(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 032 841 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.07.2022 Bulletin 2022/30

(21) Application number: **22150927.6**

(22) Date of filing: **11.01.2022**

(51) International Patent Classification (IPC):
B65H 49/12 *(2006.01)* ***B65H 63/00*** *(2006.01)*
B65H 63/08 *(2006.01)* ***B65H 67/02*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B65H 67/02; B65H 49/12; B65H 63/00; B65H 63/006; B65H 63/086; B65H 2701/31

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **26.01.2021 JP 2021010281**
01.02.2021 JP 2021014364

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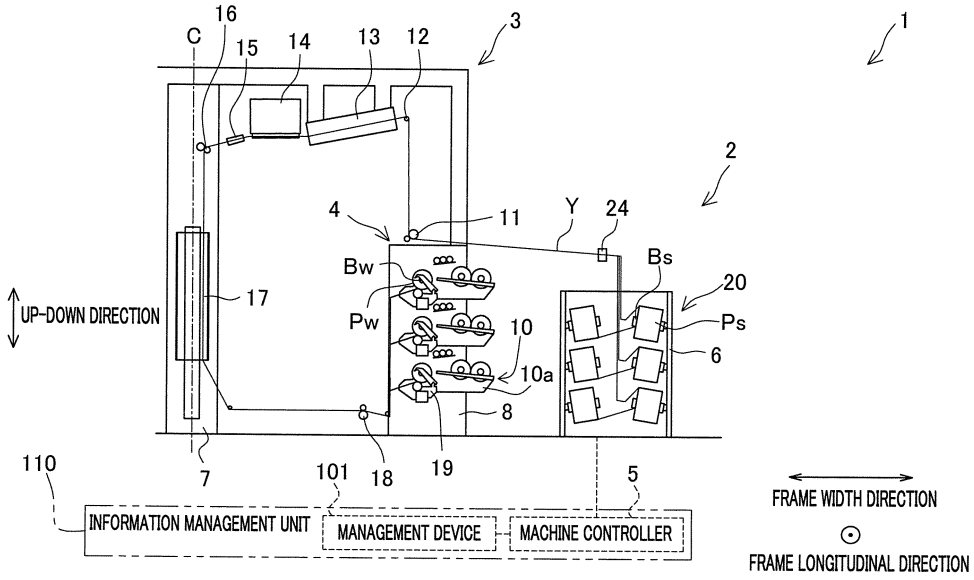
(54) YARN PROCESSING FACILITY

(57) Acquisition of various sets of useful information is achieved in a yarn processing facility that is capable of uninterruptedly supplying a yarn. A yarn processing facility 100 includes an information management unit 110 which is configured to be able to manage information. The information management unit 110 is capable of acquiring, for each yarn supply package Ps, unwinding start time information regarding an unwinding start time at which unwinding of a yarn Y from the yarn supply package Ps starts at the yarn supplying unit 2. The information management unit 110 is capable of acquiring wound package individual information of a wound package Pw formed by winding a yarn Y onto a winding bobbin Bw attached to the winding unit 4 and replacement time information regarding a replacement time at which replacement of the winding bobbin Bw is performed at the winding unit 4, in association with each wound package Pw.

FIG.3



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn processing facility.

[0002] Patent Literature 1 (International Publication No. WO2020/127489) discloses a yarn processor (yarn processing facility) which is configured to form a yarn processing end product (wound package) by processing a yarn unwound from a spinning end product (yarn supply package formed by winding a yarn onto a yarn supplying bobbin) and then winding the yarn onto a winding bobbin. The yarn processing facility is arranged to be able to support two yarn supply packages (e.g., a first yarn supply package and a second yarn supply package) for one winding bobbin. In such a yarn processing facility, when a terminal portion of a yarn in one of the first yarn supply package and the second yarn supply package is tied (connected) to a start end portion of a yarn in the other one of the two yarn supply packages, it is possible to uninterruptedly supply the yarn from the other yarn supply package when the one yarn supply package becomes empty. To be more specific, immediately after the end of the supply of the yarn from the one of the yarn supply packages, the node of the two yarns (i.e., yarn connection part) is pulled and unwinding of the yarn from the other yarn supply package starts. In this way, the yarn is uninterruptedly supplied.

[0003] A mechanical control unit for controlling the above-described yarn processing facility is configured to determine from which yarn supply package a yarn is supplied from a wound package (i.e., to associate individual information of a wound package with individual information of a yarn supply package). To be more specific, a tag of individual information of each yarn supply package and a location identification tag indicating the location of a package attachment unit (a first attachment unit or a second attachment unit) to which the yarn supply package is attached are read by an identification device. Based on a result of identification by the identification device, individual information of a yarn supply package is associated with a package attachment unit. In addition to the above, the yarn processing facility includes a detector for detecting a node. When from which yarn supply package a yarn is supplied is known (e.g., when it is known that a yarn is supplied from a first yarn supply package), the mechanical control unit performs the following determinations. When a node is not detected by the detector during a period from the start of winding of the yarn onto the winding bobbin to the end of the winding, it is determined that only the yarn in the first yarn supply package is supplied to the winding bobbin. When a node is detected by the detector during a period from the start of winding of a yarn onto a winding bobbin to the end of the winding, it is determined that both the yarn in the first yarn supply package and the yarn in the second yarn supply package are supplied to the winding bobbin.

SUMMARY OF THE INVENTION

[0004] As described above, information of association between individual information of a wound package and individual information of a yarn supply package is acquired based on a result of identification by the identification device and a result of detection by the detector. It is, however, difficult to acquire further detailed information based only on the identification result and the detection result.

[0005] An object of the present invention is to achieve acquisition of various sets of useful information in a yarn processing facility that is capable of uninterruptedly supplying a yarn.

[0006] According to a first aspect of the invention, a yarn processing facility includes: a yarn processor including: a yarn supplying unit capable of supplying a yarn; a processing unit configured to process the yarn supplied from the yarn supplying unit; and a winding unit configured to form a wound package by winding the yarn processed by the processing unit onto a winding bobbin; and an information management unit which is configured to manage information regarding the yarn processor, the yarn supplying unit including attachment units to which and from which yarn supply packages are attached and detached one by one, and when a terminal portion of a yarn included in a yarn supply package attached to an attachment unit that is one of the attachment units is connected to a start end portion of a yarn in a yarn supply package attached to an attachment unit that is another one of the attachment units, the yarn supplying unit being capable of uninterruptedly supply the yarn, immediately after finishing winding of a yarn onto one winding bobbin, the winding unit being capable of starting winding of a yarn onto a new winding bobbin replaced with the one winding bobbin, the information management unit being capable of acquiring, for each yarn supply package, unwinding start time information regarding an unwinding start time at which unwinding of the yarn from the yarn supply package starts at the yarn supplying unit, and the information management unit being capable of acquiring wound package individual information of a wound package formed by winding a yarn onto a winding bobbin attached to the winding unit and replacement time information regarding a replacement time at which replacement of the winding bobbin is performed at the winding unit, in association with each wound package.

[0007] According to this aspect of the invention, an unwinding start time of each yarn supply package is acquired. Furthermore, according to this aspect of the invention, a replacement time of each winding bobbin is acquired. On this account, it is possible to deal with a time at which a given winding bobbin is attached to the winding unit as a winding start time at which winding of a yarn onto the given winding bobbin starts. Furthermore, it is possible to deal with a time at which the given winding bobbin is replaced with the next winding bobbin (i.e., a time at which the given winding bobbin is detached from

the winding unit) as a winding end time at which the yarn is wound onto the given bobbin and formation of the wound package is completed. As such, it is possible to know the winding start time and the winding end time of each winding bobbin (wound package).

[0008] According to the aspect of the invention, it is therefore possible to acquire various types of information regarding the relationship between a winding bobbin (wound package) and a yarn supply package. For example, by performing a calculation using information of times, it is possible to know from which layer of a yarn of a yarn supply package a wound package is formed. Furthermore, when, for example, an unwinding start time exists between a winding start time and a winding end time of a wound package, it is possible to determine that a yarn connecting portion formed by connecting a terminal portion of a yarn with a start end portion of a yarn has been mixed into the wound package. In this regard, moreover, it is possible to know in which part of the wound package the yarn connecting portion has been mixed. As such, various types of useful information can be obtained.

[0009] According to a second aspect of the invention, the yarn processing facility of the first aspect is arranged such that the information management unit determines, based on the unwinding start time information and the replacement time information, that a yarn connecting portion formed by connecting the start end portion with the terminal portion is mixed into a predetermined wound package formed by winding a yarn onto a predetermined winding bobbin, when the unwinding start time exists between a first replacement time at which the predetermined winding bobbin is attached to the winding unit and a second replacement time at which the predetermined winding bobbin is detached from the winding unit.

[0010] According to the aspect of the invention, by using the unwinding start time information and the replacement time information, it is possible to easily know that a yarn connecting portion has been mixed in a wound package.

[0011] According to a third aspect of the invention, the yarn processing facility of the second aspect is arranged such that the information management unit estimates a location of the mixed yarn connecting portion in the predetermined wound package based on the first replacement time, the second replacement time, and the unwinding start time.

[0012] According to the aspect of the invention, by a calculation using the first replacement time, the second replacement time, and the unwinding start time, it is possible to easily know the position of mixture of a yarn connecting portion in a wound package.

[0013] According to a fourth aspect of the invention, the yarn processing facility of any one of the first to third aspects is arranged such that the information management unit is capable of acquiring yarn supply package individual information of the yarn supply package attached to the yarn supplying unit and the unwinding start time information in association with each yarn supply package.

[0014] According to this aspect of the invention, the yarn supply package individual information and the unwinding start time information are acquired in association with each other. By taking the anteroposterior relation of the times into account, it is possible to know from which yarn supply package a yarn is supplied to a winding bobbin.

[0015] According to a fifth aspect of the invention, the yarn processing facility of the fourth aspect further includes: an output unit which is capable of outputting information; and an output controller which is configured to control the output unit, by using the yarn supply package individual information, the unwinding start time information, wound package individual information, and the replacement time information, the output controller generates chart data indicating an unwinding period from start to end of unwinding of a yarn from each yarn supply package and a winding period from start to end of winding of a yarn onto each wound package, and causes the output unit to output a chart based on the chart data.

[0016] According to the aspect of the invention, an operator can easily associate the wound package individual information with the yarn supply package individual information only by checking output charts.

[0017] According to a sixth aspect of the invention, the yarn processing facility of the fourth or fifth aspect is arranged such that, based on the unwinding start time information and the replacement time information, the information management unit specifies a yarn supply package from which unwinding of a yarn starts at the latest and before the first replacement time at which the predetermined winding bobbin is attached to the winding unit, and associates the yarn supply package individual information of the specified yarn supply package with the wound package individual information of a predetermined wound package formed by winding the yarn onto the predetermined winding bobbin.

[0018] According to this aspect of the invention, it is at least possible to automatically associate individual information of a predetermined wound package with individual information of a yarn supply package which is supplying the yarn at the start of the winding of the yarn onto the predetermined wound package.

[0019] According to a seventh aspect of the invention, the yarn processing facility of the sixth aspect is arranged such that, when the unwinding start time exists between the first replacement time and a second replacement time at which the predetermined wound package is detached from the winding unit, the information management unit associates the yarn supply package individual information of the yarn supply package related to the unwinding start time with the wound package individual information of the predetermined wound package.

[0020] According to this aspect of the invention, when the yarn is serially supplied to a given winding bobbin from plural yarn supply packages, it is possible to auto-

matically associate sets of individual information of all of the yarn supply packages with the individual information of the given wound package.

[0021] According to an eighth aspect of the invention, the yarn processing facility of any one of the fourth to seventh aspect further includes a yarn supply package conveyance device configured to be able to convey a yarn supply package and attach and detach the yarn supply package to and from the yarn supplying unit, when a predetermined yarn supply package is attached to one attachment unit among the attachment units by the yarn supply package conveyance device, the information management unit associates the yarn supply package individual information of the predetermined yarn supply package with the one attachment unit.

[0022] According to this aspect of the invention, when a yarn supply package is attached to the attachment unit by the yarn supply package conveyance device, the yarn supply package individual information is automatically associated with the attachment unit.

[0023] According to a ninth aspect of the invention, the yarn processing facility of any one of the fourth to eighth aspects further includes a detection unit which is able to specify an attachment unit from among the attachment units, to which a yarn supply package from which a yarn is unwound is attached, based on a detection result of the detection unit, the information management unit associates the yarn supply package individual information with the unwinding start time information.

[0024] According to this aspect of the invention, the yarn supply package individual information and the unwinding start time information are easily associated with each other by using a detection result of the detection unit.

[0025] In addition to the above, when, for example, operation of a yarn processor starts, yarn supply can start from any one of yarn supply packages attached to a yarn supplying unit. In such a case, if the above-described detection unit is not provided, it is difficult to automatically determine from which yarn supply package the yarn is supplied, solely by an electronic means. In this regard, according to the aspect of the invention, it is possible to always detect from which one of the attachment units the yarn is supplied, by the detection unit. On this account, it is possible to automatically and precisely achieve association between the yarn supply package individual information and the unwinding start time information.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a schematic plan view of a yarn processing facility of an embodiment.

FIG. 2 is a block diagram of an electric configuration of the yarn processing facility.

FIG. 3 is a profile of a false-twist texturing machine.

FIG. 4 is a schematic diagram of the false-twist texturing machine, expanded along paths of yarns.

FIG. 5(a) and FIG. 5(b) are graphs each of which shows the relationship between a remaining amount of a yarn in a yarn supply package and time. FIG. 5(c) is a graph showing the relationship between an amount of a yarn wound onto a winding bobbin and time.

FIG. 6(a) is a table showing how yarn supply package individual information and sets of information of time are associated with one another. FIG. 6(b) is a table showing how wound package individual information and sets of information of time are associated with one another.

FIG. 7(a) is a table showing how sets of information such as yarn supply package individual information and individual information of a package attachment unit are associated with one another. FIG. 7(b) is a table showing how individual information of a package attachment unit and sets of information of time are associated with one another.

FIG. 8 is a table showing association between yarn supply package individual information, a package attachment unit, and times.

FIG. 9 is a table showing association between wound package individual information and yarn supply package individual information.

FIG. 10 relates to a modification and is a schematic diagram of a false-twist texturing machine.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Outline of Yarn Processing Facility)

[0027] The following will describe an embodiment of the present invention. A yarn processing facility 100 of the present embodiment will be outlined with reference to a schematic plan view in FIG. 1 and a block diagram in FIG. 2. As shown in FIG. 1 and FIG. 2, the yarn processing facility 100 includes false-twist texturing machines 1 (yarn processors of the present invention), a management device 101, a creel robot 102 (yarn supply package conveyance device of the present invention), and a wound package conveyance device 103. The false-twist texturing machines 1 are aligned along a predetermined frame longitudinal direction, for example. Each false-twist texturing machine 1 can perform false twisting of a yarn Y (see, e.g., FIG. 3) made of synthetic fibers such as polyester and nylon (polyamide fibers). As described below, each false-twist texturing machine 1 is configured to form a wound package Pw by processing a yarn Y supplied from a yarn supplying unit 2 by a processing unit 3 and winding the yarn Y onto a winding bobbin Bw attached to a winding unit 4. Each false-twist texturing machine 1 is controlled by a machine controller 5 that is a computer device mounted on each false-twist texturing machine 1.

[0028] The management device 101 is a host computer used for integrally controlling information (detailed later)

acquired by the machine controllers 5. The management device 101 includes a management input unit 101a (e.g., a keyboard), a management output unit 101b (e.g., a display), and a management storage unit 101c (e.g., a hard disk). The management output unit 101b may include an unillustrated printer. A combination of the management device 101 and the machine controllers 5 is an information management unit 110 of the present embodiment. The information management unit 110 is electrically connected to a creel controller 102a of the creel robot 102. The information management unit 110 is electrically connected to an unillustrated controller of the wound package conveyance device 103. The information handled by the information management unit 110 will be detailed later.

[0029] The creel robot 102 is arranged to be able to convey a yarn supply package Ps attached to the yarn supplying unit 2 (i.e., a package formed by winding a yarn Y onto a yarn supplying bobbin Bs). The creel robot 102 may be arranged to convey plural yarn supply packages Ps at once. The creel robot 102 is arranged to be movable in a factory in which the false-twist texturing machines 1 are provided. For example, the creel robot 102 is arranged to be able to perform reciprocal movement between an unillustrated yarn supply package stocker in which a yarn supply package Ps is stored and each false-twist texturing machine 1. The creel robot 102 is arranged so that a yarn supply package Ps stored in the yarn supply package stocker can be mounted on the robot by an operator, for example. Alternatively, the creel robot 102 may be arranged to be able to acquire a yarn supply package Ps from the yarn supply package stocker without needing human workforce. The creel robot 102 is arranged to be able to attach a yarn supply package Ps to the yarn supplying unit 2 of each false-twist texturing machine 1 and to detach the yarn supply package Ps therefrom. To put it differently, the creel robot 102 is arranged to be able to replace a yarn supply package Ps at the yarn supplying unit 2. The creel controller 102a controlling the creel robot 102 is electrically connected to the management device 101 (see FIG. 2). The creel controller 102a receives a command signal from the information management unit 110 and controls the creel robot 102 in accordance with the command signal.

[0030] The wound package conveyance device 103 is arranged to collect a wound package Pw formed at the winding unit 4 of each false-twist texturing machine 1. The wound package conveyance device 103 may be arranged to convey plural wound packages Pw at once. The wound package conveyance device 103 is arranged to convey a formed wound package Pw to, for example, an unillustrated discharge port. A controller (not illustrated) controlling the wound package conveyance device 103 is electrically connected to the management device 101. The wound package conveyance device 103 receives a command signal from the information management unit 110 and collects a formed wound package Pw in accordance with the command signal.

(Overall Structure of False-Twist Texturing Machine)

[0031] The overall structure of the false-twist texturing machine 1 will be described with reference to FIG. 3 and FIG. 4. FIG. 3 is a profile of the false-twist texturing machine 1. FIG. 4 is a schematic diagram of the false-twist texturing machine 1, expanded along paths of yarns Y (yarn paths). A direction vertical to the sheet of FIG. 3 is defined as the above-described frame longitudinal direction, and a left-right direction in the sheet is defined as a frame width direction. A direction orthogonal to the frame longitudinal direction and the frame width direction is defined as the up-down direction (vertical direction) in which the gravity acts. A direction in which a yarn Y runs will be referred to as a yarn running direction. The false-twist texturing machine 1 includes a yarn supplying unit 2 for supplying yarns Y, a processing unit 3 which performs processing (false twisting) of the yarns Y supplied from the supplying unit 2, a winding unit 4 which winds the yarns Y processed by the processing unit 3 onto winding bobbins Bw, and a machine controller 5.

[0032] The yarn supplying unit 2 includes a creel stand 6 retaining yarn supply packages Ps, and supplies the yarns Y to the processing unit 3. The processing unit 3 is arranged to unwind yarns Y from the yarn supplying unit 2 and process the yarns Y. In the processing unit 3, the following members are placed in this order from the upstream in a yarn running direction: first feed rollers 11; twist-stopping guides 12; first heaters 13; coolers 14; false-twisting devices 15; second feed rollers 16; second heaters 17; and third feed rollers 18. Each of these elements of the processing unit 3 is provided for, for example, each of later-described spindles 9 (see FIG. 4). The winding unit 4 includes a plurality of winding devices 19. Each winding device 19 winds the yarn Y for which the false winding has been performed at the processing unit 3 onto the winding bobbin Bw and forms a wound package Pw. The winding unit 4 is provided with automatic doffers 10 that correspond to the respective winding devices 19 and are configured to replace formed wound packages Pw with empty winding bobbins Bw.

[0033] The machine controller 5 is configured to control the yarn supplying unit 2, the processing unit 3, and the winding unit 4. The machine controller 5 is, for example, a typical computer device. The machine controller 5 includes a machine input unit 5a, a machine output unit 5b, and a machine storage unit 5c. The machine input unit 5a is, for example, an unillustrated touch panel and/or keyboard, and is arranged to be operable by an operator. The machine output unit 5b is, for example, an unillustrated display and is arranged to be able to output information. The machine output unit 5b may include an unillustrated printer. The machine storage unit 5c is arranged to store sets of information used for controlling the yarn supplying unit 2, the processing unit 3, and the winding unit 4. Based on the sets of information, the machine controller 5 controls the yarn supplying unit 2, the processing unit 3, and the winding unit 4. Alternatively,

the machine controller 5 may indirectly control the yarn supplying unit 2, the processing unit 3, and the winding unit 4 through unillustrated controllers that are configured to control these members. The machine controller 5 is electrically connected to the management device 101 that is a host computer. The management device 101 is able to perform later-described determinations and/or calculations by utilizing the information acquired by the machine controller 5.

[0034] The false-twist texturing machine 1 includes a main frame 7 and a winding base 8 that are spaced apart from each other in the frame width direction. The main frame 7 and the winding base 8 are substantially identical in length in the frame longitudinal direction. The main frame 7 and the winding base 8 oppose each other in the frame width direction. The false-twist texturing machine 1 includes units which are termed spans each of which includes a pair of the main frame 7 and the winding base 8. In one span, each device is placed so that the yarns Y running while being aligned in the frame longitudinal direction can be false-twisted at the same time. In the false-twist texturing machine 1, the spans are placed in a left-right symmetrical manner to the sheet, with a center line C of the frame width direction of the main frame 7 being set as a symmetry axis (main frame 7 is shared between the left span and the right span). The spans are aligned in the frame longitudinal direction.

[0035] A group of elements through which a single yarn Y supplied from the yarn supplying unit 2 passes before reaching the winding unit 4 is termed a spindle. To put it differently, the false-twist texturing machine 1 includes spindles 9 (see FIG. 4), the number of which is identical with the number of wound packages Pw that can be formed simultaneously. Roughly speaking, the spindles 9 are aligned along the frame longitudinal direction. The inclusion relation is as follows: one false-twist texturing machine 1 includes plural spans, and each of the spans includes plural spindles 9.

(Yarn Supplying Unit)

[0036] The structure of the yarn supplying unit 2 will be described with reference to FIG. 3 and FIG. 4. The creel stand 6 of the yarn supplying unit 2 includes yarn supply package retaining portions 20 (see FIG. 4) which are provided to correspond to the respective spindles 9. Each yarn supply package retaining portion 20 is arranged so that two yarn supply packages Ps are attachable thereto and detachable therefrom. In other words, the yarn supply package retaining portion 20 has two package attachment units 21 (attachment units of the present invention). For the sake of convenience, one of the two package attachment units 21 is termed a first attachment unit 22, and the other one of the units is termed a second attachment unit 23. Each of the first attachment unit 22 and the second attachment unit 23 is arranged so that one yarn supply package Ps is attachable thereto and detachable therefrom. The attachment and detachment of a yarn supply package Ps to and from the package attachment unit 21 is performed by the above-described creel robot 102.

[0037] Each yarn supply package retaining portion 20 of the yarn supplying unit 2 is arranged to be able to uninterruptedly supply the yarn Y, in a manner described below. For example, as shown in FIG. 4, a first yarn supply package PsA (given yarn supply package of the present invention) which is one of yarn supply packages Ps is attached to the first attachment unit 22. Meanwhile, a second yarn supply package PsB (another yarn supply package of the present invention) different from the first yarn supply package PsA is attached to the second attachment unit 23. A yarn Y is unwound from the first yarn supply package PsA. The terminal portion of the yarn Y in the first yarn supply package PsA is tied (connected) to the start end portion of the yarn Y in the second yarn supply package PsB. With this arrangement, a node K (yarn connecting portion)is formed between the two yarns Y. This makes it possible to uninterruptedly supply the yarn Y from the second yarn supply package PsB after the first yarn supply package PsA becomes empty. To be more specific, immediately after the supply of the yarn Y from the first yarn supply package PsA ends and the first yarn supply package PsA becomes empty, the node K is pulled toward the downstream side in the yarn running direction (i.e., toward the winding device 19 side), with the result that the yarn Y is unwound from the second yarn supply package PsB. In this way, the yarn supply package Ps from which the yarn Y is supplied is switched (yarn supply package switching). The yarn Y is therefore uninterruptedly supplied. Thereafter, the yarn supply package Ps having become empty is replaced with a new yarn supply package Ps by the creel robot 102.

[0038] On the downstream side in the yarn running direction of the yarn supply package retaining portions 20, a yarn detection sensor 24 (detection unit of the present invention) is provided. The yarn detection sensor 24 is arranged to be able to detect which one of the attachment units, the first attachment unit 22 or the second attachment unit 23, is supplying the yarn Y. As shown in FIG. 4, the yarn detection sensor 24 includes a first detection unit 25 and a second detection unit 26. The first detection unit 25 is arranged to be able to detect whether the yarn Y is being supplied from the first attachment unit 22. The second detection unit 26 is arranged to be able to detect whether the yarn Y is being supplied from the second attachment unit 23. Each of the first detection unit 25 and the second detection unit 26 is, for example, an optical sensor configured to optically detect the yarn Y. For details of the yarn detection sensor 24, see Japanese Patent No. 5873105, for example. Alternatively, each of the first detection unit 25 and the second detection unit 26 is a contact sensor, for example.

(Processing Unit)

[0039] The structure of the processing unit 3 will be

described also with reference to FIG. 3 and FIG. 4. The following will describe a part of the processing unit 3, which corresponds to one spindle 9.

[0040] The first feed roller 11 is arranged to unwind the yarn Y from the yarn supply package Ps attached to the yarn supplying unit 2 and supply the yarn Y to the first heater 13. The first feed roller 11 is provided upstream of the twist-stopping guide 12 in the yarn running direction. The conveyance speed of the first feed roller 11 conveying the yarn Y is substantially identical with the unwinding speed V (see FIG. 4) at which the yarn Y is unwound from the yarn supply package Ps.

[0041] The twist-stopping guide 12 is provided to prevent twist of the yarn Y formed by the false-twisting device 15 from being propagated to the upstream in the yarn running direction of the twist-stopping guide 12. The twist-stopping guides 12 are placed downstream of the first feed rollers 11 in the yarn running direction, and placed upstream of the first heater 13 in the yarn running direction.

[0042] The first heater 13 is configured to heat the yarn Y supplied from the first feed roller 11. The first heater 13 is placed downstream of the twist-stopping guide 12 in the yarn running direction and upstream of the cooler 14 in the yarn running direction. For the sake of simplicity, the first heater 13 of the present embodiment is arranged to heat a single yarn Y. The disclosure, however, is not limited to this arrangement. The first heater 13 may be able to simultaneously heat plural yarns Y.

[0043] The cooler 14 is configured to cool the yarn Y heated by the first heater 13. The cooler 14 is placed downstream of the first heater 13 in the yarn running direction and upstream of the false-twisting device 15 in the yarn running direction. For the sake of simplicity, the cooler 14 of the present embodiment is arranged to cool a single yarn Y. The disclosure, however, is not limited to this arrangement. The cooler 14 may be able to simultaneously cool plural yarns Y.

[0044] The false-twisting device 15 is arranged to twist the yarn Y. The false-twisting device 15 is, for example, a socalled disc-friction false-twisting device, but the disclosure is not limited to this arrangement. The false-twisting device 15 is placed downstream of the cooler 14 in the yarn running direction and upstream of the second feed roller 16 in the yarn running direction.

[0045] The second feed roller 16 is arranged to feed the yarn Y processed at the false-twisting device 15 to the second heater 17. The conveyance speed of conveying the yarn Y by the second feed rollers 16 is higher than the conveyance speed of conveying the yarn Y by the first feed roller 11. The yarn Y is therefore drawn between the first feed roller feed roller 11 and the second feed roller 16.

[0046] The second heater 17 is configured to heat the yarn Y supplied from the second feed roller 16. The second heater 17 extends along the vertical direction. For the sake of simplicity, the second heater 17 of the present embodiment is arranged to heat a single yarn Y. The disclosure, however, is not limited to this arrangement. The second heater 17 may be able to simultaneously heat plural yarns Y.

[0047] The third feed roller 18 is arranged to feed the yarn Y heated by the second heater 17 to the winding device 19. The conveyance speed of conveying the yarn Y by the third feed roller 18 is lower than the conveyance speed of conveying the yarn Y by the second feed roller 16. The yarn Y is therefore relaxed between the second feed roller 16 and the third feed roller 18.

[0048] In the processing unit 3 described above, the yarn Y which has been drawn between the first feed roller 11 and the second feed roller 16 is twisted at the false-twisting device 15. The twist formed by the false-twisting device 15 propagates to the twist-stopping guide 12 but does not propagate to the upstream of the twist-stopping guide 12 in the yarn running direction. The yarn Y which is twisted and drawn is heated at the first heater 13 and thermally set. After that, the yarn Y is cooled at the cooler 14. The yarn Y is untwisted at the downstream of the false-twisting device 15. However, each filament is maintained to be wavy in shape on account of the thermal setting described above. Subsequently, the yarn Y false-twisted by the false-twisting device 15 is thermally set by the second heater 17 while being relaxed between the second feed roller 16 and the third feed roller 18, and then the yarn Y is guided to the downstream side in the yarn running direction. Finally, the yarn Y sent from the third feed roller 18 is wound onto the winding bobbin Bw by the winding device 19. As a result, the wound package Pw is formed.

(Winding Unit)

[0049] The structure of the winding unit 4 will be described with reference to FIG. 3 and FIG. 4. The winding unit 4 includes the winding devices 19 each of which is configured to wind the yarn Y onto the winding bobbin Bw and the automatic doffers 10 (see FIG. 3) which are provided to correspond to the respective winding devices 19. One winding device 19 belongs to one spindle 9 (see FIG. 4). Each winding device 19 includes, for example, a fulcrum guide 31, a traverse unit 32, a cradle 33, and a winding roller 34. The fulcrum guide 31 is a guide which is a fulcrum when the yarn Y is traversed. For example, the traverse unit 32 can traverse the yarn Y by a traverse guide 35 which is attached to an endless belt driven in a reciprocating manner by a motor. The cradle 33 can support the winding bobbin Bw (wound package Pw) to be rotatable. The winding roller 34 is configured to rotate the wound package Pw and apply contact pressure to the surface of the wound package Pw. The winding roller 34 is, for example, rotationally driven by an unillustrated motor while being in contact with the surface of the wound package Pw. As a result of this, the wound package Pw is rotationally driven by the friction force and the shape of the wound package Pw is adjusted by the contact pressure applied to the surface of the wound package Pw.

Instead of rotationally driving the winding roller 34, the wound package Pw may be directly rotated by an unillustrated motor.

[0050] The automatic doffer 10 is configured to detach the wound package Pw from the winding device 19 and attach an empty winding bobbin Bw to the winding device 19. To put it differently, the automatic doffer 10 is able to replace a wound package Pw having been formed with an empty winding bobbin Bw at the winding unit 4. The automatic doffer 10 is provided with unillustrated cutter which is able to cut the yarn Y in the vicinity of the wound package Pw. As the running yarn Y is cut by the cutter, the formation of the wound package Pw is finished. After the cutting of the yarn by the cutter, the yarn Y is kept supplied to the winding device 19 side. The automatic doffer 10 includes an unillustrated suction which is able to suck, capture, and retain the running yarn Y supplied to the winding device 19, in a period from the finish of the formation of the wound package Pw to the start of the winding of the yarn Y onto the next winding bobbin Bw. Before the yarn Y is threaded to the winding bobbin Bw to which the yarn Y is to be wound next, a part of the yarn Y sucked by the suction is sucked and removed. The automatic doffer 10 further includes a stocker 10a which is arranged to be able to temporarily store the wound package Pw detached from the corresponding winding device 19. The stocker 10a faces a space formed between the creel stand 6 and the winding base 8, for example. The wound package Pw stored in the stocker 10a is collected by the above-described wound package conveyance device 103. For details of the structure of the automatic doffer 10, etc., for example, see Japanese Laid-Open Patent Publication No. H6-212521.

[0051] In the winding unit 4 structured as above, the yarn Y which is sent from the third feed roller 18 described above is wound onto the winding bobbin Bw by each winding device 19, and the wound package Pw is formed (winding process). As the cutter of the automatic doffer 10 cuts the yarn Y, the winding process of winding the yarn Y onto the winding bobbin Bw is finished. Almost at the same time, the wound package Pw is detached from the cradle 33 by the automatic doffer 10. Immediately thereafter, the automatic doffer 10 attaches a new winding bobbin Bw to the cradle 33. To put it differently, immediately after a wound package Pw is formed, the wound package Pw (winding bobbin Bw) is replaced with a new winding bobbin Bw by the automatic doffer 10 (winding bobbin replacement). Thereafter, it becomes possible to start the winding of the yarn Y onto the new winding bobbin Bw. The term "immediately after" indicates "after a time which is significantly shorter than a time (winding time) required to start a winding process of winding a yarn onto a winding bobbin Bw and to end the formation of a wound package Pw elapses". The phrase "immediately after a wound package Pw is formed" can be rephrased to "almost at the same time as the end of the formation of a wound package Pw".

[0052] To properly manage the quality of a wound package Pw, it is preferable to know from which yarn supply package Ps the yarn Y is supplied to form the wound package Pw. To obtain such information, means for associating individual information of a yarn supply package Ps with individual information of a wound package Pw has been proposed. As a specific example of such known proposal, a tag (not illustrated) of individual information of each yarn supply package Ps, a tag (not illustrated) indicating the location of the first attachment unit 22, and a tag (not illustrated) indicating location of the second attachment unit 23 are read by an identification device (not illustrated). Based on a result of identification by the identification device, individual information of each yarn supply package Ps is associated with the first attachment unit 22 or the second attachment unit 23. In the known proposal, a detector (not illustrated) configured to detect a passing node K is provided. For example, when it is known that a yarn is supplied from a first yarn supply package PsA, the machine controller 5 performs the following determinations. When passing of a node K is not detected by the detector during a period from the start of winding of the yarn Y onto the winding bobbin Bw to the end of the winding, it is determined that only the yarn Y in the first yarn supply package PsA is supplied to the winding bobbin Bw. When passing of a node K is detected by the detector during a period from the start of winding of the yarn Y to the winding bobbin Bw to the end of the winding, it is determined that both the yarn Y in the first yarn supply package PsA and the yarn Y in the second yarn supply package PsB are supplied to the winding bobbin Bw. As such, information of association between individual information of the wound package Pw and individual information of the yarn supply package Ps is acquired based on a result of identification by the identification device and a result of detection by the detector. It is, however, difficult to acquire further detailed information based only on the identification result and the detection result.

[0053] In order to achieve acquisition of various sets of useful information, the information management unit 110 of the present embodiment acquires sets of information described below. In a specific example, the information management unit 110 acquires and manages sets of information regarding matters shown in graphs of FIG. 5(a) to FIG. 5(c). Unless otherwise stated, the following explanation deals with only a predetermined spindle 9.

(Specific Example of Matters)

[0054] Before specifically explaining the information acquired by the information management unit 110, matters shown in the graphs of FIG. 5(a) to FIG. 5(c) as examples and times at which the respective matters occur will be described first, in order to assist the understanding of the explanation. The information management unit 110 acquires information of at least one of matters shown in the graphs of FIG. 5(a) to FIG. 5(c). (The details will be given later.)

[0055] FIG. 5(a) is a graph showing the relationship between a remaining amount (vertical axis) of the yarn Y in the yarn supply package Ps (to be more specific, the yarn supply package Ps1, Ps3) attached to the first attachment unit 22 and time (horizontal axis). FIG. 5(b) is a graph showing the relationship between a remaining amount (vertical axis) of the yarn Y in the yarn supply package Ps (to be more specific, the yarn supply package Ps2, Ps4) attached to the second attachment unit 23 and time (horizontal axis). FIG. 5(c) is a graph showing the relationship between a wound amount (vertical axis) of the yarn Y onto the winding bobbin Bw (to be more specific, the winding bobbin Bw1, Bw2, Bw3, Bw4, Bw5, Bw6) and time (horizontal axis). In all of the graphs of FIG. 5(a) to FIG. 5(c), a time t0 at which the winding of the yarn Y onto the winding bobbin Bw1 starts is the origin. In the present embodiment, the yarn amount (initial amount) of each yarn supply package Ps in a state in which the yarn Y is not unwound from each yarn supply package Ps at all is always WF for simplicity in explanation. In reality, in a step before the formation of yarn supply packages Ps, the formation of a yarn supply package Ps may be discontinued before the completion due to a reason such as yarn breakage. On this account, the initial amounts of the yarn supply packages Ps may not be identical in reality.

[0056] To begin with, at a time t0, a yarn supply package Ps1 has been attached to the first attachment unit 22. Meanwhile, a yarn supply package Ps2 has been attached to the second attachment unit 23. The remaining amount of the yarn Y in the yarn supply package Ps1 is W0 (which is smaller than the initial amount WF). The remaining amount of the yarn Y in the yarn supply package Ps2 is identical with the initial amount WF. The terminal portion of the yarn Y in the yarn supply package Ps1 is tied (connected) to the start end portion of the yarn Y in the yarn supply package Ps2, and hence a node K is formed.

[0057] At a time t0 (time ts1), the attachment of a winding bobbin Bw1 to the cradle 33 by the automatic doffer 10 is completed and the winding of the yarn onto the winding bobbin Bw1 starts. Therefore the time ts1 is a winding start time at which the winding of the yarn Y onto the winding bobbin Bw1 starts. At the same time, the yarn Y is unwound from the yarn supply package Ps1. The remaining amount of the yarn Y in the yarn supply package Ps1 decreases and the wound amount of the yarn Y wound on the winding bobbin Bw1 increases over time. At a time te1, as the cutter of the automatic doffer 10 cuts the yarn Y, the winding process of winding the yarn Y onto the winding bobbin Bw1 is finished. Therefore the time te1 is a winding end time at which the winding of the yarn Y onto the winding bobbin Bw1 ends (i.e., the formation of the wound package Pw1 is finished). The remaining amount of the yarn supply package Ps1 at this stage is W1. Onto the winding bobbin Bw1, only the yarn Y supplied from the yarn supply package Ps1 is wound. The cutting of the yarn Y by the cutter and the sucking and capturing of the yarn Y by the suction (i.e., start of sucking and removal of the yarn Y) are almost simultaneously done. Furthermore, detachment of the winding bobbin Bw1 from the cradle 33 is performed. Subsequently, at a time ts2 immediately after the time te1, the attachment of a winding bobbin Bw2 to the cradle 33 is completed and the winding of the yarn Y onto the winding bobbin Bw2 starts (i.e., the winding bobbin replacement is completed). For example, a time at which the machine controller 5 outputs a command signal instructing winding bobbin replacement to the automatic doffer 10 (i.e., a time at which the winding bobbin replacement starts) may be regarded as a winding bobbin replacement time at which the winding bobbin replacement is performed (hereinafter, this time will be simply referred to as a replacement time). The replacement time is identical with a winding end time (time te1) of a winding bobbin Bw (the winding bobbin Bw1 in this case) that was attached to the cradle 33 before the winding bobbin replacement. The replacement time is substantially identical with a winding start time (time ts2) of a winding bobbin Bw (the winding bobbin Bw2 in this case) that is attached to the cradle 33 after the winding bobbin replacement.

[0058] At a time ta1 that is later than the time ts2, the yarn supply package Ps1 attached to the first attachment unit 22 becomes empty. Therefore the time ta1 is an unwinding end time at which the unwinding of the yarn Y from the yarn supply package Ps1 ends. At the same time as the yarn supply package Ps1 becomes empty, at the time tb1 (=time ta1), a node K formed as the yarn Y in the yarn supply package Ps1 is tied with the yarn Y in the yarn supply package Ps2 is pulled toward the winding device 19. As a result, the yarn Y starts to be unwound from the yarn supply package Ps2 attached to the second attachment unit 23. Therefore the time tb1 is an unwinding start time at which the unwinding of the yarn Y from the yarn supply package Ps2 starts (i.e., the yarn Y starts to be unwound). Thereafter, at a time te2, the winding process of winding the yarn Y onto the winding bobbin Bw2 (i.e., formation of a wound package Pw2) ends. The remaining amount of the yarn supply package Ps2 at this stage is W2. Onto the winding bobbin Bw2, both the yarn Y unwound from the yarn supply package Ps1 and the yarn Y unwound from the yarn supply package Ps2 are wound. The wound package Pw2 includes the node K. Thereafter, at a time ts3, a winding process of winding the yarn Y onto a winding bobbin Bw3 starts. When at a time te3 the winding process of winding the yarn Y onto the winding bobbin Bw3 (i.e., formation of a wound package Pw3) ends, the remaining amount of the yarn supply package Ps2 is W3. Onto the winding bobbin Bw3, only the yarn Y supplied from the yarn supply package Ps2 is wound.

[0059] At a time ta2 that is later than the time ta1 and is before the yarn supply package Ps2 becomes empty, the creel robot 102 performs detachment of the yarn supply package Ps1 from the first attachment unit 22 and attachment of a yarn supply package Ps3 to the first at-

tachment unit 22 (yarn supply package replacement). The remaining amount of the yarn supply package Ps3 at this stage is WF. Thereafter, at a suitable timing, the terminal portion of the yarn Y in the yarn supply package Ps2 is tied with the start end portion in the yarn supply package Ps3 and the node K is formed. For the sake of convenience, it is assumed that an operator performs a tying operation (connecting operation) immediately after the creel robot 102 performs the yarn supply package replacement. The operator may manually perform the tying operation. Alternatively, the operator may perform the tying operation by operating an unillustrated portable tying device, for example. Alternatively, the creel robot 102 may include an automatic tying device (not illustrated) which is capable of performing the tying operation. In this way, the tying operation is not manually performed but performed by the creel robot 102.

[0060] The matters subsequent to the above will be described. The matters regarding the winding unit 4 are as follows. The yarn Y is wound onto a winding bobbin Bw4 from a time ts4 to a time te4 (i.e., a wound package Pw4 is formed). The yarn Y is wound onto a winding bobbin Bw5 from a time ts5 to a time te5 (i.e., a wound package Pw5 is formed). The yarn Y is wound onto a winding bobbin Bw6 from a time ts6 to a time te6 (i.e., a wound package Pw6 is formed). The matters regarding the yarn supplying unit 2 are as follows. At a time tb2 (=time ta3) between the time ts4 and the time te4, the yarn supply package Ps2 becomes empty and unwinding of the yarn Y from the yarn supply package Ps3 starts. Thereafter, at a time tb3, the yarn supply package Ps2 is replaced with a yarn supply package Ps4. At a time ta4 (=time tb4) between the time ts6 and the time te6, the yarn supply package Ps3 becomes empty and unwinding of the yarn Y from the yarn supply package Ps4 starts.

(Outline of Basic Information Acquired by Information Management Unit)

[0061] In consideration of the matters above, to begin with, the outline of basic information acquired by the information management unit 110 in order to perform determinations and/or calculations will be described with reference to FIG. 6(a) and FIG. 6(b). FIG. 6(a) is a table showing how later-described yarn supply package individual information and sets of information of time are associated with one another. FIG. 6(b) is a table showing how later-described wound package individual information and sets of information of time are associated with one another.

[0062] As basic information, the information management unit 110 acquires, for each yarn supply package Ps, yarn supply package individual information, unwinding start time information, and unwinding end time information in association with one another (see FIG. 6(a)). Furthermore, as basic information, the information management unit 110 acquires, for each wound package Pw, wound package individual information and replacement time information in association with one another (see FIG. 6(b)). A method of acquiring these sets of information will be detailed later. The sets of information are used at least for associating yarn supply package individual information that is individual information of a yarn supply package Ps with wound package individual information that is individual information of a wound package Pw.

[0063] The yarn supply package individual information is identification information assigned to each of yarn supply packages Ps. To each yarn supply package Ps, for example, an unillustrated ID tag indicating yarn supply package individual information is attached. The yarn supply package individual information is used for identifying a yarn supply package Ps attached to each package attachment unit 21. The unwinding start time information is information of the above-described unwinding start time. The unwinding start time is, for example, times tb1, ta3, and tb4 described above. The unwinding end time information is information of the above-described unwinding end time. The unwinding end time is, for example, the above-described times ta1, tb2, and ta4. The wound package individual information is identification information assigned to each of plural wound packages Pw. The replacement time information is information of the above-described replacement time. The replacement time is, for example, the above-described times te1 to te6. As described below, the replacement time may be treated as both of a first replacement time and a second replacement time.

(Required Information)

[0064] The following will describe information required when the information management unit 110 actually acquires yarn supply package individual information, unwinding start time information, unwinding end time information, wound package individual information, and replacement time information. To be more specific, the following will describe information regarding a yarn supply package Ps attached to and detached from a package attachment unit 21, information regarding a wound package Pw, and information acquired by the machine controller 5 during a winding process.

(Information Regarding Yarn Supply Package Conveyed By Creel Robot)

[0065] The information management unit 110 manages individual information of a yarn supply package Ps conveyed by the creel robot 102 and information associated with the individual information, in a manner as described below. To begin with, when or before a fully-would yarn supply package Ps stored in the yarn supply package stocker is mounted on the creel robot 102 by the operator, yarn supply package individual information corresponding to that yarn supply package Ps is input to the creel controller 102a by the operator. For example, the

yarn supply package individual information may be input in such a way that the operator reads an ID tag attached to each yarn supply package Ps by using an ID reader (not illustrated) electrically connected to the creel controller 102a. Alternatively, the yarn supply package individual information may be input in such a way that the operator operates the creel controller 102a based on visual information displayed on each yarn supply package Ps. Alternatively, the creel robot 102 may be provided with an unillustrated ID reader, and the creel robot 102 may read the ID tag by using the ID reader.

[0066] When the creel robot 102 attach a yarn supply package Ps to the package attachment unit 21, the information management unit 110 receives information such as the individual information of that yarn supply package Ps from the creel controller 102a. The information management unit 110 then associates the individual information of the yarn supply package Ps with the individual information of the package attachment unit 21 to which that yarn supply package Ps is attached (see FIG. 7(a)). The individual information of the package attachment unit 21 is information indicating (i) to which one of the spindles 9 the package attachment unit 21 to which the yarn supply package Ps is attached belongs and (ii) whether the package attachment unit 21 is the first attachment unit 22 or the second attachment unit 23. As such, the information management unit 110 manages the individual information of the yarn supply package Ps conveyed by the creel robot 102, in association with the operation of the creel robot 102.

[0067] When a new yarn supply package Ps is attached to the package attachment unit 21, the machine controller 5 acquires yarn supply package attachment time information regarding a yarn supply package attachment time at which that yarn supply package Ps is attached to the package attachment unit 21. The yarn supply package attachment time is, for example, the above-described time ta2 or tb3. The machine controller 5 stores the yarn supply package individual information, the individual information of the package attachment unit 21, and the yarn supply package attachment time information in association with each yarn supply package Ps (see FIG. 7(a)). In FIG. 7(a), the yarn supply package attachment time is simply referred to as an attachment time.

[0068] After a new yarn supply package Ps is attached to one of the package attachment units 21, the operator ties the start end portion of the yarn Y in that yarn supply package Ps with the terminal portion of the yarn Y in the yarn supply package Ps attached to the other one of the package attachment units 21, so as to form a node K. The operator then provides the node K at a predetermined position. Subsequently, the operator inputs, to the machine controller 5, information indicating that the node K has been provided at the predetermined position. Based on the input information, the machine controller 5 stores information indicating that the node K has been provided at the predetermined position.

(Information Regarding Wound Package)

[0069] The information management unit 110 manages the individual information of a wound package Pw in the following manner. The machine controller 5 stores, as a replacement time, a time at which a signal instructing replacement of the winding bobbin Bw is output to the automatic doffer 10. In a case of a winding bobbin Bw newly attached to the cradle 33, the replacement time is substantially identical with a winding start time at which winding of the yarn Y onto that winding bobbin Bw starts. Such a replacement time is treated as a first replacement time regarding that winding bobbin Bw (wound package Pw) . When the winding process of winding of the yarn Y onto the winding bobbin Bw ends (i.e., when the formation of a wound package Pw ends), the machine controller 5 attaches individual information (wound package individual information) to that wound package Pw. To be more specific, as the individual information of that wound package Pw, the machine controller 5 acquires, for example, information of a machine number (identification number of the false-twist texturing machine 1) and information of identification number of the spindle 9. Furthermore, the machine controller 5 stores, as a second replacement time, a time at which a signal instructing detachment of the wound package Pw from the winding device 19 is output to the automatic doffer 10. The machine controller 5 stores information of a machine number and an identification number of a spindle 9, information of a first replacement time (first replacement time information), and information of a second replacement time (second replacement time information) in association with one another. Both of the first replacement time information and the second replacement time information are included in the replacement time information. The machine controller 5 may acquire a predetermined management number as wound package individual information in association with the above-described sets of information, and attach the acquired information to each wound package Pw. For example, as shown in FIG. 6(b), provided that Pw1 to Pw6 described above are management numbers (wound package individual information), each management number is associated with a management number, a first replacement time, and a second replacement time. (It is noted that a machine number and identification number of a spindle 9 are not shown in the figure). Furthermore, the machine controller 5 prints these sets of information on an unillustrated label. The label can be attached to the winding bobbin Bw by the operator.

[0070] As another way of acquiring wound package individual information, for example, an unillustrated ID tag may be attached to an empty winding bobbin Bw in advance. In this way, wound package individual information may be attached to a winding bobbin Bw in advance before the winding process. Furthermore, the automatic doffer 10 may include an unillustrated ID reader. For example, when the automatic doffer 10 attaches a winding

bobbin Bw to the winding device 19 or detaches a wound package Pw from the winding device 19, the ID reader reads an ID tag attached to that winding bobbin Bw and the individual information of that winding bobbin Bw is sent to the machine controller 5. Alternatively, in place of the automatic doffer 10, the operator may read an ID tag by using an unillustrated ID reader. Alternatively, instead of reading an ID tag by using the ID reader, the operator may manually input the individual information of the winding bobbin Bw to the machine controller 5.

[0071] As described above, the replacement time information includes both the first replacement time information and the second replacement time information. As a specific example, the following explanation focuses on a time te1. The time te1 is a time at which a command signal, which instructs replacement of a winding bobbin Bw1 (wound package Pw1) where a winding process of winding the yarn Y is finished with a new winding bobbin Bw2 (wound package Pw2), is output from the machine controller 5. The time te1 is identical with the winding end time of the wound package Pw1 and is substantially identical with the winding start time of the wound package Pw2. On this account, as shown in FIG. 6(b), the information management unit 110 treats the information of the time te1 as first replacement time information and associates the first replacement time information with the wound package individual information of the wound package Pw2. In other words, the time te1 is treated as the first replacement time regarding the wound package Pw2. Furthermore, the information management unit 110 treats the information of the time te1 as second replacement time information and associates the second replacement time information with the wound package individual information of the wound package Pw1. In this case, the time te1 is treated as the second replacement time regarding the wound package Pw1. The first replacement time information and the second replacement time information are similarly acquired for other wound packages Pw.

[0072] The first replacement time of a winding bobbin Bw (wound package Pw) can be used as a winding bobbin attachment time at which the winding bobbin Bw is attached to the cradle 33. The second replacement time of a winding bobbin Bw (wound package Pw) can be used as a winding bobbin detachment time at which the winding bobbin Bw is detached from the cradle 33. In other words, the first replacement time information can be used as winding start time information regarding the winding start time of the winding bobbin Bw. In other words, the second replacement time information can be used as winding end time information regarding the winding end time of the winding bobbin Bw. The information management unit 110 may simply treat the first replacement time information as winding start time information and simply treat the second replacement time information as winding end time information. Alternatively, the information management unit 110 may acquire information of a winding start time and/or a winding end time in a more strict manner by performing a predetermined calculation regarding a replacement time.

(Information Acquired by Machine Controller During Winding Process)

[0073] Now, the following will describe sets of information acquired by the machine controller 5 during the winding process of winding the yarn Y onto the winding bobbin Bw. These sets of information are combined with the above-described information input to the FIG. 7(a) and used for acquiring yarn supply package individual information, unwinding start time information, and unwinding end time information.

[0074] Based on a detection result of the yarn detection sensor 24, the machine controller 5 determines whether yarn supply package switching, i.e., switching of the yarn supply package Ps supplying the yarn Y has occurred. For example, in FIG. 5(a) and FIG. 5(b), a matter that the yarn supply package Ps1 becomes empty and the yarn Y is unwound first from the yarn supply package Ps2 is the yarn supply package switching. The machine controller 5 determines that yarn supply package switching has occurred when the state of the yarn detection sensor 24 is switched from (i) a state of detecting the yarn Y by one of the first detection unit 25 and the second detection unit 26 to (ii) a state of detecting the yarn Y by the other one of the first detection unit 25 and the second detection unit 26. When the machine controller 5 determines that the yarn supply package switching has occurred, the machine controller 5 acquires and stores the following sets of information shown in the table of FIG. 7(b). The machine controller 5 stores (i) individual information of the package attachment unit 21 which starts to supply the yarn Y when the yarn supply package switching occurs (either the first attachment unit 22 or the second attachment unit 23) and (ii) a time at which the yarn supply package switching occurs, in association with each other. In regard to the package attachment unit 21 that starts to supply the yarn Y, the time at which the yarn supply package switching occurs is dealt with as an unwinding start time. Furthermore, the machine controller 5 stores (i) individual information of the package attachment unit 21 which finishes the supply of the yarn Y at the yarn supply package switching and (ii) the time at which the yarn supply package switching occurs, in association with each other. In regard to the package attachment unit 21 that finishes the supply of the yarn Y, the time at which the yarn supply package switching occurs is dealt with as an unwinding end time.

(Method of Acquiring Unwinding Start Time Information and Unwinding End Time Information)

[0075] The following will describe a method of acquiring unwinding start time information and unwinding end time information based on information acquired by the machine controller 5, with reference to FIG. 5(a), FIG.

5(b), FIG. 7(a), FIG. 7(b), and FIG. 8. FIG. 8 is a table showing association between yarn supply package individual information, a package attachment unit, and times.

[0076] By using yarn supply package attachment time information and yarn supply package switching information, the machine controller 5 acquires the unwinding start time information and the unwinding end time information by the following steps. For example, when acquiring the unwinding start time and the unwinding end time of the yarn supply package Ps3, the machine controller 5 acquires, based on the yarn supply package attachment time information, individual information of the package attachment unit 21 (first attachment unit 22) to which the yarn supply package Ps3 is attached and information of the yarn supply package attachment time (time ta2) . The machine controller 5 then acquires, as the unwinding start time of the yarn supply package Ps3, information of a time (ta3; see FIG. 5(a) and FIG. 5(b)) that is later than the time ta2 and is the earliest one among unwinding start times of the yarn supply packages Ps attached to the first attachment unit 22. Furthermore, the machine controller 5 acquires information of the unwinding end time (time ta4) associated with that unwinding start time, as the unwinding end time of the yarn supply package Ps3. In this way, the individual information, the unwinding start time information, and the unwinding end time information of the yarn supply package Ps are acquired in association with one another. To put it differently, by associating yarn supply package attachment time information of a yarn supply package Ps with information of a time at which yarn supply package switching occurs for the first time after the yarn supply package attachment time, the unwinding start time information and the unwinding end time information of the yarn supply package Ps are acquired (see FIG. 8). These sets of information can be acquired not only for the yarn supply package Ps3 but also for each of the yarn supply packages Ps.

[0077] In this way, the machine controller 5 acquires the unwinding start time information and the unwinding end time information. It is noted that the machine controller 5 is able to acquire the unwinding start time information and the unwinding end time information at any timing. For example, the machine controller 5 may acquire the unwinding start time information and/or the unwinding end time information at a timing when yarn supply package switching occurs. Alternatively, when an operator performs an operation at a given timing, the machine controller 5 may acquire the unwinding start time information and/or the unwinding end time information by using the yarn supply package attachment time information and the yarn supply package switching information acquired in the past. The unwinding start time information and/or the unwinding end time information may be acquired by the management device 101.

(Association Between Wound Package Individual Information And Yarn Supply Package Individual Information)

[0078] The following will describe a method of associating wound package individual information with yarn supply package individual information. In regard to specific association between wound package individual information and yarn supply package individual information, please refer to the table in FIG. 9. While in the method below the management device 101 acquires information regarding association, the disclosure is not limited to this arrangement. In other words, the machine controller 5 may acquire this information.

[0079] As specific examples of the association, the following will describe first and second specific examples. As a first specific example, when acquiring individual information of a yarn supply package Ps which has supplied a yarn Y to a winding bobbin Bw3 (wound package Pw3), the management device 101 acquires, to begin with, information of a first replacement time (time te2) and a second replacement time (time te3) regarding the winding bobbin Bw3 (wound package Pw3). The first replacement time may be treated as a winding bobbin attachment time or a winding start time. The second replacement time may be treated as a winding bobbin detachment time or a winding end time. Subsequently, the management device 101 associates (i) individual information of a yarn supply package Ps (yarn supply package Ps2; see FIG. 6(b)) associated with an unwinding start time (time tb1; see FIG. 5(b)) which is earlier than the time te2 and is the latest unwinding start time with (ii) individual information of the wound package Pw3. To put it differently, the management device 101 specifies individual information of a yarn supply package Ps associated with an unwinding start time that is earlier than the winding start time and is the latest one, from among sets individual information of plural yarn supply packages Ps. The management device 101 then associates the individual information of the specified yarn supply package Ps with the individual information of the wound package Pw associated with the winding start time. Furthermore, the management device 101 determines whether yarn supply package switching has occurred during a period between the time te2 and the time te3. In the example, a time at which yarn supply package switching occurred (i.e., an unwinding start time) does not exist in the period between the time te2 and the time te3. The management device 101 therefore determines that yarn supply package switching has not occurred in the period between the time te2 and the time te3. Therefore information indicating that the yarn Y was supplied to the wound package Pw3 only from the yarn supply package Ps2 is acquired (see FIG. 9).

[0080] As a second specific example, when acquiring individual information of a yarn supply package Ps which has supplied a yarn Y to a winding bobbin Bw4 (wound package Pw4), the management device 101 acquires, to begin with, information of a first replacement time (time

te3) and a second replacement time (time te4) regarding the winding bobbin Bw4 (wound package Pw4). Subsequently, the management device 101 associates (i) individual information of a yarn supply package Ps (yarn supply package Ps2; see FIG. 6(b)) associated with an unwinding start time (time tb1; see FIG. 5(b)) which is earlier than the time te3 and is the latest unwinding start time with (ii) individual information of the wound package Pw4. Furthermore, the management device 101 determines whether yarn supply package switching has occurred during a period between the time te3 and the time te4. In the example, a time (ta3) at which yarn supply package switching occurred (i.e., an unwinding start time) exists in the period between the time te3 and the time te4. The management device 101 therefore determines that yarn supply package switching occurred in the period between the time te3 and the time te4. Based on this determination, the management device 101 associates the individual information of the yarn supply package Ps (yarn supply package Ps3; see FIG. 6(b)) associated with the time ta3 with the individual information of the wound package Pw4. To put it differently, among sets of individual information of yarn supply packages Ps, the management device 101 associates (i) individual information of the yarn supply package Ps associated with the unwinding start time between the first replacement time and the second replacement time with (ii) the individual information of the wound package Pw associated with the first replacement time. Therefore information indicating that the yarn Y was supplied to the wound package Pw3 from the yarn supply package Ps2 and the yarn supply package Ps3 is acquired (see FIG. 9).

(Determination of Presence of Node)

[0081] Based on whether the above-described yarn supply package switching has occurred, the management device 101 performs the following determinations. For example, when it is determined that yarn supply package switching did not occur during a period from a first replacement time (time te2) to a second replacement time (time te3) regarding a winding bobbin Bw3 (wound package Pw3), the management device 101 determines that no node K is included in the wound package Pw3 (see FIG. 9). When it is determined that yarn supply package switching occurred during a period from a first replacement time (time te3) to a second replacement time (time te4) regarding a winding bobbin Bw4 (wound package Pw4), the management device 101 determines that a node K is included in the wound package Pw3 (see FIG. 9).

[0082] Furthermore, the management device 101 estimates a location where a node K is mixed in a wound package Pw, by the following calculation. In a simple example, the management device 101 calculates the ratio of (i) a period of time from the time te3 to the time (ta3) when the yarn supply package switching occurred to (ii) a period of time from the first replacement time (time te3) to the second replacement time (time te4) regarding the winding bobbin Bw4 (wound package Pw4). In other words, the ratio of ta3-te3 to te4-te3 is calculated. Provided that this ratio is, for example, N percent, it is estimated that a node K is mixed into a wound package Pw4 when N percent of the yarn Y is wound onto the winding bobbin Bw4.

(Output of Chart)

[0083] The information management unit 110 outputs a chart described below. The information management unit 110 generates chart data for indicating an unwinding period of each yarn supply package Ps and a winding period of each wound package Pw by using yarn supply package individual information, unwinding start time information, wound package individual information, and replacement time information. The unwinding period is a period of time from the start to the end of unwinding of the yarn Y from a yarn supply package Ps. The winding period is a period of time from the start to the end of winding of the yarn Y onto a winding bobbin Bw. Based on the generated chart data, the information management unit 110 displays (outputs), for example, graphs (charts) shown in FIG. 5(a) to FIG. 5(c) on, for example, a management output unit 101b (display) of the management device 101. The management device 101 is equivalent to an output controller of the present invention. The management output unit 101b is equivalent to an output unit of the present invention. The types of the charts are not limited to those described above. Any types of charts may be output as long as an unwinding period of each yarn supply package Ps and a winding period of each wound package Pw can be visually checked by an operator. This allows the operator to easily associate yarn supply package individual information with wound package individual information. In addition to the information shown in FIG. 5(a) to FIG. 5(c), the charts may show further detailed information. For example, at a location where individual information of a wound package Pw is displayed, individual information of a yarn supply package Ps associated with that wound package Pw may be displayed together. Furthermore, along with yarn supply package individual information, information indicating from which layer of the yarn Y in the yarn supply package Ps the yarn Y is supplied to the wound package Pw may be displayed. When the management output unit 101b has a printer, the information management unit 110 may print the charts by the printer. Alternatively, the information management unit 110 may output (display) the charts to the machine output unit 5b of the machine controller 5. Alternatively, the output controller configured to generate chart data and the output unit configured to output the charts may be provided independently from the information management unit 110.

[0084] As described above, it is possible to know an unwinding start time of each yarn supply package Ps by the information management unit 110. Furthermore, by

acquiring the replacement time information, it is possible to know a winding start time and a winding end time of each wound package Pw. It is therefore possible to acquire various types of information regarding the relationship between a winding bobbin Bw (wound package Pw) and a yarn supply package Ps. For example, it is possible to know from which layer of a yarn Y of a yarn supply package Ps a wound package Pw is formed. Furthermore, it is possible to determine whether a node K has been mixed into a wound package Pw. In this regard, moreover, it is possible to know in which part of the wound package Pw the node K has been mixed. As such, various types of useful information can be obtained.

[0085] Furthermore, by using the unwinding start time information and the replacement time information, it is possible to easily know that a node K has been mixed in a wound package Pw.

[0086] Furthermore, by a calculation using the first replacement time, the second replacement time, and the unwinding start time, it is possible to easily know the position of mixture of a node K in a wound package Pw.

[0087] Furthermore, the yarn supply package individual information and the unwinding start time information are acquired in association with each other. By taking the anteroposterior relation of the times into account, it is possible to know from which yarn supply package Ps a yarn Y is supplied to a winding bobbin Bw.

[0088] Furthermore, the operator can easily associate the wound package individual information with the yarn supply package individual information only by checking output charts.

[0089] In addition to the above, it is possible to automatically associate individual information of a predetermined wound package Pw with individual information of a yarn supply package Ps which is supplying the yarn Y at the start of the winding of the yarn onto the predetermined wound package Pw.

[0090] When the yarn Y is serially supplied to a given winding bobbin Bw from plural yarn supply packages Ps, it is possible to automatically associate sets of individual information of all of the yarn supply packages Ps with the individual information of the given wound package Pw.

[0091] In addition to the above, when the creel robot 102 attaches a yarn supply package Ps to the package attachment unit 21, it is possible to automatically associate the yarn supply package individual information with the package attachment unit 21.

[0092] In addition to the above, it is possible to always detect from which one of the package attachment units 21 the yarn is supplied, by the yarn detection sensor 24. On this account, it is possible to automatically and precisely achieve association between the yarn supply package individual information and the unwinding start time information.

[0093] The following will describe modifications of the above-described embodiment. The members identical with those in the embodiment above will be denoted by the same reference numerals, and the explanations thereof are not repeated.

(1) In the embodiment above, whether yarn supply package switching has occurred is determined based on a detection result of the yarn detection sensor 24 including the first detection unit 25 and the second detection unit 26. The disclosure, however, is not limited to this arrangement. For example, as shown in FIG. 10, a yarn supplying unit 2a of a false-twist texturing machine 1a may include, for each spindle 9a, a switching detector 41 which is different in arrangement from the yarn detection sensor 24. The switching detector 41 may include, for example, a supply sensor 42 and a node part sensor 43. The supply sensor 42 is arranged to be able to detect whether the yarn Y is being supplied from the first attachment unit 22. The node part sensor 43 is arranged to be able to detect a node K provided to be still at a predetermined position. This arrangement makes it possible to determine that yarn supply package switching has occurred when the node K moves from the predetermined position and the node K is no longer detected by the node part sensor 43. Furthermore, from which one of the attachment units, the first attachment unit 22 or the second attachment unit 23, the yarn Y is supplied at the yarn supply package switching is detectable based on a detection result o the supply sensor 42. In this way, by using a detection result of the node K, it is possible to reliably detect from which one of the attachment units, the first attachment unit 22 or the second attachment unit 23, the yarn Y is supplied. The node part sensor 43 may be arranged to be able to detect a moving node K.

(2) In the embodiment above, the information management unit 110 determines whether yarn supply package switching has occurred based on a detection result of the yarn detection sensor 24 or the switching detector 41. The disclosure, however, is not limited to this arrangement.

(3) In the embodiment above, the information management unit 110 acquires the unwinding start time information and the unwinding end time information based on the yarn supply package attachment time information and the yarn supply package switching time information. In other words, the information management unit 110 associates the yarn supply package attachment time with the unwinding start time. However, the disclosure is not limited to this. The information management unit 110 may associate (i) individual information of a package attachment unit 21 which starts to supply the yarn Y at the occurrence of yarn supply package switching, (ii) individual information of a yarn supply package Ps attached to that package attachment unit 21, and (iii) an unwinding start time (i.e., switching time) at that package attachment unit 21, with one another. The unwinding start time information may be acquired by

this arrangement. In such a case, the information management unit 110 may not acquire information of a yarn supply package attachment time. In other words, when the yarn supply package Ps is attached to the yarn supply package retaining portion 20, the information management unit 110 may simply acquire individual information of the yarn supply package Ps and individual information of the package attachment unit 21.

(4) In the embodiment above, the information management unit 110 forms associations and/or acquires various sets of information based on the winding start time information, the winding end time information, the unwinding start time information, and the unwinding end time information. The disclosure, however, is not limited to this arrangement. In other words, the information management unit 110 may simply acquire the yarn supply package individual information, the unwinding start time information, and the unwinding end time information in association with one another and acquire the wound package individual information and the replacement time information in association with one another. By using these sets of information, various sets of useful information can be acquired by another computer device (not illustrated).

(5) While in the embodiment above the information management unit 110 acquires unwinding end information, the disclosure is not limited to this arrangement. In other words, an unwinding start time of a given yarn supply package Ps is an unwinding end time of a yarn supply package Ps which supplied the yarn Y immediately before the start of unwinding of the yarn Y from that yarn supply package Ps. Based on this fact, unwinding start time information of a given yarn supply packages Ps (e.g., a yarn supply package Ps2) may be used as unwinding end information of another yarn supply packages Ps (e.g., a yarn supply package Ps1). In such an arrangement, however, the determinations and/or calculations may become complicated. In order to simplify the determinations and/or calculations, it is preferable that the information management unit 110 acquires the unwinding end information.

(6) In the embodiment above, yarn supply package replacement is performed by the creel robot 102. Furthermore, winding bobbin replacement is performed by the automatic doffer 10. The disclosure, however, is not limited to this arrangement. The yarn supply package replacement may be performed by an operator. Required information such as yarn supply package individual information may be input by the operator to, for example, the machine controller 5. The attachment and detachment of a winding bobbin Bw may be performed by the operator. Required information such as wound package individual information may be input by the operator to, for example, the machine controller 5.

(7) In the embodiment above, the information management unit 110 associates the yarn supply package individual information with the unwinding start time information for each yarn supply package Ps. The disclosure, however, is not limited to this arrangement. The information management unit 110 may not acquire the yarn supply package individual information and the unwinding start time information in association with each other. For example, the information management unit 110 may not acquire the yarn supply package individual information and may acquire only the unwinding start time information for each yarn supply package Ps. Even when such a process is performed, it is possible to acquire various sets of useful information such as information indicating whether a node K is included in a wound package Pw, by using the unwinding start time information and the replacement time information.

(8) In the embodiment above, the machine controller 5 acquires, as the replacement time information, information of a time at which a signal instructing the automatic doffer 10 to perform winding bobbin replacement is output. The disclosure, however, is not limited to this arrangement. For example, the machine controller 5 may be able to detect and/or determine the completion of winding bobbin replacement. The machine controller 5 may acquire, as the replacement time information, information of a time at which the winding bobbin replacement is completed.

(9) While in the embodiment above the information management unit 110 includes the plural machine controllers 5 and the management device 101, the disclosure is not limited to this arrangement. The information management unit 110 may include a computer device (not illustrated) in addition to the machine controller 5 and the management device 101. Alternatively, the information management unit 110 may include only the machine controller 5 or the management device 101. In other words, only one of the machine controller 5 and the management device 101 may acquire required information.

(10) While in the embodiment above the yarn processing facility 100 has plural false-twist texturing machines 1, the disclosure is not limited to this arrangement. The yarn processing facility 100 may include only one false-twist texturing machine 1. Furthermore, the management device 101 may not be provided. In this case, the false-twist texturing machine 1 is equivalent to the yarn processing facility of the present invention. While the false-twist texturing machine 1 includes plural spindles 9, the disclosure is not limited to this arrangement. In other words, the number of spindles 9 in the false-twist texturing machine 1 may be one. To put it differently, the number of yarn supply package retaining portions 20 in the yarn supplying unit 2 may be one.

(11) The present invention may be applied not to the

yarn processing facility 100 including the false-twist texturing machine 1 but to another yarn processing facility including a yarn processor. For example, the present invention may be applied to a yarn processing facility including an air texturing machine (yarn processor) recited in Japanese Laid-Open Patent Publication No. 2002-088605.

Claims

1. A yarn processing facility (100) comprising:

a yarn processor (1) including: a yarn supplying unit (2) capable of supplying a yarn (Y); a processing unit (3) configured to process the yarn (Y) supplied from the yarn supplying unit (2); and a winding unit (4) configured to form a wound package (Pw) by winding the yarn (Y) processed by the processing unit (3) onto a winding bobbin (Bw); and
an information management unit (110) which is configured to manage information regarding the yarn processor (1),
the yarn supplying unit (2) including attachment units (21) to which and from which yarn supply packages (Ps) are attached and detached one by one, and when a terminal portion of a yarn (Y) included in a yarn supply package (Ps) attached to an attachment unit (21) that is one of the attachment units (21) is connected to a start end portion of a yarn (Y) in a yarn supply package (Ps) attached to an attachment unit (21) that is another one of the attachment units (21), the yarn supplying unit (2) being capable of uninterruptedly supply the yarn (Y),
immediately after finishing winding of a yarn (Y) onto one winding bobbin (Bw), the winding unit (4) being capable of starting winding of a yarn (Y) onto a new winding bobbin (Bw) replaced with the one winding bobbin (Bw),
the information management unit (110) being capable of acquiring, for each yarn supply package (Ps), unwinding start time information regarding an unwinding start time at which unwinding of the yarn (Y) from the yarn supply package (Ps) starts at the yarn supplying unit (2), and
the information management unit (110) being capable of acquiring wound package individual information of a wound package (Pw) formed by winding a yarn (Y) onto a winding bobbin (Bw) attached to the winding unit (4) and replacement time information regarding a replacement time at which replacement of the winding bobbin (Bw) is performed at the winding unit (4), in association with each wound package (Pw) .

2. The yarn processing facility (100) according to claim 1, wherein,

the information management unit (110) determines,
based on the unwinding start time information and the replacement time information,
that a yarn connecting portion (K) formed by connecting the start end portion with the terminal portion is mixed into a predetermined wound package (Pw) formed by winding a yarn (Y) onto a predetermined winding bobbin (Bw), when the unwinding start time exists between a first replacement time at which the predetermined winding bobbin (Bw) is attached to the winding unit (4) and a second replacement time at which the predetermined winding bobbin (Bw) is detached from the winding unit (4).

3. The yarn processing facility (100) according to claim 2, wherein, the information management unit (110) estimates a location of the mixed yarn connecting portion (K) in the predetermined wound package (Pw) based on the first replacement time, the second replacement time, and the unwinding start time.

4. The yarn processing facility (100) according to any one of claims 1 to 3, wherein, the information management unit (110) is capable of acquiring yarn supply package individual information of the yarn supply package (Ps) attached to the yarn supplying unit (2) and the unwinding start time information in association with each yarn supply package (Ps).

5. The yarn processing facility (100) according to claim 4, further comprising:

an output unit (101b) which is capable of outputting information; and
an output controller (101) which is configured to control the output unit (101b),
by using the yarn supply package individual information, the unwinding start time information, wound package individual information, and the replacement time information, the output controller (101) generating chart data indicating an unwinding period from start to end of unwinding of a yarn (Y) from each yarn supply package (Ps) and a winding period from start to end of winding of a yarn (Y) onto each wound package (Pw), and causes the output unit (101b) to output a chart based on the chart data.

6. The yarn processing facility (100) according to claim 4 or 5, wherein,
based on the unwinding start time information and the replacement time information, the information management unit (110) specifies a yarn supply package (Ps) from which unwinding of a yarn (Y) starts

at the latest and before the first replacement time at which the predetermined winding bobbin (Bw) is attached to the winding unit (4), and associates the yarn supply package individual information of the specified yarn supply package (Ps) with the wound package individual information of a predetermined wound package (Pw) formed by winding the yarn (Y) onto the predetermined winding bobbin (Bw).

7. The yarn processing facility (100) according to claim 6, wherein,
when the unwinding start time exists between the first replacement time and a second replacement time at which the predetermined wound package (Pw) is detached from the winding unit (4), the information management unit (110) associates the yarn supply package individual information of the yarn supply package (Ps) related to the unwinding start time with the wound package individual information of the predetermined wound package (Pw).

8. The yarn processing facility (100) according to any one of claims 4 to 7, further comprising

a yarn supply package conveyance device (102) configured to be able to convey a yarn supply package (Ps) and attach and detach the yarn supply package (Ps) to and from the yarn supplying unit (2),
when a predetermined yarn supply package (Ps) is attached to one attachment unit (21) among the attachment units (21) by the yarn supply package conveyance device (102), the information management unit (110) associates the yarn supply package individual information of the predetermined yarn supply package (Ps) with the one attachment unit (21).

9. The yarn processing facility (100) according to any one of claims 4 to 8, further comprising

a detection unit (24) which is able to specify an attachment unit (21) from among the attachment units (21), to which a yarn supply package (Ps) from which a yarn (Y) is unwound is attached,
based on a detection result of the detection unit (24), the information management unit (110) associates the yarn supply package individual information with the unwinding start time information.

FIG.1

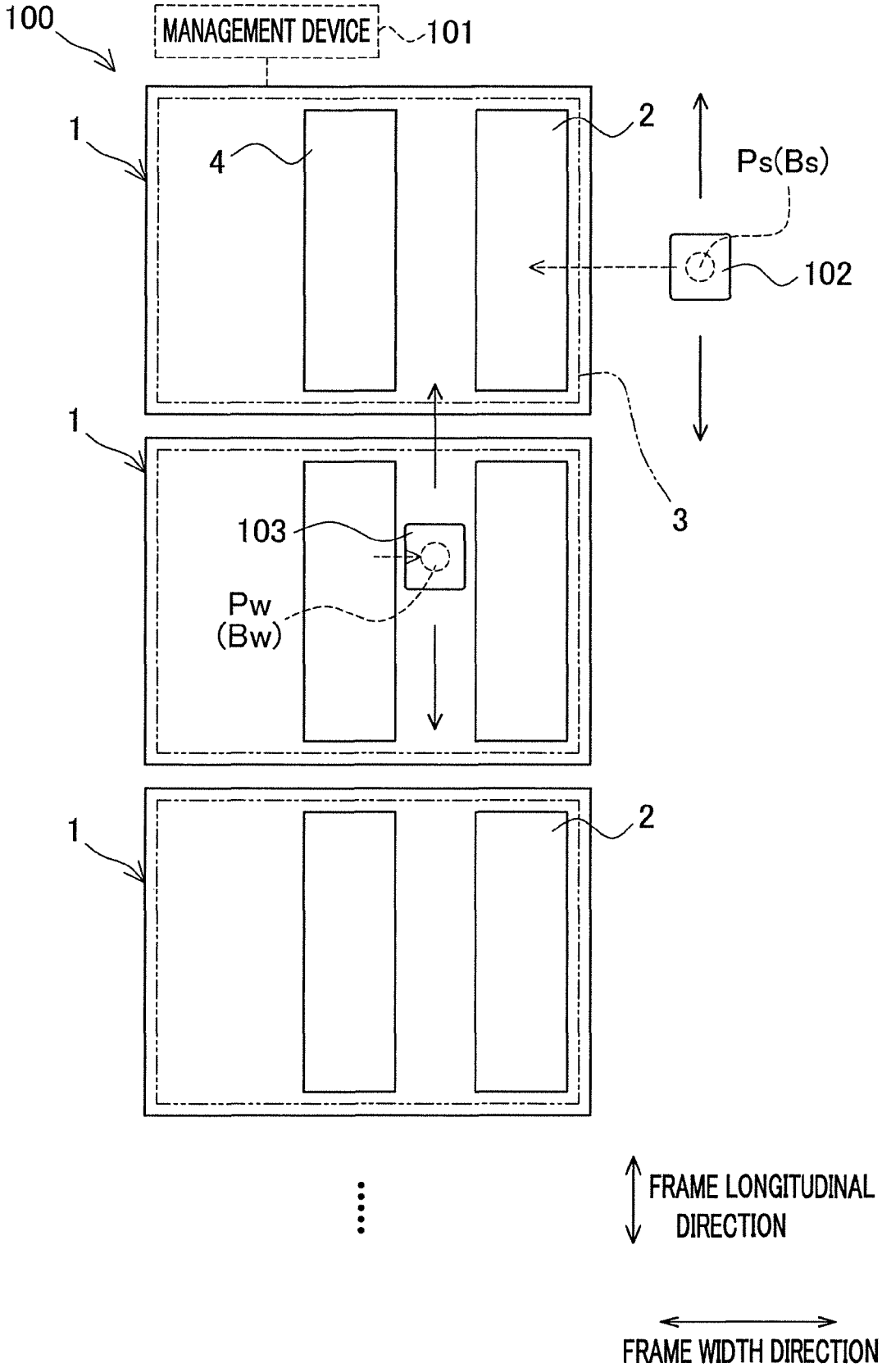

100
MANAGEMENT DEVICE
101
1
4
2
Ps(Bs)
102
1
3
103
Pw
(Bw)
1
2
FRAME LONGITUDINAL DIRECTION
FRAME WIDTH DIRECTION

FIG.2

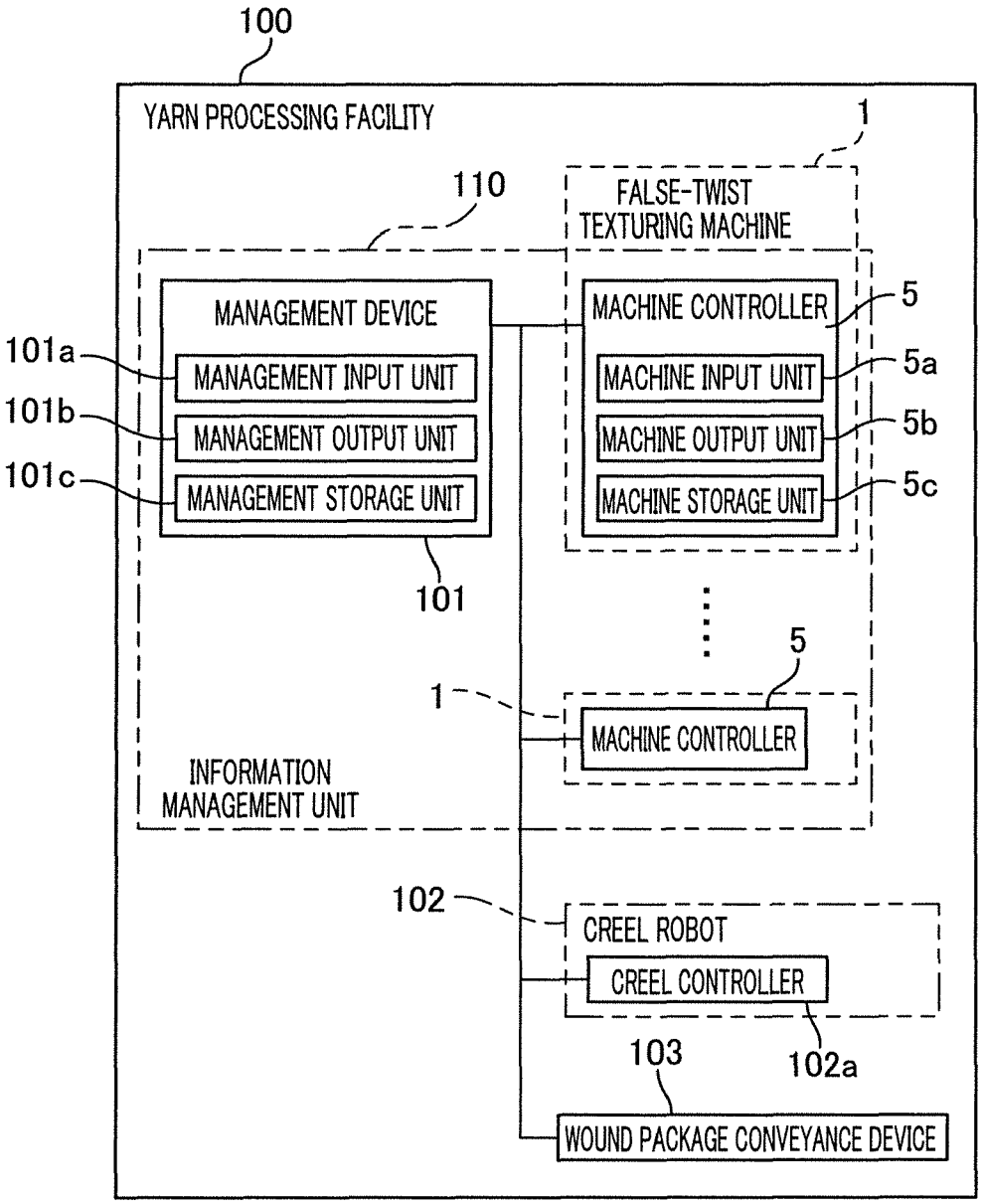

100
YARN PROCESSING FACILITY
1
110
FALSE-TWIST TEXTURING MACHINE
MANAGEMENT DEVICE
MACHINE CONTROLLER
5
101a
MANAGEMENT INPUT UNIT
MACHINE INPUT UNIT
5a
101b
MANAGEMENT OUTPUT UNIT
MACHINE OUTPUT UNIT
5b
101c
MANAGEMENT STORAGE UNIT
MACHINE STORAGE UNIT
5c
101
5
1
MACHINE CONTROLLER
INFORMATION MANAGEMENT UNIT
102
CREEL ROBOT
CREEL CONTROLLER
103
102a
WOUND PACKAGE CONVEYANCE DEVICE

FIG.3

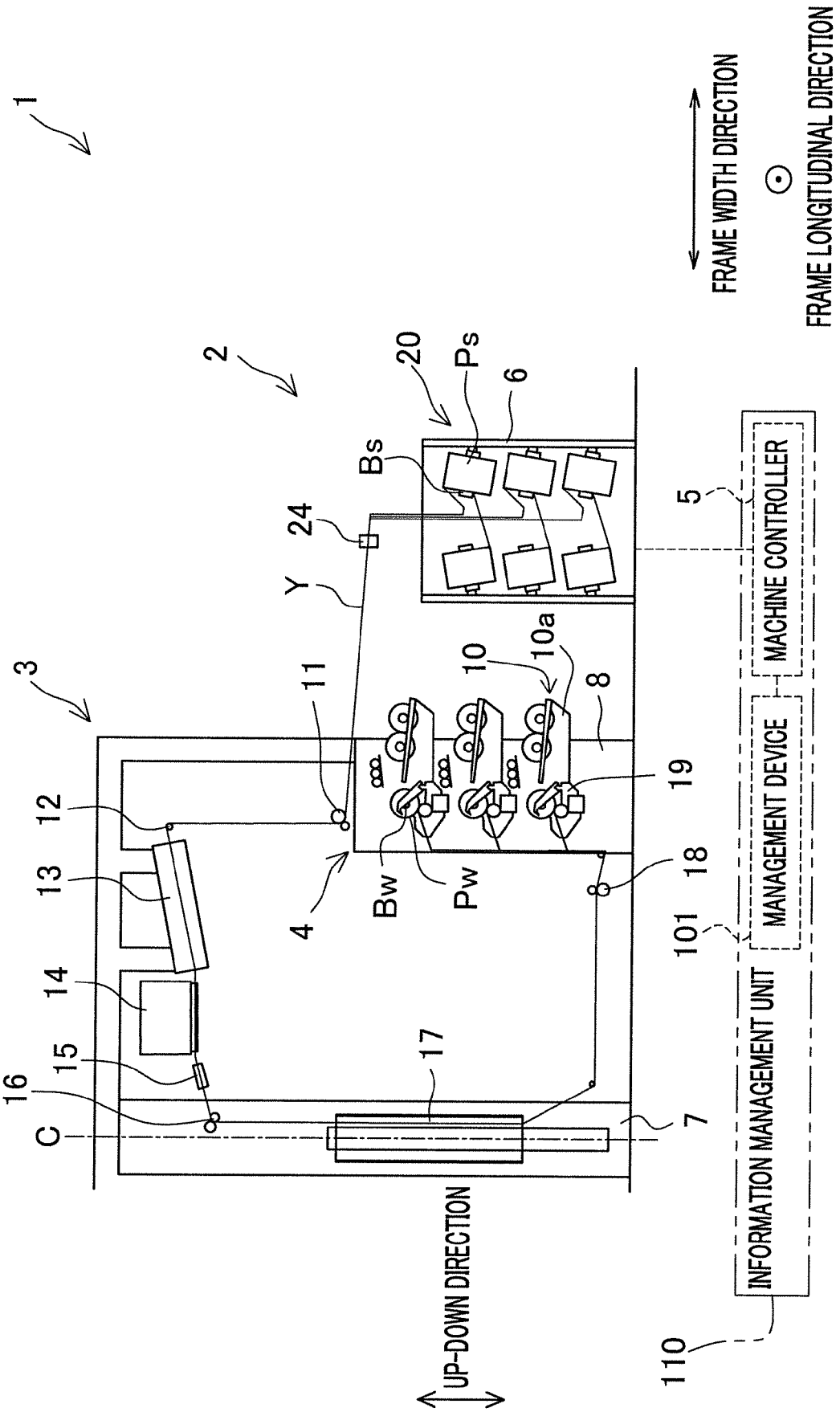

1
2
3
4
5
6
7
8
10
10a
11
12
13
14
15
16
17
18
19
20
24
Bs
Ps
Bw
Pw
Y
C
101
110
FRAME WIDTH DIRECTION
FRAME LONGITUDINAL DIRECTION
UP-DOWN DIRECTION
MACHINE CONTROLLER
MANAGEMENT DEVICE
INFORMATION MANAGEMENT UNIT

FIG.4

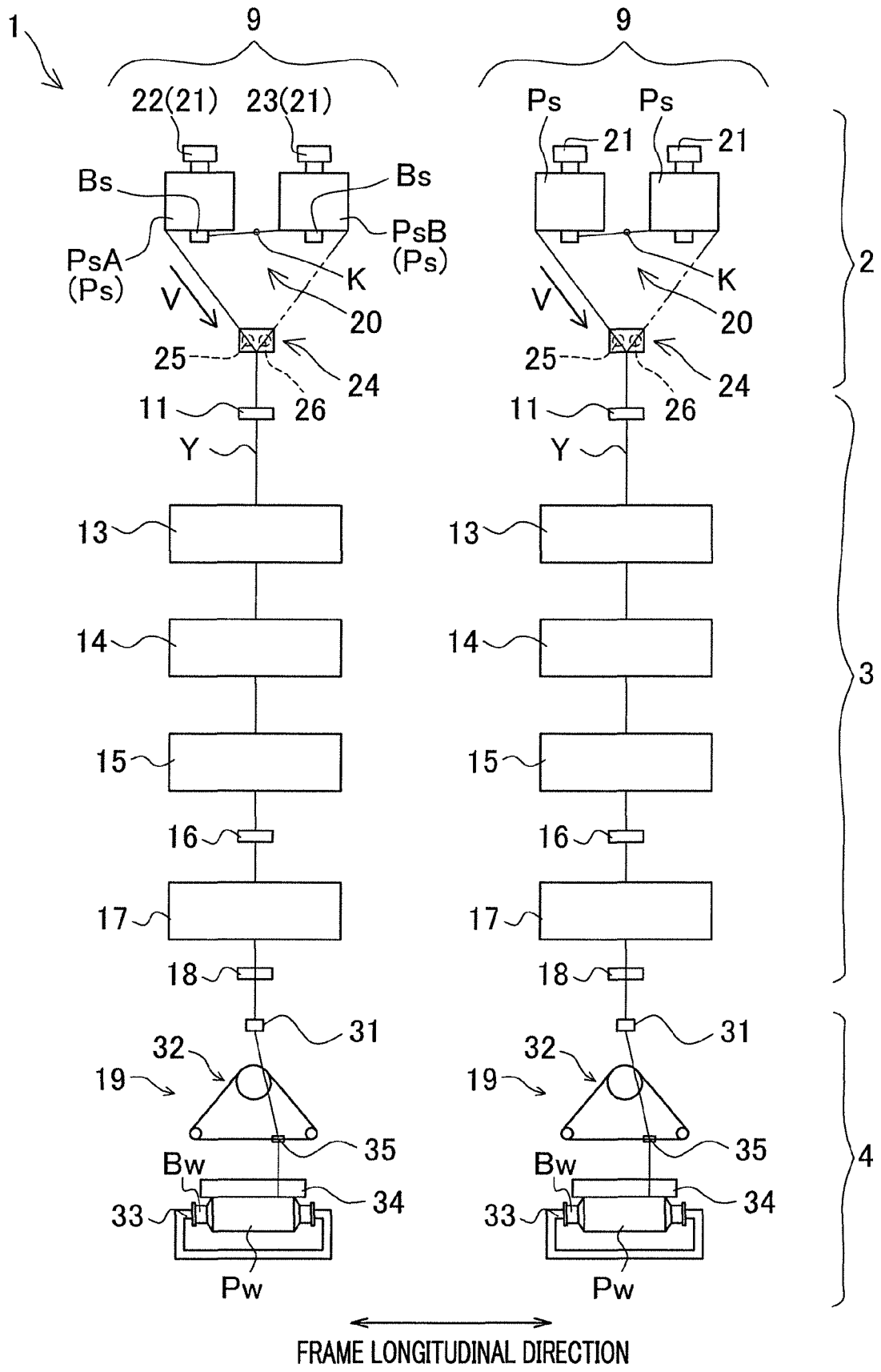

1
9
9
22(21)
23(21)
Ps
Ps
21
21
Bs
Bs
PsB
(Ps)
PsA
(Ps)
K
V
20
25
24
26
11
Y
2
13
14
15
16
17
18
3
31
32
19
35
Bw
34
33
Pw
4
FRAME LONGITUDINAL DIRECTION

FIG.5

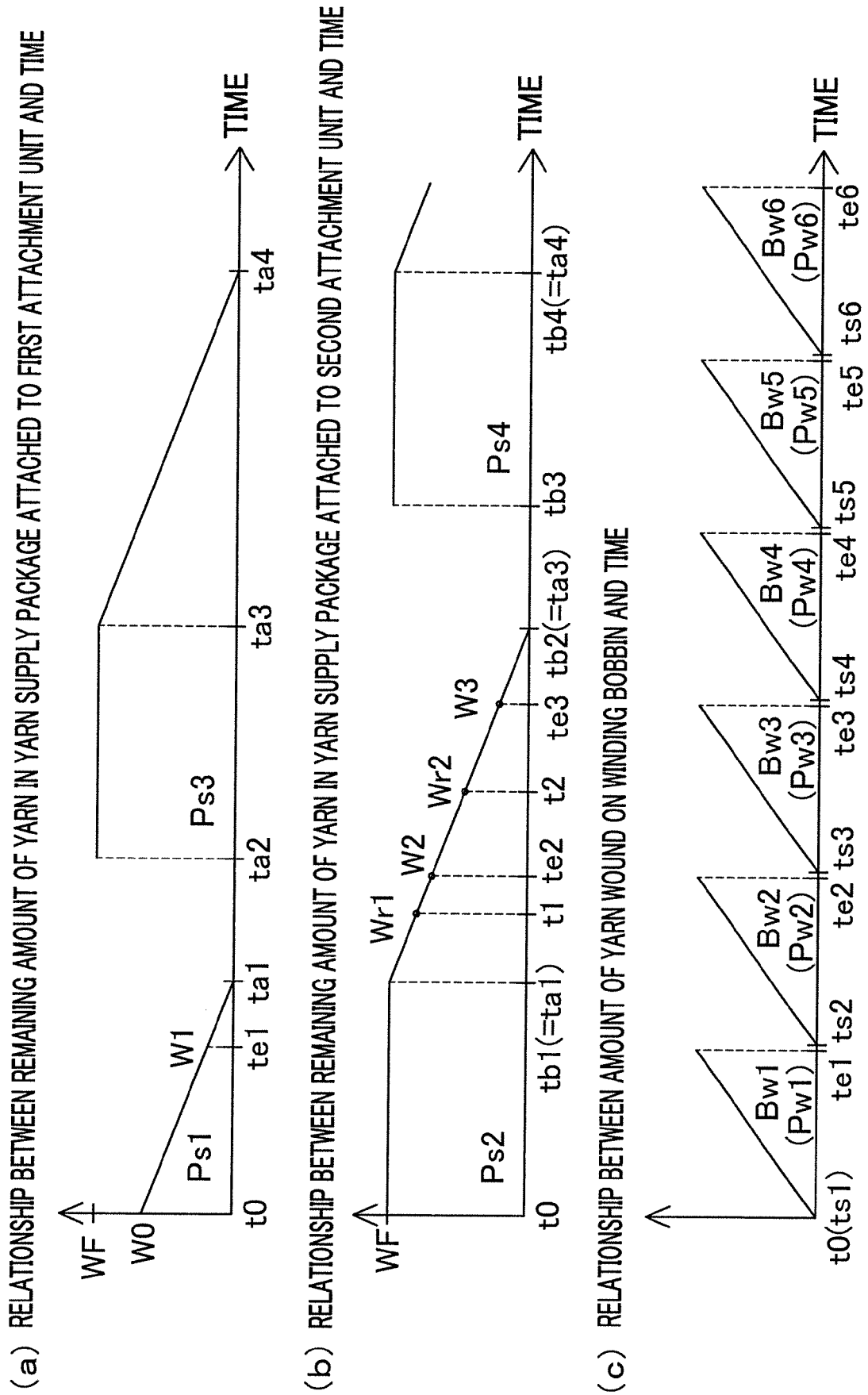

(a) RELATIONSHIP BETWEEN REMAINING AMOUNT OF YARN IN YARN SUPPLY PACKAGE ATTACHED TO FIRST ATTACHMENT UNIT AND TIME
WF
W0
W1
Ps1
Ps3
t0
te1
ta1
ta2
ta3
ta4
TIME
(b) RELATIONSHIP BETWEEN REMAINING AMOUNT OF YARN IN YARN SUPPLY PACKAGE ATTACHED TO SECOND ATTACHMENT UNIT AND TIME
WF
Wr1
W2
Wr2
W3
Ps2
Ps4
t0
tb1(=ta1)
t1
te2
t2
te3
tb2(=ta3)
tb3
tb4(=ta4)
TIME
(c) RELATIONSHIP BETWEEN AMOUNT OF YARN WOUND ON WINDING BOBBIN AND TIME
Bw1 (Pw1)
Bw2 (Pw2)
Bw3 (Pw3)
Bw4 (Pw4)
Bw5 (Pw5)
Bw6 (Pw6)
t0(ts1)
te1
ts2
te2
ts3
te3
ts4
te4
ts5
te5
ts6
te6
TIME

FIG.6

(a) ASSOCIATION BETWEEN YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION, UNWINDING START TIME INFORMATION, AND UNWINDING END TIME INFORMATION

YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION	UNWINDING START TIME	UNWINDING END TIME
Ps1	(OMITTED)	ta1
Ps2	tb1	tb2
Ps3	ta3	ta4
Ps4	tb4	(OMITTED)

(b) ASSOCIATION BETWEEN WOUND PACKAGE INDIVIDUAL INFORMATION, FIRST REPLACEMENT TIME INFORMATION, AND SECOND REPLACEMENT TIME INFORMATION

WOUND PACKAGE INDIVIDUAL INFORMATION	FIRST REPLACEMENT TIME	SECOND REPLACEMENT TIME
Pw1	(OMITTED)	te1
Pw2	te1	te2
Pw3	te2	te3
Pw4	te3	te4
Pw5	te4	te5
Pw6	te5	te6

FIG.7

(a) ASSOCIATION BETWEEN YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION, INDIVIDUAL INFORMATION OF PACKAGE ATTACHMENT UNIT, AND ATTACHMENT TIME INFORMATION

YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION	PACKAGE ATTACHMENT UNIT	ATTACHMENT TIME
Ps1	FIRST ATTACHMENT UNIT	(OMITTED)
Ps2	SECOND ATTACHMENT UNIT	(OMITTED)
Ps3	FIRST ATTACHMENT UNIT	ta2
Ps4	SECOND ATTACHMENT UNIT	tb3

(b) ASSOCIATION BETWEEN INDIVIDUAL INFORMATION OF PACKAGE ATTACHMENT UNIT, UNWINDING START TIME INFORMATION, AND UNWINDING END TIME INFORMATION

PACKAGE ATTACHMENT UNIT	UNWINDING START TIME	UNWINDING END TIME
FIRST ATTACHMENT UNIT	(OMITTED)	ta1
SECOND ATTACHMENT UNIT	tb1	tb2
FIRST ATTACHMENT UNIT	ta3	ta4
SECOND ATTACHMENT UNIT	tb4	(OMITTED)

FIG.8

ASSOCIATION BETWEEN YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION, INDIVIDUAL INFORMATION OF PACKAGE ATTACHMENT UNIT, AND TIMES

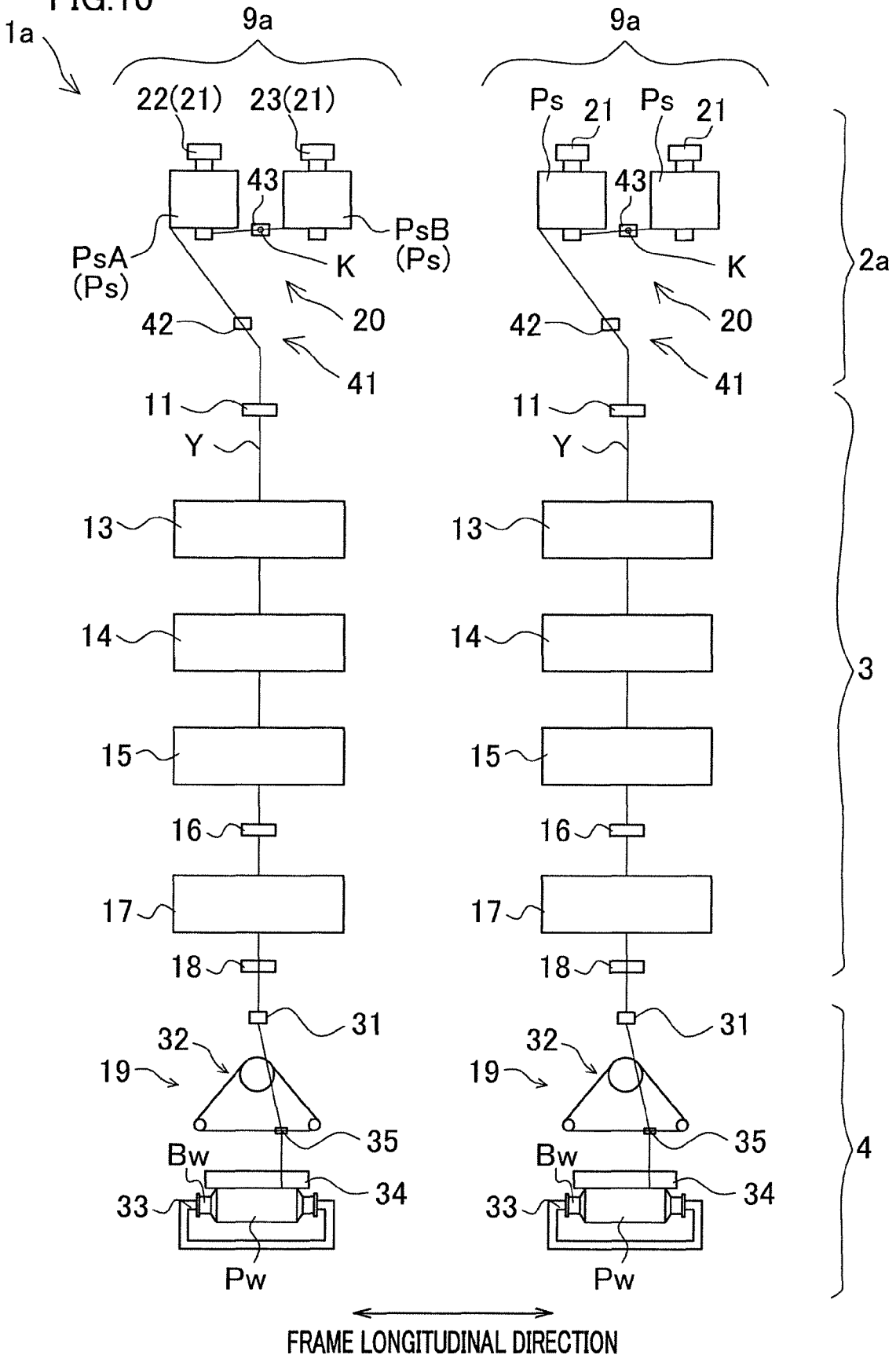
YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION	PACKAGE ATTACHMENT UNIT	ATTACHMENT TIME	UNWINDING START TIME	UNWINDING END TIME
Ps1	FIRST ATTACHMENT UNIT	(OMITTED)	(OMITTED)	ta1
Ps2	SECOND ATTACHMENT UNIT	(OMITTED)	tb1	tb2
Ps3	FIRST ATTACHMENT UNIT	ta2	ta3	ta4
Ps4	SECOND ATTACHMENT UNIT	tb3	tb4	(OMITTED)

FIG.9

ASSOCIATION BETWEEN WOUND PACKAGE INDIVIDUAL INFORMATION AND YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION

WOUND PACKAGE INDIVIDUAL INFORMATION	YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION 1	YARN SUPPLY PACKAGE INDIVIDUAL INFORMATION 2	MIXTURE OF NODE
Pw1	Ps1	—	NO
Pw2	Ps1	Ps2	YES
Pw3	Ps2	—	NO
Pw4	Ps2	Ps3	YES
Pw5	Ps3	—	NO
Pw6	Ps3	Ps4	YES

FIG.10


1a
9a
9a
22(21)
23(21)
Ps
21
Ps
21
43
43
PsA
(Ps)
PsB
(Ps)
K
K
2a
20
20
42
42
41
41
11
11
Y
Y
13
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19
19
35
35
Bw
Bw
34
34
33
33
4
Pw
Pw
FRAME LONGITUDINAL DIRECTION

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EUROPEAN SEARCH REPORT

Application Number
EP 22 15 0927

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2001/037545 A1 (STUTTEM MANFRED [DE]) 8 November 2001 (2001-11-08) * paragraphs [0007] - [0027], [0041] - [0061]; figures 1,2 *	1-9	INV. B65H49/12 B65H63/00 B65H63/08 B65H67/02
X,D	WO 2020/127489 A1 (OERLIKON TEXTILE GMBH & CO KG [DE]) 25 June 2020 (2020-06-25) * pages 9-12 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 June 2022	Pussemier, Bart

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14-06-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2001037545 A1	08-11-2001	CN 1328524 A	26-12-2001
		EP 1144295 A2	17-10-2001
		JP 4651817 B2	16-03-2011
		JP 2003526584 A	09-09-2003
		KR 20010080062 A	22-08-2001
		TR 200100962 T2	23-09-2002
		TW 440616 B	16-06-2001
		US 2001037545 A1	08-11-2001
		WO 0021866 A2	20-04-2000
WO 2020127489 A1	25-06-2020	CN 111349991 A	30-06-2020
		CN 113168174 A	23-07-2021
		WO 2020127489 A1	25-06-2020

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Patent documents cited in the description

- WO 2020127489 A **[0002]**
- JP 5873105 B **[0038]**
- JP H6212521 A **[0050]**
- JP 2002088605 A **[0093]**