

DESCRIPTION

TITLE OF THE INVENTION:

ARTICLE PROCESSING SYSTEM AND ARTICLE PROCESSING METHOD

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Field

[0001] The present invention relates to an article processing system and an article processing method.

Background

10 [0002] One example of an invention of loading articles conveyed by a conveyor onto a pallet is a loading system disclosed in Patent Literature 1. The loading system includes: a robot that places an article conveyed by a conveyor on a pallet; an imaging unit that captures an
15 image of a predetermined range on the conveyor in which the robot can move the article; and an image sensor that recognizes a state of the article loaded onto the pallet. This system recognizes the size of the article on the conveyor captured by the imaging unit, and calculates which
20 article on the conveyor is to be optimally loaded onto which position of the pallet based on the recognized size and the loaded state on the pallet recognized by the image sensor. Subsequently, based on a calculation result, the robot picks one of the articles in the predetermined range
25 and loads the article onto the pallet.

Citation List

Patent Literature

[0003] Patent Literature 1: JP 7235648 B

Summary

30 Technical Problem

[0004] When articles are loaded onto a pallet, there is a case where articles more than the number of articles in a predetermined range are conveyed by a conveyor and loaded

onto one pallet. In the case of the loading system of Patent Literature 1, the optimization of the loading is performed only in a predetermined range, having a possibility of lowered efficiency of loading than the efficiency when the calculation of the loading is performed for all the loaded articles.

[0005] The present invention has been made in view of the above, and aims to convey and efficiently load more articles than the number of articles in a predetermined range.

Solution to Problem

[0006] To solve the problem and achieve the object, an article processing system according to the present invention includes: a storage unit, provided in plurality of rows and each being configured to store an article; a first conveyor that is provided for each of the plurality of rows of storage units and conveys an article delivered from the corresponding storage unit; a conveyance unit that is provided for each of the plurality of rows of storage units and conveys an article stored in the storage unit to the first conveyor corresponding to the storage unit; a second conveyor that is provided on a downstream side in a conveying direction of the first conveyor and merges and conveys the articles conveyed by a plurality of rows of the first conveyors; a transfer device that loads the article within a predetermined range on the second conveyor, onto a loading portion; a calculation unit that calculates a loading order of the plurality of articles stored in the storage unit onto the loading portion, and groups the articles to be loaded onto the loading portion in the loading order by the number of the articles that can be accommodated within the predetermined range based on a calculation result; and a control unit that controls the

conveyance unit so that the articles belonging to the group are to be conveyed from the storage unit to the second conveyor for each group based on the loading order for the groups calculated by the calculation unit.

5 [0007] Moreover, an article processing method according to the present invention is a method performed in an article processing facility including: a storage unit, provided in plurality of rows and each being configured to store an article; a first conveyor that is provided for
10 each of the plurality of rows of storage units and conveys an article delivered from the corresponding storage unit; a conveyance unit that is provided for each of the plurality of rows of storage units and conveys an article stored in the storage unit to the first conveyor corresponding to the
15 storage unit; a second conveyor that is provided on a downstream side in a conveying direction of the first conveyor and merges and conveys the articles conveyed by a plurality of rows of the first conveyors; and a transfer device that loads the article within a predetermined range
20 on the second conveyor, onto a loading portion. The article processing method includes: a calculation step of calculating, by a calculation unit, a loading order of the plurality of articles stored in the storage unit onto the loading portion, and grouping the articles to be loaded
25 onto the loading portion in the loading order by the number of the articles that can be accommodated within the predetermined range based on a calculation result; and a control step of controlling, by a control unit, the conveyance unit so that the articles belonging to the group
30 are to be conveyed from the storage unit to the second conveyor for each group based on the loading order for the groups calculated in the calculation step.

Brief Description of Drawings

[0008] FIG. 1 is a schematic diagram of an article processing system according to an embodiment.

FIG. 2 is a block diagram of a control device.

5 FIG. 3 is a flowchart illustrating a flow of processing executed by a control device.

FIG. 4 is a diagram illustrating an example of merging of cases on a conveyor.

10 FIG. 5 is a schematic diagram of an article processing system according to a modification.

FIG. 6 is a schematic diagram of an article processing system according to a modification.

Description of Embodiments

[0009] Hereinafter, an embodiment of the present
15 invention will be described in detail with reference to the accompanying drawings. The present invention is not limited by the embodiment described below. In addition, in the description of the drawings, the same or corresponding elements are appropriately denoted by the same reference
20 numerals. Furthermore, it should be noted that the drawings are schematic, and dimensional relationships of the individual elements, etc. may be different from actual ones. Portions having different dimensional relationships and ratios across the drawings are included in some cases.
25 In addition, an orthogonal coordinate system of an X axis, a Y axis, and a Z axis is appropriately illustrated in the drawing, denoting directions with the orthogonal coordinate system. In the space indicated by the orthogonal coordinate system, a direction in which the X component
30 increases is denoted as a +X direction, while a direction in which the X component decreases is denoted as a -X direction. Similarly, the Y and Z components are also defined as a +Y direction, a -Y direction, a +Z direction,

and a -Z direction. For convenience of description, the +Z direction may be denoted as an upper direction, and the -Z direction may be denoted as a lower direction.

[0010] [Embodiment]

5 (Configuration of embodiment)

FIG. 1 is a schematic diagram of an article processing system 1000 according to an embodiment of the present invention. The article processing system 1000 includes an automated warehouse 10, conveyors 41 and 61, a palletizer
10 70, and a code reader 81. In addition, the article processing system 1000 includes a control device 100 that controls individual portions of the article processing system 1000. The configuration of the control device 100 will be described below. The article processing system
15 1000 is a system that palletizes a case A stored in the automated warehouse 10 onto a pallet P and delivers the pallet P.

[0011] The case A, which is an example of an article, is, for example, a cardboard box storing a plurality of
20 products to be sold in a shop. The size of the case A varies depending on the stored product. The case A has, on its side surface, a printed barcode for identifying a product name of the stored product. The pallet P, which is an example of a loading portion, is a flat pallet onto
25 which the cases A are to be loaded. The pallet P is delivered in a state where the cases A are loaded in plurality on the pallet P.

[0012] An automated warehouse 10, which is an example of a storage unit according to the present invention, includes
30 a storage shelf 11, a stacker crane 20, and conveyors 31 and 32. The storage shelf 11 is a shelf having a plurality of storage sections 12 to store the cases A in the left-right direction (X-axis direction), and is installed in a

plurality of stages in the up-down direction (+Z direction). The automated warehouse 10 has a plurality of storage shelves 11 at intervals. The conveyor 31 is a conveyor that conveys the case A stored in the storage section 12 from the conveyor 41 to the vicinity of the storage shelf 11. The conveyor 32, which is an example of a first conveyor according to the present invention, is a conveyor that conveys the cases A extracted from the storage section 12 and loaded onto the pallet P, to the conveyor 41. The conveyors 31 and 32 each include: a conveyance mechanism that conveys the case A; and a drive unit such as a motor that drives the conveyance mechanism. The conveyance mechanism is, for example, a conveyor such as a roller conveyor or a chain conveyor, but is not limited to these conveyors.

[0013] The stacker crane 20 which is an example of a conveyance unit according to the present invention includes a rail 21 and a transfer machine 22. The rail 21 is installed in a work passage between the storage shelves 11. The transfer machine 22 is movable in parallel with the storage shelf 11 along the rail 21 and is movable in the up-down direction. The transfer machine 22 fetches the case A from the conveyor 31, and stores the fetched case A in the storage section 12. The transfer machine 22 fetches the case A from the storage section 12, and places the fetched case A on the conveyor 32. Incidentally, the mechanism of conveying the case A between the storage section 12 and the conveyors 31 and 32 is not limited to the stacker crane 20, and may have a configuration, for example, including a self-propelled truck provided for each stage of the storage shelf 11 and a lifter that conveys the case A between the self-propelled truck of individual stages and the conveyors 31 and 32.

[0014] The conveyor 41, which is an example of a second conveyor according to the present invention, includes: a conveyance mechanism that conveys a case A; and a drive unit such as a motor that drives the conveyance mechanism.

5 The conveyor 41 conveys the case A which is depalletized from the pallet P and is to be stored in the storage section 12. In addition, the conveyor 41 conveys the case A delivered from the storage section 12 and palletized onto the pallet P to the palletizer 70.

10 [0015] A code reader 81 is installed in the vicinity of the conveyor 41. The code reader 81 is a device that scans a barcode printed on the case A conveyed by the conveyor 41 to a picking area AR to be described below. The code reader 81 is installed in a width direction of the conveyor

15 41, scans the barcode printed on a side surface of the case A facing the width direction of the conveyor 41, and outputs information indicating the scanned code to the control device 100.

[0016] The conveyor 61 is a conveyor that conveys the

20 pallet P on which the cases A are loaded. The conveyor 61 includes: a conveyance mechanism that conveys the pallet P; and a drive unit such as a motor that drives the conveyance mechanism. The conveyance mechanism is, for example, a conveyor such as a roller conveyor or a chain conveyor, but

25 is not limited to these conveyors.

[0017] The palletizer 70 which is an example of the transfer device according to the present invention is a gantry type palletizer, for example. The palletizer 70 includes slide shafts 71a, 71b, and 71c, and a holding unit

30 72. The two slide shafts 71a are installed in parallel to the Y axis across the conveyor 41 and the conveyor 61. The slide shaft 71b is stretched across the two slide shafts 71a and moves in the Y-axis direction. The slide shaft 71c

is provided on the slide shaft 71b, and moves the holding unit 72 in the up-down direction. The holding unit 72 is provided at the lower end of the slide shaft 71, holds the case A conveyed by the conveyor 41, and places the held case A on the pallet P. The palletizer 70 can hold the cases A in the picking area AR in which the holding unit 72 can hold the cases A on the conveyor 41, and holds the cases A one by one from the picking area AR and places the cases A on the pallet P on the conveyor 61. The palletizer 70 is not limited to a gantry type palletizer, and may be a robot including an articulated arm and a robot hand, for example.

[0018] FIG. 2 is a block diagram of the control device 100 that controls the article processing system 1000. The control device 100 is a computer device, and includes an arithmetic processing unit 101, a main memory unit 102, an auxiliary memory unit 103, and an interface 104.

[0019] The interface 104 outputs a signal that controls the stacker crane 20, drive units 31a, 32a, 41a, and 61a, and the palletizer 70. The drive units 31a, 32a, 41a, and 61a include components such as a motor that drives the conveyance mechanisms of the conveyors 31, 32, 41, and 61. When the drive units 31a, 32a, and 41a controlled by the control device 100 drive the conveyance mechanisms, the case A is conveyed by the conveyors 31, 32, and 41. In addition, the drive unit 61a controlled by the control device 100 drives the conveyance mechanism, whereby the pallet P is conveyed by the conveyor 61.

[0020] The main memory unit 102 is, for example, Random Access Memory (RAM), and includes volatile memory. The main memory unit 102 serves as a work space when the arithmetic processing unit 101 performs arithmetic processing, and stores a result of the arithmetic

processing of the arithmetic processing unit 101, etc. The auxiliary memory unit 103 includes Read Only Memory (ROM) and an auxiliary storage device such as nonvolatile memory. The ROM of the auxiliary memory unit 103, which is an
5 example of the memory unit, stores a program to be executed by the arithmetic processing unit 101 to perform arithmetic processing. The nonvolatile memory of the auxiliary memory unit 103 stores data to be used by the arithmetic processing unit 101 to perform arithmetic processing.

10 [0021] The arithmetic processing unit 101 is a Central Processing Unit (CPU), for example, reads a program from the auxiliary memory unit 103, and executes the processing using the main memory unit 102 as a work space. The functions of the arithmetic processing unit 101 are
15 implemented by the arithmetic processing unit 101 reading and executing the program, and in the present embodiment, the functions to be implemented are calculation unit 101a and control unit 101b. The calculation unit 101a performs calculation for efficient loading onto the pallet P for the
20 plurality of cases A, and determines the loading order, the loading position, and the direction of the case A for each case A. In addition, the calculation unit 101a groups the cases A to be loaded onto the pallet P in order of loading in the number that can be accommodated in the picking area
25 AR. The control unit 101b controls the conveyor 32 so that the cases A merge into the conveyor 41 in a group order based on the groups calculated by the calculation unit 101a.

[0022] (Operation example of embodiment)

30 Next, an operation example of the article processing system 1000 will be described. FIG. 3 is a flowchart illustrating a flow of processing executed by the control device 100 when the case A is palletized onto the pallet P

by the palletizer 70. When receiving an instruction of palletizing of the case A stored in the three-dimensional automated warehouse 3, the control device 100 performs loading calculation of the case A.

5 [0023] Specifically, when having acquired delivery data including a product name to be delivered and the number of delivery of the cases A storing the product having the product name, the control device 100 acquires the dimension of the case A storing the product having the product name
10 from dimension data stored in the auxiliary memory unit 103 for each product name included in the delivery data (step S1). The dimension data is stored in advance in the auxiliary memory unit 103, and includes the product name associated with dimensions, namely, a length, a width, and
15 a height, of the case A storing the product having the product name. The control device 100 performs loading calculation of the case A storing the product having the product name included in the delivery data using the acquired dimensions, and determines the position, order,
20 and direction of loading the case A on the pallet P for each case A to be loaded (step S2).

[0024] Next, the control device 100 groups a plurality of cases A to be loaded (step S3). Here, the control device 100 performs the grouping by the number of cases A
25 that can be accommodated within the picking area AR. For example, in the picking area AR illustrated in FIG. 1, the four cases A can be accommodated within the picking area AR, and thus, the control device 100 performs grouping such that the four cases A are to be included in one group.
30 When the total number of cases A to be loaded onto one pallet P is 12, the pallet P is grouped into a first group including cases A to be loaded first to fourth, a second group including cases A to be loaded fifth to eighth, and a

third group including cases A to be loaded ninth to twelfth.

[0025] Next, the control device 100 controls the stacker crane 20 and the drive unit 32a based on the results of the loading calculation and the grouping, and conveys the cases A storing the products having the product names designated by the delivery data, to the conveyor 41 in order of groups (step S4). Here, the control device 100 performs control so that the cases A are to be conveyed to the conveyor 41 in order of the case A belonging to the first group, the case A belonging to the second group, the case A belonging to the third group, and the case A belonging to the fourth group. In addition, when merging the case A from the conveyor 32 into the conveyor 41, the control device 100 performs control so that the case A that has reached the conveyor 32 earliest in one group will merge into the conveyor 41.

[0026] FIG. 4 is a diagram illustrating an example of merging of the cases A in the conveyor 41. In FIG. 4, the numbers in the case A indicate the order of loading onto the pallet P. In the example illustrated in FIG. 4, in a case where control is performed so that the cases A are arranged on the conveyor 41 in order of loading onto the pallet P for the ninth to twelfth cases A included in the fourth group, the tenth case A is kept waiting for merging until the ninth case A passes in front, and it takes time to merge. In contrast, in the present embodiment, the control is performed such that the cases A are to be merged in order of the tenth, the eleventh, the ninth and the twelfth in the conveyor 41, that is, the cases A are merged in one group in random order instead of being arranged on the conveyor 41 in the loading order onto the pallet P, making it possible to efficiently convey the case A without

making the case A wait at the time of merging.

[0027] The control device 100 controls the drive unit 41a to convey the case A to the picking area AR by the conveyor 41 (step S5). The code reader 81 scans the
5 barcode printed on the case A entering the picking area AR on the conveyor 41, and outputs information indicating the scanned code to the control device 100. The control device 100 acquires the information output from the code reader 81 (step S6).

10 [0028] Next, the control device 100 specifies the loading order of individual cases A in the picking area AR based on the information acquired from the code reader 81 and the result of the loading calculation (step S7). For example, when the product name identified by the first
15 acquired barcode is the product name stored in the case A to be loaded third, the control device 100 specifies the case A that has passed first as the case A to be loaded third as illustrated in FIG. 4.

[0029] Next, the control device 100 controls the
20 palletizer 70 to load the cases A in the picking area AR onto the pallet P based on the order specified in step S7 and the position and direction calculated by the loading calculation (step S8). For example, when there is a case A in the picking area AR as illustrated in FIG. 4, the
25 control device 100 loads the cases A onto the pallet P in order of the case A that has entered the picking area AR third, the case A that has entered the picking area AR second, the case A that has entered the picking area AR first, and the case A that has entered the picking area AR
30 fourth.

[0030] Next, based on the information acquired from the code reader 81, the control device 100 judges whether all the plurality of cases A to be loaded onto one pallet have

been loaded (step S9). For the case A loaded onto the pallet P by the palletizer 70, when the product name identified by the code indicated by the acquired information is not the product name to be loaded last on the pallet P (No in step S9), the control device 100 returns the flow of processing to step S5. For the case A loaded onto the pallet P by the palletizer 70, when the product name identified by the code indicated by the acquired information is the product name to be loaded last onto the pallet P (Yes in step S9), the control device 100 controls the drive unit 61a to convey the pallet P onto which the cases A are loaded, and conveys an empty pallet P by the palletizer 70 to a position where the cases A are to be placed (step S10).

[0031] As described above, according to the present embodiment, when the cases A in plurality to be loaded onto the pallet P are delivered from the parallel storage shelves 11, control is performed such that the cases A in plurality are grouped, and the cases A in one group merge into the conveyor 41 in random order, making it possible to efficiently convey the cases A without making the cases A wait at the time of merging. That is, the articles to be loaded onto the pallet are grouped, the articles are delivered from the plurality of rows of storage units for each group and merged, and the transfer device loads the articles onto the pallet for each group, making it possible to efficiently load the articles larger than the number of articles within the predetermined range in which picking is possible.

[0032] [Modifications]

Although the embodiments of the present invention have been described above, the present invention is not limited to the above-described embodiments, and can be implemented

in various other forms. For example, the present invention may be implemented by modifying the above-described embodiments as follows. Note that the above-described embodiments and the following modifications may be combined
5 with each other. The present invention also includes a configuration formed by appropriately combining the components of the individual embodiments and individual modifications described above. In addition, further effects and modifications can be easily derived by those
10 skilled in the art. Therefore, a wider aspect of the present invention is not limited to the above embodiments or modifications, and various alterations can be made.

[0033] FIG. 5 is a schematic diagram of an article processing system 1000A according to a modification of the
15 present invention. The article processing system 1000A is different from the article processing system 1000 in that the article processing system 1000A further includes conveyors 51 to 54 each of which is an example of a second conveyor. The conveyors 51 to 54, branched from the
20 conveyor 41 in a plurality of rows, are installed within a movable range of the holding unit 72 of the palletizer 70 when viewed in the upper direction, and each of the conveyors 51 to 54 include: a conveyance mechanism that conveys the case A; and a drive unit such as a motor that
25 drives the conveyance mechanism. The conveyors 51 to 54 each convey the case A conveyed by the conveyor 41 in the - Y direction.

[0034] In the case of the article processing system 1000A illustrated in FIG. 5, the picking area AR is an area
30 where the conveyors 51 to 54 are located in addition to a part of the conveyor 41. In the article processing system 1000A, the number of cases A included in the picking area AR is 12, and the number of cases A included in one group

is larger than the number in the above-described embodiment when grouping is performed in step S3. In this case, the 12 cases A included in one group can be merged in random order when merged from the conveyor 32 to the conveyor 41, and the number of cases A merged in random order is increased, making it possible to efficiently convey the cases A.

[0035] FIG. 6 is a schematic diagram of an article processing system 1000B according to a modification of the present invention. The article processing system 1000B is different from the article processing system 1000 in that a palletizer 70B is included instead of the palletizer 70 and a conveyor 41B is included instead of the conveyor 41. The palletizer 70B is an articulated robot, and includes: an articulated arm; and a robot hand that holds the case A. The palletizer 70B is controlled by the control device 100, holds the case A placed on the conveyor 41B, and places the held case A on the pallet P.

[0036] The conveyor 41B is different from the conveyor 41 in the shape of the conveyance path included in the picking area AR, which is bent in an arc shape in the picking area AR. In the article processing system 1000B, since the conveyor 41B is bent in an arc shape in the picking area AR, a larger number of cases A are included in the picking area AR. Therefore, when grouping is performed in step S3, the number of cases A included in one group is larger than the number in the embodiment. In this case, the cases A included in one group can be merged in random order when merged from the conveyor 32 to the conveyor 41B, and the number of cases A merged in random order is increased, making it possible to efficiently convey the cases A.

Reference Signs List

	[0037]	10	AUTOMATED WAREHOUSE
		11	STORAGE SHELF
		12	STORAGE SECTION
		20	STACKER CRANE
5		21	RAIL
		22	TRANSFER MACHINE
		31, 32, 41, 41B, 61	CONVEYOR
		31a, 32a, 41a, 61a	DRIVE UNIT
		70	PALLETIZER
10		81	CODE READER
		100	CONTROL DEVICE
		101	ARITHMETIC PROCESSING UNIT
		101a	CALCULATION UNIT
		101b	CONTROL UNIT
15		102	MAIN MEMORY UNIT
		103	AUXILIARY MEMORY UNIT
		104	INTERFACE
		1000, 1000A, 1000B	ARTICLE PROCESSING SYSTEM

CLAIMS

[Claim 1] An article processing system comprising:

a storage unit, provided in plurality of rows and each being configured to store an article;

5 a first conveyor that is provided for each of the plurality of rows of storage units and conveys an article delivered from the corresponding storage unit;

a conveyance unit that is provided for each of the plurality of rows of storage units and conveys an article
10 stored in the storage unit to the first conveyor corresponding to the storage unit;

a second conveyor that is provided on a downstream side in a conveying direction of the first conveyor and merges and conveys the articles conveyed by a plurality of
15 rows of the first conveyors;

a transfer device that loads the article within a predetermined range on the second conveyor, onto a loading portion;

a calculation unit that calculates a loading order of
20 the plurality of articles stored in the storage unit onto the loading portion, and groups the articles to be loaded onto the loading portion in the loading order by the number of the articles that can be accommodated within the predetermined range based on a calculation result; and

25 a control unit that controls the conveyance unit so that the articles belonging to the group are to be conveyed from the storage unit to the second conveyor for each group based on the loading order for the groups calculated by the calculation unit.

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[Claim 2] The article processing system according to claim 1,

wherein the second conveyor branches into a plurality

of rows.

[Claim 3] The article processing system according to claim 1,

5 wherein the second conveyor is a path of an arc shape within the predetermined range.

[Claim 4] The article processing system according to claim 1,

10 wherein the articles belonging to the group merge into the second conveyor in random order for each group.

[Claim 5] An article processing method performed in an article processing facility, the article processing
15 facility including:

 a storage unit, provided in plurality of rows and each being configured to store an article;

 a first conveyor that is provided for each of the plurality of rows of storage units and conveys an article
20 delivered from the corresponding storage unit;

 a conveyance unit that is provided for each of the plurality of rows of storage units and conveys an article stored in the storage unit to the first conveyor corresponding to the storage unit;

25 a second conveyor that is provided on a downstream side in a conveying direction of the first conveyor and merges and conveys the articles conveyed by a plurality of rows of the first conveyors; and

 a transfer device that loads the article within a
30 predetermined range on the second conveyor, onto a loading portion,

 the article processing method comprising:

 a calculation step of calculating, by a calculation

unit, a loading order of the plurality of articles stored
in the storage unit onto the loading portion, and grouping
the articles to be loaded onto the loading portion in the
loading order by the number of the articles that can be
5 accommodated within the predetermined range based on a
calculation result; and

a control step of controlling, by a control unit, the
conveyance unit so that the articles belonging to the group
are to be conveyed from the storage unit to the second
10 conveyor for each group based on the loading order for the
groups calculated in the calculation step.