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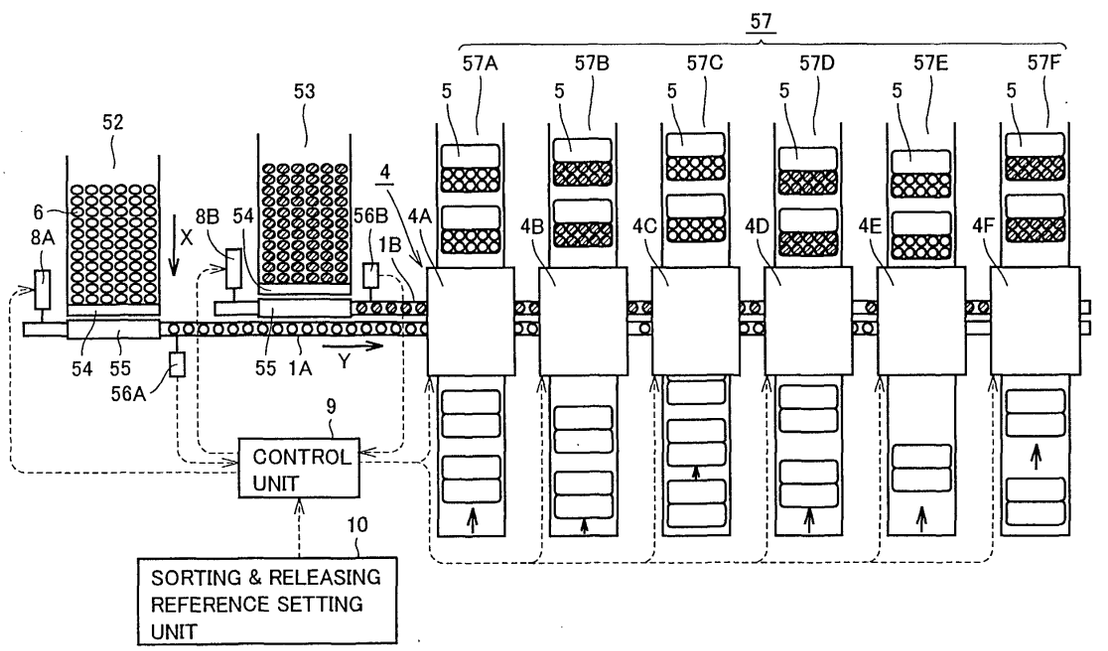
(54) Apparatus and method for sorting and packaging agricultural/animal products

(57) A sorting and packing apparatus includes two distributing conveyers (1A, 1B) arranged substantially parallel to each other to transport and thus distribute eggs (6). Two distributing conveyers (1A, 1B) are independently driven by drive motors (8A, 8B) respectively. Eggs (6) transported by distributing conveyers (1A, 1B) are collectively accommodated by six main packing units (4, 4A-4F) and sorted and packed thereby in a predetermined container (5). Eggs (6) thus packed in containers (5) are transported by container conveyers (57A-57F). Distributing conveyers (1A, 1B) operate for transportation, as controlled by a control unit (9). Thus the apparatus can avoid having an impaired ability to handle eggs and also be driven by a property of agricultural/animal products to efficiently sort and pack the products.

FIG.1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates generally to apparatus sorting and packing agricultural/animal products and methods of controlling the same and particularly to such apparatus providing an efficient sorting and packing process and such methods employed to provide such a process.

Description of the Background Art

[0002] Eggs are generally sorted and packed by means of an apparatus including a transport conveyer, a meter, a transfer unit, a distributing conveyer, and a main packing unit. Initially, eggs are transported by the transport conveyer and each have its weight measured by the meter. The eggs are then transferred by the transfer unit and then conveyed by the distributing conveyer and thus sent to the main packing unit.

[0003] Such a conventional egg sorting and packing apparatus will exemplarily be described. As shown in Fig. 11, a transport conveyer 102 connected to a poultry house transports for example a row of 12 eggs 101 as a unit in a direction X. Eggs 101 have their respective weights measured by a meter 109. Eggs 101 thus measured are transferred by a transfer unit 110 alternately to two aligned distributing conveyers 105 and 106.

[0004] For example, eggs 101 in a row a are transferred to distributing conveyer 105 and eggs 101 in the subsequent row b are transferred to distributing conveyer 106. Then eggs 101 in the subsequent row c are transferred to distributing conveyer 105.

[0005] Eggs 101 transferred to distributing conveyers 105 and 106 alternately are transported to a main packing unit 112. The two aligned distributing conveyers 105 and 106 are driven in a direction Y by a single drive motor 113.

[0006] This sorting and packing apparatus for example includes six main packing units 112 corresponding to weight classes (e.g., classes L, M and S) of eggs 101. The weight of each egg 101 previously measured by meter 109 is referred to to allow distributing conveyer 105, 106 to transport the egg to main packing unit 112 corresponding to a predetermined weight class and release the egg thereat. Eggs 101 received by main packing units 112 are packed in containers 102 and thus delivered on container conveyers 115-120.

[0007] Another example of the conventional sorting and packing apparatus will now be described. As shown in Fig. 12, this sorting and packing apparatus includes two transport conveyers 103 and 104 each transporting a row of six eggs as a unit.

[0008] Transport conveyer 103 transports eggs 101a which are in turn transferred by a transfer unit 111 to a distributing conveyer 107, and transport conveyer 104 transports eggs 101b which are in turn transferred by transfer unit 111 to a distributing conveyer 108.

[0009] Each distributing conveyer 107, 108 transports the eggs and releases them when it arrives at a main packing unit 112 corresponding to a predetermined egg weight class. In doing so, an encoder 114 provided to each distributing conveyer 107, 108 detects the distance that each egg moves. Eggs received by main packing unit 112 are packed in containers 102 and thus delivered on container conveyers 115-120.

[0010] Note that also in this sorting and packing apparatus two distributing conveyers 107, 108 are driven by a single drive motor 113.

[0011] The conventional apparatus sorting and packing agricultural/animal products as described above, however, has a disadvantage, as described below:

[0012] The conventional sorting and packing apparatuses shown in Figs. 11 and 12 each include two distributing conveyers 105, 106 (107, 108) driven by a single drive motor 113.

[0013] As such, if one of the conveyers has any trouble, the other conveyer that does not have any trouble is forced to stop.

[0014] In particular, if the apparatus is a so-called in-line selecting and packing apparatus connected directly to a poultry house for example by a transport conveyer 102 and its distributing conveyers stop, the sorting and packing apparatus would entirely stop and its ability to sort and pack eggs would be impaired significantly.

[0015] In particular, the Fig. 12 apparatus can have two transport conveyers 103, 104 each connected to a poultry house housing chickens of a different age in day, i.e., a different number of days as counted since the birth of the chickens. A difference in age in day introduces a difference in an egg property. More specifically, it results in an egg having a shell different in hardness and thus prone to crack if the chicken is older in age in day.

[0016] Distributing conveyers 107, 108 are driven by a single drive motor 113 and thus transport eggs at the same rate. Thus the conveyers transport eggs having shells prone to crack and those having shells less prone to crack, simultaneously at the same rate.

[0017] If the distributing conveyers are controlled to transport eggs relatively slowly to prevent egg shells from cracking, the sorting and packing apparatus would have its capability impaired in handling eggs. If this is resolved by controlling the distributing conveyers to transport eggs at an increased rate, more eggs would have their shells cracking.

[0018] Thus the conventional sorting and packing apparatus cannot provide an efficient sorting and packing process depending on an egg property.

SUMMARY OF THE INVENTION

[0019] The present invention has been made to resolve the disadvantages described above, and it con-

templates an agricultural/animal product sorting and packing apparatus sorting and packing such products efficiently with an egg shell property taking into consideration while avoiding impairing the apparatus's ability to handle the products and it also contemplates a method of controlling the apparatus to efficiently sort and pack such products.

[0020] The present invention in one aspect provides an apparatus sorting and packing agricultural/animal products, including: a plurality of distributing conveyers arranged substantially parallel to each other and transporting and distributing agricultural/animal products; a drive unit each provided for a respective one of the plurality of distributing conveyers to drive each the distributing conveyer independently; a control unit controlling the drive unit; and a main packing unit arranged under the plurality of distributing conveyers to accommodate collectively the agricultural/animal products distributed by each of the distributing conveyers and pack the agricultural /animal products in a predetermined container.

[0021] Thus the plurality of distributing conveyers can be driven individually by individually provided drive units, respectively. As such, if any trouble arises and any of the plurality of distributing conveyers needs to be stopped, the other distributing conveyers do not need to be stopped and can thus transport and thus distribute agricultural/animal products, which can in turn be accommodated by the main packing unit to continue to pack the agricultural/animal products. This can prevent the apparatus from having an impaired ability to sort and pack the agricultural/animal products. Furthermore, the apparatus can be driven by a property of agricultural/animal products to adjust a speed of the distributing conveyers to transport the products without damage.

[0022] The present invention in one aspect provides another apparatus sorting and packing agricultural/animal products including: a plurality of distributing conveyers arranged substantially parallel to each other and transporting and distributing agricultural/animal products; a plurality of drive units driving the plurality of distributing conveyers; a control unit controlling the plurality of drive units; and a main packing unit arranged under the plurality of distributing conveyers to accommodate collectively the agricultural/animal products distributed by each of the distributing conveyers and pack the agricultural /animal products in a predetermined container, wherein at least predetermined two of the plurality of distributing conveyers are each driven independently by a different one of the drive units.

[0023] Thus a plurality of distributing conveyers can be driven by a plurality of drive units and furthermore at least predetermined two of the distributing conveyers can be driven individually by different drive units, respectively. As such, if any trouble arises and one of the predetermined two distributing conveyers needs to be stopped, the other distributing conveyers does not need to be stopped and can thus transport and thus distribute agricultural/animal products, which can in turn be accommodated by the main packing unit to continue to pack the agricultural/animal products. As a result the apparatus can avoid having an impaired ability to sort and pack the agricultural/animal products. Furthermore the apparatus can be driven by a property of agricultural/animal products to adjust a speed of the distributing conveyers to transport the products without damage.

[0024] Preferably there exist more than one the main packing unit to consider a property of the agricultural/animal products transported; and the control unit includes a function driven by at least one of an amount of the agricultural/animal products input to and carried by each of the plurality of distributing conveyers and a distribution of a property of the agricultural/animal products to level out a plurality of main packing units in serviceability.

[0025] Thus if a property of agricultural/animal products is referred to to pack the products the plurality of main packing units each can handle an amount of the products that is adjusted to efficiently transport and pack the products.

[0026] Preferably the main packing unit includes: primary accommodating means receiving the agricultural/animal products from the plurality of distributing conveyers and accommodating the agricultural/animal products by a predetermined number as one group; standby accommodating means arranged under the primarily accommodating means to accommodate the agricultural/animal products collectively transferred from the primary accommodating means; transferring means arranged under the standby accommodating means to receive the agricultural/animal products transferred from the standby accommodating means; and common packing means arranged under the transferring means to receive the agricultural/animal products from the transferring means and pack the agricultural/animal products in the predetermined container.

[0027] Thus, agricultural/animal products released by the plurality of distributing conveyers can be collectively accommodated by the primary accommodating means and the accommodated agricultural/animal products can immediately be accommodated by the standby accommodating means serving as a buffer and the transferring means, received by their respective accommodating pockets successively. This can prevent the primary accommodating means from continuing to hold the same agricultural/animal products and agricultural/animal products transported by the distributing conveyers can be successively accommodated by the primarily accommodating means to efficiently pack the products.

[0028] Of the main packing unit, the transferring means may include the packing means. More specifically, the transferring means may also have the function of the packing means.

[0029] Preferably the agricultural/animal products are chicken eggs having a property including at least one of weight and egg shell color.

[0030] The present invention in another aspect pro-

vides a method of controlling an apparatus sorting and packing agricultural/animal products having a plurality of distributing conveyers transporting and distributing agricultural/animal products and a plurality of main packing units collectively accommodating predetermined agricultural/animal products distributed from the plurality of distributing conveyers with a property of the agricultural/animal products taken into consideration and packing the agricultural/animal products in a container, comprising referring to at least one of an amount of the agricultural/animal products input to and carried by each of the plurality of distributing conveyers and a distribution of the property of the agricultural/animal products to level out the plurality of main packing units in serviceability.

[0031] In the present method if packing agricultural/animal products depends on an amount input to each of the plurality of distributing conveyers or a property of the products the plurality of main packing units each can handle an amount of agricultural/animal products that is adjusted to efficiently transport and pack the products.

[0032] Preferably the agricultural/animal products are chicken eggs having a property including at least one of weight and egg shell color.

[0033] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] In the drawings:

Fig. 1 is a plan view of a sorting and packing apparatus in a first embodiment of the present invention;
Fig. 2 is an enlarged perspective view of a main packing unit of the Fig. 1 apparatus;
Fig. 3 is a partial, enlarged plan view for illustrating an operation of the Fig. 1 apparatus;
Fig. 4 is a table for illustrating that in the first embodiment, main packing units are leveled out in serviceability;
Fig. 5 is a table for illustrating that in a second embodiment of the present invention, main packing units are leveled out in serviceability;
Fig. 6 is a side view of a main packing unit of a sorting and packing apparatus of a third embodiment of the present invention;
Fig. 7 is a front view of the main packing unit in the third embodiment as shown in Fig. 6;
Fig. 8 is a side view of another main packing unit in the third embodiment;
Figs. 9 and 10 are each a side view of a still another main packing unit of the third embodiment;
Fig. 11 is a plan view of an exemplary, conventional sorting and packing apparatus; and
Fig. 12 is a plan view of another exemplary, conventional sorting and packing apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

[0035] A description will now be given of a sorting and packing apparatus of a first embodiment of the present invention. As shown in Fig. 1, from a poultry house (not shown) to the sorting and packing apparatus, eggs 6 are transported by transport conveyers 52 and 53. Eggs 6 are then transported and distributed by two distributing conveyers 1A and 1B arranged substantially parallel to each other. Transport conveyers 52, 53 have their respective ends closer to distributing conveyers 1A, 1B, respectively, and each provided with a meter 54 measuring the weight of each egg 6. Eggs 6 are transferred to distributing conveyers 1A and 1B by a transfer unit 55.

[0036] Two distributing conveyers 1A and 1B are individually driven by drive motors 8A and 8B, respectively. Transported by distributing conveyers 1A and 1B, each egg 6 travels a distance, which is detected by encoders 56A and 56B, respectively.

[0037] Distributing conveyers 1A and 1B transport eggs 6 for example to six main packing units 4 (4A-4F) depending on an egg property to collectively accommodate and sort and pack eggs 6 in containers 5 as predetermined. Below main packing unit 4 are arranged container conveyers 57A-57F transporting containers 5 accommodating eggs 6.

[0038] Distributing conveyers 1A and 1B operate for transportation, as controlled by a control unit 9 connected to drive motors 8A and 8B, encoders 56A and 56B, and main packing unit 4.

[0039] Control unit 9 is also connected to a sorting and releasing reference setting unit 10 to set main packing unit 4 to correspond to a property of eggs transported by distributing conveyers 1A and 1B. Thus for example if an egg weight classification is comprised of sizes L (no less than 70g), M (no less than 60g and less than 70g) and S (less than 60g) each main packing unit 4 is selected and determined to be responsible for eggs corresponding to one of the three weight classes.

[0040] In the sorting and packing apparatus thus configured, as shown in Fig. 1, initially eggs 6 are transported from a poultry house by transport conveyers 52, 53 and have their respective weights measured by meter 54. The data of the weight of egg 6 is transmitted to control unit 9. Each egg 6 measured is transferred by transfer unit 55 to distributing conveyers 1A, 1B. Egg 6 on distributing conveyer 1A travels a distance, which is detected by encoder 56A and transmitted to control unit 9, and egg 6 on distributing conveyer 1B travels a distance, which is detected by encoder 56B and transmitted to control unit 9.

[0041] Then, with reference to Figs. 2 and 3, when egg 6 transported by distributing conveyer 1A, 1B ar-

rives at a predetermined main packing unit 4 corresponding to the weight class of the egg, distributing conveyer 1A, 1B releases the egg to accommodate it in main packing unit 4. A predetermined number of eggs 6 are accommodated in main packing unit 4, they are moved therefrom to container 5 and thus carried by container conveyer 57.

[0042] The operation of the sorting and packing apparatus will now be described more specifically. A poultry house accommodates chickens of an age in day. A chicken of a different age in day lays eggs different in number per unit time and also different in size, and a chicken of an older age in day tends to lay eggs smaller in number and having a larger proportion formed by eggs larger in size.

[0043] Accordingly, with reference to Fig. 4, a first distributing conveyer (52) is assumed to transport eggs laid by 500-day-old chickens, hereinafter referred to as eggs A, and a second distributing conveyer (53) is assumed to transport eggs laid by 150-day-old chickens, hereinafter referred to as eggs B. In doing so, 20,000 eggs A are transported (input) per hour and 40,000 eggs B are transported per hour for the sake of illustration.

[0044] Furthermore, eggs A of sizes L, M and S and nonstandards (E) are assumed to form proportions of 40%, 25%, 15% and 20%, respectively, and eggs B of sizes L, M and S and nonstandards (E) are assumed to form proportions of 15%, 25%, 40% and 20%, respectively.

[0045] Note that such data is obtained from a distribution of a property of eggs of a single group of chickens, as compared with that of the egg property of the same group of chickens of the previous day. Alternatively, it may depend for example on generally known distribution data.

[0046] For the six main packing units 4 as shown in Fig. 1, eggs of sizes L, M, S transported by the first distributing conveyer 1A are handled by main packing units 4A, 4B, 4C, respectively, and those of sizes L, M, S transported by the second distributing conveyer 1B are handled by main packing units 4D, 4E, 4F, respectively. Furthermore, main packing units 4A-4F are assumed to be each capable of handling 30,000 eggs per hour.

[0047] Note that unless the apparatus is otherwise controlled, main packing unit 4 is adapted to accommodate eggs transported by the first and second distributing conveyers 1A and 1B that exclude those of nonstandards (E), for the sake of illustration.

[0048] In this scenario, in accordance with the egg size distribution as described above, the first distributing conveyer 1A transports 8,000 eggs of size L, 5,000 eggs of size M and 3,000 eggs of size S per hour and the second distributing conveyer 1B similarly transports 6,000 eggs of size L, 10,000 eggs of size M and 16,000 eggs of size S per hour.

[0049] Thus, main packing units 4A, 4B, 4C have serviceabilities of 27%, 17%, 10%, respectively, and main packing units 4D, 4E, 4F have serviceabilities of 20%, 33%, 53%, respectively.

[0050] Thus main packing units 4A-4F vary in serviceability, which the sorting and packing apparatus should avoid.

[0051] Accordingly, with reference to Fig. 4, an egg size distribution and a number of eggs input per hour are used to previously calculate and then use a number of eggs of each size to adjust a number of eggs to be handled to allow main packing units 4A-4F to be substantially uniform in serviceability. More specifically, control unit 9 and sorting and releasing reference setting unit 10 adjust a number of eggs to be handled by each of main packing units 4A-4F to level out main packing units 4A-4F in serviceability.

[0052] For example, if main packing unit 4C is allowed to handle 6,500 of 16,000 eggs of size S to be handled by main packing unit 4F per hour, then main packing unit 4F would handle 9,500 eggs per hour. As a result, main packing unit 4F would have a serviceability of 32%.

[0053] Meanwhile, main packing unit 4C receives 3,000 eggs plus 6,500 eggs per hour, it would handle a total of 9,500 eggs of size S per hour. As a result, main packing unit 4C would also have a serviceability of 32%. Thus for eggs of size S main packing units 4C and 4F are leveled out in serviceability.

[0054] Also for eggs of the other sizes, main packing units 4A-4F can similarly be leveled out and thus have their serviceabilities of 23%, 25%, 32%, 23%, 25%, 32%, respectively. Main packing units 4A-4F can thus be prevented from significant varying in serviceability.

[0055] As has been described previously, the present sorting and packing apparatus uses distributing conveyers 1A and 1B driven by drive motors 8A and 8B, respectively.

[0056] As such, if any trouble occurs and any one of distributing conveyers 1A and 1B is forced to stop, the other conveyer is not required to stop and can transport eggs which are in turn accommodated by main packing unit 4 to continue to pack the eggs.

[0057] Furthermore in this sorting and packing apparatus for example eggs of chickens of a relatively old age in day and those of chickens of a relatively young age in day can be transported by two distributing conveyers 1A and 1B, respectively, and packed. In particular, it is known that old chickens lay eggs having their sells reduced in hardness and thus prone to crack.

[0058] In the present apparatus, distributing conveyers 1A and 1B are driven by independent drive motors 8A and 8B, respectively. As such, eggs laid by older chickens and thus having shells prone to crack can be transported slowly, while eggs of younger chickens can be transported faster. This can prevent older chickens' eggs being transported from cracking and also transport younger chickens' eggs rapidly to achieve an efficient transporting and packing process accommodating an egg property.

[0059] Furthermore the present sorting and packing apparatus includes control unit 9 and sorting and releas-

ing reference setting unit 10 driven by a number of eggs input and carried by a distributing conveyer per unit time and an egg property such as size distribution to adjust a number of eggs to be handled by each main packing unit 4.

[0060] Thus, main packing units 4 can be leveled out in serviceability and thus prevented from significantly varying in serviceability. Thus eggs can be transported and packed efficiently.

[0061] Note that while the present sorting and packing apparatus includes control unit 9 and sorting and releasing reference setting unit 10 provided separately, it may include control unit 9 also having the function of unit 10.

Second Embodiment

[0062] In the first embodiment, leveling out main packing units in serviceability depends on egg size by way of example, for the sake of specific illustration. In the second embodiment, it is described as depending on shell color. Eggs are divided for example into white eggs and brown eggs depending on their shell colors.

[0063] With reference to Fig. 5, the first distributing conveyer (52) and the second distributing conveyer (53) are assumed to transport 20,000 eggs C/hour and 40,000 eggs D/hour, respectively, both including white eggs and brown eggs.

[0064] Furthermore, eggs C include brown eggs of a proportion of 80% and white eggs of a proportion of 20% and eggs D include brown eggs of a proportion of 30% and white eggs of a proportion of 70% for the sake of illustration.

[0065] Note that such data is obtained from a distribution of a property of eggs of a group of chickens relative to that of the property of eggs of the same group of chickens of the previous day, as has been described previously. Alternatively, it may be obtained for example from generally known distribution data.

[0066] For example, the Fig. 1 six main packing units 4 include main packing units 4A and 4B handling brown eggs and white eggs, respectively, of those transported by the first distributing conveyer 1A, and main packing units 4C and 4D handling brown eggs and white eggs, respectively, of those transported by the second distributing conveyer 1B, for the sake of illustration. Furthermore, each of main packing units 4A-4F is assumed to be capable of handling 30,000 eggs/hour.

[0067] In this scenario, in accordance with the egg shell color distribution, the first distributing conveyer 1A transports 16,000 brown eggs/hour and 4,000 white eggs/hour and the second distributing conveyer 1B similarly transports 12,000 brown eggs/hour and 28,000 white eggs/hour. Thus, main packing units 4A and 4B have serviceabilities of 53% and 13%, respectively, and main packing units 4C and 4D have serviceabilities of 40% and 93%, respectively.

[0068] Thus main packing units 4A-4D vary in serviceability, which the sorting and packing apparatus should avoid.

[0069] Accordingly, with reference to Fig. 5, a shell color distribution and a number of eggs input per hour are used to previously calculate and then use a number of eggs of each shell color to adjust a number of eggs to be handled to allow main packing units 4A-4F to be substantially uniform in serviceability. More specifically, control unit 9 and sorting and releasing reference setting unit 10 adjust a number of eggs to be handled by each of main packing units 4A-4F to level out main packing units 4A-4F in serviceability.

[0070] For example, of 28,000/hour to be handled by main packing unit 4D, 12,000 white eggs/hour are handled by main packing unit 4B to allow main packing unit 4D to handle 16,000 white eggs/hour. As a result, main packing unit 4D has a serviceability of 53%.

[0071] Main packing unit 4B meanwhile receives 4,000 eggs/hour plus 12,000 white eggs/hour and thus handles 16,000 white eggs/hour. As a result, main packing unit 4B also has a serviceability of 53%. Thus for white eggs the main packing units are leveled out in serviceability.

[0072] For brown eggs the main packing units 4A-4D can also be similarly leveled out and thus have serviceabilities of 47%, 53%, 47%, 53%, respectively . They can thus be prevented from significantly varying in serviceability.

[0073] Thus the present sorting and packing apparatus includes control unit 9 and sorting and releasing reference setting unit 10 driven by a number of eggs input and carried by a distributing conveyer per unit time and a shell color distribution to adjust a number of eggs to be handled by each main packing unit 4.

[0074] Thus, main packing units 4 can be leveled out in serviceability and thus prevented from significantly varying in serviceability. Thus eggs can be transported and packed efficiently.

[0075] Note that if transport conveyers 52 and 53 transport white eggs and brown eggs mixed together, a shell color sensor (not shown) can be provided to read the shell colors of eggs transported by distributing conveyers 1A and 1B, so as to facilitate distinguishing the eggs.

[0076] Furthermore, while the above description refers to shell color alone as an egg property, it may refer to shell color and egg size as egg properties to adjust a number of eggs to be handled. Furthermore, not only shell color and egg size but also a distribution of any other physical property of eggs may be referred to to level out main packing units. For example, a distribution of a quality of eggs, such as normal eggs, cracked eggs, blood-containing eggs, droppings-smeared eggs and other similar defective eggs, and an amount of eggs input may also be referred to to adjust eggs in number to level out main packing units in serviceability.

[0077] Note that to grasp such a quality of eggs, units are desirably arranged to detect cracked eggs, blood-containing eggs, smeared eggs and the like.

[0078] Furthermore, an amount of agricultural/animal products input and conveyed by each distributing conveyer may simply be referred to to adjust main packing units in serviceability.

Third Embodiment

[0079] In the present sorting and packing apparatus, eggs transported by a plurality of distributing conveyers are collectively accommodated by main packing unit 4, as will now be described by way of example.

[0080] As shown in Fig. 6, the main packing unit 4 includes primary accommodating means 11A and 11B receiving eggs 6 released by distributing conveyers 1A and 1B, respectively, and accommodating the eggs in a group in the form of a row. Below the distributing conveyors 1A and 1B there exist standby accommodating means 12A and 12B receiving such collectively transferred, grouped eggs 6 from primary accommodating means 11A and 11B and accommodating more than one such transferred group of eggs 6 separately.

[0081] Below standby accommodating means 12A and 12B there exist transferring means 18A and 18B receiving the groups of eggs 6 from standby accommodating means 12A and 12B. Below transferring means 18A and 18B there exists a common packing means 14 receiving the groups of eggs 6 from transferring means 18A and 18B and packing the eggs in a packing container 5.

[0082] Below main packing unit 4 is arranged an endless container conveyer 57 intermittently transporting an egg pack, a paper tray or any other similar packaging container 5. As will be described later, the moving means 18A and 18B are adapted to selectively transfer the groups of the eggs 6 received from the respective standby accommodating means 12A and 12B to the common packing means 14.

[0083] The endless distributing conveyors 1A and 1B disposed substantially parallel to each other each have a finger 2 holding egg 6 having had its weight measured. Egg 6 is transported in a direction X orthogonal to a direction Y followed by the container conveyer 3 transporting eggs 6.

[0084] The container conveyors 3 are installed in a number corresponding to at least the number of weight classifications of the eggs 6. For example, in a case where the eggs 6 are sorted outin seven weight classifications including 2L, L, M, MS, S, 2S, and nonstandards, at least seven container conveyors 3 are installed.

[0085] In the primary accommodating means 11A and 11B, the standby accommodating means 12A and 12B, and the transferring means 18A and 18B, the primary accommodating means 11A, the standby accommodating means 12A, and the transferring means 18A for the distributing conveyor 1A and the primary accommodating means 11B, the standby accommodating means 12B, and the transferring means 18B for the distributing conveyor 1B are configured in a similar manner.

[0086] Therefore, a detailed description will be primarily given below of the primary accommodating means 11A, the standby accommodating means 12A, and the transferring means 18A. As for the primary accommodating means 11B, the standby accommodating means 12B, and the transferring means 18B, B will be appended to the same reference numerals, and a detailed description thereof will be omitted unless particularly required.

[0087] The primary accommodating means 11A includes an openable stopper 41A and a fixed guide 13A which is also common to the standby accommodating means 12A and the transferring means 18A. The standby accommodating means 12A includes an upper standby accommodating mechanism 12A-1 in an upper stage and a lower standby accommodating mechanism 12A-2 in a lower stage. The upper standby accommodating mechanism 12A-1 has the fixed guide 13A and an openable stopper 42A, while the lower standby accommodating mechanism 12A-2 has the fixed guide 13A and an openable stopper 43A.

[0088] The fixed guide 13A is formed of a corrugated plate-like member for forming a plurality of substantially trough-shaped passages thereon, and is adapted to guide the eggs 6 which are released from the fingers 2 when the fingers 2 are opened, such that the eggs 6 slide down thereon diagonally due to their own weight toward the packing means 14 disposed below a gap between the primary accommodating means 11A and 11B.

[0089] The primary accommodating means 11A disposed below the distributing conveyor 1A forms primary accommodating pockets 16A by means of the fixed guide 13A and the openable stopper 41A. If an example is cited in which two rows each consisting of five eggs are packed in a 10-pack packaging container 5 to complete their accommodation, the primary accommodating means 11A forms five primary accommodating pockets 16A by means of the fixed guide 13A and the openable stopper 41A, and is adapted to accommodate five eggs 6 in a row in the horizontal direction.

[0090] Namely, the primary accommodating pockets 16A accommodates from an upper direction the eggs 6 released from the distributing conveyor 1A with their long axes set substantially vertically, and the plurality of primary accommodating pockets 16A are adapted to release the accommodated eggs 6 collectively in the downward direction.

[0091] When the five eggs 6 are accommodated in the primary accommodating pockets 16A in a row, an accommodation completion signal from a detector (not shown) for detecting the completion is transmitted to a control unit 9. Incidentally, instead of providing such a detector, the control unit 9 itself for controlling the release of the eggs 6 from the fingers 2 to the primary accommodating means 11A may recognize the completion of the accommodation.

[0092] The standby accommodating means 12A has the upper and lower standby mechanisms 12A-1 and

12A-2 for allowing the group of eggs 6 from the primary accommodating means 11A to stand by. If the preceding upper standby mechanism 12A-1 disposed diagonally below the primary accommodating means 11A along the fixed guide 13A is capable of accepting the eggs 6 accommodated in the primary accommodating means 11A, the openable stopper 41A of the primary accommodating means 11A is opened on the basis of an accommodation allowance signal. Consequently, a horizontal row of five eggs 6 are collectively dropped due to their own weight and transferred as a group to the upper standby mechanism 12A-1 disposed diagonally below along the fixed guide 13A.

[0093] The upper standby mechanism 12A-1, which is a preceding standby mechanism for allowing the group of eggs 6 from the primary accommodating means 11A to stand by in a preceding manner, has the fixed guide 13A and the openable stopper 42A, and forms five standby accommodating pockets 17A-1 in the horizontal direction by means of the fixed guide 13A and the openable stopper 42A. The upper standby mechanism 12A-1 is thus adapted to accommodate the eggs 6 from the primary accommodating means 11A in the respective standby accommodating pockets 17A-1.

[0094] Similarly, the lower standby mechanism 12A-2, which is a standby mechanism following the upper standby accommodating mechanism 12A-1, has the fixed guide 13A and the openable stopper 43A, and forms five standby accommodating pockets 17A-2 in the horizontal direction by means of the fixed guide 13A and the openable stopper 43A. The upper standby mechanism 12A-2 is thus adapted to accommodate the eggs 6 from the upper standby mechanism 12A-1 in the respective standby accommodating pockets 17A-2.

[0095] As for the standby accommodating pockets which are provided midway in the process of transfer of the eggs 6 from the primary accommodating means 11A to the packing means 14, it suffices if at least one row of the standby accommodating pockets are provided for the distributing conveyor 1A. In this embodiment, two rows of the standby accommodating pockets are provided as described above.

[0096] When five eggs are accommodated in the standby accommodating pockets 17A-1 in a row, the standby completion signal is transmitted to the control unit 9. If the standby accommodating pockets 17A-2 disposed diagonally below along the fixed guide 13A are capable of accepting the horizontal row of five eggs 6 waiting in the diagonally upper standby accommodating pockets 17A-1, the openable stopper 42A of the standby accommodating pockets 17A-1 is opened on the basis of the accommodation allowance signal.

[0097] Consequently, the row of five eggs 6 are transferred collectively, i.e., as a group, due to their own weight to the standby accommodating pockets 17A-2 disposed diagonally below the standby accommodating pockets 17A-1 along the fixed guide 13A.

[0098] Thus, the transfer operation in which the group of eggs 6 are transferred from the upper standby mechanism 12A-1 for allowing the group of eggs 6 from the primary accommodating means 11A to stand by in a preceding manner to the lower standby mechanism 12A-2 following the upper standby mechanism 12A-1 is effected on the basis of the state of standby of the group of eggs 6 in the lower standby mechanism 12A-2.

[0099] The transferring means 18A has the fixed guide 13A and an openable stopper 44A, which together form transfer accommodating pockets 19A. If the transferring means 18A is capable of accepting the group of five eggs 6 waiting in the lower standby accommodating pockets 17A-2 disposed diagonally thereabove, the openable stopper 43A of the standby accommodating pockets 17A-2 is opened on the basis of the accommodation allowance signal.

[0100] Consequently, the row of five eggs 6 are transferred collectively, i.e., as a group, due to their own weight to the transfer accommodating pockets 19A along the fixed guide 13A.

[0101] The packing means 14 which is used jointly for the distributing conveyors 1A and 1B is disposed centrally below the gap between the pair of transferring means 18A and 18B, and has a pair of openable stoppers 15.

[0102] When the accommodation of the five eggs 6 in the transfer accommodating pockets 19A is completed, a transfer preparation completion signal from a detector (not shown) for detecting the completion is transmitted to the control unit 9. If the packing means 14 is capable of accepting the five eggs 6 accommodated in the transfer accommodating pockets 19A disposed diagonally thereabove, an accommodation allowance signal from a detector (not shown) for detecting the acceptability is transmitted to the control unit 9.

[0103] Incidentally, instead of providing such a detector, the completion of the preparation of transfer and the acceptability may be recognized by the control unit 9 itself which controls the release of the eggs 6 from the lower standby mechanism 12A-2 to the transferring means 18A and controls the release of the eggs 6 from the packing means 14 to the packaging container 5.

[0104] When the release is allowed, the openable stopper 44A of the transferring means 18A is opened, so that the row of five eggs 6 are transferred due to their own weight to the packing means 14 disposed diagonally below along the fixed guide 13A. Since the packing means 14 is used jointly for the transfer accommodating pockets 19A and 19B, there are cases where the eggs 6 in either of the transfer accommodating pockets 19A and 19B are set in the state of standby depending on cases.

[0105] Accordingly, if five eggs 6 are accommodated in both the transfer accommodating pockets 19A and 19B, the release of the eggs 6 from the accommodating pockets 19A and 19B to the packing means 14 is effected selectively so that they will not interfere with each other. Namely, the transfer of the eggs 6 is effected se-

lectively so that the transfer of the group of eggs 6 to the common packing means 14 in the transferring means 18A and the transfer of the group of eggs 6 to the common packing means 14 in the transferring means 18B will not interfere with each other.

[0106] In this embodiment, the arrangement provided is such that, on the basis of the result of comparison between the number of groups of eggs 6 on standby in the standby accommodating pockets 17A-1 and 17A-2 on the distributing conveyor 1A side and the number of groups of eggs 6 on standby in the standby accommodating pockets 17B-1 and 17B-2 on the distributing conveyor 1B side, the group of eggs 6 of the moving means which receives the group of eggs 6 from the standby accommodating means having more numerous eggs on standby are preferentially released to the packing means 14.

[0107] It should be noted that subjects of comparison may be those in which the number of eggs 6 accommodated in the primary accommodating pockets 16A or 16B is added to the number of groups of eggs 6 on standby in the standby accommodating pockets 17A or 17B. Still alternatively, between the transfer accommodating pockets 19A and 19B, the group of eggs 6 on the side where the accommodation of the group of eggs 6 was completed first may be preferentially released to the packing means 14.

[0108] Furthermore, the numbers of eggs 6 which are determined to be distributed to the primary accommodating means 11A and 11B as a result of weight measurement and are approaching the primary accommodating means 11A and 11B on the distributing conveyors 1A and 1B, respectively, may be also used as subjects of comparison in addition to the present numbers of groups of eggs 6 on standby on the distributing conveyor 1A side and the distributing conveyor 1B side.

[0109] Namely, since the eggs 6 after the measurement are distributed to the main packing units 4 corresponding to the relevant weight classifications by the distributing conveyors 1A and 1B, as for the eggs 6 after the measurement, their positions and quantities are being grasped by the control unit 9 as information until they reach the main packing units 4 to be distributed to.

[0110] Consequently, for example, even if the total number of groups of eggs 6 being accommodated in the standby accommodating pockets 17A-1 and 17A-2 and the transfer accommodating pockets 19A on the distributing conveyor 1A side in Fig. 6 is less than the total number of groups of eggs 6 being accommodated in the standby accommodating pockets 17B-1 and 17B-2 and the transfer accommodating pockets 19B on the distributing conveyor 1B side, the number of eggs 6 which are determined to be distributed to the primary accommodating means 11A on the distributing conveyor 1A side and are approaching the main packing unit 4 on the distributing conveyor 1A is more numerous than that on the distributing conveyor 1B side, priority is given to the release of the group of eggs 6 on standby in the transfer accommodating pockets 19A on the distributing conveyor 1A side so as to prevent a decline in the processing capability.

[0111] In this case, the numbers of eggs 6 which are determined to be distributed to the primary accommodating means 11A and 11B and are approaching the main packing units 4 by the distributing conveyors 1A and 1B are also made subjects of comparison.

[0112] In other words, the sorting and packing apparatus may select the group of eggs 6 to be transferred from the transferring means 18A or 18B to the common packing means 14 on the basis of at least one of the present numbers of groups on standby in the respective standby accommodating means 12A and 12B and the numbers of eggs 6 determined to be released to the primary accommodating means 11A and 11B and being transported by the distributing conveyors 1A and 1B.

[0113] It should be noted that in a case where, for example, the group of eggs 6 in the transfer accommodating pockets 19A are preferentially released after the selection, the group of eggs 6 in the transfer accommodating pockets 19B are set in the state of standby. However, since the weight of the eggs 6 varies in a certain measure as described above, even if the eggs 6 determined to be released are temporarily concentrated in the main packing unit 4 corresponding to the packaging of the eggs of a particular weight classification, there are cases where the eggs 6 of the same weight classification are not transported for some time. For this reason, it suffices if the group of eggs 6 in the transfer accommodating pockets 19B placed on standby are released by making use of this spare time.

[0114] Accordingly, even if the group of eggs 6 in the transfer accommodating pockets 19B are temporarily placed on standby, it becomes possible to prevent a decline in the overall processing capability of the apparatus by providing a plurality of standby accommodating pockets 19A and 19B on the distributing conveyor 1A side and the distributing conveyor 1B side along the fixed guide 13A.

[0115] The packing means 14 which is common to both the distributing conveyor 1A side and the distributing conveyor 1B side has the pair of openable stoppers 15. Upon receiving five eggs 6 released from the transfer accommodating pockets 19A, the packing means 14 confirms whether or not the 10-pack packaging container 5 has been prepared at the predetermined position, and then if the packaging container 5 is at the predetermined position, the packing means 14 opens the openable stoppers 15 in response to a release allowance signal. As a result, the five eggs 6 are collectively packed in the packaging container 5 by their own weight.

[0116] The main packing unit 4 for a weight classification of the eggs 6 whose frequency of occurrence is low, e.g., for the weight classification 3L, may be arranged as follows. Assuming that the collection of a required number of eggs has been completed if the total of the eggs 6 accommodated in the pair of primary ac-

commodating means 11A and 11B has become five without waiting for the five eggs 6 to be accommodated in the primary accommodating means 11A in a row, the total of five eggs 6 accommodated in the pair of primary accommodating means 11A and 11B are collectively transferred to the standby accommodating means 12A and 12B, and are collectively transferred sequentially down to the packing means 14.

[0117] If such an arrangement is adopted, since the row of five eggs 6 are gathered in the final packing means 14, these eggs 6 are packed in the packaging container 5.

[0118] As is apparent from Fig. 7, in the downward order from the primary accommodating means 11A and 11B to the packing means 14 via the standby accommodating means 12A and 12B and the transferring means 18A and 18B, respective horizontal intervals between adjacent ones of the primary accommodating pockets 16A and 16B, the standby accommodating pockets 17A-1, 17A-2, 17B-1, 17B-2, and the transfer accommodating pockets 19A and 19B are gradually narrowed, such that horizontal intervals between adjacent ones of packing accommodating pockets 21 in the packing means 14 are made identical to those between adjacent ones of accommodating seats 7 for the eggs 6 in the packaging container 5. By so doing, the transfer of the eggs 6, which are liable to be damaged, to the packaging container 5 can be effected safely at high speed and continuously.

[0119] It should be noted that, in another embodiment, as in the case of the main packing unit of the sorting and packing apparatus shown in Fig. 8, each of the primary accommodating means 11A and 11B may be made independent from the fixed guides 13A and 13B, and may be formed by a pair of openable stoppers 41A and a pair of openable stoppers 41B, respectively.

[0120] Next, still another embodiment of the main packing unit 4 will be shown in Fig. 9. In Fig. 9, the primary accommodating means 11A, the standby accommodating means 12A, and the transferring means 18A on the distributing conveyor 1A side and the primary accommodating means 11B, the standby accommodating means 12B, and the transferring means 18B on the distributing conveyor 1B side are configured in a similar manner in the same way as described above. Therefore, a description will be basically given below of the distributing conveyor 1A side.

[0121] Since the primary accommodating means 11A disposed immediately below the distributing conveyor 1A has the pair of openable stoppers 41A for forming the primary accommodating pockets 16A. The standby accommodating means 12A disposed immediately below the primary accommodating means 11A has the upper standby mechanism 12A-1 and the lower standby mechanism 12A-2. The upper standby mechanism 12A-1 has the pair of openable stoppers 42A, while the lower standby mechanism 12A-2 has the pair of openable stoppers 43A.

[0122] The standby accommodating pockets 17A-1 and 17A-2 are formed in the downward order in the upper standby mechanism 12A-1 and the lower standby mechanism 12A-2, respectively. The transferring means 18A disposed immediately below the lower standby mechanism 12A-2 has the pair of openable stoppers 44A for forming the transfer accommodating pockets 19A.

[0123] The packing means 14, which is used jointly for the distributing conveyor 1A side and the distributing conveyor 1B side, has the pair of openable stoppers 15 for forming the packing accommodating pockets 21 as well as an electrically-operated cylinder 20 and an arm 20a. The arrangement provided is such that as the arm 20a is actuated by the electrically-operated cylinder 20, the packing accommodating pockets 21 are moved to a position immediately below the transfer accommodating pockets 19A or transfer accommodating pockets 19B in which the eggs 6 subject to release are accommodated.

[0124] In a main packing unit shown in Fig. 9, when five eggs 6 are accommodated horizontally in a row in the primary accommodating pockets 16A, an accommodation completion signal is transmitted from the primary accommodating means 11A to the control unit 9. If the upper standby mechanism 12A-1 disposed immediately below the primary accommodating means 11A is capable of accepting the eggs 6 accommodated in the primary accommodating means 11A, the upper standby mechanism 12A-1 outputs an accommodation allowance signal to the control unit 9, whereupon the control unit 9 opens the openable stoppers 41A of the primary accommodating means 11A. Consequently, the row of five eggs 6 accommodated in the primary accommodating pockets 16A are collectively transferred due to their own weight to the upper standby mechanism 12A-1 disposed immediately below.

[0125] When the row of five eggs 6 are accommodated in the standby accommodating pockets 17A-1, a standby completion signal is transmitted to the control unit 9. If the lower standby accommodating pockets 17A-2 disposed immediately below are capable of accepting the eggs 6 on standby in the standby accommodating pockets 17A-1 disposed immediately above, the lower standby accommodating pockets 17A-2 outputs an accommodation allowance signal to the control unit 9, whereupon the control unit 9 opens the openable stoppers 42A of the upper standby mechanism 12A-1 in response to the accommodation allowance signal. Consequently, the row of five eggs 6 are collectively transferred due to their own weight to the standby accommodating pockets 17A-2 disposed immediately below.

[0126] If the transferring means 18A is capable of accepting the group of eggs 6 on standby in the standby accommodating pockets 17A-2, the transferring means 18A outputs an accommodation allowance signal to the control unit 9, whereupon the control unit 101 opens the openable stoppers 43A of the lower standby mechanism 12A-2 in response to the accommodation allowance sig-

nal. Consequently, the row of five eggs 6 are collectively transferred due to their own weight to the transfer accommodating pockets 19A.

[0127] Upon completion of the accommodation of the five eggs 6 in the transfer accommodating pockets 19A, a transfer preparation completion signal is transmitted to the control unit 9. If the packing means 14 is capable of accepting the five eggs 6 accommodated in the transfer accommodating pockets 19A, the arm 20a is actuated by the electrically-operated cylinder 20, so that the packing accommodating pockets 21 can be moved to the position immediately below the transfer accommodating pockets 19A.

[0128] In this case as well, since the eggs 6 which are released from the two transfer accommodating pockets 19A and 19B on the distributing conveyor 1A side and the distributing conveyor 1B side are received by the single row of packing accommodating pockets 21, the release of the eggs from the transfer accommodating pockets 19A and 19B to the packing accommodating pockets 21 is effected selectively. The selection at that time is effected in the same way as in the above-described embodiment.

[0129] In the above-described manner, the five eggs 6 accommodated in the transfer accommodating pockets 19A are transferred to the packing accommodating pockets 21 of the packing means 14. Then, the packing means 14 confirms whether or not the 10-pack packaging container 5 has been prepared at the predetermined position, and then if the packaging container 5 is at the predetermined position, the packing means 14 opens the openable stoppers 15 in response to a release allowance signal. As a result, the five eggs 6 are collectively packed in the packaging container 5.

[0130] Although, in the main packing unit shown in Fig. 9, the 10-pack packaging container 5 receives each group of five eggs 6 on two occasions, an arrangement may be alternatively provided as follows: In the embodiment shown in Fig. 9, two pairs of openable stoppers 15 are juxtaposed to the arm 19 so as to form two rows of packing accommodating pockets 21, and after the groups of five eggs 6 have been transferred from the transfer accommodating pockets 19A to the respective two rows of the packing pockets 21, these two groups of five eggs 6 are collectively packed in the 10-pack packaging container 5.

[0131] A still another example of the main packing unit is shown in Fig. 10. In a main packing unit shown in Fig. 10, the primary accommodating means 11A, 11B, and 11C and the standby accommodating means 12A, 12B, and 12C are provided in the downward order immediately below three lines of distributing conveyors 1A, 1B, and 1C, respectively.

[0132] The main packing unit is further provided with the transferring means 18A, 18B, and 18C which are respectively disposed below the standby accommodating means 12A, 12B, and 12C, as well as the packing means 14 which is common to the transferring means 18A, 18B, and 18C and includes an endless transport conveyer 22 for receiving and circulatingly transferring horizontal rows of five eggs 6 released from the transferring means 18A, 18B, and 18C, as well as the pair of openable stoppers 15.

[0133] Since the respective primary accommodating means 11A to 11C, standby accommodating means 12A to 12C, and so on for the distributing conveyors 1A, 1B, and 1C are configured in the same way as described above, a description will be basically given below of the primary accommodating means 11A, the standby accommodating means 12A, and so on for the distributing conveyor 1A. If necessary, reference will be also given to the primary accommodating means 11B and 11C, the standby accommodating means 12B and 12C, and so on which are disposed immediately below the two other lines of distributing conveyors 1B and 1C.

[0134] The upper and lower standby mechanisms 12A-1 and 12A-2 of the standby accommodating means 12A are disposed immediately below the primary accommodating means 11A. If the case of packing a 10-pack packaging container is cited as an example, the primary accommodating means 11A accommodates five eggs 6 in a row.

[0135] The transport conveyer 22, in which accommodating seats 23 for accommodating horizontal rows of five eggs 6 are linked, is adapted to receive the eggs 6 from the transfer accommodating pockets 19A of the transferring means 18A, and collectively release five eggs 6 as a group from the accommodating seats 23 to the collecting accommodating pockets 21.

[0136] In the main packing unit shown in Fig. 10, the transfer of the eggs 6 from the primary accommodating means 11A to the standby accommodating pockets 17A-1 and 17A-2 and to the transfer accommodating pockets 19A is basically the same as the main packing unit shown in Fig. 9. Accordingly, a description will be given herein of the transfer of the eggs 6 from the transfer accommodating pockets 19A to the transport conveyer 22. the transfer of the eggs 6 from the transport conveyer 22 to the packing accommodating pockets 21, and the operation of packing the eggs 6 from the packing accommodating pockets 21 to the packaging container 5.

[0137] The row of five eggs 6 accommodated in the transfer accommodating pockets 19A are collectively released to the relevant accommodating seats 23 of the transport conveyer 22 when a row of five empty accommodating seats 23 of the transport conveyer 22 arrive at an egg releasing position below the transfer accommodating pockets 19A. Each of the accommodating seats 23 consists of a pair of openable stoppers 24 attached to the transport conveyer 22 and similar to the openable stoppers 15.

[0138] The row of five eggs 6 accommodated in the accommodating seats 23 are transported to a release position above the packing accommodating pockets 21 by the transport conveyer 22. If the packing accommo-

dating pockets 21 are empty, an accommodation allowance signal is outputted to the control unit 9, and the row of five eggs 6 in the accommodating seats 23 are released to the packing accommodating pockets 21.

[0139] Next, confirmation is made as to whether or not the 10-pack packaging container 5 has been prepared at a predetermined position, and if the packaging container 5 is at the predetermined position, the packing means 14 opens the openable stoppers 15 in response to a release allowance signal. Consequently, the five eggs 6 are collectively packed in the packaging container 5 due to their own weight.

[0140] If the packaging container 5 is not at the predetermined position for some reason or other, the packing means 14 is unable to release the row of five eggs 6 accommodated in the packing accommodating pockets 21 and remains holding the row of five eggs 6. Subsequently, even if another row of five eggs 6 in the accommodating seats 23 arrive at the release position above the packing accommodating pockets 21 by the transport conveyer 22, since the row of five eggs 6 are already present in the packing accommodating pockets 21, the new row of five eggs 6 in the other accommodating seats 23 cannot be released to the packing accommodating pockets 21.

[0141] Accordingly, in preparation for such a situation, the transport conveyor 22 is adapted to carry over and circulatingly transport the row of five eggs 6 in the accommodating seats 23 which could not be released to the packing accommodating pockets 21. The common packing means 14 of the main packing unit in this embodiment has a transporting means 25 which transports the groups of eggs 6 from the transferring means 18A, 18B, and 18C in a circulating system and which is comprised of the transport conveyer 22 and the multiplicity of openable stoppers 24.

[0142] It should be noted that, in the main packing unit, if it is assumed that the processing capability of one distributing conveyor 1A is 30,000 eggs per hour, the processing capability of the three distributing conveyors 1A, 1B, and 1C as a whole becomes 90,000 eggs per hour. Then, if a case is assumed in which the eggs 6 are continuously concentrated in the respective primary accommodating means 11A, 11B, and 11C of the three distributing conveyors 1A, 1B, and 1C, 90,000 eggs per hour is required on calculation as the processing capability of the transporting means 25.

[0143] However, since the weight of the eggs 6 varies in a certain measure, the possibility of the eggs 6 being continuously concentrated in the relevant primary accommodating means 11A, 11B, and 11C of the three distributing conveyors 1A, 1B, and 1C at the same time is small. Hence, if a means for receiving the temporary concentration is provided appropriately, there is actually no need to set the processing capability of the transporting means 25 to 90,000 eggs per hour.

[0144] In addition, in the main packing unit shown in Fig. 10, there are cases where the eggs 6 are temporarily concentrated in the primary accommodating means for at least one of the three distributing conveyors 1A, 1B, and 1C. For example, there are cases in which the eggs 6 are continuously concentrated in the primary accommodating means 11A and 11B for the distributing conveyors 1A and 1B, and the rows of five eggs 6 are accommodated in the primary accommodating pockets 16A and 16B, the upper and lower standby accommodating pockets 17A-1 and 17A-2 and 17B-1 and 17B-2, and the transfer accommodating pockets 19A and 19B which are disposed below the distributing conveyor 1A and the distributing conveyor 1B, respectively, whereas the row of five eggs are accommodated only in the transfer accommodating pockets 19C in the case of the distributing conveyor 1C.

[0145] In this case, if the processing capability of the transporting means 25 is lower than the total processing capability of the distributing conveyors 1A, 1B, and 1C, the release of the eggs 6 from the respective transfer accommodating pockets 19A, 19B, and 19C to the transporting means 25 is effected selectively.

[0146] Namely, on the distributing conveyor 1C side, there is leeway in time to keep ensuing eggs 6, which are occasionally released from the distributing conveyor 1C, on standby in the standby accommodating pockets 17C-1 and 17C-2 even if the row of five eggs 6 accommodated in the relevant transfer accommodating pockets 19C are not immediately released to the accommodating seats 23 of the transport conveyer 22. On the distributing conveyors 1A and 1B side, on the other hand, there is no leeway for standby since the rows of five eggs 6 are already accommodated in the standby accommodating pockets 17A-1, 17A-2, 17B-1, 17B-2; therefore, the release of the eggs 6 to the accommodating seats 23 of the transport conveyer 22 is effected by placing priority on the distributing conveyors 1A and 1B side.

[0147] Furthermore, in the case where the transporting means 25 is formed by the transport conveyer 22 of the so-called circulating system, the row of five eggs 6 which could not be released to the packing accommodating pockets 21 are carried over and transported. However, if the number of the eggs 6 which are carried over and transported increases, the number of the empty accommodating seats 23 of the transport conveyer 22 decreases correspondingly. Hence, in some cases it becomes difficult to release all the eggs 6 accommodated in the transfer accommodating pockets 19A, 19B, and 19C to the accommodating seats 23 of the transport conveyer 22.

[0148] In such a case, it suffices if the release of the eggs 6 from the transfer accommodating pockets 19A, 19B, and 19C to the accommodating seats 23 of the transport conveyor 22 is effected selectively in the same way as described above.

[0149] Furthermore, the Fig. 10 main packing unit between three aligned distributing conveyers 1A-1B and transport conveyer 22 includes primary accommodating means 11A-11C, standby accommodating means 12A-

12C and transferring means 18A-18C, as seen from distributing conveyers 1A-1B toward transport conveyer 22. Thus, eggs 6 received from distributing conveyers 1A-1B by primary accommodating means 11A-11C are received successively by standby accommodating means 12A-12C serving as a buffer and then transferring means 18A-18C and thus accommodated in their accommodating pockets successively.

[0150] If a sorting and packing apparatus between distributing conveyers 1A-1C and transport conveyer 22 only has accommodating means corresponding for example to primarily accommodating means 11A-11C, however, eggs received from distributing conveyers 1A-1B by primary accommodating means 11A-11C must be transferred immediately to transport conveyer 22 so as to successively receive eggs from distributing conveyers 1A-1C and accommodate the eggs in primary accommodating means 11A-11C. To do so, transport conveyer 22 needs to be increased in speed.

[0151] Increasing the speed of transport conveyer 22, however, would result for example in older chickens' eggs cracking more frequently and the sorting and packing apparatus thus having an impaired ability to handle eggs.

[0152] In contrast, the present sorting and packing apparatus includes standby accommodating means 12A-12C and transferring means 18A-18C functioning as a buffer and thus prevents primarily accommodating means 11A-11C from continuing to hold eggs. Thus, eggs transported by distributing conveyers 1A-1C can successively be accommodated by primary accommodating means 11A-11C.

[0153] Furthermore, transport conveyer 22 transporting eggs relatively slowly can be used to receive eggs accommodated for example by standby accommodating means 12A-12C and thus prevent the eggs for example from cracking. Consequently, the eggs can be packed efficiently.

[0154] Furthermore, each of the main packing units as described above includes primarily accommodating means 11A-11C positioned topmost, standby accommodating means 12A-12C thereunder and transferring means 18A-18C thereunder cooperating to transfer eggs to a packing means positioned thereunder. Thus, if the main packing unit initially receives a white egg and then a brown egg, it can prevent the later received, brown egg from being packed earlier than the initially received, white egg and it can thus efficiently pack eggs in a predetermined container.

[0155] In each embodiment described above a plurality of distributing conveyers are each provided with a driving unit and thus driven individually by way of example. Alternatively, a plurality of distributing conveyers may be driven by a plurality of distributing conveyers and at least predetermined two of the distributing conveyers may each be driven individually by a different drive unit.

[0156] As such, for example, three of four distributing conveyers may be driven by a single drive unit and the remaining one conveyer may be driven by another drive unit, independently. Alternatively, two of four distributing conveyers may be driven by a single drive unit and the remaining two conveyers may be driven by another drive unit, independently.

[0157] While in each embodiment the present sorting and packing apparatus handles eggs as an agricultural/animal product by way of example, it can also sort and pack fruits, vegetables and other similar agricultural/animal products other than eggs.

[0158] Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and scope of the present invention.

Claims

1. An apparatus sorting and packing agricultural/animal products, comprising:

   a plurality of distributing conveyers (1A, 1B) arranged substantially parallel to each other and transporting and distributing agricultural/animal products (6);
   a drive unit (8A, 8B) each provided for a respective one of said plurality of distributing conveyers (1A, 1B) to drive each said distributing conveyer independently;
   a control unit (9, 10) controlling said drive unit (8A, 8B); and
   a main packing unit (4, 4A-4F) arranged under said plurality of distributing conveyers (1A, 1B) to accommodate collectively said agricultural/animal products (6) distributed by each of said distributing conveyers (1A, 1B) and pack said agricultural/animal products (6) in a predetermined container (5).

2. An apparatus sorting and packing agricultural/animal products, comprising:

   a plurality of distributing conveyers (1A, 1B) arranged substantially parallel to each other and transporting and distributing agricultural/animal products (6);
   a plurality of drive units (8A, 8B) driving said plurality of distributing conveyers (1A, 1B);
   a control unit (9, 10) controlling said plurality of drive units (8A, 8B); and
   a main packing unit (4, 4A-4F) arranged under said plurality of distributing conveyers (1A, 1B) to accommodate collectively said agricultural/animal products (6) distributed by each of said distributing conveyers (1A, 1B) and pack said agricultural/animal products (6) in a predeter-

mined container (5), wherein at least predetermined two of said plurality of distributing conveyers (1A, 1B) are each driven independently by a different one of said drive units (8A, 8B).

3. The apparatus of claim 1 or 2, wherein:

there exist more than one said main packing unit (4, 4A-4F) to consider a property of said agricultural/animal products (6) transported; and
said control unit (9, 10) includes a function driven by at least one of an amount of said agricultural/animal products (6) input to and carried by each of said plurality of distributing conveyers (1A, 1B) and a distribution of a property of said agricultural/animal products (6) to level out each said main packing unit (4, 4A-4F) in serviceability.

4. The apparatus of any of claims 1-3, wherein said main packing unit (4, 4A-4F) includes:

primary accommodating means (11A, 11B) receiving said agricultural/animal products (6) from said plurality of distributing conveyers (1A, 1B) and accommodating said agricultural/animal products (6) by a predetermined number as one group;
standby accommodating means (12A, 12B) arranged under said primarily accommodating means (11A, 11B) to accommodate said agricultural/animal products (6) collectively transferred from said primary accommodating means (11A, 11B);
transferring means (18A, 18B) arranged under said standby accommodating means (12A, 12B) to receive said agricultural/animal products (6) transferred from said standby accommodating means (12A, 12B); and
common packing means (14, 21) arranged under said transferring means (18A, 18B) to receive said agricultural/animal products (6) from said transferring means (18A, 18B) and pack said agricultural/animal products (6) in said predetermined container (5).

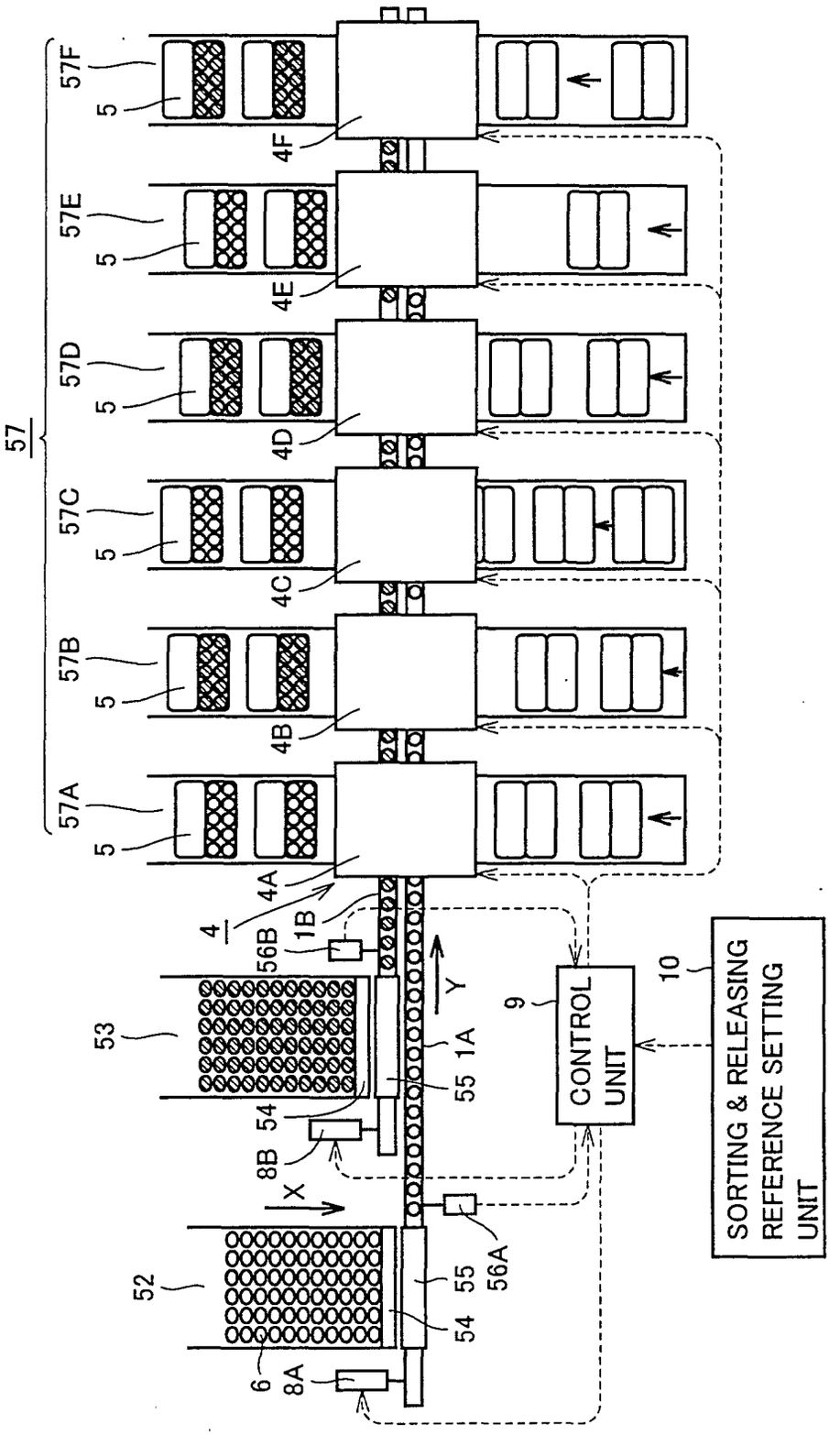
5. The apparatus of claim 4, wherein said transferring means includes said packing means.

6. The apparatus of any of claims 1-5, wherein said agricultural/animal products (6) are chicken eggs having a property including at least one of weight and egg shell color.

7. A method of controlling an apparatus sorting and packing agricultural/animal products, having a plurality of distributing conveyers (1A, 1B) transporting and distributing agricultural/animal products (6) and a plurality of main packing units (4, 4A-4F) collectively accommodating predetermined agricultural/animal products (6) distributed from said plurality of distributing conveyers (1A, 1B) with a property of said agricultural/animal products (6) taken into consideration, and packing said agricultural/animal products (6) in a container (5), comprising referring to at least one of an amount of said agricultural/animal products (6) input to and carried by each of said plurality of distributing conveyers (1A, 1B) and a distribution of said property of said agricultural/animal products (6) to level out said plurality of main packing units (4, 4A-4F) in serviceability.

8. The method of claim 7, wherein said agricultural/animal products (6) are chicken eggs having a property including at least one of weight and egg shell color.

FIG.1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57D
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4B
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56B
53
52
54
55
1A
8B
8A
6
X
Y
56A
9
CONTROL UNIT
10
SORTING & RELEASING REFERENCE SETTING UNIT

FIG.2

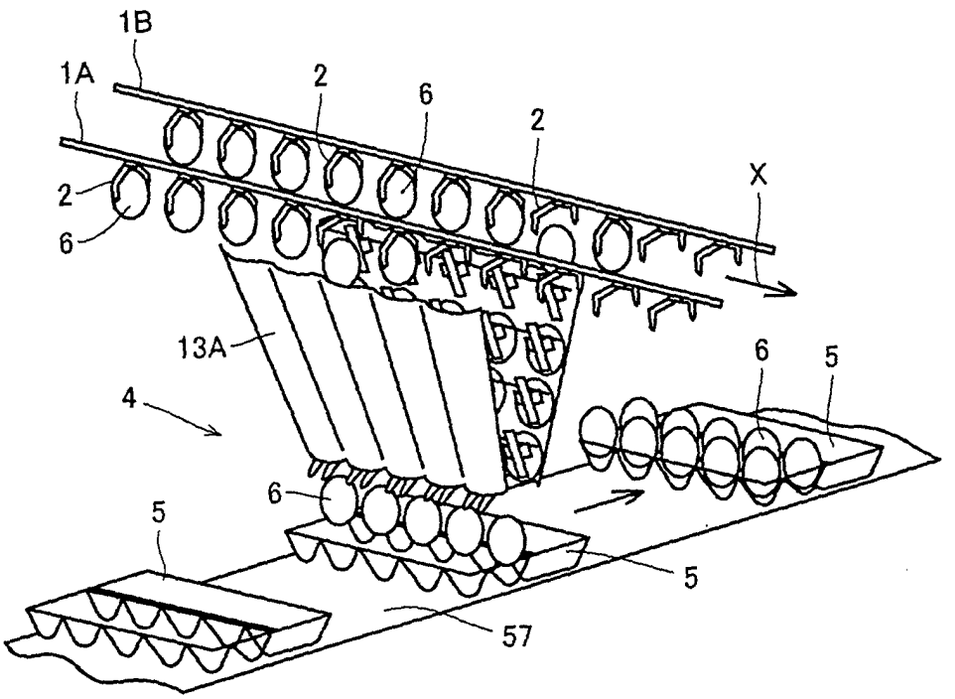


FIG.3

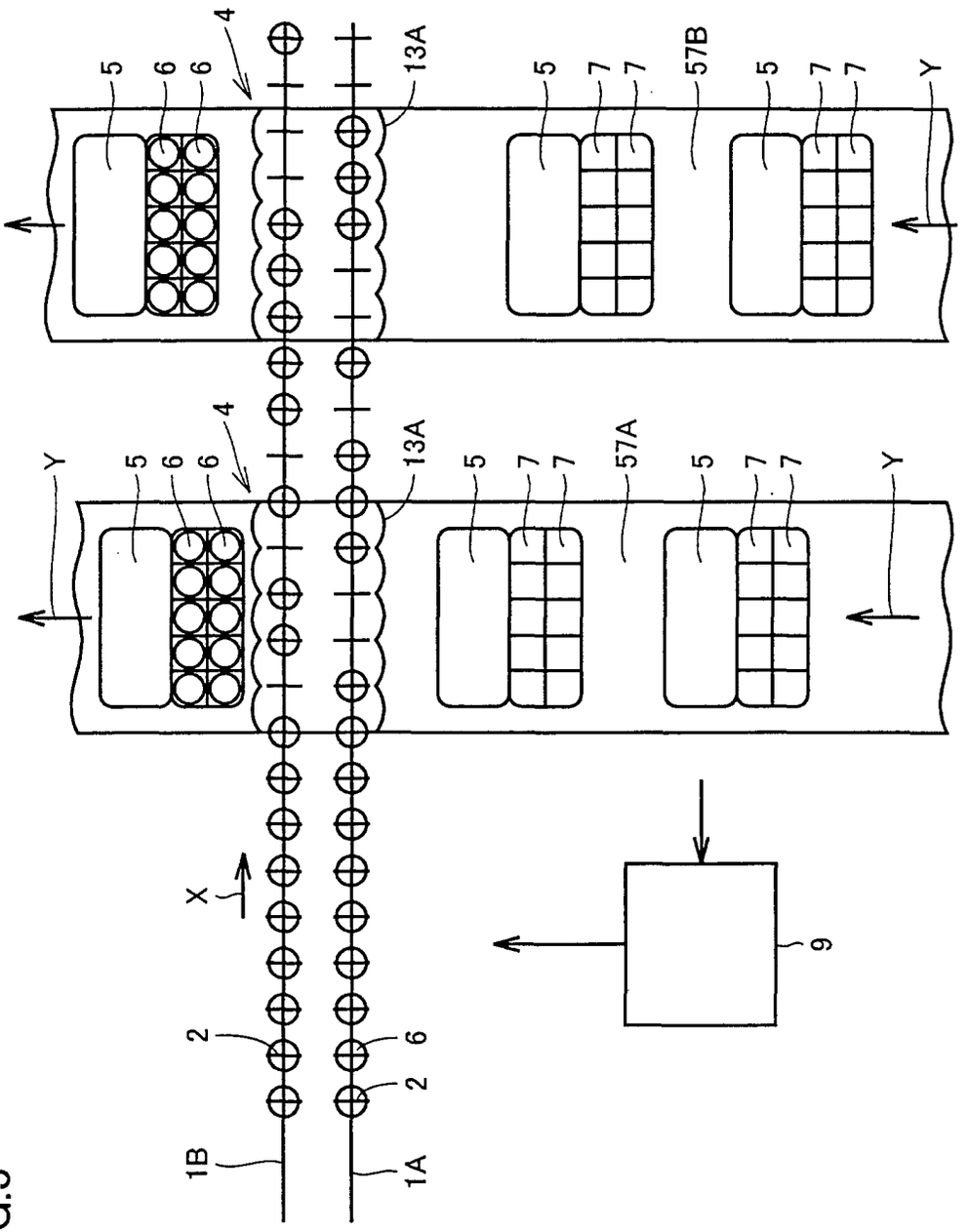


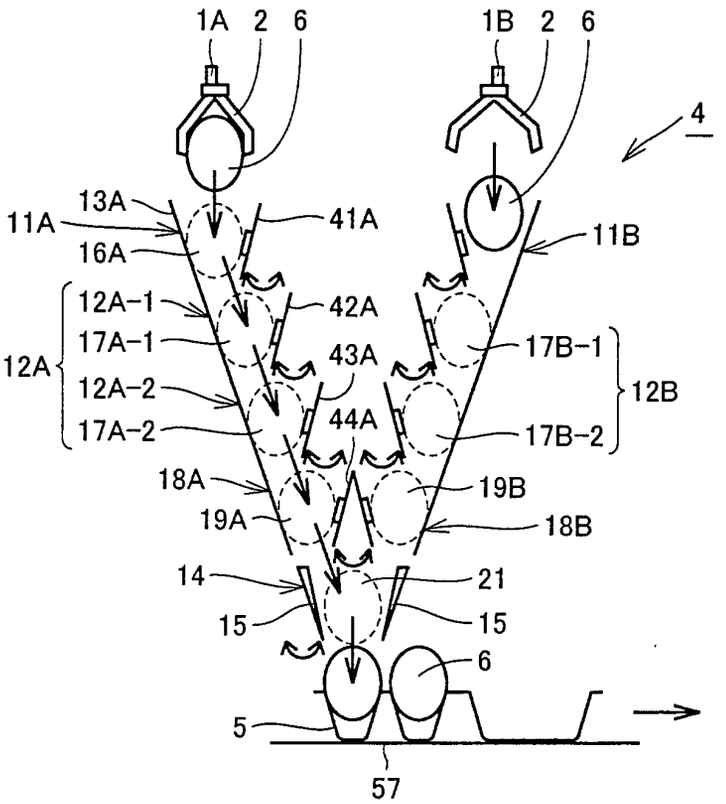
FIG.4

DISTRIBUTING CONVEYERS	AGE IN DAY	NO. OF EGGS INPUT /H. (X10,000)	SIZE	DISTRIBUTION %	NO. OF EGGS /H. (X10,000)	MAIN PACKING UNIT (30,000 EGGS/H)	SERVICEABILITY %	LEVELING-OUT PROCESS	
								ADJUSTMENT IN NO. OF EGGS /H. (X10,000)	SERVICEABILITY %
1ST	500	2.0	L	40	0.8	1(4A)	27	0.8-0.1	23
			M	25	0.5	2(4B)	17	0.5+0.25	25
			S	15	0.3	3(4C)	10	0.3+0.65	32
			E	20	0.4	-	-	-	-
2ND	150	4	L	15	0.6	4(4D)	20	0.6+0.1	23
			M	25	1.0	5(4E)	33	1.0-0.25	25
			S	40	1.6	6(4F)	53	1.6-0.65	32
			E	20	0.8	-	-	-	-

FIG.5

DISTRIBUTING CONVEYERS	NO. OF EGGS INPUT /H. (X10,000)	SHELL COLOR	DISTRIBUTION %	NO. OF EGGS /H. (X10,000)	MAIN PACKING UNIT (30,000 EGGS/H)	SERVICEABILITY %	LEVELING-OUT PROCESS	
							ADJUSTMENT IN NO. OF EGGS /H. (X10,000)	SERVICEABILITY %
1ST	2	BROWN	80	1.6	1(4A)	53	1.6-0.2	47
		WHITE	20	0.4	2(4B)	13	0.4+1.2	53
2ND	4	BROWN	30	1.2	3(4C)	40	1.2+0.2	47
		WHITE	70	2.8	4(4D)	93	2.8-1.2	53

FIG.6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6
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11A
41A
16A
11B
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42A
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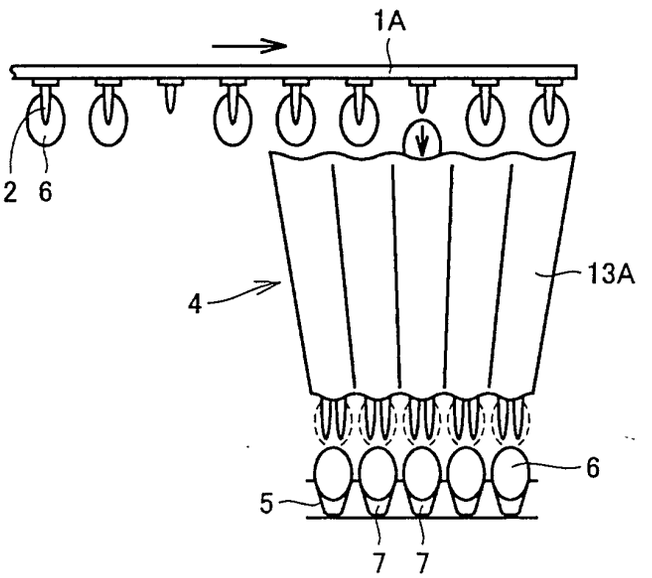
12A
43A
12A-2
12B
44A
17A-2
17B-2
18A
19B
19A
18B
14
21
15
15
6
5
57

FIG.7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7

FIG.8

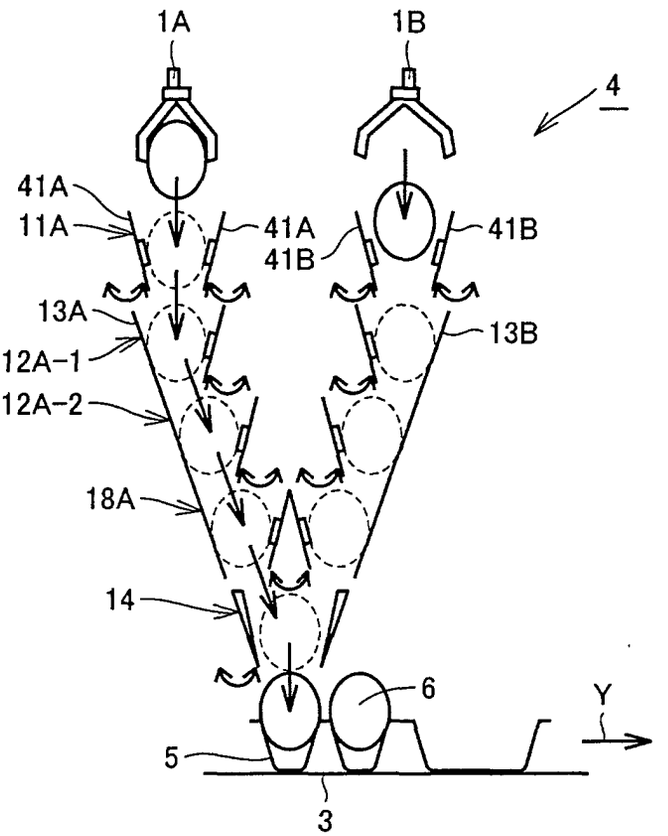
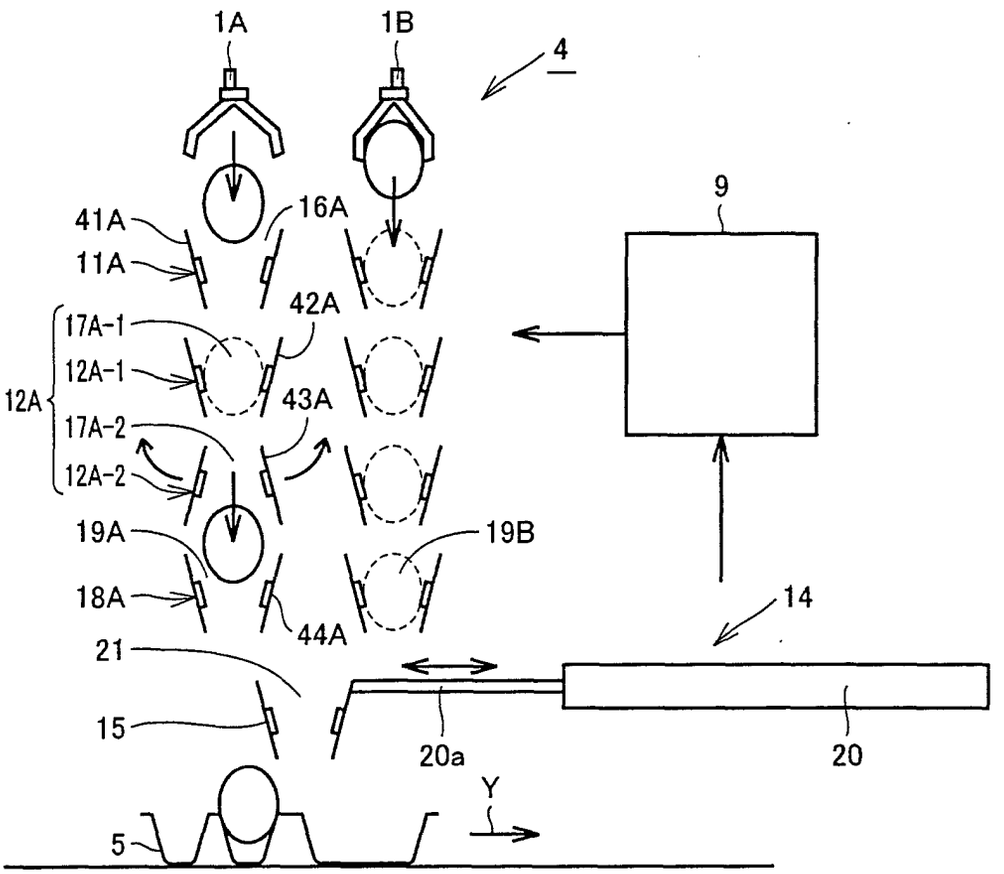


FIG.9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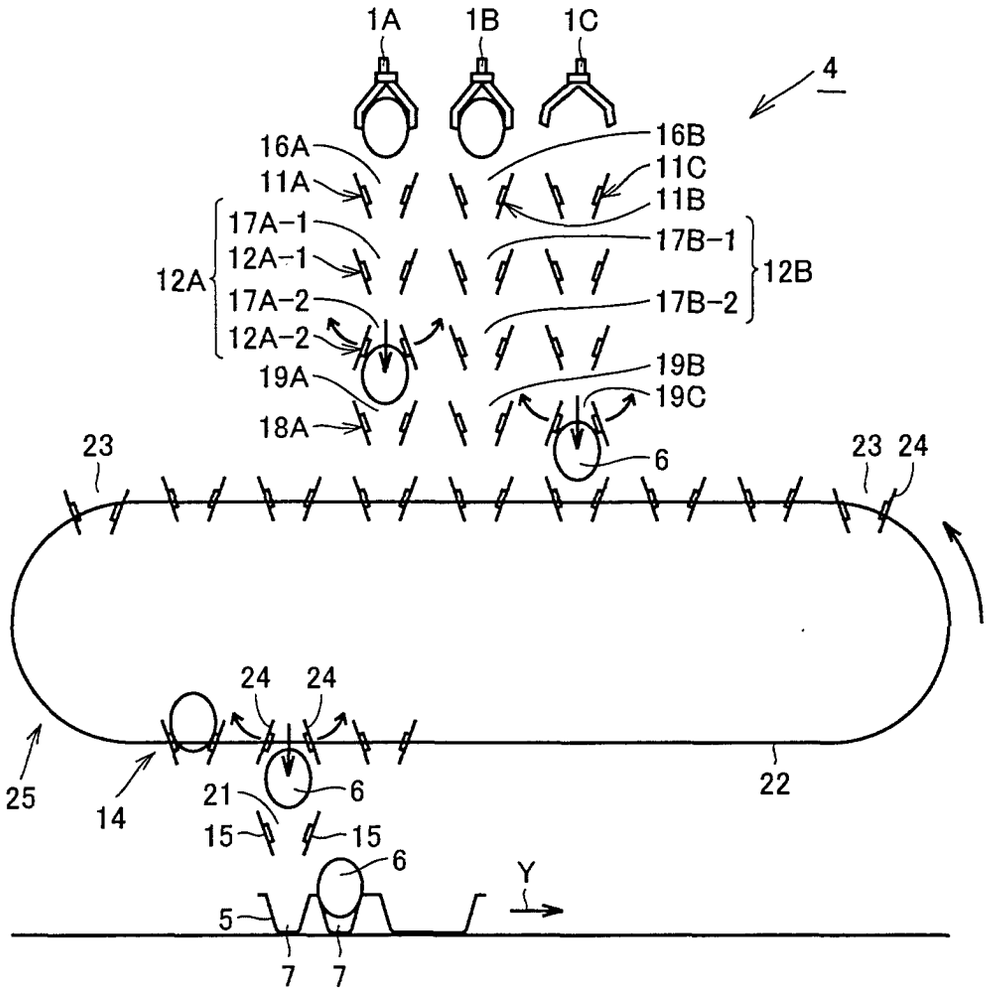
12A-2
19A
19B
18A
44A
14
21
15
20a
20
Y
5

FIG.10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17B-2
12A-2
19A
19B
19C
18A
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Y
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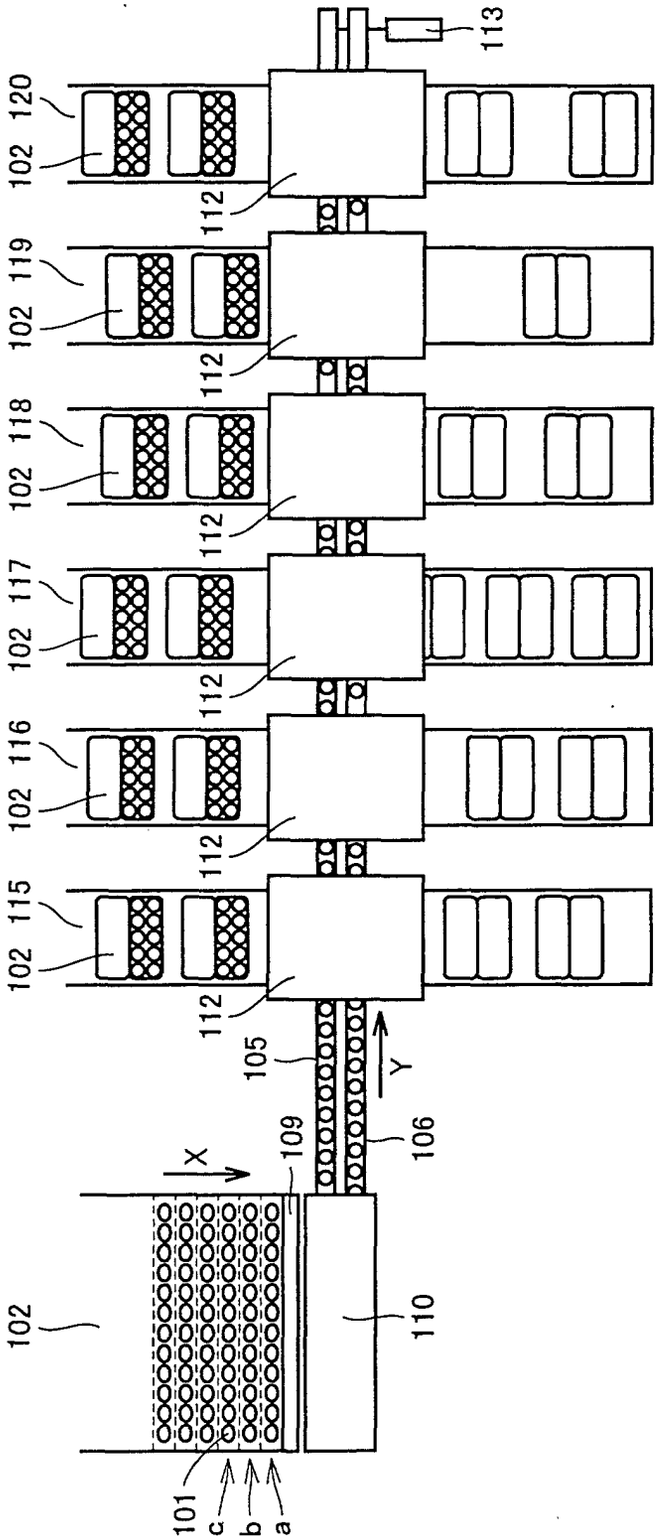
FIG.11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X
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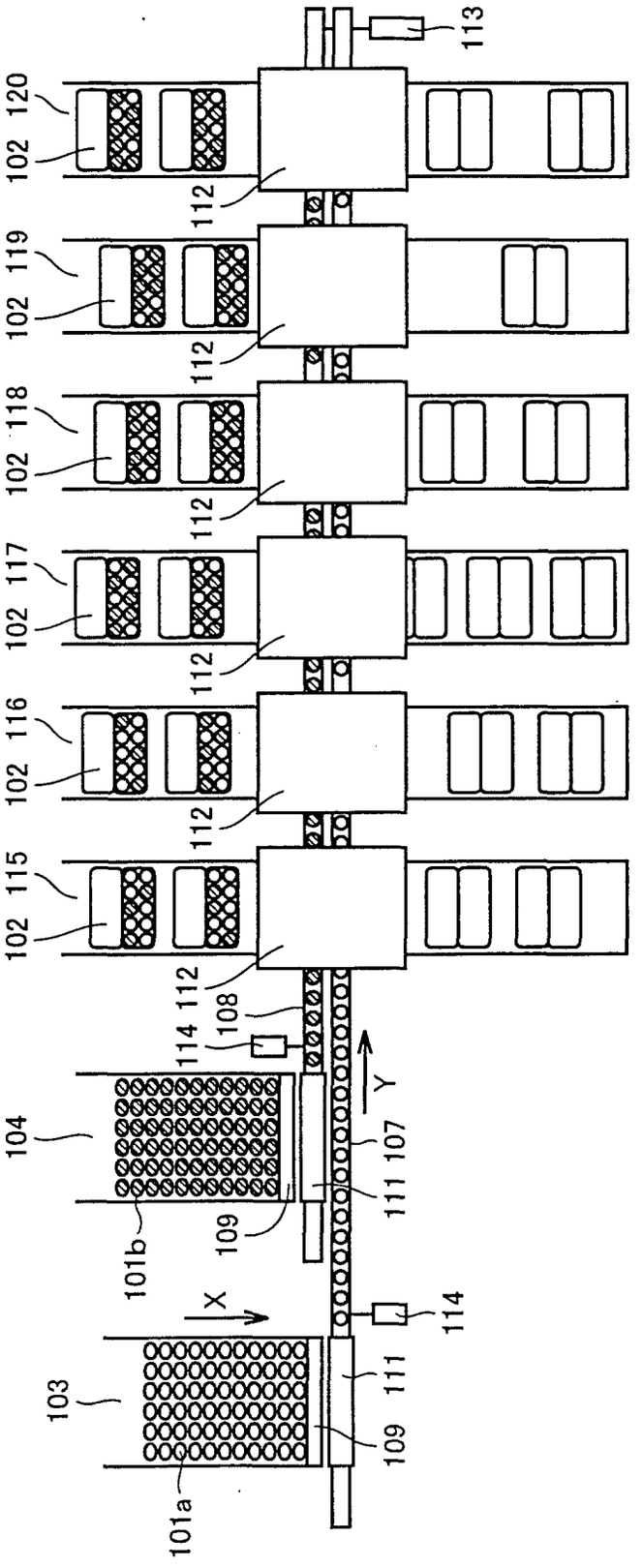
101
c
b
a

FIG.12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101b
X
114
103
111
109
101a

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 January 2002	Jagusiak, A

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EPO FORM 1503 03.82 (P04C01)

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