



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
03.08.2016 Bulletin 2016/31

(51) Int Cl.:
B65B 57/00 (2006.01) B65B 19/22 (2006.01)

(21) Application number: **13894446.7**

(86) International application number:
PCT/JP2013/076251

(22) Date of filing: **27.09.2013**

(87) International publication number:
WO 2015/045092 (02.04.2015 Gazette 2015/13)

(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

• **IMAMURA, Toshihiko**
Tokyo 130-8603 (JP)

(74) Representative: **Isarpatent**
Patent- und Rechtsanwälte Behnisch Barth
Charles
Hassa Peckmann & Partner mbB
Friedrichstrasse 31
80801 München (DE)

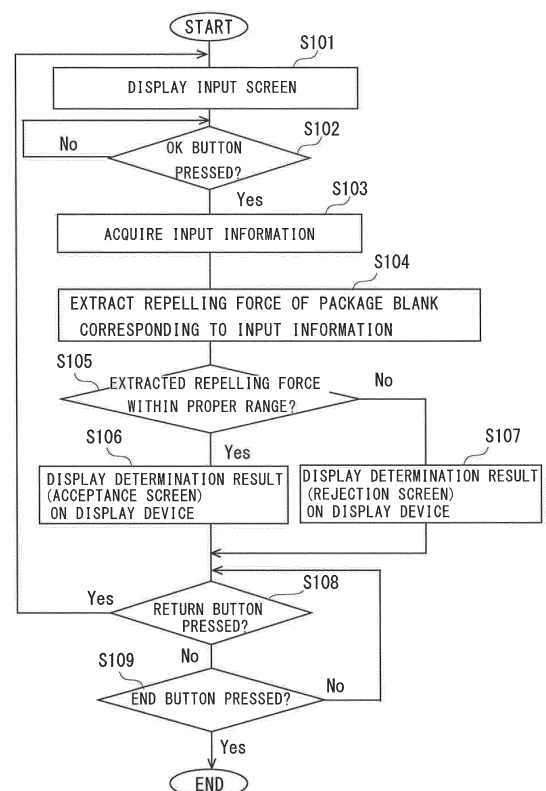
(71) Applicant: **Japan Tobacco, Inc.**
Tokyo 105-8422 (JP)

(72) Inventors:
• **OSAMURA, Kazuo**
Tokyo 130-8603 (JP)

(54) **PACKAGING BOX MANUFACTURING ASSISTANCE DEVICE AND MANUFACTURING ASSISTANCE METHOD**

(57) A packaging box manufacturing assistance apparatus for assisting in manufacture of a packaging box shaped by sequentially folding a blank using a manufacturing apparatus, the manufacturing assistance apparatus including: a storage unit that stores blank spec information relating to specs of the blank, folding spec information relating to folding specs on the manufacturing apparatus that folds the blank, and characteristic value information relating to a particular dynamic characteristic value of the blank in association with one another, an input unit that receives an entry of input information including at least the blank spec information, a processing unit that accesses the storage unit, acquires the characteristic value information corresponding to the input information entered via the input unit, and determines whether or not a value of the acquired characteristic value information falls within a predetermined proper range, and a display unit that displays a result of the determination by the processing unit.

FIG. 11



Description

Technical Field

[0001] The present invention relates to a packaging box manufacturing assistance apparatus and a packaging box manufacturing assistance method for assisting in manufacture of a packaging box shaped by folding a blank.

Background Art

[0002] As packaging boxes that hold objects to be held such as cigarettes, hard-type packages are publicly known. In general, a hard-type package is shaped by folding one or more blanks by means of a manufacturing apparatus (packaging machine) and bonding properly parts thereof.

[0003] [Patent Document 1] National Publication of International Patent Application No. 2011-525460

Summary of Invention

Technical Problem

[0004] In a folding process of folding a blank along a fold line (guideline), a particular dynamic characteristic value of the blank may affect the product quality of the resulting shaped packaging box.

[0005] For example, a case where a flap is folded relative to a first panel portion included in a blank along a fold line and the flap is bonded to a second panel portion will be considered. In this case, if a repelling force (restoring force) of the flap generated as a result of the flap being folded relative to the first panel portion is large, the flap and the second panel portion may be separated from each other by the repelling force of the flap before curing and stabilization of an adhesive for bonding the flap and the second panel portion.

[0006] Conventionally, when there is a change in, e.g., material and/or shape of a blank, mechanical adjustment work for a folding process in a manufacturing apparatus is conducted through trial and error, requiring a huge amount of time and labor. Also, if such mechanical adjustment work for the manufacturing apparatus cannot successfully be conducted, it is necessary to adjust, e.g., the material and/or the shape of the blank to mechanical properties of the manufacturing apparatus, which may result in inevitable design change in design or spec (specification) of the packaging box.

[0007] The present invention has been made in view of the aforementioned problems, and an object of the present invention is to provide a packaging box manufacturing assistance apparatus and a packaging box manufacturing assistance method that can, when shaping a packaging box by sequentially folding a blank using a manufacturing apparatus, present information regarding whether or not specs on the blank and specs on the

manufacturing apparatus match each other.

Solution to Problem

[0008] In order to achieve the above object, the present invention employs the following measures. In other words, the present invention provides a packaging box manufacturing assistance apparatus for assisting in manufacture of a packaging box shaped by sequentially folding a blank using a manufacturing apparatus, the manufacturing assistance apparatus including: a storage unit that stores blank spec information relating to specs of the blank, folding spec information relating to folding specs on the manufacturing apparatus that folds the blank, and characteristic value information relating to a particular dynamic characteristic value of the blank in association with one another; an input unit that receives an entry of input information including at least the blank spec information; a processing unit that accesses the storage unit, acquires the characteristic value information corresponding to the input information entered via the input unit, and determines whether or not a value of the acquired characteristic value information falls within a predetermined proper range; and a display unit that displays a result of the determination by the processing unit.

[0009] With the above configuration, upon reception of an entry of input information by the input unit, the processing unit accesses the storage unit to acquire characteristic value information corresponding to the input information. Then, the processing unit causes the display unit to display a result of determination of whether or not a value of the acquired characteristic value information falls within a predetermined proper range. Consequently, the packaging box manufacturing assistance apparatus according to the present invention can present useful information regarding whether or not specs on the blank and specs on the manufacturing apparatus match each other to a user. Therefore, according to the present invention, when designing a packaging box with a new design, specs of a blank can easily be determined without adjusting folding specs of a manufacturing apparatus through a trial and error process using the actual machine, as opposed to the conventional techniques. Therefore, the packaging box manufacturing assistance apparatus according to the present invention enables reduction in labor and time necessary for development of a new packaging box and thus can contribute to development cost reduction.

[0010] Here, it is possible that: the storage unit stores a database storing the blank spec information, the folding spec information and the characteristic value information in association with one another; and the processing unit extracts from the database the characteristic value information corresponding to the input information entered via the input unit. In this case, for example, it is possible to conduct tests for obtaining a particular dynamic characteristic value of a blank under various blank specs and folding specs and store results of the tests, the blank

specs and the folding specs in association with one another in a database. This enables the database to be updated each time a result of a test for obtaining a particular dynamic characteristic value of a blank is obtained, and such update of the database enables gradual enhancement in accuracy of determination made by the processing unit.

[0011] Also, it is possible that if the processing unit determines that the value of the characteristic value information extracted from the database does not fall within the predetermined proper range, the processing unit extracts a record in which specs are partly same as those in the input information and a value of the characteristic value information fall within the predetermined proper range, from the blank spec information and the folding spec information stored in the database, extracts a spec that is different from that in the input information from information included in the extracted record and causes the display unit to display the extracted spec as spec change candidate information. With such configuration, even if it is determined that the value of characteristic value information extracted from the database based on the input information falls beyond the proper range, information regarding a spec change necessary for making the particular dynamic characteristic value of the blank fall within the proper range can be presented.

[0012] Here, it is possible that the particular dynamic characteristic value is a value of a repelling force generated as a result of the blank repelling when the blank is pressed against a folding member on the manufacturing apparatus and is thereby caused to be folded.

[0013] Also, it is possible that the blank spec information includes at least one piece of spec information from among specs relating to a thickness, a material, a paper grain direction, a fold line, and surface processing of the blank.

[0014] Also, it is possible that the folding spec information includes information relating to either one of a folding speed for the manufacturing apparatus folding the blank and a shape of a folding member that is to be pressed against the blank and fold the blank.

[0015] Also, the present invention can be regarded as a packaging box manufacturing assistance method to be executed by a computer that assists in manufacture of a packaging box shaped by sequentially folding a blank using a manufacturing apparatus. In other words, the present invention provides a packaging box manufacturing assistance method to be executed by a computer that assists in manufacture of a packaging box shaped by sequentially folding a blank using a manufacturing apparatus, the method including: storing, in a storage unit of the computer, blank spec information relating to specs of the blank, folding spec information relating to folding specs on the manufacturing apparatus that folds the blank, and characteristic value information relating to a particular dynamic characteristic value of the blank in association with one another; upon reception of an entry of input information including at least the blank spec infor-

mation, accessing the storage unit and acquiring the characteristic value information corresponding to the entered input information and determining whether or not a value of the acquired characteristic value information falls within a predetermined proper range; and displaying a result of the determination on a display unit of the computer. Otherwise, the present invention can be regarded as a program to be executed by a computer that assists in manufacture of a packaging box shaped by folding a blank using a manufacturing apparatus or a computer-readable recording medium with the program recorded thereon.

[0016] Any possible combination of the measures for achieving the object of the present invention can be employed.

Advantageous Effects of Invention

[0017] The present invention enables provision of a packaging box manufacturing assistance apparatus and a packaging box manufacturing assistance method that can, when shaping a packaging box by sequentially folding a blank using a manufacturing apparatus, present information regarding whether or not specs on the blank and specs on the manufacturing apparatus match each other.

Brief Description of Drawings

[0018]

[Fig. 1] Fig. 1 is a diagram illustrating a system configuration of a manufacturing system according to an embodiment.

[Fig. 2] Fig. 2 is a diagram illustrating an example of a cigarette package manufactured by a manufacturing apparatus according to the embodiment.

[Fig. 3] Fig. 3 is a diagram illustrating an example of a package blank to be shaped into a cigarette package.

[Fig. 4A] Fig. 4A is a diagram illustrating an example of a folding mechanism of a folding and shaping unit in the manufacturing apparatus.

[Fig. 4B] Fig. 4B is a diagram illustrating an example of a folding mechanism of a folding and shaping unit in the manufacturing apparatus.

[Fig. 5] Fig. 5 is a diagram illustrating a variation of folding guides employed in the manufacturing apparatus according to the embodiment.

[Fig. 6] Fig. 6 is a diagram illustrating a variation of a cigarette package manufactured by the manufacturing apparatus according to the embodiment.

[Fig. 7] Fig. 7 is a diagram illustrating an example of a package blank to be shaped into a cigarette package.

[Fig. 8] Fig. 8 is a diagram of a hardware configuration of a manufacturing assistance apparatus according to the embodiment.

[Fig. 9] Fig. 9 is a diagram illustrating an example of a repelling force database stored in the manufacturing assistance apparatus according to the embodiment.

[Fig. 10] Fig. 10 is a diagram illustrating a schematic configuration of a testing apparatus according to the embodiment.

[Fig. 11] Fig. 11 is a flowchart illustrating an example of a flow of processing performed by a processor in the manufacturing assistance apparatus.

[Fig. 12] Fig. 12 is a diagram illustrating an example of an input screen on a display device (part 1).

[Fig. 13] Fig. 13 is a diagram illustrating an example of the input screen on the display device (part 2).

[Fig. 14] Fig. 14 is a diagram illustrating an example of an acceptance screen on the display device.

[Fig. 15] Fig. 15 is a diagram illustrating an example of a rejection screen on the display device.

[Fig. 16] Fig. 16 is a second flowchart illustrating a content of processing performed by a processor in the manufacturing assistance apparatus (part 1).

[Fig. 17] Fig. 17 is a second flowchart illustrating a content of processing performed by the processor in the manufacturing assistance apparatus (part 2).

[Fig. 18] Fig. 18 is a diagram illustrating an example of a rejection screen on a display device.

[Fig. 19] Fig. 19 is a diagram illustrating an example of a spec change candidate presentation screen on the display device.

Description of Embodiments

[0019] An embodiment of the invention will be described below with reference to the drawings.

<Embodiment>

[0020] Fig. 1 is a diagram illustrating a diagram illustrating a system configuration of a manufacturing system 1 according to an embodiment. The manufacturing system 1 includes, e.g., a manufacturing assistance apparatus 100, a testing apparatus 200 and a manufacturing apparatus 300. The manufacturing apparatus 300 is a packaging machine that sequentially folds a blank to shape the blank into a packaging box.

[0021] In the present embodiment, the manufacturing apparatus 300 manufactures a cigarette package 10, which is illustrated in Fig. 2, as an example of the packaging box. The cigarette package 10 illustrated in Fig. 2 is a hinge lid-equipped box-type hard package. Since a structure of this type of cigarette package is publicly known, only a brief description thereof will be provided: the cigarette package 10 illustrated in Fig. 2 includes a package body 20 that can hold, for example, twenty cigarette products, and an upper end of the package body 20 is opened as an opening through a cigarette product being taken out. Also, a lid 40 is integrally joined to a rear opening edge of the package body 20 via a self-hinge

30, and the lid 40 can open/close the upper end opening of the package body 20 by means of pivoting around the self-hinge 30. An inner frame 50 is laid on and attached to an inner surface of the package body 20, and when the lid 40 is closed from the position indicated in Fig. 2, the lid 40 is put over the inner frame 50, that is, put on an end of the opening of the package body 20. Also, in the package body 20, cigarette products are held in the form of an inner pack 60 that encloses the cigarette products in a bundle by means of an inner packaging material. For the inner packaging material that encloses the cigarette products, for example, aluminum-deposited paper is used.

[0022] In the cigarette package 10 illustrated in Fig. 2, the package body 20 and the lid 40 except the inner frame 50 can be formed by a package blank BL, which is illustrated in Fig. 3, and therefore, in the package blank BL, predetermined fold lines (may be referred to as "guide-lines") L and score lines C are provided. Also, for example, an illustrated one surface of the package blank BL is one subjected to laminated printing to provide, e.g., a cigarette brand, and package blanks BL are piled in a hopper (not illustrated) with the respective printed surfaces directed upward. Here, reference numeral R1 indicated in Fig. 3 denotes a part to be shaped into a package body 20 after assembly of the package blank BL, and reference numeral R2 denotes a part to be shaped into a lid 40 after assembly of the package blank BL.

[0023] The manufacturing apparatus 300 illustrated in Fig. 1 includes a folding mechanism for a package blank BL and a control unit 301. The control unit 301 is an information processing device that performs overall control of the manufacturing apparatus 300, and can communicate with the manufacturing assistance apparatus 100. Fig. 3 is a diagram illustrating an example of a package blank BL. Figs. 4A and 4B are diagrams illustrating an example of a folding mechanism 310. The package blank BL is folded along the fold lines L indicated in Fig. 3. For example, the folding mechanism 310 includes a transfer mechanism 320 that transfers the package blank BL, and folding guides 330 disposed adjacent to a path of transfer by the transfer mechanism 320. The white arrow in Fig. 4A indicates a direction of transfer of the package blank BL by the transfer mechanism 320. On the transfer mechanism 320, an inner pack 60 put on an upper portion of the package blank BL is mounted. Here, reference numeral P1 indicated in the figure denotes a back panel for forming, for example, a back surface of the package body 20, and reference numeral F1 denotes a side flap for forming, for example, a side surface of the package body 20. In the example illustrated in Fig. 4A, a fold line L is formed at a boundary between each side flap F1 and the back panel P1. Here, in Fig. 4A, the fold lines L are schematically illustrated.

[0024] Here, a case where each side flap F1 of the package blank BL is a part to be folded and each side flap F1 is folded relative to the back panel P1 will be described. First, in a transfer process of transferring the

inner pack 60 and the package blank BL in the arrow direction in the figure by means of the transfer mechanism 320, each side flap F1 projecting from the relevant side of the back panel P1 is brought into abutment with (sliding contact with) a guide surface 330a of the relevant folding guide 330. Then, as illustrated in Fig. 4B, while the side flaps F1, which are sites to be folded of the package blank BL, being pressed against the guide surfaces 330a of the respective folding guides 330, the package blank BL is transferred together with the inner pack 60, whereby each side flap F1 is folded along the relevant fold line L. In the folding mechanism 310 illustrated in Figs. 4A and 4B, specs are set so as to fold each side flap F1 at right angle to the back panel P1; however, specs can freely be set by changing a shape of the folding guides 330 and/or other folding specs (conditions). For example, Fig. 5 illustrates folding guides 331 of a type that is different from the folding guides 330 illustrated in Fig. 4. The folding guides 331 illustrated in Fig. 5 are different in shape from the folding guides 330 illustrated in Fig. 4. Reference numeral 331a in Fig. 5 denotes a guide surface of each folding guide 331. It should be understood that: the folding guides illustrated in Figs. 4 and 5 are ones indicated as examples; and the folding mechanism 310 of the manufacturing apparatus 300 can arbitrarily employ folding guides of a type that is different from those illustrated in Figs. 4 and 5 as examples. Each of the folding guides 330 and 331 corresponds to a folding member in the present invention.

[0025] As described above, the respective sites to be folded such as flaps of the package blank BL are sequentially folded along the respective fold lines L indicated in Fig. 3. An adhesive (glue) is applied in advance to the relevant parts of the package blank BL that are sequentially folded by the folding mechanism 310, and the folded flaps are bonded to other panels in such a manner that the flaps are laid on the respective other panels. In the package blank BL folded by the folding mechanism 310 of the manufacturing apparatus 300, for example, the adhesive is cured in the course of transport to the following process, whereby shaping of the cigarette package 10 is completed.

[0026] Although in Fig. 2, as an example of a cigarette package manufactured by the manufacturing apparatus 300, a hinge-lid-equipped box-type hard package is illustrated, the manufacturing apparatus 300 can manufacture various packaging boxes. For example, a tongue-lid-type cigarette package 10 such as illustrated in Fig. 6 may be manufactured by the manufacturing apparatus 300. The tongue-lid-type cigarette package 10 illustrated in Fig. 6 includes a package body 20A that holds cigarette products and a tongue-lid 40A that opens/closes an opening end of the package body 20A. In the illustrated example, inside the package body 20A, cigarette products are held in the form of an inner pack 60 that encloses the cigarette products in a bundle by means of an inner packaging material. In a front wall of the package body 20A, a cut 21 that allows a tip portion of the tongue-lid

40A to be inserted thereto is provided. Also, Fig. 7 illustrates a package blank BL' to be shaped into the tongue-lid-type cigarette package 10 illustrated in Fig. 6. In the package blank BL illustrated in Fig. 7, also, predetermined fold lines (guidelines) L and score lines C are provided. Here, reference numeral R1 indicated in Fig. 7 denotes a part to be shaped into a package body 20A after assembly of the package blank BL, and reference numeral R2 denotes a part to be shaped into the tongue-lid 40A after assembly of the package blank BL. Respective sites to be folded such as flaps of the package blank BL illustrated Fig. 7 are sequentially folded along the respective fold lines L. An adhesive (glue) is applied in advance to the relevant parts of the package blank BL that are sequentially folded by the folding mechanism 310, and the folded flaps are bonded to other panels in such a manner that the flaps are laid on the respective other panels, and then shaping of the tongue-lid-type cigarette package 10 illustrated in Fig. 6 is completed.

[0027] Next, the manufacturing assistance apparatus 100 in the present embodiment will be described. The manufacturing assistance apparatus 100 is a computer for assisting in manufacture of a cigarette package 10 (packaging box) using the manufacturing apparatus 300. The idea of "assisting in manufacture" referred to herein includes, in addition to folding spec (specification, condition) adjustment such as change in spec of the folding guides 330 and folding speed adjustment in the manufacturing apparatus 300, the idea of assisting in designing a package blank BL in terms of various specs.

[0028] Fig. 8 is a diagram of a hardware configuration of the manufacturing assistance apparatus 100 according to the present embodiment. The manufacturing assistance apparatus 100 is a general-purpose computer including, e.g., a processor 110, a main storage device 120, a communication interface 130, a display device 140, an input/output interface 150, an auxiliary storage device 160 and a removable recording medium drive device 170, and a bus 180 that interconnect these components.

[0029] The processor 110 is, for example, a CPU (central processing unit). The processor 110 executes a program (also referred to as "software" or "application") and thereby performs, e.g., processing relating to the present embodiment. The main storage device 120 caches a program or data read by the processor 110 and provides a working area for the processor 110. More specifically, the main storage device 120 is, e.g., a RAM (random access memory) or a ROM (read-only memory).

[0030] The auxiliary storage device 160 stores programs to be executed by the processor 110 and various types of data to be used by the processor 110. For example, a database (data table) and the like to be used in the present embodiment are stored in the auxiliary storage device 160. More specifically, the auxiliary storage device 160 is, e.g., a HDD (hard-disk drive) or an SSD (solid-state drive), or a flash memory. The removable recording medium drive device 170 drives a removable re-

cording medium 190 and inputs/outputs data to/from the removable recording medium 190 according to a signal from the processor 110. The programs to be executed by the processor 110 and/or the aforementioned database and the like may be stored on the removable recording medium 190. The removable recording medium 190 is, for example, a recording medium such as a USB (universal serial bus) flash memory, a CD (compact disc) or a DVD (digital versatile disc).

[0031] The communication interface 130 is an interface via which data is transmitted/received to/from another apparatus. The communication interface 130 is, for example, a wired or wireless network card or the like. The display device 140 is, for example, a CRT (cathode ray tube), a liquid-crystal display, a plasma display, an organic EL (electroluminescence) display or the like. The input/output interface 150 is connected to an input/output device, and receives an input from a user and outputs information to the user. More specifically, the input/output device includes, e.g., pointing devices 151 such as a keyboard and a mouse, the display device 140 and the testing apparatus 200. In the present embodiment, the input/output interface 150 of the manufacturing assistance apparatus 100 is connected to the testing apparatus 200 via a USB cable. However, the manufacturing assistance apparatus 100 may communicate with the testing apparatus 200 via a network.

[0032] In the manufacturing assistance apparatus 100, the components illustrated in Fig. 5 are interconnected via the bus 180. Here, a plurality of each of the components may be provided or some of the components (for example, the removable recording medium drive device 170) may be omitted. Also, the aforementioned input/output device may be integrated with the computer.

[0033] Here, in a folding process of folding a package blank BL, a magnitude of a repelling force of the package blank BL generated when a site to be folded of the package blank BL is pressed against the relevant folding guide 330 and thereby folded varies depending on, e.g., various specs of the package blank BL and/or the folding specs on the manufacturing apparatus 300. The repelling force of the package blank BL can be regarded as a restoring force that urges the cigarette blank BL folded by the folding guide 330 to return to a shape before the folding (hereinafter also referred to as "original shape"). Then, if a repelling force (restoring force) generated (exerted) when a cigarette blank BL is folded is large, the repelling force may affect the product quality of the resulting shaped cigarette package 10.

[0034] For example, referring to the example illustrated in Figs. 4A and 4B, a case where side flaps F1 are folded relative to a back panel P1 included in a package blank BL along respective fold lines L and the side flaps F1 are bonded to respective other panel portions (for example, side panels forming side surfaces of the shaped cigarette package 10 jointly with the side flaps F1) will be considered. In this case, where a repelling force (restoring force) of each side flap F1 generated where the side flap F1 is

folded relative to the back panel P1 is large, even if the side flap F1 is bonded to the relevant other panel, the side flap F1 and the other panel may be separated from each other by the repelling force of the side flap F1 before curing of an adhesive or bonding surfaces thereof may be displaced from each other.

[0035] When a cigarette package with a new design (specs) is designed, specs of a package blank BL are determined so as to conform to the cigarette package. In other words, specs of the package blank BL such as materials used for the package blank BL, a thickness and specs (for example, a width, a line count, etc.) for fold lines L and a surface processing type are designed so as to conform to the design (specs) of the cigarette package. However, if specs of the package blank BL are changed, unless folding specs on the manufacturing apparatus 300 such as the shape of the folding guides 330 or a folding speed for folding a package blank BL on the manufacturing apparatus 300 are adjusted, the repelling force (restoring force) generated when the cigarette blank BL is folded may fall beyond a proper range. Conventionally, each time specs of a package blank BL are changed, it is actually inevitable to adjust the folding specs on the manufacturing apparatus (packaging machine) through a trial-and-error process, requiring a huge amount of time and labor. Also, if adjustment of the folding specs on the manufacturing apparatus (packaging machine) is difficult, the specs of the package blank BL may inevitably be changed so as to comply with the mechanical properties of the apparatus.

[0036] Therefore, in the manufacturing system 1 according to the present embodiment, when manufacturing a cigarette package 10 with a new design (specs), information regarding whether or not matching between the specs of a newly-designed package blank BL and folding specs on the manufacturing apparatus 300 is proper, that is, information regarding whether or not a repelling force (restoring force) of the package blank BL generated when the cigarette blank BL is folded by the folding and shaping unit 310 of the manufacturing apparatus 300 falls within a proper range is presented to an operator by means of the manufacturing assistance apparatus 100. Details of the manufacturing assistance by the manufacturing assistance apparatus 100 will be described below.

[0037] In the auxiliary storage device 160 in the manufacturing assistance apparatus 100, a repelling force database DB, which is illustrated in Fig. 9, is stored. The repelling force database DB stores blank spec information relating to specs of package blanks BL (sites to be folded), folding spec information relating to folding specs (conditions) on the manufacturing apparatus 300 and repelling forces of the package blanks BL (characteristic value information relating to particular dynamic characteristic values) in association with one another. In other words, the repelling force database DB determines a correspondence relationship among blank spec information, folding spec information and a repelling force of each package blank BL generated when the package blank

BL is folded.

[0038] In the repelling force database DB, as the blank spec information, information relating to a material, a thickness, surface specs, a paper grain direction, fold lines (widths and count of fold lines) of each package blank BL is stored. Also, as the folding spec information, information relating to a folding speed of the manufacturing apparatus 300 and a shape of the folding guides 330 (guide shape) is stored. Examples of the material of the package blank BL can include, e.g., paper, plastic and paper with aluminum foil. Also, examples of the surface specs of the package blank BL can include, e.g., no surface processed, printed and vanished. Also, the paper grain of the package blank BL means grain of fibers, and examples of the paper grain include long grain and short grain. As paper grain directions stored in the repelling force database DB, information regarding whether a paper grain direction of each site to be folded in the package blank BL is in parallel to or crosses the relevant fold line L is stored.

[0039] In the manufacturing system 1 according to the present embodiment, a test of folding a testing piece imitating a part or whole of a package blank BL under various conditions can be conducted using the testing apparatus 200. The repelling forces (bending strengths) of the testing pieces obtained as a result of the folding test are associated with blank spec information and folding spec information and are added in the repelling force database DB as new records.

[0040] Fig. 10 is a diagram illustrating a schematic configuration of the testing apparatus 200 according to the embodiment. The testing apparatus 200 includes, e.g., a controller 210, a linear slider 220, a folding guide member 230, a testing piece securing unit 240 and a control panel 250. The controller 210 is a computer that controls overall operation of the testing apparatus 200, and includes a CPU and a memory. The controller 210 is connected to the input/output interface 150 of the manufacturing assistance apparatus 100 via, for example, a USB cable, enabling communication between both apparatuses.

[0041] The linear slider 220 includes two linear rails 221 extending in parallel to each other at an upper surface thereof, and a first drive plate 222 and a second drive plate 223 that are linearly driven along the respective rails 221. The linear slider 220 includes a drive motor (not illustrated) that drives the first drive plate 222 and the second drive plate 223 along a direction of the extension of the rails 221. On the first drive plate 222 and the second drive plate 223, a first support pillar member 224 and a second support pillar member 225 are provided, respectively, in an erected manner, and the folding guide member 230 is secured to the first support pillar member 224 and the second support pillar member 225 so as to be bridged therebetween. Here, the first support pillar member 224 is secured to the first drive plate 222. On the other hand, the second support pillar member 225 can move relative to the second drive plate 223 in a di-

rection X perpendicular to the direction of the extension of the rails 221 of the linear slider 220. Also, the second support pillar member 225 can be extended/retracted relative to the first drive plate 222 in a height direction Y.

[0042] The folding guide member 230 is detachably attached to the first support pillar member 224 and the second support pillar member 225 of the linear slider 220. More specifically, the folding guide member 230 includes a rod-like guide portion 231, a first arm portion 232 provided at a front end of the guide portion 231, and a second arm portion 233 provided at a rear end of the guide portion 231. The first arm portion 232 is attached to the first support pillar member 224, and the second arm portion 233 is attached to the second support pillar member 225. Also, a load cell 260 is attached to the folding guide member 230. As described later, when a test of folding a testing piece TP imitating a part or whole of a package blank BL is conducted, the load cell 260 measures a repelling force (bending strength) of the testing piece.

[0043] The testing apparatus 200 include the testing piece securing unit 240 for fixedly supporting the testing piece TP. The testing piece securing unit 240 includes a clamp unit 241 that can secure the testing piece TP by pinching the testing piece TP. The clamp unit 241 can secure the testing piece TP with fine adjustment made of a fold line position in the testing piece TP. Also, the testing piece securing unit 240 may change a position thereof relative to the linear slider 220. The control panel 250 includes a start switch and an emergency stop switch, which are used when driving the first drive plate 222 and the second drive plate 223 to slide along the rails 221 of the linear slider 220 in a test of folding the testing piece TP. Upon the start switch being pressed by an operator, the folding guide member 230 integrated with the first drive plate 222 and the second drive plate 223 slides in a travelling direction A in the figure.

[0044] Next, a content of operation in a folding test using the testing apparatus 200 will be described. A testing piece TP is pinched and secured by the clamp unit 241 with a printed surface of the testing piece TP as a lower surface and a surface provided with a fold line L as an upper surface. Here, a position where the first arm portion 232 is supported by the first support pillar member 224 is adjusted so that the front end of the guide portion 231 is lower than the testing piece TP secured to the testing piece securing unit 240 (clamp unit 241). On the other hand, a position where the second arm portion 233 is supported by the second support pillar member 225 is adjusted so that the rear end of the guide portion 231 is higher than the testing piece TP secured to the testing piece securing unit 240 (clamp unit 241). After setting of the position of the guide portion 231 at a slant (elevation angle), an operator depresses the start switch on the control panel 250. Upon the depression of the start switch on the control panel 250, the first drive plate 222 and the second drive plate 223 are driven to slide along the rails 221 of the linear slider 220 in the direction A, and the folding guide member 230 also slides in the direction A

at a predetermined set speed.

[0045] As described above, the guide portion 231 of the folding guide member 230 slides in the slant position of the front end side being lower than the testing piece TP and the rear end side being higher than the testing piece TP, and thus, in the course of the folding guide member 230 sliding, the guide portion 231 collides with the testing piece TP and the testing piece TP pressed against the guide portion 231 gradually rises along the fold line. Simultaneously with such folding of the testing piece TP, a repelling force (bending strength) of the testing piece TP during or after the folding process is measured by the load cell 260. The load cell 260 and the controller 210 are communicably connected so that an output result from the load cell 260 is input to the controller 210. Since the manufacturing assistance apparatus 100 is communicably connected to the controller 210 in the testing apparatus 200, the manufacturing assistance apparatus 100 acquires the repelling force (bending strength) of the testing piece TP as a result of the test of folding the testing piece TP using the testing apparatus 200.

[0046] Here, when the test of folding the testing piece TP is conducted in the testing apparatus 200, the processor 110 in the manufacturing assistance apparatus 100 causes an input screen that receives an entry of blank specs and folding specs for the testing piece TP to be displayed on the display device 140. An operator (user) can input the blank specs and the folding specs for the testing piece TP via the input screen by operating the pointing devices 151 such as the keyboard and/or the mouse. Upon acquisition of data relating to the result of the test of folding the testing piece TP from the testing apparatus 200, the manufacturing assistance apparatus 100 store the acquired repelling force of the testing piece TP, and the blank specs and the folding specs for the testing piece TP in association with one another in the repelling force database DB stored in the auxiliary storage device 160, whereby the record is added. As described above, each time a test of folding a testing piece TP using the testing apparatus 200 is conducted, the manufacturing assistance apparatus 100 can update the repelling force database DB based on a test result acquired from the testing apparatus 200. Here, respective items of blank spec information and folding spec information stored in the repelling force database DB, which are illustrated in Fig. 9, are ones indicated as examples, and the types and the count of the items can arbitrarily be changed. For example, the blank spec information may include at least one piece of information from among specs relating to a thickness, a material and a paper grain direction of the blank, specs relating to fold lines and specs relating to surface processing. Also, the folding spec information may include information relating to at least either of a folding speed of the manufacturing apparatus folding a blank and a shape of folding members that are to be pressed against and fold the blank. Also, if blank specs and folding specs corresponding to a result of a test of a testing piece TP, the result being acquired

by the manufacturing assistance apparatus 100 from the testing apparatus 200, include a new item not stored in the current repelling force database DB, the new item may be added in the repelling force database DB.

[0047] Next, a content of processing performed by the processor 110 in the manufacturing assistance apparatus 100 will be described in detail. Fig. 11 is a flowchart illustrating a content of processing performed by the processor 110 in the manufacturing assistance apparatus 100. The processing flow illustrated in Fig. 11 is started with reception by the manufacturing assistance apparatus 100 of an instruction to start execution of a program for performing the respective processing steps in the processing flow as a trigger.

[0048] Upon start of execution of the processing flow illustrated in Fig. 11, the processor 110 causes the display device 140 to display the input screen in step S101 (see Figs. 12 and 13). The display device 140 receives an entry of blank spec information relating to a package blank BL and folding spec information relating to the manufacturing apparatus 300. An operator (user) can enter the blank spec information and the folding spec information via the input screen by operating the pointing devices 151 such as the keyboard and/or the mouse. In the present embodiment, the pointing devices 151 such as the keyboard and the mouse correspond to an input unit. The display device 140 receives the entry of, for example, the blank specs such as 'material', 'thickness', 'surface spec', 'paper grain direction', 'fold line width', 'fold line count' of the package blank BL and folding specs such as 'folding speed' and 'guide shape' in the manufacturing apparatus 300 via the input screen illustrated in Fig. 12.

[0049] Here, for the 'material', 'surface spec', 'paper grain direction', 'folding speed' and 'guide shape' for the package blank BL (sites to be folded), it is possible that: a plurality of selection candidate lists are displayed in the form of a drop-down list on the screen; and an item may be selected from each of the selection candidate lists (see Fig. 13). For example, for the 'material' of the package blank BL, e.g., "paper", "plastic" and "paper with aluminum foil" may be displayed on a selection candidate list on the input screen. Also, for the 'surface spec', for example, e.g., "no surface processed", "printed" and "vanished" may be displayed on a selection candidate list on the input screen. Also, for the 'paper grain direction', for example, e.g., "parallel" and "cross" may be displayed on a selection candidate list on the input screen. Also, for the 'folding speed', for example, "low speed", "medium speed" and "high speed" may be displayed on a selection candidate list on the input screen. Also, for the 'guide shape', for example, "shape A", "shape B" and "shape C" may be displayed on a selection candidate list on the input screen. However, these selection candidates are indicated as examples, and the content of each selection candidate list is not limited to the content of the example. Also, input of spec information may be made by means of a direct input to each input item, not using a drop-down list format.

[0050] Here, on the input screen illustrated in Figs. 12 and 13, an "OK button B1" is displayed. Upon detection of the OK button B1 being pressed, the processor 110 determines that the entry of the blank spec information and the folding spec information is received via the input screen on the display device 140. Here, the operator can press the OK button B1 after entering input information by operating the pointing devices 151 such as the keyboard and the mouse. In step S102, the processor 110 determines whether or not the OK button B1 on the display screen of the display device 140 is pressed. In step S102, if it is determined that the OK button B1 is pressed, the processor 110 proceeds to step S103, and if not, determination of whether or not the OK button B1 is pressed is made again after a lapse of a predetermined period of time.

[0051] In step S103, the processor 110 acquires the input information entered from the input screen of the display device 140 by operation of the pointing devices 151 such as the keyboard and the mouse. More specifically, the processor 110 accesses, e.g., the RAM of the main storage device 120, which temporarily stores the input information entered via the input screen, to acquire the input information.

[0052] Next, the processor 110 proceeds to step S104 and accesses the repelling force database DB stored in the auxiliary storage device 160. Then, the processor 110 extracts a repelling force (characteristic value information) of a package blank BL, the repelling force corresponding to the input information entered via the input/output device. Next, the processor 110 in the manufacturing assistance apparatus 100 proceeds to step S105 and determines whether or not a value of the repelling force (characteristic value information) of the package blank BL extracted from the repelling force database DB falls within a predetermined proper range.

[0053] Here, the repelling force of the package blank BL is a repelling force of the package blank BL pressed against and folded by the folding guides 330 of the manufacturing apparatus 300. In the present embodiment, a proper range of a repelling force of the package blank BL generated when the package blank BL is folded is favorably determined in advance based on empirical rules from, e.g., experiments. In the present embodiment, a proper range of a repelling force (N) of a package blank BL is set as a range of 0.2 to 0.8 (N) as an example; however, this range can arbitrarily be varied. Also, an input of an upper limit value and a lower limit value that determine the proper range of the repelling force may be entered via the input screen illustrated in Fig. 12.

[0054] In step S105, if it is determined that the value of the repelling force of the package blank BL extracted from the database DB falls within the predetermined proper range, the processor 110 proceeds to step S106, and if not, the processor 110 proceeds to step S107. For example, in the present embodiment, since the proper range of the repelling force of the package blank BL is set as 0.2 to 0.8 (N), if the value of the repelling force of

the package blank BL extracted from the repelling force database DB is less than 0.2 (N) or more than 0.8 (N), it is determined that the value of the repelling force of the package blank BL does not fall within the proper range, and if not, it is determined that the value of the repelling force falls within the proper range. In step S106, the processor 110 causes the display device 140 to display an acceptance screen (see Fig. 14). Here, in step S105, it is determined that the value of the repelling force of the package blank BL falls within the predetermined proper range, and thus, a determination result of "acceptance" is displayed on the acceptance screen. Also, on the acceptance screen, together with the result of determination of acceptance or rejection for the repelling force of the package blank BL, the repelling force of the package blank BL and the proper repelling force range are displayed. Furthermore, on the acceptance screen illustrated in Fig. 14, a "return bottom B2" and an "end bottom B3" are displayed.

[0055] Also, in step S107, the processor 110 causes the display device 140 to display a rejection screen (see Fig. 15). Here, in the step S105, it is determined that the value of the repelling force of the package blank BL does not fall within

(falls beyond) the predetermined proper range, and thus, a determination result of "rejection" is displayed on the rejection screen. Also, on the rejection screen, together with the result of determination of acceptance or rejection for the repelling force of the package blank BL, the value of the repelling force of the package blank BL and the proper repelling force range is displayed, which is similar to the acceptance screen illustrated in Fig. 14. Also, as illustrated in Fig. 15, on the rejection screen, also, a "return bottom B2" and an "end bottom B3" are displayed as with the acceptance screen.

[0057] After the processor 110 causing the display device 140 to display the acceptance screen in step S106 or causing the display device 140 to display the rejection screen in step S107, the processor 110 proceeds to step S108. In step S108, the processor 110 determines whether or not the "return bottom B2" is pressed by operation of the pointing device 151 such as the keyboard or the mouse by the operator. Upon detection of the "return bottom B2" being pressed, with the press as a trigger, the processor 110 causes the display device 140 to receive an entry of blank specs and folding specs. Therefore, in step S108, if it is determined that the "return bottom B2" is pressed, the processor 110 returns to step S101 and causes the display device 140 to display the input screen (see Fig. 12). In this case, the operator can re-enter blank spec information and folding spec information via the input screen. If new specs are re-entered via the input screen, whether or not a value of a repelling force of the package blank BL falls within the predetermined proper range is determined based on the re-entered input information, and a result of the determination is output and displayed on the screen of the display device 140.

[0058] On the other hand, in step S108, if it is determined that the "return bottom B2" is not pressed, the processor 110 proceeds to step S109. In step S109, the processor 110 determines whether or not the "end bottom B3" is pressed. The "end bottom B3" is a button that serves as a trigger for terminating the program relating to the processing flow illustrated in Fig. 11. In this step, if it is determined that the "end bottom B3" is not pressed, the processor 110 returns to step S108. Also, in this step, if it is determined that the end bottom B3 is pressed, the processor 110 terminates execution of the program for performing the respective processing steps of the current processing flow.

[0059] As described above, the processor 110 (corresponding to a processing unit according to the present invention) in the manufacturing assistance apparatus 100 accesses the repelling force database DB stored in the auxiliary storage device 160 and extracts a value of a repelling force of a package blank BL that is characteristic value information corresponding to input information entered via the input screen of the display device 140 by operating the pointing devices 151 such as the keyboard and the mouse. Then, the processor 110 determines whether or not a magnitude of the repelling force of the package blank BL extracted from the repelling force database DB falls within a predetermined proper range, and a result of the determination is output and displayed on the display device 140. Therefore, the manufacturing assistance apparatus 100 according to the present embodiment enables provision of information regarding whether or not specs of a package blank BL and mechanical specs of the manufacturing apparatus 300 match each other, more specifically, useful information that is effective for determination of whether or not a particular dynamic characteristic value of a package blank BL obtained when the package blank BL is folded falls within a predetermined proper range to a user. Consequently, when a user that uses the manufacturing assistance apparatus 100 designs a cigarette package 10 with a new design, the user can easily determine specs of a package blank BL without adjustment of folding specs of a manufacturing apparatus (packaging machine) through a trial-and-error process using the actual machine, as opposed to the conventional techniques. Accordingly, in development of a new cigarette package 10, the manufacturing assistance apparatus 100 according to the present embodiment enables reduction in labor and time necessary for the development and thus can contribute to development cost reduction.

<Alteration>

[0060] Next, an alteration of the manufacturing assistance apparatus 100 according to the present embodiment will be described. A hardware configuration of the manufacturing assistance apparatus 100 according to the present alteration is similar to the hardware configuration illustrated in Fig. 8.

[0061] Figs. 16 and 17 provide a second flowchart illustrating a content of processing performed by a processor 110 in the manufacturing assistance apparatus 100. Steps S101 to S106, S108 and S109 indicated in Fig. 16 are as described with reference to Fig. 11 and thus detailed description thereof will be omitted. In step S207, the processor 110 in the manufacturing assistance apparatus 100 causes the display device 140 to display a rejection screen such as illustrated in Fig. 18. The rejection screen illustrated in Fig. 18 is different from the rejection screen illustrated in Fig. 15 in that a "design change candidate button B4" is additionally displayed (simply indicated as "candidates" in Fig. 18). The design change candidate button B4 illustrated in Fig. 18 is a button that serves as a trigger for starting processing for changing folding specs for making a value of a repelling force of a package blank BL fall within a predetermined proper range or processing for presenting candidates for changing specs of the package blank BL.

[0062] Upon end of processing in step S207, the processor 110 in the manufacturing assistance apparatus 100 proceeds to step S210. In step S210, the processor 110 determines whether or not the design change candidate button B4 is pressed by operation of the pointing device 151 such as a keyboard or a mouse. In this step, if it is determined that the design change candidate button B4 is not pressed, the processor 110 proceeds to step S108. A content of processing in step S108 is as described above. On the other hand, in step S210, if it is determined that the design change candidate button B4 is pressed, the processor 110 proceeds to step S211 indicated in Fig. 17.

[0063] In step S211, the processor 110 accesses a repelling force database DB. Then, the processor 110 extracts records in which specs are partly same as those in the input information acquired in step S103 and a value of a repelling force (characteristic value information) of the package blank BL falls within a predetermined proper range (hereinafter referred to as "partly-same spec records"), from the blank spec information and the folding spec information stored in the repelling force database DB.

[0064] Here, referring to the rejection screen illustrated in Fig. 18, it can be seen that when the processor 110 acquires the input information in step S103 of this processing flow, blank spec information such as the material of the package blank BL "plastic", the thickness "0.4 (mm)", the surface spec "vanished", the paper grain direction "cross", the fold line width "0.1 (mm)" and the fold line count "1", and folding spec information such as the folding speed "high speed" and the guide shape "shape B" are acquired.

[0065] Here, in the repelling force database DB illustrated in Fig. 9, a record of record number 4 is the same as the input information acquired by the processor 110 in terms of the respective specs included in the blank spec information and is different from the input information in terms of the respective specs included in the fold-

ing spec information. Also, a record of record number 5 is the same as the input information acquired by the processor 110 in terms of "surface spec", "fold line width" and "fold line count" included in the blank spec information and the respective specs (folding speed and guide shape) included in the folding spec information, and is different from the input information in terms of "blank material", "blank thickness" and "paper grain direction" included in the blank spec information. Also, in the record of record number 5, specs that are the same as the input information acquired by the processor 110 are the "paper grain direction", the "fold line width" and the "fold line count" included in the blank spec information and the "guide shape" included in the folding spec information, and specs that are different from the input information are the "blank material", the "blank thickness" and the "surface spec" included in the blank spec information and the "folding speed" included in the folding spec information.

[0066] Therefore, taking the repelling force database DB illustrated in Fig. 9 as an example, in step S211, the processor 110 extracts respective records of record numbers 4 to 6 as partly-same spec records from the records stored in the repelling force database DB. This is because, as described above, each of the records of record numbers 4 to 6 fit into a record in which specs are partly the same as the input information acquired in step S103 and a value of a repelling force (characteristic value information) of the package blank BL falls within the predetermined proper range (partly-same spec record).

[0067] Next, in step S212, the processor 110 extracts pieces of spec information that are different from those in the input information from pieces of spec information included in the partly-same spec records extracted from the repelling force database DB and causes the display device 140 to display the extracted specs as spec change candidate information. In step S211, the processor 110 causes the display device 140 to display, for example, a spec change candidate presentation screen such as illustrated in Fig. 19. The spec change candidate presentation screen illustrated in Fig. 19 indicates spec change candidate information obtained when the record of record number 4 is extracted as a partly-same spec record from among the records stored in the repelling force database DB illustrated in Fig. 9. Here, the spec change candidate information is information indicating candidates relating to changes of blank specs and/or folding specs of a package blank BL that are necessary for making a repelling force of the package blank BL fall within the proper range. In the screen display example illustrated in Fig. 19, the input information is displayed on the left side of the screen, and the spec change candidate information is displayed in on the right side of the screen. The spec change candidate presentation screen illustrated in Fig. 19 presents change of the "folding speed" spec entered via the input screen (see Fig. 12) from "high speed" to "low speed" and change of the "guide shape" spec from "shape B" to "shape C" as spec change candidate infor-

mation. An operator can understand that the repelling force of the package blank BL can be made to fall within the proper range by changing the blank specs and/or the folding specs according to the change candidate information presented on the spec change candidate presentation screen.

[0068] Here, a "next page button B5" indicated in Fig. 19 is a button displayed where there are a plurality of pieces of spec change candidate information extracted by the processor 110 in step S211, and if the "next page button B5" is pressed, the processor 110 causes the display device 140 to display a next piece of spec change candidate information. For example, if the "next page button B5" is pressed via the spec change candidate presentation screen illustrated in Fig. 19, a piece of spec change candidate information obtained when a record of record number 5 or 6 is extracted as a partly-same spec record may be displayed. In other words, each time the next page button B5 is pressed, pieces of spec change candidate information corresponding to different partly-same spec records may be displayed on the screen of the display device 140. Here, upon end of the processing in step S211, the processor 110 proceeds to the processing in step S108. The contents of processing in steps S108 and S109 are as already described, and detailed description thereof will be omitted.

[0069] As described above, in the processing flow according to the present alteration, even if it is determined that a repelling force of a package blank BL extracted from the repelling force database DB based on input information entered from the input screen illustrated in Fig. 12 fall beyond a proper range, the processing in steps S210 to 212 enables spec change candidate information necessary for making the repelling force of the package blank BL fall within the proper range to be displayed on the screen of the display device 140. Therefore, information that is necessary and useful for making the repelling force of the package blank BL fall within the proper range can be presented to an operator. Consequently, when a new cigarette package 10 is developed, labor and time necessary for the development can be reduced, enabling contribution to development cost reduction.

[0070] Although a preferable embodiment of the present invention and an alteration have been described above, a manufacturing assistance apparatus according to the present invention is not limited to these embodiment and alternation and can include a combination of these embodiment and alternation as long as such combination is possible. Also, arbitrary change can be made to the embodiment and the alteration as long as such change does not depart from the spirit of the present invention. For example, although the present embodiment has been described taking a repelling force of a package blank BL exerted when the package blank BL is folded as an example of a particular dynamic characteristic value of the package blank BL, the present invention is not limited to this case. For example, as an example of a particular dynamic characteristic value of a package

blank BL, a friction coefficient of the package blank BL can be employed. If a friction coefficient of a package blank BL falls beyond a proper range, such friction coefficient may adversely affect the product quality of the resulting shaped cigarette package 10. For example, in a process of folding a package blank BL in the manufacturing apparatus 300, the package blank BL is transported in such a manner that the package blank BL is pinched between transport rollers that are rotating. However, if a friction coefficient of the package blank BL is excessively large, a surface of the package blank BL may be damaged when the package blank BL is pinched by the transport rollers. Therefore, the manufacturing assistance apparatus 100 may store a database storing blank spec information relating to package blanks BL, folding spec information relating to the manufacturing apparatus 300 and friction coefficients of the package blanks BL in association with one another in the auxiliary storage device 160, and upon reception of an entry of input information, extract a friction coefficient of a package blank BL corresponding to the input information from the database and determine whether or not the extracted friction coefficient falls within a proper range, and cause the display device 140 to display a result of the determination. Consequently, useful information that contributes to determination of whether or not specs of the package blank BL and mechanical specs of the manufacturing apparatus 300 match each other can be provided to a user.

[0071] Also, although in the present embodiment, a database storing blank spec information relating to package blanks BL, folding spec information relating to the manufacturing apparatus 300 and characteristic value information relating to particular dynamic characteristic values of the package blanks BL in association with one another is stored in the auxiliary storage device 160, which is an example of a storage unit, the present invention is not limited to this case. For example, instead of extracting characteristic value information corresponding to input information from the database, the processor 110 in the manufacturing assistance apparatus 100 may execute a program that is based on a predetermined algorithm and calculate a particular dynamic characteristic value (e.g., a repelling force or a friction coefficient) of a package blank BL according to the algorithm to acquire the particular dynamic characteristic value. However, as described in the present embodiment, storing a database storing blank spec information, folding spec information and characteristic value information in association with one another in the auxiliary storage device 160 provides the advantage of each time a result of a test of a testing piece TP is obtained from the testing apparatus 200, being able to update the database. Update of the database as described above enables gradual enhancement in accuracy of determination of whether or not a particular dynamic characteristic value of a package blank BL falls within a proper range.

[0072] Also, although the present embodiment has been described taking a cigarette package as an exam-

ple of a packaging box shaped from a blank, the present invention is not limited to this case, and the manufacturing assistance apparatus and manufacturing assistance method according to the present embodiment can be employed when manufacturing any of various types of packaging boxes.

<Computer-readable recording medium>

[0073] In the present embodiment, a program that causes a computer or another machine or apparatus (hereinafter, "computer or the like") to perform the contents of processing in the processing flows illustrated in, e.g., Figs. 11, 16 and 17 can be recorded on a recording medium that can be read by the computer or the like. Then, the computer or the like is made to read and execute the program on the recording medium, enabling provision of a function of the program.

[0074] Here, a recording medium that can be read by the computer or the like refers to a recording medium that stores information such as data or a program by means of an electrical, magnetical, optical, mechanical or chemical action and allows the computer or the like to read the information. Examples of one that can be removed from the computer or the like from among such recording mediums include, e.g., a flexible disk, a magneto-optical disc, a CD-ROM, a CD-R/W, a DVD, a blue-ray disc, a DAT, an 8 mm tape, and a memory card such as a flash memory. Also, examples of a recording medium secured to the computer or the like include, e.g., hard disks and ROMs (read-only memories).

Reference Signs List

[0075]

- 1 ... Manufacturing system
- 10 ... Cigarette package
- DB ... Repelling force database
- 100 ... Manufacturing assistance apparatus
- 110 ... Processor
- 120 ... Main storage device
- 130 ... Communication interface
- 140 ... Display device
- 150 ... Input/output interface
- 160 ... Auxiliary storage device
- 170 ... Removable recording medium drive device
- 180 ... Bus
- 190 ... Removable recording medium
- 200 ... Testing apparatus
- 300 ... Manufacturing apparatus
- 310 ... Folding mechanism
- 320 ... Transfer mechanism
- 330 ... Folding guide

Claims

1. A packaging box manufacturing assistance apparatus for assisting in manufacture of a packaging box shaped by sequentially folding a blank using a manufacturing apparatus, the manufacturing assistance apparatus comprising:
 - a storage unit that stores blank spec information relating to specs of the blank, folding spec information relating to folding specs on the manufacturing apparatus that folds the blank, and characteristic value information relating to a particular dynamic characteristic value of the blank in association with one another;
 - an input unit that receives an entry of input information including at least the blank spec information;
 - a processing unit that accesses the storage unit, acquires the characteristic value information corresponding to the input information entered via the input unit, and determines whether or not a value of the acquired characteristic value information falls within a predetermined proper range; and
 - a display unit that displays a result of the determination by the processing unit.
2. The packaging box manufacturing assistance apparatus according to claim 1, wherein:
 - the storage unit stores a database storing the blank spec information, the folding spec information and the characteristic value information in association with one another; and
 - the processing unit extracts from the database the characteristic value information corresponding to the input information entered via the input unit.
3. The packaging box manufacturing assistance apparatus according to claim 2, wherein if the processing unit determines that the value of the characteristic value information extracted from the database does not fall within the predetermined proper range, the processing unit extracts a record in which specs are partly same as those in the input information and a value of the characteristic value information falls within the predetermined proper range, from the blank spec information and the folding spec information stored in the database, extracts spec information that is different from that in the input information from spec information included in the extracted record and causes the display unit to display the extracted spec information as spec change candidate information.
4. The packaging box manufacturing assistance apparatus according to any one of claims 1 to 3, wherein
 - the particular dynamic characteristic value is a value of a repelling force generated as a result of the blank repelling when the blank is pressed against a folding member on the manufacturing apparatus and is thereby caused to be folded.
5. The packaging box manufacturing assistance apparatus according to any one of claims 1 to 4, wherein the blank spec information includes at least one piece of spec information from among specs relating to a thickness, a material, a paper grain direction, a fold line, and surface processing of the blank.
6. The packaging box manufacturing assistance apparatus according to any one of claims 1 to 5, wherein the folding spec information includes information relating to either one of a folding speed for the manufacturing apparatus folding the blank and a shape of a folding member that is to be pressed against the blank and fold the blank.
7. A packaging box manufacturing assistance method to be executed by a computer that assists in manufacture of a packaging box shaped by sequentially folding a blank using a manufacturing apparatus, the method comprising:
 - storing, in a storage unit of the computer, blank spec information relating to specs of the blank, folding spec information relating to folding specs on the manufacturing apparatus that folds the blank, and characteristic value information relating to a particular dynamic characteristic value of the blank in association with one another;
 - upon reception of an entry of input information including at least the blank spec information, accessing the storage unit and acquiring the characteristic value information corresponding to the entered input information and determining whether or not a value of the acquired characteristic value information falls within a predetermined proper range; and
 - displaying a result of the determination on a display unit of the computer.
8. The packaging box manufacturing assistance method according to claim 7, wherein:
 - the storage unit stores a database storing the blank spec information, the folding spec information and the characteristic value information in association with one another; and
 - upon reception of the entry of the input information by the computer, the characteristic value information corresponding to the received input information is extracted from the database.
9. The packaging box manufacturing assistance method

od according to claim 8, wherein if the computer determines that the value of the characteristic value information extracted from the database does not fall within the predetermined proper range, the computer extracts a record in which specs are partly same as those in the input information and a value of the characteristic value information falls within the predetermined proper range, from the blank spec information and the folding spec information stored in the database, extracts spec information that is different from that in the input information from spec information included in the extracted record and causes the display unit to display the extracted spec information as spec change candidate information.

10. The packaging box manufacturing assistance method according to any one of claims 7 to 9, wherein the particular dynamic characteristic value is a value of a repelling force generated as a result of the blank repelling when the blank is pressed against a folding member on the manufacturing apparatus and is thereby caused to be folded.
11. The packaging box manufacturing assistance method according to any one of claims 7 to 10, wherein the blank spec information includes at least one piece of information from among specs relating to a thickness, a material and a paper grain direction of the blank, a spec relating to a fold line and a spec relating to surface processing.
12. The packaging box manufacturing assistance method according to any one of claims 7 to 11, wherein the folding spec information includes information relating to either one of a folding speed for the manufacturing apparatus folding the blank and a shape of a folding member that is to be pressed against the blank and fold the blank.

40

45

50

55

FIG. 1

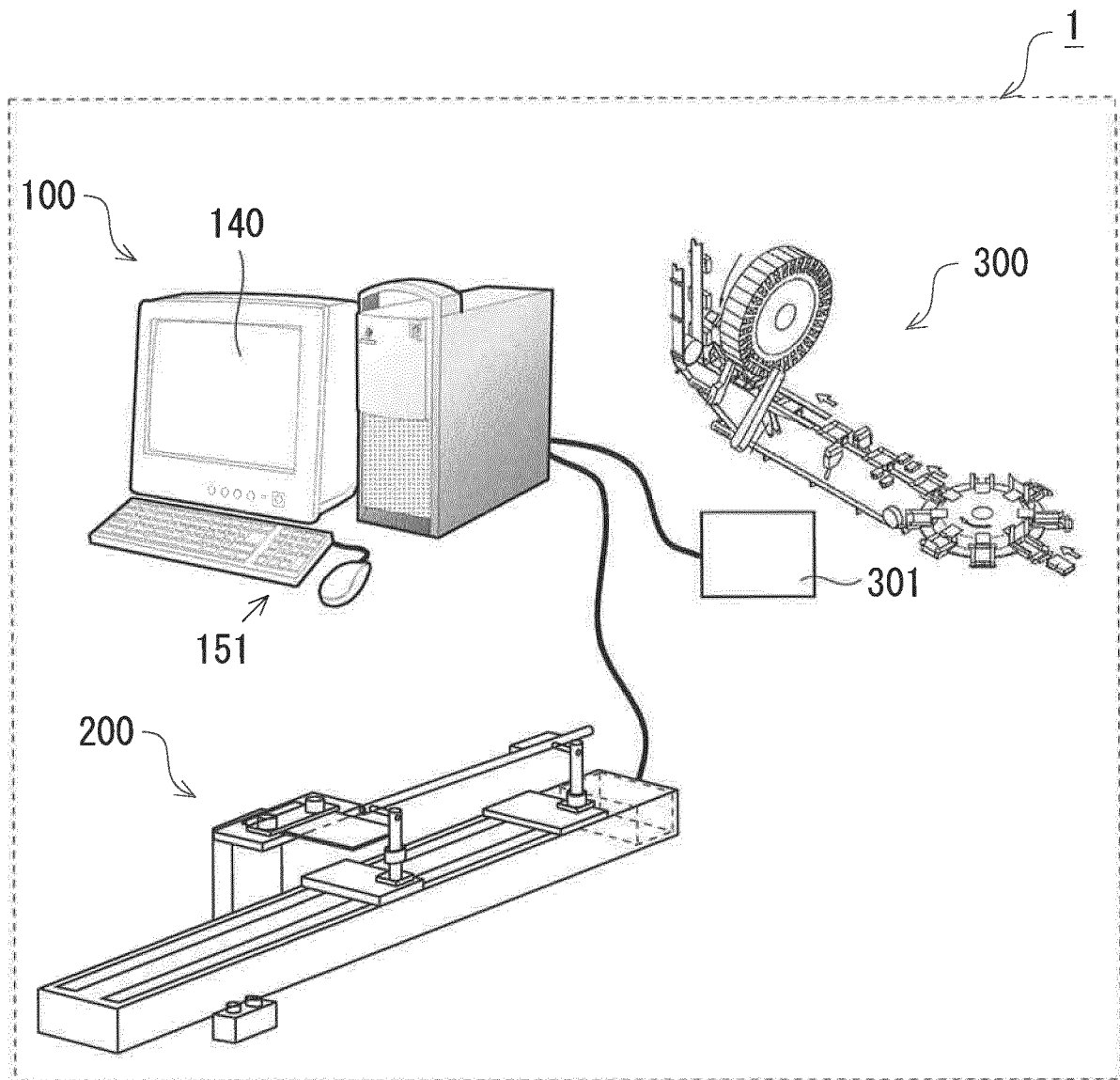


FIG. 2

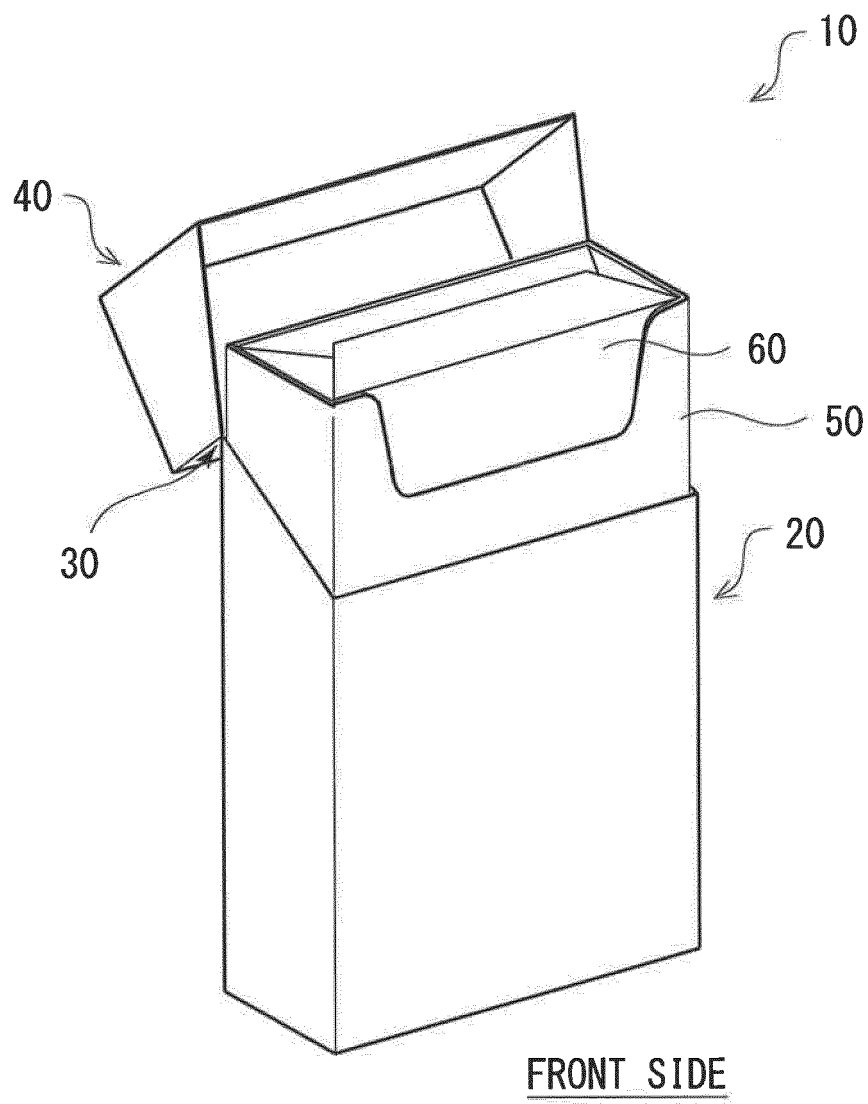


FIG. 3

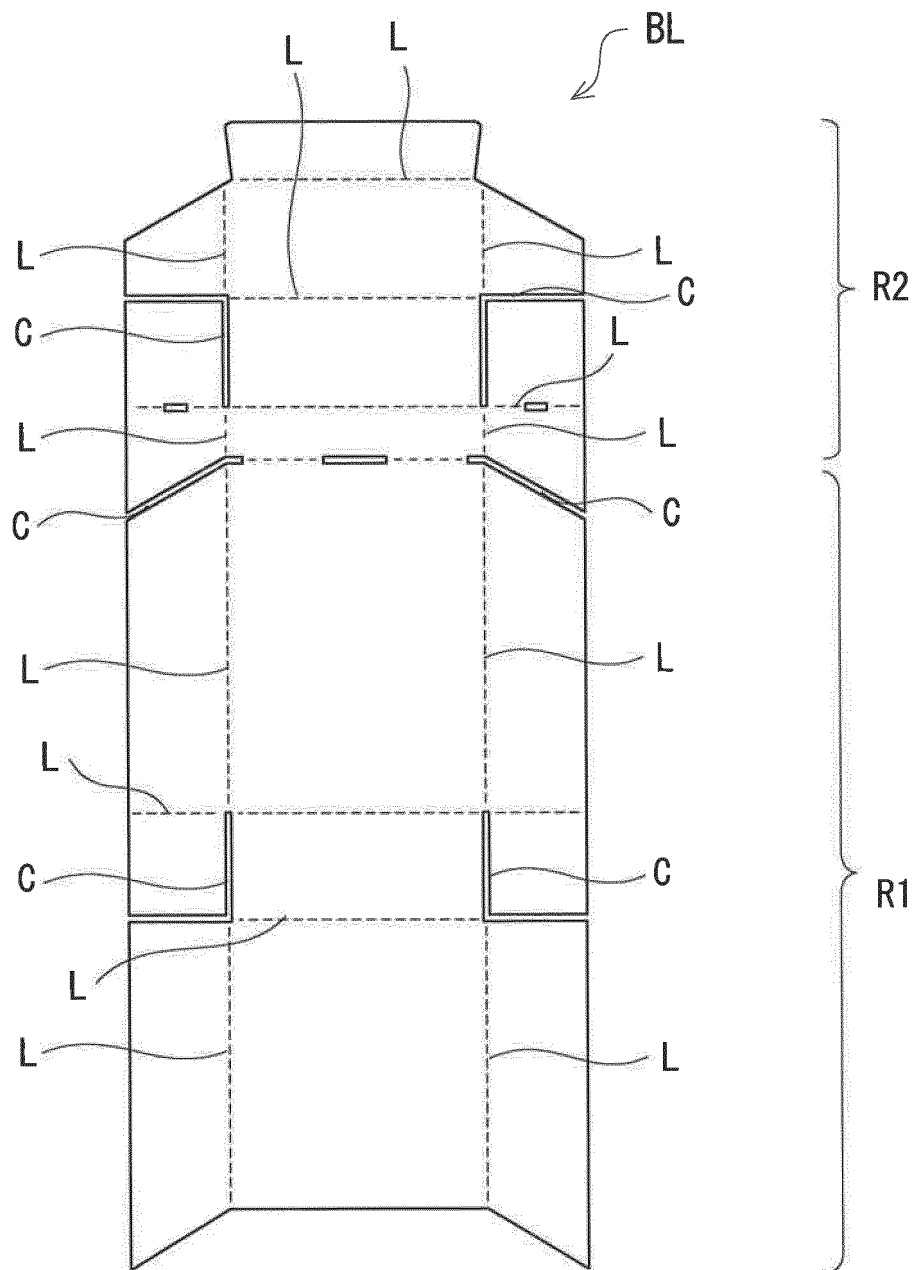


FIG. 4A

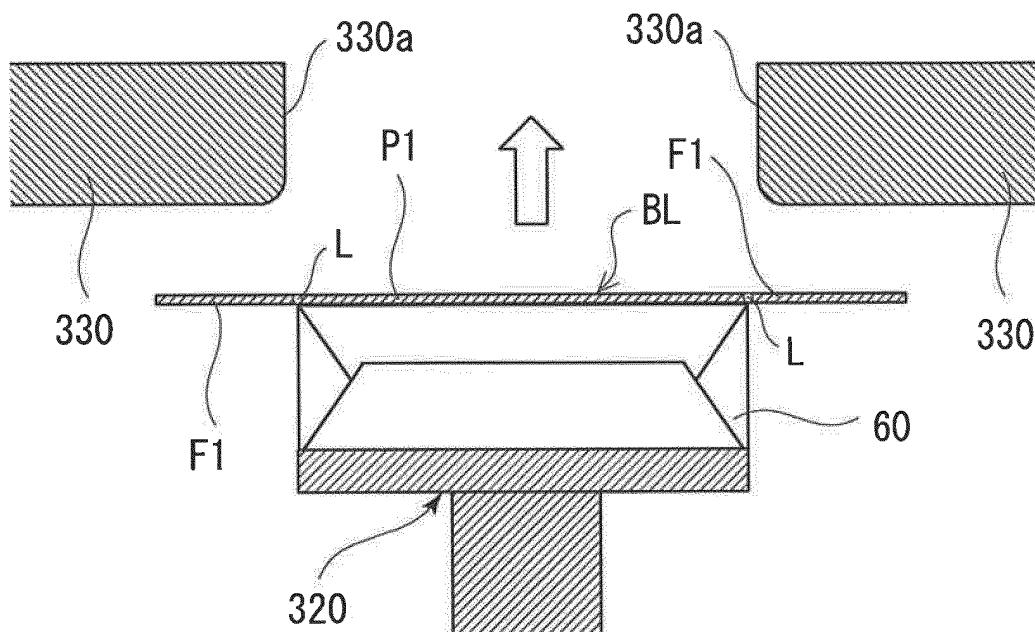


FIG. 4B

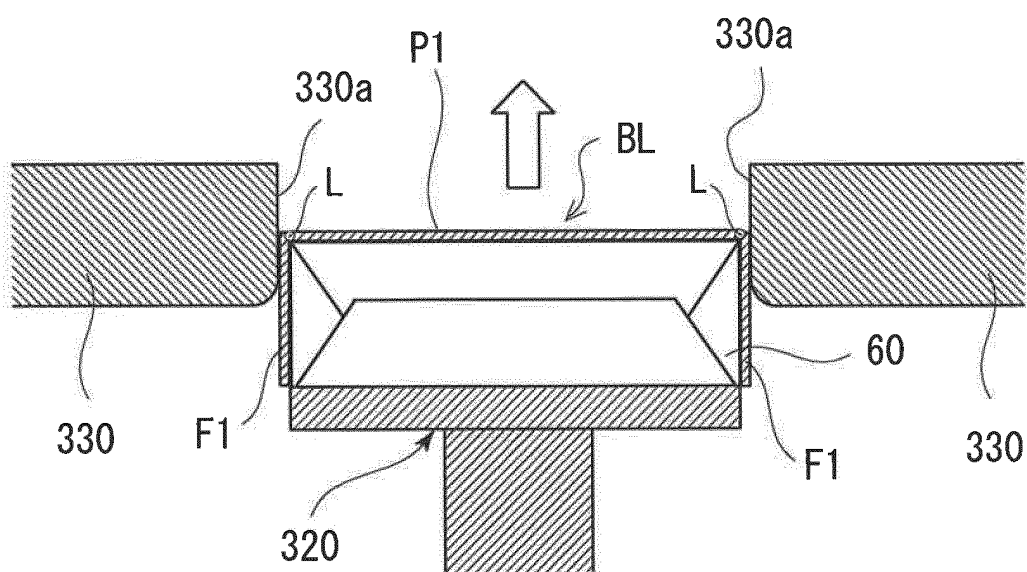


FIG. 5

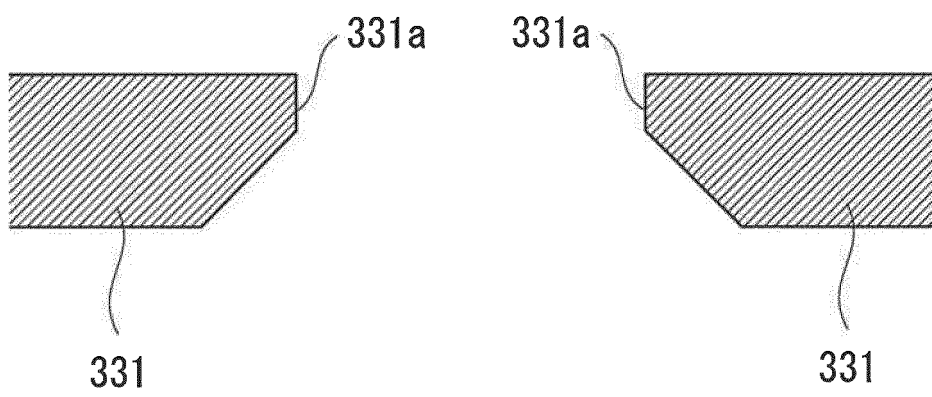


FIG. 6

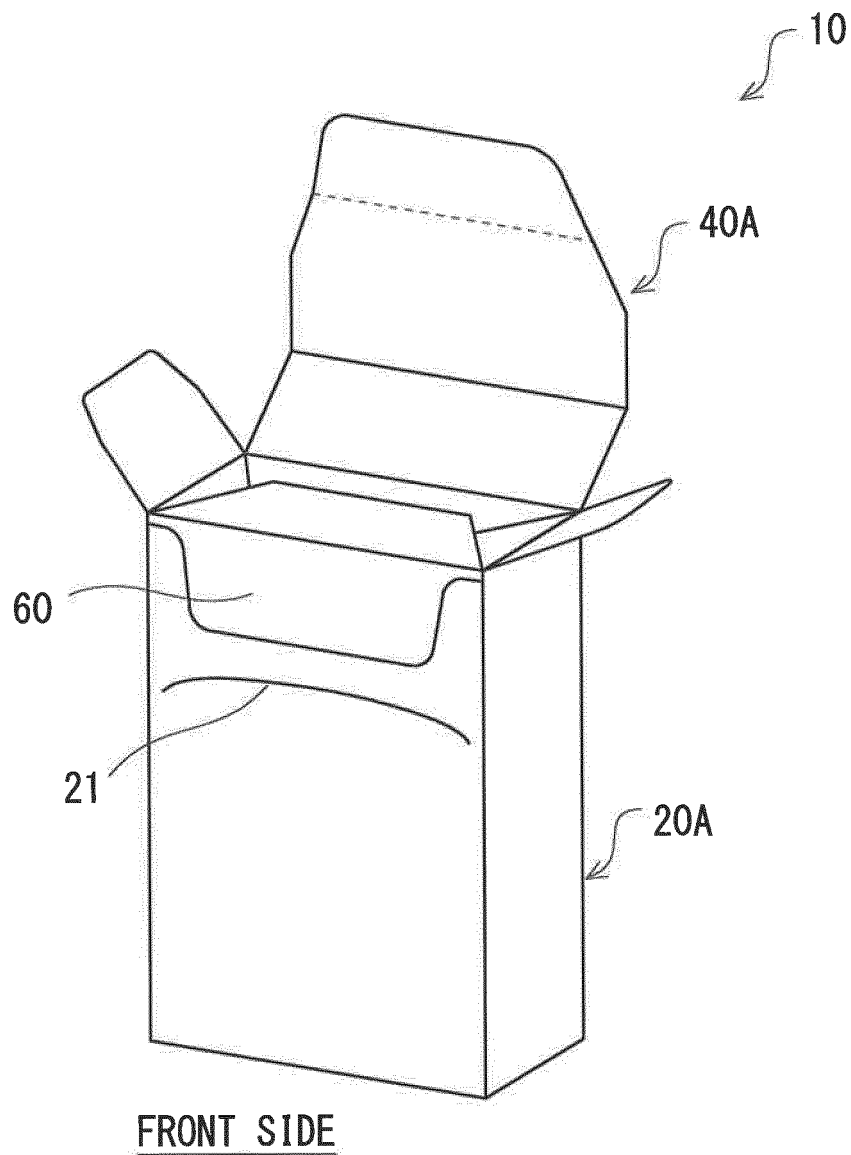


FIG. 7

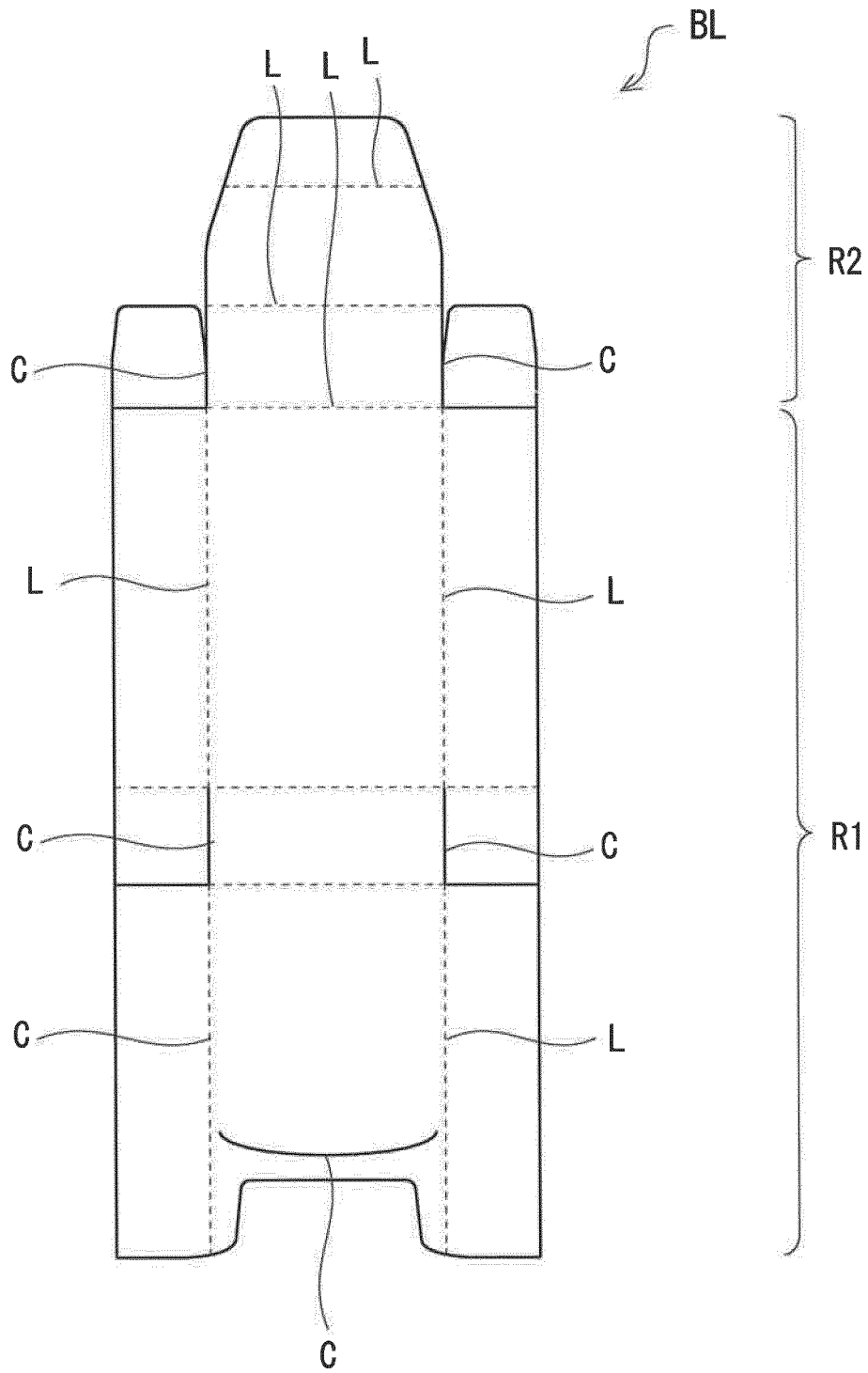


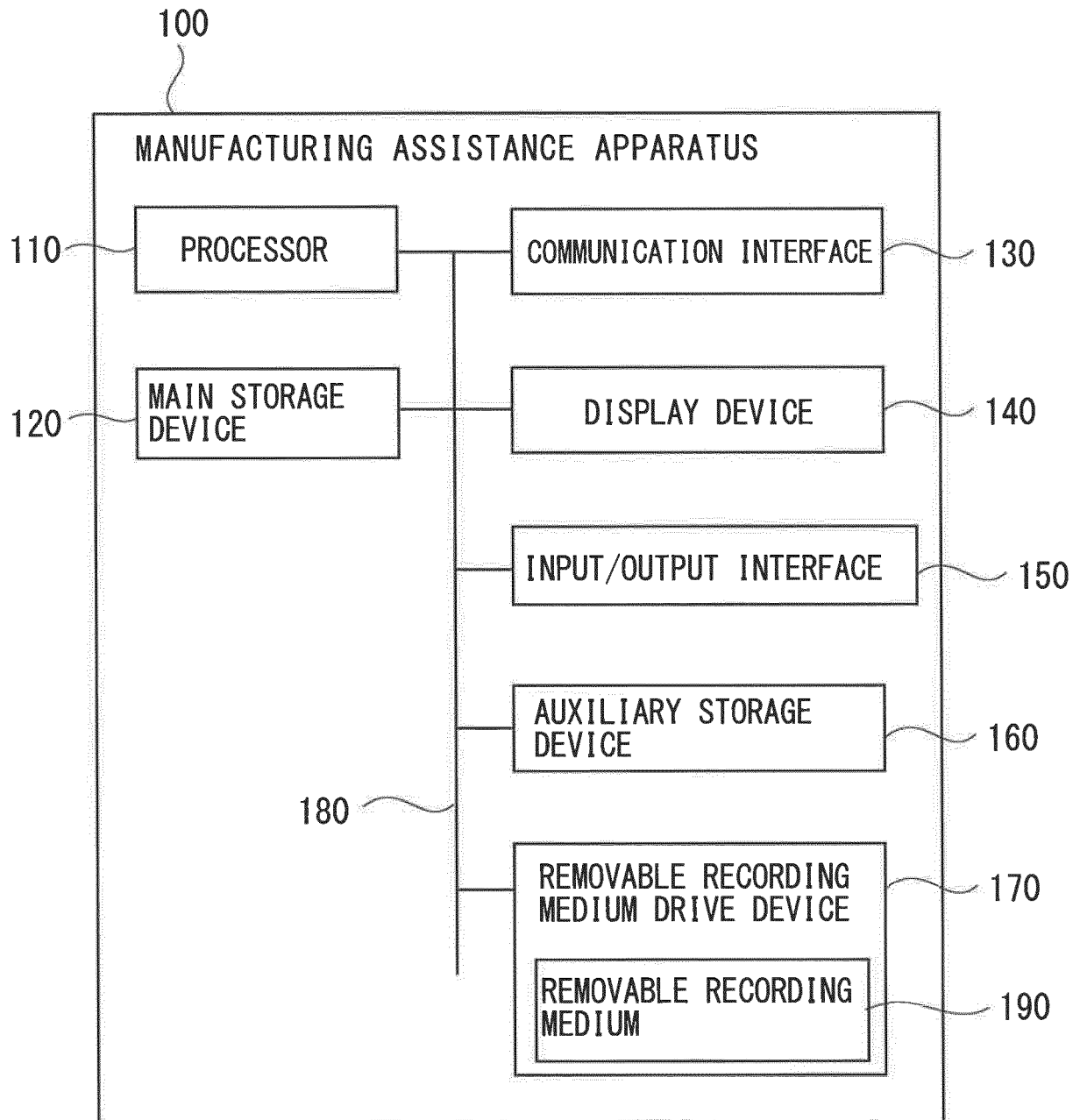
FIG. 8

FIG. 9

REPELLING FORCE DATABASE DB

BLANK SPEC INFORMATION										FOLDING SPEC INFORMATION		BLANK REPELLING FORCE (N)
	BLANK MATERIAL	BLANK THICKNESS t	BLANK SURFACE SPEC	PAPER GRAIN DIRECTION	FOLD LINE WIDTH W	FOLD LINE COUNT	FOLDING SPEED	GUIDE SHAPE				
1	PAPER	0.2	PRINTED	PARALLEL	0.2	1	LOW SPEED	SHAPE A			0.4	
2	PLASTIC	0.4	VANISHED	CROSS	0.1	1	HIGH SPEED	SHAPE B			1.5	
3	∴	∴	∴	∴	∴	∴	∴	∴			∴	
4	PLASTIC	0.4	VANISHED	CROSS	0.1	1	LOW SPEED	SHAPE C			1.0	
5	PAPER	0.2	VANISHED	PARALLEL	0.1	1	HIGH SPEED	SHAPE B			0.6	
6	PAPER	0.2	PRINTED	CROSS	0.1	1	MEDIUM SPEED	SHAPE B			0.7	
7	∴	∴	∴	∴	∴	∴	∴	∴			∴	
8	∴	∴	∴	∴	∴	∴	∴	∴			∴	
9	∴	∴	∴	∴	∴	∴	∴	∴			∴	
10	∴	∴	∴	∴	∴	∴	∴	∴			∴	

FIG. 10

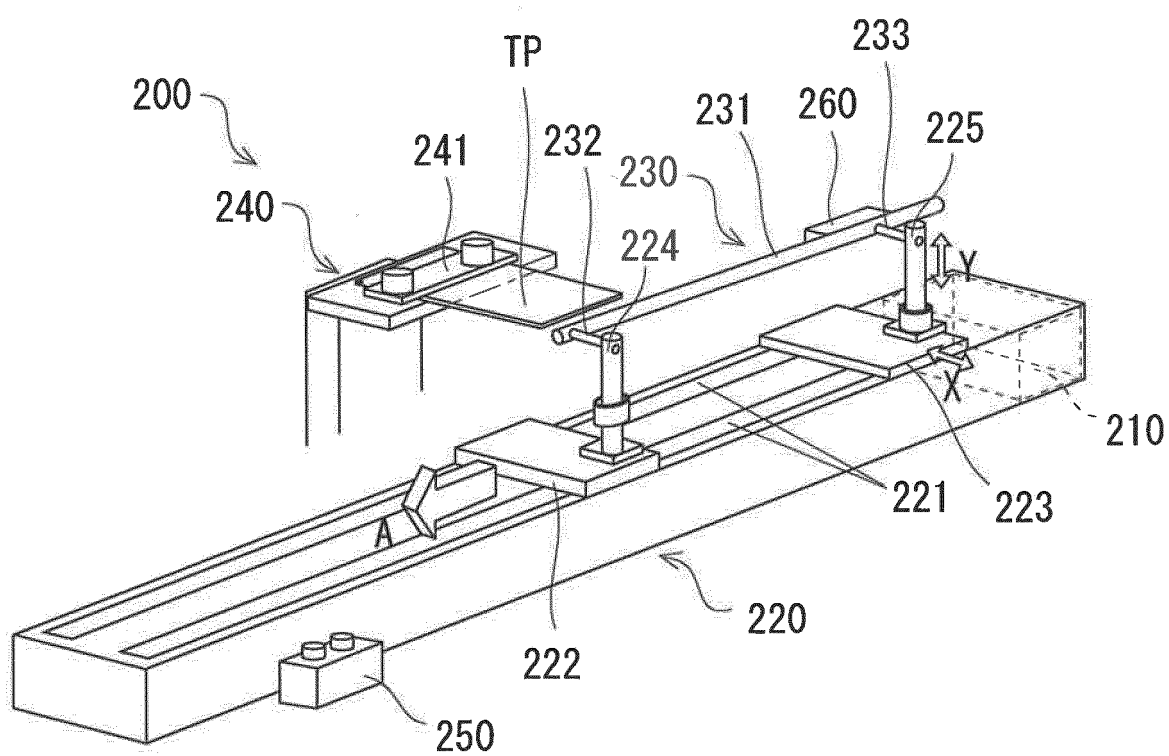


FIG. 11

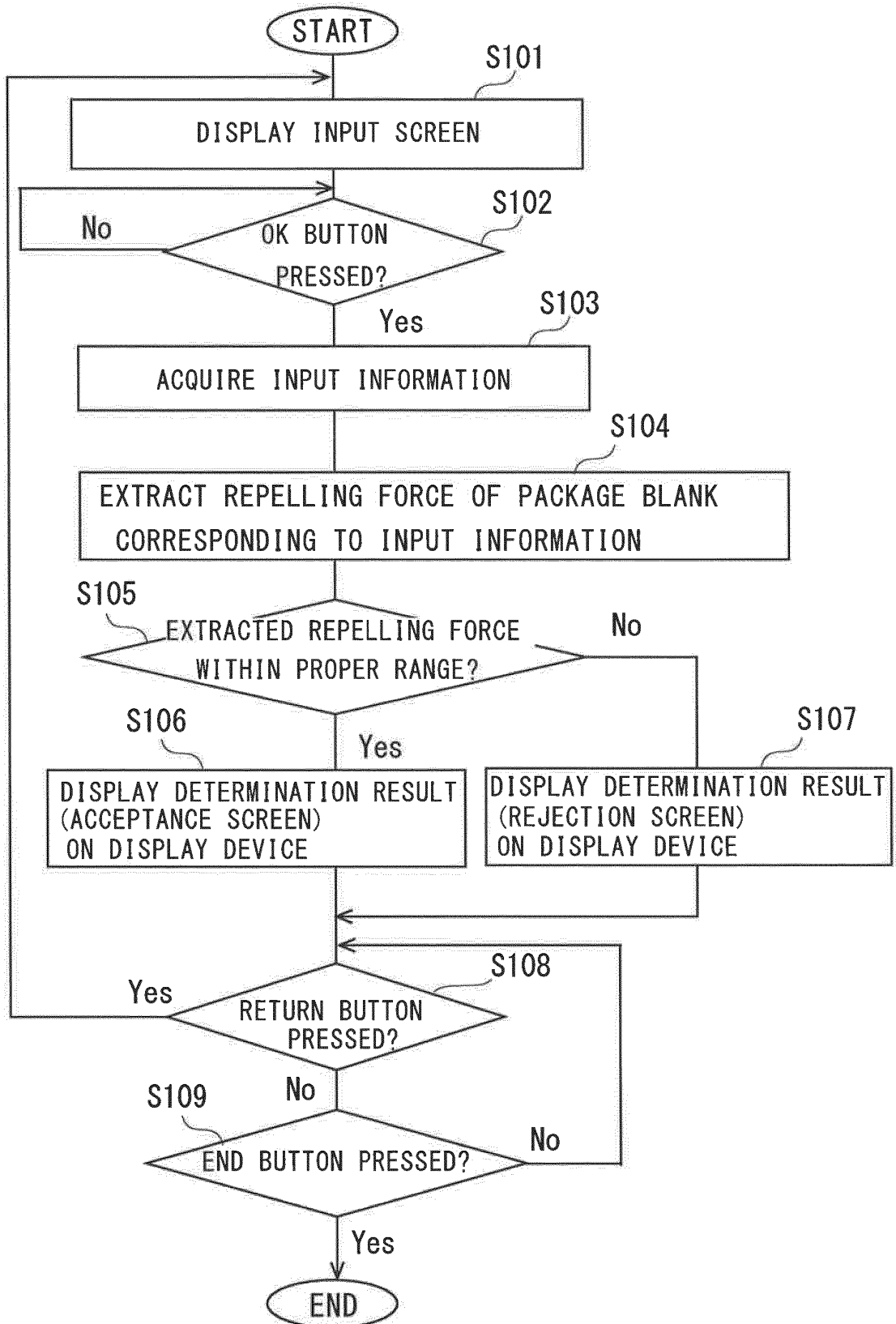


FIG. 12

BLANK SPEC INFORMATION		FOLDING SPEC INFORMATION	
BLANK MATERIAL		FOLDING SPEED	
BLANK THICKNESS (mm)		GUIDE SHAPE	
SURFACE SPEC			
PAPER GRAIN DIRECTION			
FOLD LINE WIDTH (mm)			
FOLD LINE COUNT			

OK

B1

FIG. 13

BLANK SPEC INFORMATION		FOLDING SPEC INFORMATION	
BLANK MATERIAL	PAPER ▼	FOLDING SPEED	LOW SPEED ▼
BLANK THICKNESS (mm)	0.2 ▼	GUIDE SHAPE	SHAPE A ▼
SURFACE SPEC	PRINTED ▼		
PAPER GRAIN DIRECTION	NO SURFACE PROCESSED PRINTED ☐ VANISHED ☒		
FOLD LINE WIDTH (mm)	▼		
FOLD LINE COUNT	▼		

OK

B1

FIG. 14

The screenshot shows a software window with a title bar containing three icons (minimize, maximize, close). The window is divided into two main sections: 'BLANK SPEC INFORMATION' on the left and 'FOLDING SPEC INFORMATION' on the right. The 'BLANK SPEC INFORMATION' section contains six input fields: 'BLANK MATERIAL' (PAPER), 'BLANK THICKNESS (mm)' (0.2), 'SURFACE SPEC' (PRINTED), 'PAPER GRAIN DIRECTION' (PARALLEL), 'FOLD LINE WIDTH (mm)' (0.2), and 'FOLD LINE COUNT' (1). The 'FOLDING SPEC INFORMATION' section contains two input fields: 'FOLDING SPEED' (LOW SPEED) and 'GUIDE SHAPE' (SHAPE A). Below these is a 'DETERMINATION RESULT' section showing 'REPELLING FORCE 0.4 (N)', 'PROPER RANGE 0.2~0.8 (N)', and 'DETERMINATION RESULT ACCEPTED'. At the bottom right are two buttons: 'RETURN' and 'END'. Arrows point from the labels 'B2' and 'B3' to the 'RETURN' and 'END' buttons respectively.

BLANK SPEC INFORMATION		FOLDING SPEC INFORMATION	
BLANK MATERIAL	PAPER	FOLDING SPEED	LOW SPEED
BLANK THICKNESS (mm)	0.2	GUIDE SHAPE	SHAPE A
SURFACE SPEC	PRINTED	<u>DETERMINATION RESULT</u> REPELLING FORCE 0.4 (N) PROPER RANGE 0.2~0.8 (N) DETERMINATION RESULT ACCEPTED	
PAPER GRAIN DIRECTION	PARALLEL		
FOLD LINE WIDTH (mm)	0.2		
FOLD LINE COUNT	1		
		RETURN	END

B2

B3

FIG. 15

The screenshot shows a software window with a title bar containing standard window controls (minimize, maximize, close). The window is divided into two main sections: 'BLANK SPEC INFORMATION' on the left and 'FOLDING SPEC INFORMATION' on the right. Below these, there is a 'DETERMINATION RESULT' section. The 'BLANK SPEC INFORMATION' section contains six input fields: 'BLANK MATERIAL' (PLASTIC), 'BLANK THICKNESS (mm)' (0.4), 'SURFACE SPEC' (VANISHED), 'PAPER GRAIN DIRECTION' (CROSS), 'FOLD LINE WIDTH (mm)' (0.1), and 'FOLD LINE COUNT' (1). The 'FOLDING SPEC INFORMATION' section contains two input fields: 'FOLDING SPEED' (HIGH SPEED) and 'GUIDE SHAPE' (SHAPE B). The 'DETERMINATION RESULT' section displays 'REPELLING FORCE 1.5(N)', 'PROPER RANGE 0.2~0.8(N)', and 'DETERMINATION RESULT REJECTED'. At the bottom right, there are two buttons: 'RETURN' and 'END'. Below the 'RETURN' button is a label 'B2', and below the 'END' button is a label 'B3'.

BLANK SPEC INFORMATION		FOLDING SPEC INFORMATION	
BLANK MATERIAL	PLASTIC	FOLDING SPEED	HIGH SPEED
BLANK THICKNESS (mm)	0.4	GUIDE SHAPE	SHAPE B
SURFACE SPEC	VANISHED	<u>DETERMINATION RESULT</u> REPELLING FORCE 1.5(N) PROPER RANGE 0.2~0.8(N) DETERMINATION RESULT REJECTED	
PAPER GRAIN DIRECTION	CROSS		
FOLD LINE WIDTH (mm)	0.1		
FOLD LINE COUNT	1		
		RETURN	END

B2

B3

FIG. 16

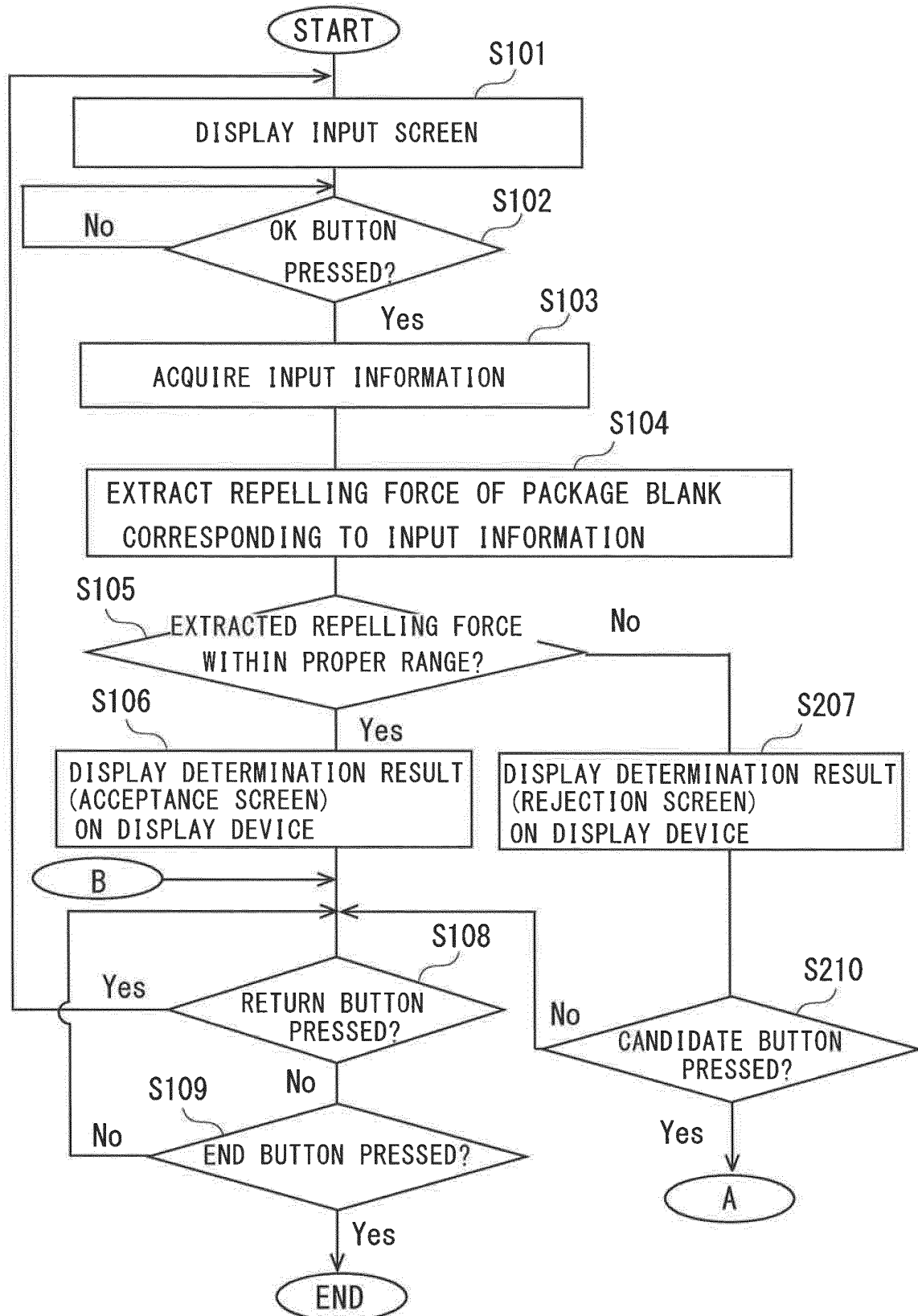


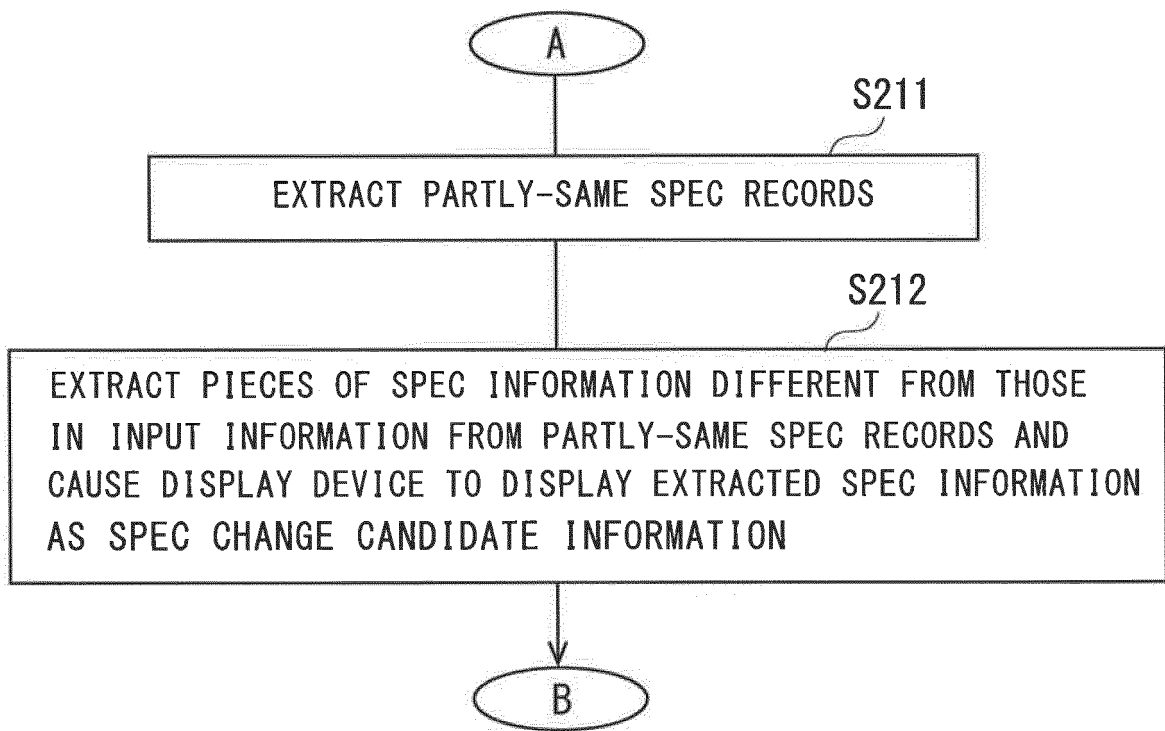
FIG. 17

FIG. 18

BLANK SPEC INFORMATION		FOLDING SPEC INFORMATION		
BLANK MATERIAL	PLASTIC	FOLDING SPEED	HIGH SPEED	
BLANK THICKNESS (mm)	0.4	GUIDE SHAPE	SHAPE B	
SURFACE SPEC	VANISHED	<u>DETERMINATION RESULT</u> REPELLING FORCE 1.5 (N) PROPER RANGE 0.2~0.8 (N) DETERMINATION RESULT REJECTED		
PAPER GRAIN DIRECTION	CROSS			
FOLD LINE WIDTH (mm)	0.1			
FOLD LINE COUNT	1			
		RETURN	CANDIDATES	END

B2 B4 B3

FIG. 19

INPUT INFORMATION		SPEC CHANGE CANDIDATE INFORMATION (1/3)	
BLANK MATERIAL	PLASTIC		
BLANK THICKNESS (mm)	0.4		
SURFACE SPEC	VANISHED		
PAPER GRAIN DIRECTION	CROSS		
FOLD LINE WIDTH (mm)	0.1		
FOLD LINE COUNT	1		
FOLDING SPEED	HIGH SPEED	⇒	LOW SPEED
GUIDE SHAPE	SHAPE B	⇒	SHAPE C
		RETURN	CANDIDATES
		END	

B2 B5 B3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/076251

A. CLASSIFICATION OF SUBJECT MATTER

B65B57/00(2006.01)i, B65B19/22(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65B57/00, B65B19/22

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-011926 A (G.D S.p.A.), 15 January 2003 (15.01.2003), entire text; all drawings & US 2002/0118228 A1 & EP 1225491 A1 & CN 1368460 A	1-12
A	WO 94/08850 A1 (Ishida Co., Ltd.), 28 April 1994 (28.04.1994), entire text; all drawings & JP 3373515 B & US 5479756 A & EP 614814 A1	1-12
A	JP 2011-051607 A (Mitsubishi Heavy Industries Food & Packaging Machinery Co., Ltd.), 17 March 2011 (17.03.2011), entire text; all drawings (Family: none)	1-12

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

05 November, 2013 (05.11.13)

Date of mailing of the international search report

03 December, 2013 (03.12.13)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/076251

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2013/016176 A1 (PACKSIZE LLC), 31 January 2013 (31.01.2013), entire text; all drawings (Family: none)	1-12
A	US 2009/0293890 A1 (G.D S.p.A.), 03 December 2009 (03.12.2009), entire text; all drawings & JP 2009-234663 A & EP 2103522 A2 & CN 101531256 A	1-12
A	JP 2007-091344 A (G.D S.p.A.), 12 April 2007 (12.04.2007), entire text; all drawings & US 2007/0068541 A1 & EP 1770019 A1	1-12
A	JP 61-287508 A (Teraoka Seiko Co., Ltd.), 17 December 1986 (17.12.1986), entire text; all drawings & US 4757451 A & US 4884209 A & EP 211478 A2	1-12
A	JP 2008-094445 A (Ishida Co., Ltd.), 24 April 2008 (24.04.2008), entire text; all drawings & US 2008/0091299 A1	1-12
A	US 2010/0200007 A1 (Kurt MEYER), 12 August 2010 (12.08.2010), entire text; all drawings & JP 2009-533031 A & WO 2007/118550 A1 & CN 101421161 A	1-12

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2011525460 A [0003]