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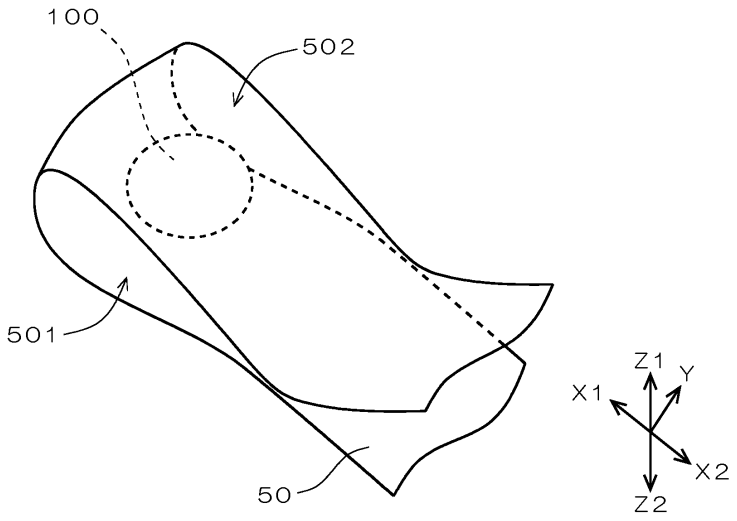
(54) Packaging apparatus

(57) A packaging apparatus 1 includes a conveying unit 14 that conveys a continuous film 50 in a direction X1 with an article 100 placed on a first portion 501 of the film 50, and folds back in a direction X2 opposite to the direction X1 a second portion 502 of the film 50 ahead of the first portion 501 with respect to the direction X1, sealing parts 16U, 16L, 17U, and 17L that seal the first portion 501 and the second portion 502 to form a bag body 40 containing the article 100, and a cutter 32 that cuts the film 50.

FIG. 16



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a packaging apparatus.

Description of the Background Art

[0002] A stretch packaging machine, which packages a product with a film by holding the film in a stretched state, pushing the product with an article placed on a tray up against the film from underneath, and folding down the periphery of the film to the bottom side of the tray, is disclosed in, for example, Japanese Patent Application Publication No. 2001-097309.

[0003] An inverse pillow packaging machine, which packages an article with a band-shaped film by forming the band-shaped film on which multiple articles are placed at predetermined intervals into a tube while conveying the film horizontally, followed by longitudinal sealing above the article and transverse sealing at the front and the back of the article, is disclosed in, for example, Japanese Patent Application Publication No. H11-105810.

[0004] The stretch packaging machine disclosed in Japanese Patent Application Publication No. 2001-097309 packages with a film a product with an article being placed on a tray. With increased environmental awareness of consumers in recent years, however, since the consumers wish to reduce the amount of trash, packaging without a tray is desired. Packaging without a tray is also beneficial for manufacturers, as costs for purchasing and managing trays will be reduced and there will be no need for a space for storing trays.

[0005] The inverse pillow packaging machine disclosed in the above Japanese Patent Application Publication No. H11-105810 forms the band-shaped film into a tube while conveying the film horizontally, and thus the packaging machine inevitably requires a long body. Therefore, since installation of the inverse pillow packaging machine requires a lot of space, it is difficult to install the inverse pillow packaging machine in a backyard of a supermarket or the like in many cases. Furthermore, since longitudinal sealing is performed above an article, longitudinal sealing seam of a bag body is located above the article. Thus upon packaging, if an article which has distinction between its obverse and reverse sides is placed on the film with its obverse side facing upward, the longitudinal sealing seam is located above the obverse side of the article, which spoils the appearance of a product when displayed. In order to avoid this, the article always has to be placed on the film with its reverse side facing upward. Furthermore, the inverse pillow packaging machine requires transverse sealing at a gap between articles laid along the conveyance direction. When misalignment with respect to the conveyance direction occurs between the film and the article due to inertia of conveyance or the like, it is possible that transverse sealing is not performed on a proper portion, and the article gets stuck in the transverse sealing seam. Particularly because the inverse pillow packaging machine has no means to prevent misalignment of the article on the film, operational condition of the packaging machine needs to be limited in order to avoid misalignment due to inertia of conveyance or the like.

SUMMARY OF THE INVENTION

[0006] It is an object of the present invention to provide a packaging apparatus that realizes packaging of an article without a tray, with fewer restrictions such as installation requirements and operational conditions in comparison with an inverse pillow packaging machine.

[0007] The packaging apparatus according to an aspect of the present invention includes a packaging material conveyor that conveys a continuous band-shaped packaging material in a first direction with an article placed on a first portion of the packaging material, and folds back in a second direction opposite to the first direction a second portion of the packaging material ahead of the first portion with respect to the first direction, a sealer that seals the first portion and the second portion to form a bag body containing the article, and a cutter that cuts the band-shaped packaging material.

[0008] In the packaging apparatus, the packaging material conveyor conveys the continuous band-shaped packaging material in the first direction with the article placed on the first portion of the packaging material, and folds back in the second direction opposite to the first direction the second portion of the packaging material ahead of the first portion with respect to the first direction. The sealer seals the first portion and the second portion to form the bag body containing the article, and the cutter cuts the band-shaped packaging material. Thus the packaging apparatus according to the first aspect realizes packaging of the article without a tray. Consequently, consumers can enjoy reduced amount of trash and manufacturers can enjoy reduced costs for purchasing and managing trays and do not need a space for storing trays.

[0009] Furthermore, size reduction of the apparatus is achieved in comparison with an inverse pillow packaging machine, since there is no need for a former to form the band-shaped packaging material into a tube. In addition, there is no longitudinal sealing of the packaging material, unlike the inverse pillow packaging machine. Therefore, in packaging of an article having distinction between its obverse and reverse sides, placing the article on the band-shaped packaging material with its obverse side facing upward does not spoil the appearance of a product, since there is no longitudinal sealing seam above the obverse side of the article. Moreover, sealing of the top of the bag body by the sealer is performed behind the article in the conveyance direction of the article.

Therefore, even if inertia of conveyance causes the article to advance in the first direction on the packaging material after cessation of conveyance, since the article moves away from the portion to be sealed at the top, chances that the article is stuck in the sealed portion are reduced. In addition, advance of the article in the first direction on the packaging material is not unlimited, since the advance of the article is limited by the packaging material ahead, and thus there is no particular disadvantage.

[0010] In the packaging apparatus, the packaging material conveyor may put the second portion folded back in the second direction over the article from above the article.

[0011] By putting the second portion over the article rather than pressing the second portion against the article from above in a stretched state, the pressure the article receives from the second portion is reduced, and thus damage to the article is prevented.

[0012] The packaging apparatus may further include a joiner that joins the band-shaped packaging material separated due to cutting by the cutter.

[0013] The joiner joins the band-shaped packaging material separated due to cutting by the cutter. Therefore, since the band-shaped packaging material separated due to cutting is joined by joiner by the time when packaging of a subsequent article is started, continuous packaging of multiple articles is practicable.

[0014] The packaging apparatus may further include a roller that rolls up a predetermined amount of the band-shaped packaging material that has been joined by the joiner, so as to collect a joined portion by the joiner of the band-shaped packaging material.

[0015] The roller rolls up a predetermined amount of the band-shaped packaging material that has been joined by the joiner, so as to collect a joined portion by the joiner of the band-shaped packaging material. Therefore, since the joined portion by the joiner of the band-shaped packaging material is prevented from being contained in part of the bag body in packaging of a subsequent article, decrease in hermeticity and strength of the bag body is prevented, at the same time as the appearance of the bag body is prevented from being spoiled.

[0016] In the packaging apparatus, the packaging material conveyor may include a holder that moves along a predetermined path while holding a tip portion of the band-shaped packaging material so as to fold back the second portion.

[0017] The holder moves along a predetermined path while holding the tip portion of the band-shaped packaging material so as to fold back the second portion. Thus a simple configuration of moving the holder along a predetermined path realizes folding back of the second portion.

[0018] The packaging apparatus may further include a setter that sets an amount of the packaging material to be conveyed in the first direction by the packaging material conveyor in accordance with a dimension of the bag body along a length of the band-shaped packaging material.

[0019] The setter sets an amount of the packaging material to be conveyed in the first direction by the packaging material conveyor in accordance with a dimension of the bag body along a length of the band-shaped packaging material (that is, a bag length). Thus setting the amount of band-shaped packaging material to be conveyed realizes formation of various kinds of bag bodies with different bag lengths. In addition, changing the amount of band-shaped packaging material to be conveyed every time realizes continuous formation of bag bodies with different bag lengths.

[0020] The packaging apparatus may further include a controller that makes a level of sealing of the first portion and the second portion by the sealer and a level of approximately the middle of the article along its thickness agree with each other.

[0021] The controller makes a level of sealing of the first portion and the second portion by the sealer and a level of approximately the middle of the article along its thickness agree with each other. Thus since the sealer seals the first portion and the second portion with their edge portions accurately overlapping with each other, precision in end result of the bag body is improved. Moreover, since the width of the packaging material used to constitute the upper side of the bag body is equal to that of the packaging material used to constitute the lower side, required width of the packaging material is minimized.

[0022] The packaging apparatus may further include a placement device for placement of the article on the band-shaped packaging material and a display that displays a position and/or a timing for placement of the article on the band-shaped packaging material at the placement device.

[0023] The display displays a position and/or a timing for placement of the article on the band-shaped packaging material at the placement device. Displaying a proper placement position of the article prevents variations in the placement position of the article caused by the operator, and also when the packaging material is sealed, the article is prevented from being stuck due to placement of the article at the outer end portion of the placement device. Furthermore, displaying a timing for placement of the article on the band-shaped packaging material allows the operator to place the article on the band-shaped packaging material in a timing displayed by the display. This prevents in advance placement of the article by the operator before packaging of a subsequent article is ready.

[0024] The packaging apparatus may further include a puller that pulls part of the band-shaped packaging material constituting the bag body.

[0025] The band-shaped packaging material is pulled by the puller, so that part of the band-shaped packaging material to be used in subsequent packaging is reserved. Thus setting an amount of the band-shaped packaging material to be reserved by the puller in accordance with

the bag length of the bag body allows the operator to place the article always at the same position of the placement device. Consequently, since there is no need to change the placement position of the article in accordance with the bag length of the bag body, work efficiency is improved. Moreover, the operator only has to place the article always at the same position of the placement device regardless of whether it is odd-numbered time or even-numbered time of packaging, and does not need to change placement position of the article depending on number of times of packaging as to whether it is odd-numbered or even-numbered, which improves work efficiency.

[0026] In the packaging apparatus, part of the band-shaped packaging material pulled by the puller may include the second portion to be used in subsequent packaging.

[0027] Part of the band-shaped packaging material pulled by the puller includes the second portion to be used in subsequent packaging. This achieves proper packaging, since the second portion to be used in subsequent packaging is reserved by the puller.

[0028] The packaging apparatus may further include a position definer that defines a position at which the band-shaped packaging material is folded.

[0029] The position definer defines a position at which the band-shaped packaging material is folded. By defining a position at which the band-shaped packaging material is folded, a bag body of a desired dimension (bag length) is obtained.

[0030] The packaging apparatus may further include a weigher that weighs the article.

[0031] The weigher enhances practicability of the apparatus.

[0032] The packaging apparatus may further include a printer that prints information on the article on a label.

[0033] The printer enhances practicability of the apparatus.

[0034] The present invention provides a packaging apparatus that realizes packaging without a tray, with fewer restrictions such as installation requirements and operational conditions in comparison with an inverse pillow packaging machine.

[0035] These and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

FIG. 1 is a perspective view illustrating an overall structure of a packaging apparatus according to a first preferred embodiment of the present invention.
FIG. 2 is a diagram schematically illustrating the layout of processing devices in the packaging apparatus.
FIG. 3 is a diagram schematically illustrating the configuration of the processing devices illustrated in FIG. 2.
FIG. 4 is a front view illustrating a structure of a film-pulling unit.
FIG. 5 is a side view illustrating the structure of the film-pulling unit.
FIG. 6 is a diagram illustrating packaging of an article by a sealing device in a process sequence.
FIG. 7 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 8 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 9 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 10 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 11 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 12 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 13 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 14 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 15 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 16 is a perspective view schematically illustrating a state of the film.
FIG. 17 is a diagram schematically illustrating sealed portions of the film.
FIG. 18 is a block diagram illustrating part of functions of a control device.
FIG. 19 is a perspective view illustrating an overall structure of a packaging apparatus according to a second preferred embodiment of the present invention.
FIG. 20 is a diagram illustrating packaging of an article by a sealing device in a process sequence.
FIG. 21 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 22 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 23 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 24 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 25 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 26 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 27 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 28 is a diagram illustrating packaging of the article by the sealing device in a process sequence.
FIG. 29 is a diagram illustrating packaging of the article by the sealing device in a process sequence.

FIG. 30 is a perspective view schematically illustrating a state of the film.
FIG. 31 is a diagram schematically illustrating sealed portions of the film.
FIG. 32 is a top view illustrating a configuration of the placement platform.
FIG. 33 is a cross-sectional view illustrating a cross-sectional structure of the placement platform.
FIG. 34 is a perspective view illustrating part of the structure of a cover.
FIG. 35 is a block diagram illustrating a configuration of a control device of the packaging apparatus.
FIG. 36 is a top view illustrating an example of control of the display means by the control device.
FIG. 37 is a top view illustrating an example of control of the display means by the control device.
FIG. 38 is a top view illustrating an example of control of the display means by the control device.
FIG. 39 is a top view illustrating an example of control by the control device when the article is placed outside a proper placement position.
FIG. 40 is a top view illustrating another example of a configuration of the placement platform.
FIG. 41 is a top view illustrating an example of control of the display means illustrated in FIG. 40 by the control device.
FIG. 42 is a top view illustrating another example of a configuration of the placement platform.
FIG. 43 is a top view illustrating an example of control of the display means illustrated in FIG. 42 by the control device.
FIG. 44 is a perspective view schematically illustrating an overall structure of a packaging apparatus according to a third preferred embodiment of the present invention.
FIG. 45 is a diagram schematically illustrating the layout of the processing devices in the packaging apparatus.
FIG. 46 is a diagram schematically illustrating the configuration of the processing devices illustrated in FIG. 45.
FIG. 47 is a diagram illustrating movements of a placement and weighing device and a sealing device in a process sequence.
FIG. 48 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 49 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 50 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 51 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 52 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
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FIG. 57 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 58 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 59 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 60 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 61 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 62 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 63 is a diagram illustrating movements of the placement and weighing device and the sealing device in a process sequence.
FIG. 64 is a perspective view schematically illustrating a state of a film.
FIG. 65 is a diagram schematically illustrating sealed portions of the film.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0037] Preferred embodiments of the present invention are described in detail below referring to the drawings. It should be noted that identical reference numerals throughout the drawings indicate identical or equivalent elements.

First Preferred Embodiment

[0038] FIG. 1 is a perspective view illustrating an overall structure of a packaging apparatus 1 according to a first preferred embodiment of the present invention. FIG. 1 illustrates the structure of the packaging apparatus 1 without a cover of an apparatus casing. The packaging apparatus 1, being installed in, for example, a backyard of a supermarket, performs every processing including packaging, weighing, and pricing of articles by a single apparatus. Target articles include food products such as

meat, fish, and vegetables. At the front side of the apparatus casing (the side as viewed in the direction X1 in the figure), a display device 60, an operating device 61, and a label printer 62 are arranged. The display device 60 displays information such as various settings, weighed results of articles, and prices in accordance with weight values. The operating device 61 includes a numeric key pad, an operating switch, and so forth, so that an operator operates the operating device 61 to input the various settings. The label printer 62 outputs a label on which the weight value, the price, and so forth of the articles are printed for each of the articles.

[0039] FIG. 2 is a diagram schematically illustrating the layout of the processing devices in the packaging apparatus 1. The packing apparatus 1 includes a placement device 2, a sealing device 3 arranged behind the placement device 2, a weighing device 4 arranged beside the sealing device 3, and a delivery device 5 arranged in front of the weighing device 4. Moreover, a pulling device 6 is arranged between the placement device 2 and the sealing device 3. At the placement device 2, a target article is placed on a film by an operator. The article placed at the placement device 2 is conveyed along with the film in the direction X1 in the figure as indicated by the arrow L1 to the sealing device 3. The sealing device 3 packages the article with the film. The pulling device 6 pulls down the film to reserve a predetermined amount of film. The article which has been packaged by the sealing device 3 is conveyed in the direction Y in the figure as indicated by the arrow L2 to the weighing device 4. The weighing device 4 weighs the article. The article is conveyed in the direction X2 in the figure as indicated by the arrow L3, and delivered from the delivery device 5. The placement device 2 and the delivery device 5 are arranged side by side to be approximately level with the apparatus casing.

[0040] FIG. 3 is a diagram schematically illustrating the configuration of the processing devices illustrated in FIG. 2. The placement device 2 includes a placement platform 10 and a roller 11. The sealing device 3 includes a conveying unit 14, sealing parts 15L, 16L, and 17L, and a sealing height adjustment unit 18. The sealing height adjustment unit 18, having a feature as a conveyor belt, conveys the article in the direction Y in the figure as indicated by the arrow M1. Multiple rollers 19 are arranged between the sealing device 3 and the weighing device 4. The weighing device 4 includes a conveyor belt 20, so that it conveys the article in the direction X2 in the figure as indicated by the arrow M2 while weighing the article by weighing means such as a load cell. The delivery device 5 includes a delivery platform 21 with multiple rollers arranged side by side. The pulling device 6 includes rollers 13A and 13B and a film-pulling unit 12 arranged between the rollers 13A and 13B. As illustrated in FIG. 1, the placement platform 10 and the delivery platform 21 are arranged side by side to be approximately level with the apparatus casing.

[0041] FIGS. 4 and 5 are respectively a front view and a side view illustrating a structure of the film-pulling unit 12. As illustrated in FIGS. 4 and 5, the film-pulling unit 12 includes rollers 12U and 12L and a pair of side plates 12S. The roller 12U is attached between the upper ends of the pair of side plates 12S, while the roller 12L is attached between the lower ends of the pair of side plates 12S. Thus there is a space between the rollers 12U and 12L for an article 100 to pass through. The conveying unit 14 has a similar structure in which rollers 14U and 14L are respectively attached between the upper ends and between the lower ends of a pair of side plates.

[0042] FIGS. 6 to 15 are diagrams illustrating packaging of an article by the sealing device 3 in a process sequence. The sealing device 3 includes an upper sealing unit 70U and a lower sealing unit 70L. The upper sealing unit 70U includes sealing parts 15U, 16U, and 17U, a cutter 32, and a roller 31. The sealing parts 15U, 16U, and 17U respectively correspond to the sealing parts 15L, 16L, and 17L illustrated in FIG. 3. The cutter 32 is provided in a gap between the sealing parts 15U and 16U in parallel to the sealing parts 15U and 16U. The upper sealing unit 70U is movable upward and downward (in the directions Z1 and Z2 in the figure), driven by a drive mechanism not illustrated in the figure. Moreover, the sealing height adjustment unit 18 is movable upward and downward, driven by a drive mechanism not illustrated in the figure, and the film-pulling unit 12 is also movable upward and downward, driven by a drive mechanism not illustrated in the figure. Furthermore, the conveying unit 14 is movable backward and forward (in the directions X1 and X2 in the figure), driven by a drive mechanism not illustrated in the figure.

[0043] In a standby state as illustrated in FIG. 6, the film-pulling unit 12 has been driven downward, and the conveying unit 14 has been driven forward (that is, to the front as viewed from the front side of the apparatus casing). A band-shaped film 50, which is a packaging material, being continuous with constant width is routed from a film-supplying roll 30 via the roller 11, the upper surface of the placement platform 10, the roller 13A, the roller 12U, the roller 13B, the roller 14L, the roller 14U, and a roller 33 in this order, to a film-collecting roll 34, as indicated by the heavy broken line in the figure.

[0044] Next referring to FIG. 7, an operator places a target article 100 on the film 50 on the placement platform 10. The packaging apparatus 1 according to the present embodiment allows the article 100 to be placed directly on the film 50 without a tray. It should be noted, however, that use of a tray is not prohibited but an article on a tray can be placed at the placement platform 10.

[0045] Next referring to FIG. 8, the film-pulling unit 12 is driven upward to the position where the roller 12L is level with the rollers 13A and 13B within an even plane. Simultaneously the conveying unit 14 is driven backward (that is, to the back as viewed from the front side of the apparatus casing). The conveying unit 14, after being driven the distance equivalent to the amount of the film 50 reserved by the pulling device 6, further proceeds through the space between the upper sealing unit 70U

and the lower sealing unit 70L toward the back. At this time, rotation of the film-collecting roll 34 has been stopped, so that the film-supplying roll 30 supplies a required amount of film 50. Thus the conveying unit 14 proceeds so as to convey the film 50, and accordingly, the article 100 placed on the film 50 is conveyed from the placement platform 10 through the space between the rollers 12U and 12L onto the sealing height adjustment unit 18. That is, the conveying unit 14 is driven to convey the article 100 while the article 100 is on the film 50. As the conveying unit 14 is driven, the film length between the roller 33 and the roller 14U increases, while the distance between the conveying unit 14 and the article 100 decreases.

[0046] Next referring to FIG. 9, the film-pulling unit 12 is driven downward. At this time, rotation of the film-collecting roll 34 has been stopped, so that the film-supplying roll 30 supplies a required amount of film 50. Thus part of the film 50 (a second portion 502 described below) to be used in subsequent packaging is reserved by the pulling device 6. The direction in which the film 50 is pulled to be reserved is not necessarily downward, but may be upward, lateral, obliquely downward, or the like.

[0047] Next referring to FIG. 10, the sealing height adjustment unit 18 is driven downward for a predetermined distance in accordance with a thickness of the article 100. The sealing height adjustment unit 18 is driven downward to the position where the upper surface of the sealing parts 15L, 16L, and 17L is approximately level with the middle of the article 100 along its thickness. That is, the sealing height adjustment unit 18 serves as controlling means that makes the level of the upper surface of the sealing parts 15L, 16L, and 17L and the level of approximately the middle of the article 100 along its thickness agree with each other. It should be noted, however, that all that is required here is that relative position between the article 100 and the sealing parts 15L, 16L, and 17L are adjusted, and thus the lower sealing unit 70L may be driven upward, instead of the sealing height adjustment unit 18 being driven downward.

[0048] Next referring to FIGS. 11 and 12, the conveying unit 14 is driven forward in a predetermined inclination and on a predetermined track so as to avoid contact with the article 100. Thus the conveying unit 14 leaves the space between the upper sealing unit 70U and the lower sealing unit 70L and returns to the initial position as illustrated in FIG. 6. FIG. 16 is a perspective view schematically illustrating a state of the film 50. After a series of movements of the conveying unit 14 up to here, a second portion 502 of the film 50 ahead (ahead in the direction X1 in the figure) of a first portion 501 where the article 100 is placed has been folded back in the direction X2 in the figure over the article 100. Referring to FIGS. 11 and 12, when the conveying unit 14 leaves the space between the upper sealing unit 70U and the lower sealing unit 70L, the second portion 502 that has been folded back by the conveying unit 14 freely falls from above the article 100 down to the article 100 without being stretched, rather than being pressed against the article 100 from above in a stretched state. Thereby, the second portion 502 is put over the article 100 from above. Unlike with a packaging machine for automatically packaging a box-shaped product with packaging paper, for example, the film 50 is folded only once per article 100. The conveying unit 14 serves as position-defining means that defines a position at which the film 50 is folded.

[0049] Next referring to FIG. 13, the upper sealing unit 70U is driven downward, so that the film 50 is sandwiched between the sealing parts 15U, 16U, and 17U above and the sealing parts 15L, 16L, and 17L below. Then the edge portions of the first portion 501 and the second portion 502 are sealed together by thermo compression bonding. FIG. 17 is a diagram schematically illustrating sealed portions of the film 50. The sealing parts 17U and 17L seal areas AR1 at the lateral sides, while the sealing parts 16U and 16L seal an area AR2 at the top. A bag body 40 containing the article 100 between the first portion 501 and the second portion 502 is thereby formed. It is not necessarily the case that three sides of the bag body 40 are sealed, but for example, the area AR2 may remain unsealed and only the two lateral sides are sealed. In such a case, since the top of the bag body 40 is open, the operator can put a little sachet of seasoning or the like into the bag body 40 after the bag body 40 is delivered from the packaging apparatus 1.

[0050] The cutter 32 cuts the film 50 along the line N near the area AR2. In order to join the film 50 separated due to this cutting, an area AR3 near the line N is sealed by the sealing parts 15U and 15L. Thereby, the film 50 once separated by cutting is rejoined at the joined portion 41.

[0051] Next referring to FIG. 14, the upper sealing unit 70U is driven upward, thereby returning to the initial position as illustrated in FIG. 6. Then the sealing height adjustment unit 18 is driven upward, and accordingly the bag body 40 on the sealing height adjustment unit 18 is also moved upward.

[0052] Next referring to FIG. 15, the conveyor belt of the sealing height adjustment unit 18 is driven so that the bag body 40 is conveyed from the sealing height adjustment unit 18 onto the conveyor belt 20 of the weighing device 4 via a roller 19, jumping over the sealing part 17L. The film-collecting roll 34 is driven to roll up a predetermined amount of film 50, so as to collect the joined portion 41 of the film 50. Then the sealing height adjustment unit 18 is driven downward, thereby returning to the initial position as illustrated in FIG. 6. This leads to a standby state for subsequent packaging.

[0053] FIG. 18 is a block diagram illustrating part of functions of a control device mounted on the packaging apparatus 1. The control device includes a setting part 45 and a memory 46. The operator inputs a dimension of the bag body 40 along the length of the film 50 (that is, the bag length) and a thickness of the article 100, using the operating device 61 illustrated in FIG. 1. The inputted values of the bag length and the thickness of

the article 100 are inputted to the setting part 45 respectively as data S1 and data S2.

[0054] Based on the data S1, the setting part 45 sets the amount of film 50 to be pulled down by the film-pulling unit 12 (that is, the amount of difference in position of the film-pulling unit 12 between in FIG. 8 and in FIG. 9) and the amount of the film 50 to be conveyed by the conveying unit 14 (that is, the amount of difference in position of the conveying unit 14 between in FIG. 7 and in FIG. 8). The longer the bag is, the larger the amounts to be pulled down and to be conveyed are, and the shorter the bag is, the smaller the amounts to be pulled down and to be conveyed are. For example, when the bag length is doubled, the amounts to be pulled down and to be conveyed are each doubled as well. More specifically, a data table in which relations between various bag lengths and each proper value of the amounts to be pulled down and to be conveyed corresponding to each bag length are described is stored in the memory 46 in advance, and the setting part 45 reads the amounts to be pulled down and to be conveyed corresponding to the bag length indicated by the data S1 from the memory 46. The setting part 45 inputs data S3 on the set amount to be pulled down to the driving part of the film-pulling unit 12. The setting part 45 also inputs data S4 on the set amount to be conveyed to the driving part of the conveying unit 14.

[0055] Based on the data S2, the setting part 45 sets the distance to drive the sealing height adjustment unit 18 (that is, the amount of difference in position of the sealing height adjustment unit 18 between in FIG. 9 and in FIG. 10). The setting part 45 sets the distance to drive the sealing height adjustment unit 18 at a half value of the thickness of the article 100 indicated by the data S2. The setting part 45 inputs data S5 on the set driving distance to the driving part of the sealing height adjustment unit 18.

[0056] In the packaging apparatus 1 according to the first preferred embodiment, the conveying unit 14 conveys the film 50 in the direction X1 with the article 100 placed on the first portion 501 of the film 50, while folding back in the direction X2 opposite to the direction X1 over the article 100 the second portion 502 of the film 50 ahead of the first portion 501 with respect to the direction X1. Moreover, the sealing parts 16U, 16L, 17U, and 17L seal the edge portions of the first portion 501 and the second portion 502 together so as to form the bag body 40 containing the article 100 between the first portion 501 and the second portion 502, and the cutter 32 cuts the bag body 40 off the film 50. Thus the packaging apparatus 1 according to the present embodiment realizes packaging of the article 100 without a tray. Consequently, consumers can enjoy reduced amount of trash and manufacturers can enjoy reduced costs for purchasing and managing trays and do not need a space for storing trays.

[0057] Moreover, sealing of the top of the bag body 40 by the sealing parts 16U and 16L is performed behind the article 100 in the conveyance direction of the article 100 (direction X1). Therefore, even if inertia of conveyance causes the article 100 to advance in the direction X1 on the film 10 after cessation of conveyance, since the article 100 moves away from the portion to be sealed at the top, chances that the article 100 is stuck in the sealed portion are reduced. In addition, advance of the article 100 in the direction X1 on the film 50 is not unlimited, since the advance of the article 100 is limited by the film 50 ahead, and thus there is no particular disadvantage.

[0058] Furthermore, size reduction of the apparatus is achieved in comparison with an inverse pillow packaging machine, since there is no need for a former to form the film into a tube. In addition, there is no longitudinal sealing of the film 50, unlike the inverse pillow packaging machine. Therefore, in packaging of the article 100 having distinction between its obverse and reverse sides, placing the article 100 on the film 50 with its obverse side facing upward does not spoil the appearance of a product, since there is no longitudinal sealing seam above the obverse side of the article 100.

[0059] Moreover, in the packaging apparatus 1 according to the first preferred embodiment, the sealing parts 15U and 15L joins the film 50 separated to cut off the bag body 40 by the cutter 32. Therefore, since the film 50 separated to cut off the bag body 40 is joined by the sealing parts 15U and 15L by the time when packaging of a subsequent article 100 is started, continuous packaging of multiple articles 100 is practicable.

[0060] Moreover, in the packaging apparatus 1 according to the first preferred embodiment, the film-collecting roll 34 rolls up a predetermined amount of film 50 that has been joined by the sealing parts 15U and 15L, so as to collect the joined portion 41 by the sealing parts 15U and 15L of the film 50. Therefore, since the joined portion 41 of the film 50 is prevented from being contained in part of the bag body 40 in packaging of a subsequent article 100, decrease in hermeticity and strength of the bag body 40 is prevented, at the same time as the appearance of the bag body 40 is prevented from being spoiled.

[0061] Moreover, in the packaging apparatus 1 according to the first preferred embodiment, the setting part 45 sets the amount of the film 50 to be conveyed in the direction X1 by the conveying unit 14 in accordance with the dimension of the bag body 40 along the length of the film 50 (that is, the bag length). Thus setting the amount of film 50 to be conveyed realizes formation of various kinds of bag bodies 40 with different bag lengths. In addition, changing the amount of film 50 to be conveyed every time realizes continuous formation of bag bodies 40 with different bag lengths.

[0062] Moreover, the packaging apparatus 1 according to the first preferred embodiment sets the distance to drive the sealing height adjustment unit 18 downward in accordance with the thickness of the article 100 so that approximately the middle of the article 100 along its thickness is level with the sealing parts 15L, 16L, and 17L. Since sealing with approximately the middle of the article

100 along its thickness being level with the upper surface of the sealing parts 15L, 16L, and 17L allows the sealing parts 15L, 16L, and 17L to seal the first portion 501 and the second portion 502 with their edge portions accurately overlapping with each other, precision in end result of the bag body 40 is improved. Moreover, since the width of the film 50 used to constitute the upper side of the bag body 40 is equal to that of the film 50 used to constitute the lower side, required width of the film 50 is minimized.

[0063] In addition, the pulling device 6 for pulling down part of the film 50 constituting the bag body 40 is provided between the placement device 2 and the sealing device 3. Setting an amount of the film 50 to be reserved at the pulling device (that is, amount to be pulled down by the film-pulling unit 12) in accordance with the bag length of the bag body 40 allows the operator to place the article 100 always at the same position of the placement device 2 (the placement platform 10). Consequently, since there is no need to change the placement position of the article 100 in accordance with the bag length of the bag body 40, work efficiency is improved. Furthermore, the operator only has to place the article 100 always at the same position of the placement device 2 (placement platform 10) regardless of whether it is odd-numbered time or even-numbered time of packaging, and does not need to change placement position of the article 100 depending on number of times of packaging as to whether it is odd-numbered or even-numbered, which improves work efficiency.

[0064] In the packaging apparatus 1 according to the first preferred embodiment, the film-pulling unit 12 includes the roller 12L. When the film 50 on which the article 100 is placed is conveyed by the conveying unit 14 from the placement device 2 to the sealing device 3 over the pulling device 6, the roller 12L serving as anti-drop means and positioned between the rollers 13A and 13B prevents the article 100 from dropping from the gap between the rollers 13A and 13B. Thus smooth conveyance of the article 100 from the placement device 2 to the sealing device 3 is realized.

[0065] In the packaging apparatus 1 according to the first preferred embodiment, the placement device 2 and the delivery device 5 are arranged to be approximately level with each other in front of the above apparatus casing. Thus an operator do not need to change the posture up and down to place the article 100 at the placement device 2 and to receive a packaged article 100 from the delivery device 5. Accordingly, physical strain on the operator due to change of posture is reduced, and thus work efficiency is improved.

[0066] In addition, a conveying unit 14 for conveying the article 100 from the placement device 2 to the sealing device 3, the sealing height adjustment unit 18 for conveying the bag body 40 from the sealing device 3 to the weighing device 4, and the conveyor belt 20 for conveying the bag body 40 from the weighing device 4 to the delivery device 5 are all arranged within the apparatus casing. Therefore, size reduction of the apparatus is achieved in comparison with the case where a bag body formed by the sealing device 3 is delivered from the back of the apparatus casing and then conveyed to the front of the apparatus casing by a conveyor belt or the like that is external to the casing.

Second Preferred Embodiment

[0067] FIG. 19 is a perspective view illustrating an overall structure of a packaging apparatus 1 according to a second preferred embodiment of the present invention. FIG. 19 illustrates the structure of the packaging apparatus 1 without a cover of an apparatus casing. The packaging apparatus 1, being installed in, for example, a backyard of a supermarket, performs every processing including packaging, weighing, and pricing of articles by a single apparatus. Target articles include food products such as meat, fish, and vegetables. At the front side of the apparatus casing (the side as viewed in the direction X1 in the figure), a display device 60, an operating device 61, a label printer 62, a starting switch 63, and a speaker 64 are arranged. The display device 60 displays information such as various settings, weighed results of articles, and prices in accordance with weight values. The operating device 61 includes a numeric key pad, an operating switch, and so forth, so that an operator operates the operating device 61 to input the various settings. The label printer 62 outputs a label on which the weight value, the price, and so forth of the articles are printed for each of the articles.

[0068] FIGS. 20 to 29 are diagrams illustrating packaging of an article by the sealing device 3 in a process sequence. The sealing device 3 includes an upper sealing unit 70U and a lower sealing unit 70L. The upper sealing unit 70U includes sealing parts 15U, 16U, and 17U, a cutter 32, and a roller 31. The sealing parts 15U, 16U, and 17U respectively correspond to the sealing parts 15L, 16L, and 17L illustrated in FIG. 3. The cutter 32 is provided in a gap between the sealing parts 15U and 16U in parallel to the sealing parts 15U and 16U. The upper sealing unit 70U is movable upward and downward (in the directions Z1 and Z2 in the figure), driven by a drive mechanism not illustrated in the figure. Moreover, the sealing height adjustment unit 18 is movable upward and downward, driven by a drive mechanism not illustrated in the figure, and the film-pulling unit 12 is also movable upward and downward, driven by a drive mechanism not illustrated in the figure. Furthermore, the conveying unit 14 is movable backward and forward (in the directions X1 and X2 in the figure), driven by a drive mechanism not illustrated in the figure.

[0069] In a standby state as illustrated in FIG. 20, the film-pulling unit 12 has been driven downward, and the conveying unit 14 has been driven forward (that is, to the front as viewed from the front side of the apparatus casing). A transparent, band-shaped film 50, which is a packaging material, is routed from a film-supplying roll 30 via a roller 11, the upper surface of a placement platform 10,

a roller 13A, a roller 12U, a roller 13B, a roller 14L, a roller 14U, and a roller 33 in this order, to a film-collecting roll 34, as indicated by the heavy broken line in the figure.

[0070] Next referring to FIG. 21, an operator places a presently target article 100 (indicated by a reference code "100A" to distinguish from a subsequently target article 100B) on the film 50. The packaging apparatus 1 according to the present embodiment allows the article 100A to be placed directly on the film 50 without a tray. It should be noted, however, that use of a tray is not prohibited but an article on a tray can be placed at the placement platform 10. After placing the article 100A at the placement platform 10, the operator presses a starting switch 63 (see FIG. 19). The starting switch 63 may be a type of switch that is depressed with a foot (foot switch).

[0071] When the operator presses the starting switch 63, next referring to FIG. 22, the film-pulling unit 12 is driven upward to the position where the roller 12L is level with the rollers 13A and 13B within an even plane. Simultaneously the conveying unit 14 is driven backward (that is, to the back as viewed from the front side of the apparatus casing). The conveying unit 14 proceeds through the space between the upper sealing unit 70U and the lower sealing unit 70L toward the back. At this time, rotation of the film-collecting roll 34 has been stopped, so that the film-supplying roll 30 supplies a required amount of film 50. Thus the conveying unit 14 proceeds so as to convey the film 50, and accordingly, the article 100A placed on the film 50 is conveyed from the placement platform 10 through the space between the rollers 12U and 12L onto the sealing height adjustment unit 18.

[0072] Next referring to FIG. 23, the film-pulling unit 12 is driven downward. At this time, rotation of the film-collecting roll 34 has been stopped, so that the film-supplying roll 30 supplies a required amount of film 50. Thus part of the film 50 to be used in subsequent packaging is reserved by the pulling device 6. Then the operator places a subsequent article 100B at the placement platform 10. Even if the operator presses the starting switch 63 at this time, since processing of the present article 100A has not been completed, packaging of the article 100B is in a standby state.

[0073] Next referring to FIG. 24, the sealing height adjustment unit 18 is driven downward for a predetermined distance in accordance with a thickness of the article 100A. The sealing height adjustment unit 18 is driven downward to the position where the upper surface of the sealing parts 15L, 16L, and 17L is approximately level with the middle of the article 100A along its thickness. It should be noted, however, that all that is required here is that relative position between the article 100A and the sealing parts 15L, 16L, and 17L are adjusted, and thus the lower sealing unit 70L may be driven upward, instead of the sealing height adjustment unit 18 being driven downward.

[0074] Next referring to FIGS. 25 and 26, the conveying unit 14 is driven forward in a predetermined inclination and on a predetermined track so as to avoid contact with the article 100A. Thus the conveying unit 14 leaves the space between the upper sealing unit 70U and the lower sealing unit 70L and returns to the initial position as illustrated in FIG. 20. FIG. 30 is a perspective view schematically illustrating a state of the film 50. After a series of movements of the conveying unit 14 up to here, a second portion 502 of the film 50 ahead (ahead in the direction X1 in the figure) of a first portion 501 where the article 100A is placed has been folded back in the direction X2 in the figure over the article 100.

[0075] Next referring to FIG. 27, the upper sealing unit 70U is driven downward, so that the film 50 is sandwiched between the sealing parts 15U, 16U, and 17U above and the sealing parts 15L, 16L, and 17L below. Then the edge portions of the first portion 501 and the second portion 502 are sealed together by thermo compression bonding. FIG. 31 is a diagram schematically illustrating sealed portions of the film 50. The sealing parts 17U and 17L seal areas AR1 at the lateral sides, while the sealing parts 16U and 16L seal an area AR2 at the top. A bag body 40 containing the article 100A between the first portion 501 and the second portion 502 is thereby formed. It is not necessarily the case that three sides of the bag body 40 are sealed, but for example, the area AR2 may remain unsealed and only the two lateral sides are sealed. In such a case, since the top of the bag body 40 is open, the operator can put a little sachet of seasoning or the like into the bag body 40 after the bag body 40 is delivered from the packaging apparatus 1.

[0076] The cutter 32 cuts the film 50 along the line N near the area AR2. In order to join the film 50 separated due to this cutting, an area AR3 near the line N is sealed by the sealing parts 15U and 15L. Thereby, the film 50 once separated by cutting is rejoined at the joined portion 41.

[0077] Next referring to FIG. 28, the upper sealing unit 70U is driven upward, thereby returning to the initial position as illustrated in FIG. 20. Then the sealing height adjustment unit 18 is driven upward, and accordingly the bag body 40 on the sealing height adjustment unit 18 is also moved upward.

[0078] Next referring to FIG. 29, the conveyor belt of the sealing height adjustment unit 18 is driven so that the bag body 40 is conveyed from the sealing height adjustment unit 18 onto a conveyor belt 20 of the weighing device 4 via a roller 19, jumping over the sealing part 17L. The film-collecting roll 34 is driven to roll up a predetermined amount of film 50, so as to collect the joined portion 41 of the film 50. Then the sealing height adjustment unit 18 is driven downward, thereby returning to the initial position as illustrated in FIG. 20. This leads to start of the same packaging as described above of the subsequent article 100B.

[0079] During the above operation of the packaging apparatus 1, when the operator places the article 100 at the outer end portion of the placement platform 10 (that is, the end portion close to the roller 11), the article 100

can get stuck at the top of the bag body 40 when the film 50 seals in the article 100, due to lack of conveyance distance of the article 100 inside the sealing device 3. Moreover, referring to FIG. 23, when the operator places the article 100B at the placement platform 10 before downward movement of the film-pulling unit 12 is completed, the article 100B moves in the direction X1 along with subsequent downward movement of the film-pulling unit 12 and can possibly drop from between the rollers 13A and 13B. Measures to prevent such inconveniences are described below.

[0080] FIG. 32 is a top view illustrating a configuration of the placement platform 10. FIG. 33 is a cross-sectional view illustrating a structure in a cross section along the line K-K in FIG. 32. As illustrated in FIGS. 32 and 33, the placement platform 10 has a structure in which a transparent cover 81 is attached to a casing 80 shaped like a box whose upper surface is open. The upper surface of the cover 81 serves as an article placement surface on which the article 100 is placed. Multiple reflector plates 83 extending in the direction Y are arranged side by side in the direction X1 at regular intervals within the casing 80. Thus the space inside the casing 80 is divided into multiple band-shaped areas M arranged side by side in the direction X1. Moreover, each of the areas M is provided with a predetermined number (one in this example, but may be multiple) of light-emitting elements 82. Each of the light-emitting elements 82 includes LEDs that emit lights of red, blue, and yellow, for example. In this way, placement platform 10 has a structure in which display means having multiple light-emitting elements 82 are embedded within the article placement surface so as to be recognized from outside. In this display means, the upper surface of the cover 81 serves as a display surface.

[0081] FIG. 34 is a perspective view illustrating part of the structure of the cover 81. The cover 81 has a structure in which an electrode film 85 having multiple transparent electrodes 87 extending in the direction Y being arranged side by side in the direction X1 and an electrode film 86 having multiple transparent electrodes 88 extending in the direction X1 being arranged side by side in the direction Y are facing each other via a spacer not illustrated in the figure. When the article 100 is placed at the placement platform 10 (that is, on the cover 81), the transparent electrodes 87 and the transparent electrodes 88 conduct in the placement position under a load of the article 100. Placement of the article 100 at the placement platform 10 and the placement position are detected by detecting the current fed by the conduction between the transparent electrodes 87 and 88 as an electric signal.

[0082] FIG. 35 is a block diagram illustrating a configuration of a control device 47 of the packaging apparatus 1. The control device 47 receives input of a signal S11 indicating information on a kind of the target article 100 or the like (such as a product code), a signal S 12 indicating completion of pulling down of the film 50 by the film-pulling unit 12 (see FIG. 23), a signal S13 indicating placement of the article 100 at the placement platform 10 and the placement position, a signal S 14 indicating pressing of the starting switch 63, and a signal S15 indicating start of conveyance of the film 50 by the conveying unit 14 (see FIG. 22). Whether or not the film-pulling unit 12 has completed pulling down the film 50 can be determined by, for example, detecting arrival of the film-pulling unit 12 at the lowest point with an optical sensor, or by counting the number of drive pulses if the film-pulling unit 12 is driven by a stepping motor.

[0083] The control device 47 outputs a signal S21 to control each of the light-emitting elements 82 as to whether or not light should be emitted and which color of light should be emitted, a signal S22 to control the speaker 64 (see FIG. 19), and a signal S23 to adjust the placement position of the article 100 at the placement platform 10 (details are described below).

[0084] FIGS. 36 to 38 are top views illustrating an example of control of the display means by the control device 47. When the conveying unit 14 starts conveying the film 50 in processing the article 100A as illustrated in FIG. 22, the control device 47, upon receipt of the signal S15, makes the whole area AR10 of the display surface emit a red light with the signal S21 as illustrated in FIG. 36. In this example, the red light indicates prohibition of placement of a subsequent article 100B at the placement platform 10. More specifically, red-light emission of the display surface notifies the operator that it is presently in a timing during which placement of the article 100B is prohibited (placement prohibited timing).

[0085] If the operator erroneously places the article 100B at the placement platform 10 despite the timing during which the display surface is emitting the red light, the control device 47, upon receipt of the signal S 13, makes the speaker 64 output a predetermined warning message to lead the operator to collect the placed article 100B, such as, a voice message saying, for example, "Please do not place the product yet."

[0086] As processing of the article 100A proceeds and the film-pulling unit 12 completes pulling down the film 50 as illustrated in FIG. 23, the control device 47, upon receipt of the signal S12, makes the area AR11 corresponding to the proper placement position emit a blue light and makes the other area AR12 emit no light with the signal S21 as illustrated in FIG. 37. The dimension of the area AR11 (the dimension in the direction X1) is preset in accordance with a kind of the article 100 or the like and is stored in the memory 46. The control device 47 refers to the memory 46 to set the area AR11 corresponding to a product code contained in the signal S 11.

[0087] In this example, the blue light indicates permission for placement of a subsequent article 100B at the placement platform 10 and a position for placement of the article 100B. More specifically, blue-light emission of the display surface notifies the operator that it is presently in a timing during which placement of the article 100B is permitted (placement permitted timing), and area AR11, which is a part of the display surface, emitting the blue light notifies the operator of a position for placement of

the article 100B. In receipt of this notification, the operator places the article 100B on the film 50 within the area AR11 that emits the blue light, and then, presses the starting switch 63 to start processing the article 100B.

[0088] As described above, even if the operator presses the starting switch 63 at this time, since the processing of the present article 100A has not been completed, packaging of the subsequent article 100B is in a standby state. In such a case, the control device 47, upon receipt of the signal S 14, makes the whole area AR10 of the display surface emit a yellow light with the signal S21 as illustrated in FIG. 38. In this example, the yellow light indicates prohibition of contact with the placed article 100B at the placement platform 10. More specifically, yellow-light emission of the display surface notifies the operator that it is presently in a timing during which contact with the article 100B is prohibited (contact prohibited timing). Emission of the yellow light continues from when the starting switch 63 is pressed to start processing the article 100B until when the conveying unit 14 starts conveying the film 50 in processing of the article 100B. Thus emission of the yellow light continues in the states in FIGS. 24 to 29. When the conveying unit 14 starts conveying the film 50, the red light is emitted as described above.

[0089] FIG. 39 is a top view illustrating an example of control by the control device 47 when the article 100B is placed outside the proper placement position. If the operator erroneously places the article 100B outside the area AR11 despite the display surface emitting the blue light as illustrated in FIG. 37, the control device 47 adjusts the placement position of the article 100B at the placement platform 10. More specifically, the control device 47 specifies an improper placement position of the article 100B (position indicated by the broken line in FIG. 39) based on the signal S13, and calculates necessary conveyance distance to move the article 100B from the improper placement position to the proper placement position. When a predetermined amount of the film 50 is rolled up to collect the joined portion 41 of the film 50 in processing of the article 100A (see FIG. 29), the driving part of the film-collecting roll 34 is controlled so that an extra amount of the film 50 corresponding to the necessary conveyance distance is rolled up. Consequently, as illustrated in FIG. 39, the article 100B moves on the placement platform 10 along with the film 50 to the proper placement position. Then the conveying unit 14 starts conveying the film 50. It should be noted that when adjusting the placement position of the article 100 at the placement platform 10, it is not necessarily the case that the placement position of the article 100 is notified.

[0090] FIG. 40 is a top view illustrating another example of a configuration of the placement platform 10. Display means (a dot-matrix LED, for example) having a structure in which multiple light-emitting elements 90 are arrayed in a matrix is arranged within the casing 80. Each of the light-emitting elements 90 includes LEDs that emit lights of red, blue, and yellow, for example.

[0091] FIG. 41 is a top view illustrating an example of control of the display means illustrated in FIG. 40 by the control device 47. When the film-pulling unit 12 completes pulling down the film 50 as illustrated in FIG. 23, the control device 47, upon receipt of the signal S12, makes the area AR21 corresponding to the proper placement position emit a blue light and makes the other area AR22 emit no light with the signal S21 as illustrated in FIG. 37. The dimensions of the area AR21 (the dimensions in the directions X1 and Y) are preset in accordance with a kind of the article 100 or the like and is stored in the memory 46. The control device 47 refers to the memory 46 to set the area AR21 corresponding to a product code contained in the signal S11.

[0092] In a manner similar to the above, the blue light indicates permission for placement of a subsequent article 100B at the placement platform 10 and a position for placement of the article 100B. More specifically, blue-light emission of the display surface notifies the operator that it is presently in a timing during which placement of the article 100B is permitted, and area AR21, which is a part of the display surface, emitting the blue light notifies the operator of a position for placement of the article 100B. In receipt of this notification, the operator places the article 100B on the film 50 within the area AR21 that emits the blue light, and then, presses the starting switch 63 to start processing the article 100B. Other controls are the same as the above.

[0093] FIG. 42 is a top view illustrating another example of a configuration of the placement platform 10. An arbitrary image display device 95 such as a liquid crystal display device is arranged as display means within the casing 80.

[0094] FIG. 43 is a top view illustrating an example of control of the display means illustrated in FIG. 42 by the control device 47. When the film-pulling unit 12 completes pulling down the film 50 as illustrated in FIG. 23, the control device 47, upon receipt of the signal S12, displays a diagram 96 depicting the target article 100 at the proper placement position with the signal S21 as illustrated in FIG. 43. In this example, packaging of three fish together is performed and the diagram 96 depicting three fish is displayed on the display surface. The layout and the dimensions of the diagram 96 are preset in accordance with a kind of the article 100 or the like and are stored in the memory 46. The control device 47 refers to the memory 46 to set the diagram 96 corresponding to a product code contained in the signal S 11.

[0095] The diagram 96 displayed on the display surface indicates permission for placement of a subsequent article 100B at the placement platform 10 and a position and an orientation (arrangement) for placement of the article 100B. More specifically, the diagram 96 displayed on the display surface notifies the operator that it is presently in a timing during which placement of the article 100B is permitted, and also notifies the operator of a position and an orientation for placement of the article 100B. In receipt of this notification, the operator places the article 100B over the diagram 96 displayed on the display

surface, and then, presses the starting switch 63 to start processing the article 100B. In the placement prohibited timing, the display surface may emit the red light in the whole area, and at the same time, display a text message saying, for example, "Please do not place the product yet." In the contact prohibited timing, the display surface may emit the yellow light in the whole area, and at the same time, display a text message saying, for example, "Please do not touch the product placed. Other controls are the same as the above.

[0096] The above describes an example of displaying three different states (the placement permitted timing, the placement prohibited timing, and the contact prohibited timing), but control of display may be performed between only two different states (the placement permitted timing and the placement prohibited timing), omitting display of the contact prohibited timing.

[0097] Moreover, the above describes an example of notifying the state by means of display on the display surface, but the state may be notified by means of a voice message outputted from the speaker 64. Alternatively, the notification may be made by means of both display and the voice message.

[0098] Moreover, the above describes an example of notifying the state by means of different colors of lights of the light-emitting element, but the state may be notified by means of lighting, flashing, and extinguishing with a single-colored light-emitting element.

[0099] In the packaging apparatus 1 according to the second preferred embodiment, the article 100 is placed on the film 50 at the placement device 2. Then the conveying unit 14 (packaging material conveying means) conveys the film 50 with the article 100 placed thereon from the placement device 2 to the sealing device 3, and the sealing device 3 forms the film 50 into a bag shape and seals edge portions to form a bag body 40 containing the article 100. Thus the packaging apparatus 1 according to the second preferred embodiment realizes packaging of the article 100 without a tray. Consequently, consumers can enjoy reduced amount of trash and manufacturers can enjoy reduced costs for purchasing and managing trays and do not need a space for storing trays.

[0100] The display means (position notification means) embedded within the placement platform 10 notifies a proper position to place the article 100 on the film 50 (proper placement position) at the placement device 2. Thus variations in the placement position of the article 100 caused by the operator is prevented, and also when the film 50 is sealed, the article 100 is prevented from being stuck due to placement of the article 100 at the outer end portion of the placement platform 10.

[0101] In the packaging apparatus 1 according to the second preferred embodiment, the display means (timing-notifying means) embedded within the placement platform 10 notifies a timing during which placement of the article 100 on the film 50 at the placement device 2 is permitted. Thus the operator can place the article 100 on the film 50 in the permitted timing notified by the timing-notifying means. This prevents in advance placement of the article 100B by the operator before packaging of the subsequent article 100B is ready.

[0102] In the packaging apparatus 1 according to the second preferred embodiment, the timing-notifying means notifies a timing during which placement of the article 100 on the film 50 at the placement device 2 is prohibited. Thus notification as the placement prohibited timing is made until packaging of the subsequent article 100B is ready, which prevents in advance placement of the article 100B by the operator before packaging of the subsequent article 100B is ready.

[0103] In the packaging apparatus 1 according to the second preferred embodiment, the speaker 64 (warning means) performs predetermined warning, when the article 100 is placed on the film 50 in the timing during which placement of the article 100 on the film 50 is prohibited. Thus if the operator erroneously places the article 100 despite the placement prohibited timing, warning by the warning means leads the operator to collect the placed article 100.

[0104] In the packaging apparatus 1 according to the second preferred embodiment, the timing-notifying means notifies a timing during which contact with the article 100 placed on the film 50 at the placement device 2 is prohibited. Thus after the operator gives directions to start packaging until the conveying unit 14 actually starts conveying the film 50, notification as the contact prohibited timing is made, which prevents in advance start of conveyance soon after the operator touches the article 100.

[0105] In the packaging apparatus 1 according to the second preferred embodiment, position-notifying means and/or timing-notifying means gives a predetermined notification with display means embedded within the article placement surface of the placement platform 10. Thus since information on a proper placement position and a placement timing of the article 100 is directly displayed on the placement platform 10, the operator is accurately and efficiently notified of such information.

[0106] In the example illustrated in FIG. 32, a structure in which multiple band-shaped light-emitting areas M are arranged side by side along the conveyance direction of the film 50 by the conveying unit 14 (the direction X1) realizes display means at a low cost. Moreover, in the example illustrated in FIG. 40, a structure in which multiple light-emitting elements 90 are arrayed in a matrix realizes a notification to the operator about the proper placement position of the article 100 not only with respect to the conveyance direction (the direction X1) but also with respect to a width direction (the direction Y) that is perpendicular to the conveyance direction. Moreover, in the example illustrated in FIG. 42, the image display device 95 displays a diagram 96 depicting the article 100, realizing a notification to the operator about not only the proper placement position of the article 100 but also the orientation, the arrangement, and so forth of the article 100.

[0107] In the packaging apparatus 1 according to the second preferred embodiment, position-adjusting means (the driving part of the film-collecting roll 34) adjusts the position of the article 100 at the placement platform 10 before the conveying unit 14 starts conveying the film 50. Thus when the operator places the article 100 in an improper position despite the notification of the proper placement position of the article 100, adjustment of the position of the article 100 to the proper placement position by the position-adjusting means prevents in advance the article 100 from being stuck when the packaging material is sealed.

Third Preferred Embodiment

[0108] FIG. 44 is a perspective view schematically illustrating an overall structure of a packaging apparatus 1 according to a third preferred embodiment of the present invention. The packaging apparatus 1, being installed in, for example, a backyard of a supermarket or the like, performs every processing including packaging, weighing, and pricing of articles by a single apparatus. Target articles include food products such as meat, fish, and vegetables. At the front side of the apparatus casing (the side as viewed in the direction X1 in the figure), a display device 60, an operating device 61, and a label printer 62 are arranged. The display device 60 displays information such as various settings, weighed results of articles, and prices in accordance with weight values. The operating device 61 includes a numeric key pad, an operating switch, and so forth, so that an operator operates the operating device 61 to input the various settings. The label printer 62 outputs a label on which the weight value, the price, and so forth of the articles are printed for each of the articles.

[0109] FIG. 45 is a diagram schematically illustrating the layout of the processing devices in the packaging apparatus 1. The packaging apparatus 1 includes a placement and weighing device 2A, a sealing device 3 arranged behind the placement and weighing device 2A, and a delivery device 5 arranged beside the placement and weighing device 2A and the sealing device 3. In the placement and weighing device 2A, a target article is placed on the film and weighed. The article which have been placed and weighed at the placement and weighing device 2A is conveyed along with the film in the direction X1 in the figure as indicated by the arrow L1 to the sealing device 3. The sealing device 3 packages the article with the film. The article which has been packaged by the sealing device 3 is conveyed in the direction Y in the figure as indicated by the arrow L2 to the delivery device 5. The article is conveyed in the direction X2 in the figure as indicated by the arrow L3 and is delivered from the delivery device 5. The placement and weighing device 2A and the delivery device 5 are arranged side by side to be approximately level with the apparatus casing. The placement and weighing device 2A, the sealing device 3, and the delivery device 5 are arranged within an almost even plane, so that their article placement surfaces are level with one another. Thus the article advances almost without a drop via the conveyance route as indicated by the arrows L1, L2, and L3 in this order.

[0110] FIG. 46 is a diagram schematically illustrating the configuration of the processing devices illustrated in FIG. 45. The placement and weighing device 2A includes a placement platform 10 where the article is placed, a chuck 713 (first packaging material conveying means) that holds and conveys the film, a cutter 712 (cutting means) that cuts the film, and a film conveyor 711. The sealing device 3 includes a chuck 714 (a second packaging material conveying means) that holds and conveys the film, sealing parts 16 and 17 (sealing means), a sealing height adjustment unit 18, and a roller 715 that is movable backward and forward in the direction $\pm$Y in the figure. The sealing height adjustment unit 18 includes a conveyor belt that conveys the article in the direction Y in the figure. Multiple rollers 19 are arranged side by side between the sealing device 3 and the delivery device 5. The delivery device 5 includes a conveyor belt 20 that conveys the article in the direction X2 in the figure and a delivery platform 21 having multiple rollers arranged side by side. As illustrated in FIG. 44, the placement platform 10 and the delivery platform 21 are arranged side by side to be approximately level with the apparatus casing.

[0111] FIGS. 47 to 63 are diagrams illustrating movements of the placement and weighing device 2A and the sealing device 3 in a process sequence. The film conveyor 711 includes an upper conveyor 711U and a lower conveyor 711L. The cutter 712 includes an upper cutter 712U and a lower cutter 712L. The chuck 713 includes an upper chuck 713U and a lower chuck 713L. Weighing means 80 such as a load cell is attached under the placement platform 10. The chuck 714 includes an upper chuck 714U and a lower chuck 714L. The sealing part 16 includes an upper sealing part 16U and a lower sealing part 16L. The sealing part 17 includes an upper sealing part 17U and a lower sealing part 17L. The upper sealing parts 16U and 17U constitutes an upper sealing unit 70U and the lower sealing parts 16L and 17L constitutes a lower sealing unit 70L.

[0112] First referring to FIG. 47, a band-shaped film 50 has been supplied from the film-supplying roll 30, with its tip slightly extending off the downstream end of the film conveyor 711. The upper chuck 713U from above and the lower chuck 713L from below sandwiches the tip of the film 50 that extends off the film conveyor 711 to hold the tip of the film 50.

[0113] Next referring to FIG. 48, the upper chuck 713U and the lower chuck 713L moves on the placement platform 10 in the direction X1 in the figure, while holding the film 50. The film conveyor 711 is also driven simultaneously with the movement of the upper chuck 713U and the lower chuck 713L, and thus, the film-supplying roll 30 newly supplies the film 50. The upper chuck 713U and the lower chuck 713L stop at a predetermined position on the placement platform 10, in accordance with the

length of the film 50 to be used in one packaging.

[0114] Next referring to FIG. 49, the upper cutter 712U moves in the direction Z2 in the figure and the lower cutter 712L moves in the direction Z1 in the figure, so that the film 50 is cut by the upper cutter 712U and the lower cutter 712L. Thus one-packaging-long film 50A having a length to be used in one packaging is obtained.

[0115] Next referring to FIG. 50, the upper chuck 713U and the lower chuck 713L move in the direction X1 in the figure on the placement platform 10, while holding the film 50A. Thus, the film 50A is conveyed onto the placement platform 10. The tip of the film 50A slightly extends off the downstream end of the placement platform 10.

[0116] Next referring to FIG. 51, the upper chuck 713U and the lower chuck 713L move to a predetermined evacuation position. Thus the upper chuck 713U and the lower chuck 713L release the film 50A, so that the film 50A is placed on the placement platform 10 without being held. In this state, the weighing means 80 weighs the film 50A and the weight value is stored. The film 50A is weighed once per packaging cycle.

[0117] Next referring to FIG. 52, the operator places the article 100. The packaging apparatus 1 according to the present embodiment allows the naked article 100 to be placed directly on the film 50 without a tray (an article container). It should be noted, however, that use of a tray is not prohibited but an article on a tray can be placed at the placement platform 10. The article 100 is placed at a specified position of the placement platform 10 via the film 50A. In this state, the weighing means 80 weighs the total of the film 50A and the article 100. Then, computing means not illustrated in the figure subtracts the weight value of the film 50A that has been stored in advance from the total weight value of the film 50A and the article 100, thereby calculating the weight value of the article 100 alone.

[0118] Next referring to FIG. 53, the upper chuck 714U from above and the lower chuck 714L from below sandwiches the tip of the film 50A that extends off the placement platform 10 to hold the tip of the film 50A.

[0119] Next referring to FIG. 54, the upper chuck 714U and the lower chuck 714L moves in the direction X1 in the figure, while holding the film 50A. Along with the movement of the upper chuck 714U and the lower chuck 714L, the article 100 placed on the film 50A also moves. The upper chuck 714U and the lower chuck 714L stops at a predetermined position after moving over the downstream end of the lower sealing unit 70L. In order to ensure a stretched state of the film 50A with respect to a lateral direction (the direction Y), the both lateral edges of the film 50A may be grasped with a film conveyor not illustrated in the figure.

[0120] Next referring to FIG. 55, the roller 715 that has been evacuated is moved onto the film 50A. The roller 715 holds down the both lateral edges of the film 50A. The roller 715 serves as position-defining means that defines a position at which the film 50 is folded.

[0121] Next referring to FIG. 56, the upper chuck 714U and the lower chuck 714L moves obliquely upward in the direction X2 in the figure, while holding the film 50A. At this time, since the roller 715 is holding down the both lateral edges of the film 50A, the film 50A is kept in a stretched state. Thus along with the movement of the upper chuck 714U and the lower chuck 714L, the article 100 placed on the film 50A moves in the direction X1 in the figure, and is conveyed onto the sealing height adjustment unit 18.

[0122] Next referring to FIG. 57, the roller 715 is moved to an evacuation position as illustrated in FIG. 46. Thus the roller 715 stops holding down the film 50A, and the film 50A is released from a stretched state.

[0123] Next referring to FIGS. 58 and 59, the upper chuck 714U and the lower chuck 714L moves obliquely downward in the direction X2 in the figure, while holding the film 50A. At this time, since the film 50A has been released from the stretched state as the roller 715 is not holding it down, the article 100 stays in the same position even if the upper chuck 714U and the lower chuck 714L moves. As illustrated in FIG. 59, the upper chuck 714U and the lower chuck 714L stops at a position slightly shifted in the direction X2 in the figure from where the lower sealing part 16L is.

[0124] Referring to FIG. 60, the sealing height adjustment unit 18 is driven downward for a predetermined distance in accordance with a thickness of the article 100. The sealing height adjustment unit 18 is driven in the direction Z2 in the figure to the position where the upper surface of the lower sealing parts 16L and 17L is approximately level with the middle of the article 100 along its thickness. It should be noted, however, that all that is required here is that relative position between the article 100 and the lower sealing parts 16L and 17L are adjusted, and thus the lower sealing unit 70L may be driven upward, instead of the sealing height adjustment unit 18 being driven downward.

[0125] Next referring to FIG. 61, the upper chuck 714U and the lower chuck 714L move to a predetermined evacuation position. Thus, the upper chuck 714U and the lower chuck 714L release the film 50A.

[0126] FIG. 64 is a perspective view schematically illustrating a state of the film 50A. After a series of movements of the chuck 714 up to here, a second portion 502 of the film 50A ahead (ahead in the direction X1 in the figure) of a first portion 501 where the article 100 is placed has been folded back in the direction X2 in the figure over the article 100. In this way, the chuck 714 as a packaging material conveying means first conveys the film 50A on the first portion 501 of which the article 100 is placed at the placement platform 10 from the placement device 2 to the sealing device 3, and then folds back over the article 100 the second portion 502 ahead of the first portion 501 and afterwards lets it fall from above.

[0127] Following FIG. 61, referring next to FIG. 62, the upper sealing unit 70U is driven in the direction Z2 in the figure, so that the film 50A is sandwiched between the upper sealing parts 16U and 17U above and the lower

sealing parts 16L and 17L below. Then the edge portions of the first portion 501 and the second portion 502 are sealed together by thermo compression bonding. FIG. 65 is a diagram schematically illustrating sealed portions of the film 50A. The upper sealing part 17U and the lower sealing part 17L seal areas AR1 at the lateral sides, while the upper sealing part 16U and the lower sealing part 16L seal an area AR2 at the top. A bag body 40 containing the article 100 between the first portion 501 and the second portion 502 is thereby formed. It is not necessarily the case that three sides of the bag body 40 are sealed, but for example, the area AR2 may remain unsealed and only the two lateral sides are sealed. In such a case, since the top of the bag body 40 is open, the operator can put a little sachet of seasoning or the like into the bag body 40 after the bag body 40 is delivered from the packaging apparatus 1.

[0128] Next referring to FIG. 63, the upper sealing unit 70U is driven in the direction Z1 in the figure, thereby returning to the initial position as illustrated in FIG. 61. Then the sealing height adjustment unit 18 is driven in the direction Z1 in the figure, and accordingly the bag body 40 on the sealing height adjustment unit 18 is also moved upward. Then, the conveyor belt of the sealing height adjustment unit 18 is driven so that the bag body 40 is conveyed from the sealing height adjustment unit 18 onto the conveyor belt 20 (see FIG. 46) of the delivery device 5 via a roller 19, jumping over the lower sealing part 17L. Then the sealing height adjustment unit 18 is driven in the direction Z2 in the figure, thereby returning to the initial position as illustrated in FIG. 62. Moreover, the chucks 713 and 714 return to the initial position as illustrated in FIG. 47. This leads to a standby state for subsequent packaging.

[0129] In the packaging apparatus 1 according to the third preferred embodiment, the chuck 714 conveys the film 50A with the article 100 being placed on its first portion 501 (a first region), and folds back over the article 100 the second portion 502 (a second region) of the film 50A ahead of the first portion 501. Then, the sealing parts 16 and 17 seal the edge portions of the first portion 501 and the second portion 502 of the folded film 50A together. Thus the packaging apparatus 1 according to the third preferred embodiment realizes packaging of the article 100 without a tray. Consequently, consumers can enjoy reduced amount of trash and manufacturers can enjoy reduced costs for purchasing and managing trays and do not need a space for storing trays.

[0130] In the packaging apparatus 1 according to the third preferred embodiment, the weighing means 80 weighs the film 50A before the article 100 is placed on the film 50A, and weighs the total of the film 50A and the article 100 after the article 100 is placed on the film 50A. Thus by subtracting the weight value before placement of the article from the weight value after placement of the article, the weight of the article 100 alone without the weight of the film 50A is accurately calculated.

[0131] In the packaging apparatus 1 according to the third preferred embodiment, the cutter 712 cuts one-packaging-long film 50A off the band-shaped film 50, and the chuck 713 conveys the one-packaging-long film 50A cut off by the cutter 712 onto the placement platform 10. Thus since the film 50A has been already cut off when the chuck 714 starts conveying the film 50A, it is not necessary to cut the band-shaped film 50 after start of conveyance by the chuck 714 or at the time of sealing by the sealing parts 16 and 17. Consequently, a mechanism for rejoining separated band-shaped film 50, or a mechanism for collecting unnecessary film produced due to cutting is omitted, which achieves size reduction of the apparatus.

First Modification of Third Preferred Embodiment

[0132] Instead of cutting off the one-packaging-long film 50A by the cutter 712 before sealing by the sealing device 3, the tip of the band-shaped film 50 drawn out to the sealing device 3 may be folded back and sealed so as to form a bag body connected with the band-shaped film 50, and then a cutter may be arranged near the upper sealing part 16U to cut the bag body off the band-shaped film 50.

[0133] When the film 50 is folded back, in a manner similar to the above third preferred embodiment, the roller 715 that has been evacuated is moved onto the film 50, and holds down the both lateral edges of the film 50, so that the position at which the film 50 is folded is defined.

[0134] In this first modification, in a manner similar to the above first preferred embodiment, a pulling device 6 may be provided between the placement device 2 and the sealing device 3 so as to reserve a proper amount of the film 50 in accordance with the bag length of the bag body. This allows the operator to place the article 100 always at the same position of the placement platform 10, and thus work efficiency is improved, since there is no need to change the placement position of the article 100 in accordance with the bag length of the bag body.

Second Modification of Third Preferred Embodiment

[0135] When the film 50 is transparent, colored two-side identification may be added to the film 50 to facilitate distinction between its obverse and reverse sides. The two-side identification may be added to an obverse side of the film 50, or to a reverse side. Moreover, the two-side identification may be added by means of printing on the film 50 or a label attached to the film 50. For example, arbitrary information such as texts, signs, logotypes, or designs regarding shops, products, or the like is added to the obverse side of the film 50 as the two-side identification. Alternatively, different design between the obverse side and the reverse side of the film 50 may serve as the two-side identification.

[0136] While the invention has been described in detail, the foregoing description is in all aspects illustrative and not restrictive. It is understood that numerous other

modifications and variations can be devised without departing from the scope of the invention.

Claims

1. A packaging apparatus comprising:

   a packaging material conveyor that conveys a continuous band-shaped packaging material in a first direction with an article placed on a first portion of the packaging material, and folds back in a second direction opposite to the first direction a second portion of the packaging material ahead of the first portion with respect to the first direction;
   a sealer that seals the first portion and the second portion to form a bag body containing the article; and
   a cutter that cuts the band-shaped packaging material.

2. The packaging apparatus according to claim 1, wherein
   the packaging material conveyor puts the second portion folded back in the second direction over the article from above the article.

3. The packaging apparatus according to claim 1 or claim 2, further comprising:

   a joiner that joins the band-shaped packaging material separated due to cutting by the cutter.

4. The packaging apparatus according to claim 3, further comprising:

   a roller that rolls up a predetermined amount of the band-shaped packaging material that has been joined by the joiner, so as to collect a joined portion by the joiner of the band-shaped packaging material.

5. The packaging apparatus according to any of the preceding claims, wherein
   the packaging material conveyor includes a holder that moves along a predetermined path while holding a tip portion of the band-shaped packaging material so as to fold back the second portion.

6. The packaging apparatus according to any of the preceding claims, further comprising:

   a setter that sets an amount of the packaging material to be conveyed in the first direction by the packaging material conveyor in accordance with a dimension of the bag body along a length of the band-shaped packaging material.

7. The packaging apparatus according to any of the preceding claims, further comprising:

   a controller that makes a level of sealing of the first portion and the second portion by the sealer and a level of approximately the middle of the article along its thickness agree with each other.

8. The packaging apparatus according to any of the preceding claims, further comprising:

   a placement device for placement of the article on the band-shaped packaging material; and
   a display that displays a position and/or a timing for placement of the article on the band-shaped packaging material at the placement device.

9. The packaging apparatus according to any of the preceding claims, further comprising:

   a puller that pulls part of the band-shaped packaging material constituting the bag body.

10. The packaging apparatus according to claim 9, wherein
    part of the band-shaped packaging material pulled by the puller includes the second portion to be used in subsequent packaging.

11. The packaging apparatus according to any of the preceding claims, further comprising:

    a position definer that defines a position at which the band-shaped packaging material is folded.

12. The packaging apparatus according to any of the preceding claims, further comprising:

    a weigher that weighs the article.

13. The packaging apparatus according to any of the preceding claims, further comprising:

    a printer that prints information on the article on a label.

FIG. 1

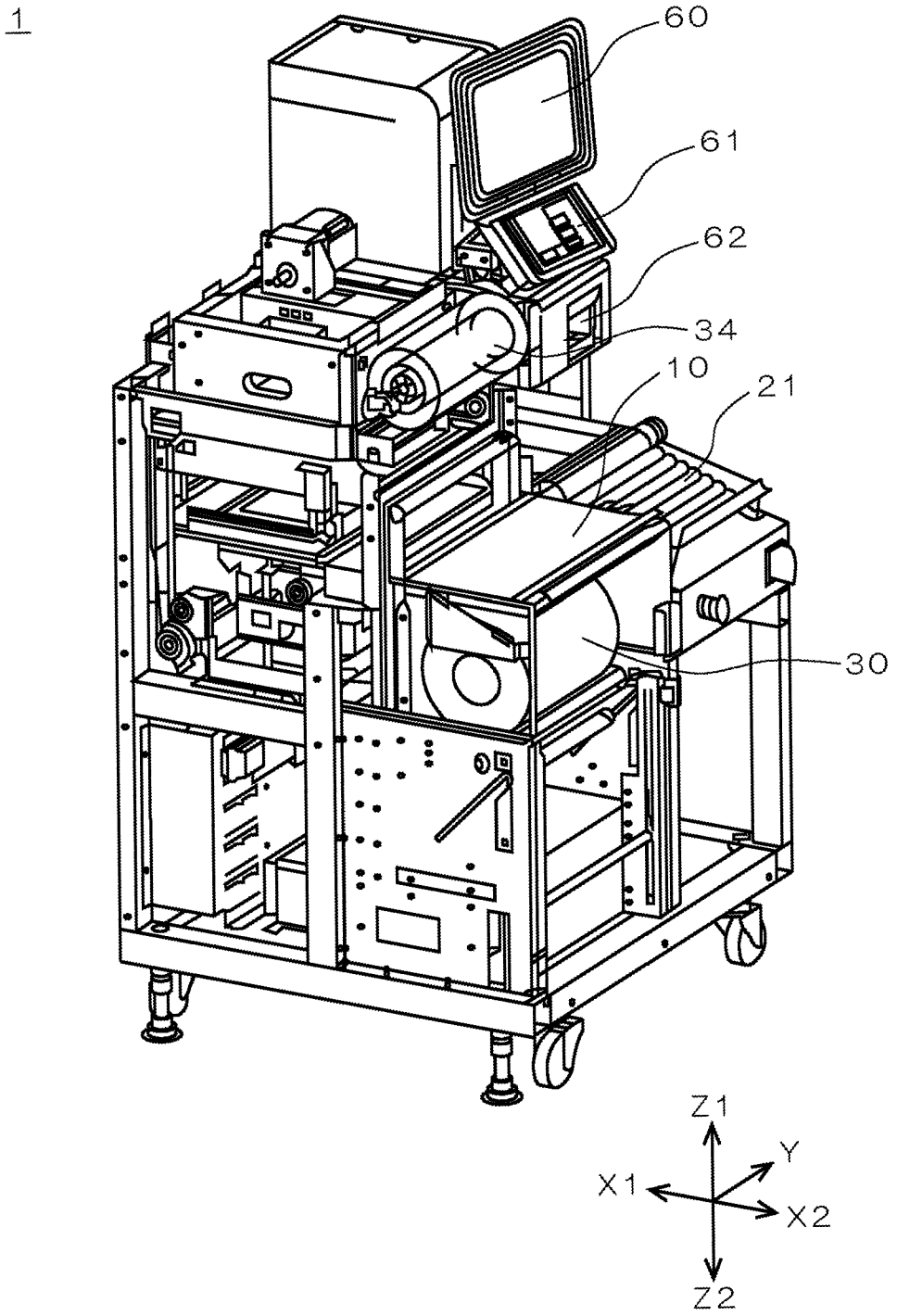


FIG. 2

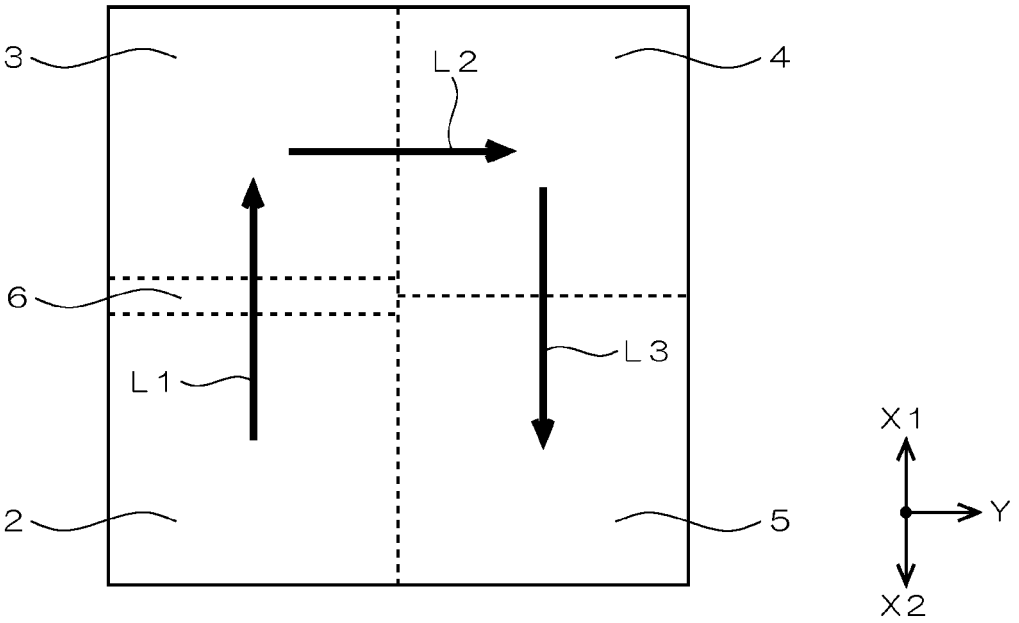
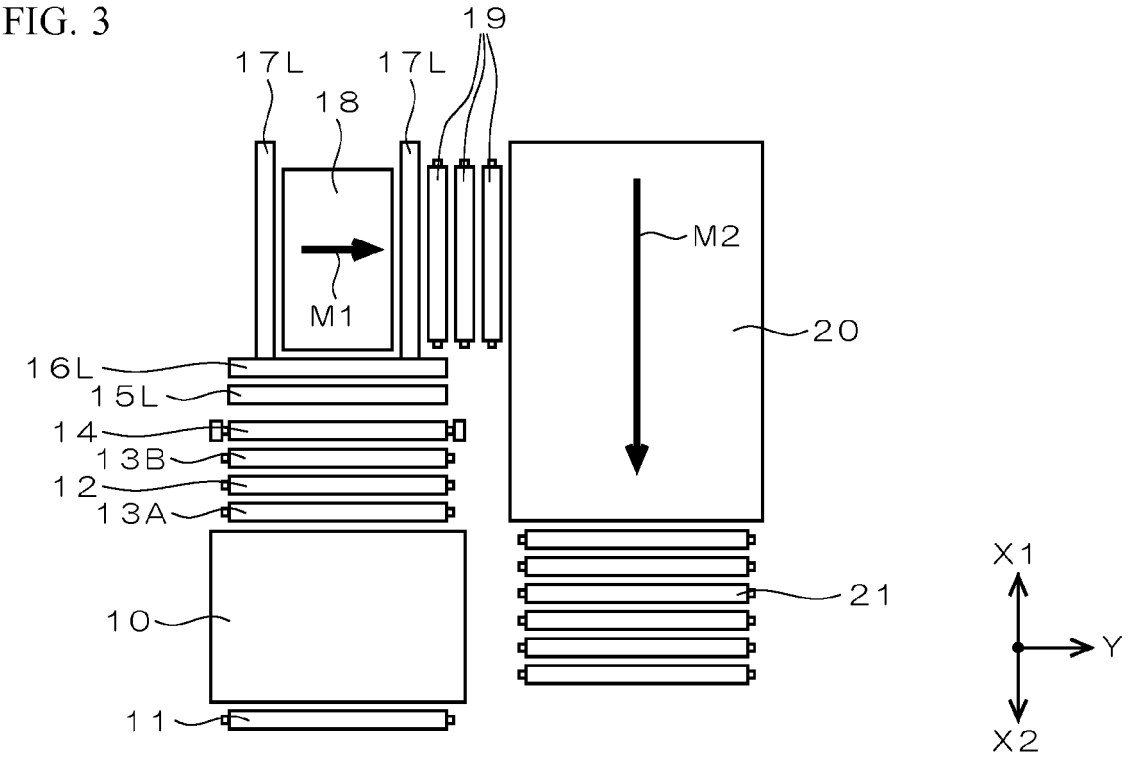

3
L2
4
6
L1
L3
2
5
X1
Y
X2

FIG. 3


19
17L
17L
18
M1
M2
20
16L
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14
13B
12
13A
10
21
11
X1
Y
X2

FIG. 4

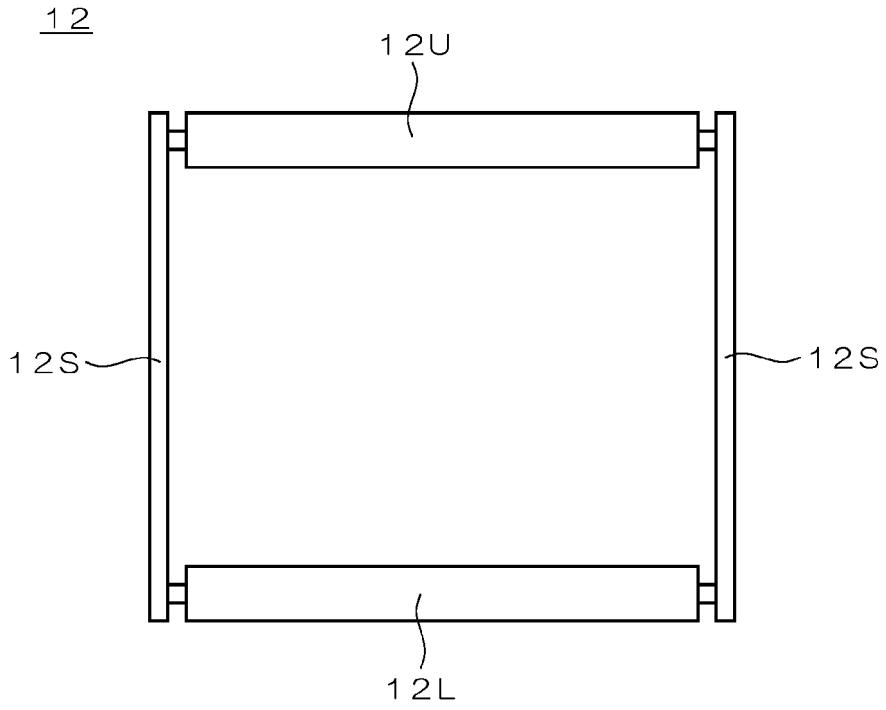


FIG. 5

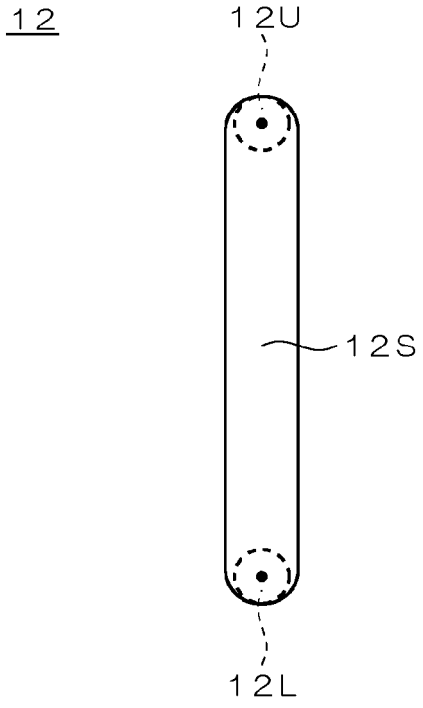
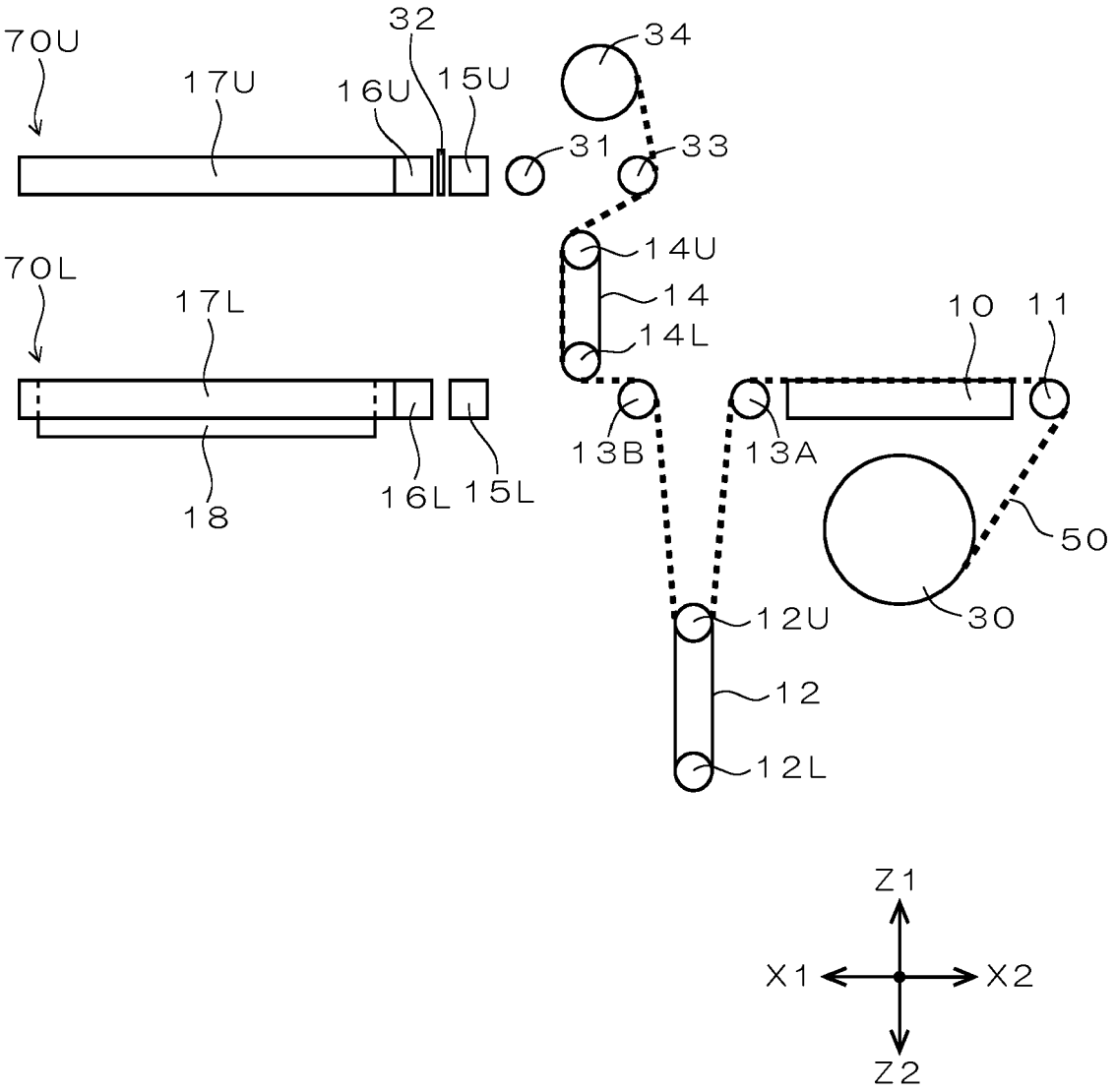


FIG. 6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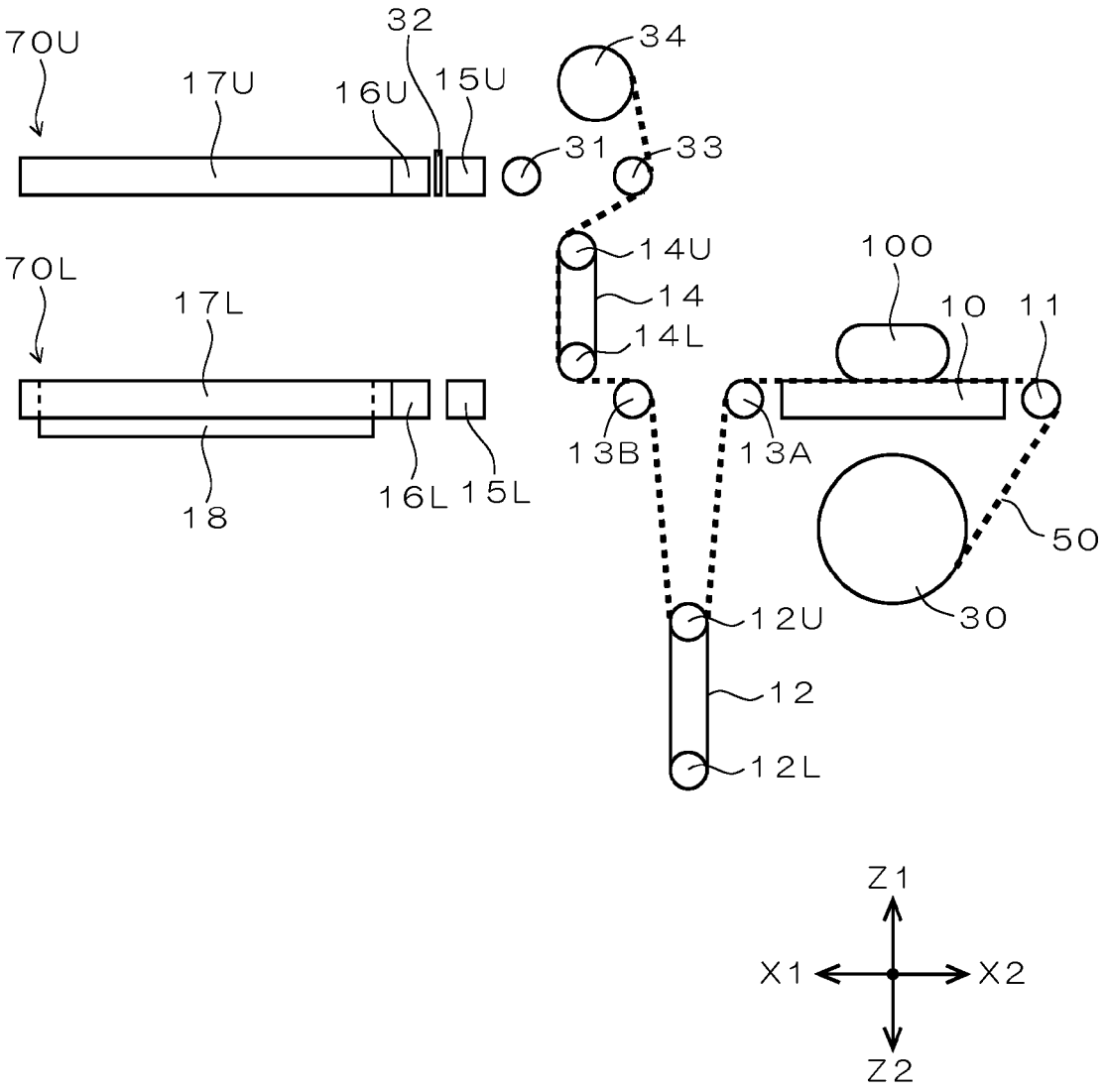
16U
15U
32
34
31
33
14U
14
14L
70L
17L
18
16L
15L
13B
13A
10
11
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 7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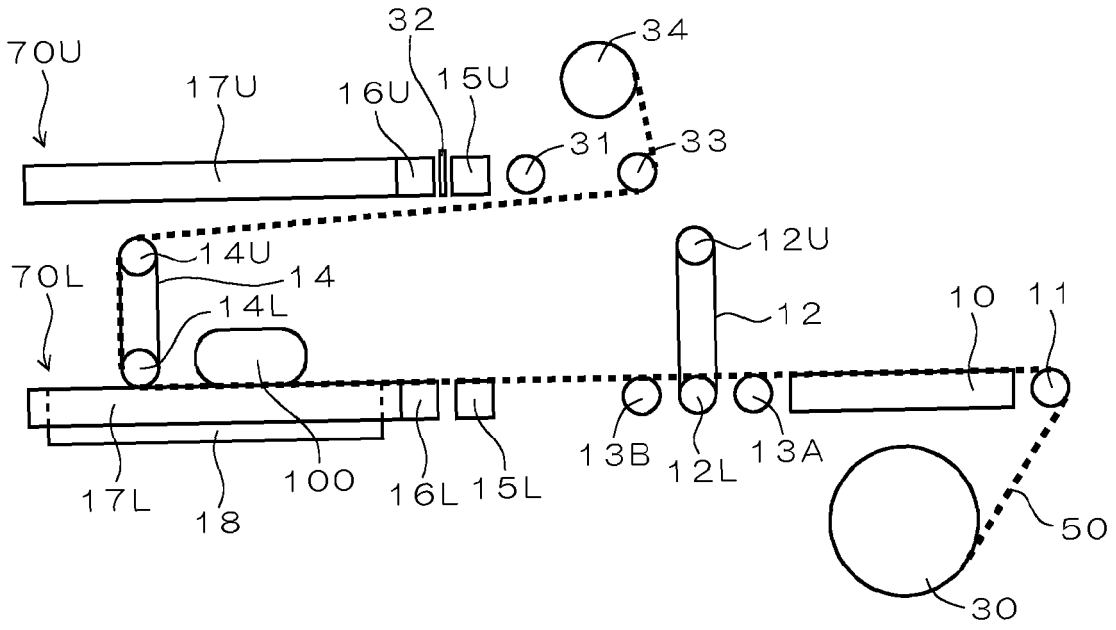
16U
32
15U
34
31
33
14U
14
14L
70L
17L
18
16L
15L
13B
13A
100
10
11
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 8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16U
32
15U
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33
70L
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10
11
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100
16L
15L
13B
12L
13A
50
30

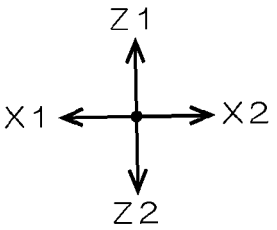
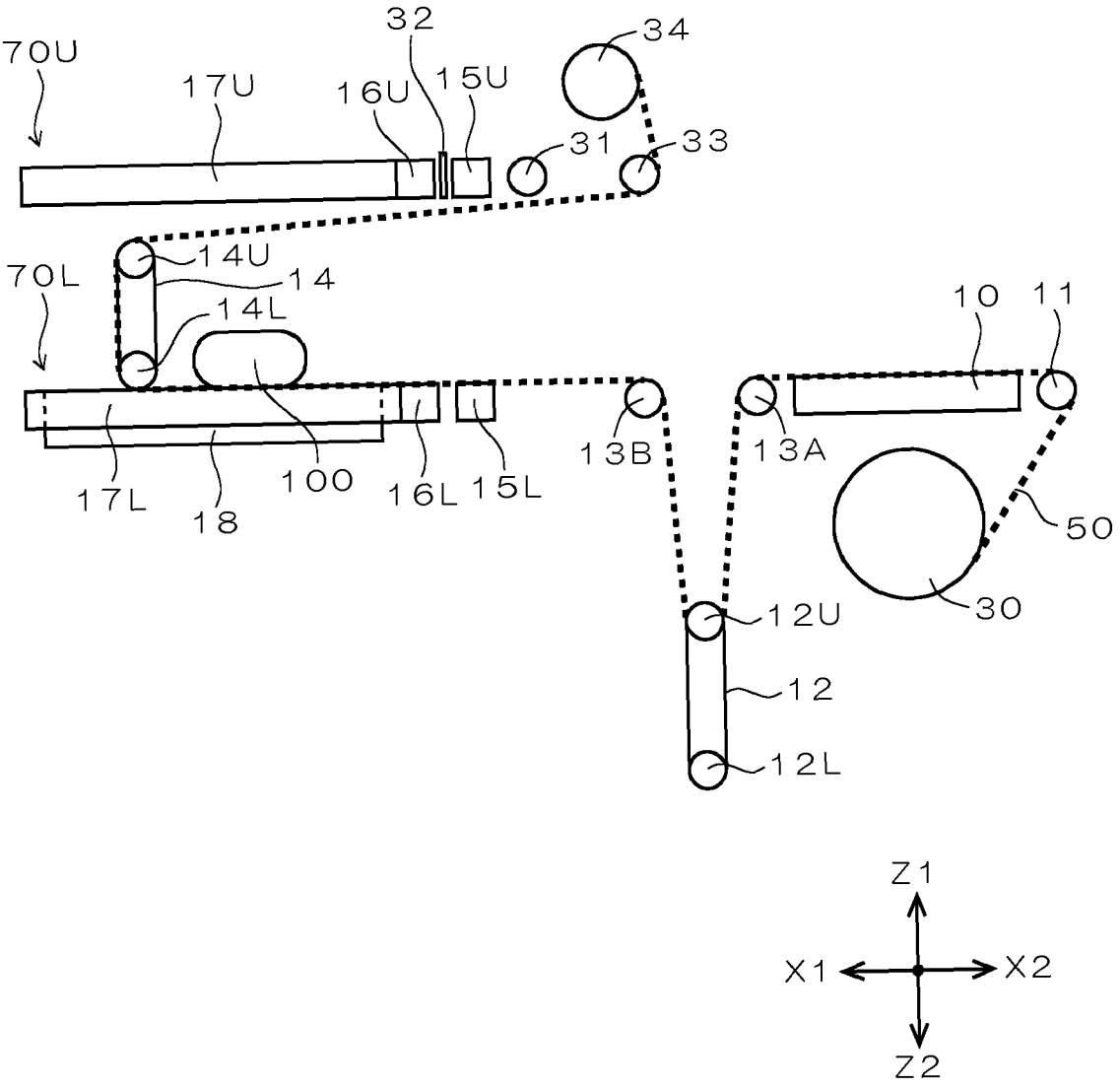

Z1
X1
X2
Z2

FIG. 9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16U
32
15U
34
31
33
70L
14U
14
14L
17L
18
100
16L
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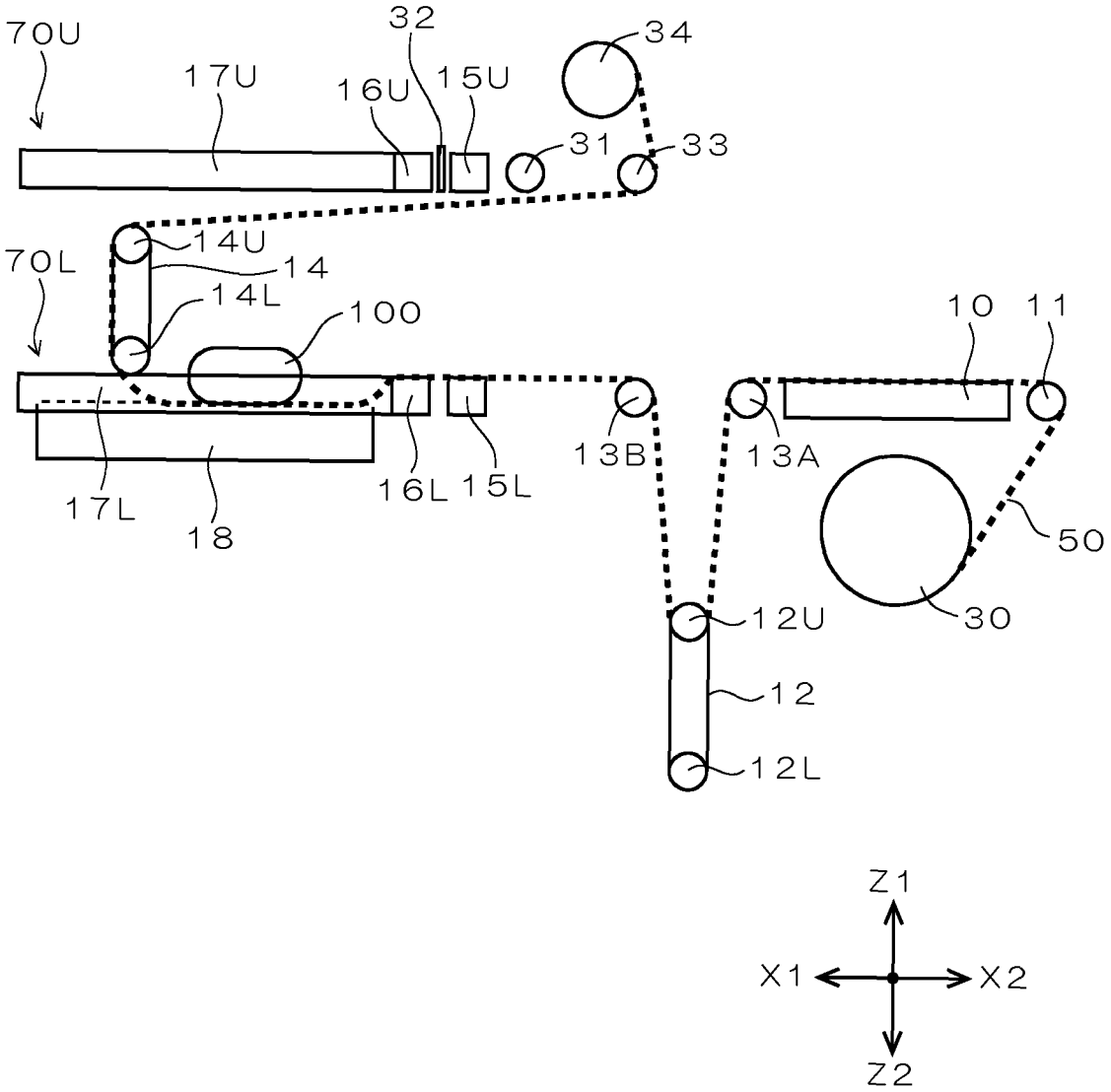
13B
13A
10
11
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 10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17U
32
16U
15U
34
31
33
70L
14U
14
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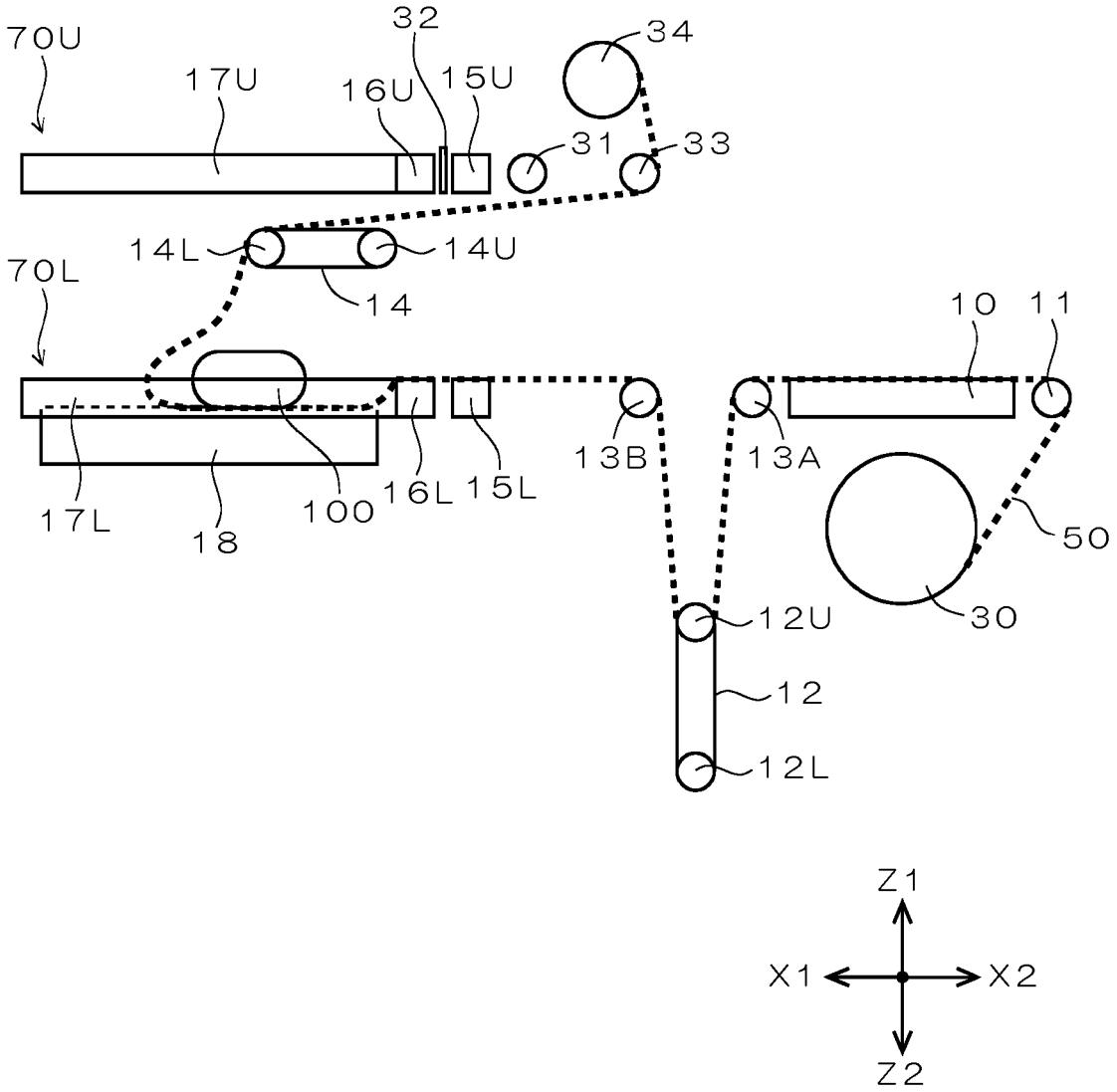
100
10
11
17L
18
16L
15L
13B
13A
50
12U
30
12
12L
Z1
X1
X2
Z2

FIG. 11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17U
16U
32
15U
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31
33
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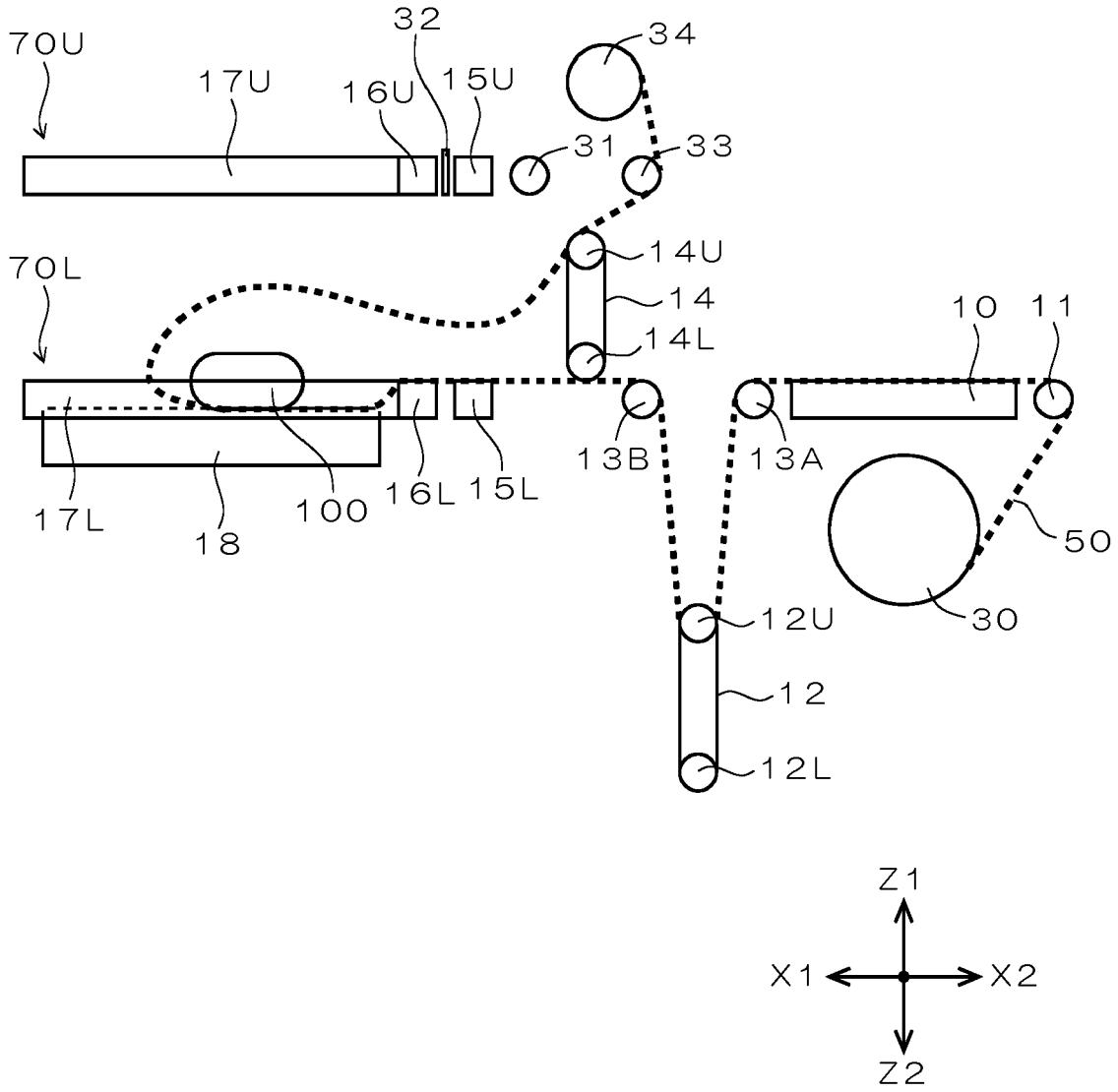
14U
14
70L
10
11
13B
13A
17L
18
100
16L
15L
50
12U
30
12
12L
Z1
X1
X2
Z2

FIG. 12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16U
32
15U
34
31
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70L
14U
14
14L
10
11
17L
18
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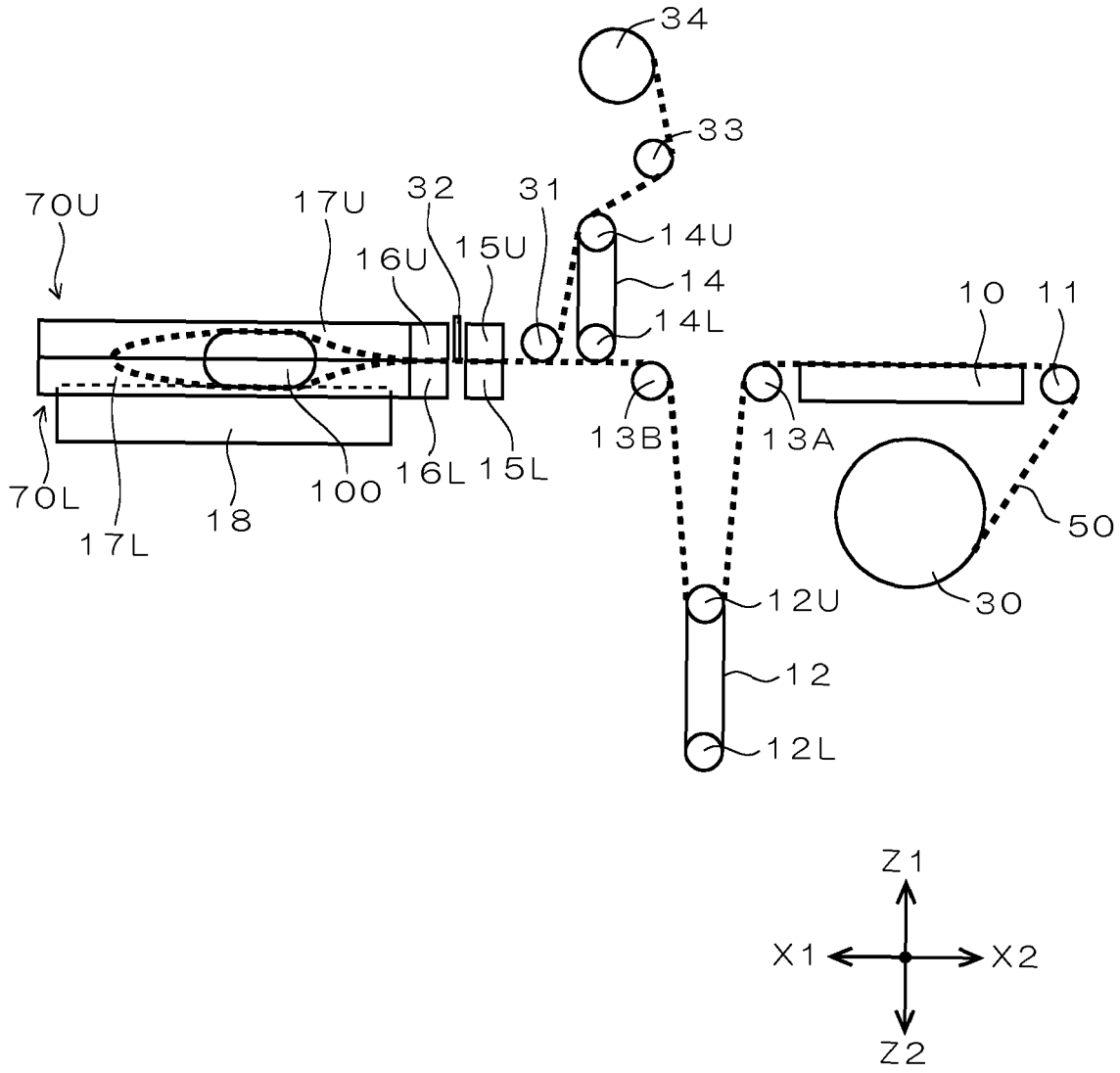
12
12L
Z1
X1
X2
Z2

FIG. 13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33
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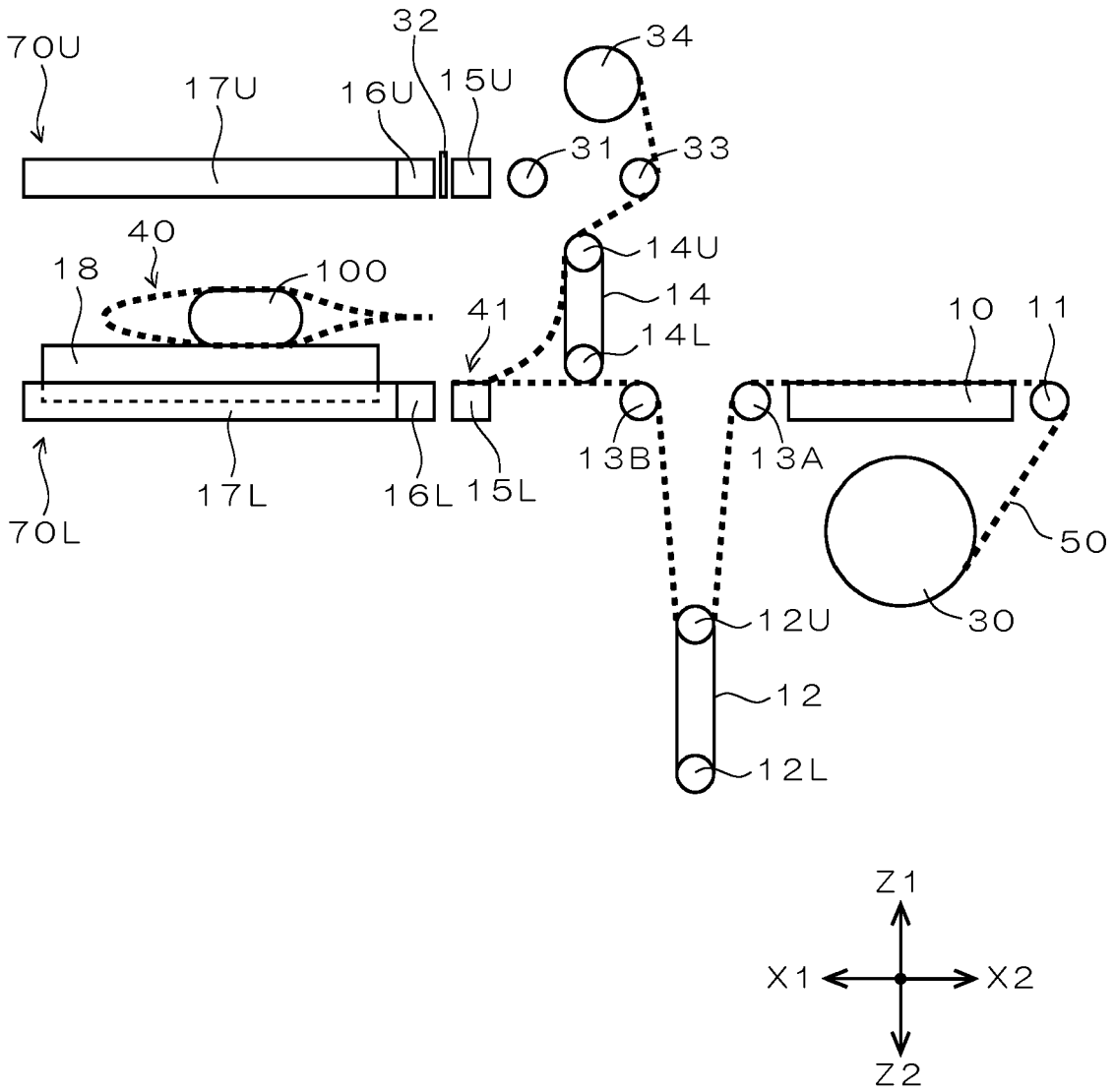
17U
32
31
16U
15U
14U
14
14L
10
11
70L
17L
18
100
16L
15L
13B
13A
50
12U
30
12
12L
Z1
X1
X2
Z2

FIG. 14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16U
32
15U
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31
33
40
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100
41
14U
14
14L
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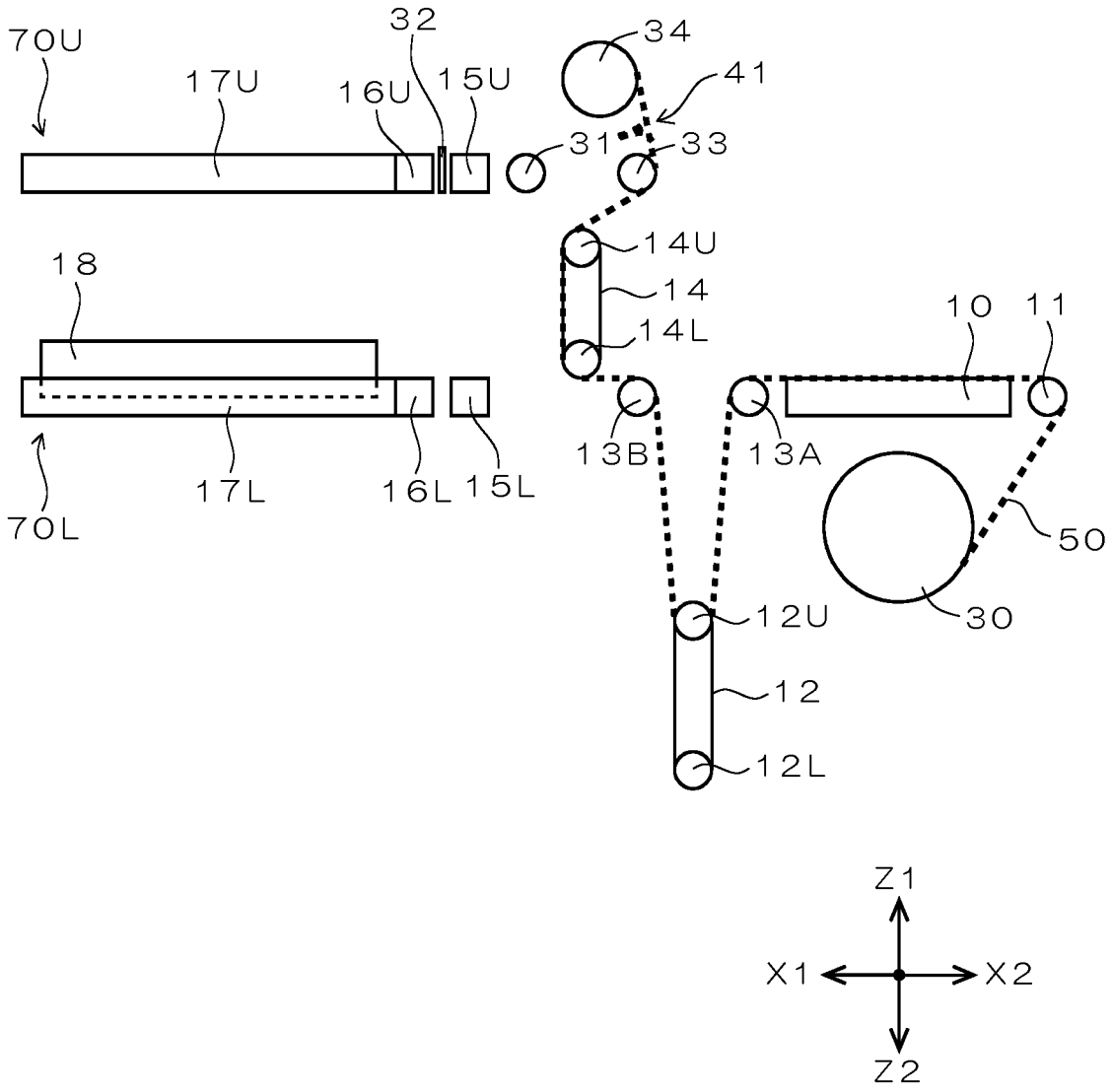
11
70L
17L
16L
15L
13B
13A
50
12U
30
12
12L
Z1
X1
X2
Z2

FIG. 15


70U
17U
16U
32
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34
41
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14
14L
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13A
17L
16L
15L
70L
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 16

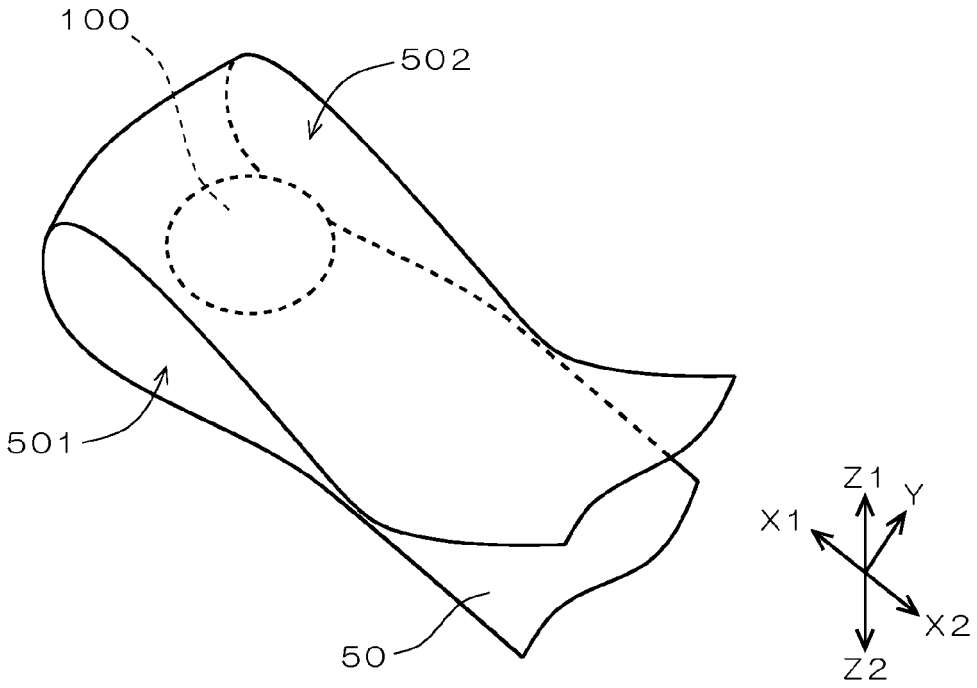


FIG. 17

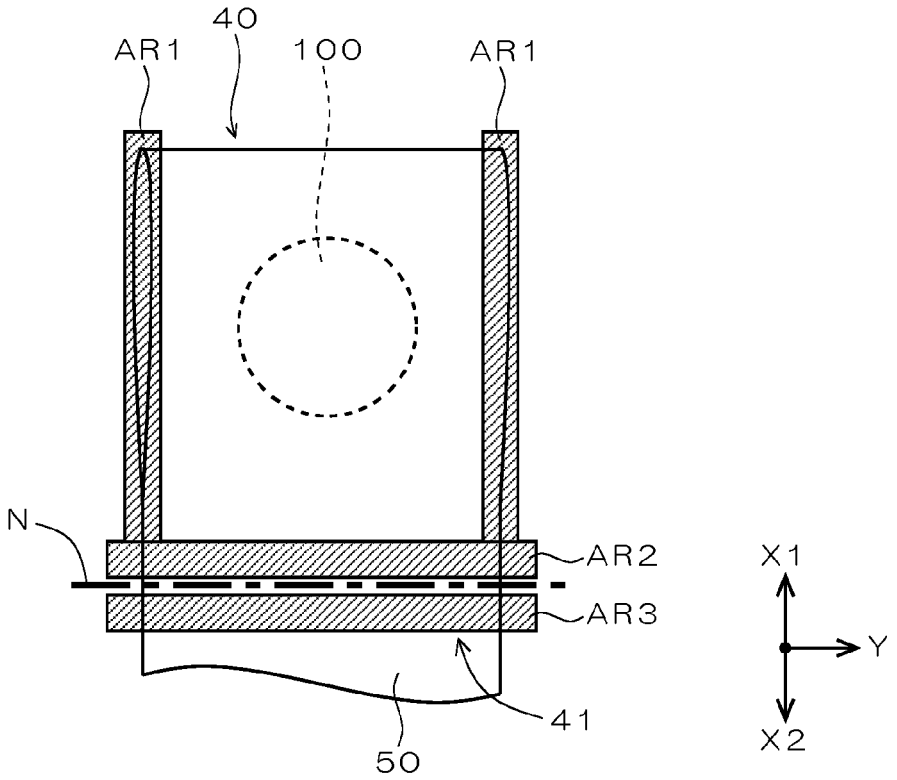


FIG. 18

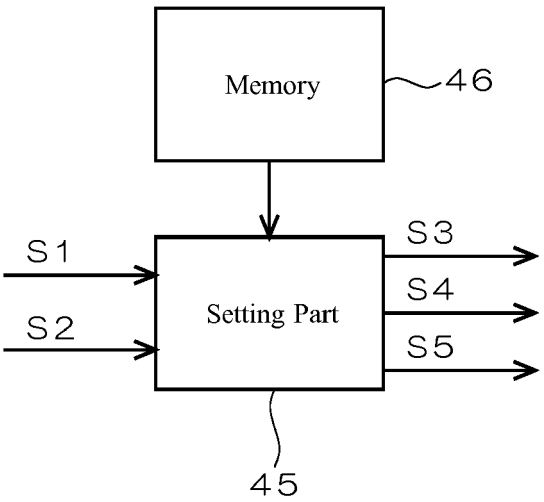


FIG. 19

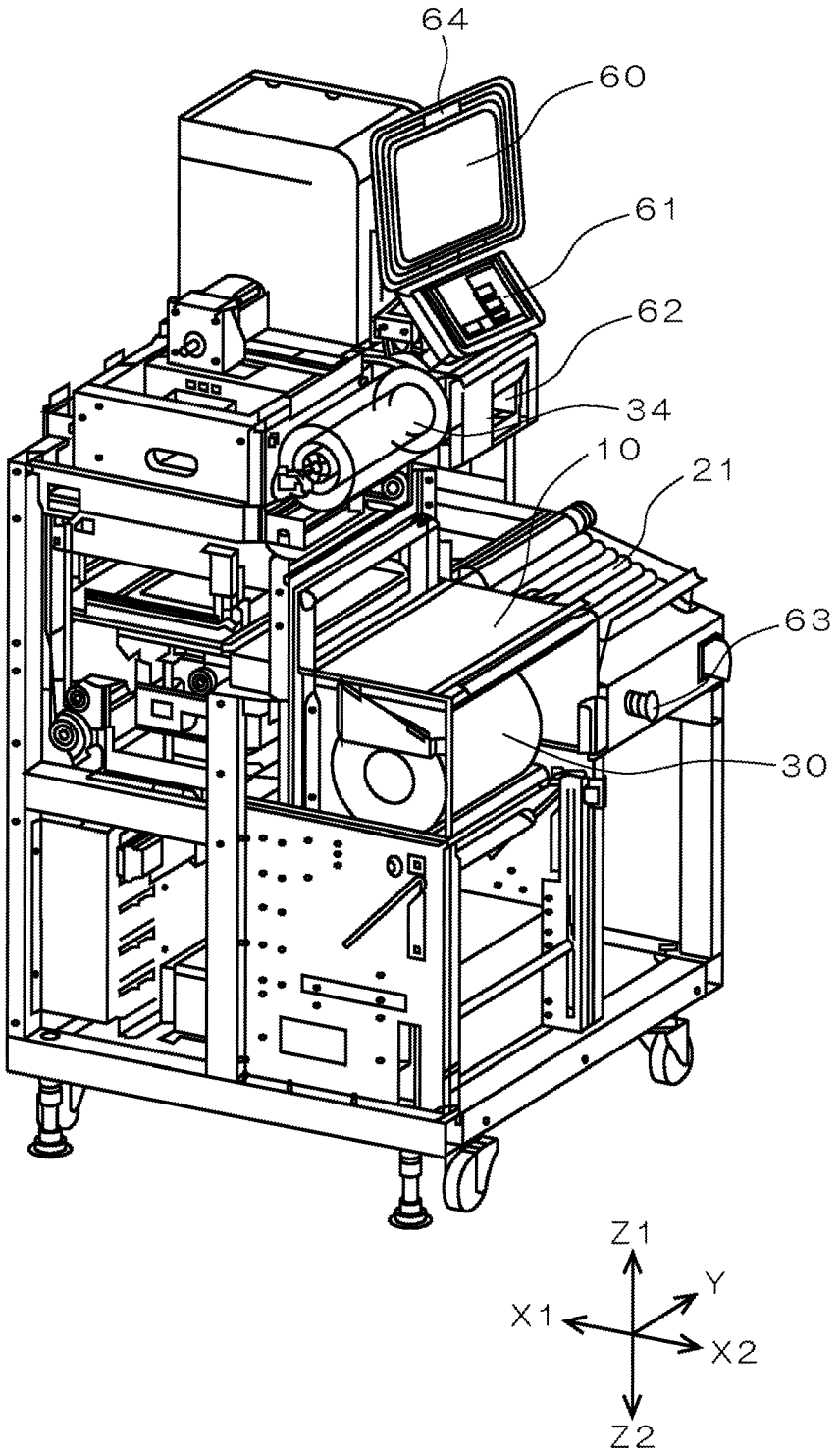


FIG. 20

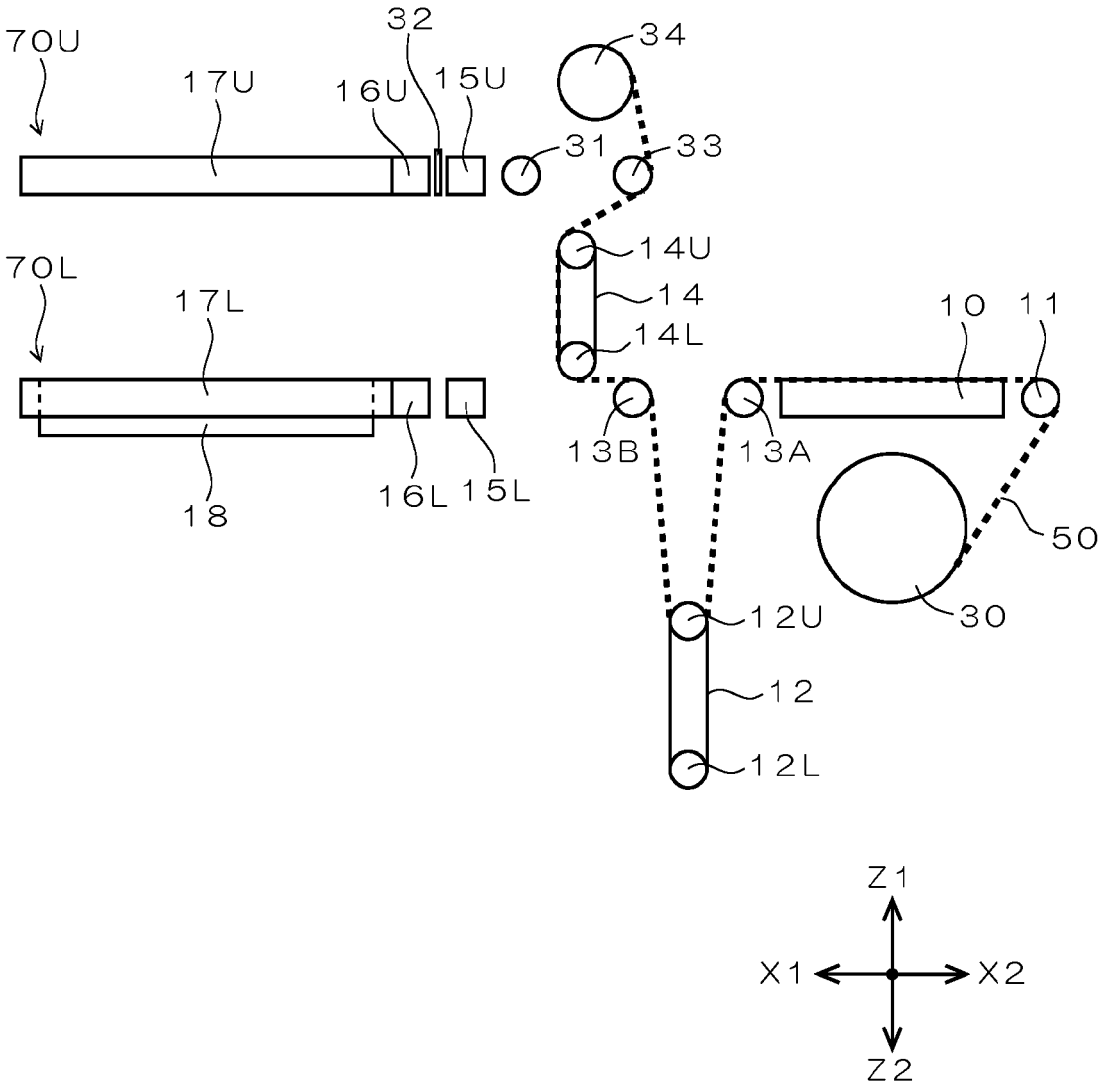

70U
17U
16U
15U
32
34
31
33
14U
14
14L
70L
17L
18
16L
15L
13B
13A
10
11
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 21

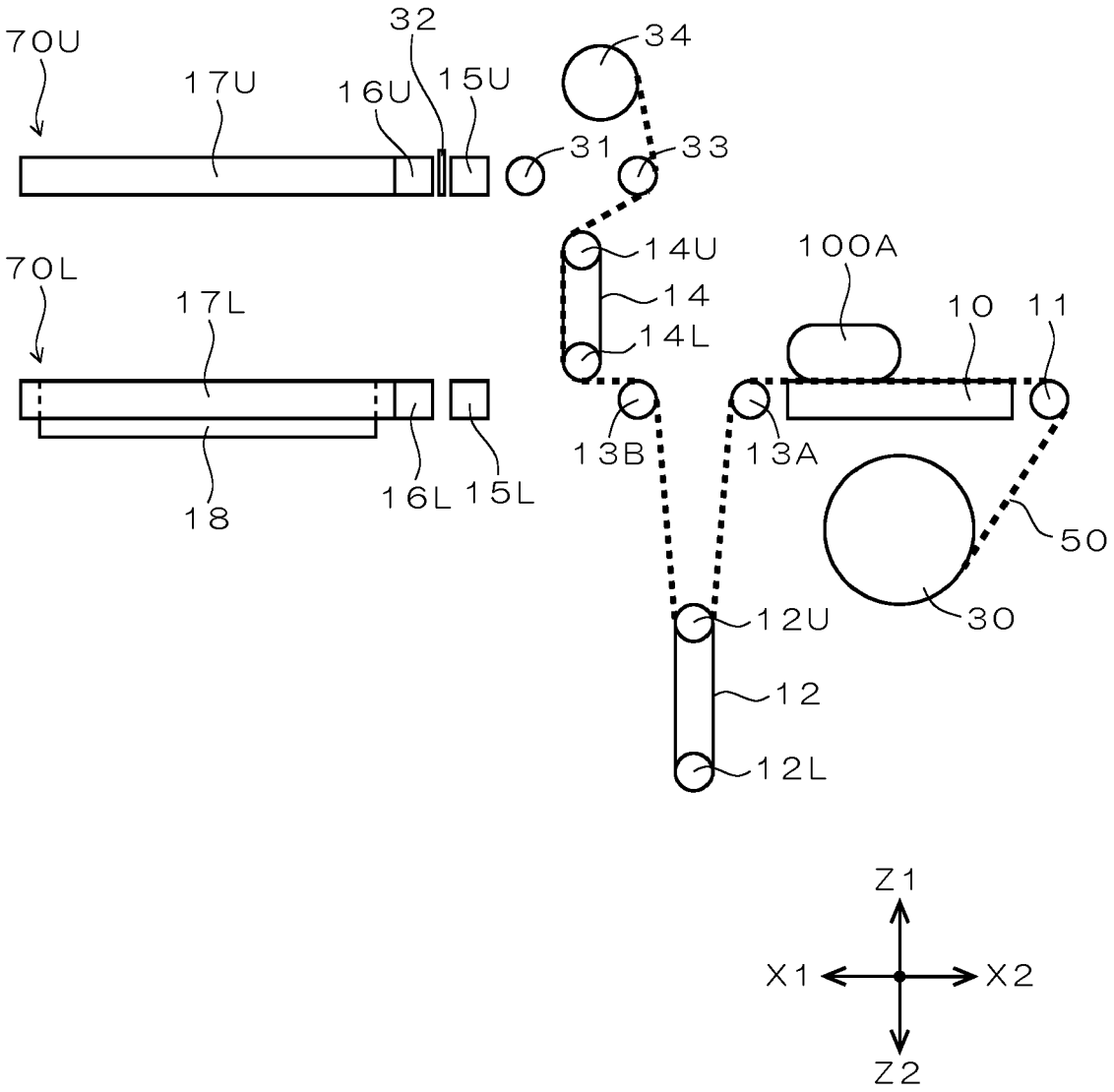
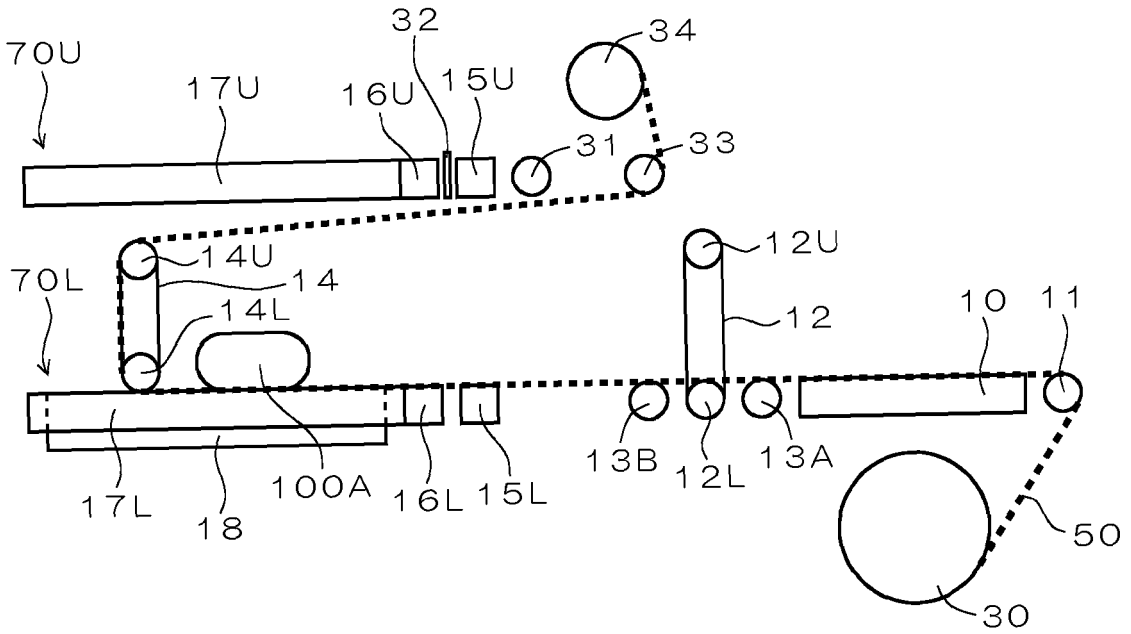

70U
17U
16U
32
15U
34
31
33
14U
14
14L
100A
10
11
70L
17L
18
16L
15L
13B
13A
50
12U
12
12L
30
Z1
X1
X2
Z2

FIG. 22


70U
17U
16U
32
15U
34
31
33
70L
14U
14
14L
12U
12
10
11
17L
18
100A
16L
15L
13B
12L
13A
50
30

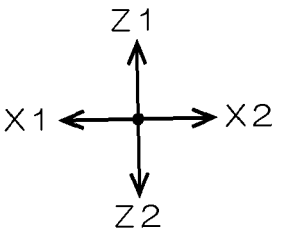

Z1
X1
X2
Z2

FIG. 23

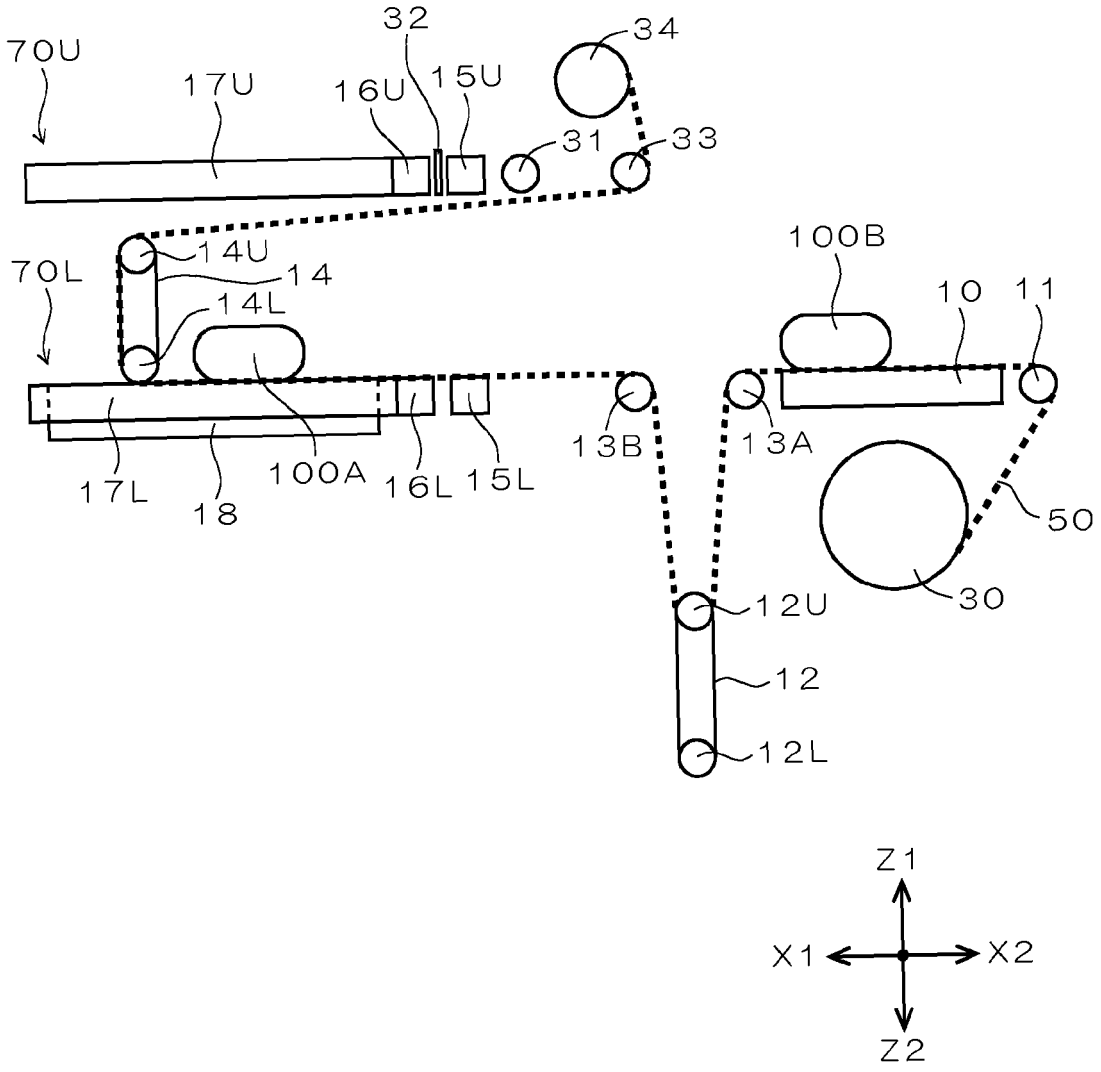

70U
17U
16U
32
15U
34
31
33
70L
14U
14
14L
17L
18
100A
16L
15L
13B
13A
100B
10
11
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 24

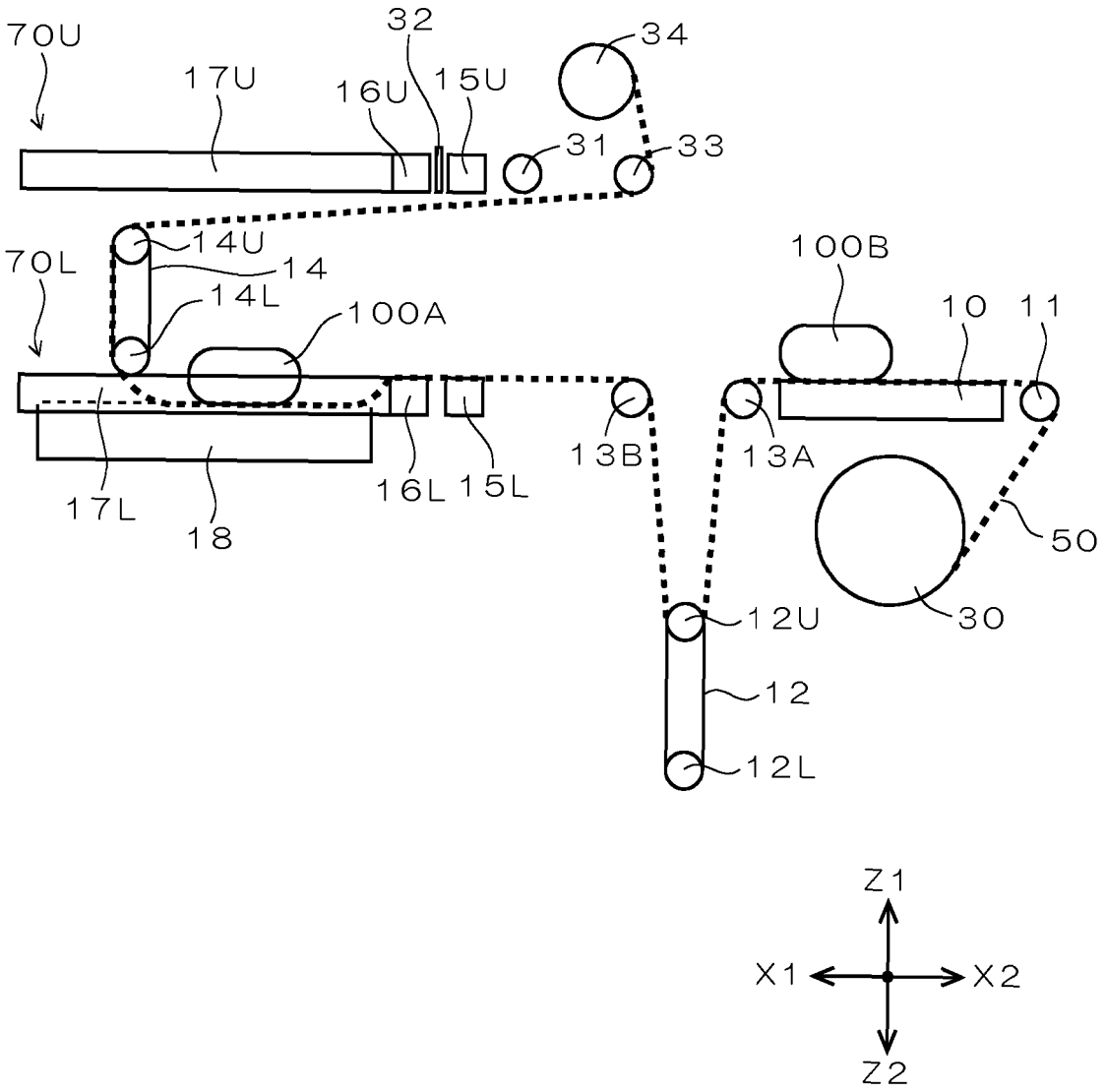

70U
17U
32
16U
15U
34
31
33
70L
14U
14
14L
100A
100B
10
11
13B
13A
17L
18
16L
15L
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 25

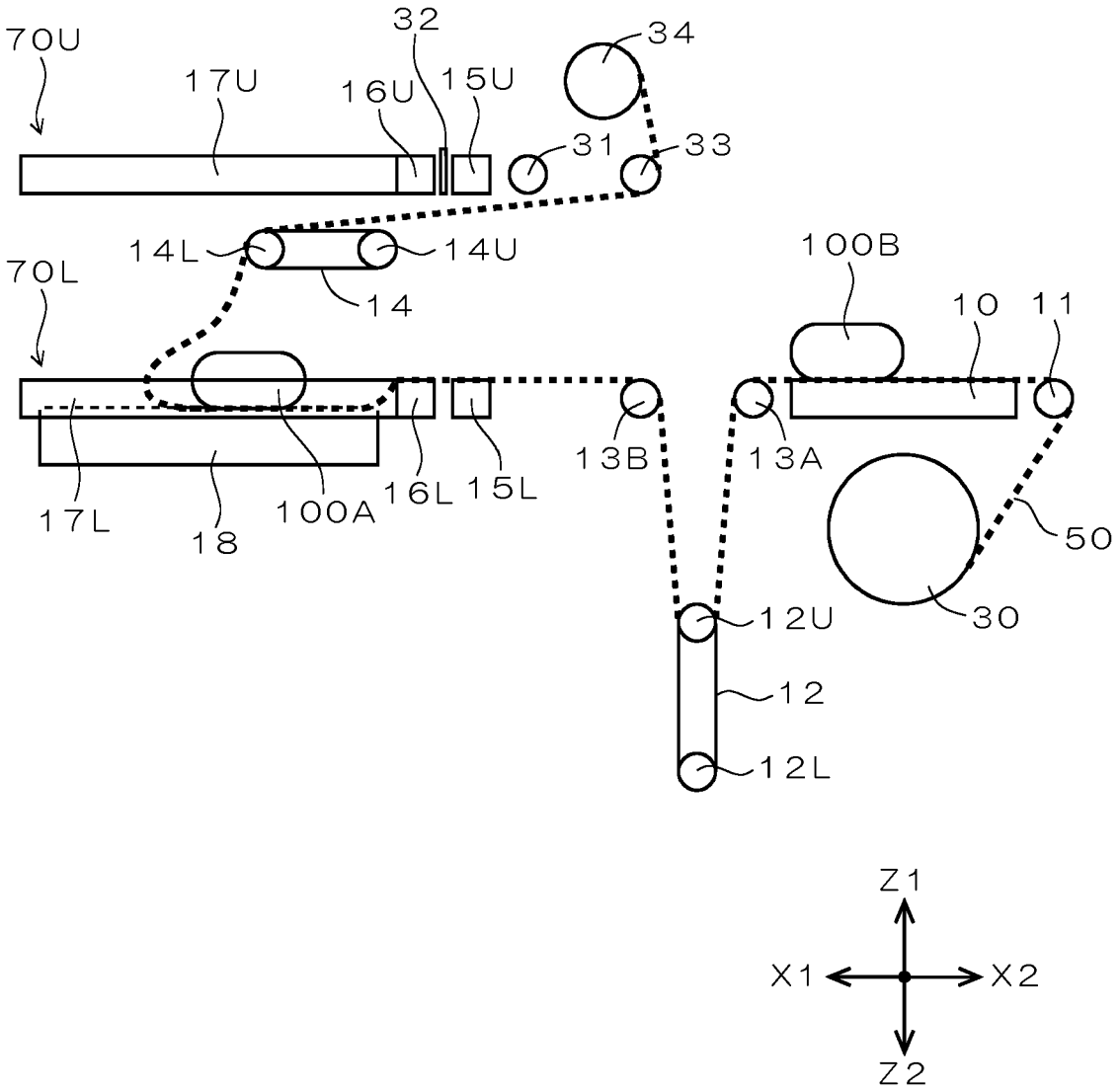

70U
17U
16U
32
15U
34
31
33
14L
14U
14
70L
100B
10
11
17L
18
100A
16L
15L
13B
13A
50
12U
30
12
12L
Z1
X1
X2
Z2

FIG. 26

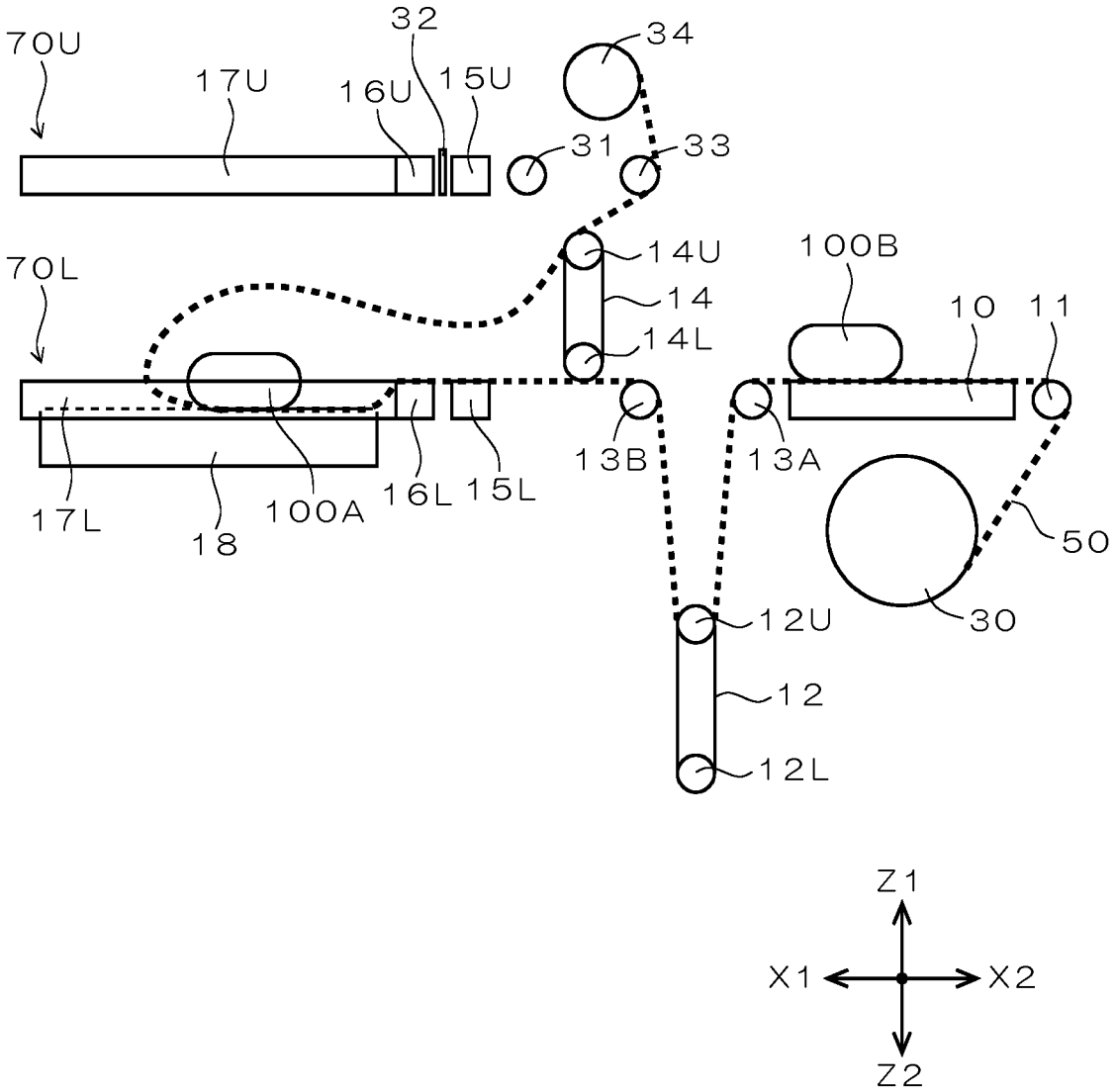

70U
17U
16U
32
15U
34
31
33
14U
14
14L
70L
100B
10
11
17L
18
100A
16L
15L
13B
13A
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 27

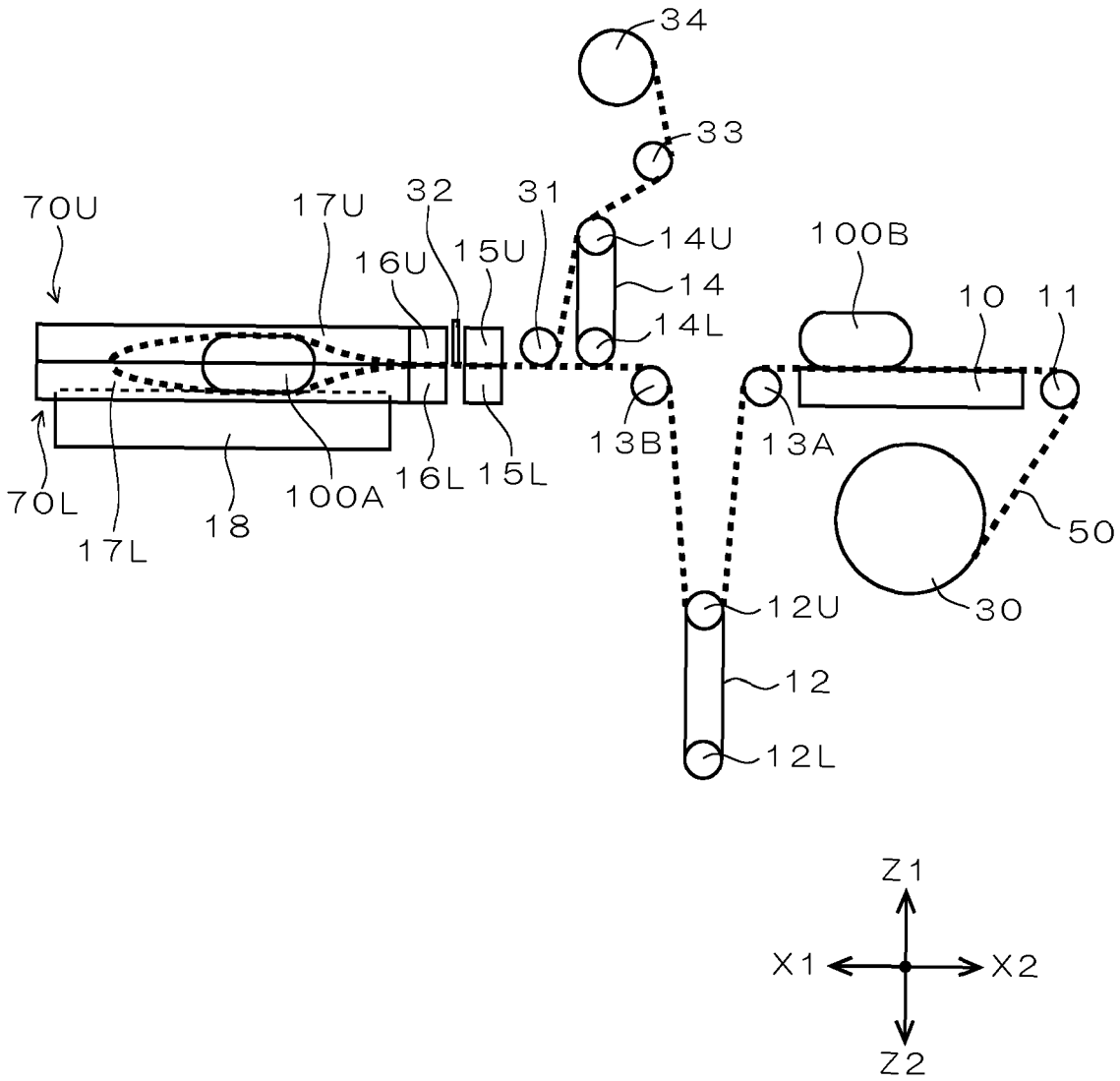

34
33
70U
17U
32
31
14U
16U
15U
14
14L
100B
10
11
13B
13A
70L
17L
18
100A
16L
15L
50
12U
30
12
12L
Z1
X1
X2
Z2

FIG. 28

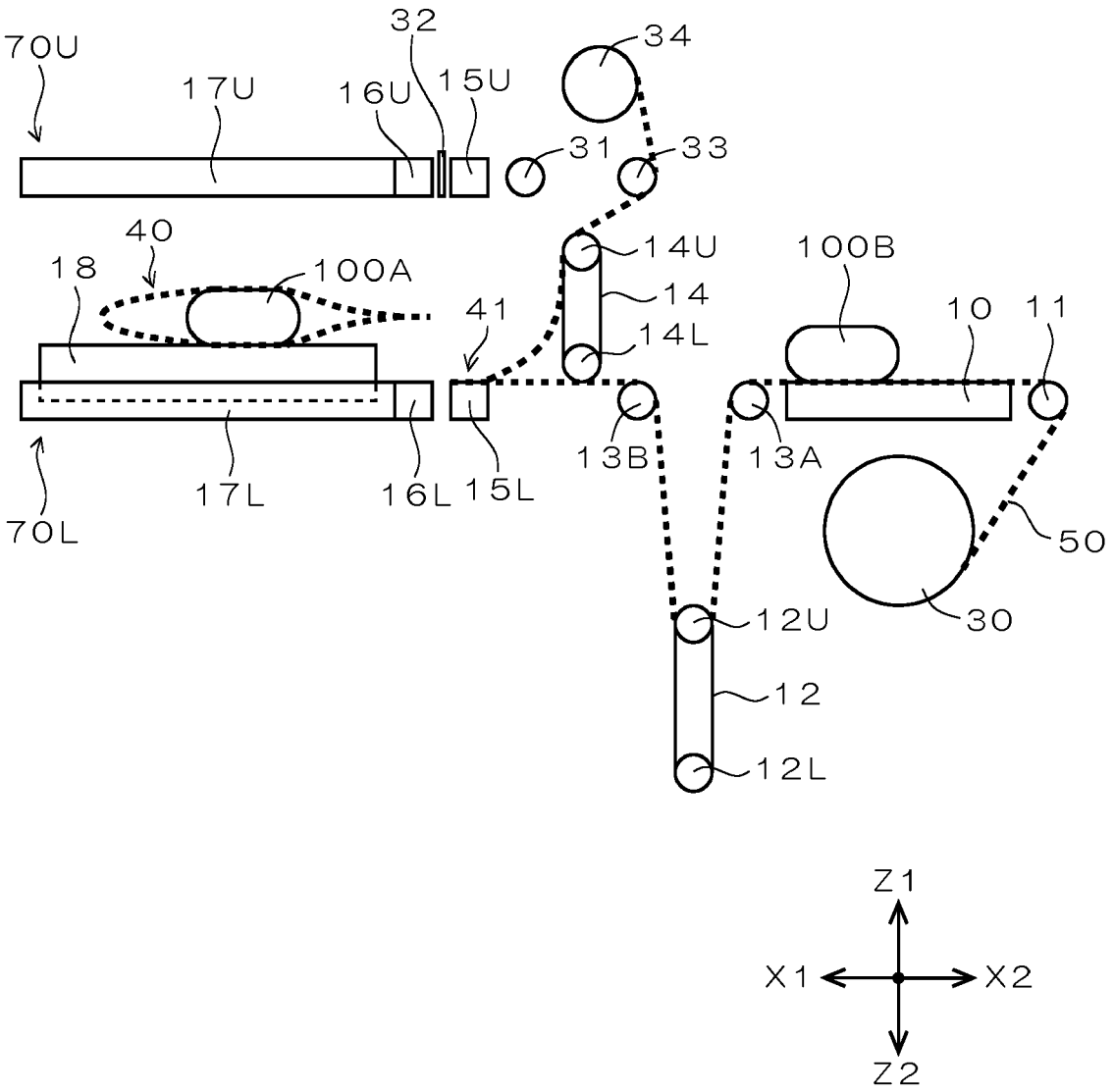

70U
17U
16U
15U
32
34
31
33
40
18
100A
41
14U
14
14L
100B
10
11
70L
17L
16L
15L
13B
13A
50
30
12U
12
12L
Z1
X1
X2
Z2

FIG. 29

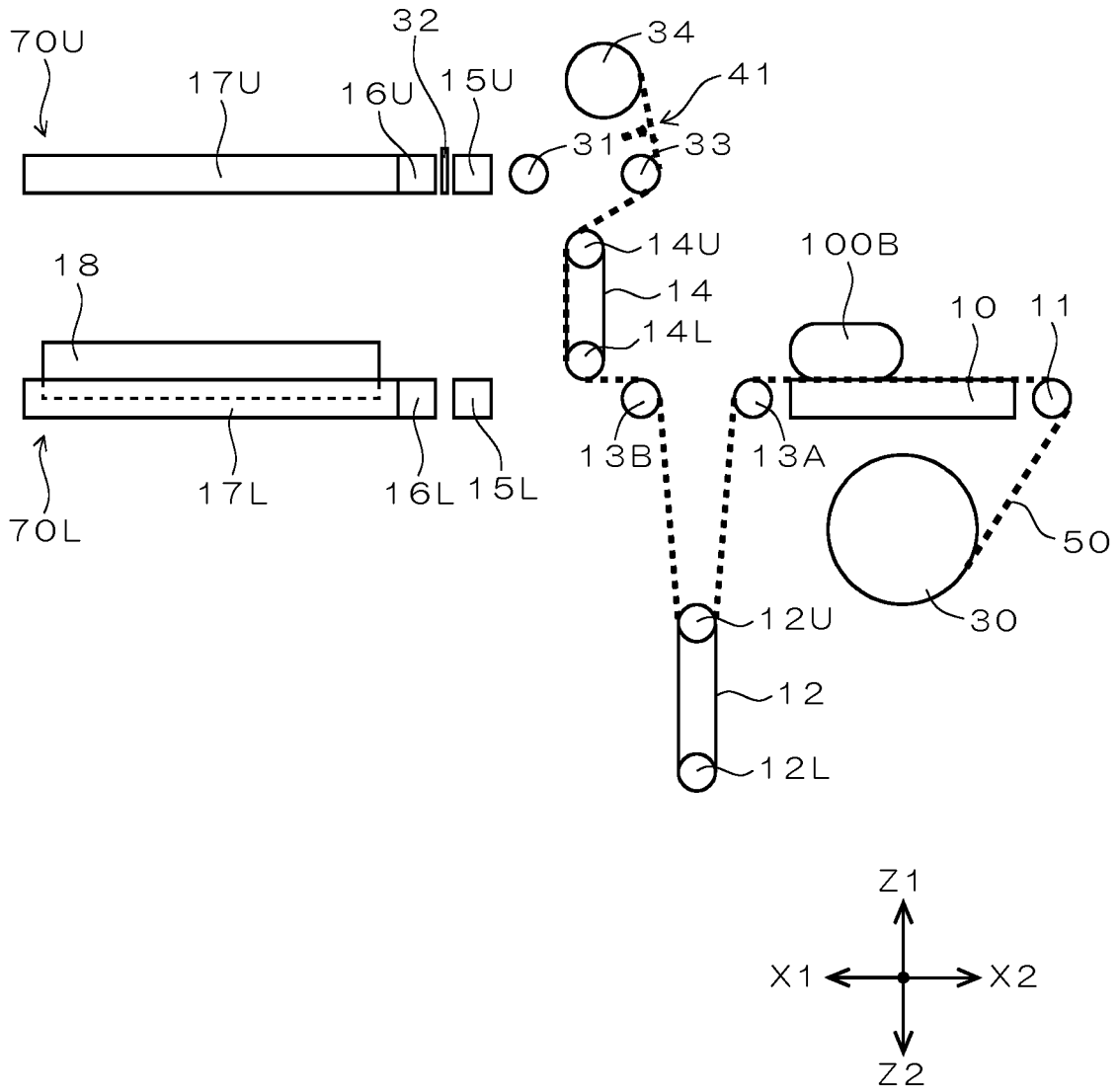

70U
17U
16U
32
15U
34
41
31
33
14U
14
14L
100B
10
11
18
13B
13A
17L
16L
15L
70L
50
12U
12
12L
30
Z1
X1
X2
Z2

FIG. 30

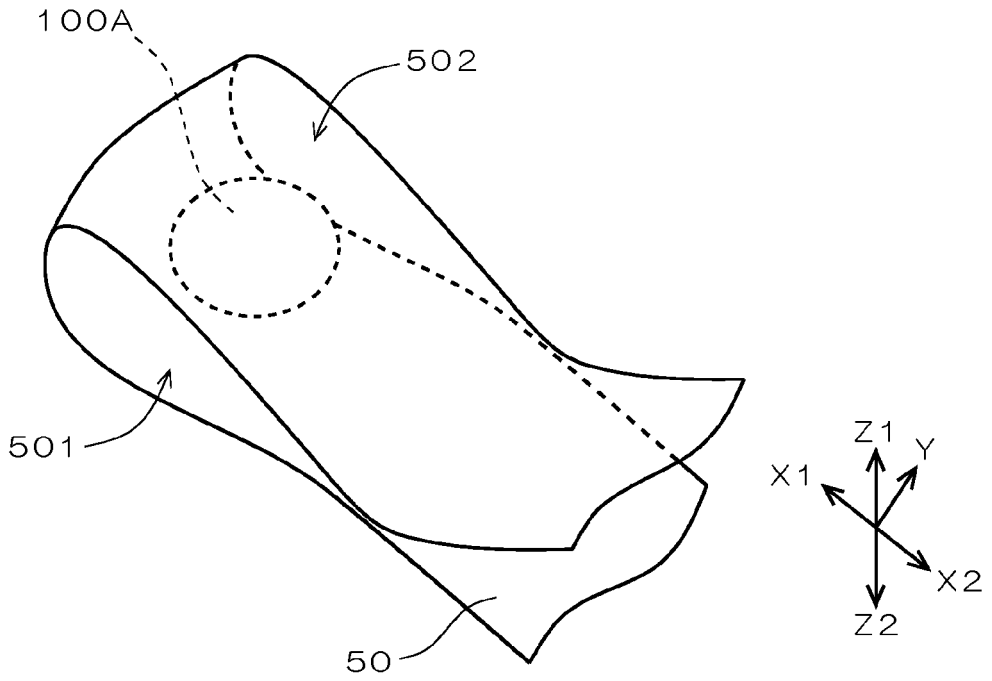


FIG. 31

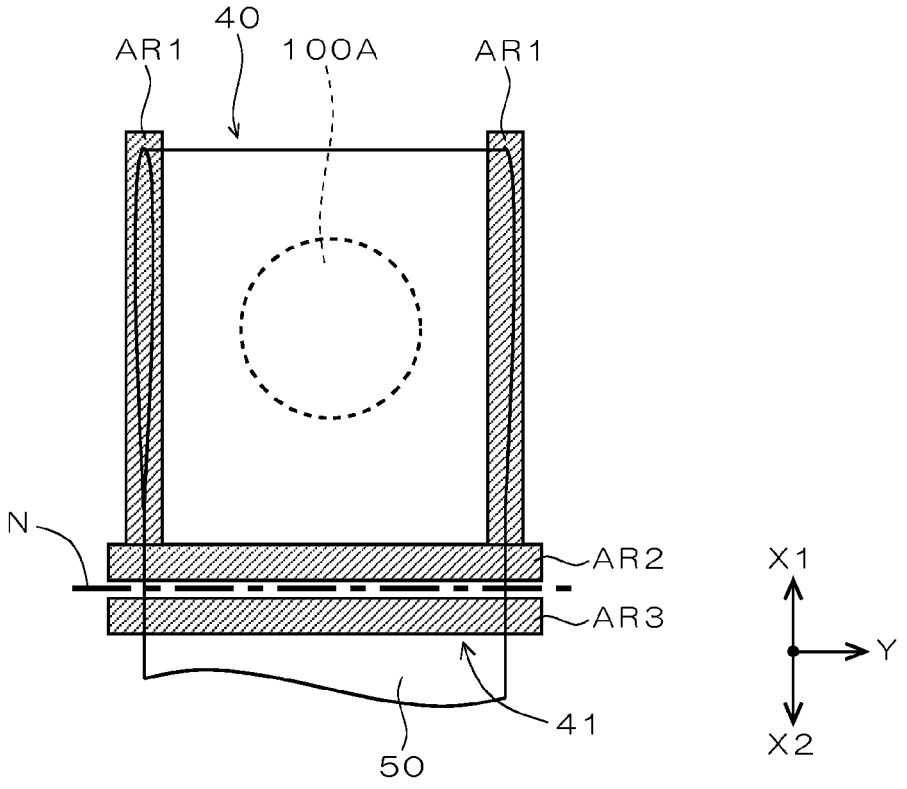


FIG. 32

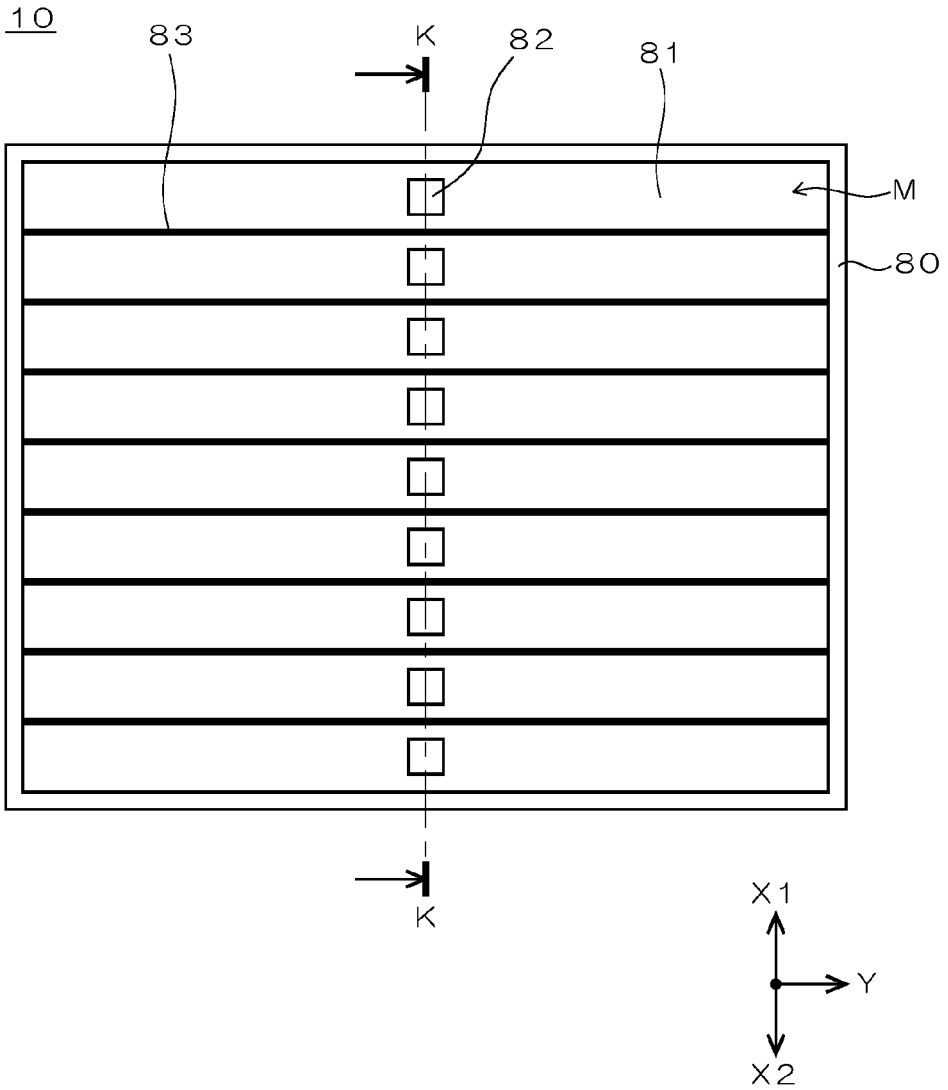


FIG. 33

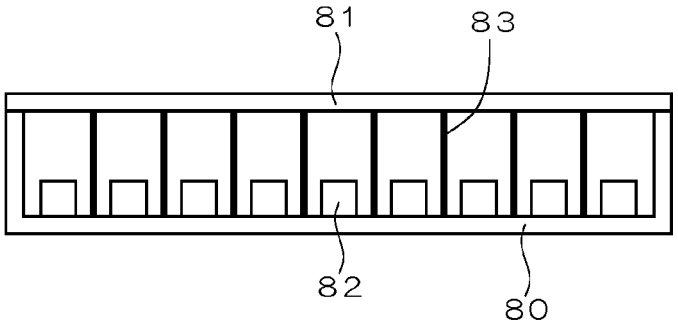


FIG. 34

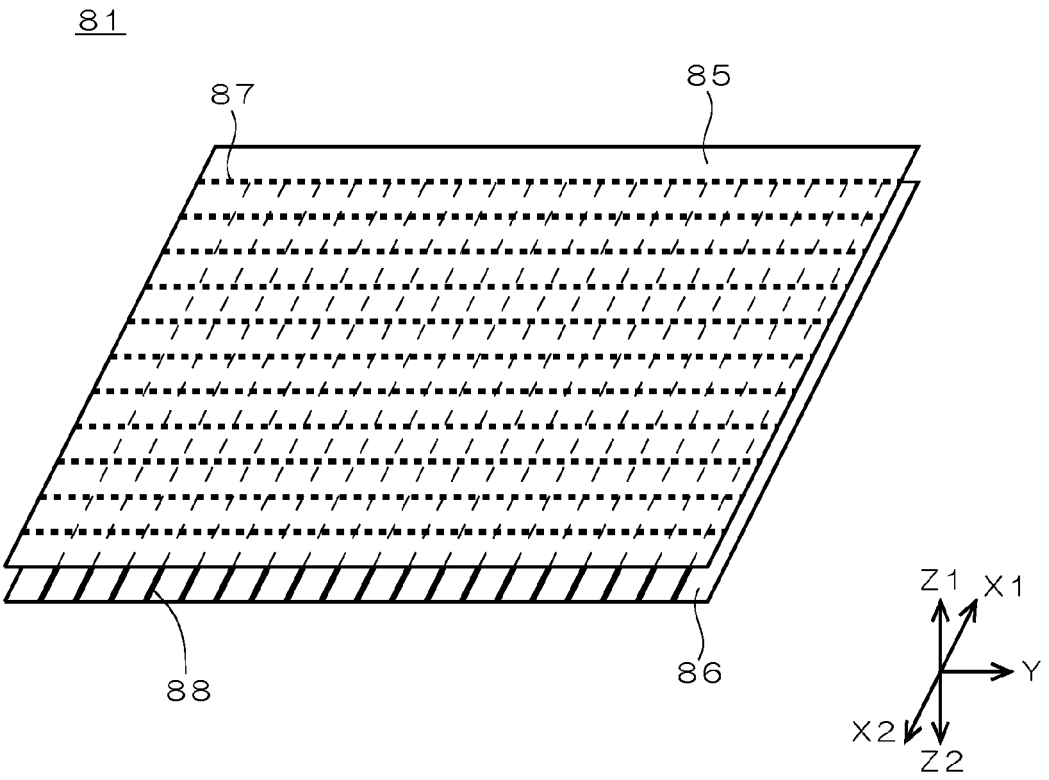

81
87
85
88
86
Z1
X1
Y
X2
Z2

FIG. 35

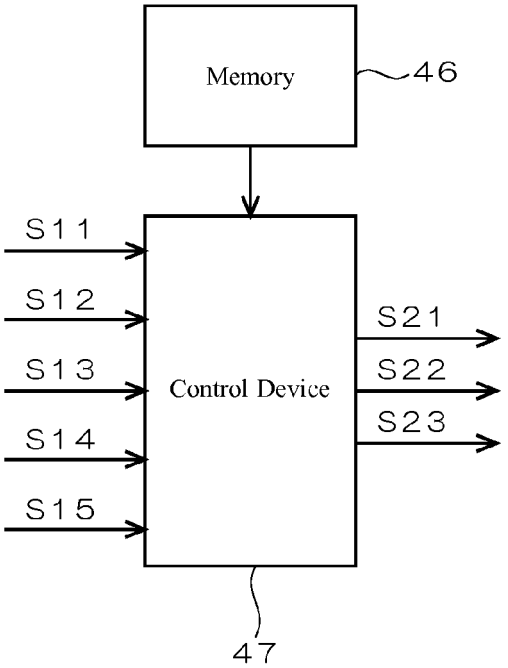

Memory
46
S11
S12
S13
S14
S15
Control Device
S21
S22
S23
47

FIG. 36

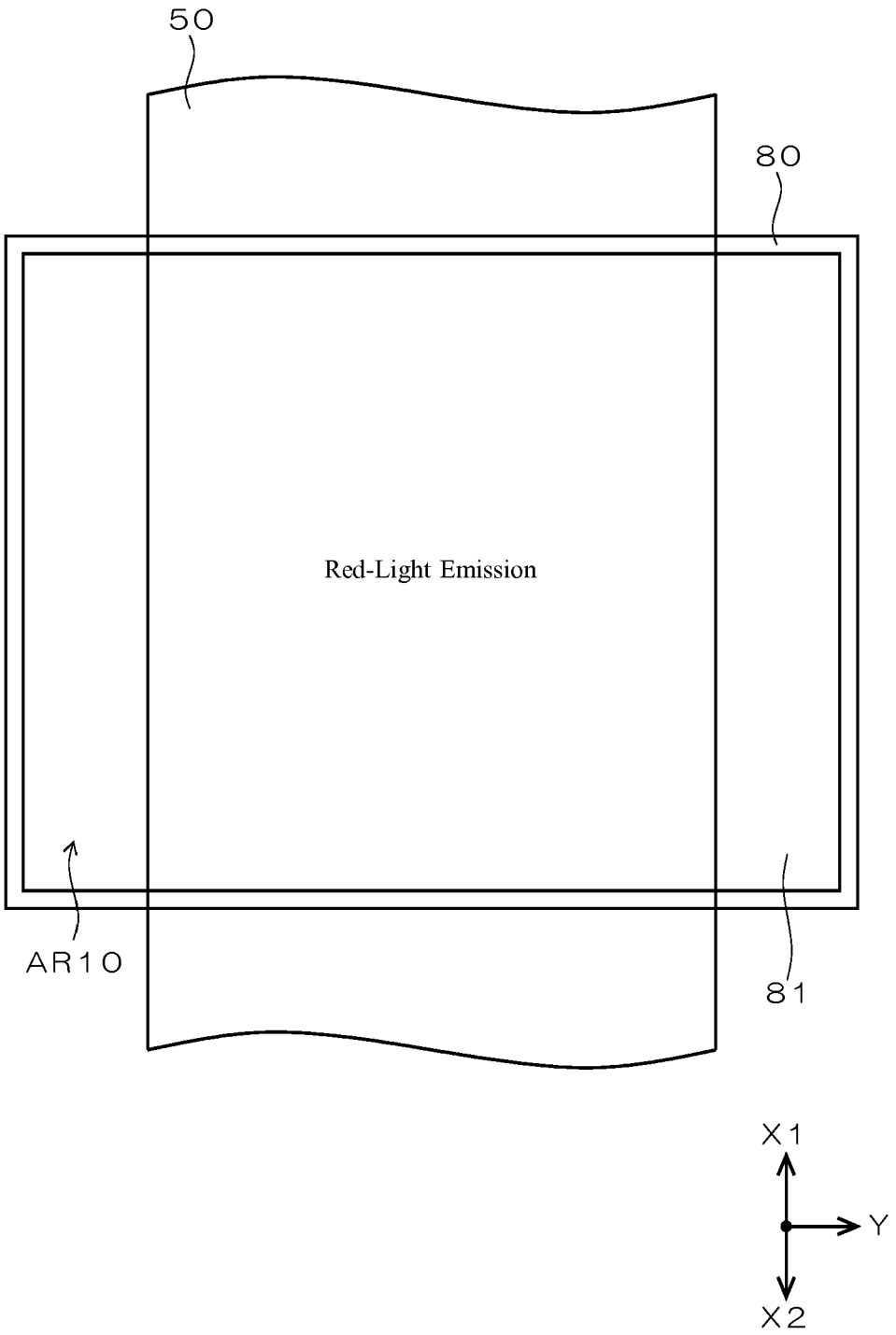


FIG. 37

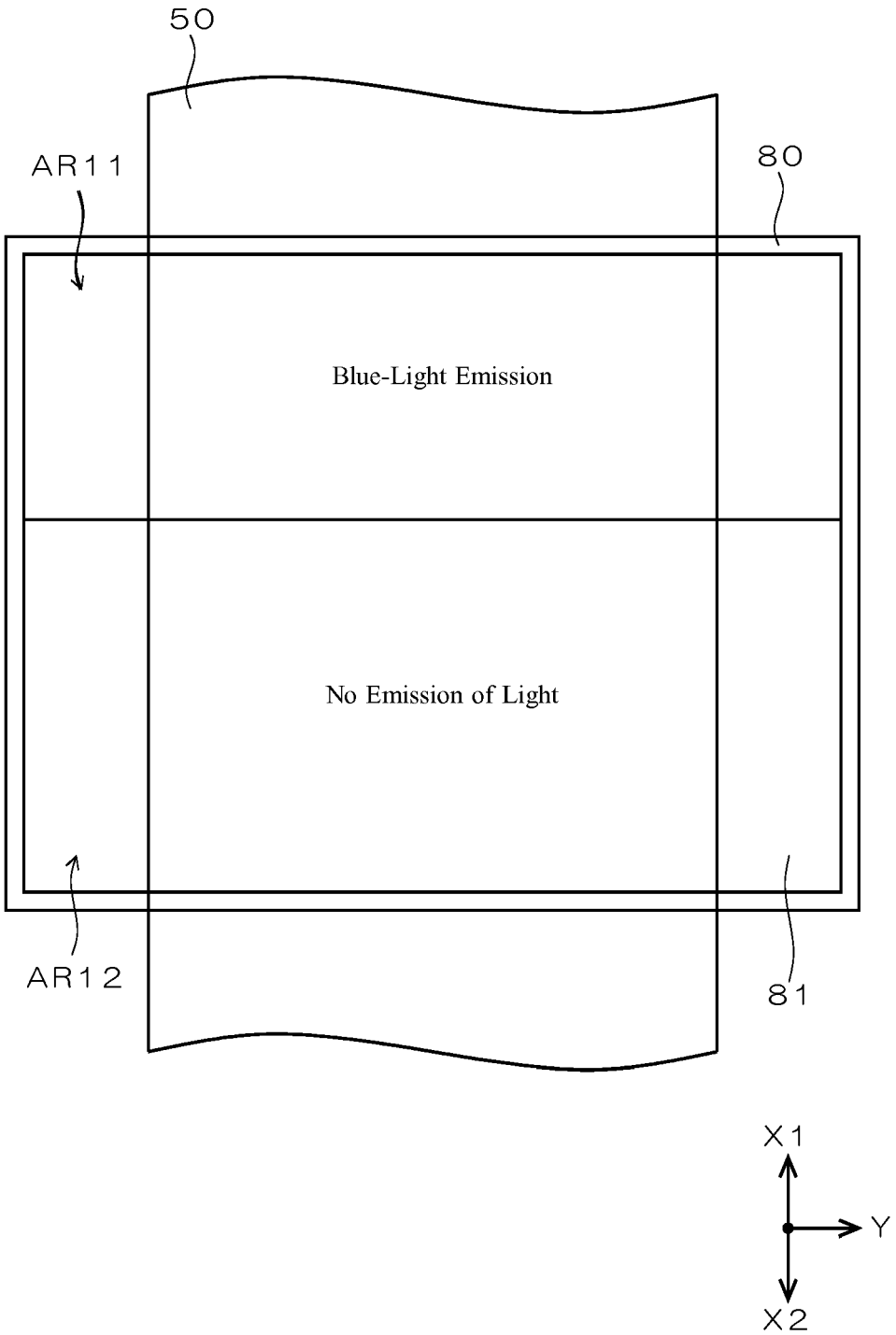

50
AR11
80
Blue-Light Emission
No Emission of Light
AR12
81
X1
Y
X2

FIG. 38

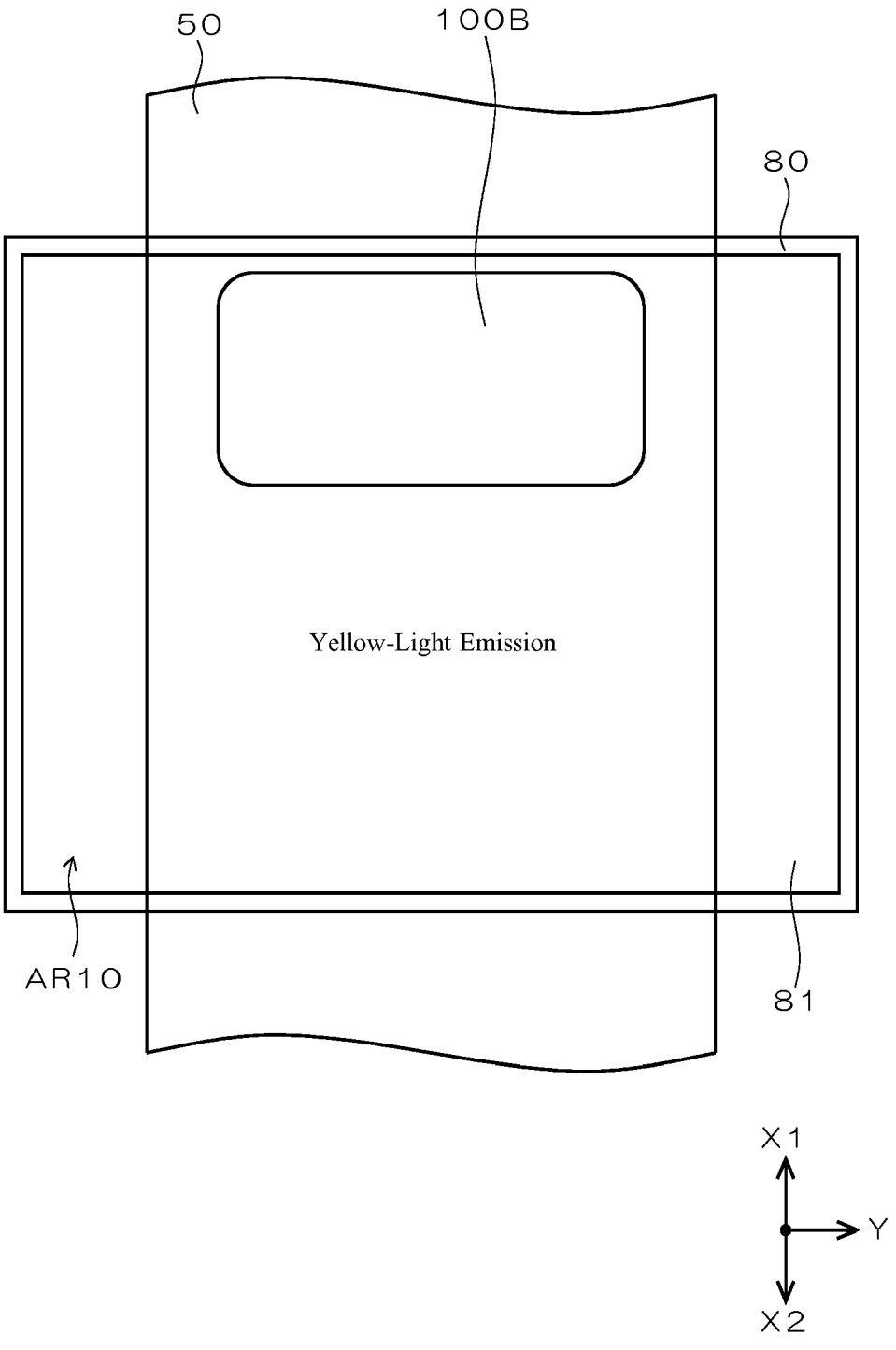


FIG. 39

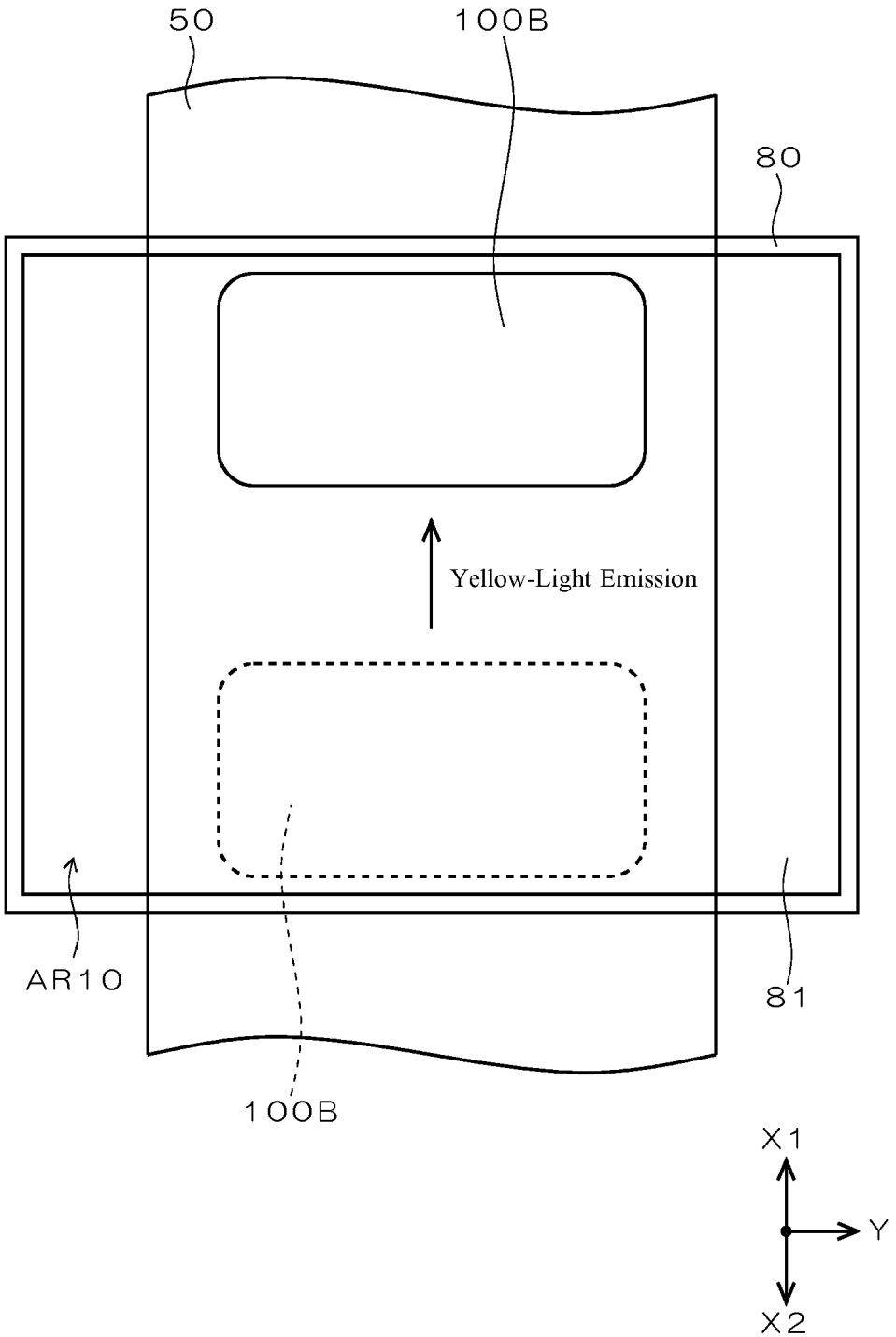
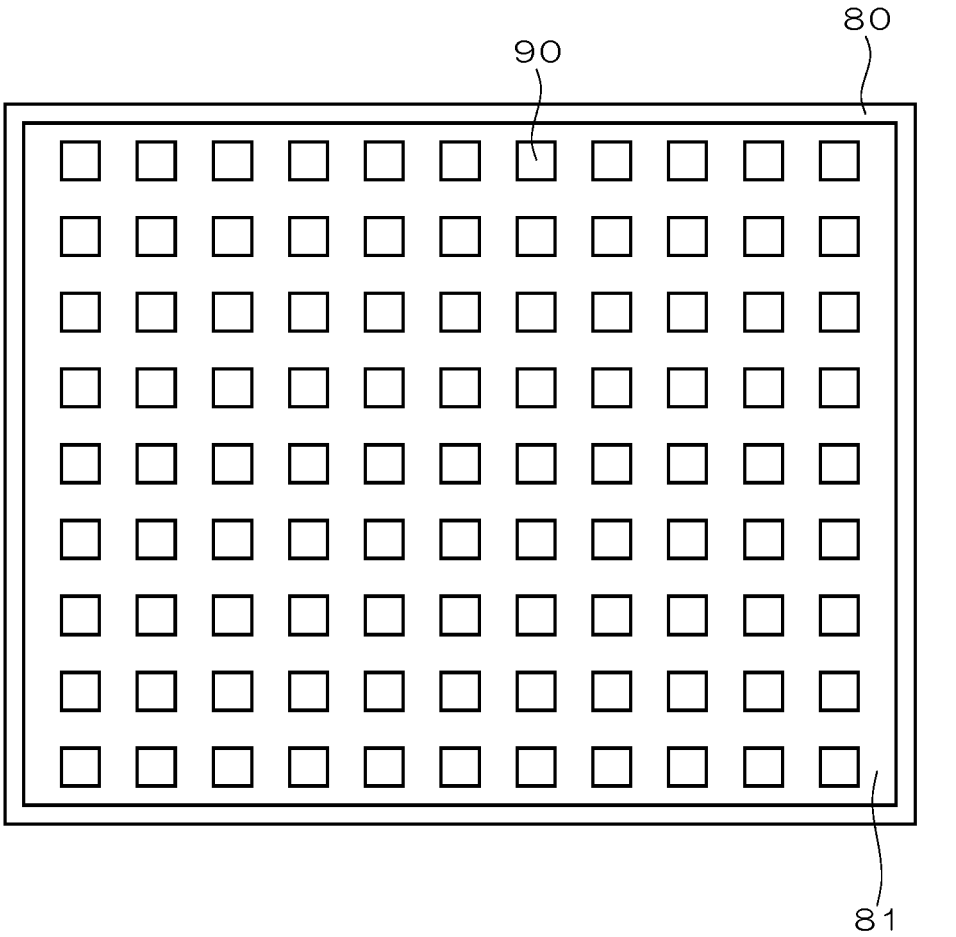


FIG. 40



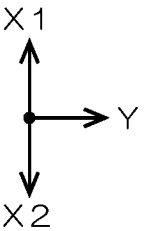


FIG. 41

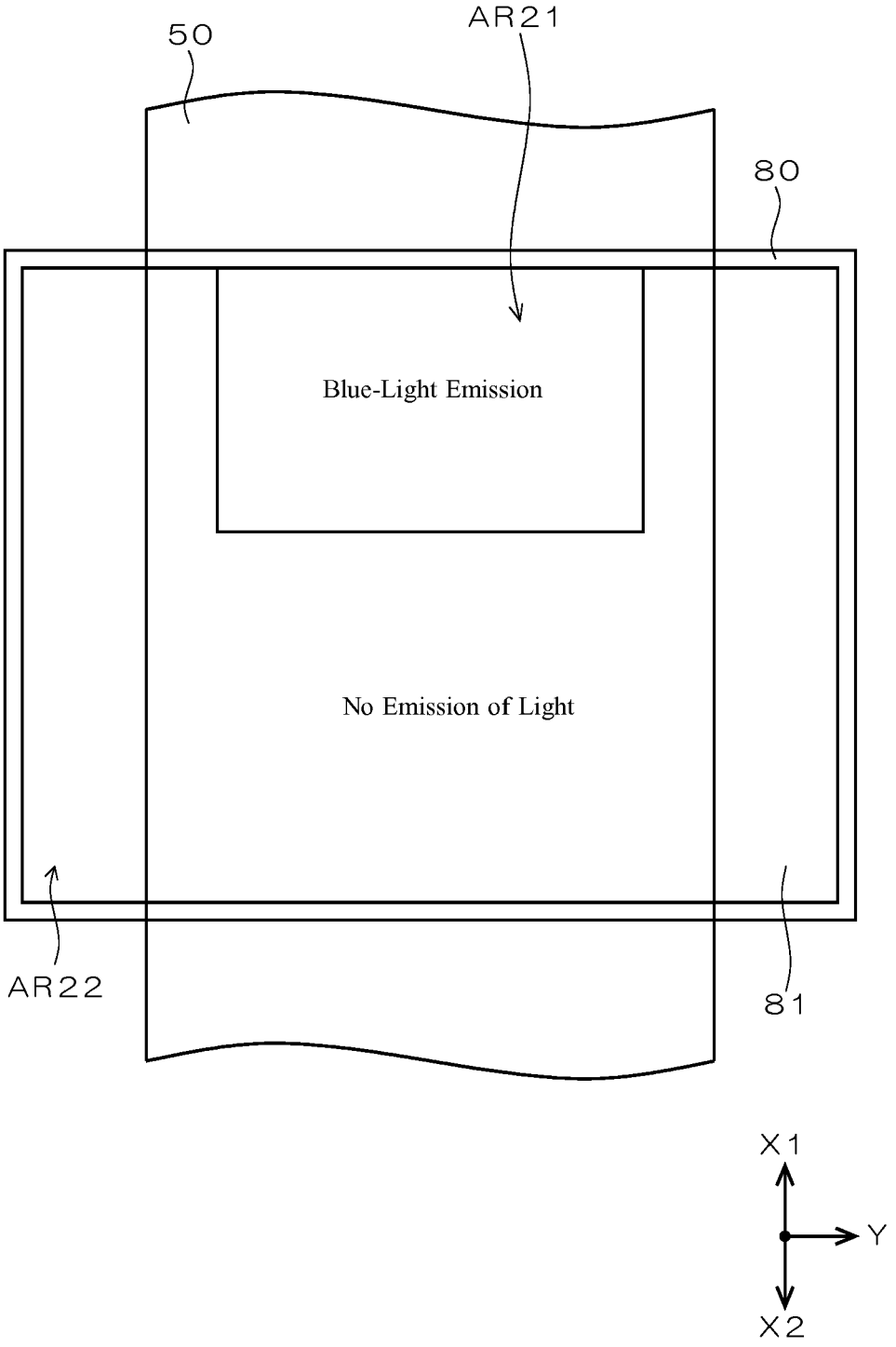

50
AR21
80
Blue-Light Emission
No Emission of Light
AR22
81
X1
Y
X2

FIG. 42

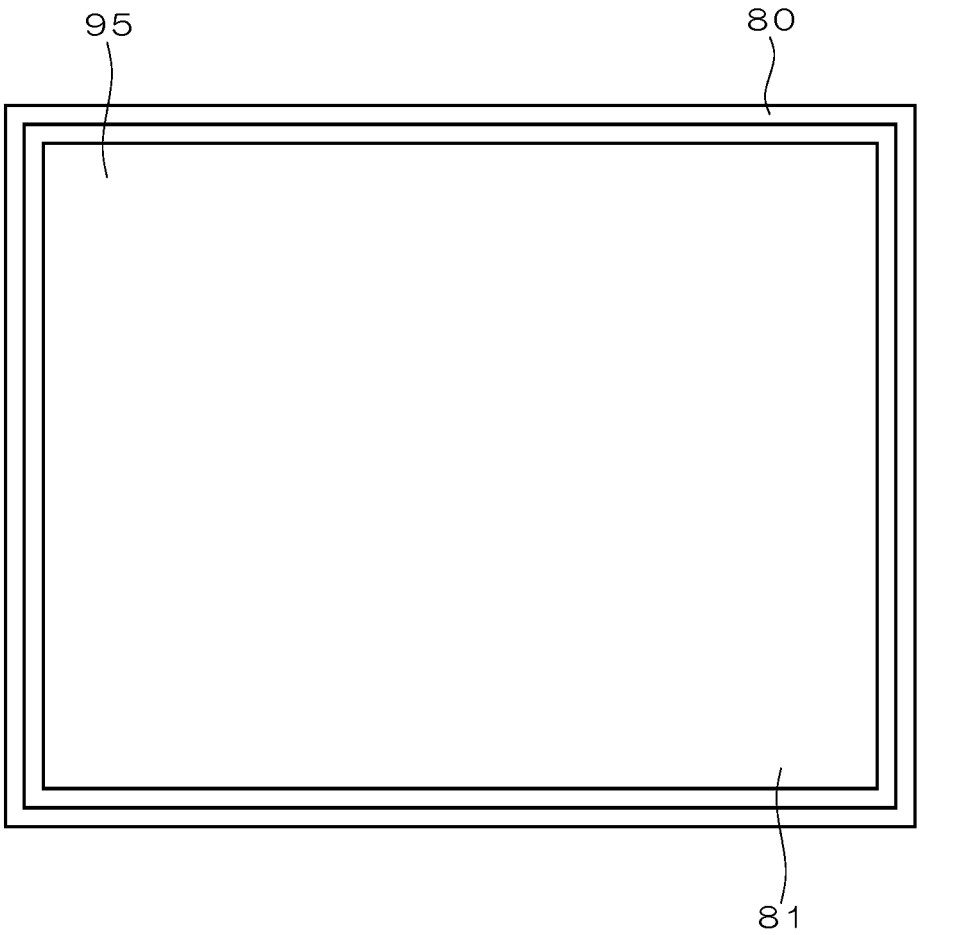


FIG. 43

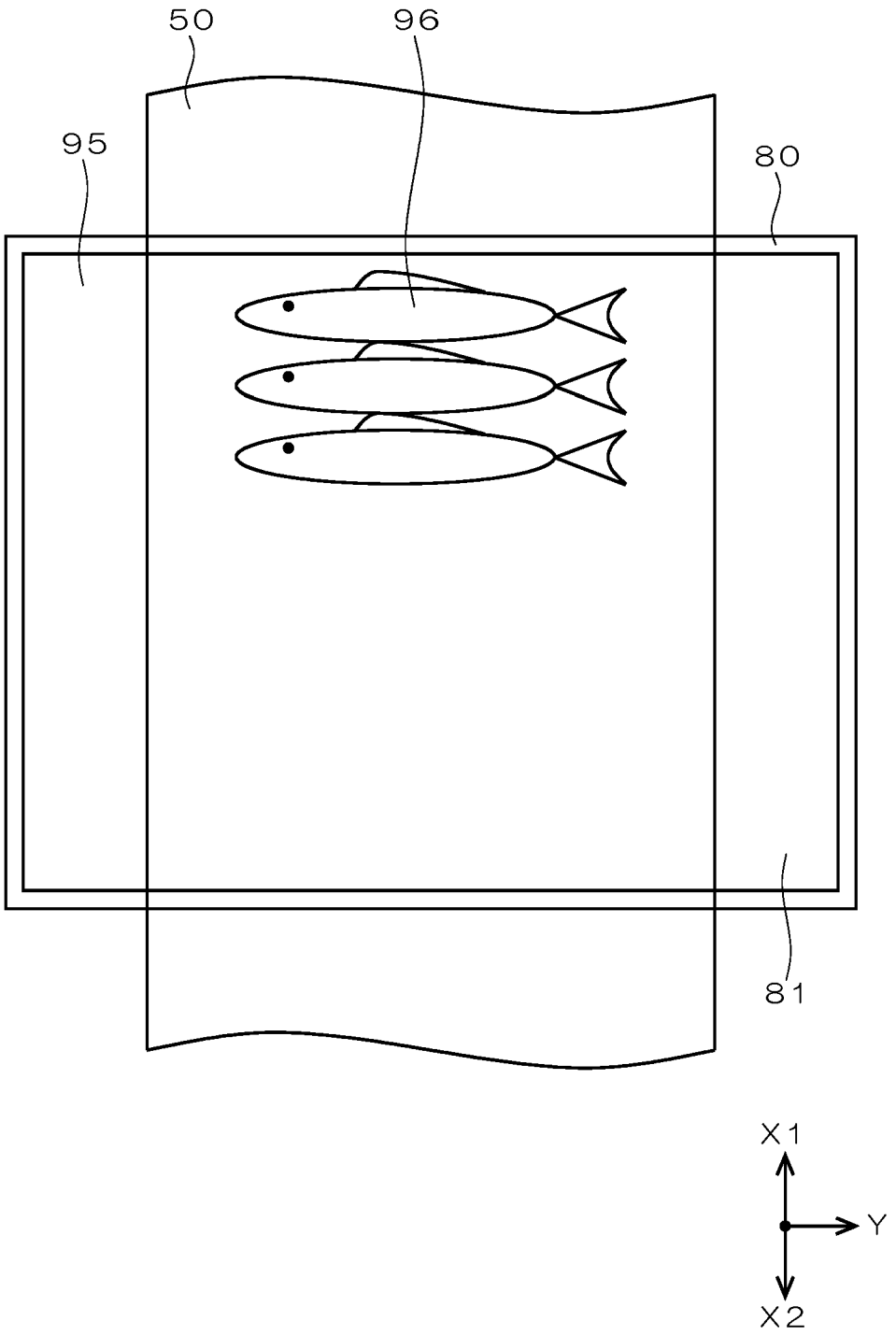


FIG. 44

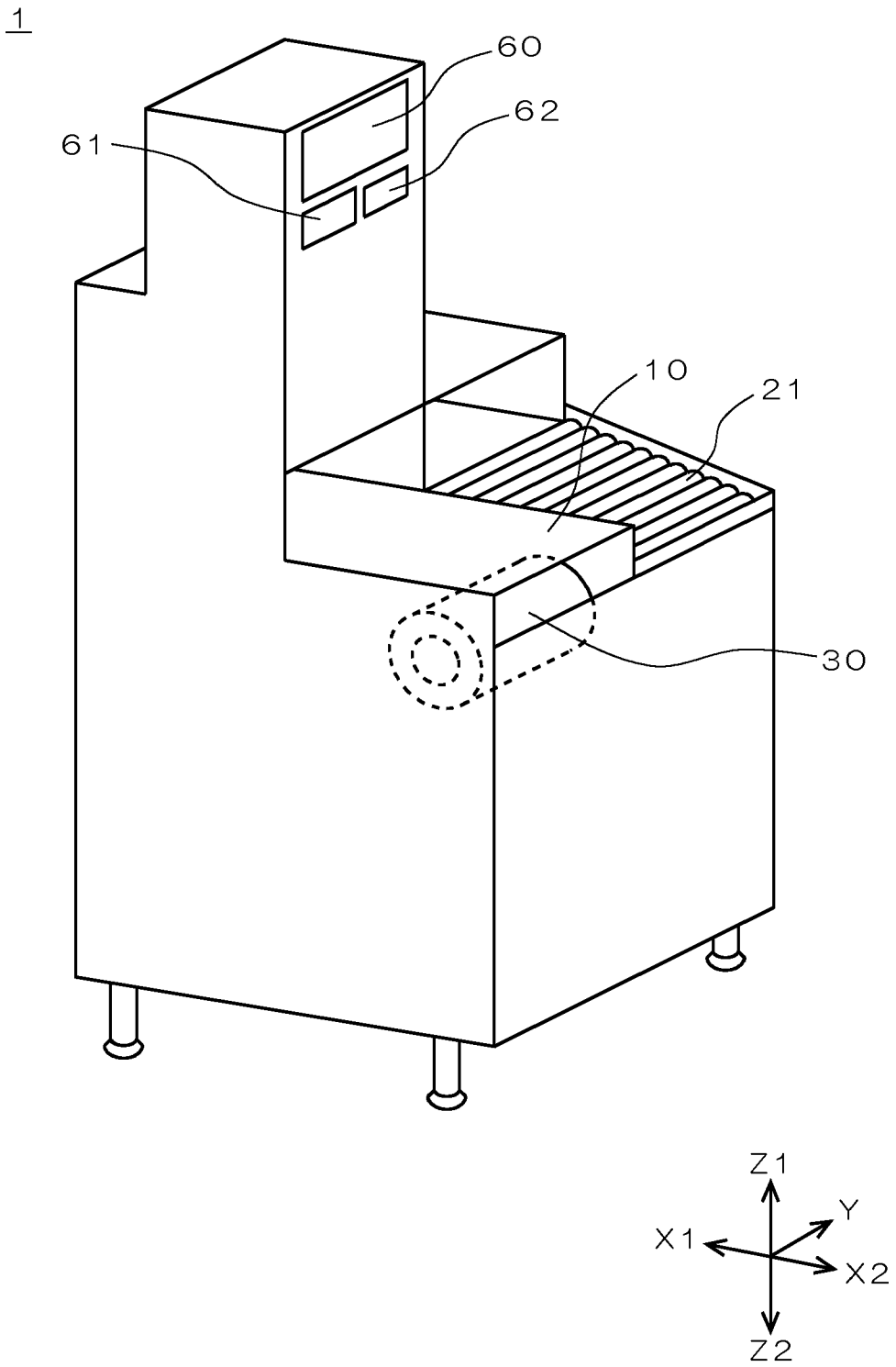


FIG. 45

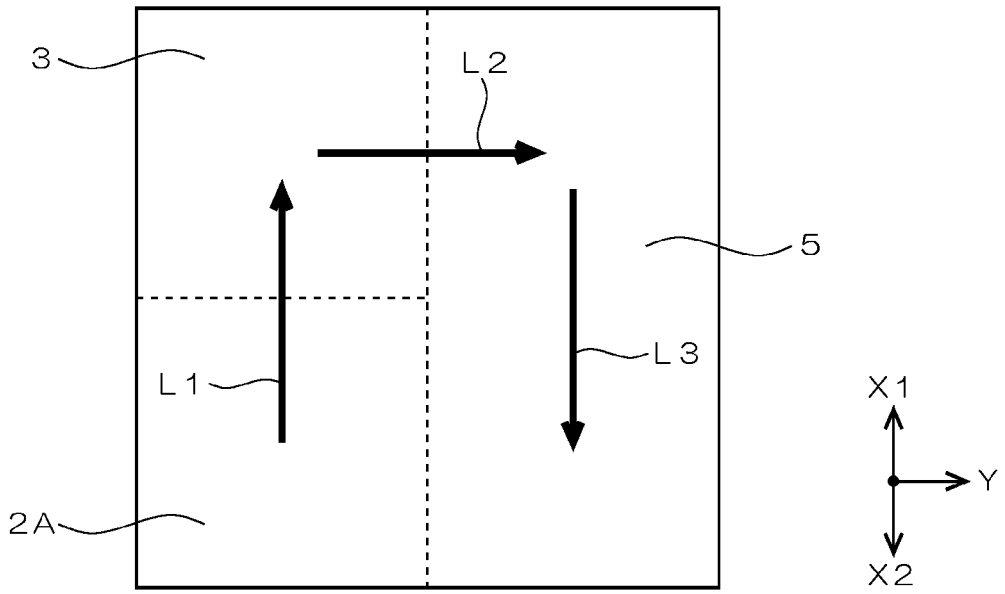

3
L2
5
L3
L1
2A
X1
Y
X2

FIG. 46

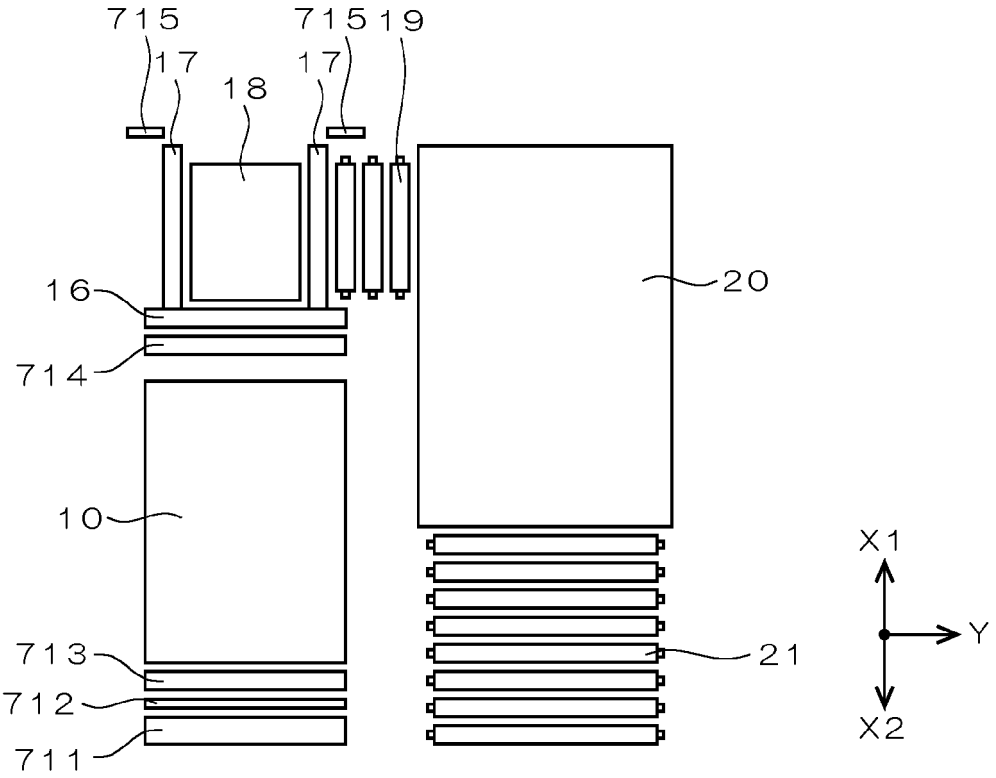

715
17
18
715
17
19
20
16
714
10
713
712
711
21
X1
Y
X2

FIG. 47

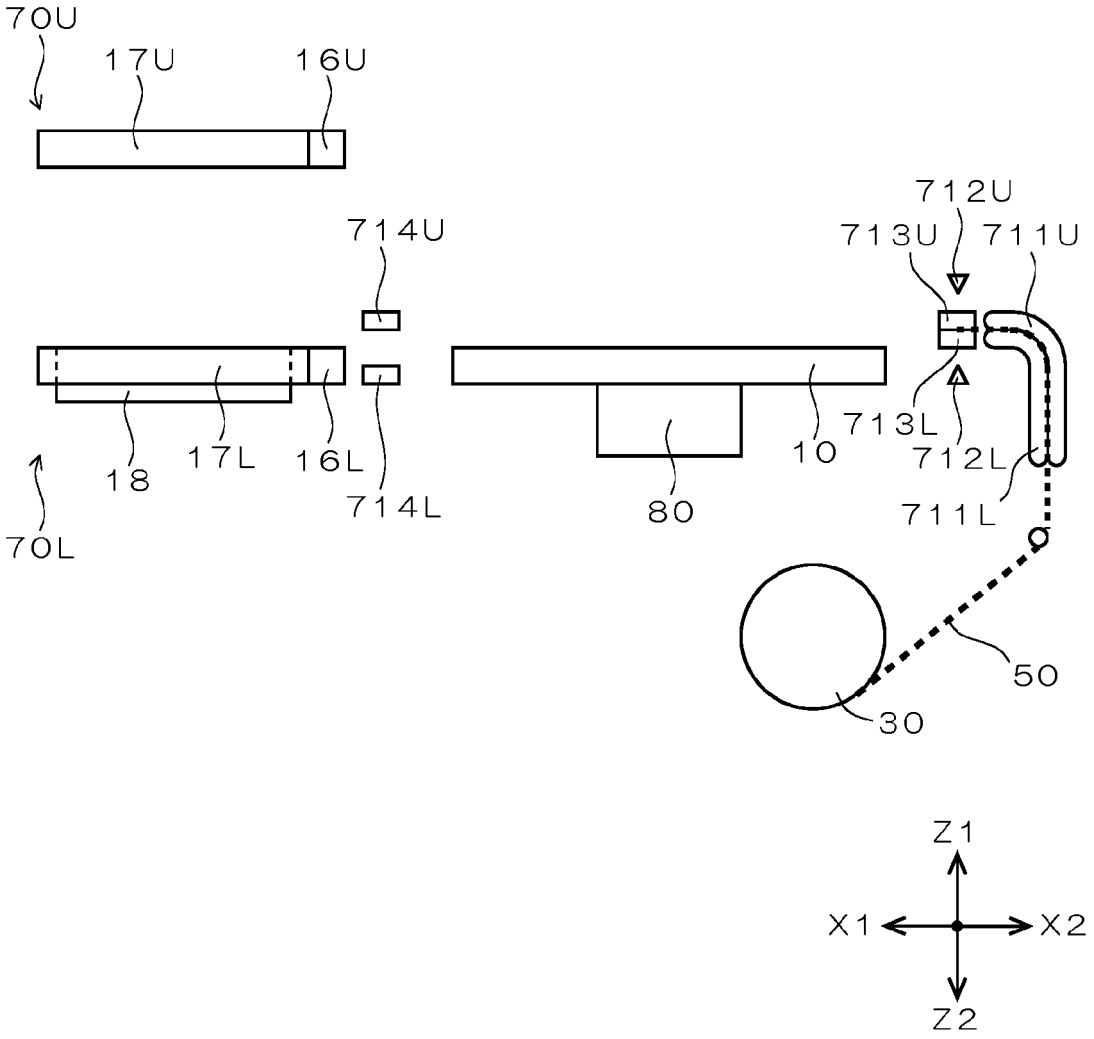

70U
17U
16U
714U
712U
713U
711U
18
17L
16L
714L
713L
712L
711L
10
80
70L
50
30
Z1
X1
X2
Z2

FIG. 48

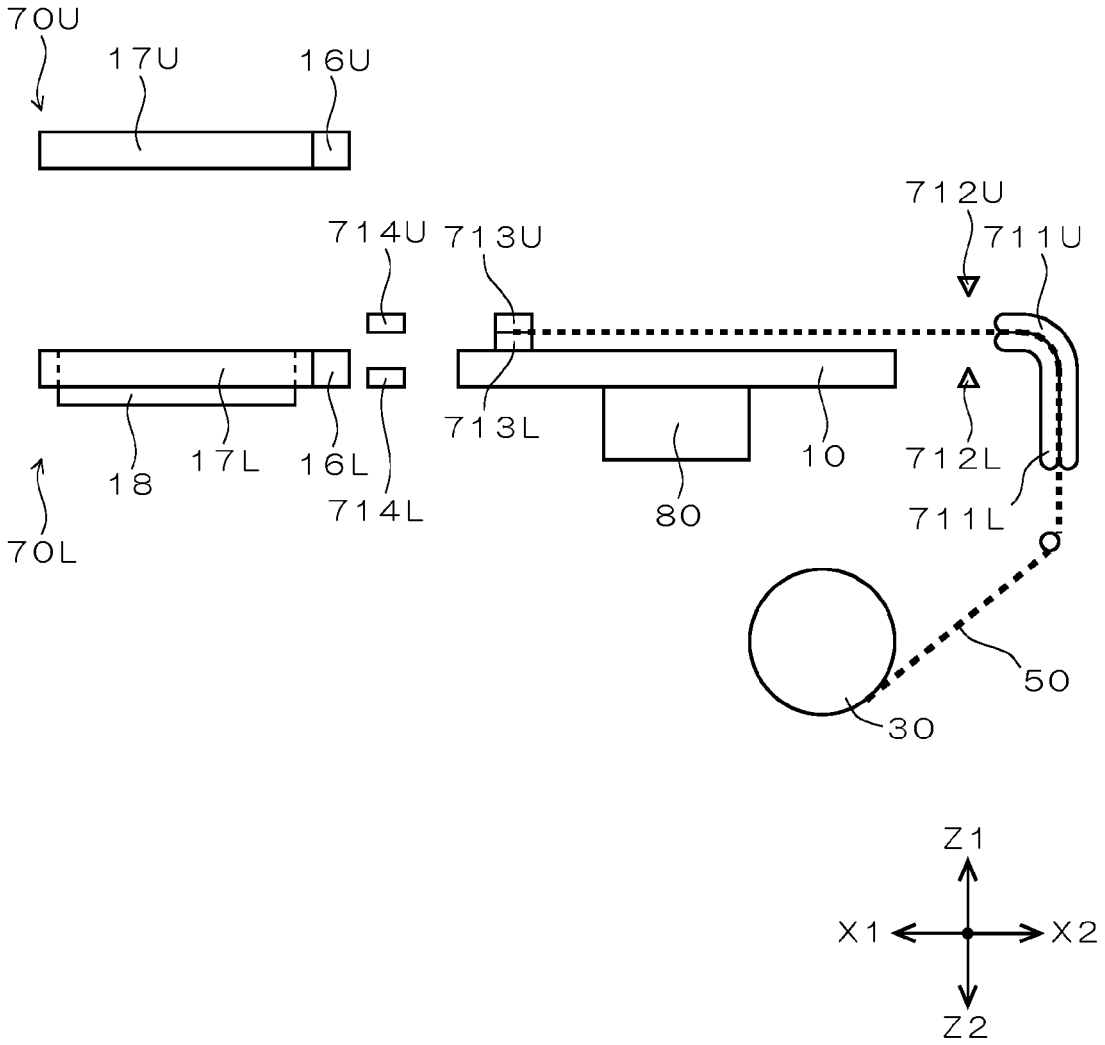

70U
17U
16U
714U
713U
712U
711U
713L
712L
18
17L
16L
714L
10
711L
70L
80
50
30
Z1
X1
X2
Z2

FIG. 49

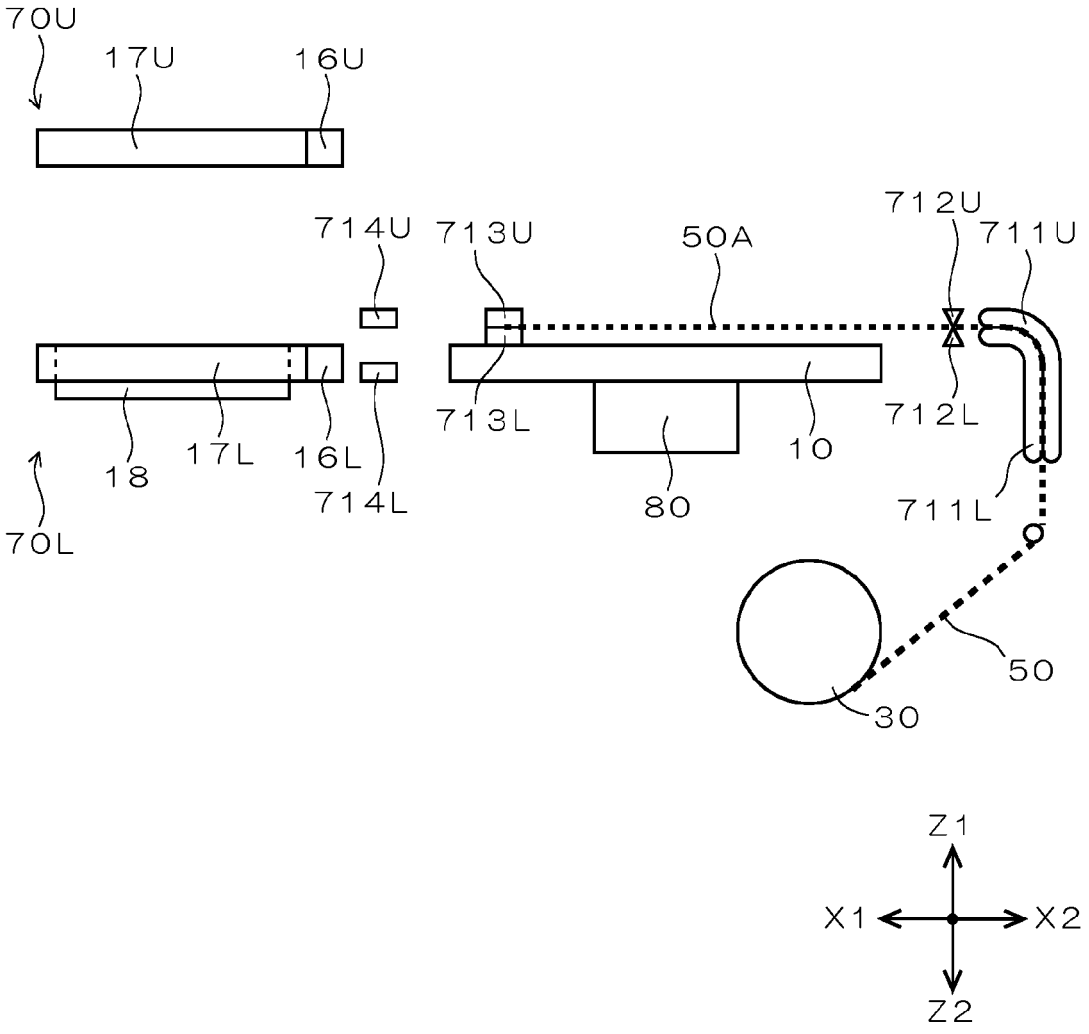

70U
17U
16U
714U
713U
50A
712U
711U
18
17L
16L
714L
713L
10
712L
70L
80
711L
50
30
Z1
X1
X2
Z2

FIG. 50

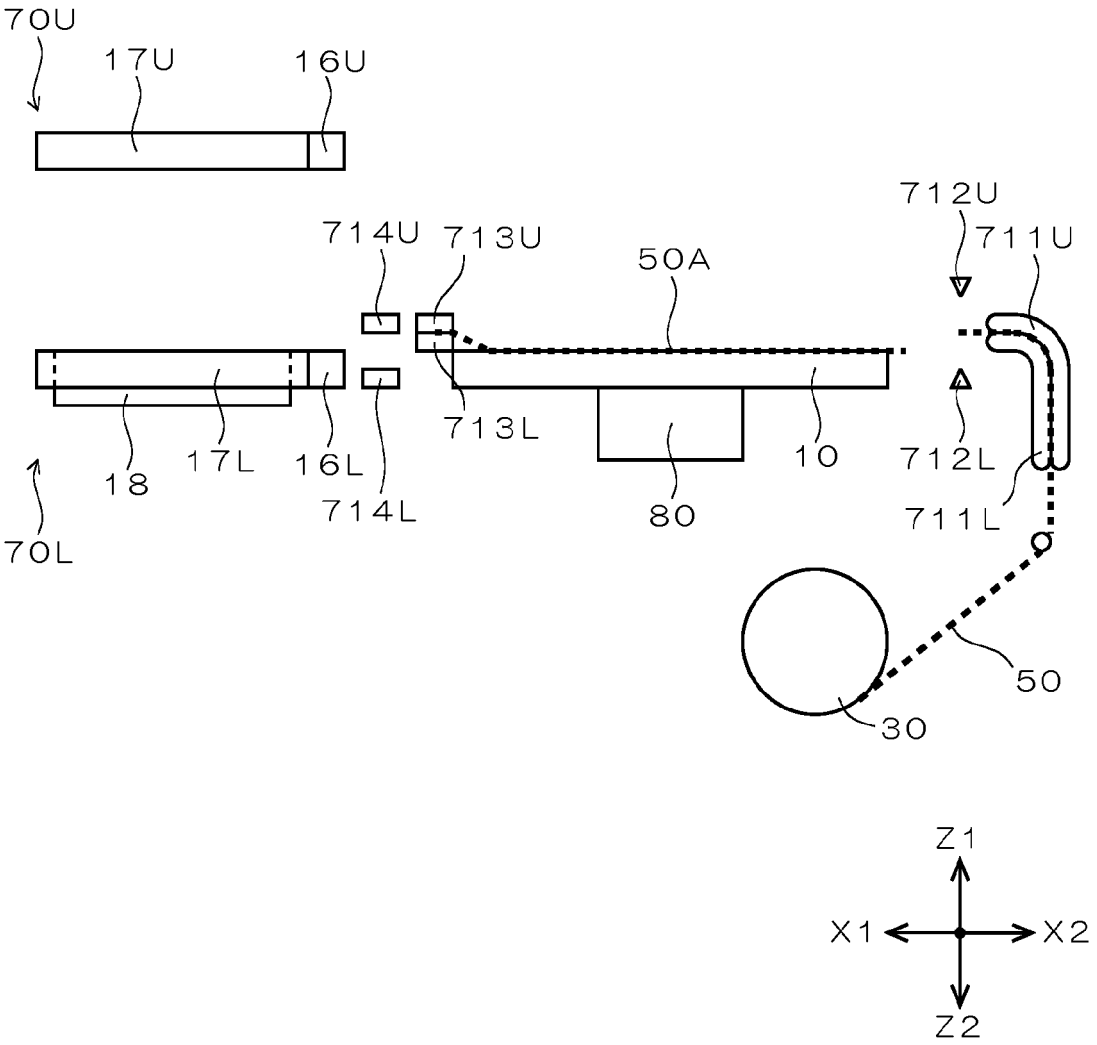

70U
17U
16U
714U
713U
50A
712U
711U
713L
18
17L
16L
714L
80
10
712L
711L
70L
50
30
Z1
X1
X2
Z2

FIG. 51

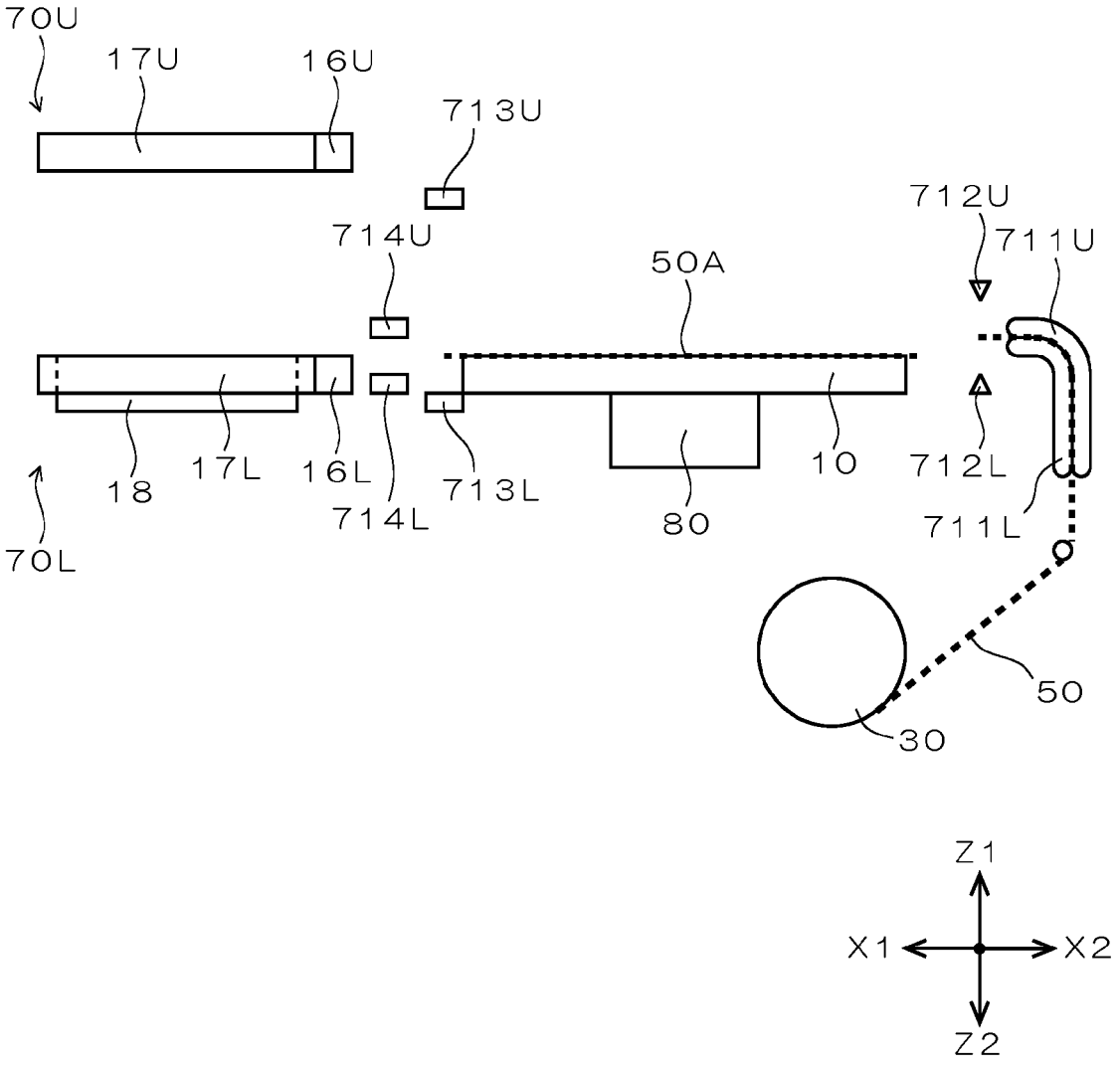

70U
17U
16U
713U
714U
50A
712U
711U
18
17L
16L
714L
713L
80
10
712L
711L
70L
50
30
Z1
X1
X2
Z2

FIG. 52

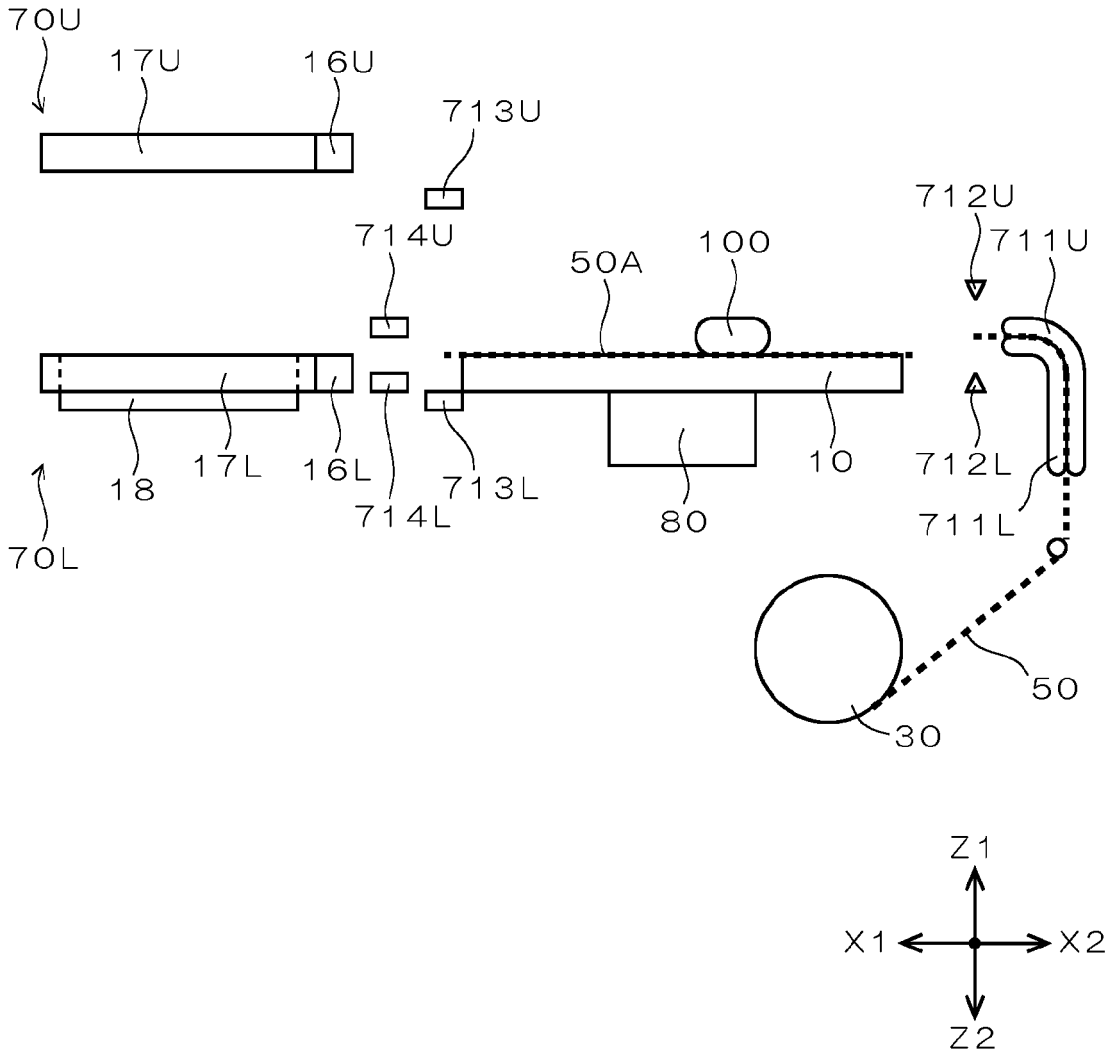

70U
17U
16U
713U
714U
50A
100
712U
711U
18
17L
16L
714L
713L
80
10
712L
711L
70L
50
30
Z1
X1
X2
Z2

FIG. 53

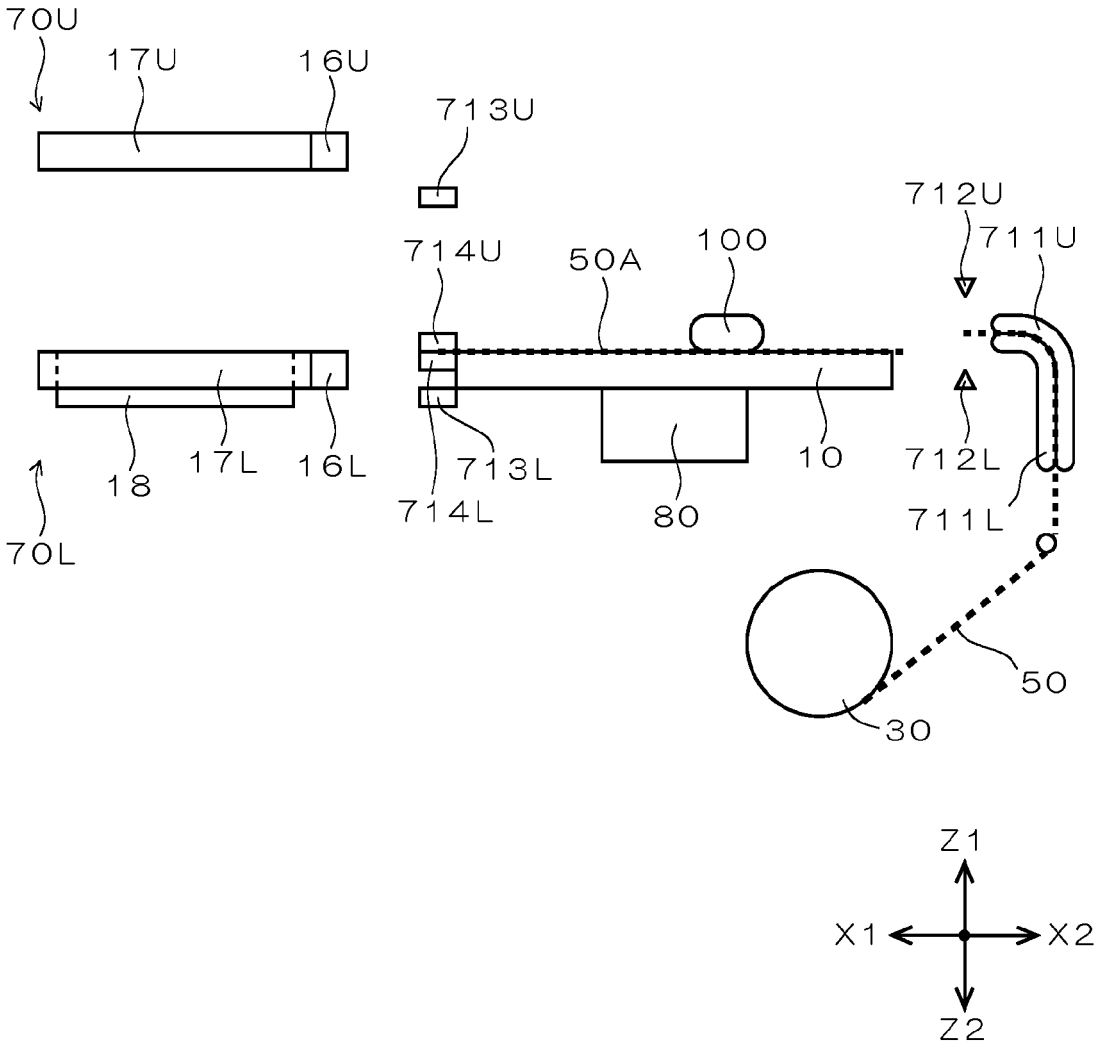

70U
17U
16U
713U
712U
711U
714U
50A
100
18
17L
16L
713L
10
712L
70L
714L
80
711L
50
30
Z1
X1
X2
Z2

FIG. 54

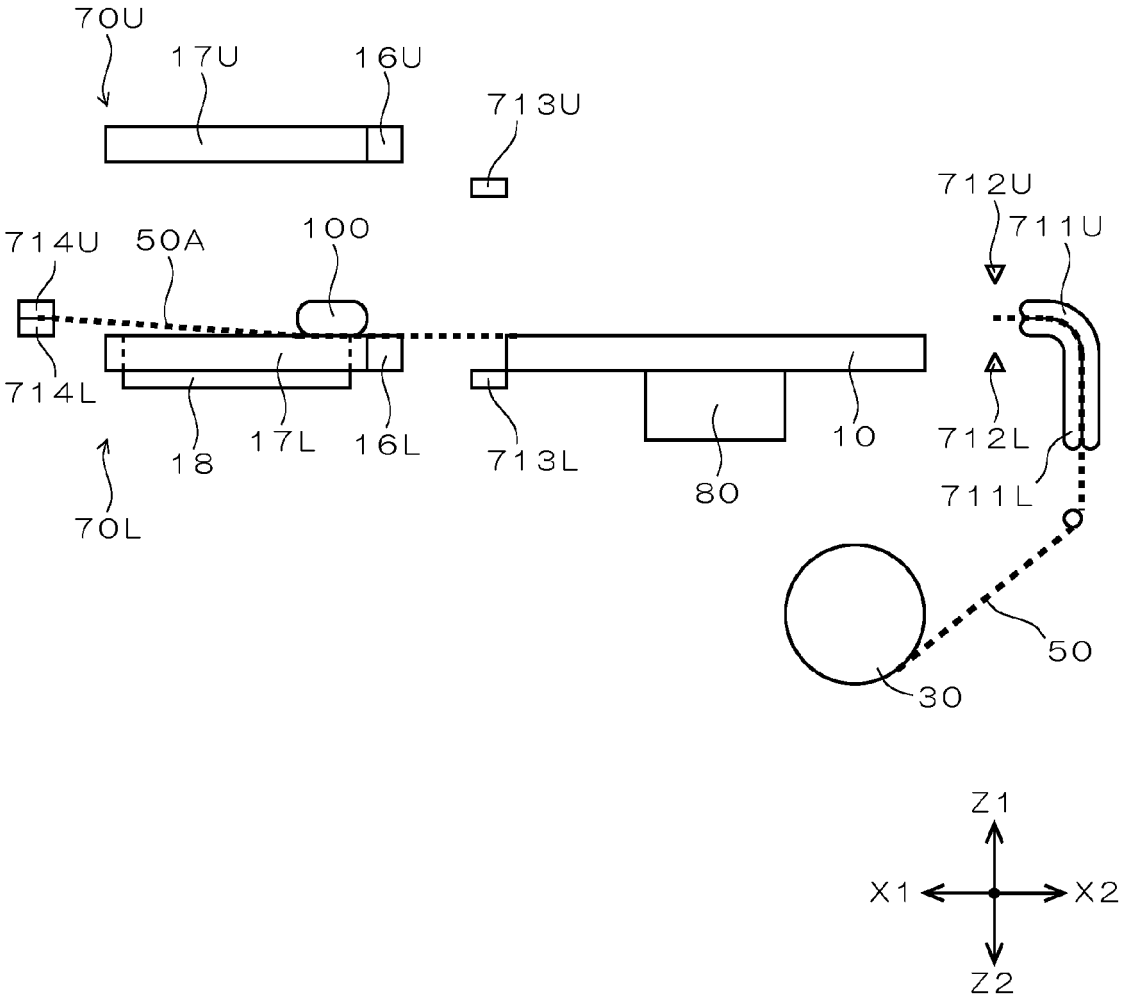

70U
17U
16U
713U
712U
711U
714U
50A
100
714L
18
17L
16L
713L
80
10
712L
711L
70L
50
30
Z1
X1
X2
Z2

FIG. 55

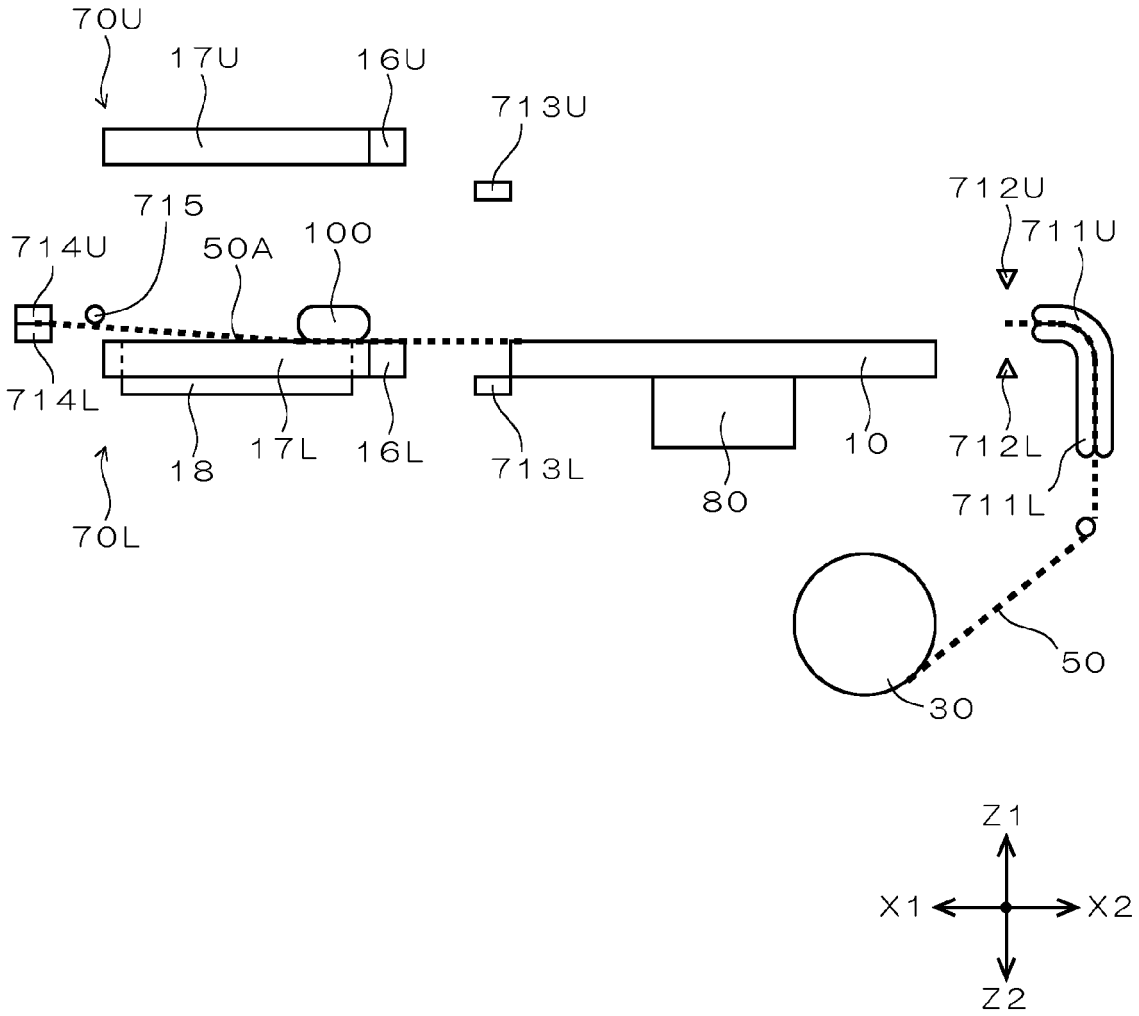

70U
17U
16U
713U
715
714U
50A
100
712U
711U
714L
18
17L
16L
713L
80
10
712L
711L
70L
50
30
Z1
X1
X2
Z2

FIG. 56

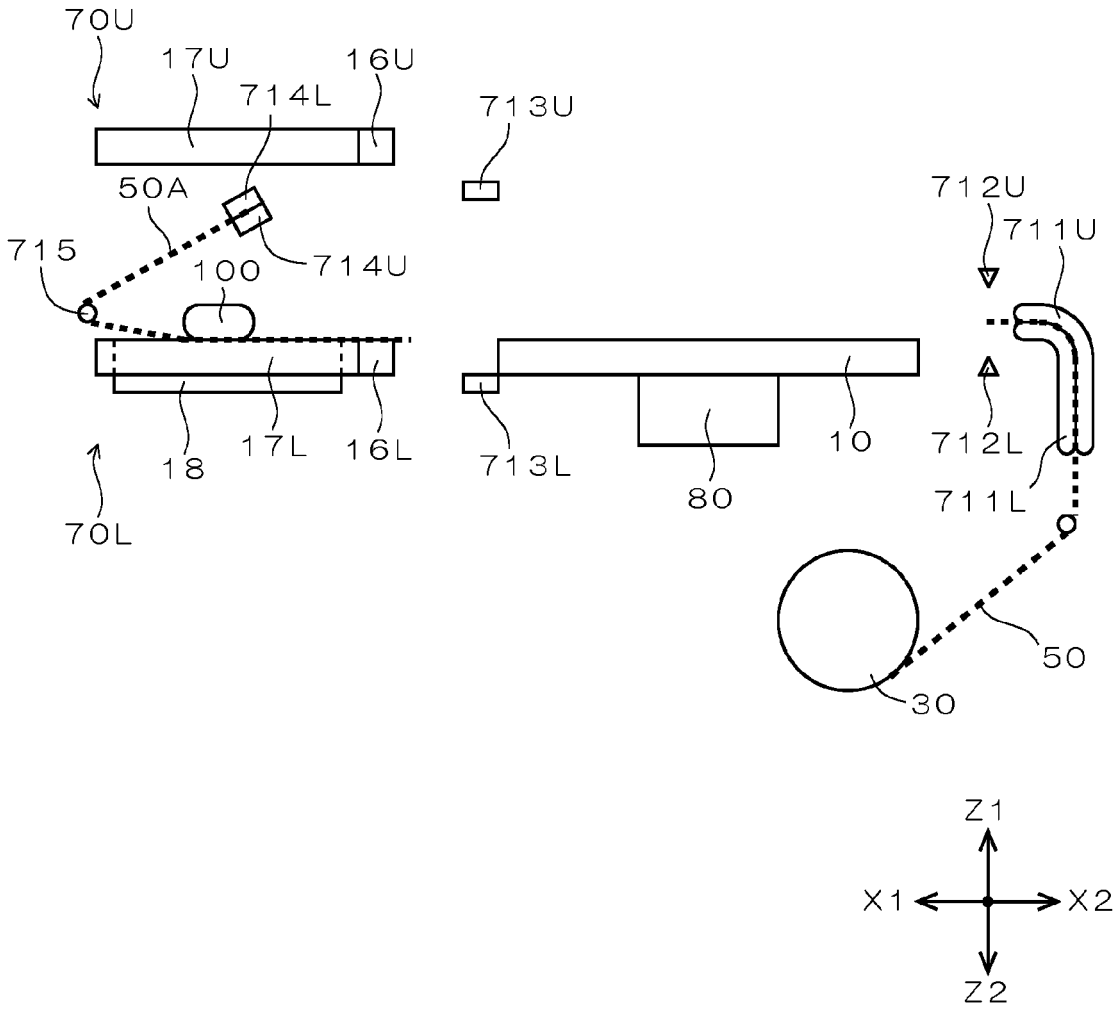

70U
17U
16U
714L
713U
50A
712U
711U
715
100
714U
18
17L
16L
713L
10
712L
711L
80
70L
50
30
Z1
X1
X2
Z2

FIG. 57

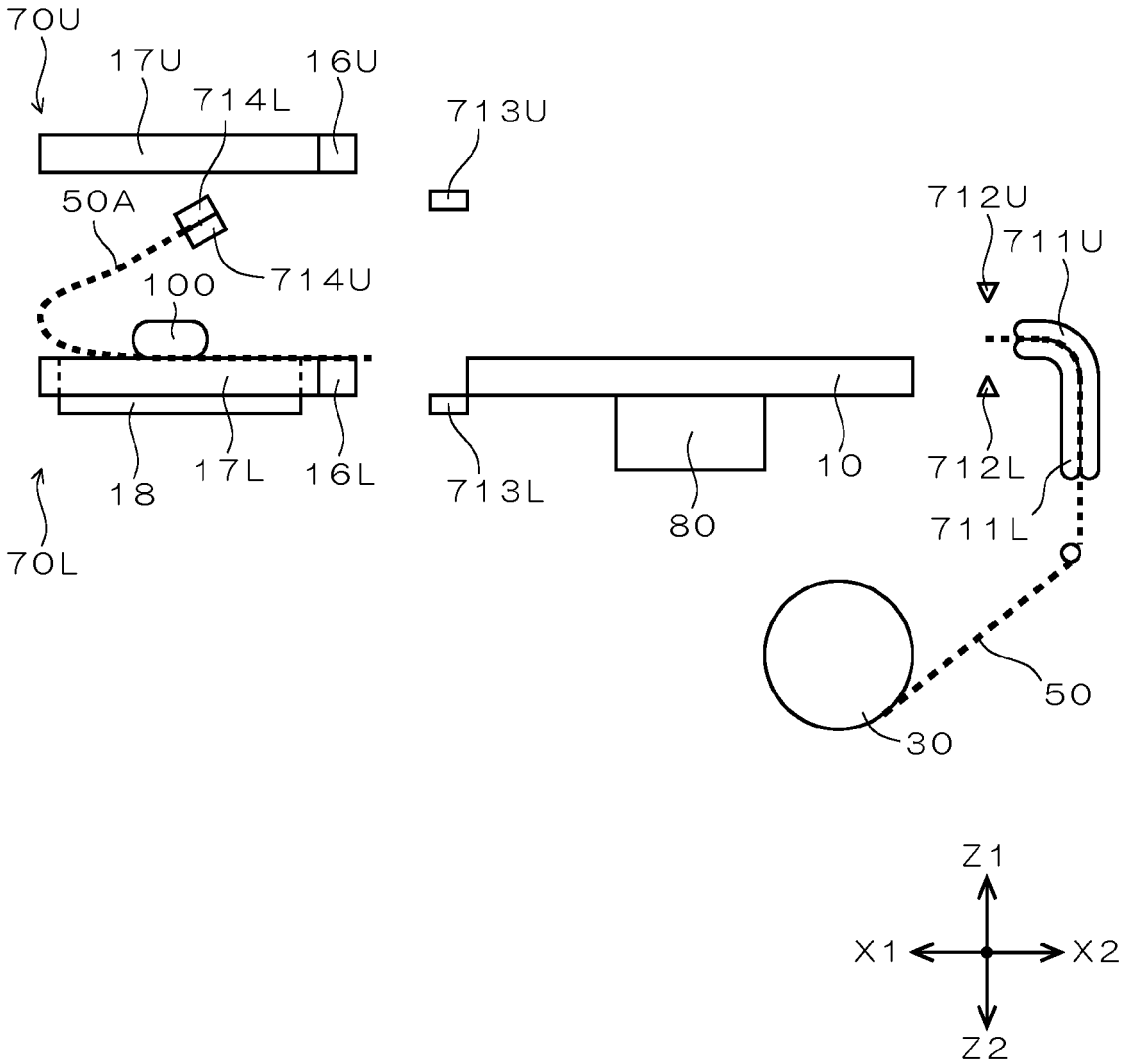

70U
17U
16U
714L
713U
50A
712U
711U
100
714U
18
17L
16L
713L
10
712L
711L
80
70L
50
30
Z1
X1
X2
Z2

FIG. 58

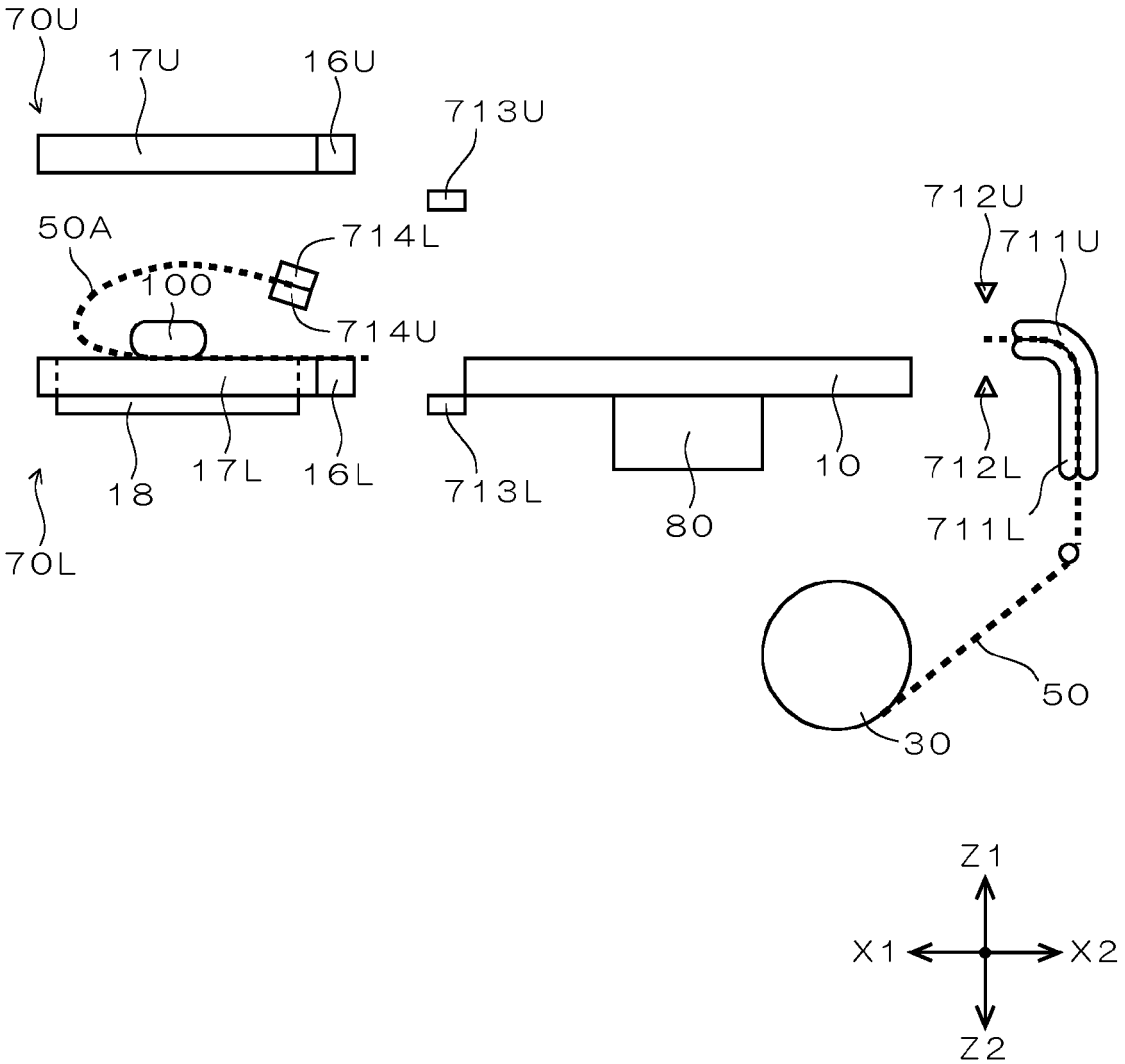

70U
17U
16U
713U
50A
714L
100
714U
712U
711U
18
17L
16L
713L
80
10
712L
711L
70L
50
30
Z1
X1
X2
Z2

FIG. 59

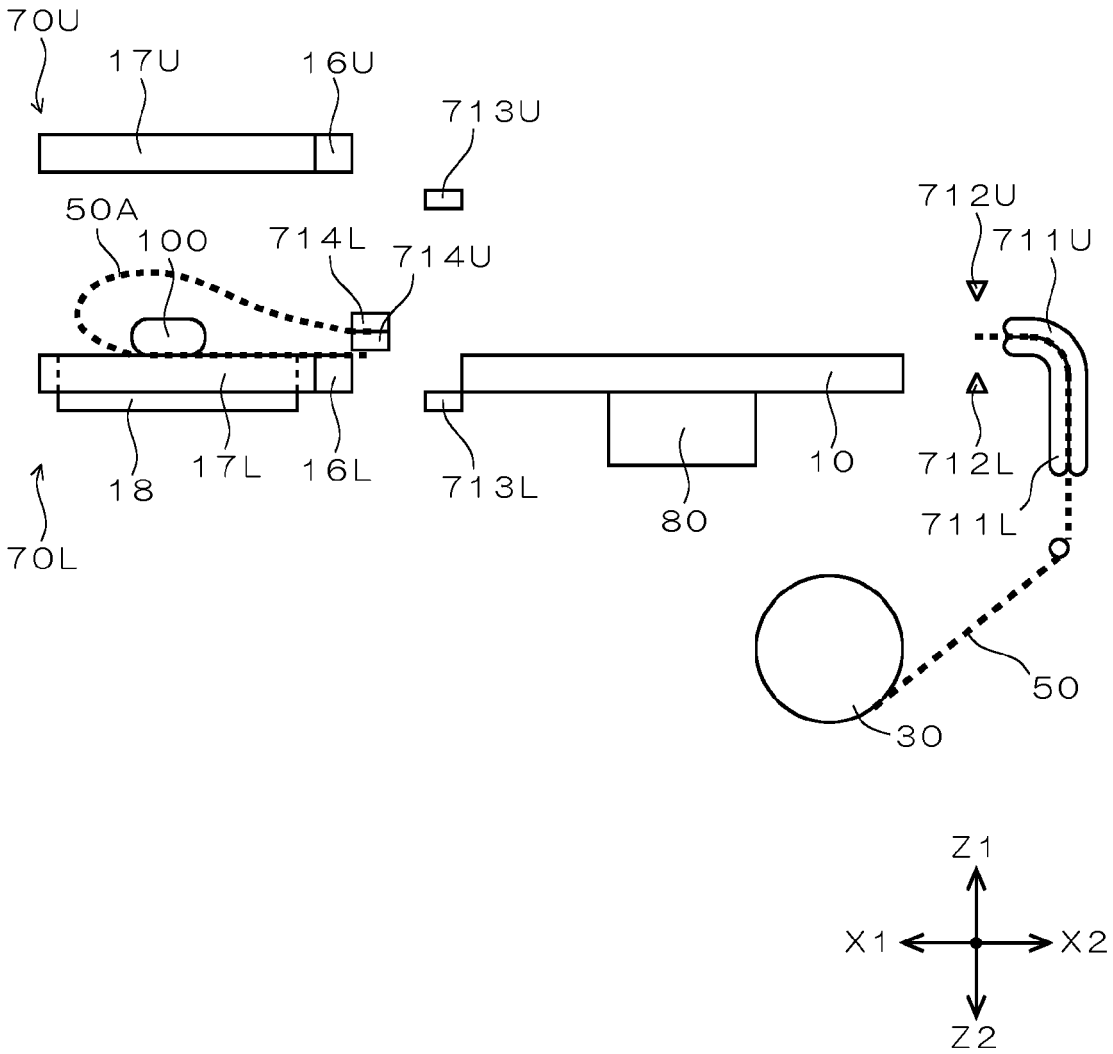

70U
17U
16U
713U
50A
100
714L
714U
712U
711U
18
17L
16L
713L
80
10
712L
711L
70L
50
30
Z1
X1
X2
Z2

FIG. 60

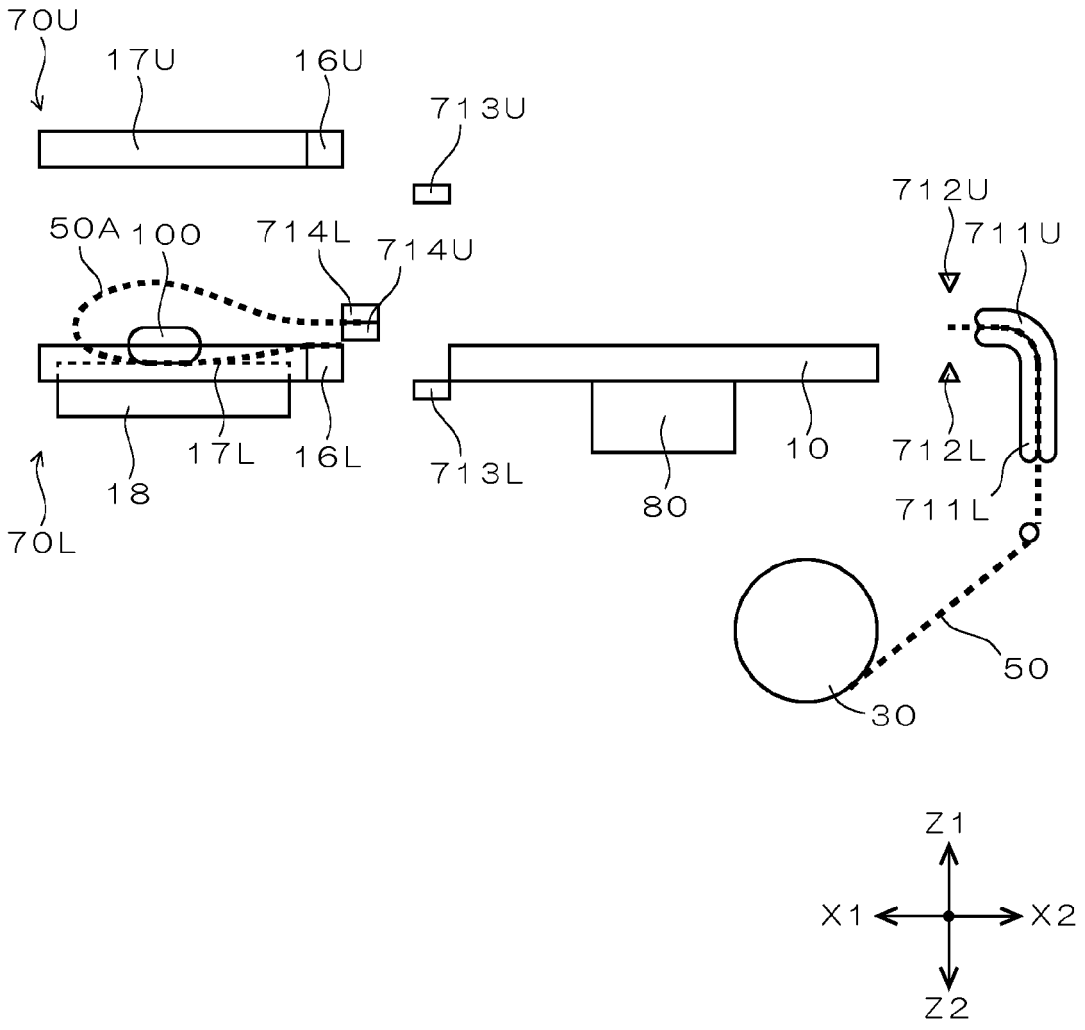

70U
17U
16U
713U
50A
100
714L
714U
712U
711U
712L
711L
17L
16L
18
70L
713L
80
10
50
30
Z1
X1
X2
Z2

FIG. 61

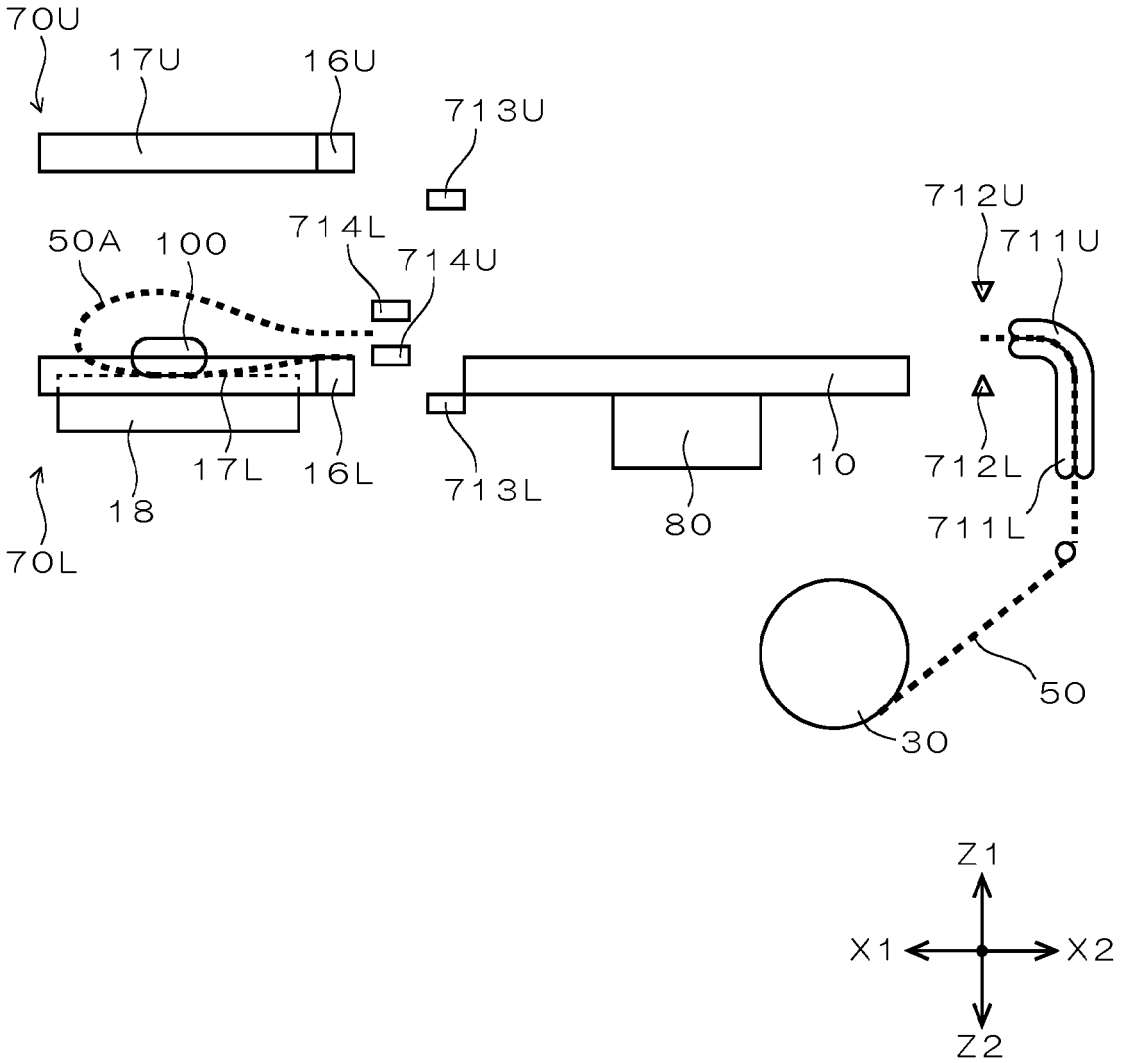

70U
17U
16U
713U
712U
711U
50A
100
714L
714U
712L
711L
18
17L
16L
713L
80
10
70L
50
30
Z1
X1
X2
Z2

FIG. 62

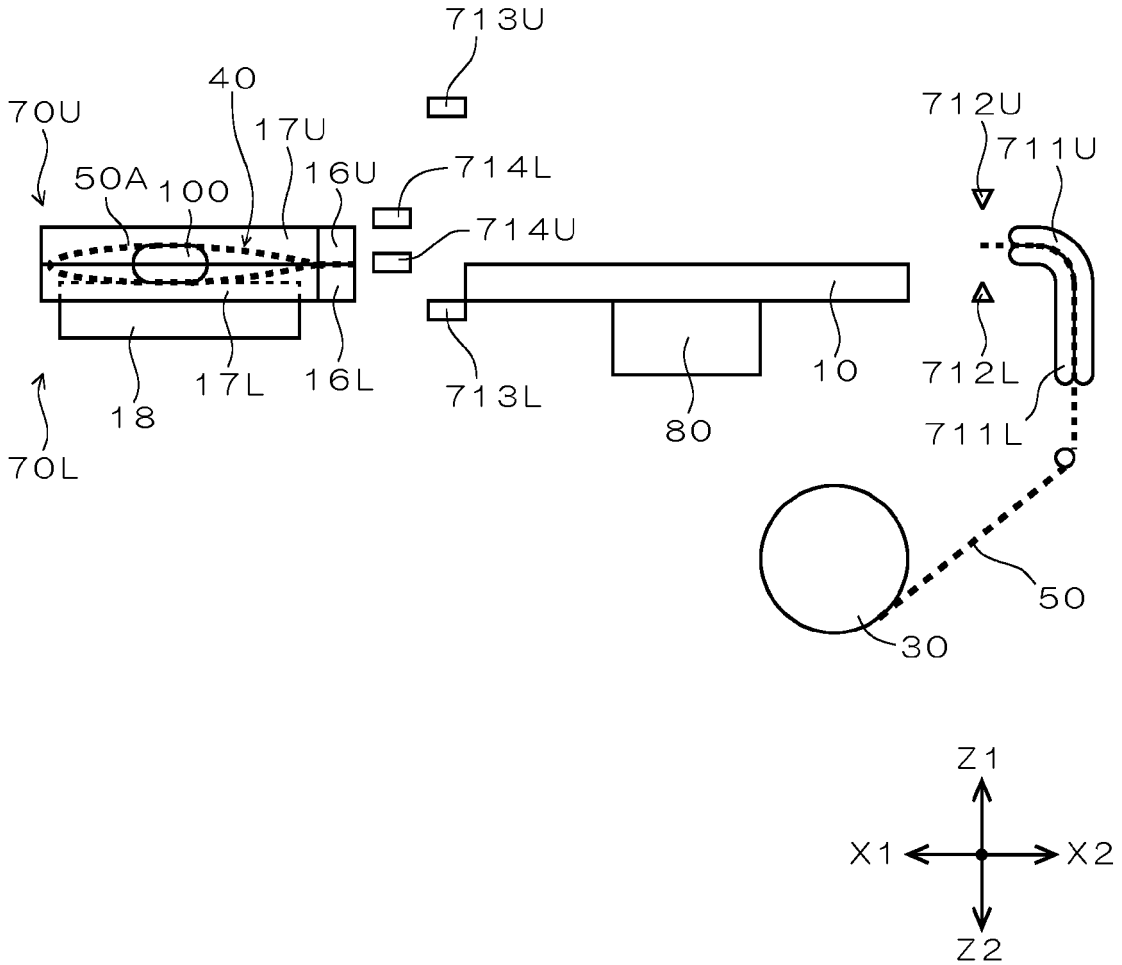

713U
40
70U
17U
712U
711U
50A
100
16U
714L
714U
712L
711L
70L
18
17L
16L
713L
80
10
50
30
Z1
X1
X2
Z2

FIG. 63

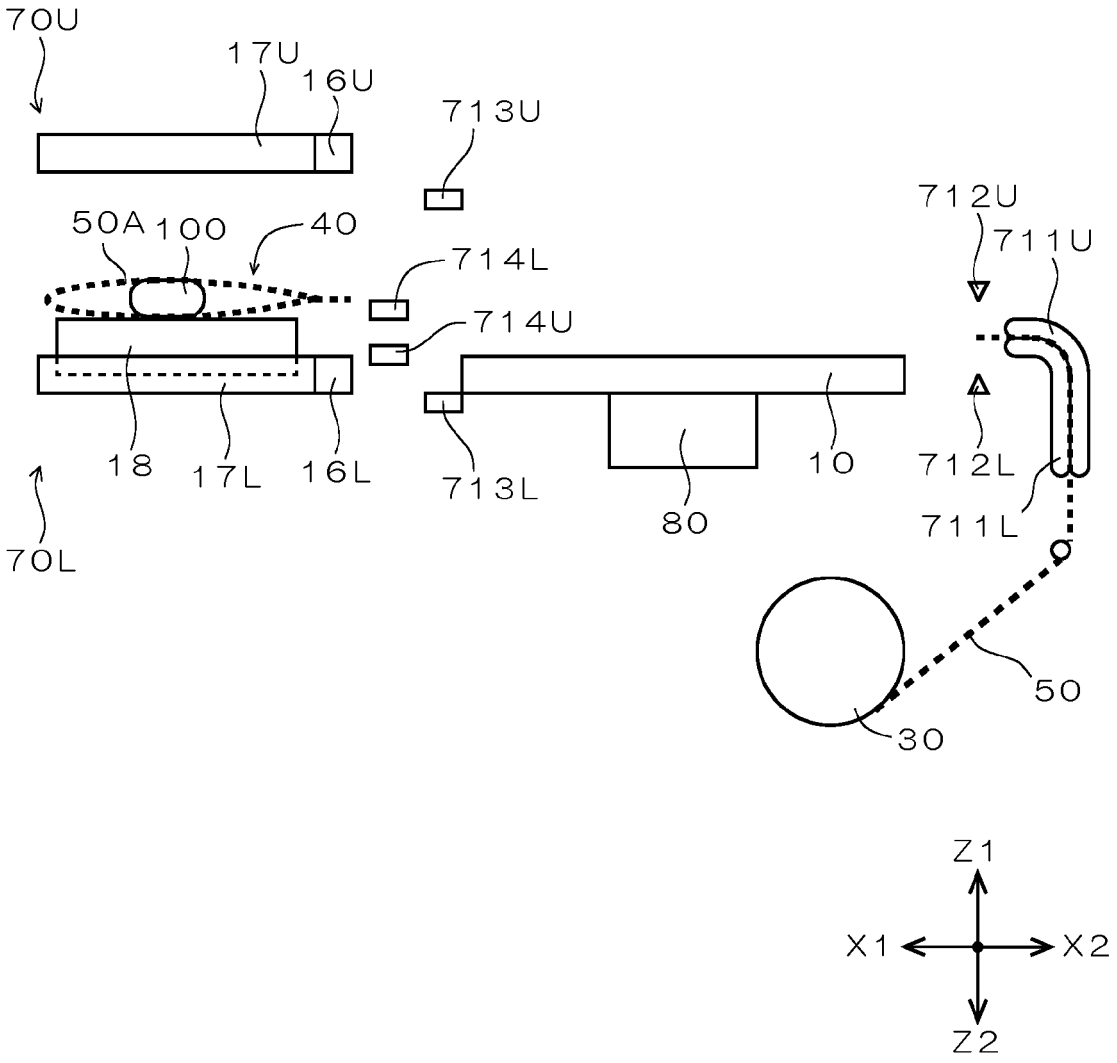

70U
17U
16U
713U
50A
100
40
714L
714U
712U
711U
18
17L
16L
713L
80
10
712L
711L
70L
50
30
Z1
X1
X2
Z2

FIG. 64

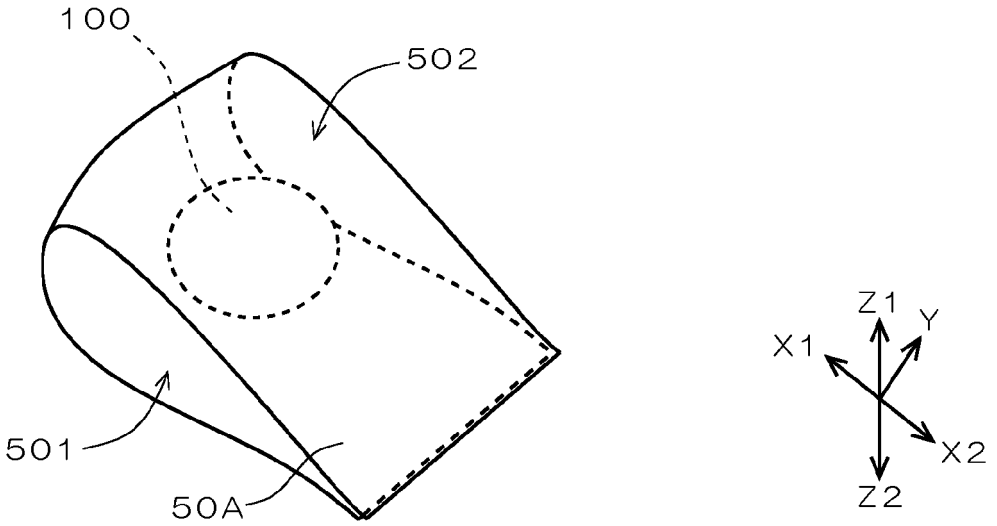
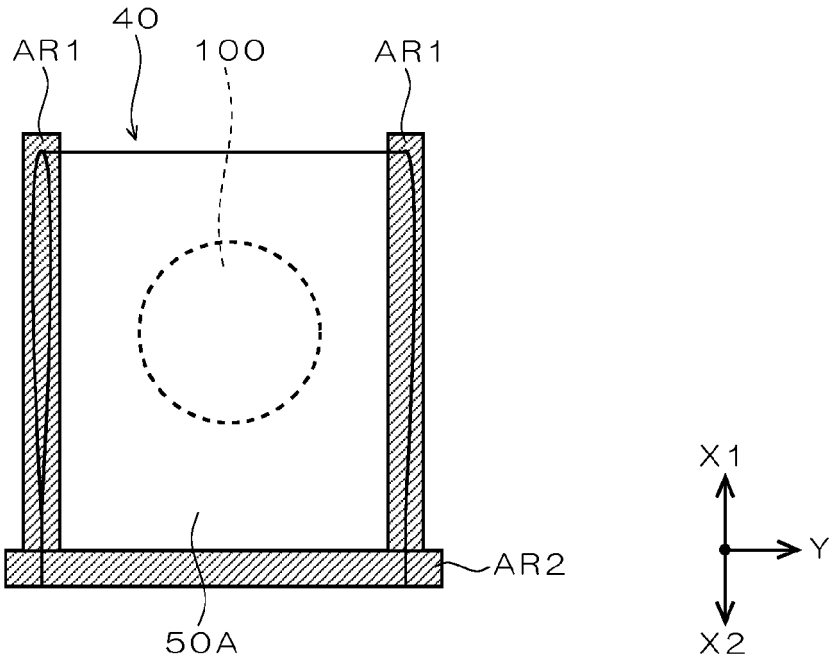


FIG. 65



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2001097309 A **[0002] [0004]**
- JP H11105810 B **[0003] [0005]**