Description

Apparatus for handling goods to be sorted

The invention relates to a device for handling sort items, according to the preamble to claim 1.

Sort items within a sort item handling plant are transported in particular in known mail sorting plants or indeed in airport facilities with the aid of a transport tray system. In the case of the latter, after the baggage items have been taken into the handling plant, they are transferred to transport trays. Consequently, the conveying system is set up for conveying a standardized or uniform item to be conveyed, which is a major advantage in the prevention of malfunctions. The transport trays are transported by a conveying system that is stationary or fixed to the floor and has rails, track switches, merges, ascending sections, high-speed sections and the like in which fixed drive elements are integrated. The drive elements used are driven rollers, belts, linear motors and so on. At a sorting destination, the transport tray can be tilted by a special positioner in order to discharge the transported baggage sort item to a conveying unit that guides it away.

Moreover, a solution having circulating accommodation cells that take the form of so-called cross-belt carts is known. These carts are equipped with a drivable belt that, at a sorting destination, is driven transversely to the direction of transport, for conveying away the baggage sort item.

A further known solution comprises the arrangement of webbing belt elements, preferably U-shaped channels, that take a

pivotable form. A baggage sort item is transported from one webbing belt element on to the next. At a sorting destination, the appropriate webbing belt element is pivoted outward, as a result of which the baggage sort item is discharged to a sorting end point that guides it away, for example a chute. The item is discharged at the nominal speed of the sorter and exclusively longitudinally, in the direction of transport.

The object of the invention is to provide a device for handling sort items of the type mentioned in the introduction, in which the cost of manufacture, operation and maintenance can be reduced.

According to the invention, the object is achieved by a generic device having the features specified in the characterizing part of claim 1. According to this, the sorting plant has at least one main conveying section for transport means of the set of transport means, at least one unloading point, allocated to at least one sorting destination, for unloading the transport means, and an unloading section that is allocated to the unloading point and branches off from the main conveying section, and which takes a form such that travel on the unloading section by a laden transport means brings about unloading of the associated sort item at the unloading point. As a result of this - and in contrast to conventional tilting trays equipped with a tilt drive, cross-belt carts and webbing belt elements - it is possible to dispense with a positioner of the transport means that is specially set up for unloading an accommodated sort item. By comparison with the known solutions - in which the sort item is unloaded exclusively perpendicular to the direction of transport - increased flexibility in respect of the direction of unloading may be achieved. Travel on the unloading section

by a laden transport means advantageously brings about forced unloading of a sort item accommodating means of the transport means, without there being a need to trigger a movement of this sort item accommodating means in relation to other parts of the transport means. In particular during travel along the unloading section, it is advantageously possible to perform a movement of the sort item accommodating means in relation to the floor, in particular a tilt, by means of a constructional embodiment of a guide system of the unloading section. It is possible for the way unloading of the transport means is performed to be provided in a constructionally simple manner with the aid of a small number of differently laid-out modules. Thus, to form an unloading point, a track switch at a branching point of the main conveying section may be sufficient and, for a tilting procedure of the transport means, specially laid-out section segments for the unloading section may be sufficient. By this means, a large number of unloading points may be achieved at low cost.

The term "sort item" should in particular be understood to mean a baggage item or an item of mail having a particular sorting destination, or a bundle of baggage items or mail items to which the same sorting destination is allocated.

The term "sorting destination" preferably refers to a point in an airport facility, railway station facility, harbor facility or a similar establishment for receiving passengers that is equipped with a baggage handling device in which a baggage item is handled once it has been transported at least through the sorting plant, for reception by a receiver. A receiver, in this sense, may be a passenger transport means such as a vehicle, an aircraft or a passenger ship into which the sorted baggage item is to be loaded. The receiver may also be a

baggage discharge means that serves to discharge baggage items to passengers. Thus, a sorting destination in the first case mentioned may in particular be a transfer point, also called a make-up area, at which the sorted baggage item is loaded manually and/or at least partly automatically into a transport means which conveys it to the passenger transport means or loads it directly into the passenger transport means. These said transfer points and the corresponding sorting destinations are thus preferably allocated to a passenger transport means to be laden. In the second case mentioned, a sorting destination may be a point at which the baggage item reaches a plant for baggage discharge, also called baggage reclaim. For example, the baggage item may at this point be transferred onto a carousel that conveys the baggage sort item into an area accessible to the passengers.

If a baggage item is to be stored before being discharged to one of the above-mentioned sorting destinations, a storage cell in a storage plant may be considered a temporary receiver, in the above sense. The storage cell may in this case be considered a temporary sorting destination that is allocated to a baggage item to be stored if a final sorting destination of the types mentioned above is not or cannot be allocated.

The term "input point" preferably relates to a point in one of the above-mentioned establishments for receiving passengers at which a baggage item to be sorted reaches a baggage handling plant. For example, an input point may correspond to a baggage check-in counter at which a passenger hands in a baggage sort item. In another embodiment, an input point may be a point at which a baggage item of an arriving passenger transport means

is, after being unloaded from the passenger transport means, loaded onto a conveying system of a baggage handling plant.

Handling that takes place "between" an input point and sorting destinations should in particular be understood to mean handling that takes place along at least one transport path that connects the input point to at least one sorting destination, with the course of the transport path for a sort item depending on the sorting destination that is allocated to the sort item. In this case, the sorting destination corresponds to the end of the transport path. The arrangement of the sorting plant "between" the input point and the sorting destinations relates to the flow of sort items along these transport paths.

In particular, the sorting plant is provided for the provision of a specific transport path that leads to an allocated sorting destination. The transport path can connect the input point directly to the sorting destination, or it may be formed by at least two portions that on the one hand connect the input point to a storage plant and on the other connect the latter to an allocated sorting destination.

In a preferred embodiment of the invention, the sorting plant has a set of unloading points that are arranged one after the other, as seen in the conveying direction of the main conveying section, there being allocated to this set of unloading points a set of unloading sections that branch off from the main conveying section at branching points that are arranged one after the other. As a result, a large number of sorting destinations may be served by the main conveying section in a compact embodiment.

In particular, the unloading sections are oriented parallel to one another and merge into a common no-load section for unladen transport means, as a result of which efficient removal of unladen transport means and a space-saving arrangement of the unloading sections may be achieved.

In this context, a space-saving combination of the unloading sections with conveying elements that guide away the unloaded sort items to the sorting destinations may be achieved if the main conveying section is constructed to be straight and the unloading sections are oriented obliquely in relation to the main conveying section. The term "oblique" orientation should in particular be understood to mean an orientation in which an acute angle is formed in each case between the main conveying section and the unloading sections.

According to an alternative variant, the unloading sections join into the main conveying section again, as a result of which the space requirement lateral to the main conveying section can be kept small, since a no-load section parallel to the main conveying section can be eliminated. Favorably, the unloading sections join into the main conveying section at merge points, with the branching points and the merge points of the unloading sections preferably alternating.

Moreover, it is proposed that there is allocated to each of the unloading sections a conveying element, which serves to guide away to the allocated sorting destination a sort item that is unloaded along the unloading section and which extends below the unloading section, as a result of which a further saving on space may be achieved.

According to a further advantageous embodiment of the invention, the main conveying section has a closed ring-shaped portion.

Furthermore, it is proposed that each of the transport means has a sort item accommodating means and a drive means that is coupled for coupling to a drive system that is fixed to the floor, for moving the transport means onward, as a result of which current and widely available sort item accommodating means such as, in particular, transport trays, and a conveying system provided therefor may be employed.

However, it is advantageously possible to dispense with drive elements of a stationary conveying system, at least in a part area of the sorting plant, if the transport means take the form of transport vehicles each including a drive unit that is provided for autonomous onward movement of the transport vehicle, at least within a part area of the sorting plant. Further, it is possible to achieve increased flexibility in the direction of loading, transport and discharge and in the speed of transport in various areas. This increased flexibility may further advantageously be used to optimize the overall throughput. In particular, the speed of a transport vehicle on an unloading section may be different from a nominal speed of the main conveying section.

In particular, the set of transport vehicles for autonomous onward movement is provided at least in a part area of the sorting plant bordering on the sorting destinations. To put it another way, the transport vehicles may move autonomously on a transport path portion that leads to the sorting destination. In a particularly advantageous embodiment, the transport vehicles may move autonomously along an entire transport path

that connects the input point or a loading station for loading the transport vehicles to a sorting destination, as a result of which the use of fixed drive elements may to a very large extent be avoided in the entire sorting plant. If the transport path leads via a storage plant, transport along the above-mentioned portions may be by means of different transport vehicles.

In a preferred embodiment of the invention, the device for handling sort items has a set of sort item accommodating means that each form an accommodation surface for a sort item and are provided for separable coupling to a transport vehicle of the set of transport vehicles. As a result, transport of a sort item to the allocated sorting destination can be performed by means of a single sort item accommodating means. To put it another way, a sort item may remain on the same sort item accommodating means during its handling until it is unloaded at a sorting destination. This sort item accommodating means may in particular be provided with an encoding device, which is encoded with data of the sort item that is accommodated or is to be accommodated. This data may advantageously be read and evaluated by read devices of the sorting plant, for preparing a transport path or for tracking the sort item. In a simple embodiment, the sort item accommodating means take the form of transport trays. The sort item accommodating means are preferably provided with a coupling interface by means of which a separable coupling to a coupling region of the transport vehicles may be made.

Moreover, it is proposed that the sort item handling device has a guide device that is fixed to the floor and that is provided for guiding the transport vehicles. As a result of this, equipping the transport vehicles with a complex, active

steering device that is set up for any kind of movement may be avoided, with the guide device nonetheless being to a very great extent, in particular entirely, free of drive elements. In this arrangement, an energy-saving drive unit may be employed for equipping the transport vehicles. If - in a particular embodiment - the transport vehicles are self-sufficient in respect of their power supply, then, because of the low power consumption, energy stores of small size may be used. In this embodiment, moreover, a permanent power feed provided for example via the static guide device may be dispensed with.

The guide device may in particular be formed by modular and purely passive trackway elements that are selected from a small number of modules. These may take the form of a straight segment, a horizontal curved segment, a vertical curved segment, a track switch segment that may also be used as a merging segment, and so on. The layout of the guide device may be set up to be particularly flexible. For example, on the basis of a small number of trackway modules, it is possible to provide the layout of a linear sorter, which may take a straight, U-shaped, serpentine, one-sided, two-sided form, and so on, and/or a ring-shaped sorter. An arrangement of sorting portions in a plurality of planes one above the other may be realized by connecting straight segments and/or vertical curved segments.

Advantageously, the guide device has the above-described branching points, at which unloading sections branch off from the main conveying section and which each enable onward travel in a first or in at least a second conveying direction, with the transport vehicles each having an active steering device that brings about onward transport in the first or second

conveying direction, as a result of which passive static guide elements, in particular passive track switches, can be employed at these branching points. The term "active" steering device should be understood to mean a steering device that is operable by means of a drive of the transport vehicle.

In order to control a large quantity of transport vehicles, it is proposed that the transport vehicles each have a control unit for controlling onward movement and that a traffic guidance system that is fixed to the floor is provided, to which the control unit is provided with a data link. Communication between the control unit and the traffic guidance system may be via a transmitting and receiving unit of the transport vehicle, which is provided for making a preferably wireless data link to the traffic guidance system.

As an alternative or in addition, some of the control tasks may be performed in a decentralized manner, in that the transport vehicles each have a control unit for controlling onward movement, and the control units on the vehicles are provided for data communication with one another. This may in particular be performed by establishing wireless data communication between the transmitting and receiving units of the transport vehicles.

As described above, unloading of an accommodated sort item may be triggered by a movement of the transport means in relation to the floor, wherein this movement is achieved by means of a specific embodiment of guide elements of the unloading section in that for example the unloading section has a twisted section segment, or a curved and at least partly vertically oriented section segment. As an alternative, there is allocated to the unloading section a deflecting element that

is fixed to the floor, as a result of which the horizontal orientation of the transport means may be maintained during unloading.

Further properties and advantages of the invention will become apparent from exemplary embodiments which are explained below in more detail with reference to the drawings, in which

FIG 1 shows a baggage handling device having a sorting plant and a storage plant,

FIG 2 shows a transport vehicle for transporting a baggage sort item,

FIG 3 shows a detailed view of the sorting plant from above, in the area of unloading points,

FIG 4 shows the transport vehicle from FIG 2, along a twisted section segment, at an unloading point,

FIG 5 shows the transport vehicle from FIG 2, along a curved section segment, at an unloading point,

FIG 6 shows the transport vehicle from FIG 2, along a section segment that is provided with a deflector, at an unloading point,

FIG 7 shows a variant on the linear layout from FIG 3,

FIG 8 shows the arrangement of two sets of unloading points which are served by a common main conveying section,

FIG 9 shows an alternative embodiment to the arrangement from FIG 8,

FIG 10 shows the arrangement of two sets of unloading points which are served by a common ring-shaped main conveying section,

FIG 11 shows an alternative embodiment to the arrangement from FIG 10, with conveying sections on different planes,

FIG 12 shows the arrangement of two sets of unloading points, with two corresponding unloading points of the sets allocated to the same sorting destination,

FIG 13 shows the combination of two arrangements according to FIG 3, with transition sections between the allocated main conveying sections,

FIG 14 shows the combination of two arrangements according to FIG 8, with transition sections between the allocated main conveying sections,

FIG 15 shows a variant on the arrangement according to FIG 10, with shortening sections between parts of the ring,

FIG 16 shows an alternative embodiment of the arrangement from FIG 15, with conveying sections on different planes,

FIG 17 shows the storage plant from FIG 1 in a view from above,

FIG 18 shows the storage plant from FIG 1 in a side view,

FIG 19 shows a variant on the storage plant from FIG 18,

FIG 20 shows the storage plant from FIG 19 in a front view,

FIG 21 shows a variant on a transport means, and

FIG 22 shows a variant on the layout from FIG 3.

FIG 1 shows a handling plant 10 of an airport in a schematic view from above. This serves to handle, in particular to accommodate and transport, baggage sort items 12 along transport sections 14, wherein a baggage sort item 12 follows a transport path according to a combination of transport sections 14, and the combination is formed according to sorting criteria that are allocated to the baggage sort item 12.

The handling plant 10 is part of a baggage handling device 13 of the airport, which moreover has at least one input point 15 having a plurality of input stations 16 and a plurality of sorting destinations 18. In the exemplary embodiment under consideration, the assumption is made that the input point 15 corresponds to a baggage handover area or check-in area of the airport, the input stations 16 being formed by staff-operated and/or automatic counters. At the input point 15, the baggage sort items 12 are each provided with an identification means by means of which information at least regarding the flight destination, the allocated flight and the owner of the baggage sort item 12 is stored in optical and/or electronic form. The identification means may take the form of a wraparound baggage label with the bar code printed on, or as an electronic memory with a receiving and transmitting unit, in particular an RFID tag.

The sorting destinations 18 correspond to transfer stations at which a baggage sort item 12 that is handled by the handling plant 10 is transferred, manually or in at least partly automated manner, onto or into a transport means 22 that serves to transport a collection of baggage sort items 12 to an aircraft. The transport means 22 may take the form of transport bins or containers (e.g. standardized loading units such as so-called ULDs).

In a further embodiment (not shown), the input point 15 may be a transfer station at which baggage sort items 12 of a flight that has landed are transferred from an above-mentioned transport means 22 onto a conveying system of the handling plant 10. In this case, the sorting destinations 18 may correspond to a baggage output area or baggage claim area of the airport, in particular a particular baggage output belt, or a further transfer station if the baggage sort item 12 is transit baggage.

In the exemplary embodiment illustrated, the baggage handling plant is an inspection plant 24 in which the handed-over baggage sort items 12 are inspected, in particular being scanned by X-rays.

The handling plant 10 has a loading station 26 at which the baggage sort items 12 that are passed for further handling by the inspection plant 24 are loaded onto transport means 28. The transport means 28 each have an accommodation surface 30 that is provided for the individual accommodation of a baggage sort item 12. The transport means 28 may be loaded manually or in at least partly automated manner, in the unmoving condition of the transport means 28 preferably perpendicular to the

direction of conveying, or in the moving condition of the transport means 28 preferably obliquely to the direction of conveying or from above.

In an alternative embodiment, the transport means 28 may already be loaded in the area of the input point 15, in particular at each input station 16. In this case, the transport means 28 serve to transport the baggage sort items 12 through the inspection plant 24. In this embodiment, the loading station 26 may be dispensed with.

The handling plant 10 has a sorting plant 32 which serves to sort a baggage sort item 12 that is loaded onto a transport means 28 according to the sorting criteria. The sorting plant 32 adjoins the loading station 26 at one end and the sorting destinations 18 at the other. On the basis of the information stored in the identification means, a baggage sort item 12 is allocated to one of the sorting destinations 18. This may be performed in particular at the loading station 26, which is equipped with a read unit, one of the sorting destinations 18 being allocated to the baggage sort item 12 and/or the transport means 28 on the basis of information that is read. In this case, the sorting plant 32 serves to transport the baggage sort items 12 that are loaded onto a transport means 28 at the loading station 26 to the allocated sorting destination 18.

The transport means 28 follow a transport path that leads from the loading station 26 to the allocated sorting destination 18. This transport path is a combination of transport sections 14 that form a section network, with branching points 34 and merge points 35. The combination or the course of the transport path may be calculated in advance when allocating

the sorting destination 18, in particular before and/or during loading of the baggage sort item 12 onto the transport means 28. As an alternative or in addition, the transport path may be determined and/or changed one piece at a time during transport.

For the sake of clarity, a handling plant 10 of highly simplified layout in a small airport is illustrated in FIG 1. It goes without saying that other layouts, adapted to different airport configurations, are possible.

FIG 2 shows a transport means 28 in front view. The transport means 28 has an accommodating region 37 in which there is arranged a baggage accommodating means 36, and a coupling region 38, which serves to support the accommodating region 37 and/or the baggage accommodating means 36 and is coupled to a guide device 40 of a transport section 14 that is fixed to the floor. On its upper side, the baggage accommodating means 36 forms the accommodation surface 30 of the transport means 28. This is in particular in the form of a transport tray whereof the base surface is separable from the coupling region 38. The baggage accommodating means 36 may accordingly be removed from the accommodating region 37 of the transport means 28 and undergo further handling, it being possible for this transport means 28 to be coupled to a further laden or unladen baggage accommodating means 36. Accordingly, the handling plant 10 has a set of baggage accommodating means 36 that can be releasably secured to the coupling regions 38 of the transport means 28. In a particular embodiment, the baggage accommodating means 36 may be provided with a writable storage unit, which serves to store information that serves to allocate the baggage accommodating means 36 to the transported baggage sort item 12 or to the identification data thereof.

In the embodiment of FIG 2 under consideration, the transport means 28 take the form of transport vehicles. These each have a drive unit 41 that is provided for driving an onward movement of the transport means 28 along the transport sections 14. By means of the drive unit 41 the transport means 28 can move onward autonomously within the sorting plant 32. The guide device 40 that is fixed to the floor is of a passive construction, that is to say that the transport sections 14 are free of drive elements serving to move the transport means 28 onward. In the exemplary embodiment that is illustrated, the guide device 40, as a guide rail, forms guide surfaces 42 that are in contact with driven roller bodies 44 of the transport means 28. To supply the drive unit 41 with electrical power, the transport means 28, in particular the coupling region 38, is provided with an energy store 43. Preferably, no energy is supplied via the transport sections 14.

The transport sections 14 and the guide devices 40 are formed by passive trackway elements such as straight segments, curved segments, inclined segments, track switch segments, merging segments, on which the transport means 28 move. The branching points 34 that are formed by the track switch segments enable further travel in a first or in at least one second direction of conveying, and preferably take the form of passive track switches. For this purpose, the transport means 28 are each provided with an active - that is to say, actuable by a drive - steering device 46, which is actuated to select the direction of conveying. For example, the active steering device 46 may bring about steering of the roller bodies 44.

The drive unit 41 and the active steering device 46 are controlled locally by a control unit 48 of the transport means 28. This serves in particular to control not only the speed of the transport means 28 but also the active steering control 46 for selecting the direction of conveying at a branching point 34. The handling plant 10 has a traffic guidance system 50 that is fixed to the floor (see FIG 1) and serves to control traffic of the transport means 28 in the sorting plant 32. The control units 48 of the transport means 28 are connected by a data link to the traffic guidance system 50, via transmitting and receiving units (not illustrated in more detail). The control unit 48 can transmit information on the position and the speed of the transport means 28 to the traffic guidance system 50, and obtain control commands from the traffic guidance system 50.

In addition, the transport means 28 may be connected to one another by data link in that the control units 48 on the vehicles are provided for data communication with one another.

In an alternative embodiment, shown in FIG 21, the transport means 28 are driven for onward movement by a drive system that is fixed to the floor. The transport means 28 has a baggage accommodating means 36, which takes the form of a transport tray, and a drive means 55 that serves for coupling to the drive system fixed to the floor. In the exemplary embodiment under consideration, the drive means 55 and a drive element 57 of a transport section 14 cooperate to form a linear motor. Further embodiments of the drive means and drive elements, which are based for example on the utilization of a toothed belt, are also possible. The transport means 28 is supported and/or guided by way of guide elements 59 - illustrated

schematically in the figure - of the transport section 14 and corresponding elements of the transport means 28.

The description below applies to both embodiments of the transport means 28 according to FIG 2 and FIG 21.

FIG 3 shows a section of the sorting plant 32 in a schematic view from above, in particular in the area of sorting destinations 18. As described above, a baggage sort item 12 that is allocated to a particular sorting destination 18 is transferred at this sorting destination 18 to a transport means 22 that accommodates a collection of baggage sort items 12 for a particular flight. For each sorting destination 18, a respective unloading point 52 of the sorting plant 32 is provided, at which the baggage sort item 12 that is provided for that allocated sorting destination 18 is unloaded from a transport means 28.

In order to reach a sorting destination 18, the baggage sort item 12 is unloaded from the transport means 28 at the corresponding unloading point 52. The sorting plant 32 moreover includes, in the area of the sorting destinations 18, a main conveying section 56 on which the transport means 28 travel before they reach the unloading points 52, and which serves a set of a plurality of unloading points 52 or sorting destinations 18. The main conveying section 56 transports baggage sort items 12 that are preferably each allocated to a respective one of these different sorting destinations 18. Further, the sorting plant 32 has unloading sections 58 which each branch off from the main conveying section 56 at branching points 34 and are allocated to a different unloading point 52. The unloading sections 58 in this case take a form such that travel on an unloading section 58 by a laden

transport means 28 brings about unloading of the allocated baggage sort item 12. A particular baggage sort item 12 accordingly reaches an allocated sorting destination 18 as a result of a change in the conveying direction of the corresponding transport means 28 at an unloading point 52 or branching point 34 at which the unloading section 58 that is allocated to the corresponding sorting destination 18 branches off. After leaving the main conveying section 56, the transport means 28 travels along the unloading section 58, the accommodated baggage sort item 12 being forcibly unloaded from the transport means 28.

FIG 4 to FIG 6 shows various embodiments of an unloading section 58. In these embodiments, unloading of a transport means 28 may be achieved with the accommodating region 37 or the baggage accommodating means 36 remaining rigid in relation to the coupling region 38 during the unloading procedure.

In the embodiments shown in FIG 4 and FIG 5, the accommodation surface 30 is tilted in relation to the floor, by the entire transport means 28 being inclined in relation to the floor. This is done by means of a corresponding embodiment of the unloading section 58, that is to say in particular of section segments that are parts of the guide device 40.

FIG 4 shows an exemplary embodiment which is designated by the addition of the letter "a" to the reference numerals, and in which the unloading section 58a has at least one section segment 60a that is twisted in the direction of conveying. The twisted section segment 60a brings about an inclination of the transport means 28 perpendicular to the direction of conveying, while the direction of conveying - that is, the direction of travel of the transport means 28 - is maintained.

During this, the baggage sort item 12 is driven away from the accommodation surface 30 by the force of gravity. In so doing, it arrives on a conveying element 62 that in particular takes the form of a chute and that guides the baggage sort item 12 away to the allocated sorting destination 18.

In the embodiment that is designated by the letter "b", according to FIG 5, the unloading section 58b has a section segment 60b that is curved in the direction of conveying. During travel on the section segment 60b, the direction of conveying, or the direction of travel of the transport means 28, deviates from a horizontal plane - that is to say that the movement of the transport means 28 has at least one vertical component. Travel on the section segment 60b brings about an inclination in the accommodation surface 30, such that the baggage sort item 12 is moved away from the accommodation surface 30 by the force of gravity, tangentially to the direction of conveying, and arrives on the conveying element 62 that guides it away.

In the embodiment according to FIG 6, the transport means 28 is unloaded as it travels on an unloading section 58c, which has only straight section segments 60c. Accordingly, the accommodation surface 30 remains in a horizontal orientation in relation to the floor. The unloading point 52c has a deflecting element 64c that is fixed to the floor laterally, next to the unloading section 58c. During travel on the unloading section 58c, the baggage sort item 12 is guided away from the accommodation surface 30 by the deflecting element 64c and arrives on the conveying element 62 that guides it away.

FIG 3, FIG 7 to FIG 12 and FIG 22 show different layouts of the arrangement of the main conveying section 56 and the unloading sections 58.

In FIG 3, the sorting destinations 18 - as seen in the conveying direction of the main conveying section 56 - are arranged only on one side of the main conveying section 56, which is oriented to be straight. The destinations 18 are arranged linearly one after the other, as seen in the conveying direction of the main conveying section 56. Accordingly, branching points 34 are arranged linearly one after the other in the main conveying section 56, in particular spaced regularly from one another. At these, a respective unloading section 58, which is oriented obliquely in relation to the conveying direction of the main conveying section 56, branches off from the main conveying section 56. The unloading sections 58 are arranged in portions and parallel in one plane with one another, in a manner saving space.

The sorting plant 32 moreover includes a no-load section 66, which is allocated to the main conveying section 56 and is oriented parallel thereto. Empty transport means 28 travel on this once they have been guided along an unloading section 58. Each unloading section 58 that branches off from the main conveying section 56 accordingly opens into the no-load section 66, or joins into the latter at a merge point 35. A respective conveying element 62 that extends below the corresponding unloading section 58 and the no-load section 66 leads to the sorting destinations 18. The conveying elements 62 that lead away extend parallel to one another and perpendicular to the main conveying section 56.

FIG 22 shows an alternative arrangement of the unloading sections 58 in relation to the main conveying section 56. According to this variant, the unloading sections 58 that branch off from the main conveying section 56 at the branching points 34 join into the main conveying section 56 again at merge points 35. Accordingly, a no-load section is dispensed with, or the unloaded transport means 28 are conveyed onward via the main conveying section 56. In the embodiment shown, unloading sections 58 branch off from the main conveying section 56 on both sides thereof. Branching points 34 and merge points 35 are arranged in the main conveying section 56 and alternate such that the unloading sections 58 partly overlap on either side of the main conveying section 56 - as seen perpendicular thereto.

In FIG 7 to FIG 12, further layouts are shown, the description below being limited to the differences from the embodiment according to FIG 3.

FIG 7 shows a further linear layout in which sorting destinations 18 - as seen in the conveying direction of the main conveying section 56 - and the allocated unloading points 52 are arranged on either side of the straight main conveying section 56. Accordingly, unloading sections 58 branch off from this on both sides thereof, that is to left and right. The sorting plant 32 consequently has two no-load sections 66, which are allocated to the same main conveying section 56 and extend on either side thereof and parallel thereto. In this embodiment, a main conveying section 56 is allocated to two sets of unloading points 52, the sets adjoining one another and, in relation to the sets, the main conveying section 56 being arranged centrally between the sets.

FIG 8 shows a combination of two spatially separated sets of sorting destinations 18 and unloading points 52. These are served by a common main conveying section 56, with the layout for the main conveying section 56 to serve each set corresponding to a linear layout according to FIG 3. The sets of unloading points 52 extend parallel to one another and are arranged opposite one another. Between the two sets of unloading points 52, the conveying direction of the main conveying section 56 changes. In particular, the conveying direction is reversed by means of a U-shaped section segment 68 in the main conveying section 56. Further, a no-load section 66 that runs substantially parallel to the main conveying section 56 is also provided.

In respect of the relative arrangement of the main conveying section 56 and the no-load section 66, and in respect of the U-shaped section segment 68, the main conveying section 56 in the embodiment according to FIG 8 is arranged on the inside in the region of the U-shaped section segment 68. FIG 9 shows a further layout, which differs from the embodiment of FIG 8 in that the main conveying section 56 is arranged on the outside. This produces the further difference that unloading the baggage sort items 12 in FIG 8 takes place toward the outside, in respect of the U-shaped layout, whereas the baggage sort items 12 are unloaded in an inwardly oriented direction in the embodiment according to FIG 9.

In the layout shown in FIG 10 - as in FIG 8 and FIG 9 - two sets of sorting destinations 18 and unloading points 52 are served by a common main conveying section 56. The latter takes the form of a ring, with the sets of unloading points 52 arranged on either side of the ring and, again, the conveying direction of the main conveying section 56 being reversed

between the sets of unloading points 52. The main conveying section 56 has at least two merge points 35, at which laden transport means 28 coming from further portions of the sorting plant 32 are joined into the ring. The laden transport means 28 leave the ring by being guided onto an unloading section 58 that branches off from the ring. Unloading of the baggage sort items 12 takes place toward the outside, in relation to the ring.

FIG 11 shows a further embodiment having a ring-shaped layout, which differs from the embodiment according to FIG 10 in that two ring-shaped main conveying sections 56.1 and 56.2 (illustrated in dashed lines) are arranged in two different planes one above the other.

In FIG 12, at least two different main conveying sections 56.1, 56.2 are allocated to a single set of sorting destinations 18. These have opposing conveying directions. As a result, the sorting destinations 18 of the set are served by transport means 28 that come from different portions of the sorting plant 32, in particular from opposing directions. The transport means 28 of the first and the second main conveying sections 56.1 and 56.2 are unloaded in the same direction. Two unloading points 52, one unloading point 52 for each main conveying section 56, are allocated to one sorting destination 18. Accordingly, two unloading sections 58, each branching off from one of the different main conveying sections 56, are allocated to one sorting destination 18 and to the conveying element 62 that leads away to this. In this arrangement, the conveying element 62 runs below the two unloading sections 58.

FIG 13 to FIG 16 show further layouts. The main difference in these from the layouts shown in FIG 3 and FIG 7 to FIG 12

relates to the area located directly upstream - as seen in the conveying direction of a main conveying section 56 - of a set of sorting destinations 18 and unloading points 52: the transport means 28 can, before they reach a set of unloading points 52, leave the main conveying section 56 leading thereto, as a result of which vacant points are produced in the main transport line. In the embodiment under consideration, two sets of unloading points 52 that are spatially separated from one another respectively have allocated to them a different main conveying section 56.1, 56.2. At least one transition section 70.1 that branches off from the main conveying section 56.1 and merges with the main conveying section 56.2 is provided. Thus, a transition between the main conveying section 56.1 and the main conveying section 56.2 is possible for a transport means 28. A transition from the main conveying section 56.2 to the main conveying section 56.1 is also possible by means of a transition section 70.2.

Further, within a main conveying section 56 or a transition section 70 there is provided an internal overtaking section 72 that enables overtaking of transport means 28 within the same main conveying section 56 or transition section 70.

FIG 14 shows a layout which shows a combination of two arrangements according to FIG 8. As described above, an arrangement of this kind has at least two sets of unloading points 52 that are served by a common main conveying section 56. In the embodiment according to Figure 14, accordingly two main conveying sections 56.1, 56.2 are provided that each serve one of these arrangements of two sets of unloading points 52. Transition sections 70.1, 70.2 that - as explained above for Figure 13 - enable a transition between the main conveying sections 56.1, 56.2 are provided.

FIG 15 shows a variant on the layout illustrated in FIG 10. As described above for FIG 10, both sets of unloading points 52 are served by a common ring-shaped main conveying section 56. The latter accordingly has a first, in particular straight portion 56′, which serves the first set of unloading points 52, and a second, in particular straight portion 56′′, which serves the opposing set of unloading points 52. Both portions 56′, 56′′ are connected to one another by curved section segments in which the conveying direction is reversed.

The difference from the embodiment of FIG 10 lies in the arrangement of a connecting section 74′ which branches off from the main conveying section 56 in the first portion 56′ and joins into the main conveying section 56 again in the second portion 56′′. A reversed transition is possible by means of a second connection section 74′′. In this way, a transition from the one set of transfer stations 52 to the other set of transfer stations 52 is possible before the end of the first-named set has been reached.

FIG 16 shows a further embodiment having a ring-shaped layout according to FIG 15, which differs from that embodiment in that two ring-shaped main conveying sections 56.1 and 56.2 are arranged in two different planes one above the other. This is a variant on the layout according to FIG 11 with the arrangement of shortening sections 74′, 74′′.

The handling plant 10 moreover has a storage plant 76 which is illustrated schematically in FIG 1. The storage plant 76 is served by the set of transport means 28 and serves to accommodate laden or unladen baggage accommodating means 36 for a particular storage period.

An exemplary embodiment of the storage plant 76 is shown in FIG 17 and FIG 18. In FIG 17, the storage plant 76 is illustrated in a schematic view from above. It is served by a transport section 14 to which a set of storage cells 78 is allocated. The storage cells 78 extend parallel to one another between a discharging portion 80 of the transport section 14, in which a baggage accommodating means 36 is separated from the coupling region 38 of the transport means 28 in order to arrive in an allocated storage cell 78, and a loading portion 82 of the transport section 14, in which a baggage accommodating means 36 is coupled to the coupling region 38 of a transport means 28 that is located in this portion.

As can be seen from FIG 18, which shows a storage cell 78 in a side view perpendicular to the direction of conveying of the transport section 14, the storage cells 78 take the form of passive conveying elements that are inclined between the discharging portion 80 and the loading portion 82 of the transport section 14 such that the baggage accommodating means 36 move as far as the end of the storage cell 78 facing the loading portion 82 as a result of the force of gravity. At this end there is arranged a switchable stopping element, which is not shown. In the embodiment under consideration, the passive conveying elements take the form of rollers, with further embodiments such as, in particular, a sliding surface also being conceivable.

The length of a storage cell 78 determines its accommodating capacity, which is dimensioned for the storage of a single baggage accommodating means 36 up to the storage of a group of baggage accommodating means 36 that carry baggage sort items 12 having at least one identical sorting parameter.

FIG 19 and FIG 20 show an alternative embodiment of the storage plant 76. This is based on the arrangement according to FIG 17 and FIG 18, a plurality of such arrangements being placed one above the other. The transport section 14 is formed by an alternating arrangement of discharging portions 80 and loading portions 82 and has the shape of a helix, as can be seen in FIG 20. In this embodiment, individual access to a particular baggage accommodating means 36 in the higher levels of the storage plant 76 may be performed in a particularly simple and efficient manner in that the baggage accommodating means 36 arranged in the corresponding storage cell 78 in front of the latter are taken up by transport means 28 and accommodated again in a storage cell 78 of a level that is lower down.

Claims

1. A device for handling sort items (12) according to sorting criteria between at least one input point (15) and sorting destinations (18), having at least one sorting plant (32), which is arranged between the input point (15) and the sorting destinations (18) and has a set of transport means (28) for transporting sort items (12), the transport means (28) each being provided for accommodating a sort item (12) that is allocated to a sorting destination (18), characterized in that the sorting plant (32) has at least one main conveying section (56) for the set of transport means (28) to travel thereon, at least one unloading point (52), allocated to at least one sorting destination (18), for unloading the transport means (28), and an unloading section (58) that is allocated to the unloading point (52) and branches off from the main conveying section (56), and which takes a form such that travel on the unloading section (58) by a laden transport means (28) brings about unloading of the associated sort item (12) at the unloading point (52).

2. The device as claimed in claim 1, wherein the sorting plant (32) has a set of unloading points (52) that are arranged one after the other, as seen in the conveying direction of the main conveying section (56), there being allocated to this set of unloading points (52) a set of unloading sections (58) that branch off from the main conveying section (56) at branching points (34) that are arranged one after the other.

3. The device as claimed in claim 2, wherein the unloading sections (58) are oriented parallel to one another and merge

into a common no-load section (66) for unladen transport means (28).

4. The device as claimed in claim 2 or 3, wherein the main conveying section (56) is constructed to be straight and the unloading sections (58) are oriented obliquely in relation to the main conveying section (56).

5. The device as claimed in claim 2, wherein the unloading sections (58) join into the main conveying section (56) again.

6. The device as claimed in one of claims 2 to 5, wherein there is allocated to each of the unloading sections (58) a conveying element (62), which serves to guide away to the allocated sorting destination (18) a sort item (12) that is unloaded along the unloading section (58) and which extends below the unloading section (28).

7. The device as claimed in one of claims 2 to 6, wherein the main conveying section (56) has a closed ring-shaped portion.

8. The device as claimed in one of claims 1 to 7, wherein each of the transport means (28) has a sort item accommodating means (36) and a drive means (55) that is coupled for coupling to a drive system that is fixed to the floor, for moving the transport means (28) onward.

9. The device as claimed in one of claims 1 to 7, wherein the transport means (28) take the form of transport vehicles each including a drive unit (41) that is provided for autonomous onward movement of the transport vehicle, at least within a part area of the sorting plant (32).

10. The device as claimed in claim 9, having a set of sort item accommodating means (36) that each form an accommodation surface (30) for a sort item (12) and are provided for separable coupling to a transport vehicle of the set of transport vehicles.

11. The device as claimed in claim 9 or 10, having a guide device (40) that is fixed to the floor, for guiding the transport vehicles (28).

12. The device as claimed in claim 2 and one of claims 9 to 11, wherein the guide device (40) has the branching points (34) that each enable onward travel in a first or in at least a second conveying direction, and the transport vehicles (28) each have an active steering device (46) that brings about onward transport in the first or second conveying direction.

13. The device as claimed in one of claims 1 to 12, wherein the unloading section (58a) has a twisted section segment (60a).

14. The device as claimed in one of claims 1 to 12, wherein the unloading section (58b) has a curved and at least partly vertically oriented section segment (60b).

15. The device as claimed in one of claims 1 to 12, wherein there is allocated to the unloading section (58c) a deflecting element (64c) that is fixed to the floor.