An apparatus for separating overlapping parcels in a vertical position has separating sections arranged along a transport path immediately behind one another, and a drive controller for the separating sections. Drives of those separating sections, in which the most advanced upstream parcel is located are stopped immediately as soon as its front edge is detected in a reception position and a slip-free further transport is securely guaranteed. Number and length of the separating sections are selected in accordance with the range of parcel lengths and the rated transport speed so that a subsequent parcel located at a minimum gap distance is not yet located in the upstream rearmost stopped separating section. The drive of each stopped separating section is started again as soon as the rear edge of the preceding parcel has left this separating section or as soon as the subsequent parcel is located before a free separating section.
The invention relates to a separating distance for overlapping flat parcels in a vertical position in accordance with the preamble of claim 1.

Single-stage (U.S. Pat. No. 3,372,925, U.S. Pat. No. 2,941,653) and multistage (U.S. Pat. No. 6,135,441 A) separating devices are known. With multistage separating devices the individual stages of the separating device are separated spatially from each other. These are belt drive groups separated after one another (U.S. Pat. No. 6,135,441 A).

The device known from U.S. Pat. No. 2,941,653 comprises a separating section, in which the parcels are also accelerated and an acceleration section in which the parcels are further accelerated, and in which in addition in the case of a double transport one of the parcels is removed.

Transferring parcels between two transport sections over a transfer gap at different transport speeds is known from FR 2 657 857 A1.

The way in which parcels can be passed between two transport sections at different transport speeds without a transfer gap is known from U.S. Pat. No. 3,372,925, U.S. Pat. No. 2,941,653 and U.S. Pat. No. 1,858,320 respectively. In this context, arranging individually supported deflection rollers of the transport belts of two adjacent transport sections alternating in height on a common axis is known from U.S. Pat. No. 3,372,925 and from U.S. Pat. No. 1,858,320.

The position of the parcels is monitored in these known devices with the aid of light barriers. With these solutions it is difficult to separate parcels in a wide range of lengths with high throughput and while keeping the load imposed to a low level.

A separating distance described in U.S. Pat. No. 6,550,764 B2 features two separately driven separating sections, but which are far enough away from each other for even the large parcels not to be able to be located simultaneously in both separating sections during transport. A reception point is also arranged here after each separating section. The separating sections thus do not act jointly on a parcel or a double extraction.

In addition a separating section is known from DE 102 12 024 A1 with two separating sections following directly after one another, which however are not separately controllable.

The object of the invention is to create a separating distance for overlapping flat parcels in a vertical position with which the parcels can also be separated in a large range of lengths with high throughputs at low loads.

In accordance with the invention the object is achieved by the features of claim 1.

In this case the drive control for the separating sections is designed so that the drive of those separating sections, in which the most advanced upstream parcel is located in each case are stopped immediately as soon as its front edge is detected in the reception position and a largely slip-free further transport is securely guaranteed. Number and length of the separating sections are selected in accordance with the range of parcel lengths and the rated transport speed so that subsequent parcel located at the minimum gap distance is not yet located in the upstream rearmost stopped separating section. The drive of each stopped separating section is started again as soon as the rear edge of the preceding parcel has left this separating section in each case or as soon as the subsequent parcel in each case is located just before a free separating section.

The stop/start process of the separating sections for transporting the preceding parcel thus does not influence the transport of the subsequent parcel in the separating distance, which then without interruption and load moves with a small gap from the preceding parcel up to the reception point.

Advantageous embodiments of the invention are set down in the subclaims.

To maintain the minimum, i.e. the optimum gap between the parcels, it is advantageous for the short parcels for the gap from the midpoint of the downstream rear deflection rollers of the transport belts from the separating section at the reception point of this corresponds to the minimum parcel length minus the minimum gap between the parcels minus the distance covered by the parcels on braking from the relevant rated speed to the value 0 or on acceleration from standstill to the rated speed.

So that the subsequent parcel can follow the previous parcel at a minimum distance it is advantageous, if upstream from the separating section at the reception point at least one separating section is arranged, for which the distance of the center points of the deflection rollers of the transport belts on the transport path corresponds to the minimum gap between the parcels minus the distance covered by the parcels on braking from the relevant rated speed to the value 0 or on acceleration from standstill to the relevant rated speed. The gaps between the centers of the deflection rollers of the transport belts of these transport sections from the adjacent deflection rollers of the adjacent transport sections correspond in this case at least to the distance which the parcels cover on braking from the relevant rated speed to the value 0 or on acceleration from standstill to the relevant rated speed, but at their maximum are not greater than the minimum parcel length.

To maintain the minimum, i.e. the optimum gap between the parcels even with long parcels, it is advantageous for the gap between the center points of the deflection rollers of the separating sections arranged upstream adjoining the separating section(s) downstream, of which the deflection rollers on the transport path are spaced from each other by the value of the minimum gap between the parcels minus the distance which the parcels cover when braking from the relevant rated speed to the value 0 or on acceleration from standstill to the relevant rated speed, from the reception point correspond to at least the length of the longest parcel minus the minimum gap reduced by the braking or acceleration distance between the parcels.

The invention is explained below in an exemplary embodiment with reference to the drawing.

The FIGURE shows

A multistage separating device consist of an input area not shown in which stacks of vertical parcels are fed automatically to first separating units, e.g. vacuum-assisted extraction belts on which the frontmost parcels are drawn off in each case and then fed to further separating sections 12-13: of a separating distance. This is necessary since the parcels are frequently located, sometimes deliberately, at the start of the separating distance in overlapped form as an overlapping
flow of parcels and parcel flow is then to be resolved into individual parcels moved with gaps between them. Fixed retaining elements can be arranged on the side opposite the removal or transport belt. These retaining elements are however frequently not in a position to completely resolve the overlapped flow. In FIG. 1 the rear part of the separating distance is shown in a head-on view, with the retaining elements lying opposite the separating elements on the transport path not being shown for reasons of clarity.

Individually-supported deflection rollers 2 of the transport belts 3, which are driven in the separating sections 12, 13a in each case by a drive motor 4.1, 4.2, are mounted between the two separating sections 13a on a common shaft 1. The transfer gap in the flow of the vertical parcels which are standing in the transport path on an underfloor belt not shown to support transport is reduced in this way to 0 mm. The arrangement allows an absolutely impact-free parcel transfer to the subsequent separating section 13a.

The different-height, preferably alternating arrangement of the transport belts 3 in the separating sections 12, 13a means that the retaining elements acting between the transport belts 3 must change their vertical positions. Parcels 8, 9, which have hooked onto holes or fastenings in each other, i.e. multiple removals, can, as a result of the different gripping points of the retaining elements on the parcels 8, 9, be released from each other more easily.

If the belt transport is to be additionally assisted by vacuum, stably arranged vacuum chambers 7 of the accepting separating sections 12, 13c in each case are advantageously arranged close to the transition from the previous separating section. The parcel 8.9 to be accelerated is pulled at an early stage in the next upstream separating section by its vacuum chamber 7 onto its transport belt 3 so that the carrying force is increased.

Each next upstream separating section has a higher transport speed in relation to the preceding separating section, which provides additional support for the separating process.

An array of sensors 11 with individual light barriers 11a - d is arranged along the transport path, with which the positions of the front and/or rear edges of the parcels 8,9 for triggering switching signals for the drive motors are identified.

So that the parcels 8,9 are transferred with few difficulties into the reception point 10, clamped between transfer rollers 6, of which the opposing rollers are not shown, the transfer rollers 6 are arranged so that they can rotate jointly on a shaft with the rear deflection rollers 2 of the last separating section 13c. So that the parcels are transported in the separating distance with small gaps in the most protected manner possible, operation is set up so that each subsequent parcel 8,9 is transported without interruption at least through the upstream part of the transport path up to the reception point. In this process however overlaps of the parcels are also to be resolved where possible. For this reason the first parcel is transported through the separating sections 13a-c to parcel reception point 10 without stopping. As soon as the light barrier 11d positioned directly over the clamping point of the parcel transfer 10 is darkened by the front edge of the parcel, the parcel 8,9 is gripped by the rollers of the reception point 10 and all separating sections 13a-c in which the first parcel is located are stopped (this is the separating section 13c for the short parcel 9, for longer parcels in addition the separating section 13d as well and for a very long parcel 8 also the separating section 13a too). The first parcel is now drawn out by the transfer rollers 6 of the reception point 10 against stationary transport belt 3. These additionally act as retaining elements on the parcel transport side on any double withdrawal which might occur.

Number, gaps and lengths of the separating sections 13a-c are selected so that the subsequent parcel with "minimum gap" distance in each case is not yet located in one of the stopped separating sections 13. In this example, in relation to the shortest and the longest parcel 9,8, this means: The distance between center points of the deflection rollers 2 of the separating sections 13c located on the transport path at the reception point 10 corresponds to the length of the shortest parcel 9 minus the minimum gap between the parcels 8,9 minus the acceleration or braking distance which is necessary to bring a parcel 8.9 from standstill up to the relevant rated speed or from the rated speed to a standstill. Before this there is a separating section 13b, of which the center points of the deflection rollers 2 on the transport path are at a distance of the value of the minimum parcel gap minus the acceleration/braking distance from each other. The center points of these deflection rollers 2 are at a distance from the center points of the adjacent deflection rollers 2 of the adjacent separating sections 13a, 13c of at least the amount of the acceleration/braking distance. The distance between the center points of these deflection rollers 2 must however also be smaller than the length of the shortest parcel 9 to ensure its safe transport.

If the front edge of the longest parcel 8 has reached the reception point 10, the distance from the rear edge to the center point of the rear deflection roller 2 on the transport path of the separating section 13a is the amount of the minimum parcel gap minus the acceleration/braking distance.

If the difference between the shortest and the longest parcel 9,8 is greater, a number of separating sections, for which the distance between the center points 1 of the deflection rollers 2 on the transport is the amount of the minimum parcel gap minus the acceleration braking distance, are arranged after one another.

As soon as the rear edge of the preceding parcel leaves the relevant separating sections 13a-c, which is detected by the light curtains 11a-d the drive motors 4.2 to 4.5 of the relevant separating sections are started again to transport the subsequent parcel i.e. this enters moving separating sections. The drive motors 4.2 to 4.5 can also be started as soon as the subsequent parcel 8, 9 is located shortly before a free separating section 13a, 13b, 13c.

If the start of the resolution of overlapping is determined by the fact that the rear edge of the previous parcel is moving more slowly than the transfer rollers 6 of the reception point 10, and if this resolution is successful before the parcel transfer, the gap between the front edge of the rear parcel of the overlap and the rear edge of the front parcel of the overlap is monitored with the aid of a timer unit (in the drive motor 4.5 of the transfer rollers 6) and the sensor array 11. When the required gap is achieved the separating sections 13a, 13b and 13c 13a, 13b and 13c are started again.

If the overlap is not separated before transfer of the parcel in the reception point 10, a double withdrawal is occurring. As soon as the rear edge of the overlap has then reached the reception point 10, the separating sections 13a, 13b and 13c are started again.

1.-4. (canceled)
5. An apparatus for separating overlapping flat parcels in a vertical position, comprising:
a number of separately-driven separating sections arranged along a transport path immediately behind one another; and

a drive controller for the separating sections,

wherein each separating section comprises:

transport belts for transporting parcels,

a retaining element at a height between the transport belts and operating with frictional force on the parcels, and

an array of sensors arranged along the transport path and configured to detect front and rear edges of the parcels,

wherein separated parcels are accepted clamped into a transport means and removed from the separating distance at a reception point at a downstream flow end of the separating apparatus,

wherein the drive controller comprises a drive motor for each separating section, and is configured so that the drive motor of those separating sections, in which a frontmost downstream parcel is located, is immediately stopped as soon as its front edge is detected in the reception point,

wherein number and length of the separating sections are selected in accordance with a range of lengths of the parcels and rated transport speeds so that a subsequent parcel spaced at a minimum gap in each case is not yet located in a rearmost downstream stopped separating section, and

wherein the drive motor of each stopped separating section is restarted as soon as a rear edge of a previous parcel in each case has left a current separating section or as soon as the subsequent parcel in each case is located before a free separating section.

6. The separating apparatus of claim 5, wherein downstream rear deflection rollers of the transport belt have a center point, wherein a distance between the center point and a separating section upstream from it to the reception point corresponds to a minimum parcel length plus a minimum gap between the parcels minus a distance, which the parcels cover during braking from the relevant rated speed to a standstill, or one acceleration from standstill to the relevant rated speed.

7. The separating apparatus of claim 5, wherein deflection rollers of the transport belts have a center point, wherein upstream from the separating sections at the reception point at least one separating section is arranged, for which a distance of the center points corresponds to a minimum gap between the parcels minus a distance covered by the parcels on braking from the relevant rated speed to standstill or on acceleration from standstill to the relevant rated speed, and distances of the center points of these separating sections from adjacent deflection rollers of adjacent separating sections at least correspond to a distance which the parcels cover on braking from the relevant rated speed to standstill or on acceleration from standstill to the relevant rated speed, but at a maximum are not greater than the minimum parcel length.

8. The separating apparatus of claim 5, wherein downstream rear deflection rollers of the transport belts have a center point, wherein a distance between the center points of the deflection rollers arranged upstream of the separating sections adjacent downstream to the separating sections of their deflection rollers on the transport path corresponds to an amount of a minimum gap by which the parcels are spaced from one another, minus a distance covered by the parcels on braking from the relevant rated speed to standstill or on acceleration from standstill to the relevant rated speed from the reception point at least the length of a longest parcels minus a minimum gap between the parcels reduced by the braking or acceleration distance.