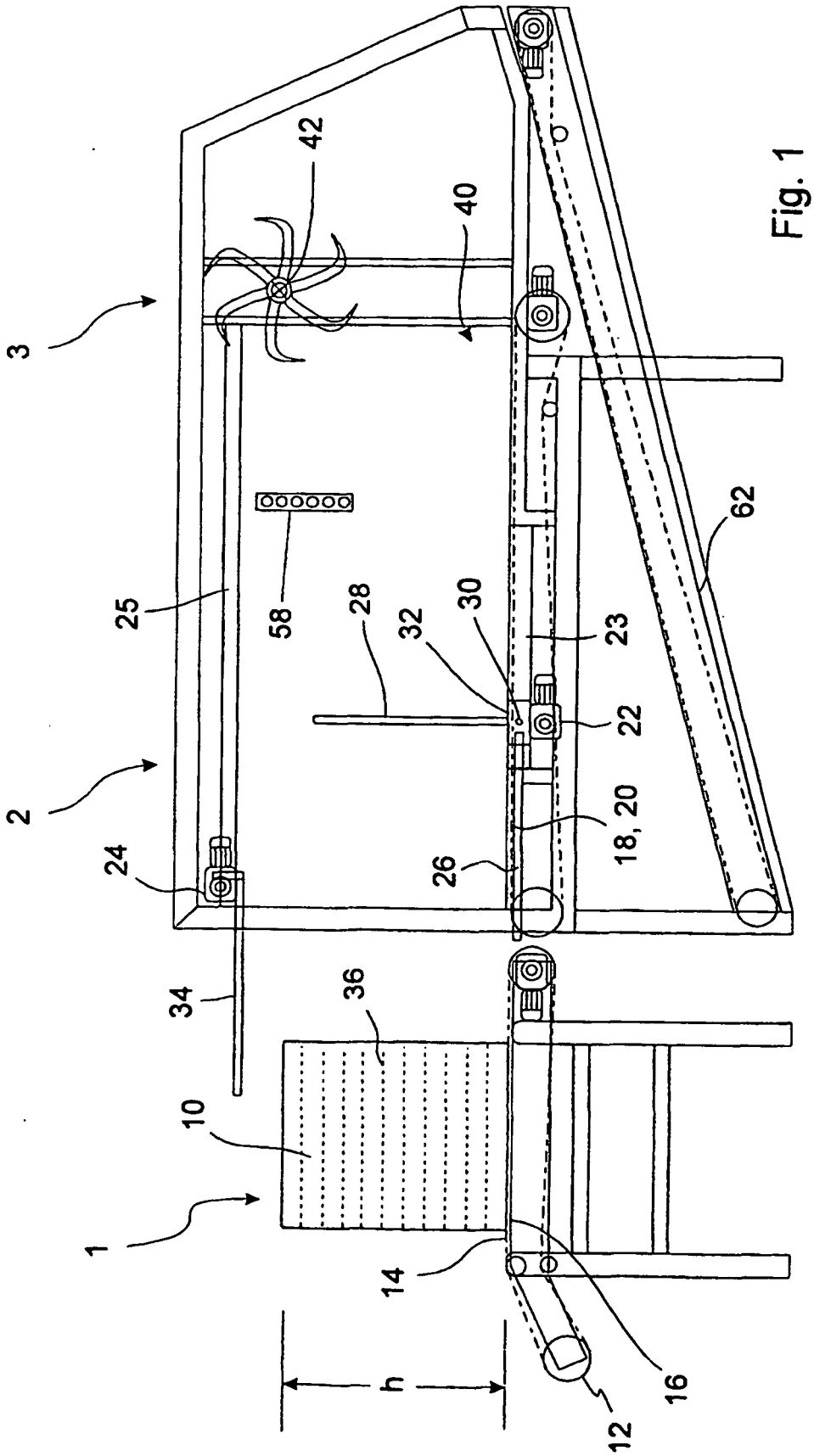


Fig. 1

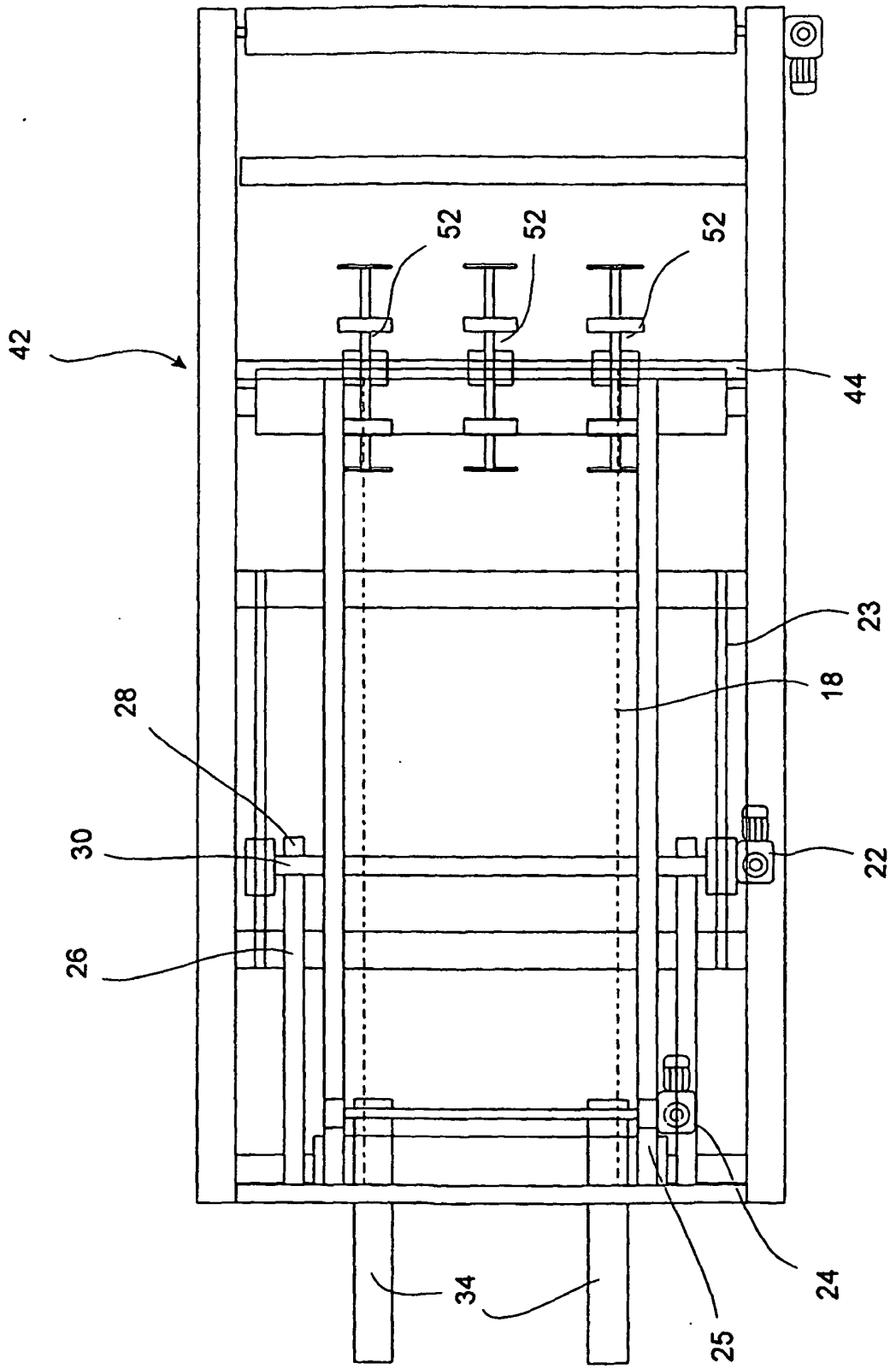


Fig. 2

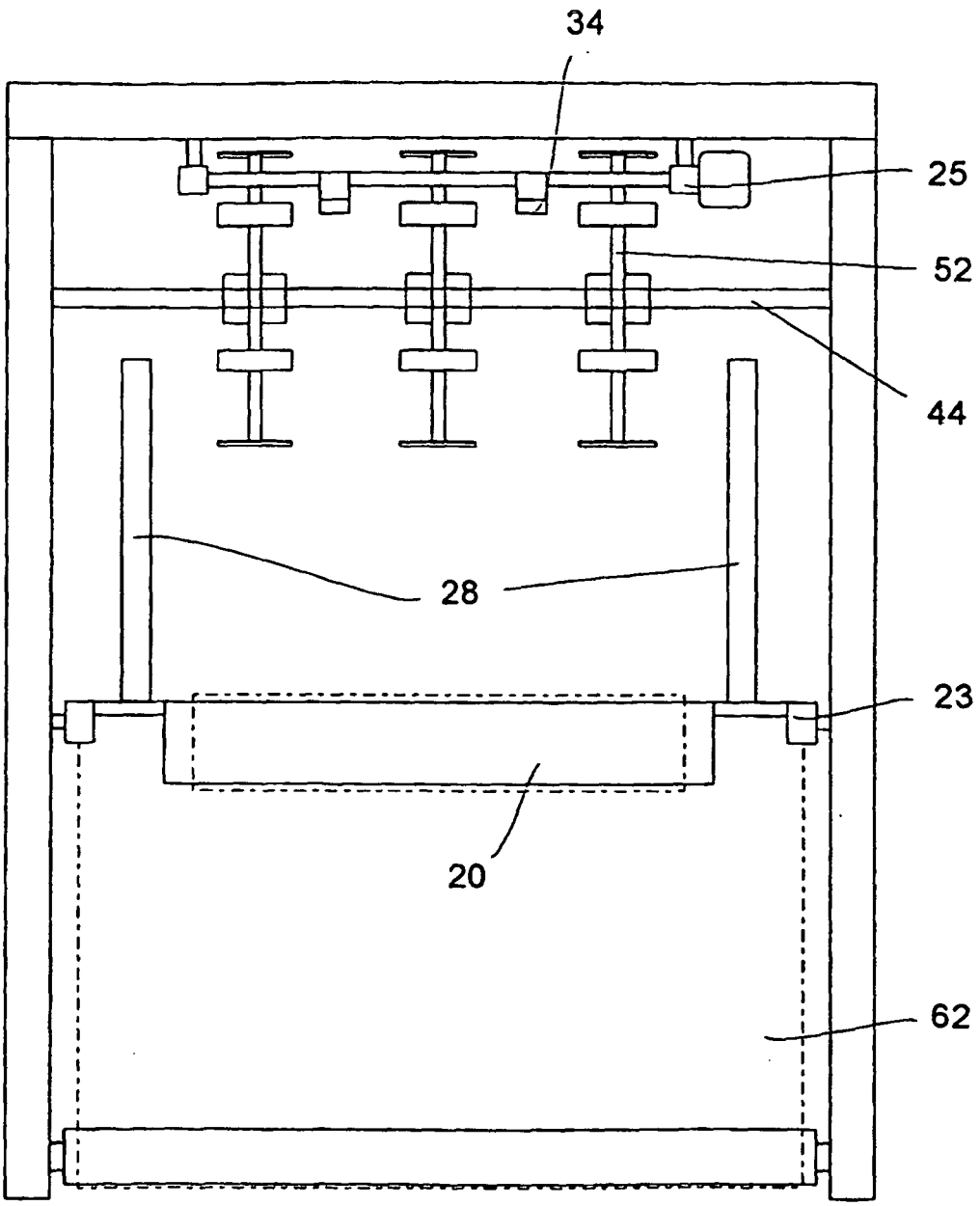


Fig. 3

Fig. 4

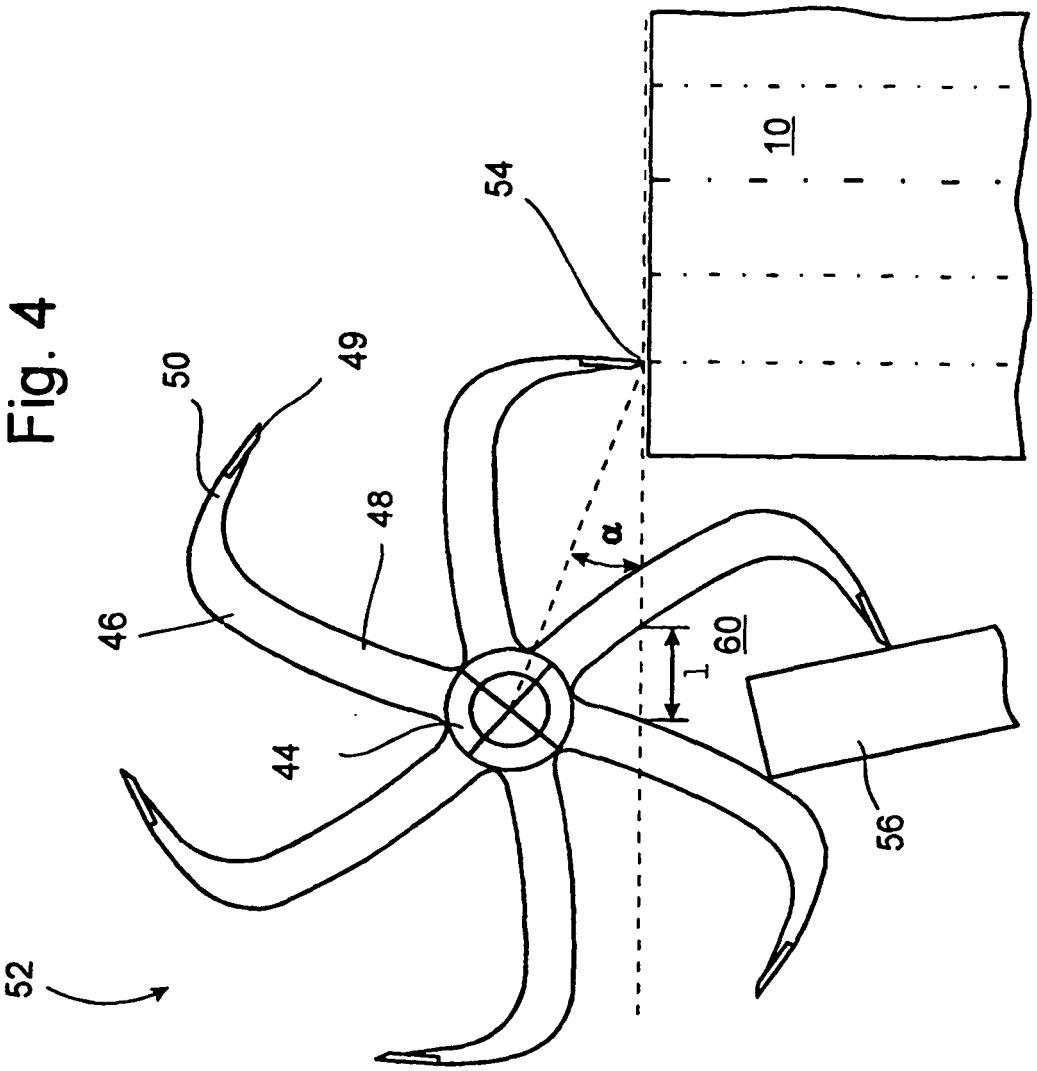
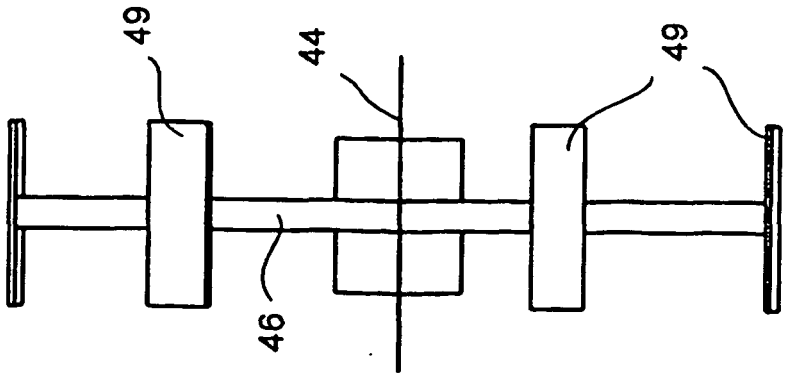


Fig. 5



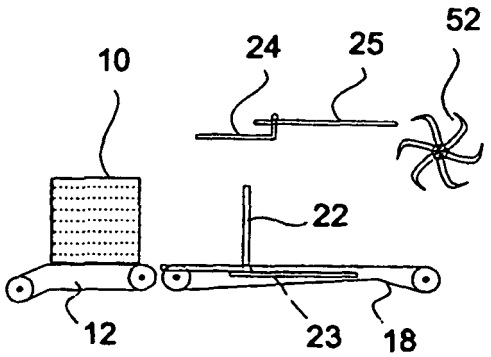


Fig. 6

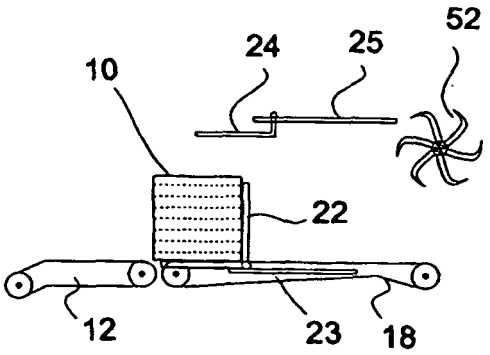


Fig. 7

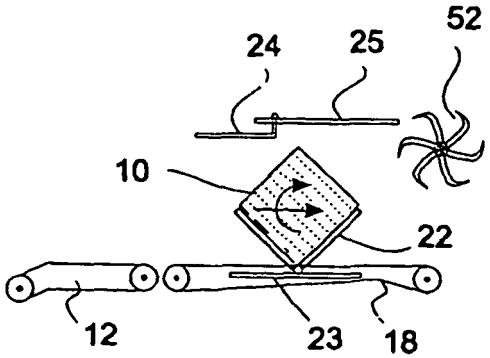


Fig. 8

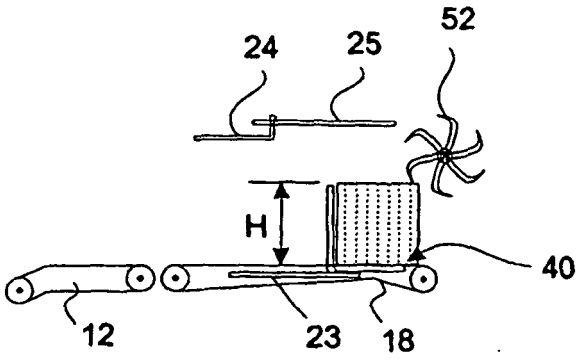


Fig. 9

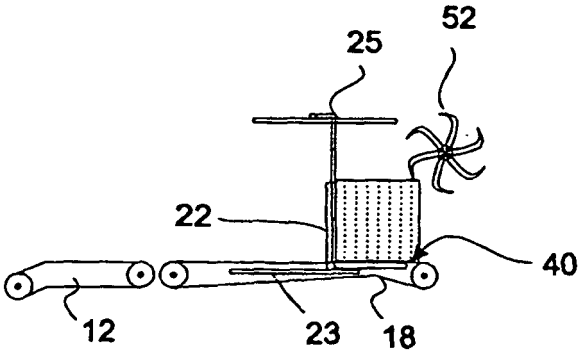


Fig. 10

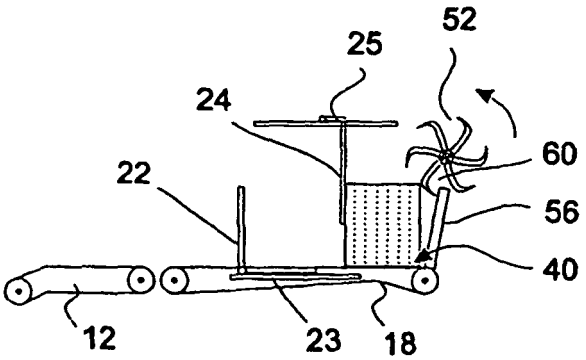


Fig. 11

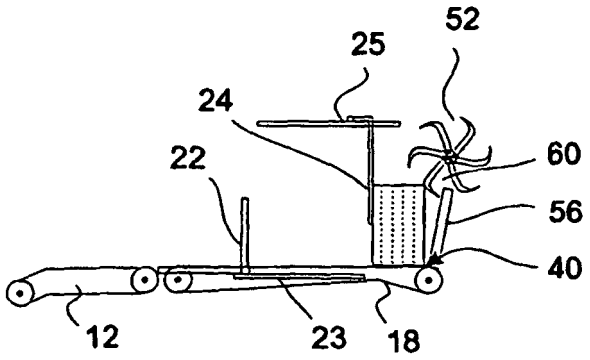


Fig. 12

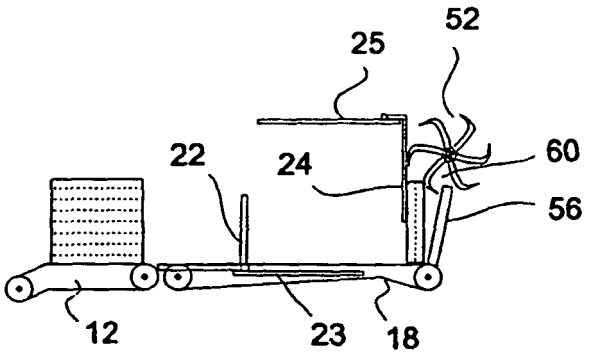


Fig. 13

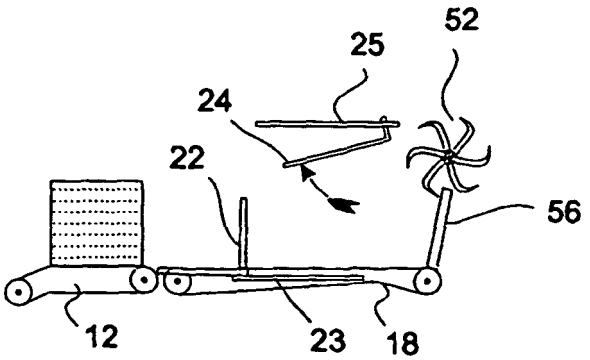


Fig. 14