METHOD AND DEVICE FOR MERGING TWO FLOWS OF OBJECTS

ABSTRACT

A method for transporting and merging two flows of objects, in particular flat mail items, includes providing each of the two object flows with at least two respective objects. The two object flows follow one another in each respective transport path. One transport path merges into the other transport path. The two objects transported on the merging transport path are pushed over one another before reaching the merging point in such a manner that, when viewed in the transport direction, they overlap at least partially. The two objects are transported to a merging point in this overlapped state, infiltrated into the other transport path between the two objects transported on the other transport path and continue to be transported on the other transport path.
FIG. 2

T
FV-3
F1
FV-4
F2
Ps-3
St-1
F4
F3
F5
Ps-1
Ps-2
Ps-3
FV-2
F6
F7
F8
Li
FV-1
METHOD AND DEVICE FOR MERGING TWO FLOWS OF OBJECTS

CROSS-REFERENCE TO RELATED APPLICATION


BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The invention relates to a method and a device for transporting and merging two flows of objects, in particular flat mail items.

[0003] A method for transporting two flows of objects, in which each object flow respectively includes at least two objects that are transported following one another in each respective transport path, with the one transport path merging into the other transport path and the objects transported on the merging transport path being brought into the other transport path and continuing to be transported there, is known from International Publication No. WO 2006/110486 A2. That publication describes a sorting unit with at least two different feeders. Those feeders are connected by way of a matrix configuration through a number of transport paths to two different processing facilities, so that each feeder can load each processing unit. It is therefore necessary to combine one flow of flat mail items from one feeder with a further flow of flat mail items from another feeder.

[0004] It happens quite frequently, with the method known from International Publication No. WO 2006/110486 A2, that objects on the merging transport path or on the other transport path have to be stopped, to allow collision-free infiltration.

[0005] U.S. Pat. No. 6,793,063 describes a method and a device for combining two flows of objects. In that case, stacks of objects are separated and each object is classified by automatic reading.

BRIEF SUMMARY OF THE INVENTION

[0006] It is accordingly an object of the invention to provide a method and a device for merging two flows of objects, which overcome the hereinafter-mentioned disadvantages of the heretofore-known methods and devices of this general type and with which there is only a short delay for an object transported in the other transport path during infiltration.

[0007] With the foregoing and other objects in view there is provided, in accordance with the invention, a method for transporting two flows of objects each having at least two respective objects following one another in each respective transport path. The method comprises merging one transport path into the other transport path by bringing the objects transported on a merging transport path into another transport path at a merging point and continuing to transport the objects from the merging transport path in the other transport path. The two objects transported on the merging transport path are pushed over one another before reaching the merging point, causing the two objects to be transported in an at least partially overlapping state as viewed in a transport direction. The two objects are transported on the merging transport path to the merging point in the at least partially overlapping state, the two objects are infiltrated on the merging transport path into the other transport path between the two objects transported on the other transport path and the two objects from the merging transport path continue to be transported on the other transport path.

[0008] According to the invention two flows of objects are transported. Each of the two object flows includes at least two respective objects. These two objects are transported following one another in one respective transport path each. The one transport path merges into the other transport path.

[0009] The two objects, which are transported on the merging transport path, are pushed over one another before reaching the merging point in such a manner that, when viewed in the transport direction, they overlap at least partially. The two objects are transported to the merging point in this overlapping state, infiltrated into the other transport path between the two objects transported on the other transport path and continue to be transported on the other transport path.

[0010] With the objects of the invention in view, there is also provided a device for transporting two flows of objects. The device comprises a plurality of conveyor devices forming a merging transport path and another transport path into which the merging transport path merges at a merging point. The conveyor devices are each configured to transport a respective object flow containing at least two objects on each respective transport path to bring the objects transported on the merging transport path into the other transport path and continue to transport the objects transported on the merging transport in the other transport path. At least one stacking device is configured to push the two objects transported on the merging transport path over one another before reaching the merging point by placing the objects on the merging transport path in an at least partially overlapping state as viewed in a transport direction. The objects are transported from the merging transport path in the at least partially overlapping state to the merging point, the objects are infiltrated from the merging transport path into the other transport path between the two objects transported on the other transport path and the objects continue to be transported from the merging transport path on the other transport path.

[0011] Therefore, after infiltration:

[0012] the preceding one of the two objects which were already being transported on the other transport path before infiltration;

[0013] then the two objects pushed over one another, and

[0014] then the following one of the two objects, which were already being transported on the other transport path before infiltration;

[0015] continue to be transported on the other transport path.

[0016] Since the two objects from the merging transport path are pushed together, a high packing density is achieved. When they are pushed over one another, these two objects extend less far, when viewed in the transport direction, than before they were pushed together. This means that the following object on the other transport path has to be delayed less or for a shorter time, in order to infiltrate the two objects pushed over one another.

[0017] Instead of delaying the following object, infiltration can instead be implemented by accelerating the preceding object on the other transport path. In this instance, the invention means that this acceleration can be less marked or shorter.

[0018] In accordance with a concomitant feature of the invention, the action of pushing over one another is canceled.
after infiltration, in that the two objects that have been infiltrated in an overlapping manner are separated again and then continue to be transported with a gap between them. This embodiment allows the objects to be processed in a manner that is not possible with overlapping objects, for example the reading of addresses or other information applied to the objects.

[0019] Other features which are considered as characteristic for the invention are set forth in the appended claims.

[0020] Although the invention is illustrated and described herein as embodied in a method and a device for merging two flows of objects, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

[0021] The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0022] FIG. 1 is a diagrammatic, side-elevational view of processing facilities and transport paths of an exemplary embodiment of the invention; and

[0023] FIG. 2 is a side-elevational view of a merging transport path and read transport path.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Referring now to the figures of the drawings in detail and first, particularly, to FIG. 1 thereof, there is seen an exemplary embodiment in which flat objects are in the form of flat mail items, for example letters and/or postcards. The mail items are processed by a sorting unit. In the exemplary embodiment, the sorting unit has a read facility and a number of output transport paths, which lead respectively to an output container.

[0025] FIG. 1 shows a diagram of the processing facilities and transport paths of the exemplary embodiment.

[0026] The read facility reads the respective destination address provided on a mail item. Each mail item is transported to and ejected into one of the output containers as a function of the respective destination address.

[0027] Preferably a number of possible destination addresses are combined respectively into one destination region. All of the mail items for the same destination region are ejected into the same output container. The output container can be a transportable container, in which the mail items are transported away, or an output compartment, from which the ejected mail items are removed. The mail items are preferably ejected into an output container in such a manner that they are stacked into a stack, so that they lie flat one on top of another or upright in relation to one another in the output container. One embodiment of such a method is known from European Patent EP 915051 B1, corresponding to U.S. Pat. No. 6,179,284.

[0028] In order to ensure that the read facility can read the respective destination address, the mail items have to be carried individually past at least one camera K of the read facility. This camera K produces a digital image of the surface of each mail item, on which the destination address of the mail item is printed.

[0029] However, the mail items are supplied to the sorting unit in stacks. Therefore, the sorting unit in the exemplary embodiment has a number of feeders. Each feeder has a separator. In the exemplary embodiment, each separator is tailored to a specific type of mail item, e.g., one for separating large-format letters and one for separating standard letters and postcards. A mechanical separating facility has divided the mail items accordingly to size beforehand.

[0030] In the example in FIG. 1 there are two separators Ve-1, Ve-2.

[0031] A merging transport path leads to a read transport path LT from each feeder. The mail items are carried past the at least one camera K of the read facility on this read transport path LT. It is possible for each mail item to be carried past a number of cameras one after another, for example to read the mail item from different sides or from different viewing angles. Since the mail items originate from a number of feeders, a number of transport paths merge into the read transport path LT.

[0032] In the example in FIG. 1, a first merging transport path eT-1 leaves the separator Ve-1 and merges into the read transport path LT and a second merging transport path eT-2 leads from the separator Ve-2 into the read transport path LT. The first merging transport path eT-1 merges into a first stacking device SV-1 and the second merging transport path eT-2 merges into a second stacking device SV-2.

[0033] A separator Ve-L in the read transport path LT separates a number of mail items again, when they have been pushed together to form a small stack for infiltration purposes. FIG. 1 also shows a transport direction T in which the mail items are transported in the read transport path LT.

[0034] Output transport paths in turn branch off from the read transport path LT. All of the mail items for one output container are ejected from the read transport path LT into the output transport path to this output container.

[0035] In the example in FIG. 1, there are four output containers AB-1, AB-2, AB-3 and AB-4. Four output transport paths AT-1, AT-2, AT-3 and AT-4 to the four output containers AB-1, AB-2, AB-3 and AB-4 branch off from the read transport path LT. An ejection device AS-1 ejects those mail items, which are intended for the output container AB-1, from the read transport path LT into the output transport path AT-1. The other three ejection devices AS-2, AS-3, AS-4 shown operate correspondingly.

[0036] Each mail item is preferably transported on the transport paths in such a way that it is held by at least one conveyor device each time. Such a conveyor device includes an endless conveyor belt and a counter conveyor element, between which the mail item is clamped and thereby held. The counter conveyor element is, for example, a roller supported in a rotatable manner or a further endless conveyor belt. The endless conveyor belt and the counter conveyor element rotate at the same speed, thereby transporting the mail item between them.

[0037] Each flat mail item is preferably transported upright. The lower edge can rest on a further endless conveyor belt. Alternatively, during transportation, the mail item does not rest on a base but is held in the air by the conveyor belts.

[0038] According to the invention, there is a stacking device in each merging transport path. At least two successive separated mail items run into this stacking device. The stack-
ing device pushes the at least two mail items over one another in such a manner that they overlap at least partially. The at least two overlapping mail items leave the stacking device as a first small stack and are transported up to the point where this merging transport path merges into the read transport path.

[0039] FIG. 2 shows an exemplary embodiment of such a stacking device. The following conveyor devices are shown in this example:

[0040] a first conveyor device FV-1 with two driven endless conveyor belts F7 and F8;

[0041] a second conveyor device FV-2 with two driven endless conveyor belts F5 and F6;

[0042] a third conveyor device FV-3 with two driven endless conveyor belts F1 and F4; and

[0043] a fourth conveyor device FV-4 with two driven endless conveyor belts F2 and F3.

[0044] The first conveyor device FV-1 belongs to the merging transport path e1-1 in FIG. 1. The second conveyor device FV-2 is part of the first stacking device SV-1. The third conveyor device FV-3 and the fourth conveyor device FV-4 lie in the read transport path LT.

[0045] A succession of mail items has already been transported in the read transport path LT, preferably in the form of further small stacks, with a gap in between each. These small stacks originate, for example, from other merging transport paths. The first small stack is to be infiltrated into a gap between mail items in the read transport path. Individual mail items are also transported in the read transport path LT, for example because they are too thick to be combined to form a small stack.

[0046] In the example in FIG. 2, a small stack St-1 and an individual mail item Ps-3 are transported in the transport direction T in the read transport path LT. Two mail items Ps-1 and Ps-2 are to be combined to form a small stack and are to be infiltrated between the small stack St-1 and the further mail item Ps-3. After infiltration, the mail items are to be transported in such a manner that there is a distance both between the mail item Ps-3 and the small stack containing the mail items Ps-1 and Ps-2 and between the small stack and the further small stack St-1, respectively.

[0047] A light barrier in the merging transport path is used to determine the length of a first small stack to be infiltrated. A further light barrier, disposed in the read transport path, is used to determine the size of the gap between two successive mail items or further small stacks in the read transport path.

[0048] The first small stack is then infiltrated into the gap, if its length plus a minimum distance from the last preceding and first following mail item is smaller than the gap. Otherwise, the following mail items or further small stacks are preferably transported slowly or even temporarily stopped, while the preceding mail items or further small stacks are transported at the same or even faster speed. This lengthens the gap, so that the first small stack can be inserted.

[0049] The work of the stacking device in the merging transport path is described in more detail below with reference to FIG. 2.

[0050] The stacking device shown in FIG. 2 includes the conveyor belts F5 and F6 and the rollers, around which these two conveyor belts F5 and F6 pass. The merging transport path is formed, for example, by the conveyor belts F7 and F8. This transport path merges into a further transport path, namely the read transport path LT, which includes the conveyor belts F1, F2, F3 and F4 and into which a small stack St-1 is transported.

[0051] In one embodiment, the mail items are deflected as they pass through the stacking device. The transport direction in which they are transported is therefore modified by an angle α, which is preferably between 30 degrees and 60 degrees, e.g. it is equal to 45 degrees.

[0052] A preceding mail item Ps-1 is transported by a first conveyor device (endless conveyor belt and counter conveyor element) FV-1 in the old transport direction, until the mail item Ps-1 is taken up by a second conveyor device FV-2. In the example in FIG. 2, this first conveyor device FV-1 includes the conveyor belts F7 and F8. A second conveyor device FV-2 includes the conveyor belts F5 and F6. The second conveyor device FV-2 deflects the mail item Ps-1 by the angle α into the new conveyance direction and transports the mail item Ps-1 until it is no longer held by the first conveyor device FV-1 (with the conveyor belts F7 and F8). The first conveyor device FV-1 then stops or slows down the further transportation of the preceding mail item Ps-1. For this purpose, it is necessary for the mail item Ps-1 to no longer be held by the first conveyor device FV-1, as otherwise it would be compressed by the two conveyor devices FV-1 and FV-2.

[0053] The first conveyor device FV-1 transports a following mail item Ps-2 until it arrives at the stopped preceding mail item Ps-1 at an angle. During the stoppage, the preceding mail item Ps-1 rests in front of an endless conveyor belt F6 of the second conveyor device FV-2, when viewed in the old transport direction. This means that the arriving following mail item Ps-2 cannot bend the stopped preceding mail item Ps-1 upon arrival but is deflected, because the first conveyor device continues to transport the following mail item in the old transport direction, until the second conveyor device has taken up the following mail item.

[0054] The second conveyor device takes up the preceding and following mail items. These mail items now overlap at least partially. A small stack is thus formed, including the preceding mail item Ps-1 and the following mail item Ps-2. The stacking device transports this small stack away in the new transport direction, with the second conveyor device FV-2 continuing to transport the small stack containing the mail items Ps-1 and Ps-2.

[0055] The mail items are generally rectangular and therefore each has a front edge when viewed in the transport direction. A light barrier Li in the merging transport path is used to measure the time when the front edge of the preceding mail item passes the light barrier and the time when the front edge of the following mail item passes the light barrier. The transportation speeds of the two conveyor devices FV-1, FV-2 are controlled and are therefore also known. The second conveyor device FV-2 transports the preceding mail item in the new transport direction until the front edge is in a defined position, when the rear edge is no longer held by the first conveyor device. The point at which the front edge of the following mail item meets the stopped preceding mail item is therefore at a known and adjustable minimum distance from the front edge of the preceding mail item. This distance is preferably as small as possible, so that the overall length of the small stack is as short as possible.

[0056] The light barrier Li in the merging transport path preferably also measures the times when the rear edges of the two mail items pass the light barrier Li. The overall length of the small stack now formed is calculated from this informa-
tion and the transportation speed of the first conveyor device \( FV-1 \) and the above-mentioned distance between the front edge of the preceding mail item \( Ps-1 \) and the meeting point.

0057. The conveyor devices of the sorting unit can only transport mail items up to a certain thickness. This maximum thickness is determined by the distance between the endless conveyor belt and the counter conveyor element, as well as the extent to which this distance can be extended. The space available for changing the transportation direction of small stacks also limits the maximum thickness. Therefore, a maximum thickness for small stacks is predetermined in this embodiment. Each small stack can at most be as thick as the maximum thickness.

0058. In one embodiment, the thickness of each mail item is measured, after it has passed through the respective feeder and separator and before it reaches the stacking device. If two successive mail items are of two thicknesses and the sum of their thicknesses is less than or equal to the maximum thickness, these mail items are combined to form a small stack. It is possible for more than two mail items to be combined, if the sum of their thicknesses is less than the maximum thickness. If the sum of the thicknesses of two successive mail items is greater than the maximum thickness, these mail items are infiltrated into the read transport path \( LT \) one after another and not as a small stack.

0059. As mentioned above, the endless conveyor belts operate in a controlled manner. Their transportation speeds are therefore known. Therefore, and because the light barrier \( Li \) measures the position of each mail item, it is known when a small stack, transported in the read transport path \( LT \), reaches the separator \( Ve-L \) in the read transport path \( LT \). This separator \( Ve-L \) separates small stacks again, so that the camera can produce a digital image of each mail item. Since the time when a small stack reaches the separator \( Ve-L \) is known, it does not have to be determined whether mail items reach the separator \( Ve-L \) overlapping or individually.

1. A method for transporting two flows of objects each having at least two respective objects following one another in each respective transport path, the method comprising the following steps:

- merging one transport path into the other transport path by bringing the objects transported on a merging transport path into another transport path at a merging point and continuing to transport the objects from the merging transport path in the other transport path;
- pushing the two objects transported on the merging transport path over one another before reaching the merging point causing the two objects to be transported in an at least partially overlapping state as viewed in a transport direction; and
- transporting the two objects on the merging transport path to the merging point in the at least partially overlapping state and infiltrating the two objects on the merging transport path into the other transport path between the two objects transported on the other transport path and continuing to transport the two objects from the merging transport path on the other transport path.

2. The method according to claim 1, which further comprises pushing the two objects transported on the merging transport path over one another as viewed in the transport direction, resulting in a predetermined distance between front edges of the two objects transported on the merging transport path, as viewed in the transport direction.

3. The method according to claim 2, wherein the front edges of the two objects, after having been pushed over one another, lie on top of one another as viewed in a direction perpendicular to the transport direction.

4. The method according to claim 1, which further comprises separating the two objects transported in the at least partially overlapping state once again after the infiltrating step, forming a gap between the two objects as viewed in the transport direction.

5. The method according to claim 1, which further comprises carrying out the step of pushing the two objects over one another by carrying out the following sub-steps:

- deflecting a preceding object from an old transport direction into a new transport direction and then stopping the preceding object;
- continuing to transport a following object until it meets the stopped preceding object;
- likewise deflecting the following object into the new transport direction; and
- continuing to transport the two deflected objects in the new transport direction in the at least partially overlapping state.

6. The method according to claim 1, which further comprises:

- measuring respective thicknesses of the two objects transported on the merging transport path;
- only pushing the two objects over one another, if a sum of their two thicknesses is less than or equal to a predetermined thickness limit; and
- otherwise infiltrating the two objects into the other transport path with a gap formed between them, if the sum of their two thicknesses is more than the predetermined thickness limit.

7. A device for transporting two flows of objects, the device comprising:

- a plurality of conveyor devices forming a merging transport path and another transport path into which the merging transport path merges at a merging point;
- said conveyor devices each being configured to transport a respective object flow containing at least two objects on each respective transport path and to bring the objects transported on the merging transport path into the other transport path and continue to transport the objects transported on the merging transport path in the other transport path;
- at least one stacking device configured to push the two objects transported on the merging transport path over one another before reaching the merging point by placing the objects on the merging transport path in an at least partially overlapping state as viewed in a transport direction; and
- said conveyor devices transporting the two objects from the merging transport path in the at least partially overlapping state to the merging point, infiltrating the objects from the merging transport path into the other transport path between the two objects transported on the other transport path and continuing to transport the objects from the merging transport path on the other transport path.

8. The transport device according to claim 7, which further comprises a separator disposed in the other transport path for separating the at least two overlapping transported objects again.