

DESCRIPTION

Title of the Invention: **LOADING ASSISTANCE DEVICE**

Technical Field

[0001] The present invention relates to a loading assistance device for assisting in loading an article including readable identification information indicating a category onto each of a plurality of supports.

Background Art

[0002] For example, Japanese Unexamined Patent Application Publication No. 10-025022 (Patent Literature 1) discloses a technology about a loading assistance device. Hereinafter, reference signs in parentheses in describing Background Art are the reference signs in Patent Literature 1.

[0003] A loading assistance device (sorter) in Patent Literature 1 includes a transport conveyor (14) configured to successively transport articles (10) in the same category from a storage rack (15) of an automated warehouse, a printer (20) adjacent to the transport conveyor (14), and a reader (30) disposed downstream from the printer (20) and adjacent to the transport conveyor (14). A plurality of chutes (13) connected to the transport conveyor (14) is arranged further downstream from the reader (30). The printer (20) prints automatic reading sorting information (11) and visual check sorting information (12) on each of the articles (10) in the same category which articles (10) are transported by the transport conveyor (14). The reader (30) then reads the automatic reading sorting information (11) on the articles (10) and hereby sorts each of the articles (10) into a predetermined one of the chutes (13). An operator then sorts the articles (10) sorted into the chute (13) into a predetermined cart while the operator checks the visual check sorting information (12).

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 10-025022

Summary of Invention

Technical Problem

[0005] In the meantime, in the loading assistance device disclosed in Patent Literature 1, a necessary number of articles in each of different categories are loaded onto each of a plurality of carts based on order information assigned to the each of a plurality of carts. A plurality of articles loaded onto each cart is used in a shipment destination, for example, in such a manner that the number of articles in the same category is inspected, or articles per category are taken out. On this account, it is desirable that a required number of articles in each of a plurality of categories be loaded onto a cart in order in consideration of convenience in handling of the articles at the shipment destination. For example, in a case where articles are transported to each cart from the automated warehouse, a plurality of articles is aligned in advance in order of loading onto each cart and transported. This facilitates the articles to be loaded onto each cart in order in consideration of convenience in handling of the articles at the shipment destination. However, in order to transport a plurality of articles aligned in advance in order of loading onto each cart, it is necessary to provide a device such as a sorter configured to rearrange the articles in order of transport, for the automated warehouse or a transport path from the automated warehouse to the cart. This easily cause the upsizing of a facility or an increasing in cost. Besides, in a case where a plurality of articles is aligned per cart and transported, only limited carts can perform loading, so that some carts should stand by for loading. This easily decreases the efficiency of loading as the whole facility. In the meantime, in a case where articles to be loaded onto a plurality of carts are transported without aligning a plurality of articles for each cart in advance, the articles can be loaded onto the plurality of carts at the same time, which easily improves the efficiency of loading as the whole facility. However, it is difficult to load articles onto each cart in order in consideration of convenience in handling of the articles at the shipment destination, and it may take time and effort at the shipment destination.

[0006] In view of this, a loading assistance device which improves the efficiency of loading of articles onto a plurality of supports and which easily enhances convenience in handling of the articles at a shipment destination of each of the supports is desired.

Solution to Problem

[0007] A loading assistance device according to this disclosure is a loading assistance device for assisting in loading of articles each including readable identification information indicating a category onto each of a plurality of supports. The loading assistance device includes: an infeed unit into which the articles in a plurality of categories are transported; at least one work area including a plurality of work sections

each provided with a corresponding support onto which corresponding articles are to be loaded; a transport device configured to transport the articles from the infeed unit to the at least one work area; and a control system. The loading is an operation for loading each of the articles onto a corresponding support in the at least one work area based on order information designating the number of articles per category to be loaded onto the corresponding support. The control system is configured to perform a section determination process of determining a loading destination section for each of the articles to be loaded from among the plurality of work sections, in such a manner that (i) articles in different categories are loaded in the plurality of work sections, (ii) articles in other designated categories, which are other than a target designated category allocated to a target support placed in a target work section as one of the plurality of work sections among designated categories each as a category of one or more articles designated by the order information on the target support, are not allocated to the target work section until the number of articles in the target designated category allocated to the target support reaches a target designated article number, which is the number of articles in the target designated category designated by the order information, and (iii) the articles in the other designated categories are allocated to the target work section after the number of articles in the target designated category allocated to the target support reaches the target designated article number.

[0008] In this configuration, even in a case where articles in a plurality of categories are loaded onto one support, articles in the same category are loaded in succession. Accordingly, in a shipment destination of each support, it is possible to enhance convenience in a case where the number of articles in the same category is inspected or articles are extracted per category, for example.

Besides, articles in different categories are loaded in the plurality of work sections of the work area. Accordingly, in a case where articles in a plurality of categories are mixed and transported by the transport device, it is possible to easily equalize the loading of the articles onto each of the plurality of supports. This easily facilitates the efficiency of loading in a plurality of work sections.

As such, with this configuration, it is possible to facilitate the efficiency of loading onto a plurality of supports and to easily enhance convenience of handling of articles in the shipment destination of each support.

[0009] Further features and advantages of a loading assistance device are made clear from the following description on exemplary and nonlimiting embodiments to be described with reference to the drawings.

Brief Description of Drawings

[0010] Fig. 1 is a schematic view of an article transport facility;
Fig. 2 is a plan view schematically illustrating each control block and a work area;
Fig. 3 is a plan view of the work area;
Fig. 4 is a control block diagram;
Fig. 5 is a view schematically illustrating a section determination process;
Fig. 6 is a control flow diagram;
Fig. 7 is a control flow diagram;
Fig. 8 is a view schematically illustrating an allocation category determination process;
Fig. 9 is a control flow diagram;
Fig. 10 is a view schematically illustrating a control of the quantity of articles to be transported to the work area; and
Fig. 11 is a view schematically illustrating an allocation category determination process in an alternative embodiment.

Description of Embodiments

[0011] [First Embodiment]

The following describes an example in which a loading assistance device 1 is applied to an article transport facility 100 as a first embodiment with reference to the drawings.

[0012] As illustrated in Fig. 1, the article transport facility 100 includes the loading assistance device 1, and a warehouse (not illustrated) configured to store articles W. A plurality of articles W retrieved from the warehouse is loaded onto a support 2 via the loading assistance device 1. The plurality of articles W loaded onto the support 2 is shipped together with the support 2. Herein, the support 2 is a cart, and the cart onto which the plurality of article W is loaded is loaded on a truck or the like and is transported to a designated shipment destination. Note that the support 2 may be a pallet on which the articles W can be stacked, a container into which the articles W can be accommodated, or the like other than the cart.

[0013] In the present embodiment, the articles W transported from a truck or the like may be directly loaded onto the support 2 without being stored in the warehouse. Even in this case, the articles W are loaded onto the support 2 via the loading assistance device 1. In the present example, the articles W are containers that can be stacked on the support 2. More specifically, the article W is a carton container (here, a cardboard

box) in which products are accommodated. The products to be accommodated in the carton container may be food, drinking-water, or the like to be shipped to each supermarket, for example. The products to be accommodated in the carton container can be clothes, books, machine parts, and the like. Note that the article transport facility 100 may include no warehouse, and in a case where the articles W transported from a truck or the like are directly loaded onto the support 2 as described above, a stop area for the truck can be provided.

[0014] The loading assistance device 1 is a device configured to assist in loading of the articles W each including readable identification information 91 indicating a category onto each of a plurality of supports 2.

In the present embodiment, the loading assistance device 1 assists in loading of a plurality of articles W (carton containers) onto the supports 2 (herein, carts) based on article categories. In the present example, as illustrated in Fig. 4, a one-dimensional code containing identification information 91 is printed in advance on a lateral surface of each article W, and a first reader 11 (corresponding to a "reader") (described later) detects the one-dimensional code and acquires the identification information 91. Note that a two-dimensional code may be printed on the article W instead of the one-dimensional code, or a label on which a one-dimensional code, a two-dimensional code, or the like is printed may be attached onto the article W in advance.

[0015] The categories of the articles W indicate classifications for classifying the articles W to be managed by the loading assistance device 1 based on a predetermined reference. Herein, article categories are based on identification codes (for example, a product identification code such as a JAN code or an EAN code) of items accommodated in each article W. In the following description, in order to facilitate understanding of the description, the category of an article W may be expressed by a category name (for example, a category "A," "B," "C," and so on) instead of the identification code of items accommodated in the article W. For example, in a case where the category of the article W is "A," items in the category "A" are accommodated in the article W. The identification information 91 contains information on the category of the items accommodated in the article W. Note that the categories of the articles W may be determined based on a minimum management unit (SKU) of items (products or the like) accommodated in each article W, in other words, based on a minimum management unit for inventory management.

[0016] Here, the loading assistance device 1 can assist in loading of the articles W in the same article category onto the support 2 or assist in loading of the articles W in different article categories onto the support 2. The specific configuration and feature of

the loading assistance device 1 will be described as follows.

[0017] As illustrated from Figs. 1 to 3, the loading assistance device 1 includes an infeed unit 3 to which the articles W in multiple categories are transported, a work area 5 including a plurality of work sections 4 each provided with the support 2 onto which a corresponding article W is loaded, a transport device 6 configured to transport the articles W from the infeed unit 3 to the work area 5, and a control system 7 (see Fig. 4). In the present embodiment, the loading assistance device 1 includes a plurality of work areas 5.

[0018] The articles W in different categories are transported to the infeed unit 3. Such a plurality of articles W is transported from the infeed unit 3 to the transport device 6. In the present example, the infeed unit 3 includes infeed conveyors 31, and hereby, the articles W transported to the infeed unit 3 are transported to the transport device 6. In the example of Fig. 1, a plurality of infeed conveyors 31 is provided, and the articles W are transported from each of the infeed conveyors 31. In the present example, the articles W retrieved from the warehouse can be transported to the infeed unit 3, or the articles W can be directly transported to the infeed unit 3 from a truck. Note that a railway vehicle may stop in the infeed unit 3, so that the articles W may be transported from containers loaded in the railway vehicle.

[0019] As illustrated from Figs. 1 to 3, the transport device 6 includes a main path 61, and a plurality of branch paths 62 branching off from the main path 61, as a path to transport the articles W. The main path 61 is connected to the infeed unit 3, upstream from a transport path 12 for the articles W. Each of the plurality of branch paths 62 branches off from a downstream portion of the main path 61 in the transport path 12 for the articles W. In the present example, the main path 61 and the branch paths 62 are conveyors. More specifically, a main conveyor 65 is provided along the main path 61. A branch conveyor 63 is provided along the branch path 62. The article W transported from the infeed unit 3 moves on the main path 61 and the branch path 62 and is then transported to the work area 5.

[0020] In the example illustrated herein, each of the plurality of branch paths 62 includes a first branch conveyor 63a, and a plurality of second branch conveyors 63b, as the branch conveyor 63. Here, the article transport facility 100 includes a plurality of floors (herein, two floors). The warehouse, the infeed unit 3 (the plurality of infeed conveyors 31), and the plurality of work areas 5 (described later) are provided on a floor surface of a first floor. A plurality of first branch conveyors 63a is provided on a floor surface of a second floor. The main conveyor 65 is provided over the first floor and the second floor to connect the infeed unit 3 to the plurality of first branch conveyors 63a.

Each of the plurality of second branch conveyors 63b is provided on the first floor in such a manner as to overlap with an area where the first branch conveyors 63a are located, as viewed vertically (see Figs. 1, 2). Here, the transport device 6 includes a plurality of lifting and lowering devices 67. Each of the plurality of second branch conveyors 63b is connected to its corresponding first branch conveyor 63a via the lifting and lowering device 67 (for example, a lifter or the like). Hereby, the article W is transported from the first branch conveyor 63a to the second branch conveyor 63b. In the example of Fig. 1, the first branch conveyor 63a is formed in a spiral shape as viewed vertically and allows a plurality of articles W transported to the work area 5 to stay in the first branch conveyor 63a. This can hardly cause a deadlock (for example, a state where no article W can be transferred to the infeed unit 3) or the like due to congestion of the articles W in the main path 61 and the branch paths 62.

[0021] In the example of Fig. 1, the transport device 6 further includes a re-transport path 66, and a re-transport conveyor 68 is provided along the re-transport path 66. The re-transport path 66 connects a portion of the main path 61 which portion is downstream from branching-off points of the plurality of branch paths 62 (here, a downstream end portion of the main path 61) to a portion of the main path 61 which portion is upstream from junctions with the plurality of infeed conveyors 31 (here, an upstream end portion of the main path 61). The re-transport path 66 is a path that causes an article W not to be transported to the branch paths 62 but to return to the main path 61 in a case where a writer 10 (described later) writes wrong information on the article W or in a case where a first reader 11 or a second reader 9 wrongly reads information on the article W, for example.

[0022] Note that, in the present example, as described above, the main path 61 and the branch paths 62 are conveyors, but the present invention is not limited to this. The transport device 6 may include an unmanned transport vehicle (for example, AGV, STV, or the like) configured to transport the article W, and the main path 61 and the branch path 62 may be paths on which the unmanned transport vehicle travels.

[0023] As illustrated in Figs. 2, 3, in the work area 5, an operator P performs loading of the articles W onto the support 2 in each of the plurality of work sections 4. Here, the loading is an operation for loading the articles W onto each of the plurality of supports 2 in the work area 5 based on order information 92 designating the number of articles per category in terms of the articles W to be loaded onto the each of the plurality of supports 2. In the present embodiment, the operator P performs loading of the articles W onto each of the plurality of supports 2. The order information 92 indicates categories of the articles W to be loaded onto the support 2 in the work section 4 and the

number of articles per category, the categories and the number of articles being allocated to the work section 4. Herein, one support 2 is provided for one work section 4.

In the example of Fig. 5, a support 2 having a store number indicating a shipment destination is placed in each of three work sections 4. For example, order information 92 for a support 2 with a store number "001" is such that three articles W in a category "A," two articles W in a category "B," two articles W in a category "C," and one article W in a category "D" are to be loaded on the support 2.

[0024] In the present embodiment, as illustrated in Figs. 1, 2, at least one work area 5 is provided for each of the plurality of branch paths 62. In the present example, a plurality of work areas 5 is provided for each of the plurality of branch paths 62. More specifically, a plurality of work areas 5 is provided for one branch path 62, and respective numbers of work areas 5 corresponding to the branch paths 62 are the same. In the example herein, two work areas 5 are provided for one branch path 62. In the example of Fig. 3, the work area 5 is provided for each of two second branch conveyors 63b branching off from the first branch conveyor 63a in the downstream from the lifting and lowering device 67.

[0025] As illustrated in Fig. 3, a plurality of work sections 4 is placed in one work area 5. In the present example, the same number of work sections 4 is placed in each of the plurality of work areas 5. In the example illustrated herein, 14 work sections 4 are placed in one work area 5, but the number of work sections 4 can be modified appropriately. One operator P is assigned to one work area 5. The operator P loads the articles W transported to the second branch conveyor 63b onto each of the plurality of work sections 4 based on the order information 92. In the example of Fig. 2, 18 work areas 5 are provided for 9 branch paths 62.

[0026] As illustrated in Figs. 1, 4, the loading assistance device 1 further includes the first reader 11 (corresponding to a "reader") provided along the transport path 12 for the articles W transported by the transport device 6 and configured to read the identification information 91 on the articles W. The first reader 11 is provided along the main path 61 and between the infeed unit 3 and the writer 10 (described later). The first reader 11 sequentially reads the identification information 91 on each of the plurality of article W transported from the infeed unit 3 to the main conveyor 65. The identification information 91 read by the first reader 11 is transmitted to a control device H (described later). In the present example, the first reader 11 is a reader configured to read a one-dimensional code, and detects a one-dimensional code printed on the article W in advance and acquires the identification information 91, as described above.

Note that the first reader 11 may be a scanner configured to scan an IC tag, an RFID tag, or the like or may be an image reader or the like configured to detect a character or a pattern on the surface of the article W.

[0027] As illustrated in Figs. 1, 4, the loading assistance device 1 further includes the writer 10 provided between the first reader 11 and the work area 5 on the transport path 12 and configured to write work assistance information 93 on the surface of the article W. The writer 10 is provided along the main path 61 and upstream from the plurality of branch paths 62. In the present example, the writer 10 is provided between the first reader 11 and the second reader 9 (described later). The writer 10 sequentially writes the work assistance information 93 on each of the plurality of articles W transported by the main conveyor 65 and passing the first reader 11. Here, the writer 10 is an attaching device (labeler) configured to attach, onto a lateral surface of the article W, a label on which the work assistance information 93 is printed. Note that the writer 10 can be a printer or the like configured to directly print the work assistance information 93 on the lateral surface of the article W.

[0028] In the present example, as illustrated in Figs. 1, 4, the loading assistance device 1 further includes the second reader 9 provided along the main path 61 and between the writer 10 and the plurality of branch paths 62 and configured to read the work assistance information 93 on the surface of the article W. The second reader 9 reads the work assistance information 93 on each of the plurality of articles W transported by the main conveyor 65 and passing the writer 10. The work assistance information 93 thus read is transmitted to the control device H (described later). The second reader 9 is a reader configured to read a one-dimensional code. In the example of Fig. 4, the second reader 9 reads a one-dimensional code included in the work assistance information 93 attached to the article W.

[0029] In the present example, as described above, the first reader 11, the writer 10, and the second reader 9 are placed in this order from the upstream along the main path 61. These three devices are provided adjacent to the main conveyor 65.

[0030] The work assistance information 93 includes information to transport each of the articles W in a plurality of categories which articles W are transported to the infeed unit 3 to a corresponding one of the plurality of work areas 5 and to load each of the articles W onto a corresponding support 2 based on the order information 92. In the example of Fig. 4, the work assistance information 93 includes a store number ("001"), an item number (HKU122) of items accommodated in the article W, a number ("ST01") indicating the work area 5, and a one-dimensional code. The one-dimensional code includes information on a transport destination (the work area 5, the branch conveyor

63) of the article W being transported.

[0031] As illustrated in Fig. 4, the control system 7 includes the control device H. The control device H controls the infeed unit 3, the transport device 6, the writer 10, the first reader 11, and the second reader 9. The control device H is configured to be communicable with a host control device (hereinafter referred to as a host controller C). The control device H acquires the order information 92 from the host controller C. The control device H includes an arithmetic processing unit such as a CPU and a peripheral circuit such as a memory, and the control device H implements its functions in cooperation with these pieces of hardware and programs executed on the hardware such as the arithmetic processing unit. The control device H may include a group of a plurality of pieces of hardware (a plurality of separate pieces of hardware) that can communicate with one another, rather than a single piece of hardware.

[0032] In the present embodiment, as illustrated in Fig. 4, the control device H includes a setting section 71 configured to perform each process (described below), an acquisition section 72 configured to acquire the order information 92, the identification information 91, and the work assistance information 93, and a storage section 73 configured to store these pieces of information.

[0033] As illustrated in Fig. 6, the control system 7 performs a section determination process of determining a loading destination section 41 as a work section 4 where loading of each article W is performed. In response to the control system 7 determining the loading destination section 41, the support 2 onto which the article W is loaded is determined. In the present embodiment, the control device H performs the section determination process on the article W being transported by the transport device 6.

[0034] In the present embodiment, as illustrated in Fig. 6, the control device H first acquires order information 92 (S1). In the present example, the control device H acquires pieces of order information 92 on all articles W transported to the infeed unit 3 from the host controller C and stores the pieces of order information 92. The control device H can acquire the pieces of order information 92 before loading is started (for example, on the morning of a loading start date, or the like). Then, the control device H acquires pieces of identification information 91 on the articles W (S2). The control device H performs the section determination process (S3). In the present example, the control device H performs the section determination process on the article W the identification information 91 of which is acquired by the first reader 11. After that, the control device H determines work assistance information 93 (S4). In the present embodiment, as illustrated in Fig. 4, the control system 7 controls the writer 10 such that information indicating the loading destination section 41 for each article W,

determined by the section determination process, is written on the surface of the article W as the work assistance information 93. In the present example, the control device H determines the work assistance information 93 based on the loading destination section 41 determined by the section determination process, the identification information 91, and the order information 92. The control device H controls the writer 10 to write, on the article W, the work assistance information 93 thus set. After that, the second reader 9 reads the work assistance information 93 written on the article W. Then, the article W is sorted to a corresponding one of the plurality of branch paths 62 such that the article W is transported to the work area 5 including the loading destination section 41 thus set.

[0035] In the following description, a target support 21 is the support 2 placed in a target work section 40 among the plurality of work sections 4, a designated category is a category of one or more articles W designated by order information 92 on the target support 21, a target designated category is one of the designated categories, and a target designated article number is the number of articles in the target designated category designated by the order information 92.

[0036] As illustrated in Figs. 5, 7, the control system 7 performs the section determination process of determining the loading destination section 41 for each article W in such a manner that the control system 7 does not allocate, to the target work section 40, articles W in other designated categories designated by the order information 92 until loading of articles W in different categories is performed in a plurality of work sections 4 and the number of allocated articles W in the target designated category designated to the target support 21 reaches the target designated article number, and the control system 7 allocates, to the target work section 40, the articles W in the other designated categories designated by the order information 92 after the number of allocated articles W in the target designated category designated to the target support 21 reaches the target designated article number. Note that, in the present specification, "after" includes "at the same time" and naturally includes "right after."

[0037] In the present embodiment, the control system 7 (herein, the control device H) performs the section determination process in such a manner that loading of the articles W in different categories is performed in all work sections 4 belonging to one particular work area 5 (hereinafter referred to as a "target work area 5a"). Fig. 5 schematically illustrates an example in which the target work area 5a includes three work sections 4. Fig. 5 also schematically illustrates categories of articles W to be loaded onto the support 2 in each work section 4 based on the order information 92 and the numbers of articles W. The table in Fig. 5 illustrates categories and transportation orders of a plurality of articles W sequentially transported to the main path 61. The following more

specifically describes the section determination process on the article W passing the first reader 11.

[0038] In the present example, the control device H searches the target work area 5a for a work section 4 which has order information 92 including an article category (here, the target designated category) indicated by identification information 91 acquired from the first reader 11 and in which the number of articles in the category thus allocated does not reach the target designated article number (S31). Here, "allocate" means to perform setting to load an article W in a given category onto a support 2 in a particular work section 4. In an example of "TRANSPORTATION ORDER 1, ARTICLE CATEGORY A (hereinafter just referred to as "A1")" in Fig. 5, the control device H searches for a work section 4 which has order information 92 including "A" and in which the number of allocated articles in the category "A" is less than the target designated article number. In this example, two work sections in shipment destination numbers "001" and "002" are extracted as a search result. Then, the control device H extracts a work section 4 in which articles in other categories are not allocated, from the work sections 4 thus extracted (S32). In the above example of Fig. 5, in the work section 4 numbered "001" and "002," categories "B" to "F" are not allocated.

Accordingly, the control device H just extracts the work sections 4 numbered "001" and "002". Then, in a case where the control device H determines that there is no work section 4 to which an article in the acquired article category has been allocated (S33: No), the control device H allocates the acquired article category to one of the extracted work sections 4 (S35). After that, the control device H determines the work section 4 to which the article category is allocated, as a loading destination section 41 (S36). In the above example in Fig. 5, the category "A" is also not allocated to the work sections 4 numbered "001" and "002," and therefore, the control device H allocates "A" to one of the two work sections 4 numbered "001" and "002." Here, the control device H allocates "A" preferentially to the work section 4 with the shipment destination number "001," which is smaller than "002." In this case, the control device H determines that an article W in "A1" is loaded onto a support 2 numbered "001." That is, in this example, the loading destination section 41 for the article W in "A1" is the work section 4 in which the support 2 numbered "001" is placed. In Fig. 5, for easy understanding of the figure, "A1" is described above the support 2 numbered "001" and is surrounded with a solid frame. Thus, in Fig. 5, in terms of an article W allocated to each work section 4, its category is surrounded with a solid frame above the support 2. Note that, in a case where there is a plurality of supports 2 to which the same article category can be allocated, a support 2 with a larger target designated article number may be selected

preferentially and set as the loading destination section 41. In Fig. 5, the support 2 (here, a cart) is illustrated in a simplified manner.

[0039] In the meantime, in a case where the control device H determines that there is a work section 4 to which the acquired article category has been allocated (S33: Yes), the control device H determines the work section 4 as the loading destination section 41 (S34). In the example of "A2" in Fig. 5, the category "A" has been already allocated to the work section 4 numbered "001" in the section determination process for the article W in "A1." Accordingly, the control device H determines the article W in "A2" to be loaded onto the support 2 numbered "001." That is, a loading destination section 41 for the article W in "A2" is the work section 4 numbered "001." The following continuously describes the section determination process based on the example in Fig. 5.

[0040] In the example of "C3" in Fig. 5, the order information 92 of each of the work sections 4 with the shipment destination numbers "001" to "003" includes a category "C." Here, since "A" has been already allocated to the work section 4 numbered "001," the control device H cannot determine an article W in "C3" to be loaded onto the support 2 numbered "001." Accordingly, the control device H extracts the work sections 4 numbered "002" and "003" to which no article category is allocated. Then, "C" is assigned to a support 2 with the shipment destination number "002," which is smaller than "003." The control device H then determines the article W in "C3" to be loaded onto the support 2 numbered "002." That is, a loading destination section 41 for the article W in "C3" is the work section 4 numbered "002." Thus, the control device H does not allocate the acquired article category to the work section 4 to which other categories different from the acquired article category have been already allocated. In this example, three articles W have been transported to the target work area 5a in order of "A1," "A2," and "C3." Then, the operator P loads the articles W in "A1" and "A2" onto the support 2 numbered "001" and loads the article W in "C3" onto the support 2 numbered "002."

[0041] In the example of "D4" in Fig. 5, the order information 92 of each of the work sections 4 with the shipment destination numbers "001" to "003" includes D." Here, "A" has been allocated to the work section 4 numbered "001," and "C" has been allocated to the work section 4 numbered "002." Accordingly, the control device H cannot determine an article W in "D4" to be loaded onto the supports 2 numbered "001" and "002." In view of this, the control device H extracts the work section 4 numbered "003" to which no article category is allocated. Here, the target designated article number of "D" in the work section 4 numbered "003" is 1. Accordingly, the control

device H does not allocate "D" to the work section 4 numbered "003," and the control device H determines the work section 4 numbered "003" as a loading destination section 41 for the article W in "D4." The operator P loads, onto the support 2 numbered "003," the article W in "D4" transported to the target work area 5a after the article W in "C3." Thus, the control device H does not allocate the article category to the work section 4 having the order information 92 including an article category with a target designated article number of 1.

[0042] In the example of "A5" in Fig. 5, the order information 92 of each of the work sections 4 with the shipment destination numbers "001" and "002" includes "A." Here, since "A" has been already allocated to the work section 4 numbered "001," the control device H determines the article W in "A5" to be loaded onto the support 2 numbered "001." That is, a loading destination section 41 for the article W in "A5" is the work section 4 numbered "001." Here, the target designated article number of the category "A" in the work section 4 numbered "001" is 3. Accordingly, in response to the work section 4 numbered "001" being newly determined as the loading destination section 41 for the article W in "A5," the number of articles in the category "A" thus determined reaches the same number as the target designated article number of "A" (see solid-line portions "A1, A2, A5" in "001" in Fig. 5). In this case, the control device H releases the allocation of "A" to the work section 4 numbered "001." Hereby, the control device H can newly allocate a category (here "B, C, D") other than "A" to the work section 4 numbered "001." Thus, in a case where the number of allocated articles in a target designated category in the work section 4 to which any of the designated categories is allocated as the target designated category reaches a corresponding target designated article number, the control device H releases the allocation of the target designated category to the work section 4. Hereby, the control device H can allocate a designated category different from the target designated category previously allocated, to the same work section 4.

[0043] In the example of "B6" in Fig. 5, the order information 92 of each of the work sections 4 with the shipment destination numbers "001" and "003" includes a category "B." No article category is allocated to the work sections 4 numbered "001" and "003." The control device H determines the work section 4 numbered "003" as the loading destination section 41 so that an article W in "B6" is loaded onto the support 2 numbered "003" in which the target designated article number of "B" is 1. Here, the work section 4 numbered "003" that does not require allocation of "B" is extracted in preference to the work section 4 numbered "001" that requires allocation of the category "B," and the work section 4 numbered "003" is determined as the loading destination

section 41. Thus, the control device H can preferentially determine the work section 4 that does not require allocation, as the loading destination section 41. In the meantime, the control device H may allocate a target designated category to the work section 4 (here, the work section 4 numbered "001") that requires allocation, and may preferentially determine the work section 4 as the loading destination section 41.

[0044] Note that, in the example of Fig. 5, as described above, in a case where a particular work section 4 includes a given article category with a target designated article number of 1 as the order information 92, the control device H does not allocate the given article category to the particular work section 4 and determines the particular work section 4 as the loading destination section 41. However, the present invention is not limited to this. For example, even in a case where a particular work section 4 includes a given article category with a target designated article number of 2 or more (for example, 2) as the order information 92, the control device H may determine the particular work section 4 as the loading destination section 41 without allocating the given article category to the particular work section 4.

[0045] In the present example, it is preferable that a display device (not illustrated) be provided for each of the plurality of work sections 4, for example. The control device H can display, on the display device, loading information (the loading destination section 41, a loading method onto the support 2, and the like) on the article W for which the loading destination section 41 is determined. The control device H may write the loading destination section 41 on the article W as the work assistance information 93 so that the operator P visually recognizes the loading destination section 41. It is preferable that each operator P have a terminal device configured to transmit, to the control device H, information on a support 2 to which loading has been finished.

[0046] As illustrated in Figs. 2, 8, 9, the control system 7 performs an allocation category determination process of determining a plurality of control blocks 8 in such a manner that each of the plurality of control blocks 8 includes at least one work area 5, and determining at least one allocation category of articles W to be allocated to each of the control blocks 8 as a loading target. In the present example, the control system 7 determines a plurality of control blocks 8 in such a manner that each of the plurality of control blocks 8 includes a plurality of work areas 5. More specifically, the control device H determines a plurality of (here, three) work areas 5 to be included in each of the plurality of control blocks 8. The control device H also determines the control blocks 8 to include the same number of work areas 5.

[0047] In the present embodiment, as illustrated in Fig. 2, the control system 7 determines a plurality of control blocks 8 in such a manner that each of the control

blocks 8 includes a plurality of branch paths 62. The control system 7 also determines the plurality of control blocks 8 in such a manner that a plurality of work areas 5 provided for one branch path 62 are included in different control blocks 8. In the present example, the control device H determines the plurality of control blocks 8 in such a manner that each of the plurality of control block 8 includes a plurality of branch paths 62, and a plurality of work areas 5 corresponding to one branch path 62 is included in different control blocks 8. In the example of Fig. 2, one control block 8 includes three branch paths 62. One branch path 62 is provided to correspond to two work areas 5, and a plurality of control blocks 8 is set in such a manner that these two work areas 5 belong to different control blocks 8. In the example of Fig. 2, one control block 8 includes a plurality of (here, three) work areas 5 corresponding to different branch paths 62. As such, one control block 8 includes a plurality of work areas 5 corresponding to a plurality of branch paths 62, respectively. Note that one control block 8 may include one work area 5, or a plurality of control blocks 8 may include different numbers of work areas 5. The following describes the allocation category determination process more specifically.

[0048] In the present embodiment, as illustrated in Fig. 8, in the allocation category determination process, allocation categories are determined in such a manner that the articles W in the same category are not transported to a plurality of control blocks 8. Hereby, the articles W in different categories are transported to the plurality of control blocks 8.

[0049] Fig. 8 illustrates an example of the allocation category determination process by performed the control device H on a plurality of (here, six) control blocks 8. The control device H performs a process of allocating different categories of the articles W among categories of the articles W included in the order information 92, to the plurality of control blocks 8 (hereinafter referred to as a control block allocation process). Here, the control device H first allocates a category "A" to a control block 8 numbered "1," allocates a category "B" to a control block 8 numbered "2," allocates a category "C" to a control block 8 numbered "3," allocates a category "D" to a control block 8 numbered "4," allocates a category "E" to a control block 8 numbered "5," and allocates a category "F" to a control block 8 numbered "6." Hereby, articles W in "A" are transported to a plurality of work areas 5 belonging to the control block 8 numbered "1," articles W in "B" are transported to a plurality of work areas 5 belonging to the control block 8 numbered "2," articles W in "C" are transported to a plurality of work areas 5 belonging to the control block 8 numbered "3," articles W in "D" are transported to a plurality of work areas 5 belonging to the control block 8 numbered "4," articles W in "E" are

transported to a plurality of work areas 5 belonging to the control block 8 numbered "5," and articles W in "F" are transported to a plurality of work areas 5 belonging to the control block 8 numbered "6." In a case where different categories of the articles W are allocated to the plurality of control blocks 8, a category corresponding to the property of an article W can be allocated to each control block 8 in order of categories read by the first reader 11 (that is, in order of categories transported from the infeed unit 3). For example, the category "A" is defined as chicken, the category "B" is defined as beef, the category "C" is defined as pork, or the like, and these categories can be allocated to respective control blocks 8. Alternatively, the category "A" is defined as fresh food, the category "B" is defined as processed food, and the category "C" is defined as bread and confectionery, or the like, and these categories can be allocated to respective control blocks 8. Thus, when the control device H performs the control block allocation process on each control block 8, the control device H transports an article W in an allocated category to each work area 5 belonging to the control block 8. In the following description, as illustrated in Fig. 8, a target control block 81 is one of the plurality of control blocks 8, and a target allocation category is one allocation category allocated to the target control block 81.

[0050] As illustrated in Figs. 8, 9, the control system 7 exclusively allocates the target allocation category exclusively to the target control block 81 until loading of the articles W in the target allocation category is completed in all work sections 4 included in the target control block 81. After the loading of the articles W in the target allocation category is completed in all the work sections 4 included in the target control block 81, the control system 7 releases the exclusive allocation and allows the same category as the target allocation category to be allocated as an allocation category to another control block 8. In the present example, after the control device H performs the control block allocation process on the target control block 81, the control device H performs an exclusive allocation process of transporting only the articles W in the allocated category to all the work sections 4 included in the target control block 81 and refraining from allocating different categories thereto. In response to the control device H receiving information indicating that the loading of the articles W in the target allocation category is completed in all the work sections 4 included in the target control block 81, the control device H releases exclusive allocation of the target allocation category to the target control block 81. Hereby, an allocation category different from the target allocation category can be allocated to the target control block 81. More specifically, in response to the control device H releasing exclusive allocation of the target allocation category to the target control block 81, a category different from the target allocation

category and not allocated to the other control blocks 8 can be allocated as a new target allocation category. The following more specifically describes this with reference to the flowcharts of Figs. 8, 9.

[0051] After the control device H performs the control block allocation process (S5), the control device H performs the exclusive allocation process (S6). In the example of the control block 8 numbered "2" in Fig. 8, after the control device H allocates the category "B" to the target control block 81 (here, the control block 8 numbered "2") in a first control block allocation process, the control device H performs the exclusive allocation process of transporting only articles W in "B" to all work areas 5 belonging to the target control block 81. Then, when the control device H determines that loading of the articles W in the allocated category is completed (S7: Yes), the control device H releases exclusive allocation of the allocated category. In the example in Fig. 8, when the control device H determines that loading of the articles W in "B" is completed in all the work sections 4 included in the target control block 81, the control device H releases exclusive allocation of the allocated category. In this case, in response to the control device H receiving loading completion information from all the work sections 4 belonging to the target control block 81, the control device H determines that loading of the articles W in the category is completed. It is preferable that transmission of the loading completion information from each work section 4 to the control device H be performed by the terminal device or the like of the operator P.

[0052] In the present embodiment, as illustrated in Fig. 8 in a case where the number of categories of the articles W is larger than the number of control blocks 8, the control system 7 determines respective allocation categories to the control blocks 8 in such a manner that respective numbers of allocation categories allocated to the plurality of control blocks 8 are close to each other. In the present example, the control device H performs the control block allocation process in such a manner that respective numbers of allocation categories allocated to the control blocks 8 are close to each other. Here, first, allocation categories are allocated to the control blocks 8 in order of categories of articles transported from the infeed unit 3. In the example of Fig. 8, the control device H allocates a plurality of categories (here, eight categories from "A" to "H") more than the number of control blocks 8 to the control blocks 8. After the control device H sequentially allocates the categories "A" to "F" to the control blocks 8 numbered "1" to "6," the control device H subsequently allocates the category "G" to the control block 8 numbered "1" and the category "H" to the control block 8 numbered "2." Thus, the control device H allocates the plurality of categories more than the number of control blocks 8 in such a manner as to go around the plurality of control blocks 8. When

loading of all the articles W in the target allocation category is completed in the target control block 81, the control device H allocates the target allocation category to an adjacent control block 8 (see an arrow in Fig. 8). For example, when loading of the articles in the category "B" is completed in the control block 8 numbered "2," B is allocated to the control block 8 numbered "3" as its target allocation category. Similarly, when loading of the articles in the category "D" is completed in the control block 8 numbered "4," "D" is allocated to the control block 8 numbered "5" as its target allocation category. The control device H allocates, to the control blocks 8, the categories of the articles W more than the number of control blocks 8, so that the numbers of allocation categories allocated to the control blocks 8 can be close to each other. The control device H can also allocate a plurality of categories in consideration of time required for loading of articles in the target allocation category in the target control block 81. For example, when loading of the articles in "A" is completed in the control block 8 numbered "1," "A" is allocated to the control block 8 numbered "2" as its target allocation category. Here, in a case where it takes relatively long time for loading of articles in "A" in the control block 8 numbered "1," "H," which is a category different from "A," is allocated to the control block 8 numbered "2" before "A," so that loading of articles in a plurality of categories (here, "B" and "H") can be completed in the control block 8 numbered "2" before loading of articles in "A" is performed. Note that the content of the control block allocation process to make the numbers of allocation categories allocated to the control blocks 8 close to each other is not limited to this. For example, in the control block allocation process, in a case where loading of all the articles W in the target allocation category is completed in the target control block 81, the target allocation category can be allocated to a control block 8 with a smallest number of allocation categories at that point.

[0053] As illustrated in Fig. 10, the control system 7 controls the quantities of articles W to be transported by the transport device 6 to a plurality of work areas 5 included in each control block 8 in such a manner that respective numbers of articles W to be loaded in the work areas 5 are close to each other. The "number of articles W to be loaded" here may be the number of articles W regardless of category or may be the number of articles W per category. In the latter case, the control device H controls the quantity of articles W to be transported such that generally the same number of articles W in one category allocated to the target control block 81 is transported to each work area 5. The example of Fig. 10 illustrates a case where the articles W in the same category (in the present example, the articles W in the category "A") are sequentially transported to the target control block 81 including a plurality of (here, three) work

areas 5, for simplification. The table in Fig. 10 illustrates transportation orders of the articles W to be transported to the target control block 81 and the category of the articles W to be transported.

Here, the control device H transports the articles W in the same category (here, "A") to a plurality of (here, three) work areas 5, and hereby, respective numbers of articles in the same category to be transported to the work areas 5 are close to each other. More specifically, articles W in "A1" and "A4" are transported to a work area 5 numbered "1" (in Fig. 10, just referred to as an "area"), articles W in "A2" and "A5" are transported to a work area 5 numbered "2," and an article W in "A3" is transported to a work area 5 numbered "3." In the present example, each of a plurality of (here, six) control blocks 8 is controlled in a similar manner. In the example of Fig. 2, the control device H controls a plurality of second branch conveyors 63b included in one control block 8 in addition to the main conveyor 65 and the first branch conveyor 63a so as to adjust the quantity of articles W to be transported to each work area 5.

[0054] [Second Embodiment]

Next will be described a second embodiment of the loading assistance device 1 with reference to Figs. 9, 11. The following describes mainly differences from the first embodiment in terms of the loading assistance device 1 of the present embodiment. Points not particularly specified are similar to those in the first embodiment, and therefore, they are referred to as the same reference signs as used in the first embodiment and not described specifically.

[0055] As illustrated in Fig. 9, the control system 7 (here, the control device H) performs, on the target control block 81, the control block allocation process (S5) and then the exclusive allocation process (S6), similarly to the first embodiment. In Fig. 11, as an example of the control block allocation process, different categories of the articles W are allocated to the control blocks 8. More specifically, after the control device H sequentially allocates the categories "A" to "F" of the articles W to the control blocks 8 numbered "1" to "6" in the order described herein, the control device H allocates a category "G" to the control block 8 numbered "1" (in Fig. 11, this state is called an "initial state"). Here, "A10" in Fig. 11 indicates that 10 articles W in the category "A" are allocated to the control block 8 numbered "1." Hereby, the control device H transports 10 articles W in the category "A" to the control block 8 numbered "1." The control device H does not allocate the articles W in the category "A" to the control blocks 8 other than the control block 8 numbered "1" until the control device H determines that loading of 10 articles W in the category "A" is completed in the control block 8 numbered "1." That is, the control device H performs the exclusive allocation

process of exclusively allocating the articles W in the category "A" to the control block 8 numbered "1."

[0056] As illustrated in Fig. 11, after the control system 7 releases the exclusive allocation, the control system 7 determines the same category as the target allocation category as a new allocation category for a control block 8 with a smallest number of remaining articles to be loaded until completion of loading of all the articles W in a currently allocated category, from among a plurality of control blocks 8 other than the target control block 81. In the present example, in response to the control device H releasing exclusive allocation of the target allocation category to the target control block 81, the control device H selects a control block 8 with a smallest number of remaining articles to be loaded at that point until loading of articles in an allocated category exclusively allocated thereto is completed, and the control device H allocates, to the selected control block 8, the same category as the target allocation category thus released from the target control block 81. The control device H repeatedly determines allocation categories in a range set by the order information 92.

[0057] In the example of Fig. 11, in response to completion of loading of the articles W in the category "A" in the control block 8 numbered "1," the control device H releases exclusive allocation of the category "A." Just after that, the control device H allocates the category "A" as a new allocation category to the control block 8 numbered "3" with a smallest number of remaining articles to be loaded until loading of the articles in a category allocated thereto is completed (INTERIM PROGRESS 1 in Fig. 11). In the example illustrated herein, the number of remaining articles to be loaded until completion of loading of the articles in the category "C" allocated to the control block 8 numbered "3" is "5" at the point when loading of the articles W in the category "A" is completed in the control block 8 numbered "1." The control device H allocates the category "A" as a new allocation category to the control block 8 numbered "3" and performs a control to transport 30 articles W in the category "A" to the control block 8 numbered "3."

[0058] In response to completion of loading of the articles W in the category "C" in the control block 8 numbered "3," the control device H releases exclusive allocation of the category "C." Just after that, the control device H allocates the category "C" as a new allocation category to the control block 8 numbered "5" with a smallest number of remaining articles to be loaded until loading of the articles in a category allocated thereto is completed (INTERIM PROGRESS 2 in Fig. 11). In the example illustrated herein, the number of remaining articles to be loaded until completion of loading of the articles in the category "E" allocated to the control block 8 numbered "5" is "5" at the

point when loading of the articles W in the category "C" is completed in the control block 8 numbered "3." The control device H allocates the category "C" as a new allocation category to the control block 8 numbered "5" and performs a control to transport 50 articles W in the category "C" to the control block 8 numbered "5." Of course, the number of articles W to be transported is determined based on the order information 92. Since the category of articles W is allocated to each of the plurality of control block 8 as such, it is possible to restrain unbalance in the number of articles to be transported to each control block 8. Hereby, for example, it is possible to reduce to the utmost such a situation that some control blocks are kept unused because loading of all articles to be loaded thereto is completed, but loading of articles in multiple categories are still continued in the other control blocks. Besides, the control blocks 8 can be used evenly, and as a result, it is possible to complete loading in all the plurality of control blocks 8 in relatively short time.

[0059] [Other Embodiments]

(1) The above embodiment has described, as an example, the configuration in which the operator P performs loading of the articles W onto each of the plurality of supports 2. However, the present invention is not limited to this. For example, a well-known picking robot or the like may perform loading of the articles W onto each of the plurality of supports 2.

[0060] (2) The above embodiment has described, as an example, the configuration in which the control system 7 performs the allocation category determination process of determining a plurality of control blocks 8 in such a manner that each of the plurality of control blocks 8 includes at least one work area 5, and determining at least one allocation category of articles W to be allocated to each of the control blocks 8 as a loading target. However, the present invention is not limited to this. For example, the control system 7 may not determine the plurality of control block 8.

[0061] (3) The above embodiment has described, as an example, the configuration in which, in a case where the number of categories of the articles W is larger than the number of control blocks 8, the control system 7 determines respective allocation categories to the control blocks 8 in such a manner that respective numbers of allocation categories allocated to the plurality of control blocks 8 are close to each other.

However, the present invention is not limited to this. For example, the control system 7 may change the number of allocation categories to be allocated to each of the plurality of control blocks 8, based on the content (for example, the number of articles W to be loaded, an article category, expiry date, and the like) of the order information 92 in the each of the plurality of control blocks 8. Thus, the control system 7 can change the

setting of the allocation category to each control block 8 appropriately.

[0062] (4) The above embodiment has been described, as an example, the configuration in which the control system 7 controls the quantities of articles W to be transported by the transport device 6 to a plurality of work areas 5 included in each control block 8 in such a manner that respective numbers of articles W to be loaded in the work areas 5 are close to each other. However, the present invention is not limited to this. For example, the control system 7 can control the quantities of articles W to be transported as described above in terms of some control blocks 8 among the plurality of control blocks 8. Alternatively, the control system 7 can control the quantities of articles W to be transported to be different between a plurality of work areas 5 included in one control block 8. Thus, the quantities of articles W to be transported to a plurality of work areas 5 belonging to each control block 8 can differ from each other appropriately.

[0063] (5) The above embodiment has described, as an example, the configuration in which at least one work area 5 is provided for each of the plurality of branch paths 62. However, the present invention is not limited to this. For example, instead of the work area 5, a discharge area to discharge articles W can be provided for some branch paths 62 among the plurality of branch paths 62. For example, in a case where the writer 10 writes wrong information on an article W or the first reader 11 or the second reader 9 wrongly reads information on an article W, it is preferable that the article W be transported to the discharge area. In this case, the re-transport path 66 is unnecessary, thereby making it possible to downsize the whole facility.

[0064] (6) The above embodiment has described, as an example, the configuration in which the control system 7 determines a plurality of control blocks 8 in such a manner that a plurality of work areas 5 provided for one branch path 62 is included in different control blocks 8. However, the present invention is not limited to this. For example, the control system 7 can determine a plurality of control blocks 8 in such a manner that a plurality of work areas 5 provided for one branch path 62 are included in the same control block 8.

[0065] (7) The above embodiment has described, as an example, the configuration in which the loading assistance device 1 includes the writer 10 configured to write the work assistance information 93 on the surface of the article W. However, the present invention is not limited to this.

For example, the loading assistance device 1 may not include the writer 10. In this case, the control system 7 can be configured to determine work assistance information 93 based on identification information 91 of an acquired particular article W

and store the work assistance information 93 in the storage section 73, to control the transport device 6 based on the work assistance information 93 thus stored, such that the article W is transported to a work area 5 in the loading destination section 41, and to cause a display device provided for the work area 5 to display information on the loading destination section 41. In this case, the control system 7 can grasp the position of the article W on the transport path 12 by reading the identification information 91 on the article W at each place on the transport path 12.

[0066] (8) The above embodiment has described, as an example, the configuration in which, after the control system 7 releases exclusive allocation, the control system 7 determines the same category as the target allocation category as a new allocation category for a control block 8 with a smallest number of remaining articles to be loaded until completion of loading of all articles W in a currently allocated category, from among a plurality of control blocks 8 other than the target control block 81. However, the present invention is not limited to this. For example, after the control system 7 releases exclusive allocation, the control system 7 can determine the same category as the target allocation category as a new allocation category for a control block 8 with a shortest predetermined time until completion of loading of all articles W in a currently allocated category, from among a plurality of control blocks 8 other than the target control block 81.

[0067] (9) Note that the configurations disclosed in the above embodiments can be applied in combination with the configurations disclosed in other embodiments (including combinations of the embodiments described as the other embodiments) as long as no inconsistency occurs. In terms of other configurations, the embodiments disclosed in the present specification are also just examples in all respects. Accordingly, various modifications can be made appropriately as far as it does not deviate from the scope of this disclosure.

[0068] [Overview of Embodiment]

The following describes an outline of the loading assistance device described above.

[0069] The loading assistance device according to this disclosure is a loading assistance device for assisting in loading of articles each including readable identification information indicating a category onto each of a plurality of supports. The loading assistance device includes: an infeed unit into which the articles in a plurality of categories are transported; at least one work area including a plurality of work sections each provided with a corresponding support onto which corresponding articles are to be loaded; a transport device configured to transport the articles from the

infeed unit to the at least one work area; and a control system. The loading is an operation for loading each of the articles onto a corresponding support in the at least one work area based on order information designating the number of articles per category to be loaded onto the corresponding support. The control system is configured to perform a section determination process of determining a loading destination section for each of the articles to be loaded from among the plurality of work sections, in such a manner that (i) articles in different categories are loaded in the plurality of work sections, (ii) articles in other designated categories, which are other than a target designated category allocated to a target support placed in a target work section as one of the plurality of work sections among designated categories each as a category of one or more articles designated by the order information on the target support, are not allocated to the target work section until the number of articles in the target designated category allocated to the target support reaches a target designated article number, which is the number of articles in the target designated category designated by the order information, and (iii) the articles in the other designated categories are allocated to the target work section after the number of articles in the target designated category allocated to the target support reaches the target designated article number.

[0070] In this configuration, even in a case where articles in a plurality of categories are loaded onto one support, articles in the same category are loaded in succession. Accordingly, in a shipment destination of each support, it is possible to enhance convenience in a case where the number of articles in the same category is inspected or articles are extracted per category, for example.

Besides, articles in different categories are loaded in the plurality of work sections of the work area. Accordingly, in a case where articles in a plurality of categories are mixed and transported by the transport device, it is possible to easily equalize the loading of articles onto each of the plurality of supports. This easily facilitates the efficiency of loading in a plurality of work sections.

As such, with this configuration, it is possible to facilitate the efficiency of loading onto a plurality of supports and to easily enhance convenience of handling of articles in the shipment destination of each support.

[0071] Here, the at least one work area may include a plurality of work areas. The control system may determine a plurality of control blocks each including at least one of the plurality of work areas and perform an allocation category determination process of determining at least one allocation category of articles to be allocated as a loading target to each of the plurality of control blocks in such a manner that articles in different categories are transported to the plurality of control blocks. The control system may

exclusively allocate, to a target control block as one of the plurality of control blocks, a target allocation category as one allocation category allocated to the target control block until loading of articles in the target allocation category is completed in all work sections included in the target control block. The control system may release the exclusive allocation after the loading of the articles in the target allocation category is completed in all the work sections included in the target control block, in such a manner as to allow the same category as the target allocation category to be allocated as an allocation category to another control block.

[0072] In this configuration, in terms of each support in each work area, it is possible to easily complete, at an early stage, loading of articles in one designated category designated by the order information just by a designated number of articles.

Accordingly, it is possible to start loading articles in a subsequent category onto each support at an early stage, and eventually, in terms of each support in each work area, it is possible to easily complete, at an early stage, loading of articles in all designated categories designated by the order information just by respective designated numbers of articles.

[0073] In a case where the number of categories of the articles is larger than the number of control blocks, the control system may determine respective allocation categories to the plurality of control blocks in such a manner that respective numbers of allocation categories allocated to the plurality of control blocks are close to each other.

[0074] With this configuration, a workload of the loading in each of the plurality of control block can be easily made generally even. This accordingly makes it possible to easily enhance work efficiency as a whole facility.

[0075] After the control system releases the exclusive allocation, the control system may determine the same category as the target allocation category as a new allocation category to a control block with a smallest number of remaining articles to be loaded until completion of the loading of all articles in a currently allocated category, from among a plurality of control blocks other than the target control block.

[0076] In this configuration, it is possible to restrain unbalance in the number of articles to be transported to each of the plurality of control blocks.

[0077] The at least one work area may include a plurality of work areas. The control system may determine a plurality of control blocks each including a plurality of work areas, and the control system may control respective quantities of articles to be transported by the transport device to the plurality of work areas included in each of the plurality of control blocks in such a manner that respective numbers of articles to be loaded in the plurality of work areas are close to each other.

[0078] With this configuration, it is possible to easily equalize workloads in the plurality of work areas included in each control block. This accordingly makes it possible to easily enhance work efficiency as a whole facility.

[0079] The transport device may include a main path, and a plurality of branch paths branching off from the main path, as a path to transport the articles. Each of the plurality of branch paths may be provided with at least one of the plurality of work areas. The control system may determine the plurality of control blocks in such a manner that each of the plurality of control blocks includes a plurality of branch paths among the plurality of branch paths.

[0080] With this configuration, each control block includes a plurality of paths to transport the articles. Accordingly, even in a case where multiple articles allocated to one control block are transported at the same time, it is possible to separately transport those articles via the plurality of branch paths. This makes it possible to relieve congestion on the transport path.

[0081] The at least one of the plurality of work areas provided for the each of the plurality of branch paths may include a plurality of work areas. The control system may determine the plurality of control blocks in such a manner that the plurality of work areas provided for the each of the plurality of branch paths is included in different control blocks.

[0082] With this configuration, it is possible to easily secure a large number of branch paths included in one control block. This makes it possible to more easily relieve congestion on the transport path.

[0083] The loading assistance device may further include: a reader provided along a transport path of the articles to be transported by the transport device and configured to read the identification information of each of the articles; and a writer provided between the reader and the at least one work area on the transport path and configured to write work assistance information on a surface of each of the articles. The control system may control the writer to write information indicating the loading destination section of each of the articles, which loading destination section is determined in the section determination process, on the surface of the each of the articles as the work assistance information.

[0084] With this configuration, it is possible to easily transport each article to a loading destination section determined in the section determination process and to easily perform the loading of the article onto the support in the loading destination section without error.

[0085] The loading assistance device according to this disclosure should be able to

achieve at least one of the above effects.

Description of Reference Numerals

[0086] 1: loading assistance device
2: support
3: infeed unit
4: work section
5: work area
6: transport device
7: control system
8: control block
10: writer
12: transport path
21: target support
40: target work section
41: loading destination section
61: main path
62: branch path
81: target control block
91: identification information
92: order information
93: work assistance information
W: article

CLAIMS

1. A loading assistance device for assisting in loading of articles each including readable identification information indicating a category onto each of a plurality of supports, the loading assistance device comprising:

an infeed unit into which the articles in a plurality of categories are transported;

at least one work area including a plurality of work sections each provided with a corresponding support onto which corresponding articles are to be loaded;

a transport device configured to transport the articles from the infeed unit to the at least one work area; and

a control system,

the loading being an operation for loading each of the articles onto a corresponding support in the at least one work area based on order information designating the number of articles per category to be loaded onto the corresponding support,

the control system being configured to perform a section determination process of determining a loading destination section for each of the articles to be loaded from among the plurality of work sections, in such a manner that (i) articles in different categories are loaded in the plurality of work sections, (ii) articles in other designated categories, which are other than a target designated category allocated to a target support placed in a target work section as one of the plurality of work sections among designated categories each as a category of one or more articles designated by the order information on the target support, are not allocated to the target work section until the number of articles in the target designated category allocated to the target support reaches a target designated article number, which is the number of articles in the target designated category designated by the order information, and (iii) the articles in the other designated categories are allocated to the target work section after the number of articles in the target designated category allocated to the target support reaches the target designated article number.

2. The loading assistance device according to claim 1, wherein

the at least one work area includes a plurality of work areas,

the control system determines a plurality of control blocks each including at least one of the plurality of work areas and performs an allocation category determination process of determining at least one allocation category of articles to be

allocated as a loading target to each of the plurality of control blocks in such a manner that articles in different categories are transported to the plurality of control blocks,

the control system exclusively allocates, to a target control block as one of the plurality of control blocks, a target allocation category as one allocation category allocated to the target control block until loading of articles in the target allocation category is completed in all work sections included in the target control block,

the control system releases the exclusive allocation after the loading of the articles in the target allocation category is completed in all the work sections included in the target control block, in such a manner as to allow the same category as the target allocation category to be allocated as an allocation category to another control block.

3. The loading assistance device according to claim 2, wherein
in a case where the number of categories of the articles is larger than the number of control blocks, the control system determines respective allocation categories to the plurality of control blocks in such a manner that respective numbers of allocation categories allocated to the plurality of control blocks are close to each other.

4. The loading assistance device according to claim 2, wherein
after the control system releases the exclusive allocation, the control system determines the same category as the target allocation category as a new allocation category to a control block with a smallest number of remaining articles to be loaded until completion of the loading of all articles in a currently allocated category, from among a plurality of control blocks other than the target control block.

5. The loading assistance device according to claim 1, wherein
the at least one work area includes a plurality of work areas,
the control system determines a plurality of control blocks each including a plurality of work areas, and
the control system controls respective quantities of articles to be transported by the transport device to the plurality of work areas included in each of the plurality of control blocks in such a manner that respective numbers of articles to be loaded in the plurality of work areas are close to each other.

6. The loading assistance device according to any one of claims 2 to 5, wherein
the transport device includes a main path, and a plurality of branch paths branching off from the main path, as a path to transport the articles,

each of the plurality of branch paths is provided with at least one of the plurality of work areas,

the control system determines the plurality of control blocks in such a manner that each of the plurality of control blocks includes a plurality of branch paths among the plurality of branch paths.

7. The loading assistance device according to claim 6, wherein
the at least one of the plurality of work areas provided for the each of the plurality of branch paths includes a plurality of work areas, and
the control system determines the plurality of control blocks in such a manner that the plurality of work areas provided for the each of the plurality of branch paths is included in different control blocks.

8. The loading assistance device according to claim 1, further comprising:
a reader provided along a transport path of the articles to be transported by the transport device and configured to read the identification information of each of the articles; and
a writer provided between the reader and the at least one work area on the transport path and configured to write work assistance information on a surface of each of the articles, wherein
the control system controls the writer to write information indicating the loading destination section of each of the articles, which loading destination section is determined in the section determination process, on the surface of the each of the articles as the work assistance information.