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METHOD AND DEVICE FOR SEPARATING LETTERS**5 Description:**

The invention relates to a method for separating letters in which irregularly spaced and disordered piles of letters that are being transported on a conveyor belt are rendered into a continuous stream of letters that are largely not lying on top of each other and that are distributed virtually homogeneously over the conveyor belt. Moreover, the invention comprises a device that is suitable for carrying out the method.

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An automated separation and sorting line usually comprises a conveyor belt onto which the boxes or sacks that are delivered at irregular intervals are emptied, as a result of which irregularly spaced and disordered piles of letters are formed on the conveyor belt.

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The letters arranged on the conveyor belt in such a way are then normally fed to one or more successive separation means with the objective of rendering the above-mentioned arrangement of the letters consisting of disordered piles into an arrangement that consists of letters that are largely not lying on top of each other and that are situated virtually homogeneously on the conveyor belt, thus corresponding to a continuous stream of letters that are largely not lying on top of each other and that are distributed virtually homogeneously on the conveyor belt.

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An arrangement of separation means for separating letters is described in U.S. Pat. No. 2,905,309, especially in Figure 1 of said publication. In the disclosed arrangement, the letters initially reach a first conveyor belt via an inclined plane, whereby said
5 conveyor belt conveys the letters to a second conveyor belt via a swing tray that exerts an influence on the regulation of the conveyor belt. This second conveyor belt feeds the letters to another separation means that
10 consists of a rotating drum with protruding thin strips or "fingers" that pull or push the letters individually off the conveyor belt and into a shaft. The drum is installed above the conveyor belt crosswise to the conveying direction in such a way that the strips can
15 touch the conveyor belt and the drum in the described device rotates in such a way that the strips move in the conveying direction whenever they are below the axis of rotation.

20 The described arrangement and especially the transport via the swing tray that influences the regulation of the conveyor belt is carried out with the same objective as that of the method according to the invention but it is very complex. Moreover, in case of a high
25 mail volume, it can happen that letters lying on the tray are pushed off by the subsequent letters so that the conveyor belt can no longer be regulated so as to be adapted to the mail volume and an overload of the system can occur.

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However, such a method is not suitable for use in bulk processing of mailpieces as is carried out, for

The invention is based on the objective of creating a method for separating letters in which even large, irregularly spaced and disordered piles of letters that are being transported on the conveyor belt are rendered reliably and in trouble-free serial operation into a continuous stream of letters that are largely not lying on top of each other and that are distributed virtually homogeneously over the conveyor belt.

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This objective is achieved in the method according to the generic part of Claim 1 in that at least one retention plate affixed at an axis of rotation in a radial orientation with respect thereto rotates around the axis of rotation that is arranged crosswise to the conveying direction of the conveyor belt, horizontally and above the conveyor belt, in such a way that the retention plate situated below the axis of rotation has a speed component in a direction that is opposite to the conveying direction of the conveyor belt.

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The method is especially well-suited for separating standard letters that are being transported and that are piled randomly on top of one another, having formats comparable to the formats DIN B6 or DIN C6, DIN long, DIN C5 or else larger formats, for example, when large envelopes are used.

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Such letters are typically delivered unsorted in boxes or sacks to a transshipment station of a postal service provider where they are separated and sorted in preparation for their further forwarding.

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The invention likewise comprises a device that is suitable for carrying out the method having an axis of rotation that is arranged crosswise to the conveying direction of a conveyor belt, horizontally and above
5 the conveyor belt, and one or more retention plates that are affixed at the axis of rotation in a radial orientation with respect thereto and that rotate around said axis of rotation, whereby the rotating retention plates can be driven in such a way that, in at least
10 one operating state of the device, they have a speed component that is opposite to the conveying direction of the conveyor belt whenever they are below the axis of rotation.

15 The axis of rotation and the retention plate are arranged in the method according to the invention in such a way that the letters fed onto the conveyor belt of the device accumulate in front of the retention plate whenever the axis of rotation is in a position in
20 which the retention plate faces perpendicularly downwards, forming a right angle with the conveyor belt. This position of the axis of rotation and of the retention plate is to be designated here as the initial position so that reference can be made to this position
25 hereinafter.

As a result of the rotational movement having the direction of rotation shown, the letters lying directly in front of the retention plate in the initial position
30 are pushed back during the first half-period of the rotation or thrown upwards or set upright if the retention plate reaches under the letters.

Due to the carrying movement of the rotating retention plate and promoted by the accumulation pressure being built up in front of the device, the letters that have been thrown upwards or set upright manage to enter the downstream conveying area of the conveyor belt, beyond the axis of rotation.

Moreover, the result of the rotational movement is that, during the course of a period of the movement, a gap between the retention plate and the conveyor belt opens up and closes again, through which a few of the letters accumulated at the bottom in the initial position are conveyed into the downstream conveying area of the conveyor belt.

Thus, on the downstream conveying side of the device, a random arrangement of letters forms on the conveyor belt in which the letters are virtually homogeneously distributed on the conveyor belt and are largely not lying on top of each other.

The efficiency of the method according to the invention can be increased in that two or more retention plates are installed at the axis of rotation in a radial orientation with respect thereto, whereby an especially preferred embodiment of the invention is characterized in that the angular distances between the retention plates are the same.

In this manner, it is possible to decrease the extension of the plates in the radial direction with respect to the axis of rotation as compared to the case with only one plate and nevertheless to achieve the same accumulation effect as in this case since this effect arises solely from the surface of the plates that are positioned perpendicularly on the conveyor belt. The extension of the gap that forms between the conveyor belt and the plates during the rotation, however, depends on the radial extension of the plates and, in the embodiment with several plates, it is smaller than in comparison to the embodiment with one plate.

The frequency of the periodical course resulting from the use of the method according to the invention is increased in the embodiment with several plates at a rotational frequency that is the same as in the embodiment with only one plate, so that even a very high mail volume can be processed.

It is likewise especially advantageous for one or more of the retention plates to have a smaller radial extension than at least one other plate, as a result of which a gap remains between the conveyor belt and a retention plate having a smaller radial extension when this plate is positioned perpendicularly downwards on the conveyor belt, through which gap the letters can pass that are in the lower layer of the pile that has accumulated in front of the device.

In this manner, the risk of overloading the device in

Moreover, with an eye towards reducing this risk, it is very advantageous to affix the axis of rotation onto the device in such a way that the height at which it is
5 arranged above the conveyor belt can be varied.

In another preferred embodiment of the invention, the end piece of at least one of the retention plates is configured elastically in alignment with the radius in
10 order to avoid damage to the letters that have been pushed back and in order to promote the upwards throwing movement and the carrying of the letters by means of a whip-like effect.

15 Another improvement in the efficiency of the method for separating letters according to the invention can be achieved in that the separation by means of rotating retention plates on the basis of the above-described method according to the invention is preceded by a
20 first separation of letters that is carried out using a retention device.

In a preferred embodiment, this first preceding separation means consists of a hanging retention plate
25 attached at an axis arranged above the conveyor belt crosswise to the conveying direction whose attachments allow it to swing back and forth and whose end piece is preferably configured so as to be elastic.

30 Here, the first separation device is configured in such a way that a pile of letters can pass it, whereby the letters present in the pile are then separated by means

Especially preferred embodiments of the invention will be explained below on the basis of the accompanying drawings. Schematic views show the following:

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Figure 1 a cross section through a device for separating letters having two retention plates as seen in the conveying direction;

10 Figure 2 a longitudinal section through this device as seen perpendicular to the conveying direction;

Figure 3 a cross section and a longitudinal section
15 through the first separation device, which can precede the device shown in the other figures.

Letters are fed in irregularly spaced, disordered piles to a conveyor belt 1 or 1' of the device. The part of
20 the conveyor belt 1 moving in the conveying direction lies on a contact surface 2, is deflected at the end of the conveying section and runs back underneath the contact surface 2.

25 The returning part 1' of the conveyor belt makes friction contact with a rotating roller 3 that, driven by a motor 4 that is not more precisely specified here, drives the conveyor belt.

The device for separating letters that is affixed to the conveying means has a holding frame that spans the conveying means and that is attached to the lateral delineations 5 and 5' of the conveyor belt. The frame
5 consists of a frame construction that is joined to the lateral delineations 5 and 5' so as to be fixed relative to the device and that has lateral tubes 6 and 6' positioned upwards perpendicular to the conveyor belt as well as a cross brace 7 by means of which a
10 centered thread is driven downwards in the direction of the conveyor belt 1.

A screw 8 is inserted into the thread and said screw 8 is centrally attached rotatably at its end facing the
15 conveyor belt 1 to the cross brace 9 of another movable part of the frame that is held in position by the screw 8.

The movable part of the frame likewise has lateral
20 tubes 10 and 10' which are joined to the cross brace 9 at their upper ends facing away from the conveyor belt 1 and which surround the lateral tubes 6 and 6' of the part of the frame that is rigidly joined to the conveying means so that the lateral tubes 6 and 6'
25 serve as a guide for the lateral tubes 10 and 10' of the movable part of the frame.

Receptacles 11 and 11' are attached at the lower ends of the lateral tubes 10 and 10' facing the conveyor
30 belt 1, an axis of rotation 12 being rotatably supported on and attached at said receptacles 11 and 11' in such a way so as to span the conveyor belt

The distance between the axis of rotation 12 and the conveyor belt 1 can be varied by turning the screw 8, which can be done using a crank 13 attached to the end
5 of the screw 8 that lies above the cross brace 7.

Inside the lateral delineations 5 and 5', the axis of rotation 12 is surrounded by a roller 14 to which retention plates 15 and 15' are firmly attached in such
10 a way that they are arranged relative to the axis of rotation 12 in the radial direction and at equal angular distances with respect to each other.

An end piece 16 made of an elastic material is attached
15 to one of the retention plates 15 and, in the position of the axis of rotation 12 and of the retention plates 15 and 15' shown in Figures 1 and 2, said end piece 16 should extend to near the conveyor belt 1 in order to be able to effectively carry out the method for
20 separating letters according to the invention.

Another retention plate 15' does not have an elastic end piece and thus has a smaller radial extension than the retention plate 15 that is provided with the end
25 piece 16.

The rotational movement of the axis of rotation 12 and of the retention plates 15 and 15' is likewise driven by the motor 4 via a V-belt 17 that encircles the upper
30 radius of a drive wheel 18 attached to an extension of the axis of rotation 12 projecting beyond the receptacle 11 on the motor side in such a way as to

cause the rotational movement by virtue of the friction contact.

The employed V-belt 17, like the other described means,
5 can of course be replaced by other means having the
same effect. For example, it is possible to use a motor
situated in the rotating roller rather than the V-belt
or else a motor that is directly mounted from the
outside - especially as a direct drive. The
10 adjustability can be likewise achieved in this manner.

The described height adjustment can also be achieved,
for example, in that the receptacle of the separator is
configured in the side walls of the conveyor belt so as
15 to be height-adjustable. A height adjustment in
several - especially two or three - stages is just a
suitable as a continuous adjustment.

Claims:

1. A method for separating letters in which
irregularly spaced and disordered piles of letters
5 that are being transported on a conveyor belt (1)
are rendered into a continuous stream of letters
that are largely not lying on top of each other and
that are distributed virtually homogeneously over
the conveyor belt (1),
10 **characterized in that**
at least one retention plate (15) affixed at an
axis of rotation (12) in a radial orientation with
respect thereto rotates around the axis of rotation
(12) that is arranged crosswise to the conveying
15 direction of the conveyor belt (1), horizontally
and above the conveyor belt (1) in such a way that
the retention plate (15) situated below the axis of
rotation (12) has a speed component in a direction
that is opposite to the conveying direction of the
20 conveyor belt (1).
2. The method according to Claim 1,
characterized in that
several retention plates (15, 15') rotate around
25 the axis of rotation (12).
3. The method according to one or more of the
preceding claims,
characterized in that
30 the distance between the axis of rotation (12) and
the conveyor belt (1) is varied.

4. A device for separating letters that renders
irregularly spaced and disordered piles of letters
that are being transported on a conveyor belt (1)
into a continuous stream of letters that are
5 largely not lying on top of each other and that are
distributed virtually homogeneously over the
conveyor belt (1),

characterized in that

10 it has an axis of rotation (12) that is arranged
crosswise to the conveying direction of a conveyor
belt (1), horizontally and above the conveyor belt
(1), and one or more retention plates (15, 15')
that are affixed at the axis of rotation (12) in a
radial orientation with respect thereto and that
15 rotate around said axis of rotation (12), whereby
the rotating retention plates (15, 15') can be
driven in such a way that, in at least one
operating state of the device, they have a speed
component that is opposite to the conveying direc-
20 tion of the conveyor belt (1) whenever they are
below the axis of rotation (12).

5. The device according to Claim 4,
characterized in that
25 the angular distances between the retention plates
(15, 15') are the same.

6. The device according to one or both of Claims 4 and
5,
30 **characterized in that**
one or more of the retention plates (15') has a
smaller extension in the radial direction relative

to the axis of rotation (12) than at least one other retention plate (15).

- 5 7. The device according to one or more of Claims 4 to 6,

characterized in that

an end piece (16) of at least one of the retention plates (15) is configured elastically in alignment with the radius relative to the rotational movement
10 of the retention plates (15, 15').