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Description

The invention relates to a conveying installation unit according to the pre-characterising clause of claim 1.

A generic conveying installation unit is known from DE 10 2008 037 261 A1, which has a succession of conveying elements for conveying piece goods. The conveying elements are each configured as cross-belt conveyors for loading and unloading piece goods and each has its own functional unit in the form of a local drive for the respective cross-belt. A start/stop command to activate or deactivate a local drive is transmitted to a local control unit of the corresponding conveying element by means of a radio signal. Brief interruptions to the data traffic when moving from a first radio cell to a further radio cell (also referred to as roaming) can however have an adverse effect on accuracy when activating or deactivating a conveying element. At a typical conveying speed of the conveying elements of 2.5 m/s such an interruption can result in an error of approx. 15 cm in the positioning of piece goods transport by a conveying element during loading or unloading, as a start/stop command is received with a delay by the local drive of the conveying element. In order to reduce such inaccuracy, it is proposed in the above-mentioned publication that, in addition to using radio signals, which serve to transmit a default for an action to be executed to the local control unit of a conveying element, a system with a transmitter/receiver light barrier should be provided specifically to activate or deactivate the local drives, transmitting the start/stop command in the form of a binary optical signal to the corresponding conveying element. Such optical activation is deployed in addition to transmission by means of radio signals, thus incurring additional outlay and costs.

US 7,212,884 B2 discloses a generic conveyor unit with which a leadless transmission of control signals takes place in the main conveyor direction.

The object of the invention is to provide a generic conveying installation unit, with which it is possible to achieve a high level of accuracy in the control of the functional units of the conveying elements by means of a structurally simple and cost-effective transmission of the control signal.

Based on a conveying installation unit with mobile conveying elements, which are provided to convey piece goods and each comprise a functional unit, and a mobile signal unit, which is provided to establish a wireless link with a stationary communication unit, wherein the functional units can each be controlled by means of a control signal received by the signal unit, it is proposed that the signal unit comprises at least two mobile receiving units arranged at a distance from one another and a mobile control unit, which is actively connected to the receiving units and to the functional units so as to assign the control signal. With regard to a control operation of a functional unit triggered by the receipt of the control signal, the influence of geometric conditions of a transmission technology on the control operation can be reduced, in particular avoided, by a spatial distribution of receiving units for receiving the control signal and their coordination by means of a control unit. This allows a high level of accuracy to be achieved in the execution of the control operation without deploying an additional transmission technology.

A “mobile” unit refers in particular to a unit which can be moved relative to a base on which the conveying installation unit is positioned. The mobile conveying elements are driven to move in a main conveying direction for the purpose of conveying piece goods. The mobile signal unit expediently accompanies a movement of the conveying elements and can advantageously be fastened to the conveying elements for this purpose. The receiving units of the signal unit are preferably each fastened to a different conveying element. A “stationary” unit corresponds in particular to a unit which is fixed relative to the base. The “main conveying direction” of the conveying installation unit relates in particular to the movement direction of a base body of the conveying elements, it being possible for the function of the functional unit assigned thereto to move an item of piece goods in a direction that is different from the main conveying direction relative to

the base body. "Provided" in particular means specifically embodied, equipped, designed and/or programmed.

The control signal for controlling the functional unit of a conveying element advantageously carries information relating to an item of piece goods transported by the conveying element. This information can correspond to properties of the piece goods, for example geometric data, an alignment or position of the piece goods, and/or parameters of the action to be executed by the functional unit, for example a movement direction, acceleration value, etc. Alternatively or additionally the control signal can correspond to an activation signal for activating or deactivating the functional unit. An "activation signal" refers in particular to a trigger and/or start/stop signal for starting or stopping a control operation of the functional unit. If the control signal is an activation signal for a functional unit, a delay in the activation or deactivation of the functional unit can advantageously be reduced by the inventive embodiment of the signal unit.

The functional unit is provided to perform an operation in conjunction with an item of piece goods transported by the corresponding conveying element. For example, the functional unit can be provided to determine information relating to a position and/or alignment of the piece goods on the conveying element and/or relative to a reference position or reference direction. The functional unit can also serve to transmit this information to a central control unit by means of the mobile signal unit. The inventive configuration of the signal unit is however suitable in particular for a conveying installation unit, in which the functional unit of the conveying elements is a drive unit, which is provided to lead away and/or feed an item of piece goods from or to the assigned conveying element. This advantageously reduces inaccuracy when positioning piece goods on the conveying element or when unloading transported piece goods onto an unloading track.

In one preferred embodiment of the invention it is proposed that the conveying installation unit has a main conveying direction, in which the conveying elements move, and a stationary communication unit, which includes at least two transmit

units which are spatially separated from one another, each of which has a transmission range, wherein the individual transmission ranges overlap in pairs in an overlap zone and wherein the distance between the mobile receiving units is greater than the extent of the overlap zone along the path travelled by one of the receiving units in the main conveying direction. This advantageously avoids an interruption of communication between the stationary communication unit and the mobile signal unit. This allows a data transmission between a first stationary transmit unit and a mobile receiving unit within the transmission range of the first transmit unit to continue, while a further receiving unit of the mobile signal unit is arranged in the overlap zone. While this receiving unit remains in the overlap zone, said receiving unit is assigned to a second stationary transmit unit which has a further transmission range that forms the overlap zone with the transmission range of the first transmit unit.

A "transmission range" in relation to the control signal can be defined in particular by the relationship between the signal strength of the control signal at a specified location and the signal strength of the control signal generated by the transmit unit, with a lower limit of this relationship being defined to set the limit of the transmission range.

A particularly structurally simple and cost-effective communication between the mobile signal unit and the stationary communication unit can be achieved if such communication takes place by means of radio signals and in particular if the stationary communication unit and the mobile signal unit are components of a WLAN network.

The inventive embodiment of the signal unit is also suitable in particular for a conveying installation unit in which the signal unit is assigned to a number of conveying elements, which are arranged in series one behind the other in the manner of a train of conveying elements. A "train" of elements refers in particular to a succession of elements, in which an intermediate distance between adjacent

elements remains constant during common movement of the elements. This allows a particularly simple link between the control unit of the signal unit and the functional units assigned thereto.

In one advantageous development it is proposed that the mobile signal unit and the stationary communication unit are provided for communication by means of a plurality of transmit channels. The proposed embodiment of the signal unit means that it is possible to avoid a particularly disadvantageous delay in the transmission of the control signal, which could result when the delays per transmit channel are added together. If the wireless link is achieved by way of radio signals, one transmit channel is preferably configured as a frequency channel.

A high level of accuracy can be achieved for the conveying or sorting of individual items of piece goods if the conveying elements are each provided to convey an individual item of piece goods.

An exemplary embodiment of the invention is described below with reference to the drawing, in which:

Figure 1 shows a schematic view of an inventive conveying installation unit with a train of cross-belt conveyors for unloading packages onto sorting paths and with a mobile signal unit for communication with a stationary communication unit and

Figure 2 shows a side view of a conveying element of the conveying installation unit.

Figure 1 shows a schematic view from above of a conveying installation unit 10. It corresponds to a segment of a conveying installation, which is part of a sorting facility for sorting piece goods 12. In the exemplary embodiment in question the piece goods 12 shown with continuous lines are configured as packed items, in particular packages. Further embodiments of the sorting installation for sorting pallets, containers or luggage items are also possible. The conveying installation

unit 10 corresponds to a partial region of the sorting installation, in which the piece goods 12 are conveyed along a main direction 14 by means of conveying elements 16 and led away from the material flow onto corresponding unloading tracks 20 to be conveyed further in an unloading direction 18 according to a destination assigned to them, the unloading direction 18 being aligned obliquely relative to the main conveying direction 14.

The conveying elements 16 are arranged in series one behind the other in the manner of a train and are driven to move in the main conveying direction 14 by a drive unit (not shown in detail), the movement taking place relative to the base 22, on which the conveying installation unit 10 is positioned. Only part of the train of conveying elements 16 is shown in the figure for the sake of clarity. In a typical embodiment of the conveying installation the train comprises approx. 60 conveying elements. A conveying element 16 has a typical extent of approx. 80 cm in the main conveying direction 14, the train having an overall length of approx. 50 m. The distance between two adjacent conveying elements 16 remains constant during movement of the train.

During operation of the conveying installation unit 10 the piece goods 12 are each conveyed by a different conveying element 16, with one conveying element 16 being provided in each instance to transport an individual item of piece goods 12. The conveying elements 16 are also each equipped with a functional unit 24, which is provided to perform a function in conjunction with the item of piece goods 12 transported by the corresponding conveying element 16. In the example in question the functional units 24 equipping the conveying elements 16 and shown with broken lines are each configured as drive units which serve to lead the item of piece goods 12 transported on the conveying element 16 away from the conveying element 16 so as to move it onto an unloading track 20 assigned to a specified destination. To this end the conveying elements 16 each have a base body 26 that can be moved in the main conveying direction 14 relative to the base 22, and a conveying means 28 that can be driven by the corresponding functional unit 24 and can be moved relative to the base body 26, by means of which a movement of the transported item of piece goods 12 can be generated to lead it

away from the conveying element 16 onto a specified unloading track 20. The conveying means 28 generates a movement of the piece goods 12 in a removal direction 29, which is aligned in a perpendicular manner relative to the main conveying direction. In the example in question the conveying means 28 of a conveying element 16 is configured as a band that can be driven by the functional unit 24. In particular it is embodied as a cross-belt, which generates movement of the transported item of piece goods 12 perpendicular to the main conveying direction 14. An embodiment of a conveying element 16 is shown in Figure 2. Further embodiments of a conveying means 28 of a conveying element 16, for example as a tiltable element which can be angled by means of the functional unit 24, or as a shoe-type element, are possible.

The functional units 24, in other words in the example in question the drive units for driving the corresponding conveying means 28, are controlled by means of a central control unit 30, which is actively connected to the functional units 24. The control unit 30 is a mobile unit, which moves with the train of conveying elements 16 relative to the base 22 and is fastened to one of the conveying elements 16 for this purpose. All the functional units 24 of the train of conveying elements 16 can be controlled by means of the control unit 30. A variant in which the train of conveying elements 16 has a number of control units is possible. A control operation, in particular activation of the functional unit 24 of a specified conveying element 16, is initiated when the item of piece goods 12 transported by the conveying element 16 is in a suitable position to be led away from the conveying element 16 onto the unloading track 20 assigned to its destination. When a control operation or activation of the corresponding functional unit 24 is to be initiated by the mobile control unit 30, a control signal 34 is generated by a central, stationary control unit 32 and transmitted to the mobile control unit 30 for the execution of the control operation.

Communication between the central stationary control unit 32 and the mobile control unit 30 takes place by means of a stationary communication unit 36, which is provided for the wireless transmission of signals. The stationary communication unit 36 has a set of stationary transmit units 38.1, 38.2, which are spatially

separated from one another and which each transmit signals in a transmission range 40.1 or 40.2. To this end the transmit units 38 each comprise a signal generation unit 42, which processes the control signal 34 based on a signal from the central control unit 32, and an antenna 44, for example in the form of a coaxial cable used to generate a radio signal. The control signal is preferably an electromagnetic wave, which has a frequency in the gigahertz range. Communication between the central stationary control unit 32 and the mobile control unit 30 also takes place by means of a mobile signal unit 46, which is provided to establish wireless communication with the stationary communication unit 36. The signal unit 46 moves with the train of conveying elements 16 and forms a so-called WLAN network (or wireless local area network) with the stationary communication unit 36.

To receive the control signal 34 the signal unit 46 has two mobile receiving units 48.1, 48.2, which are arranged so that they are separated by some distance from one another. To transmit the received control signal 34 to the mobile control unit 30 the receiving units 48.1, 48.2 are actively connected to the control unit 30. Because the control unit 30 is actively connected to the receiving units 48 on the one hand and to the functional units 24 on the other hand, an assignment of the control signal 34 to a relevant functional unit 24 can take place by means of the control unit 30. The signal unit 46 also has two transmit units, which serve to transmit a signal from the mobile control unit 30 to the stationary communication unit 36 and in the exemplary embodiment in question are configured as a single piece with one of the receiving units 48 in each instance. Separately embodied transmit units and receiving units of the signal unit 46 are however possible.

As opposed to the stationary control unit 32, which is referred to as the “server”, the mobile control unit 30 connected to the receiving units 48 is referred to technically as the “client” of the mobile signal unit 46, to which the control signals 34 from the stationary control unit 32 are addressed. To this end there must be a unique assignment of the mobile signal unit 46, and in particular of a hardware address (or MAC address) of the client, to a stationary transmit unit 38 of the communication unit 36. The transmission ranges 40.1 and 40.2 overlap, resulting

in an overlap zone 50, into which one of the mobile receiving units 48 passes during the course of the movement of the mobile signal unit 46 of the train of conveying elements 16 in the main conveying direction 14. While this receiving unit 48 remains in the overlap zone 50, communication by said receiving unit 48 with one of the stationary transmit units 38 is cancelled, while communication with the adjacent stationary transmit unit 38 should be established. The overlap zone 50 is referred to technically as the "roaming area". While the receiving unit 48.1 remains in the overlap zone 50, an assignment of the mobile signal unit 46, which is assigned to the stationary transmit unit 38.2 before the receiving unit 48.1 enters the overlap zone 50, to the adjacent stationary transmit unit 38.1 is established. This takes place by means of a sampling process, during which no communication takes place between the mobile receiving unit 48.1 and the stationary transmit unit 38.1 or 38.2. The sampling process has a duration of typically 12 ms for one transmit channel. Communication between the mobile signal unit 46 and the stationary communication unit 36 takes place by way of a plurality of transmit channels. In the present example communication takes place by means of five transmit channels, so the new assignment of the mobile signal unit 46 to the stationary transmit unit 38.1 has a duration of approx. 60 ms.

During this assignment process communication can continue between the mobile signal unit 46 and the stationary communication unit 36, as the receiving unit 48.2 is still in the transmission range 40.2 of the transmit unit 38.2. The sending of a control signal 34 from the central control unit 32 to the mobile control unit 30 and a corresponding control operation of the relevant functional unit 24 can therefore also take place during the process of assignment to the adjacent stationary transmit unit 38.1 as described above. To this end the distance D between the mobile receiving units 48.1, 48.2 is selected so that it is greater than the extent L of the overlap zone 50 in the main conveying direction 14 along a path S travelled by the receiving unit 48.1 in the main conveying direction 14. In particular the distance D should be greater than 2 m, which corresponds to a typical extent of the overlap zone 50 in the main conveying direction 14 in the region of the conveying elements 16.

When the new assignment of the mobile signal unit 46 to the stationary transmit unit 38.1 has taken place, the control signal 34 received during the assignment process by way of the receiving unit 48.2 is received repeatedly by way of the receiving unit 48.1. The control unit 30 is provided to identify such duplication of receipt and to reject the control signal 34 received later.

The above description is directed towards the conveying and unloading of piece goods 12 from a sorting facility. The invention is equally suitable for a further component of the conveying installation in which the piece goods 12 are fed to the conveying installation unit 10 from loading paths.

Patentkrav

1. Transportanlægsenhed med mobile transportorganer (16), som tjener til transport af stykgods (12) og hver omfatter en funktionsenhed (24) og en mobil signalenhed (46), som kan tilvejebringe en trådløs forbindelse til en stationær kommunikationsenhed (36), og hvor funktionsenhederne (24) til enhver tid kan styres ved hjælp af et fra signalenheden (46) modtaget styresignal (34), hvorved signalenheden (46) omfatter mindst to mobile, med indbyrdes afstand anbragte modtagerenheder (48.1, 48.2) og en mobil styreenhed (30), som for at kunne tilforordne styresignalet (34), står i aktiv forbindelse med modtagerenhederne (48.1, 48.2) og med funktionsenhederne (24),

kendetegnet ved, at den har en hovedtransportretning (14), i hvilken transportorganerne (16) kan bevæges, og en stationær kommunikationsenhed (36), som har mindst to fra hinanden rumligt adskilte sendeenheder (38.1, 38.2), der hver har et overføringsområde (40.1, 40.2), og at de enkelte overføringsområder (40.1, 40.2) parvis overlapper hinanden i en overlapningszone (50), og at afstanden (D) mellem de mobile modtagerenheder (48.1, 48.2) er større end længden (L) af en overlapningszone (50) målt langs en bane (S), der gennemløbes af en af modtagerenhederne (48.1) i hovedtransportretningen (14).

2. Transportanlægsenhed ifølge krav 1, **kendetegnet ved,** at styresignalet (34) er et aktiveringssignal til en funktionsenhed (24).

3. Transportanlægsenhed ifølge et af de foregående krav, **kendetegnet ved, at** den stationære kommunikationsenhed (36) og den mobile signalenhed (46) er bestanddele af et WLAN-net.

4. Transportanlægsenhed ifølge et af de foregående krav, **kendetegnet ved, at** signalenheden (46) er tilforordnet til flere transportorganer (16), som er indrettet på række efter hinanden ligesom et tog af transportorganer (16).

5. Transportanlægsenhed ifølge ethvert af de foregående krav, **kendetegnet ved, at** den mobile signalenhed (46) og den stationære kommunikationsenhed (36) er tilvejebragt for at muliggøre en kommunikation ved hjælp af et antal sendekanaler.

6. Transportanlægsenhed ifølge et af de foregående krav, **kendetegnet ved, at** transportorganernes (16) funktionsenhed (24) er en drivenhed, som er tilvejebragt for at kunne bortlede og/eller tilføre et stykgodsemne (12) fra henholdsvis til det tilforordnede transportorgan (16).

7. Transportanlægsenhed ifølge et af de foregående krav, **kendetegnet ved, at** transportorganerne (16) er således indrettet, at de hver kan transportere et enkelt stykgodsemne (12).

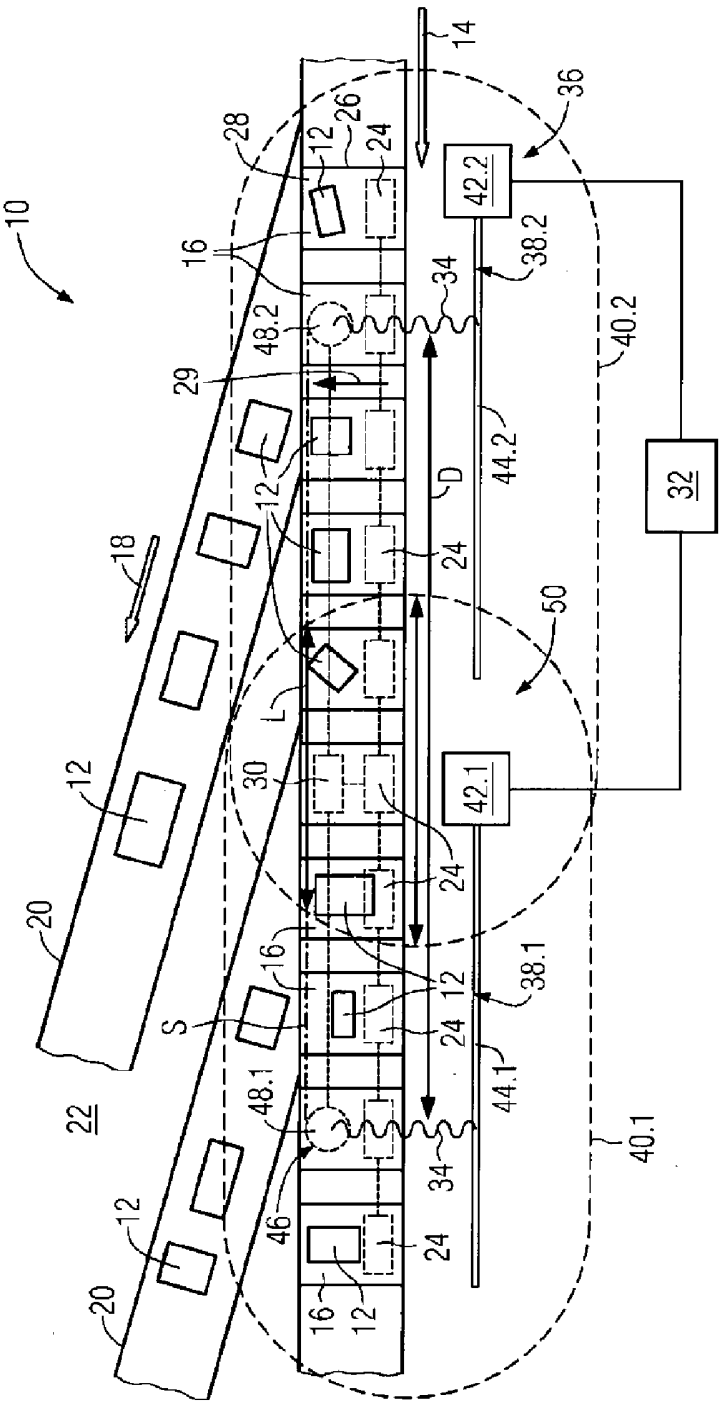
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FIG 1

FIG 2