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(54) REEL MEMBERS AND FILM WINDING METHODS

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(57) **ABSTRACT**

A method adaptable for winding a long adhesive film at multiple stages in such a diameter that adhesive cannot be squeezed out is provided, as is a reel member that can be applied to this method. A reel member **50**A includes a winding spool **52**A around which a given film can be wound, and a plurality of flanges **51**A mounted on the winding spool **52**A and each having a guide groove **53**A for passing the film from winding spool **52**A on one side to winding spool **52**A on the other side of the flange **51**A.

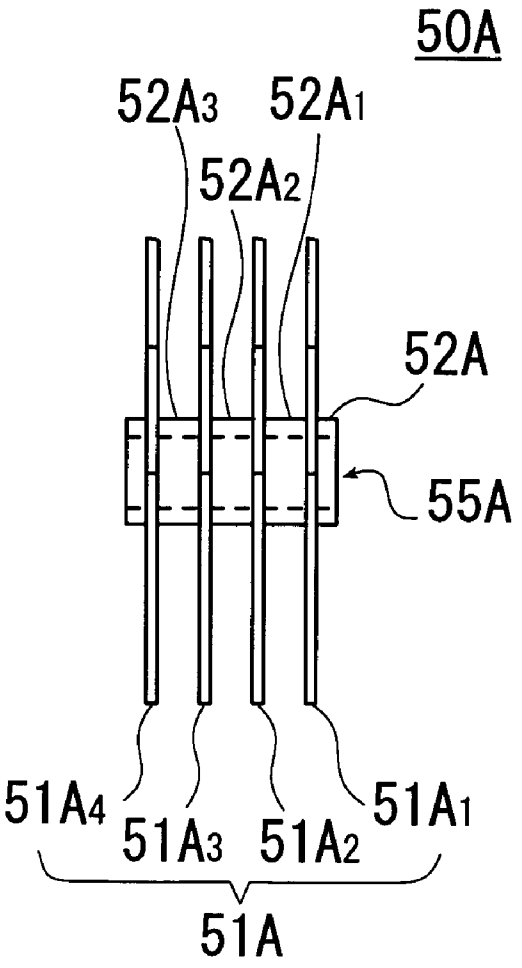


Fig.1a

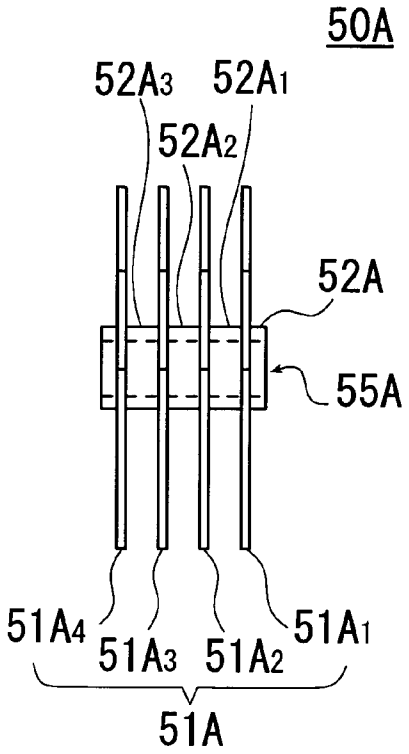


Fig.1b

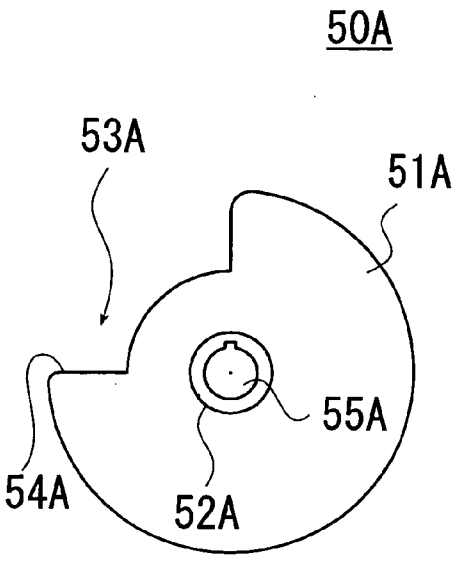


Fig.2a

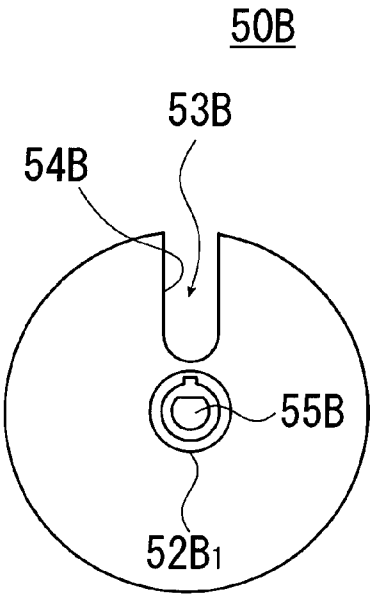


Fig.2b

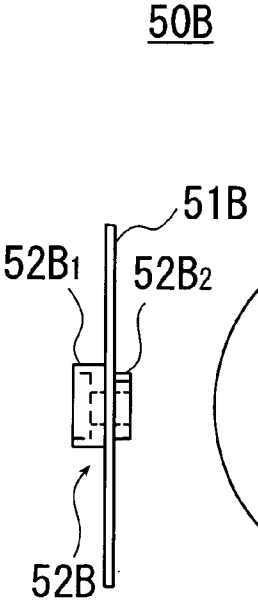


Fig.2c

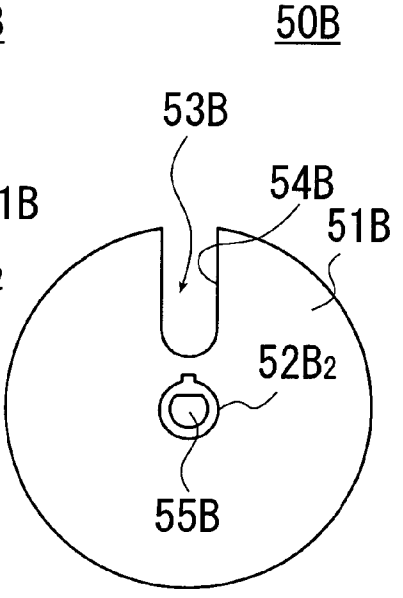


Fig.3

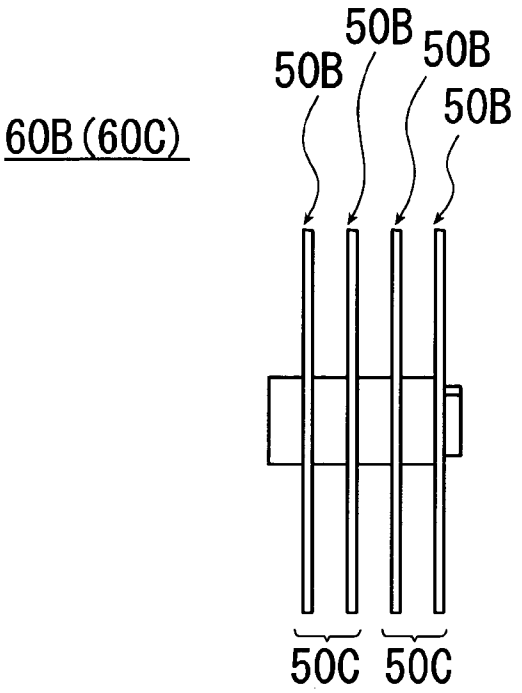


Fig.4a

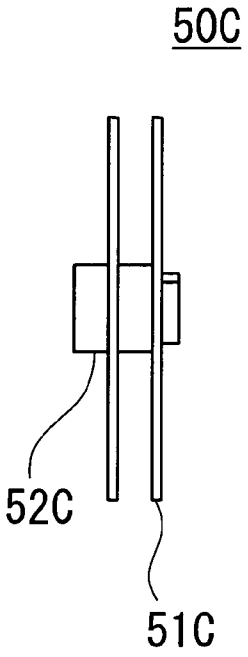


Fig.4b

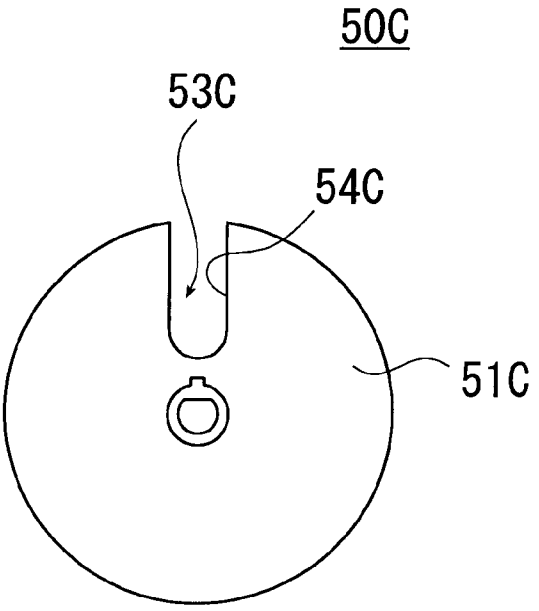


Fig.5a

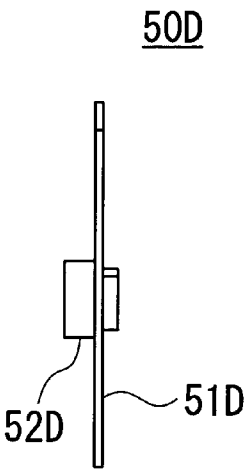


Fig.5b

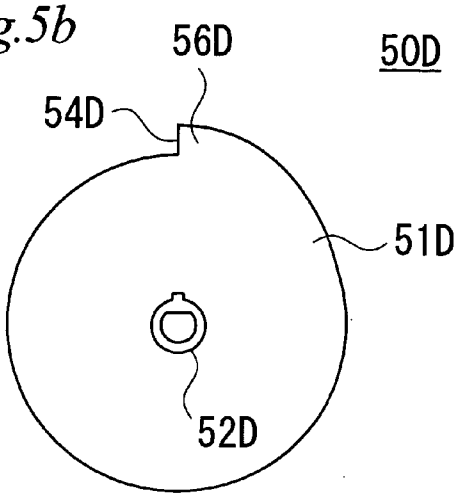


Fig.6a

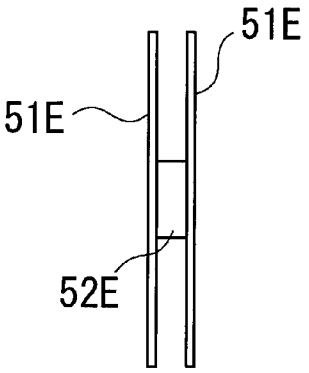


Fig.6b

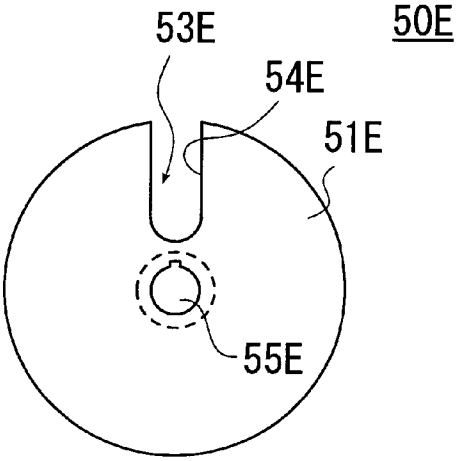


Fig.7

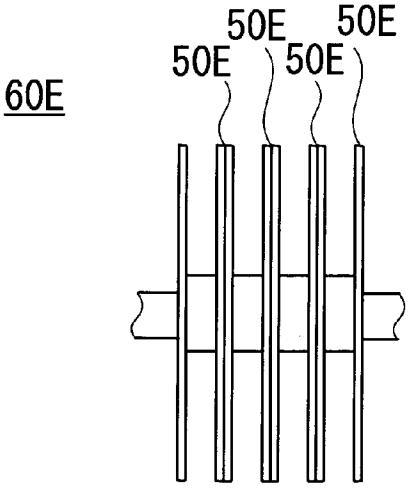


Fig.8a

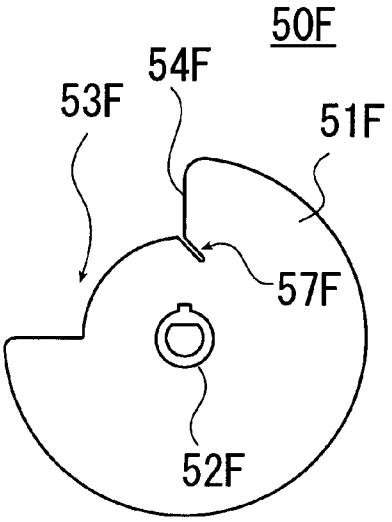


Fig.8b

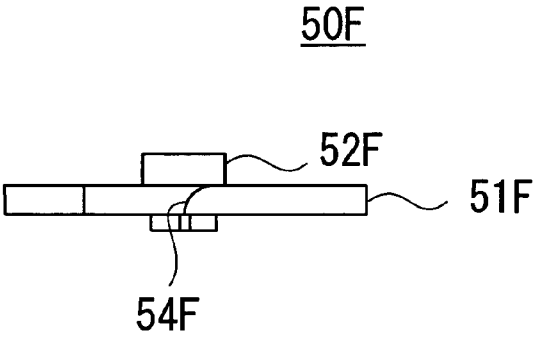


Fig.8c

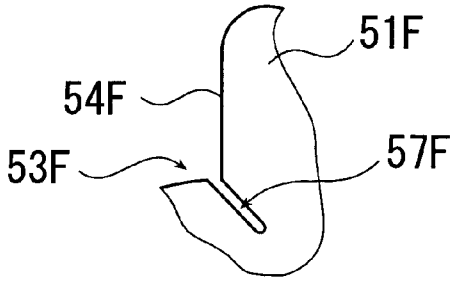


Fig.9a

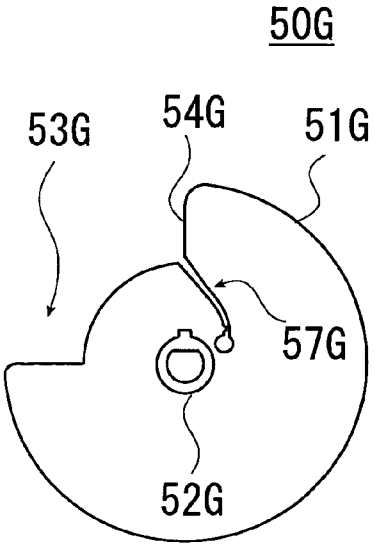


Fig.9b

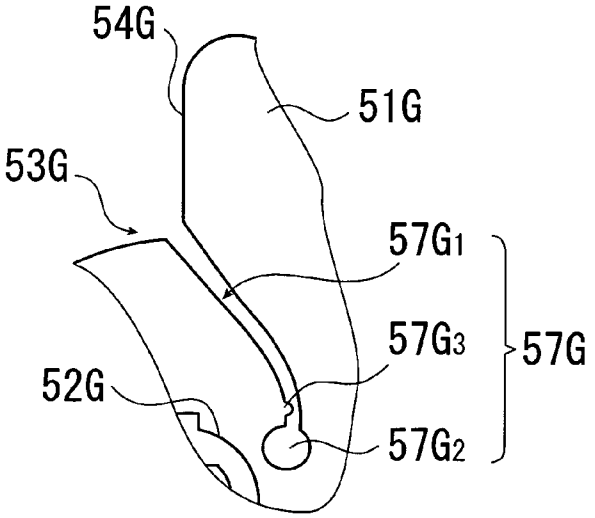


Fig.10

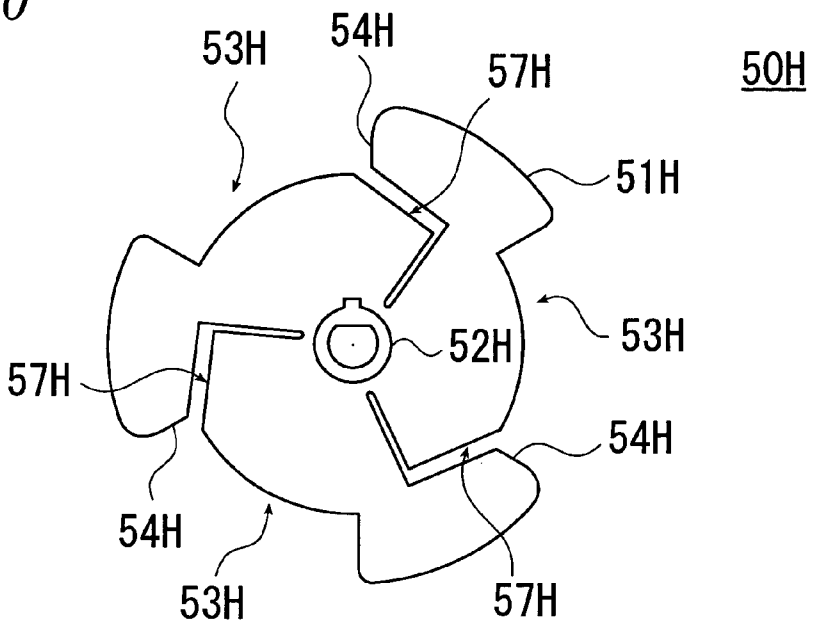


Fig.11a

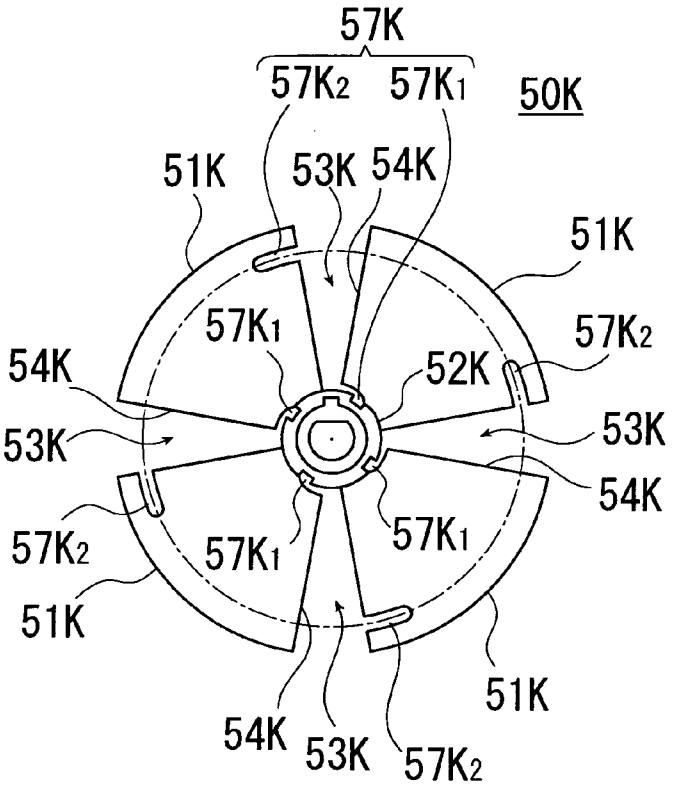


Fig.11b

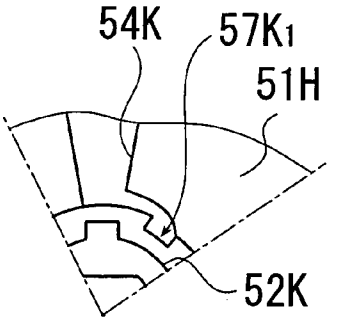


Fig.12b

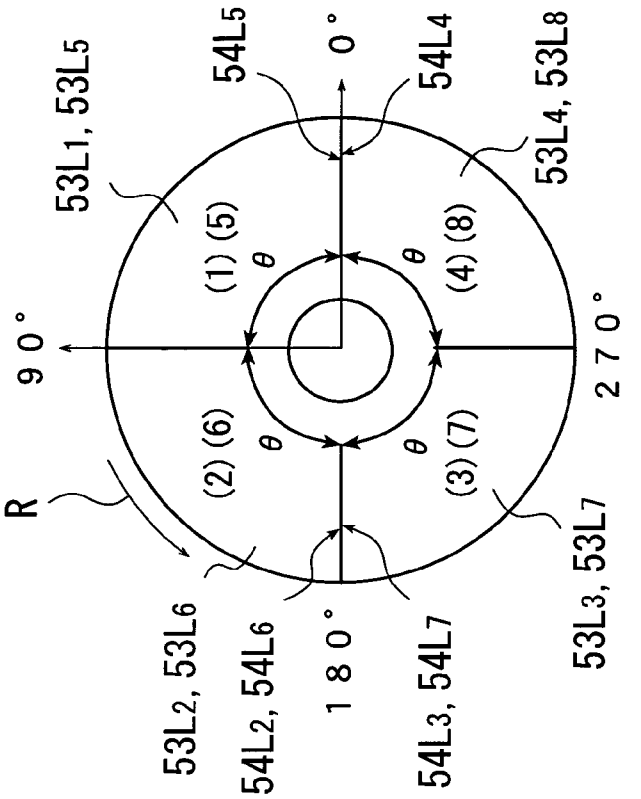


Fig.12a

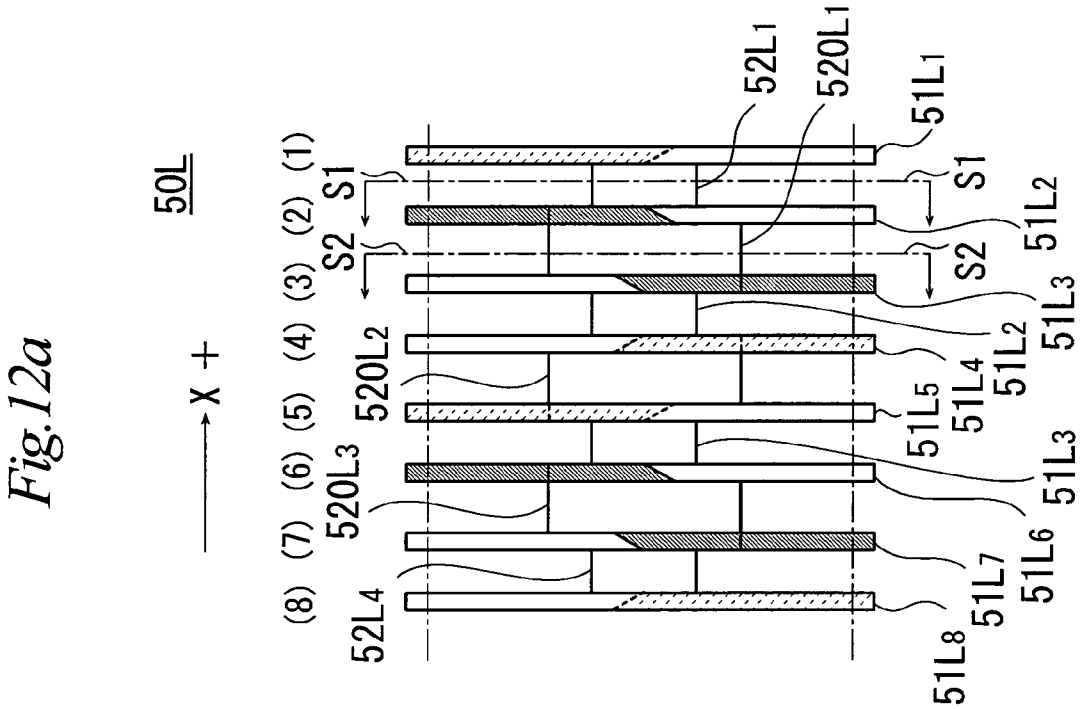


Fig.13a

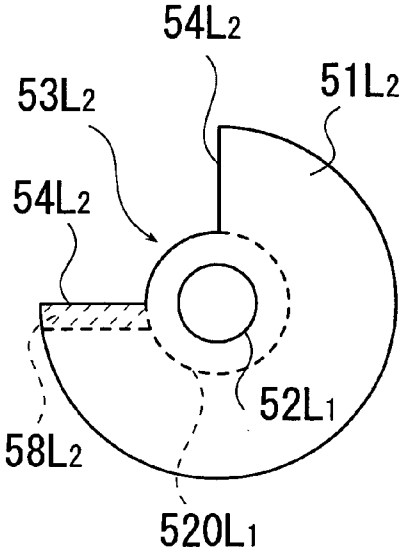


Fig.13b

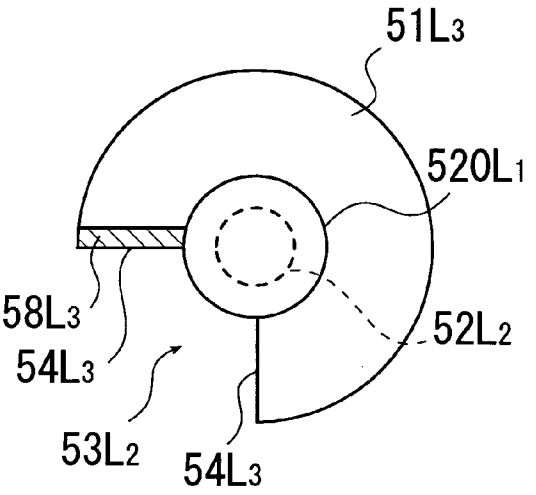


Fig.14

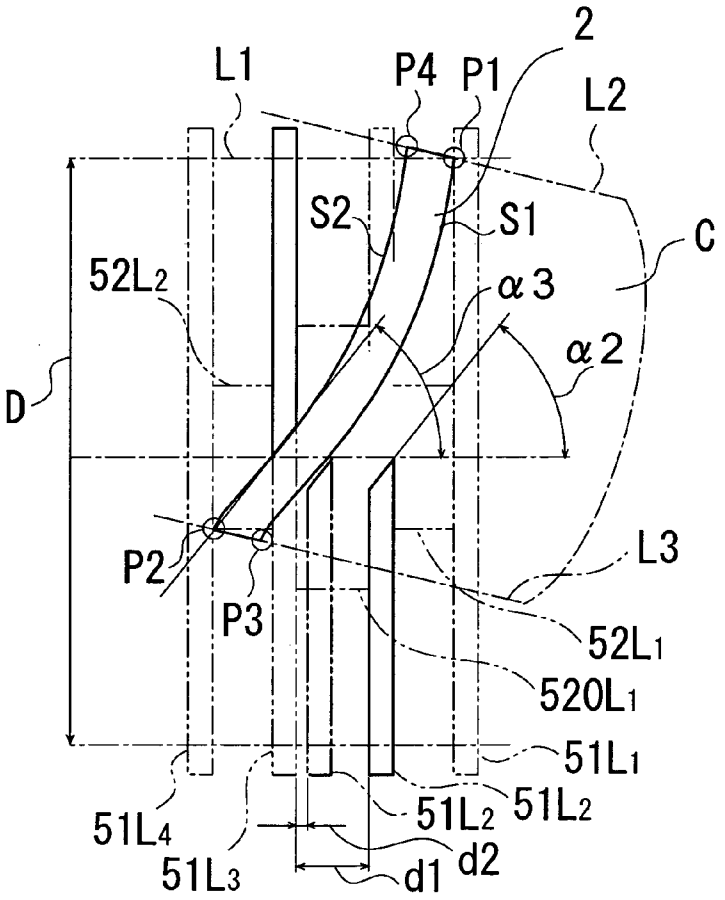


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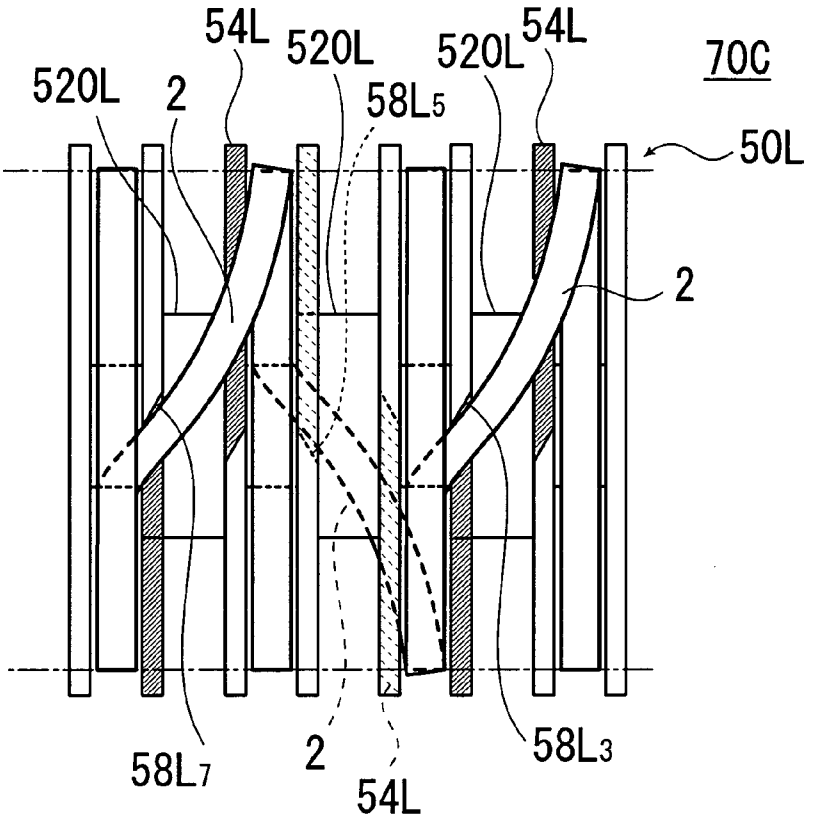

54L
520L
520L
54L
70C
520L
2
58L5
50L
2
58L7
2
54L
58L3

Fig.16

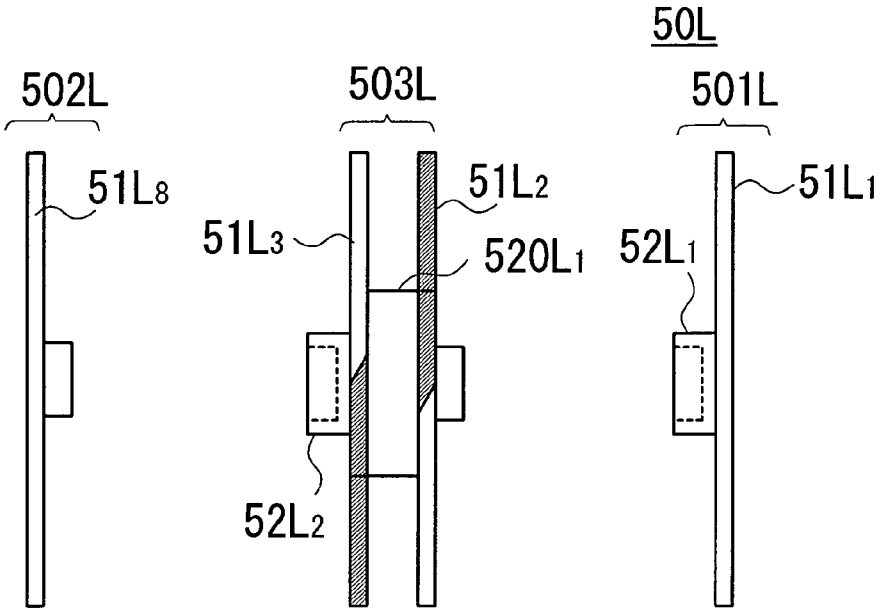
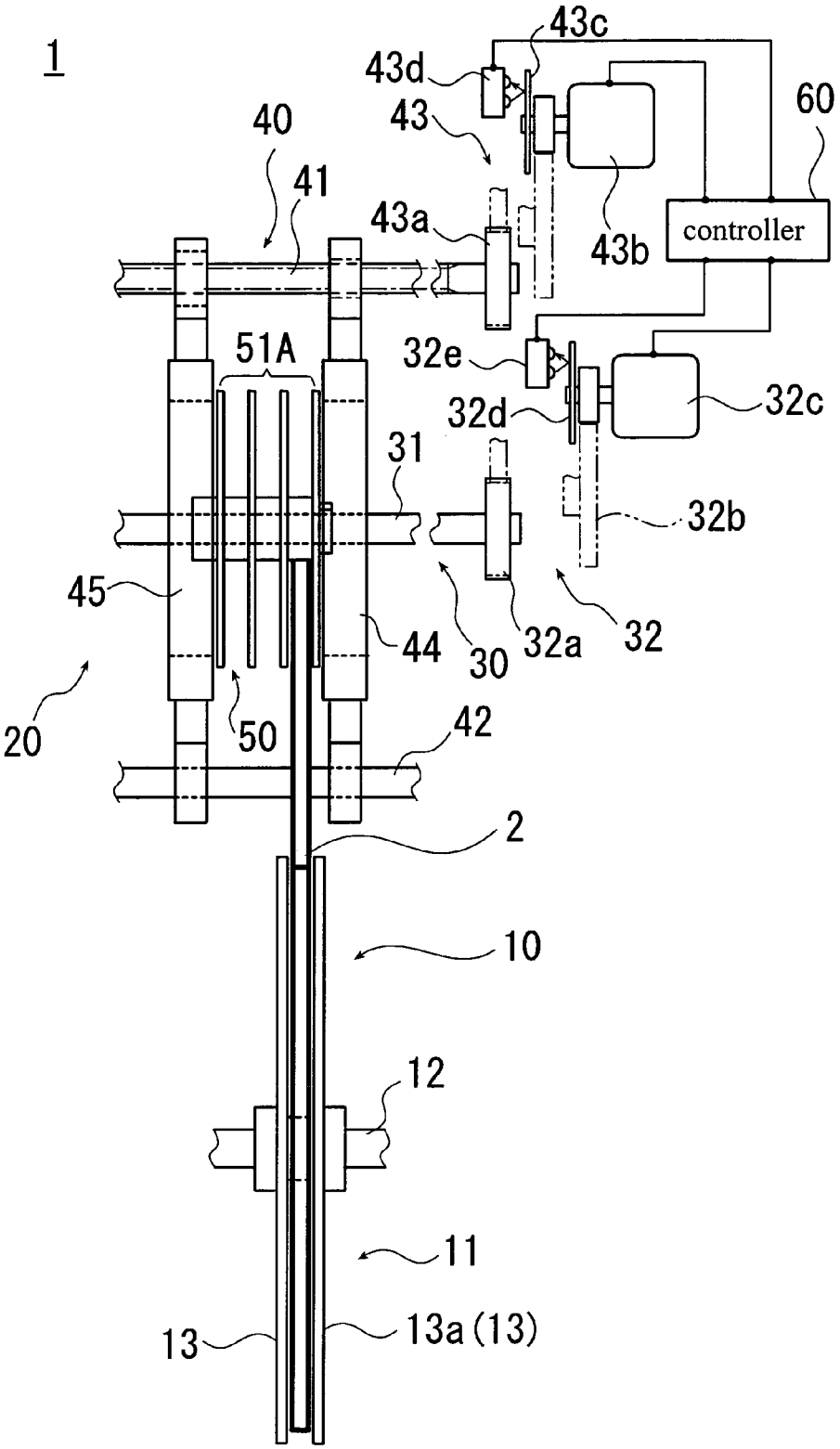

50L
502L
503L
501L
51L8
51L2
51L1
51L3
520L1
52L1
52L2

Fig.17


1
43c
43d
43
60
40
41
43a
43b
controller
51A
32e
32c
32d
31
32b
45
44
30
32a
32
20
50
42
2
10
12
11
13
13a (13)

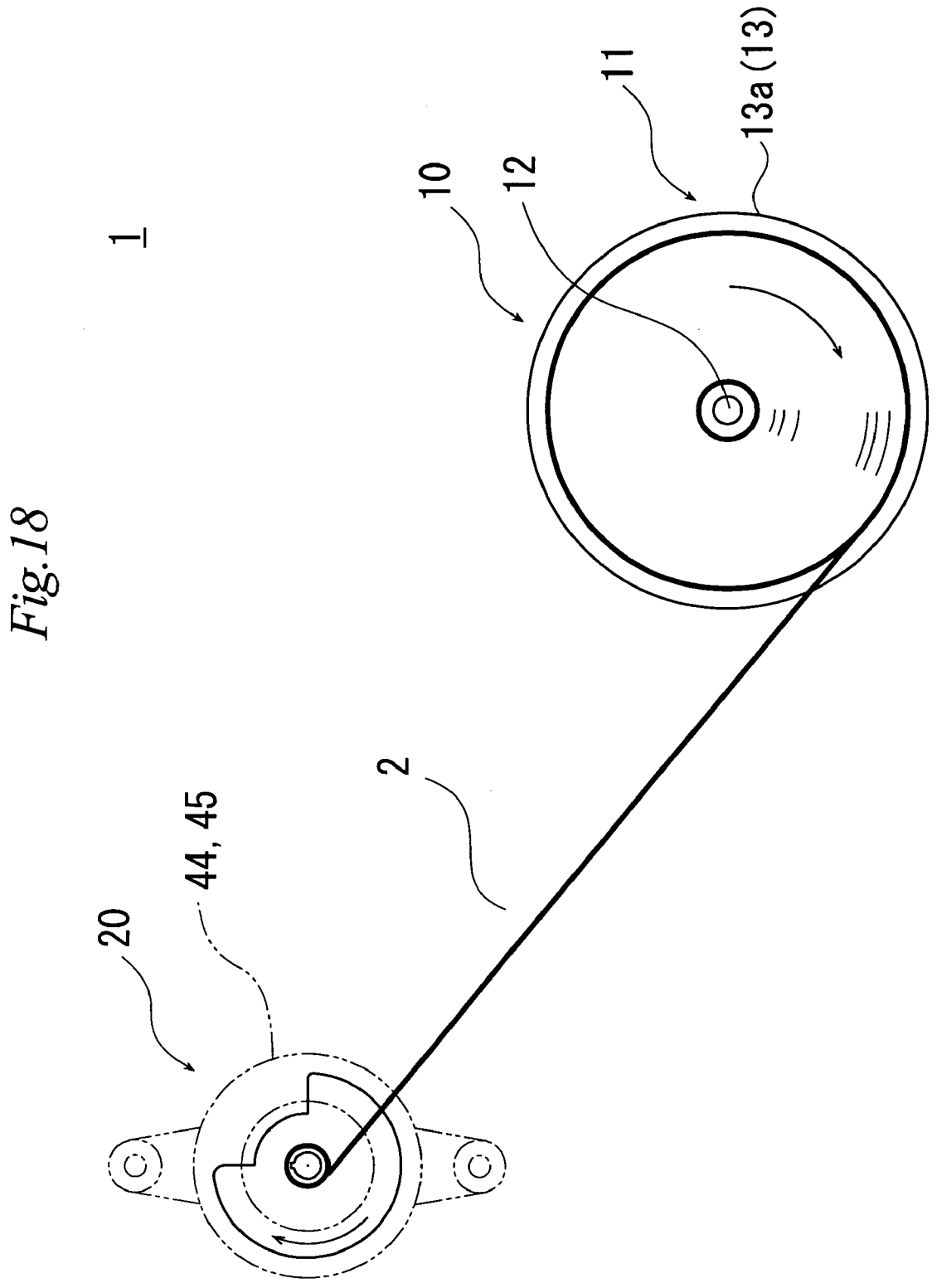


Fig. 18

Fig.19a

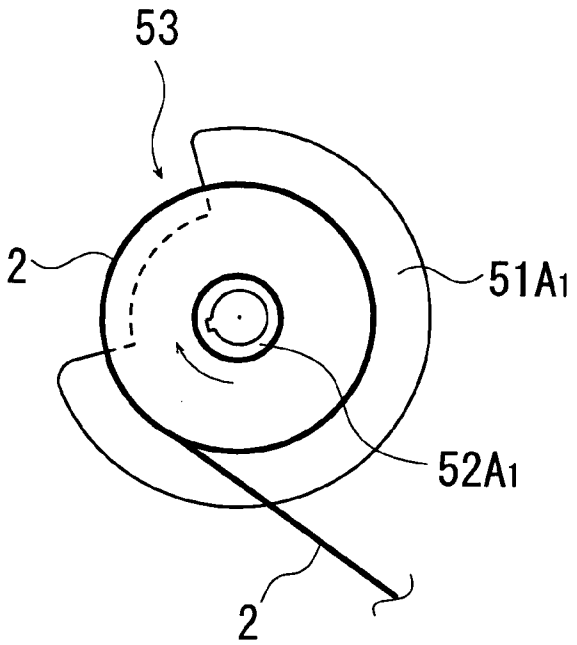


Fig.19b

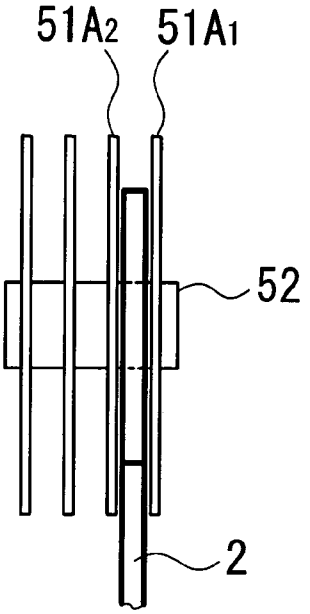


Fig.20a

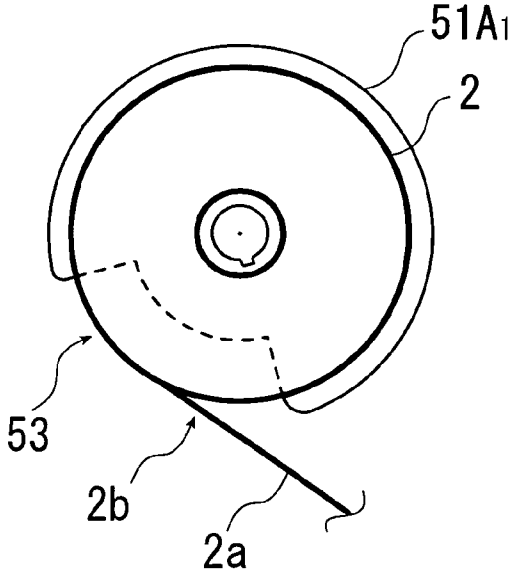


Fig.20b

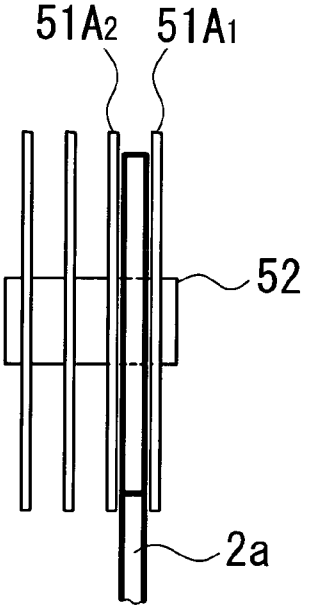


Fig.21a

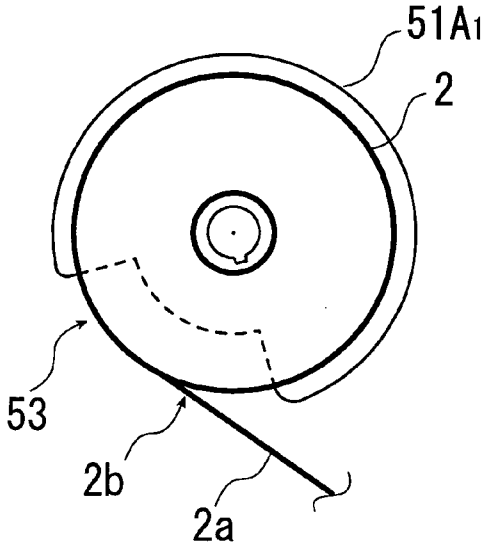


Fig.21b

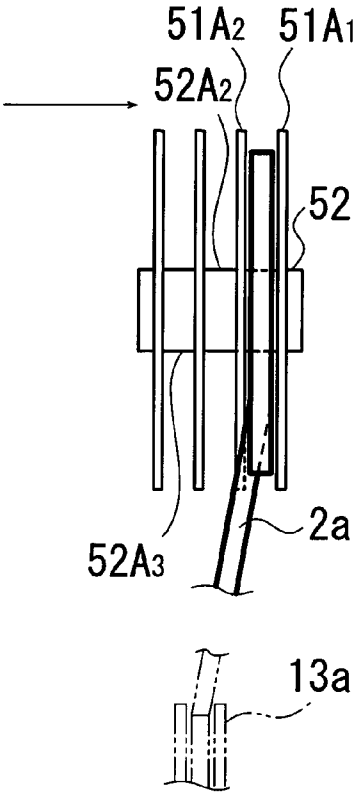


Fig.22a

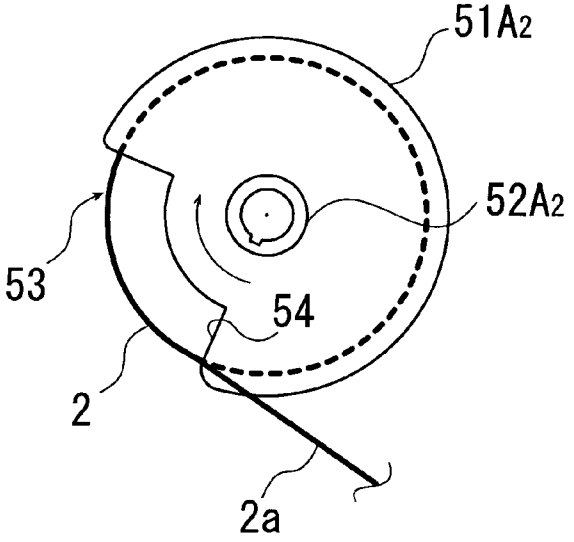


Fig.22b

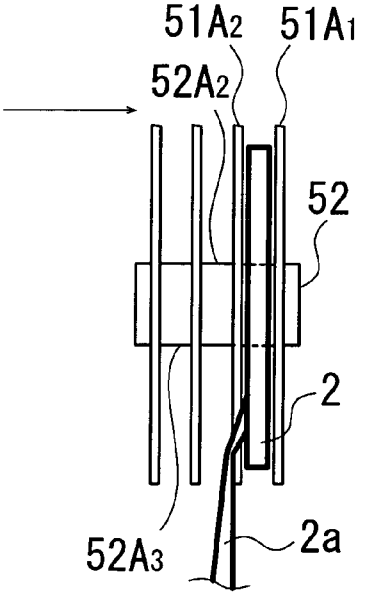


Fig.23a

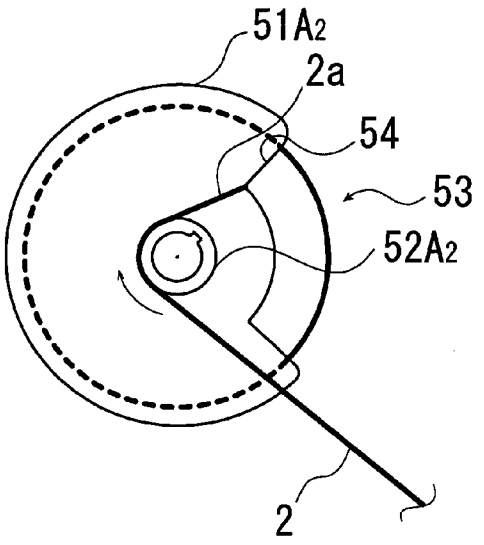


Fig.23b

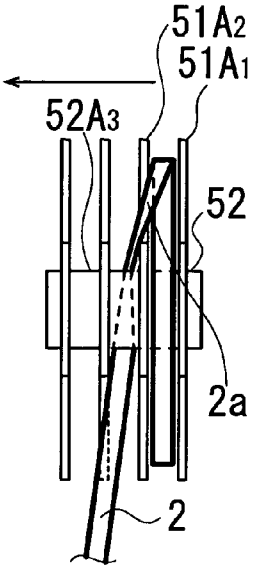


Fig.24a

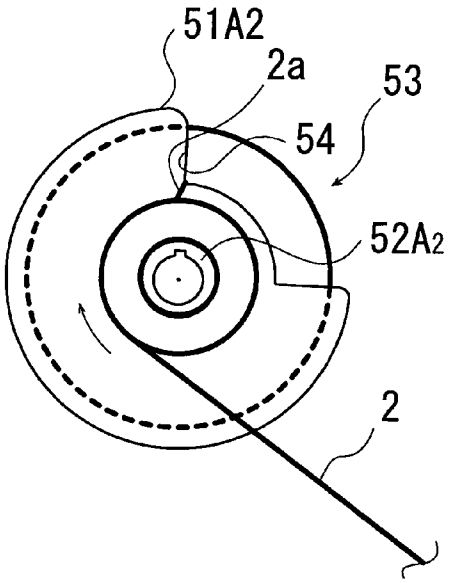


Fig.24b

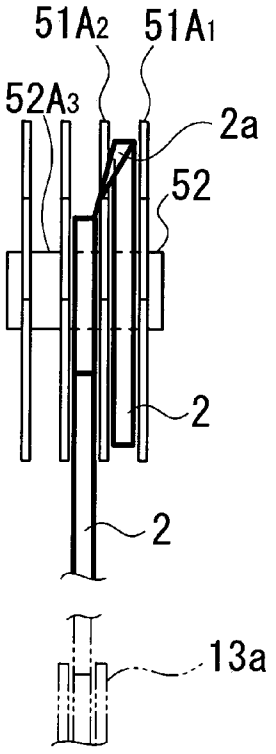


Fig.25a

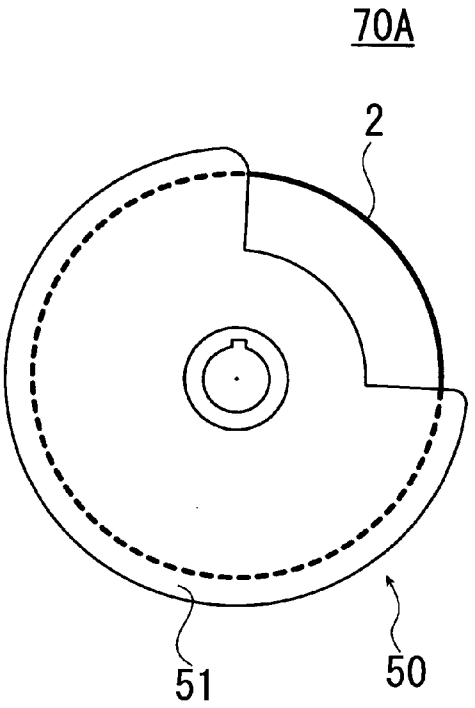


Fig.25b

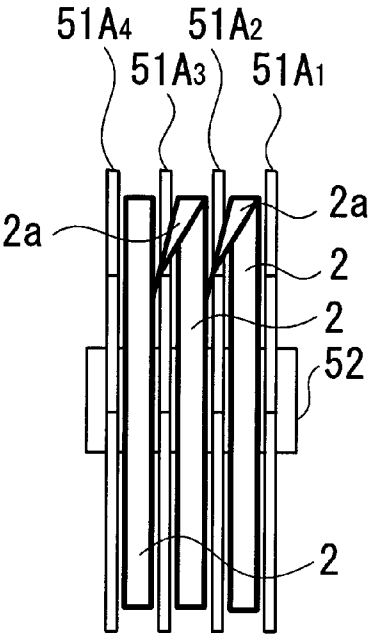


Fig.26

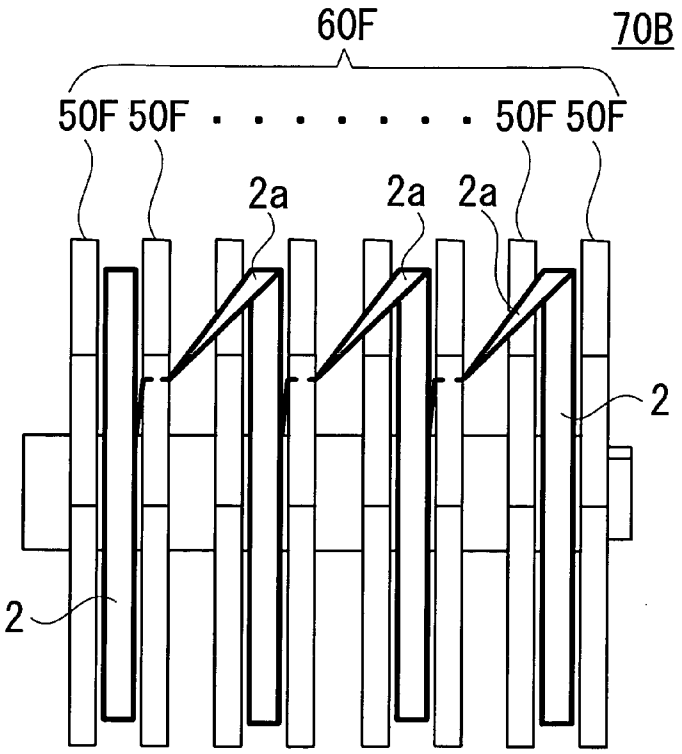


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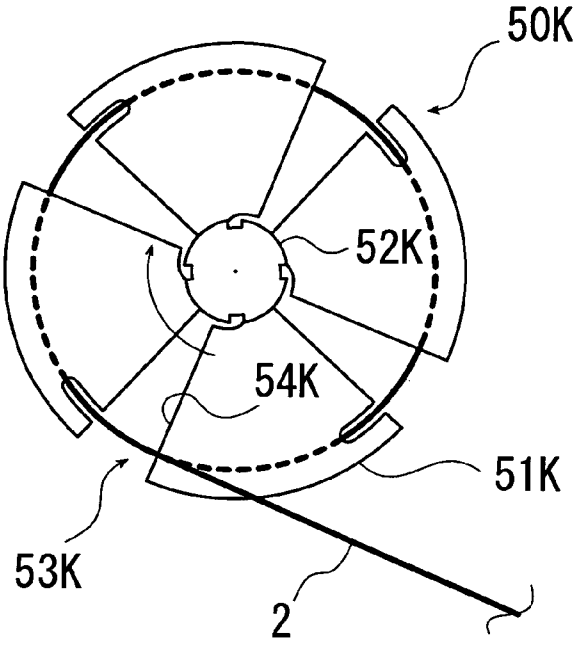


Fig.28

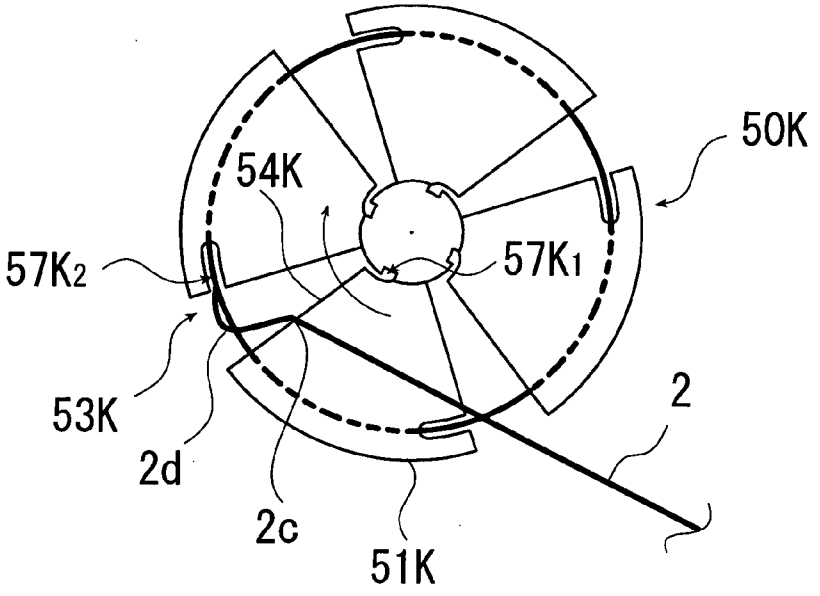


Fig.29

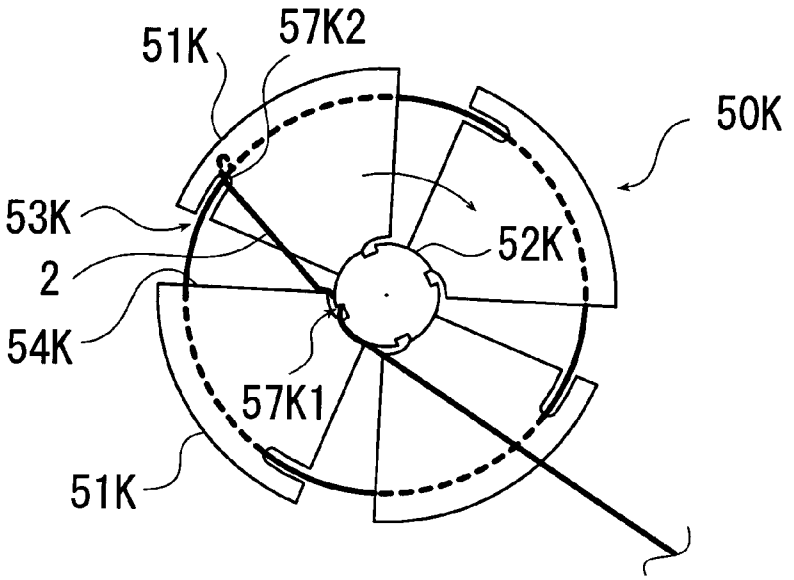
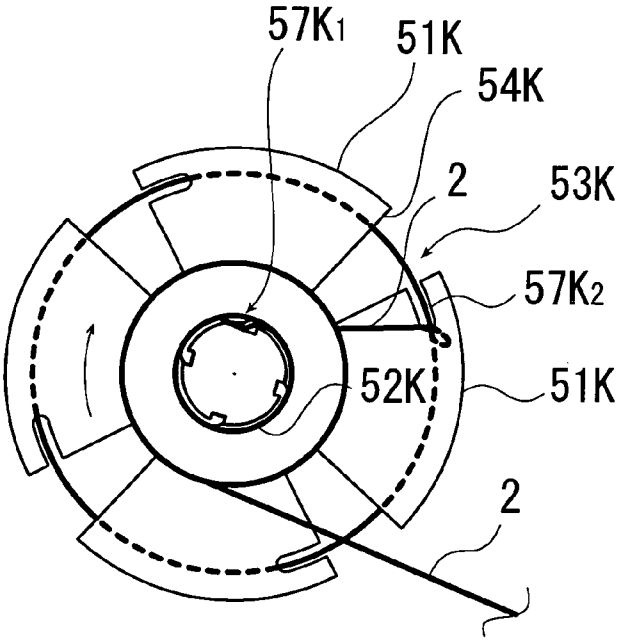

51K
57K2
50K
53K
52K
2
54K
57K1
51K

Fig.30


57K1
51K
54K
2
53K
57K2
52K
51K
2

REEL MEMBERS AND FILM WINDING METHODS

FIELD OF THE INVENTION

[0001] The present invention relates to the technique of winding a long continuous film such as an anisotropic conductive adhesive film or an insulating adhesive film, for example.

PRIOR ART

[0002] Generally, an anisotropic conductive adhesive film or an insulating adhesive film is used to electrically connect electronic components such as liquid crystal panels or IC chips to each other, for example.

[0003] Such adhesive films are delivered to clients in the form of rolls of the films wound around reel members finished through certain preparation processes.

[0004] Recently, further longer adhesive films are desired from the client side.

[0005] However, longer adhesive films involve greater roll diameters, which cause a higher stress to be generated in the adhesive films with the result that adhesive may be squeezed out of the adhesive films.

[0006] The present invention was made to solve these technical problems with the purpose of providing a method for winding a long adhesive film at multiple stages in such a diameter that adhesive cannot be squeezed out and a reel member that can be applied to this method.

SUMMARY OF THE INVENTION

[0007] The present invention provides a reel member comprising a winding spool around which a given film can be wound and a plurality of flanges mounted on the winding spool, wherein each of the flanges has a guide groove for passing the film between winding spools adjacent to each other. By using the reel member of the present invention, the film can be smoothly moved from a winding spool on one side to a winding spool on the other side by passing the film through the guide groove at the stage when winding of the film around the winding spool on the one side has been completed.

[0008] In the reel member of the present invention, an engaging part capable of engaging with the film is advantageously formed in the guide groove.

[0009] Thus, the film can be wound around a winding spool on the other side by catching the film at the engaging part in the guide groove when it is passed through the guide groove.

[0010] In the reel member of the present invention, a retaining part capable of retaining the film is advantageously formed in the guide groove.

[0011] Thus, the film can be wound around a winding spool on the other side without slack by retaining the film at the retaining part in the guide groove when it is passed through the guide groove.

[0012] In the reel member of the present invention, the guide grooves are advantageously opposed to each other.

[0013] Thus, the film can be axially moved or caught at the same timing between flanges.

[0014] In the reel member of the present invention, the outer diameter of the flange is advantageously determined on the basis of the value of the stress generated in the film wound around the winding spool.

[0015] This ensures that the film can be wound without running off the outer periphery of the flange, whereby the adhesive cannot be squeezed out.

[0016] In the reel member of the present invention, the winding spools are advantageously axially connectable to each other.

[0017] Thus, a long film can be handled as appropriate by adjusting the number of reel members depending on the length of the film.

[0018] The present invention also provides a reel member comprising a winding spool around which a given film can be wound and a plurality of flanges mounted on the winding spool and having an engaging projection capable of engaging with the film on the outer periphery.

[0019] The reel member of the present invention has the advantage that not only the film can be smoothly moved from a winding spool on one side to a winding spool on the other side or can be caught at the engaging projection but also the range of the timing of performing this can be wider.

[0020] In the reel member of the present invention, the engaging projections are advantageously opposed to each other.

[0021] Thus, the film can be axially moved or caught at the same timing between flanges.

[0022] The present invention also provides a reel member comprising a winding spool around which a given film can be wound and a flange mounted on the winding spool and having an engaging projection capable of engaging with the film on the outer periphery, wherein the winding spools are axially connectable to each other.

[0023] The present invention also provides a reel member comprising a winding spool around which a given film can be wound and a flange mounted on the winding spool and having a guide groove for passing the film, wherein the winding spools are axially connectable to each other.

[0024] The present invention also provides a reel member assembly formed of a plurality of reel members connected to each other, each reel member comprising a winding spool around which a given film can be wound and a flange mounted on the winding spool and having a guide groove for passing the film wherein the winding spools are axially connectable to each other.

[0025] According to the present invention wherein the winding spools are axially connectable to each other, a long film can be handled as appropriate by adjusting the number of reel members depending on the length of the film.

[0026] The present invention also provides a film package comprising a reel member assembly formed of a plurality of reel members connected to each other, each reel member comprising a winding spool around which a given film can be wound and a flange mounted on the winding spool and having a guide groove for passing the film wherein the

winding spools are axially connectable to each other and wherein a continuous film is wound around the winding spool of the reel member assembly.

[0027] According to the film package of the present invention, a long film can be easily handled at the market.

[0028] In the film package of the present invention, an empty winding spool is advantageously interposed between winding spools around which the film is wound.

[0029] The present invention also provides a reel member comprising a plurality of winding spools coaxially arranged at predetermined intervals and a flange mounted at each end of each winding spool wherein a guide groove is cut away from each flange at a given center angle and the guide grooves are arranged with a phase shift of the center angle.

[0030] According to the reel member of the present invention, the center of gravity of the reel member as a whole can be located on the winding axis so that a long film can be wound always at a constant torque and can be guided between opposed guide edges in the guide grooves adjacent to each other to the next winding spool.

[0031] In the reel member of the present invention, a spacer spool for guiding the film is advantageously inserted between the winding spools.

[0032] Thus, the film can be guided along the side face of the spacer spool to the next winding spool and the film can be gently passed by selecting the length of the spacer spool.

[0033] In the reel member of the present invention, the opposed guide edges in the guide grooves adjacent to each other are advantageously chamfered at a given angle.

[0034] Thus, the film can be smoothly guided to the next winding spool along the chamfered bevel of the flange.

[0035] The present invention also provides a film package comprising a reel member comprising a plurality of winding spools coaxially arranged at predetermined intervals and a flange mounted at each end of each winding spool and having a guide groove cut away from each flange at a given center angle and the guide grooves are arranged with a phase shift of the center angle wherein a continuous film is wound around the reel member.

[0036] The film used in the film package of the present invention is preferably an insulating adhesive film or an anisotropic conductive adhesive film.

[0037] In the film package of the present invention, the film advantageously comprises an adhesive applied on a release film and the release film is exposed at a necessary part for passing the film from one to the other side of the flange.

[0038] This has the advantage that not only the insulating adhesive film or anisotropic conductive adhesive film can be saved but also the quality of the insulating adhesive film or anisotropic conductive adhesive film can be guaranteed to clients who avoid using kinks when the film is passed.

[0039] The present invention also provides a method for winding a continuous film drawn out from the feeding side onto a winding shaft at multiple stages, comprising the steps of:

[0040] winding a given part of the film onto a part of the winding shaft by rotating the winding shaft at a given speed, and then

[0041] winding the given part of the film onto another part of the winding shaft by stopping or slowing the rotation of the winding shaft and axially moving the winding shaft relative to the feeding side.

[0042] According to the method for winding a film of the present invention, a long film can be wound at multiple stages within a desired limited roll diameter of the film, and especially an insulating adhesive film or anisotropic conductive adhesive film can be wound at multiple stages within such a roll diameter that the adhesive cannot be squeezed out.

[0043] The present invention also provides a method for winding a continuous film drawn out from the feeding side onto a winding shaft at each part of the winding shaft divided by flanges, comprising the steps of:

[0044] winding a given part of the film onto a part of the winding shaft by rotating the winding shaft at a given speed, and then

[0045] winding the given part of the film on another part of the winding shaft after passing the film over the flange by stopping or slowing the rotation of the winding shaft and axially moving the winding shaft relative to the feeding side.

[0046] According to the method for winding a film of the present invention, a long film can be wound at multiple stages within a limited diameter even when a reel member having a plurality of flanges on the winding axis is used.

[0047] The present invention also provides a method for winding a continuous film using a reel member comprising a winding spool and a plurality of flanges mounted on the winding spool and having a guide groove for passing the film between winding spools adjacent to each other, comprising the step of winding the film on a winding spool and then the next winding spool with at least one empty winding spool being interposed.

[0048] According to the method for winding a film of the present invention, a film can be wound at multiple stages while it is passed over the flange without folding.

[0049] The present invention also provides a method for winding a continuous film using a reel member comprising a plurality of winding spools coaxially arranged at predetermined intervals, and a flange mounted at each end of each winding spool and having a guide groove cut away from each flange at a given center angle and arranged with a phase shift of the center angle, the method comprising the step of shifting the timing of axially moving the winding spools by the center angle of the guide groove.

[0050] According to the method for winding a film of the present invention, the weight can be evenly balanced and a film can be smoothly passed while it is spirally guided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0051] **FIG. 1** (*a*) is a front view showing the outline structure of a reel member according to a first embodiment of the present invention and **FIG. 1** (*b*) is a right side view showing the outline structure of the reel member.

[0052] **FIG. 2** (*a*) is a left side view showing the outline structure of a reel member according to a second embodiment of the present invention, **FIG. 2** (*b*) is a front view showing the outline structure of the reel member, **FIG. 2** (*c*) is a right side view showing the outline structure of the reel member and **FIG. 3** is a front view showing that such reel members are connected.

[0053] **FIG. 4** (*a*) is a front view showing the outline structure of a reel member according to a third embodiment of the present invention and **FIG. 4** (*b*) is a right side view showing the outline structure of the reel member.

[0054] **FIG. 5** (*a*) is a front view showing the outline structure of a reel member according to a fourth embodiment of the present invention and **FIG. 5** (*b*) is a right side view showing the outline structure of the reel member.

[0055] **FIG. 6** (*a*) is a front view showing the outline structure of a reel member according to a fifth embodiment of the present invention, **FIG. 6** (*b*) is a right side view showing the outline structure of the reel member and **FIG. 7** is a front view showing that such reel members are connected on a shaft.

[0056] **FIG. 8** (*a*) is a front view showing the outline structure of a reel member according to a sixth embodiment of the present invention, **FIG. 8** (*b*) is a plan view showing the outline structure of the reel member and **FIG. 8** (*c*) is an enlarged view of a retaining groove of the reel member.

[0057] **FIG. 9** (*a*) is a front view showing the outline structure of a reel member according to a seventh embodiment of the present invention and **FIG. 9** (b) is an enlarged view of a retaining groove of the reel member.

[0058] **FIG. 10** is a front view showing the outline structure of a reel member according to an eighth embodiment of the present invention.

[0059] **FIG. 11** (*a*) is a front view showing the outline structure of a reel member according to a ninth embodiment of the present invention and **FIG. 11** (*b*) is an enlarged view of a part of a retaining groove of the reel member.

[0060] **FIG. 12** (*a*) is a front view showing the outline structure of a reel member according to a tenth embodiment of the present invention and **FIG. 12** (*b*) shows the positional relationship between guide grooves in the flanges of the reel member.

[0061] **FIG. 13** (*a*) is a right side view of the reel member taken along S1-S1 line of **FIG. 12**(*a*), **FIG. 13** (*b*) is a right side view of the reel member taken along S2-S2 line, **FIG. 14** is a diagram for illustrating the bevel angle of the reel member, **FIG. 15** is a front view showing a film package comprising a film wound around the reel member, and **FIG. 16** shows the reel member disassembled into several components.

[0062] **FIG. 17** is a front view showing the outline structure of an example of a multistage winding system for carrying out a method for winding a film according to the present invention, **FIG. 18** is a left side view showing the outline structure of the multistage winding system.

[0063] **FIG. 19** (*a*) and **FIG. 19**(*b*) show how a film is wound around a reel member of the present invention according to a method for winding a film of the present invention.

[0064] **FIG. 20**(*a*) and **FIG. 20**(*b*) show how a film is wound around a reel member of the present invention according to a method for winding a film of the present invention.

[0065] **FIG. 21**(*a*) and **FIG. 21**(*b*) show how a film is wound around a reel member of the present invention according to a method for winding a film of the present invention.

[0066] **FIG. 22**(*a*) and **FIG. 22**(*b*) show how a film is wound around a reel member of the present invention according to a method for winding a film of the present invention.

[0067] **FIG. 23**(*a*) and **FIG. 23**(*b*) show how a film is wound around a reel member of the present invention according to a method for winding a film of the present invention.

[0068] **FIG. 24**(*a*) and **FIG. 24**(*b*) show how a film is wound around a reel member of the present invention according to a method for winding a film of the present invention.

[0069] **FIG. 25** (*a*) is a left side view showing an embodiment of a film package of the present invention and **FIG. 25** (*b*) is a front view showing the film package.

[0070] **FIG. 26** is a front view showing another embodiment of a film package of the present invention.

[0071] **FIG. 27** shows how a film is wound around another reel member of the present invention according to a method for winding a film of the present invention.

[0072] **FIG. 28** shows how a film is wound around another reel member of the present invention according to a method for winding a film of the present invention.

[0073] **FIG. 29** shows how a film is wound around another reel member of the present invention according to a method for winding a film of the present invention.

[0074] **FIG. 30** shows how a film is wound around another reel member of the present invention according to a method for winding a film of the present invention.

[0075] Various numeral references represent the following elements: **50**(A-H, K, L), reel member; **51**(A-H, K, L), flange; **52**(A-H, K, L), winding spool; **520**L, spacer spool; **53**(A-C, E, F, G, H, K, L), guide groove; **54**(A-H), guide edge; **54**L, guide edge; **56**(D), engaging projection; **57**(F, G. H, K), retaining groove; **60**(B, C, E, K), reel member assembly; **70**(A, B, C), film package.

THE MOST PREFERRED EMBODIMENTS OF THE INVENTION

[0076] Reel members of the present invention are used to wind a continuous long film at multiple stages.

[0077] Films used in the present invention are advantageously, but not limited to, insulating adhesive films or anisotropic conductive adhesive films, especially for electrically connecting electrodes of circuit boards to electrodes of IC chips.

[0078] Insulating adhesive films here comprise an insulating adhesive formed as a film on a release film. Aniso-

tropic conductive adhesive films are similar films except that the adhesive contains conductive particles.

[0079] Now, preferred embodiments of reel members capable of winding such insulating adhesive films and anisotropic conductive adhesive films (hereinafter sometimes referred to as simply "films") are explained with reference to the attached drawings.

[0080] In the films used in the following embodiments, the adhesive is removed at predetermined intervals to partially expose the release film.

[0081] **FIG. 1** (*a*) is a front view showing the outline structure of a reel member according to a first embodiment of the present invention and **FIG. 1** (*b*) is a right side view showing the outline structure of the reel member.

[0082] As shown in FIGS. **1** (*a*) and (*b*), reel member **50**A according to the present embodiment is integrally formed of e.g., a resin and comprises a winding spool **52**A and a plurality of flanges **51**A.

[0083] Flanges **51**A are formed as discs having a given outer diameter and arranged in parallel to each other at predetermined intervals on cylindrical winding spool **52**A.

[0084] The insulating adhesive film or anisotropic conductive adhesive film used here not shown comprises adhesive films of a predetermined length (e.g., 25 m) repeatedly formed at predetermined intervals on a release film depending on the film width (e.g., 1.9 mm) or film thickness (e.g., 0.1 mm) in order that adhesive cannot be squeezed out of the release film under the stress generated during winding.

[0085] Each interval between adhesive films, i.e., each exposed length of the release film, is determined within a minimum range necessary for passing the film in the direction of the winding spool in order to save the adhesive film during winding at multiple stages.

[0086] To adapt reel member **50**A according to the present embodiment to such a film, the number of flanges **51**A is determined depending on the repetition number of the adhesive films and each interval between flanges **51**A is determined to be somewhat greater than the film width. The outer diameter of flange **51**A is determined to be greater than the roll diameter depending on the length of the adhesive film in order to protect the rolled film.

[0087] As shown in **FIG. 1**(*b*), each flange **5**A has a guide groove **53**A of the same shape for passing the film to another flange **51**A adjacent thereto. Guide grooves **53**A are each cut away in an approximately sectorial shape to only partially expose the rolled film and axially aligned in opposite to guide grooves **53**A in flanges **5**A adjacent thereto.

[0088] Thus, a guide edge **54**A formed on the outer periphery of each guide groove **53**A comes into contact with the film at the same position as the other guide edges **54**A in the circumferential direction of flange **51**A.

[0089] Winding spool **52**A is formed in a length depending on the number of flanges **51** or the interval therebetween. Winding spool **52**A has an axially running through-hole **55**A of a given cross section, and the through-hole **55**A has a shape in which can be fitted e.g., a keyed shaft not shown in the present embodiment.

[0090] **FIG. 2** (*a*) is a left side view showing the outline structure of a reel member according to a second embodiment of the present invention, **FIG. 2** (*b*) is a front view showing the outline structure of the reel member and **FIG. 2** (*c*) is a right side view showing the outline structure of the reel member. **FIG. 3** is a front view showing that such reel members are connected.

[0091] As shown in **FIG. 2**(*a*) to **FIG. 2**(*c*), reel member **50**B according to the present embodiment comprises a winding spool **52**B and a flange **51**B integrally formed with each other.

[0092] In the case of the present embodiment, flange **51**B differs from flange **51**A of the first embodiment in the shape of guide groove **53**B. That is, this guide groove **53**B is formed in a shape radially extending to the vicinity of winding spool **52**B in a width greater than the film width.

[0093] Winding spool **52**B comprises a spool segment $52B_1$ having a length somewhat greater than the film width and an insert segment $52B_2$ coaxial with spool segment $52B_1$ with flange **51**B interposed therebetween, wherein insert segment $52B_2$ is in the form of a keyed cylinder while spool segment $52B_1$ has a bore having a key groove in which can be fitted insert segment $52B_2$.

[0094] Thus, a reel member **50**B is axially connected to another reel member **50**B having the same structure so that guide grooves **53**B in flanges **51**B of both members are axially aligned in opposite to each other.

[0095] Winding spool **52**B has a through-hole **55**B in the same manner as in the previous embodiment. In the present embodiment, this through-hole **55**B has a form in which can be fitted a shaft having a cross section in the form of a letter "D".

[0096] As shown in **FIG. 3**, e.g., four such reel members **50**B are connected to form a reel member assembly **60**B wherein winding spools **55**B are combined into one winding spool and flanges **51**B are arranged in parallel to each other.

[0097] **FIG. 4** (*a*) is a front view showing the outline structure of a reel member according to a third embodiment of the present invention and **FIG. 4** (*b*) is a right side view showing the outline structure of the reel member.

[0098] As shown in FIGS. **4**(*a*) and (*b*), reel member **50**C according to the present embodiment comprises a winding spool **52**C and two flanges **51**C integrally formed with each other.

[0099] In the case of the present embodiment, flanges **51**C are identical with flanges **51**B of the second embodiment and arranged in parallel to each other on winding spool **52**C.

[0100] Winding spool **52**C has the same structure as that of winding spool **52**B of the second embodiment except that it differs from the second embodiment in length because two flanges **51**B are provided.

[0101] As shown in **FIG. 3**, e.g., two such reel members **50**C are connected to form a reel member assembly **60**C in the same manner as in the second embodiment.

[0102] **FIG. 5** (*a*) is a front view showing the outline structure of a reel member according to a fourth embodiment of the present invention and **FIG. 5** (*b*) is a right side view showing the outline structure of the reel member.

[0103] As shown in FIGS. **5**(*a*) and (*b*), reel member **50**D according to the present embodiment comprises a winding spool **52**D and a flange **51**D integrally formed with each other.

[0104] In the case of the present embodiment, flange **51**D differs from flanges **51**A to **51**C of the first to third embodiments in that it has no guide groove. That is, this flange **51**D is formed by gradually increasing the radius of a part of the outer periphery of flange **51**A to **51**C of the previous embodiments into an arc having an engaging projection **56**D having a guide edge **54**D capable of coming into contact with the film at the part where the difference in radius is maximum.

[0105] Winding spool **52**D has the same structure as that of winding spool **52**B of the second embodiment.

[0106] **FIG. 6** (*a*) is a front view showing the outline structure of a reel member according to a fifth embodiment of the present invention and **FIG. 6** (*b*) is a right side view showing the outline structure of the reel member. **FIG. 7** is a front view showing that such reel members are connected on a shaft.

[0107] As shown in FIGS. **6** (*a*) and (*b*), reel member **50**E according to the present embodiment comprises a winding spool **52**E and a pair of flanges **51**E integrally formed with each other.

[0108] In the case of the present embodiment, flanges **51**E have the same structure as that of flanges **51**C of the third embodiment.

[0109] On the other hand, winding spool **52**E has a through-hole **55**E having a circular cross section with a key groove in the same manner as in the first embodiment.

[0110] As shown in **FIG. 7**, plurality of such reel members **50**E are connected on a shaft by e.g., adhesion to form a reel member assembly **60**E.

[0111] **FIG. 8**(*a*) is a front view showing the outline structure of a reel member according to a sixth embodiment of the present invention, **FIG. 8** (*b*) is a plan view showing the outline structure of the reel member and **FIG. 8** (*c*) is an enlarged view of a retaining groove of the reel member.

[0112] As shown in **FIG. 8**(*a*) to **FIG. 8**(*c*), reel member **50**F according to the present embodiment comprises a winding spool **52**F and a flange **51**F integrally formed with each other.

[0113] Flange **51**F of the present embodiment has a guide groove **53**F similar to the guide groove in flange **51**A of the first embodiment except for additional features as follows.

[0114] That is, flange **51**F has a thickness of 5 mm to 6 mm to protect the film against folding when it is passed on guide edge **54**F in guide groove **53**F and the part including this guide edge **54**F has a convex cross section so that guide edge **54**F is curved.

[0115] Flange **51**F also has a retaining groove **57**F for retaining the film to prevent slack when the film is passed to another reel member.

[0116] This retaining groove **57**F has a width somewhat smaller than the thickness of the film and extends in a direction approximately orthogonal to the radial direction of flange **51**F from the corner of guide groove **53**F on guide edge **54**F.

[0117] Winding spool **52**F has the same structure as that of winding spool **52**B of the second embodiment.

[0118] **FIG. 9** (*a*) is a front view showing the outline structure of a reel member according to a seventh embodiment of the present invention and **FIG. 9** (*b*) is an enlarged view of a retaining groove of the reel member.

[0119] As shown in FIGS. **9** (*a*) and (*b*), reel member **50**G according to the present embodiment comprises a winding spool **52**G and a flange **51**G integrally formed with each other.

[0120] Flange **51**G of the present embodiment is similar to flange **51**F of the sixth embodiment except that it has a retaining groove **57**G different from retaining groove **57**F of the sixth embodiment.

[0121] Retaining groove **57**G has a leading groove $\mathbf{57G}_1$ extending to the proximity of the center of flange **51**G from the corner of guide groove **53**G on guide edge **54**G. This retaining groove **57**G has a width greater than the thickness of the film. Leading groove **57**G, in guide groove **53**G A terminates in circular retaining hole $\mathbf{57G}_2$ having a diameter somewhat greater than the width of the film.

[0122] A projecting anchor $\mathbf{57G}_3$ is formed near retaining hole $\mathbf{57G}_2$ in leading groove $\mathbf{57G}_1$ so that the width of leading groove $\mathbf{57G}_1$ is smaller than the thickness of the film.

[0123] Winding spool **52**G has the same structure as that of winding spool **52**B of the second embodiment.

[0124] **FIG. 10** is a front view showing the outline structure of a reel member according to an eighth embodiment of the present invention.

[0125] As shown in **FIG. 10**, reel member **50**H according to the present embodiment comprises a winding spool **52**H and a flange **51**H integrally formed with each other.

[0126] In the case of the present embodiment, flange **51**H has a plurality of guide grooves **53**H. These guide grooves **53**H are formed at regular intervals on the outer periphery of flange **51**H at the same center angle to locate the center of gravity of flange **51**H itself on winding spool **52**H to keep a balance.

[0127] Retaining groove **57**H is also formed in the same shape on the same position in each guide groove **53**H. Each retaining groove **57**H has a width relatively greater than the thickness of the film and extends in one direction from a corner of guide groove **53**H and turns in a radial direction in a width somewhat smaller than the thickness of the film.

[0128] Winding spool **52**H has the same structure of winding spool **52**B of the second embodiment.

[0129] **FIG. 11** (*a*) is a front view showing the outline structure of a reel member according to a ninth embodiment of the present invention and **FIG. 11** (*b*) is an enlarged view of a part of a retaining groove of the reel member.

[0130] As shown in FIGS. **11** (*a*) and (*b*), reel member **50**K according to the present embodiment comprises a winding spool **52**K and a plurality of flanges **51**K integrally formed with each other.

[0131] In the case of the present embodiment, flanges **51**K are formed in the shape of a sector having the same center angle and arranged at regular intervals on the outer periphery of winding spool **52**K to keep a balance similarly to the previous embodiment. These flanges **51**K form guide grooves **53**K between flanges **51**K and have a guide edge **54**K on one edge of each flange **51**K.

[0132] Retaining groove **57**K comprises a first retaining groove **57**K, running from a corner of each guide groove **53**K into flange **51**K to extend into the winding direction of winding spool **52**K and further incise winding spool **52**K and a second retaining groove $\mathbf{57K_2}$ formed on the edge of another flanges **51**K opposed to guide edge **54**K.

[0133] This second retaining groove $\mathbf{57K_2}$ is formed to extend in a direction reverse to the winding direction on the same circumference having the roll diameter of the film.

[0134] Winding spool **52**K has the same structure as that of winding spool **52**B of the second embodiment except that it is partially incised by retaining groove $\mathbf{57K_1}$.

[0135] **FIG. 12** (*a*) is a front view showing the outline structure of a reel member according to a tenth embodiment of the present invention and **FIG. 12** (*b*) shows the positional relationship between guide grooves in the flanges of the reel member. **FIG. 13** (*a*) is a right side view of the reel member taken along S1-S1 line and **FIG. 13** (*b*) is a right side view of the reel member taken along S2-S2 line. **FIG. 14** is a diagram for illustrating the bevel angle of the reel member.

[0136] As shown in **FIG. 12**(*a*), reel member **50**L according to the present embodiment comprises winding spools **52**L and spacer spools **520**L and plurality of flanges **51**L integrally formed with each other. Here, a plurality of winding spools **52**L and spacer spools **520**L are alternately arranged.

[0137] The outer diameter and the length of spacer spool **520**L are determined on the basis of given conditions described below provided that they are greater than the outer diameter and the length of winding spool **52**L.

[0138] Each flange **51**L has a guide groove **53**L cut away in the form of a sector at a given center angle.

[0139] Here, the weight of reel member **50**L as a whole is evenly balanced with respect to the winding axis by selecting the center angle θ of guide groove **53**L to be 360 degrees/n ("/" means a ratio) and phase-shifting guide grooves **53**L at intervals of this center angle θ provided that n means the unit number of flanges **51**L forming reel member **50**L.

[0140] When the unit number n of flanges **51**L is **4**, for example, the center angle θ of guide groove **53**L is 90 degrees and accordingly the total number of flanges **51**L is an integral multiple of the unit number n (here **8**) as shown in FIGS. **12** (*a*), (*b*).

[0141] When flanges are successively designated as $\mathbf{51L_1(1)}$ to $\mathbf{51L_8(8)}$ from the side of the sliding direction X+ of the winding shaft, flanges $\mathbf{51L_1(1)}$, $\mathbf{51L_5(5)}$ have guide grooves $\mathbf{53L_1}$, $\mathbf{53L_5}$ (shown by hatched areas with dashed lines) in a zone of 0-90 degrees; flanges $\mathbf{51L_2(2)}$, $\mathbf{51L_6(6)}$ have guide grooves $\mathbf{53L_2}$, $\mathbf{53L_6}$ (shown by hatched areas with solid lines) in a zone of 90-180 degrees; flanges $\mathbf{51L_3(3)}$, $\mathbf{51L_7(7)}$ have guide grooves $\mathbf{53L_3}$, $\mathbf{53L_7}$ (shown by hatched areas with solid lines) in a zone of 180-270 degrees; and flanges $\mathbf{51L_4(4)}$, $\mathbf{51L_8(8)}$ have guide grooves $\mathbf{53L_4}$, $\mathbf{53L_8}$ (shown hatched areas with dashed lines) in a zone of 270-360 degrees in a rotating coordinate system (winding direction R is positive) as shown in the right side view.

[0142] By this arrangement of guide grooves, the centers of gravity of flanges **51**L themselves are as follows. For the centers of gravity of flanges **51**L, flanges $\mathbf{51L_1(1)}$, $\mathbf{51L_5(5)}$ are symmetrical to the flanges $\mathbf{51L_3(3)}$, $\mathbf{51L_7(7)}$ with respect to the winding axis and the flanges $\mathbf{51L_2(2)}$, $\mathbf{51L_6(6)}$ are symmetrical to the flanges $\mathbf{51L_4(4)}$, $\mathbf{51L_8(8)}$ with respect to the winding axis, so that the center of gravity of reel member **53**L as a whole is located on the winding axis.

[0143] Downstream guide edges $\mathbf{54L_2}$, $\mathbf{54L_4}$, $\mathbf{54L_6}$ in the winding direction R of flanges $\mathbf{51L_2(2)}$, $\mathbf{51L_4(4)}$, $\mathbf{51L_6(6)}$ on the feeding side are opposed at the same plane to upstream guide edges $\mathbf{54L_3}$, $\mathbf{54L_5}$, $\mathbf{54L_7}$ in the winding direction R of flanges $\mathbf{51L_3(3)}$, $\mathbf{51L_5(5)}$, $\mathbf{51L_7(7)}$ on the receiving side.

[0144] In the case of the present embodiment, guide edges $\mathbf{54L_2}$, $\mathbf{54L_4}$, $\mathbf{54L_6}$ on the feeding side and guide edges $\mathbf{54L_3}$, $\mathbf{54L_5}$, $\mathbf{54L_7}$ on the receiving side are further chamfered at a given angle to form bevels parallel to each other in order that the film cannot be folded when it is passed.

[0145] For example, guide edge $\mathbf{54L_2}$ of flange $\mathbf{51L_2(2)}$ has a guide bevel $\mathbf{58L_2}$ downwardly inclined from the horizontal plane including the winding axis and guide edge $\mathbf{54L_3}$ of flange $\mathbf{51L_3(3)}$ has a guide bevel $\mathbf{58L_3}$ upwardly inclined from the horizontal plane including the winding axis, as shown in FIGS. **13** (*a*), (*b*) and **FIG. 12** (*a*).

[0146] The other guide edges $\mathbf{54L_4}$, $\mathbf{54L_6}$ on the feeding side and guide edges $\mathbf{54L_5}$, $\mathbf{54L_7}$ on the receiving side are also designed in the same manner.

[0147] Referring now to **FIG. 14**, the bevel angles α of guide edges **54**L are explained.

[0148] When the film is passed from the outermost turn of the film wound around winding spool $\mathbf{52L_1}$ to the next winding spool $\mathbf{52L_2}$ via spacer spool $\mathbf{520L_1}$, such a film preferably follows a spiral curve on a specific cylindrical surface because it need be guided without folding.

[0149] In the case of the present embodiment, it will be described for the region including flanges $\mathbf{51L_1}$ to $\mathbf{51L_4}$, and winding spools $\mathbf{52L_1}$, $\mathbf{52L_2}$ and spacer spool $\mathbf{520L_1}$ between them in whole of the reel member **50**L. A virtual cylindrical surface C including lines L**2**, L**3** as the outermost generatrices and imaginarily integral with the side face of spacer spool **520**L provided that L**1** is the uppermost generatrix on a film **2** having a roll diameter D; L**2** is a line tangent to the floating part of the film **2** when it is passed from the intersection P**1** between the inner face of flange $\mathbf{51L_1}$ and L**1**; and L**3** is a line drawn from the intersection P**2** between the inner face of flange $\mathbf{51L_4}$ and the lowermost generatrix on winding spool $\mathbf{52L_2}$ in parallel with line L**2**.

[0150] Then, a trajectory of the film edge S**1** connecting the intersection P**1** with a point P**3** distant from the intersection P**2** by the film width on the line L**3** to form a spiral curve and a trajectory of the film edge S**2** connecting the intersection P**2** with a point P**4** distant from the intersection P**1** by the film width on the line L**2** to form a spiral curve are supposed on the virtual cylindrical surface C.

[0151] The bevel angle α3 of flange **51**L_3 is determined in such a manner that guide bevel **58**L_3 may be tangent with the trajectory of the film edge S**2**. The bevel angle α2 of flange **51**L_2 is the same as the bevel angle α3 of flange **51** L_3.

[0152] The bevel angles α1, α4-α8 of the other flanges **51**L_1, **51**L_4-**51**L_8 are also the same as the bevel angle α3 of flange **51**L_3.

[0153] Guide bevel **58**L_2 of flange **51**L_2 may be or may not be tangent with the trajectory of the film edge S**1** depending on the relation with the length d of spacer spool **520**L_1.

[0154] When the length d**1** of spacer spool **520**L_1 is selected in such a manner that guide bevel **58**L_2 may not be tangent with the trajectory of the film edge S**1** as in the present embodiment, the film can be advantageously gently passed because the pitch angle of the spiral curve increases with the increased virtual cylindrical surface C along with a film-guiding space defined by the length d**1** of spacer spool **520**L_1, upstream guide edge **54**L_2 of flange **51**L_2 and downstream guide edge **54**L_3 of flange **51**L_3 at an angle of 180 degrees with the upstream guide edge.

[0155] When the length d**2** (<d**1**) of spacer spool **520**L_1 is selected in such a manner that guide bevel **58**L_2 may be tangent with the trajectory of the film edge S**1** contrary to the present embodiment, the winding slack can be advantageously prevented by guiding both edges of the film simultaneously along guide bevel **58**L_3 of flange **51**L_3 and guide bevel **58**L_2 of flange **51**L_2 though the film is steeply passed because the film guiding space becomes smaller.

[0156] **FIG. 15** is a front view showing a film package comprising a film wound around a reel member according to the present embodiment.

[0157] As shown in **FIG. 15**, this film package **70**C is obtained by applying a method for winding a film described below to a reel member **50**L according to the present embodiment wherein film **2** is passed in a curve close to a spiral curve in contact with guide bevels **58**L_3, **58**L_5 and **58**L_7.

[0158] However, film **2** can be passed in a curve further closer to the trajectories of the film edge S**1**, S**2** if the end face of (unchamfered) guide edge **54**L or the side face of spacer spool **520**L at least in contact with film **2** is closer to virtual cylindrical surface C.

[0159] **FIG. 16** shows a reel member according to the present embodiment disassembled into several components.

[0160] The reel member **50**L described above is integrally formed, but reel member **50**L according to the present embodiment can also be assembled from a plurality of components.

[0161] For example, a first component **501**L comprises flange **51**L_1 and winding spool **51**L_1, a second component **502** comprises flange **51**L_8, and a third component **503**L consists of flange **51**L_2 and flange **51**L_3 together with spacer spool **520**L_1 and winding spool **52**L_2, and component **501**L and component **503**L are connectable to each other while component **503**L and component **502**L are connectable to each other, as shown in **FIG. 16**.

[0162] In such a reel member **50**L, the unit number n of flanges **51**L can be selected as any integral multiple by connecting components **501**L-**503**L with a phase shift of 90 degrees.

[0163] Guide grooves **53**L_1, **53**L_8 are formed in flanges **51**L_1(**1**), **51**L_8(**8**) in the present embodiment to evenly balance the weight, but they are basically unnecessary for passing a film.

[0164] Thus, flange **51**L without guide groove **53**L can be provided on each outer side of an array of any integral multiple of the unit number n of flanges **51**L having guide groove **53**L in order to evenly balance the weight and protect the film.

[0165] In carrying out a method for winding a film according to the present invention, a multistage winding system as shown below is used, for example. This multistage winding system is first explained with reference to the drawings.

[0166] **FIG. 17** is a front view showing the outline structure of an example of a multistage winding system for carrying out a method for winding a film according to the present embodiment. **FIG. 18** is a left side view showing the outline structure of the multistage winding system.

[0167] As shown in **FIG. 17** or **FIG. 18**, multistage winding system **1** according to the present embodiment comprises a feeding apparatus **10** and a winding apparatus **20**.

[0168] Feeding apparatus **10** is designed to apply a given load on reel member **11** around which a given film **2** has been wound while reel member **11** is rotatably supported on feeding shaft **12**.

[0169] Reel member **11** of feeding apparatus **10** has the approximately same structure as those of reel members **50** according to the first to fifth embodiments described above except that the outer diameter of flange **13** is determined to be greater than the outer diameters of flanges **51** of the previous embodiments depending on the overall length of the insulating adhesive film or anisotropic conductive adhesive film.

[0170] Winding apparatus **20** comprises a winding mechanism **30**, a moving mechanism **40** and a controller **60**.

[0171] Winding mechanism **30** comprises a winding shaft **31** parallel to feeding shaft **12** of feeding apparatus **10**.

[0172] This winding shaft **31** is designed to be fitted into the through-hole in winding spool **51** of reel member **50** according to the embodiments described above with a slight gap, thereby supporting reel member **50** in such a manner that it can be axially moved while it is fixed against circumferential movement.

[0173] At one end of such winding shaft **31** is provided a driving member **32**. This driving member **32** is designed to transmit the power of a winding motor **32***c* comprising a stepping motor to a gear **32***a* fixed to winding shaft **31** through a train of gears **32***b* to rotate winding shaft **31**.

[0174] An encoder **32***d* is fixed to the driving shaft of winding motor **32***c* and a light reflective sensor **32***e* is provided near the encoder **32***d*.

[0175] Such winding motor **32***c* and sensor **32***e* are electrically connected to controller **60**. This controller **60** is designed to count the number of pulses of winding motor **32***c* on the basis of signals from sensor **32***e* and to control the rotation of winding motor **32***c* on the basis of the number of pulses.

[0176] Moving mechanism **40** comprises a pair of driving shafts **41** having an external screw parallel to winding shaft **31** and a slide shaft **42**. At one end of driving shaft **41** is provided a driving member **43** having the same structure as that of the driving member of winding mechanism **30**. That is, this driving member **43** comprises a slide motor **43***b* rotating driving shaft **41** by transmitting power to a gear **43***a* on driving shaft **41** and a light transmissive sensor **43***d* capable of detecting an encoder **43***c* on driving shaft **41**. These slide motor **43***b* and sensor **43***d* are connected to controller **60** so that they are controlled in the same manner as winding mechanism **30**.

[0177] A moving plate **44** and a pressing plate **45** are mounted on these driving shaft **41** and slide shaft **42**. Moving plate **44** is screwed to driving shaft **41** and slidably engaged with slide shaft **42**. Pressing plate **45** is not screwed to driving shaft **41** and designed to be biased toward moving plate **44** by a coil spring not shown while it is slidably engaged with only slide shaft **42**.

[0178] Both moving plate **44** and pressing plate **45** are in the form of e.g., a ring so that they may come into contact with only the outer periphery of flange **51** of reel member **50**.

[0179] Next, a preferred embodiment of a method for winding a film according to the present invention is explained referring to examples in which some of reel members **50**A to **50**L according to the first to tenth embodiments are applied to the multistage wining system **1** described above.

[0180] **FIG. 19** to **FIG. 24** are left side views and front views showing how a film is wound around a reel member of the present invention according to a method for winding a film of the present embodiment.

[0181] **FIG. 25** (*a*) is a left side view showing a film package according to the present embodiment and **FIG. 25** (*b*) is a front view showing the film package.

[0182] As shown in **FIG. 17**, a reel member **11** around which a film **2** has been wound is first mounted on a feeding apparatus **10** and e.g., a reel member **50**A according to the first embodiment is mounted on a winding apparatus **20**, and then reel member **50**A on the winding side is positioned with respect to reel member **11** on the feeding side in such a manner that the flange **51** A on the side of moving plate **44** of winding apparatus **20** (the rightmost flange in **FIG. 17**) and the flange **13** at the right of feeding apparatus **10** (hereinafter referred to as "right flange **13***a*") are coplanar.

[0183] Then, film **2** drawn from reel member **11** on the feeding side is wound around winding spool **51**A of reel member on the winding side. Here, flanges **51**A of reel member **50**A are designated as first flange $\mathbf{51A}_1$, second flange $\mathbf{51A}_2$, third flange $\mathbf{51A}_3$ and fourth flange $\mathbf{51L}_4$ successively from the right side and winding spools **52**A of reel member **50**A are designated as first winding spool **52**A, between first and second flanges $\mathbf{51A}_1$, $\mathbf{51A}_2$, second winding spool $\mathbf{52A}_2$ between second and third flanges $\mathbf{51A}_2$, $\mathbf{51A}_3$ and third winding spool $\mathbf{52A}_3$ between third and fourth flanges $\mathbf{51A}_3$, $\mathbf{51A}_4$ as shown in **FIG. 1** (*a*) for convenience of explanation.

[0184] Under a command from controller **60** described above, winding motor **32**C is activated to start the rotation of winding shaft **31** and also start to count the number of pulses of winding motor **32**C.

[0185] Thus, reel member **50**A winds film **2** tensioned under a load from feeding apparatus **10** onto first winding spool $\mathbf{52A}_1$ (see FIGS. **19** (*a*), (*b*)).

[0186] Controller **60** stops the operation of winding motor **32***c* when it judges from the count of the number of pulses of winding motor **32***c* that the entry **2***b* of release film **2***a* at the point that the release film on the feeding side in contact with rolled film **2** on the winding side is on the point of entering into guide groove **53**A of second flange $\mathbf{51A}_2$ after first winding spool $\mathbf{52A}_1$ of reel member **50**A has finished winding adhesive film **2** and started to wind release film **2***a*, as shown in FIGS. **20** (*a*), (*b*).

[0187] Under a command from controller **60**, slide motor **43***b* is operated for a time corresponding to a given number of pulses to rotate driving shaft **41**. Thus, reel member **50**A moves until second flange $\mathbf{51A}_2$ reaches a distance over the position of right flange **13***a* on the feeding side along winding shaft **31**, as shown in FIGS. **21** (*a*), (*b*). In this case, release film **2***a* on the feeding side is twisted against rolled film **2** on the winding side so that release film **2***a* runs off from guide groove **53**A of second flange $\mathbf{51A}_2$ to approach third flange $\mathbf{51A}_3$.

[0188] When reel member **50**A is rotated again in this state, second flange $\mathbf{51A}_2$ catches release film **2***a* at guide edge **54**A, as shown in FIGS. **22** (*a*), (*b*).

[0189] As reel member **50**A rotates, it then winds release film **2***a* around second winding spool $\mathbf{52A}_2$ while it is caught by second flange $\mathbf{51A}_2$ and after a while, feeding of release film **2***a* is finished and the next adhesive film **2** is sent and wound, as shown in FIGS. **23** (*a*), (*b*).

[0190] Under a command from controller **60**, slide motor **43***b* is also operated to return reel member **50**A until second flange $\mathbf{51A}_2$ becomes coplanar with right flange **13***a* on the feeding side.

[0191] Thus, reel member **50**A winds film **2** from the feeding side in parallel to second winding spool $\mathbf{52A}_2$, as shown in FIGS. **24** (*a*), (*b*).

[0192] Then, the winding operation as described above is also applied to third winding spool $\mathbf{52A}_3$ of reel member **50**A.

[0193] Thus, a film package **70**A is obtained in which film **2** is wound around each winding spool **52**A with exposed parts of release film **2***a* of film **2** being passed from flanges **51**A to winding spools **52**A as shown in FIGS. **25** (*a*), (*b*) by applying the method for winding a film according to the present embodiment to reel member **50**A.

[0194] **FIG. 27** to **FIG. 30** show how a film is wound around another reel member of the present invention according to the method for winding a film according to the present embodiment.

[0195] This method uses a reel member assembly comprising a plurality of reel members **50**K according to the ninth embodiment described above (hereinafter simply referred to as "reel member **50**K").

[0196] The present embodiment is described below essentially about the effect resulting from the difference in shape

between reel member **50**K and reel member **50**A, though the winding method itself is similar to the winding method using reel member **50**A according to the first embodiment described above.

[**0197**] **FIG. 27**, **FIG. 29** and **FIG. 30** correspond to **FIG. 22** (*a*), **FIG. 23** (*a*) and **FIG. 24** (*a*), respectively.

[**0198**] In the present embodiment, reel member **50**K itself is slid and then rotated when film **2** is on the point of entering into first guide groove **53**K after film **2** has been wound around one of winding spool **52**K, as shown in **FIG. 27**. Thus, film **2** comes into contact with guide edge **54**K while straddling flange **51**K.

[**0199**] As reel member **50**K is further rotated, film **2** moves into the direction in which the contact point **2***c* with guide edge **54**K toward first retaining groove **57**K_1 while unrolled part **2***d* of film **2** moves toward second retaining groove **57**K_2, as shown in **FIG. 28**.

[**0200**] Then, film **2** is caught across the edges of two flanges **51**K while it touches the bottom of second retaining groove **57**K_2 and sinks in first retaining groove **57**K_1, as shown in **FIG. 29**.

[**0201**] Then, film **2** is wound around the next winding spool **52**K while it is tensioned between first and second retaining grooves **57**K_1, **57**K_2, as shown in **FIG. 30**.

[**0202**] Other embodiments of methods for winding a film according to the present invention are explained below.

[**0203**] For example, at least one empty winding spool **52** can be interposed between a winding spool **52** around which a film **2** has been wound and the next winding spool **52** around which film **2** is to be wound, i.e., the film **2** can be wound with an interval of one winding spool **52** according to the present invention, in order to protect the film from folding when it is passed over any of the reel members **50**A-**50**L according to the first to tenth embodiments.

[**0204**] According to such an arrangement, the film **2** can be passed between a flange **51** for drawing out the film **2** from a winding spool **52** around which the film **2** has been wound and a flange **51** for winding the film **2** around the next winding spool **52** at a gentler angle as compared with the case when the film **2** is wound around all winding spools **52**.

[**0205**] However, this method is preferably applied to reel member **50**F according to the sixth embodiment described above.

[**0206**] In this case, film **2** is passed against the curved surface in guide groove **53**F of flange **51** and wound around the next winding spool **52**F after it is sunk in retaining groove **57**F in guide groove **53**F of another flange **51**F next but one winding spool **52**F.

[**0207**] Thus, a film package **70**B is obtained in which film **2** is passed at a gentler angle as shown in **FIG. 26** by applying the method for winding a film called skipping method described above to reel member assembly formed of a plurality of reel members **50**F connected to each other.

[**0208**] According to another embodiment of a method for winding a film, a film can be wound with a reel member having a spacer for passing the film between winding spools on the feeding side and receiving side in order to smoothly pass the film without folding.

[**0209**] In this case, reel member **50**L according to the tenth embodiment shown in **FIG. 12** (*a*) is preferably used, for example, in order to evenly balance the weight.

[**0210**] When this reel member **50**L is used, it is necessary to shift the timing of passing the film, i.e., the timing of sliding each winding spool **52**L by 90 degrees.

[**0211**] According to another embodiment of a method for winding a film wherein reel member **50**A according to the first embodiment shown in **FIG. 1** is applied to the multistage winding system **1** described above, the rotation of reel member **50**A can be stopped when entry **2***b* of release film **2***a* on the feeding side approaches guide edge **54**A of second flange **51**A_2 at the stage when adhesive film **2** has been wound around first winding spool **52**A_1. Following treatments are similar to the above-described method of winding.

[**0212**] In this case, release film **2***a* is caught at guide edge **54**A of second flange **51**A_2 while reel member **50**A is axially moved after the rotation of reel member **50**A is stopped.

[**0213**] In the case where any one of reel members **50**B, **50**C or **50**E according to the second, third or fifth embodiment shown in **FIG. 3**, FIGS. **4** (*a*), (*b*) or FIGS. **6** (*a*), (*b*) is applied to the multistage winding system **1** described above, the shape and size of each guide groove **53**B, **53**C, **53**E are different as compared with the case where reel member **50**A according to the first embodiment is applied.

[**0214**] Therefore, the timing of stopping the rotation of reel member **50** must be changed when reel members **50**B, **50**C, **50**E according to these second, third and fifth embodiments are used.

[**0215**] However, the other operations are similar to those of the first embodiment, e.g., release film **2***a* is transferred through guide groove **53** in second flange **51** to second winding spool **52** and then wound around it by catching it at its guide edge **54** or release film **2***a* is transferred to second winding spool **52** by catching it at guide edge **54** of second flange **51** and then wound around it at the stage when adhesive film **2** has been wound up around first winding spool **52**.

[**0216**] When reel member **50**D according to the fourth embodiment shown in FIGS. **5** (*a*), (*b*) is applied to the multistage winding system **1** described above, the range of the timing of stopping the rotation of reel member **50**D can be wider as compared with the previous embodiments because release film **2***a* can be caught at guide edge **54**D of engaging projection **56**D after it is slid on the outer periphery of each flange **51**D as it rotates.

[**0217**] The present embodiment is similar to the previous embodiments in that release film **2***a* is passed at the periphery of engaging projection **56**D of each flange **51**D and caught at guide edge **54**D.

[**0218**] According to still another embodiment of a method for winding a film, reel member **50** can be continued to rotate during axial movement of reel member **50** more slowly than during winding.

[**0219**] In this case, the rotation speed of reel member **50** is determined consideration that release film is passed through guide groove **53** in each flange **51** or release film **2***a* is caught at guide edge **54** of each flange.

[0220] According to still another embodiment of a method for winding a film using any of reel member **50**G, **50**H according to the seventh or eighth embodiment shown in **FIG. 9** or **10**, a film has been wound around one winding spool **52** and then can be retained near the winding spool **52** by dropping it in retaining groove **57** along guide edge **54** of flange **51**.

[0221] According to the seventh embodiment, the film is wound around winding spool **52**G while it is in contact with the edge of retaining hole **57**G_2 under tension with the position being changed in retaining hole **57**G_2 because it is blocked by anchor **57**G_3 and thereby restrained from movement in retaining hole **57**G_2 as reel member **50**G rotates.

[0222] According to the eighth embodiment, the film is fixed at the bottom of retaining groove **57**H and by interposing between the inner walls of retaining groove **57**H and wound around winding spool **52**H while it is tensioned from this fixed part as reel member **50**H rotates.

[0223] In the present invention, retaining grooves **57**G, **57**H in these reel members **50**G, **50**H as well as retaining grooves **57**F, **57**K in the previous reel members **50**F, **50**K can be used not only to automatically retain the film to flange **51** when it is wound at multiple stages but also these retaining grooves **57** can be used to retain the film to flange **51** when the film is manually passed though only the step of winding that the film is automatically performed.

[0224] When the film is manually passed, however, retaining groove **57** alone suffices without guide groove **53** because guide groove **53** in flange **51** is not required to perform the original function of automatically passing the film but merely required as a working hole for affixing the head of a film to winding spool **52** or inserting the film into retaining groove **57**.

[0225] In the present invention, therefore, retaining groove **57** is included in the concept of guide groove **53** so far as they are broadly common in passing the film over flange **51**. For example, reel members **50**F, **50**G, **50**H may not be provided with guide groove **53** but retaining groove **57** alone as "guide groove" and reel member **50**K may be provided with retaining groove **57** including the shape of guide groove **53** as "guide groove".

[0226] According to the embodiment described above, a long film can be wound at multiple stages within such a diameter that adhesive cannot be squeezed out of the film because the adhesive film is wound around winding spool **52** of reel member **50** and then the rotation of reel member **50** is stopped (or slowed), after which reel member **50** is axially moved, whereby winding of the film around the next winding spool **52** can be smoothly started, after as described above.

[0227] A long film can be more effectively wound at multiple stages by using reel members **50** shown in the first to tenth embodiments when the present embodiment of film winding method is carried out.

[0228] According to the first to third and fifth to tenth embodiments wherein each flange **51** has guide groove **53**, a film is passed through guide groove **53** at the stage when the film has been wound up around a one of winding spool **52** so that the film can be smoothly moved to the next winding spool **52**.

[0229] Especially, a film can be wound around the next winding spool **52** without slack by catching the film at the edge (guide edge) of guide groove **53** according to the first to third and fifth embodiments or by catching the film while it is retained in retaining groove **57** according to the sixth to ninth embodiments.

[0230] Guide groove **53** in flange **51** also has the advantage that a film can be wound without running off the outer periphery of each flange **51** or the length of film (release film) to be passed from one winding spool **52** to the next winding spool **52** can be reduced by extending guide groove **53** to the vicinity of winding spool **52** as in the second, third, fifth and ninth embodiments or extending the retaining groove to the vicinity of the winding spool as in the seventh and eighth embodiments.

[0231] The fourth embodiment having projection **56** on each flange **51** has the advantage that not only a film can be smoothly moved from one winding spool **52** to the next winding spool or caught at projection **56** but also the range of the timing of performing this can be wider.

[0232] According to the second to ninth embodiments wherein reel members **50** are axially connectable to each other, a long film can be handled as appropriate by adjusting the number of reel members **50** depending on the length of the film.

[0233] According to the first to ninth embodiments wherein each guide groove **53** or each projection **56** is provided at the same position on the periphery of flange **51**, the film can be axially moved or caught at the same timing between flanges **51**.

[0234] According to the sixth embodiment wherein flange **51** has a certain thickness and guide groove **53** has a curved inner surface along which the film is passed, the film can be prevented from folding when it is passed.

[0235] Especially when a film winding method called skipping method is applied to such a reel member **50**, the film can be more effectively prevented from folding.

[0236] According to the sixth to ninth embodiments wherein retaining groove **57** is formed on guide edge **54** of guide groove **53** to automatically retain the film at flange **51**, the film can be prevented from slacking when it is passed.

[0237] Especially according to the ninth embodiment wherein not only the film to be wound around winding spool **52** but also the outer part of the already wound film can be retained, the film can be more effectively prevented from slacking.

[0238] The sixth to ninth embodiments are advantageously suitable for winding a thin film because a minimum necessary tension can be applied to the film once the film is retained in retaining groove **57** though even the first to fifth embodiments can prevent slacking of a film by winding the film around winding spool **52** while it is caught at a corner or the bottom of guide groove **53** provided that a certain amount of tension must be continuously applied to the film so that the film cannot be moved from the part of guide groove **53** at which it is caught.

[0239] According to the eighth and ninth embodiments wherein the center of gravity of flange **51** itself is located on winding spool **52**, the film can be evenly wound under a

necessary minimum tension because reel member **50** having such a flange **51** in its structure can be rotated at a constant moment of rotations.

[**0240**] The film package **70** comprising such a reel member **50** around which a film has been wound can be delivered in various forms because it is stable with the center of gravity as a whole being located on winding spool **52**.

[**0241**] According to the tenth embodiment, a long film can be wound always at a constant moment of rotations by evenly balancing the weight of reel member **50**L and the long film can be wound without folding by spirally guiding and smoothly passing it, with the result that a film package **70**C containing a film without creases (without waste) can be provided to clients.

[**0242**] Especially in this embodiment, the length of the film that can be wound at multiple stages can be further increased while maintaining an even weight balance by increasing the number of winding spools **52**L and flanges **51**L per a unit number n determined in terms of the weight balance.

[**0243**] When a film of 50 m is wound around a winding spool **52**L, for example, the length of the film that can be wound with reel member **50**L is a unit number n (=4) multiplied by an integer N, i.e., 200×N meters ("×" means multiplication).

ADVANTAGES OF THE INVENTION

[**0244**] It is apparent from the foregoing description that the present invention is adaptable for winding a long adhesive film at multiple stages in such a diameter that adhesive cannot be squeezed out and a reel member that can be applied to this method can be obtained.

1. A reel member comprising:

a winding spool around which a given film can be wound, and

a plurality of flanges mounted on the winding spool,

wherein each of the flanges has a guide groove for passing the film between winding spools adjacent to each other.

2. The reel member of claim 1 wherein an engaging part capable of engaging with a film is formed in the guide groove.

3. The reel member of claim 1 wherein a retaining part capable of retaining a film is formed in the guide groove.

4. The reel member of claim 1 wherein the guide grooves are opposed to each other.

5. The reel member of claim 1 wherein the outer diameter of the flange is determined on the basis of the value of the stress generated in the film wound around the winding spool.

6. The reel member of claim 1 wherein the winding spools are axially connectable to each other.

7. A reel member comprising:

a winding spool around which a given film can be wound, and

a plurality of flanges mounted on the winding spool and each flange having an engaging projection capable of engaging with the film on the outer periphery.

8. The reel member of claim 7 wherein the engaging projections are opposed to each other.

9. A reel member comprising:

a winding spool around which a given film can be wound, and

a flange mounted on the winding spool and having an engaging projection capable of engaging with the film on the outer periphery,

wherein the winding spools are axially connectable to each other.

10. A reel member comprising:

a winding spool around which a given film can be wound, and

a flange mounted on the winding spool and having a guide groove for passing the film,

wherein the winding spools are axially connectable to each other.

11. The reel member of claim 10 wherein an engaging part capable of engaging with the film is formed in the guide groove.

12. The reel member of claim 10 wherein a retaining part capable of retaining the film is formed in the guide groove.

13. A reel member assembly formed of a plurality of reel members connected to each other, each reel member comprising a winding spool around which a given film can be wound, and a flange mounted on the winding spool and having a guide groove for passing the film, wherein the winding spools are axially connectable to each other.

14. A film package comprising a reel member assembly formed of a plurality of reel members connected to each other, each reel member comprising a winding spool around which a given film can be wound, and a flange mounted on the winding spool and having a guide groove for passing the film, wherein the winding spools are axially connectable to each other and wherein a continuous film is wound around the winding spool of the reel member assembly.

15. The film package of claim 14 wherein an empty winding spool is interposed between the winding spools around which the film is wound.

16. The film package of claim 14 wherein the film is an insulating adhesive film.

17. The film package of claim 14 wherein the film is an anisotropic conductive adhesive film.

18. A reel member comprising:

a plurality of winding spools coaxially arranged at predetermined intervals, and

a flange mounted at each end of each winding spool,

wherein a guide groove is cut away from each flange at a given center angle and the guide grooves are arranged with a phase shift of the center angle.

19. The reel member of claim 18 wherein a spacer spool for guiding the film is inserted between the winding spools.

20. The reel member of claim 18 wherein the opposed guide edges in the guide grooves adjacent to each other are chamfered at a given angle.

21. A film package comprising a reel member comprising:

a plurality of winding spools coaxially arranged at predetermined intervals, and

a flange mounted at each end of each winding spool and having a guide groove cut away from each flange at a

given center angle and the guide grooves are arranged with a phase shift of the center angle,

wherein a continuous film is wound around the reel member.

22. The film package of claim 21 wherein the film is an insulating adhesive film.

23. The film package of claim 21 wherein the film is an anisotropic conductive adhesive film.

24. The film package of claim 21 wherein the film comprises an adhesive applied on a release film and the release film is exposed at a necessary part for passing the film from one to the other side of the flange.

25. A method for winding a continuous film drawn out from a feeding side onto a winding shaft at multiple stages, comprising the steps of:

winding a given part of the film onto a part of the winding shaft by rotating the winding shaft at a given speed, and then

winding the given part of the film onto another part of the winding shaft by stopping or slowing the rotation of the winding shaft and axially moving the winding shaft relative to the feeding side.

26. A method for winding a continuous film drawn out from a feeding side onto a winding shaft at each part of the winding shaft divided by flanges, comprising the steps of:

winding a given part of the film onto a part of the winding shaft by rotating the winding shaft at a given speed, and then

winding the given part of the film on another part of the winding shaft after passing the film over at least one of the flanges by stopping or slowing the rotation of the winding shaft and axially moving the winding shaft relative to the feeding side.

27. A method for winding a continuous film using a reel member comprising a winding spool and a plurality of flanges mounted on the winding spool and having a guide groove for passing the film between winding spools adjacent to each other, comprising the step of winding the film on a winding spool and then the next winding spool with at least one empty winding spool being interposed.

28. A method for winding a continuous film using a reel member comprising a plurality of winding spools coaxially arranged at predetermined intervals, and a flange mounted at each end of each winding spool and having a guide groove cut away from each flange at a given center angle and arranged with a phase shift of the center angle, the method comprising the step of shifting the timing of axially moving the winding spools by the center angle of the guide groove.

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