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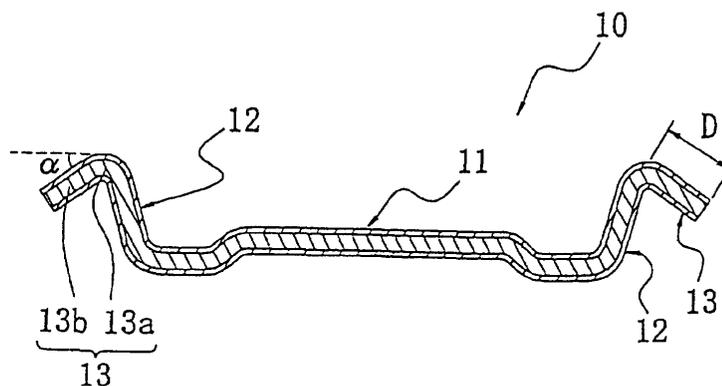
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(54) **PACKAGING CONTAINER, PACKAGING BODY INCLUDING THE SAME, AND PACKAGING METHOD**

(57) A tray which is capable of providing a sufficient bond strength in an operation for thermobonding the tray and a stretch film by an inclined heat roller. A tray (10) comprises a bottom surface (11), a wall surface (12), and a flange (13). The bottom surface (11) is a surface for placing an object to be packaged. The wall surface (12) extends upward from the bottom surface (11) to surround the latter. The flange (13) extends outward from

the upper end of the wall surface (12). Further, the flange (13) has a curved portion (13a) on the wall surface side and an inclined portion (13b) positioned outwardly of the curved portion (13a). And the inclined portion (13b) has a substantially linear cross section in its upper surface. Further, the curved portion (13a) is formed such that the wall surface (12) and the inclined portion (13b) form a continuous shape.

Fig. 2



Description

(Technical Field)

5 **[0001]** The present invention relates to a packaging container, a packaging body including the same, and a packaging method. More particularly, the present invention relates to a packaging container for packaging an article to be packaged by bonding a film to a flange, a packaging body including the same, and a packaging method.

(Background)

10 **[0002]** The practice of using a film to package an article contained in a packaging container has been used for some time. Widely practiced methods include the "overlap method," in which an article to be packaged is placed inside a container and the entire container is covered with a film, and the "mold fixed seal method," in which the packaging container is fixed in a mold and a film is put over the upper surface of the container and thermally welded.

15 **[0003]** However, both of the aforementioned methods have problems.

[0004] In the overlap method, the entire packaging container is covered in a film and the film is overlapped and thermally welded to itself at the bottom of the container. Consequently, the interface between the container body and the film is merely a state of physical contact and, if the contents are liquid, there is the risk that the liquid will leak if the container is tilted. In short, the overlap method provides inferior sealing performance. Additionally, since the entire container is covered, large amounts of film are used because the film must be several times larger than the planar size of the container; this is disadvantageous from the standpoint of trash disposal and reducing the consumption of resources.

[0005] Meanwhile, the mold fixed seal method requires a thermo-compression bonding mold for each container. Since this method lacks flexibility to accommodate different sizes and shapes of container, it is seldom used in industries requiring many types of packaging container.

25 **[0006]** Therefore, in Japanese Patent Application H11-137025, the present applicant proposed a method in which a film covering the upper surface of a packaging container (tray) is touched with a heated roller in a slanted state and the roller is rolled over the flange of the packaging container. With this method, a mold is not needed for each container and, furthermore, thermal bonding of the film with the packaging container and thermal cutting can be accomplished simultaneously using a heated roller slanted at a prescribed angle. Consequently, the method can accommodate a wide variety of container shapes and containers with excellent sealing performance can be obtained.

30 **[0007]** Existing containers, however, are shaped such that the flange is in a horizontal plane or such that the flange is curled. Therefore, even if the heat roller is touched against the flange at the proper angle, there are times when the two make linear contact and sufficient bonding strength cannot be obtained. Furthermore, a linear seal has the disadvantage of poor sealing performance, particularly with respect to liquids. There is also the danger of developing pinholes.

(Presentation of the Invention)

40 **[0008]** The object of the present invention is to provide a packaging container, a packaging body including the same, and a packaging method, in which sufficient bonding strength can be obtained when a packaging container and a film are thermally bonded using a heat roller slanted at a prescribed angle.

[0009] The packaging container of claim 1 is provided with a bottom panel, a wall panel, and a flange. The bottom panel is a panel for placing an article to be packaged. The wall panel extends upward from the bottom panel in such a manner that it surrounds the bottom panel. The flange extends outward from the upper end part of the wall panel. The flange has a curved part on its wall panel side and a slanted part positioned to the outside of the curved part. The cross section of the upper surface of the slanted part is substantially a straight line and the curved part is formed such that the wall panel and the slanted part have an uninterrupted shape.

50 **[0010]** The flange on a conventional packaging container has a planar shape oriented in a horizontal plane or a curled curve shape, and linear contact results when the heated roller (hot body) is made to contact the flange in a slanted condition. Therefore, the packaging container and the film covering the upper surface of the packaging container are bonded together in a linear seal-like state. Consequently, the film is easily ripped or peeled due to the transport and physical shock of the distribution process and it is highly possible that the stored article will be exposed. Also, leakage will occur if the packaged article is a liquid. Since the bonding is linear, the line-scaled bond section sometimes develops pinholes and the like due to friction when the hot body moves, resulting in the loss of sealing performance.

55 **[0011]** Therefore, the packaging container of this claim has a flange provided with a slant that is roughly aligned with the angle at which the hot body makes contact. Also, since the upper surface of the slanted part of the flange is a straight line (the cross section of the upper surface is a straight line), the seal formed between the packaging container

and the film when the slanted hot body touches the flange is a planar seal rather than a linear seal and a stronger bond with improved sealing performance is obtained. It is acceptable if the straight line of the slanted part of the flange mentioned here is substantially straight. That is, it is acceptable if there is a slight curve because the pressure resulting when the hot body is pressed against the flange will cause the contact surface of the flange to become a straight line, making a planar bond possible.

[0012] There are cases where the slant angle of the straight-line slanted part of the flange is parallel with the slant angle of the hot body from the beginning and there are cases where the pressure of the hot body being pressed against the flange during sealing causes the slant angle to become roughly equal to that of the hot body. In either case, the contact is planar and a planar seal results. In the latter case, since the slant angle is aligned by pressing the hot body against the flange, a seal pressure gradient runs from the inside of the flange to the outside of the flange. Consequently the pressure is stronger toward the outside edge of the flange and this pressure creates a condition in which it is easier for the film to be cut (thermally cut). It is therefore preferred that the slant angle of the hot body and the straight-line slanted part of the flange be aligned by the pressing of the hot body, as in the latter case.

[0013] If a conventional packaging container is used and sealing is performed with a slanted heat roller, a phenomenon occurs wherein the film does not make close contact (does not make completely close contact) with the packaging container at the portion of the flange positioned to the inside of the seal portion. In short, a layer of air forms between the film and the flange of the packaging container during sealing.

[0014] This air layer insulates the heat provided by the hot body during sealing and the heat from the hot body is concentrated on the film, thus applying a large thermal stress. With the thermal resistance of the films normally used in packaging, this phenomenon causes pinholes to develop.

[0015] To prevent this occurrence of pinholes, it is necessary to make the film touch closely against the packaging container even at portions that will come into close proximity of the hot body - if not in contact with the hot body - so that the heat from the hot body is not concentrated on the film.

[0016] In view of this necessity, the packaging container of this claim has a curved part formed on the inside of the slanted part (seal portion) of the flange so that the film makes close contact with the curved part. The heat from the hot body thermally bonds the film to the slanted part and also is conducted through the curved part of the flange and radiated away. As a result, the pinholes that occur with conventional packaging containers are held in check and packaging with good sealing performance can be accomplished.

[0017] The film is put into close contact with the flange of the packaging container and, in order to maintain the close contact, the film is pulled by the apparatus and held in a state of tension. It is also better if the surfaces of the slanted part and curved part of the flange of the packaging container have enough contact surface area for the film to bond sufficiently thereto. That is, it is better to have planar contact and not point contact (in order to secure a sufficient static coefficient of friction) and it is better if the surface is smooth. In general, if the surface has a luster, sufficient close contact can be achieved between the film and the packaging container. As mentioned earlier, putting the film in close contact with the flange is necessary in order to prevent the heat of the hot body from concentrating on the film during sealing and causing pinholes and the like. Regarding the appearance of the packaging container after packaging, having some tension in the film improves the appearance and increases the transparency and visibility of the film when the contents are viewed through the film from the outside after the contents have been inserted and packaged. It is also preferable to apply tension to the film and contrive to improve the appearance from the standpoint of improving the consumer's desire to purchase. Therefore, since the present invention holds the film in a state of tension and simultaneously seals with a hot body, it is best if the flange surface is smooth in order to prevent the tension from acting directly on the seal part immediately after sealing and also in order to reduce the center-directed film tension caused by frictional forces at the surface of the flange so that the risk of bad sealing occurring because of film tension immediately after sealing can be reduced as much as possible.

[0018] The packaging container of claim 2 is a packaging container as recited in claim 1, wherein the slanted part is at a slant angle in the range from 20 to 60 degrees with respect to the bottom panel.

[0019] The packaging container of claim 3 is a packaging container as recited in claim 1 or claim 2, wherein the width of the slanted part is 2 mm or greater.

[0020] Based on test results, it was found that high bonding strength and high sealing performance were obtained when the width of the slanted part where the film is thermally bonded was 2 mm or greater.

[0021] The packaging container of claim 4 is a packaging container as recited in any one of claims 1 to 3, wherein a bonding agent is applied to the surface of the flange.

[0022] The packaging body of claim 5 is equipped with a packaging container as recited in any one of claims 1 to 4 and a film. The film covers the upper surface of the packaging container and its periphery is bonded to the flange.

[0023] The packaging body of claim 6 is a packaging body as recited in claim 5, wherein the periphery of the film follows the curved part of the flange without any air gaps and is bonded to the slanted part of the flange.

[0024] The packaging body of claim 7 is a packaging body as recited in claim 5 or 6, wherein the flange further has a protruding part. The protruding part is positioned on the outer perimeter of the slanted part and aids in the thermal

cutting of the film.

[0025] The packaging body of claim 8 is a packaging body as recited in any one of claims 5 to 7, wherein the film is thermally bonded to the flange by pressing a slanted hot body against the slanted part while the periphery of the film is in close contact with the curved part and the slanted part.

5 **[0026]** The packaging method of claim 9 is provided with a first step, a second step, a third step, and a fourth step. In the first step, an article to be packaged is placed in a packaging container having a slanted flange at its periphery. In the second step, a film is supplied above the packaging container and tension is applied to the film. In the third step, the packaging container is raised and the flange is made to touch against the tensioned film. In the fourth step, a hot
10 body is pressed against the flange (against which the film is touching) at a slant angle larger than the slant angle of the flange.

[0027] Here, the hot body presses against the slanted flange of the packaging container at a slant angle that is larger than the slant angle of the flange. Since a typical packaging container is elastic, the pressure of the hot body causes the flange to deform so as to align with the hot body and, when the hot body touches the flange, a planar seal - not a linear seal - is formed between the packaging container and the film. As a result, a strong bond with a high sealing
15 performance is obtained.

[0028] The deformation of the flange when the hot body is pressed there-against causes the pressure applied to the outer edge section of the seal portion to be stronger than that applied to other portions. More specifically, in the case of a packaging container, such as a plastic tray that is highly elastic, the difference in pressure between the inside and outside of the seal portion will be large. Consequently, the heat of the hot body and the tension in the film make it
20 possible for the film to be thermally cut easily at the outside edge section of the seal portion. For example, it is possible to thermally cut the film automatically if, at the completion of sealing, tension is applied between the seal portion of the film and the portion to the outside thereof.

[0029] The thermal cutting performance will decline if the difference between the slant angle of the flange and the slant angle of the hot body is too small, and it is difficult to obtain a planar seal if the same difference is too large. Therefore, it is preferable to set this difference to a value that is appropriate for both the cutting performance and
25 achieving a planar seal.

[0030] In the packaging method of claim 9, there is almost no bonding of the film at the apex of the flange; rather, a planar seal is obtained at the slanted portion of the flange only. The reason is that the hot body is pressed against the slanted flange of the packaging container at a slant angle that is larger than the slant angle of the flange. If the film
30 were bonded to the apex of the flange, the film would be in a softened state and in tension at the apex bonding point when the hot body was released and the flange returned to its original shape. As a result the film would be thermally cut or become crinkled, degrading the product value of the packaged article. With this method, however, the occurrence of such trouble is suppressed because there is almost no bonding of the film at the apex of the flange.

[0031] The packaging method of claim 10 is a packaging method as recited in claim 9, wherein in step 4 the hot body is pressed against the flange such that the width of the portion where the flange and the hot body contact each other
35 is 2 mm or greater.

(Brief Description of the Drawings)

40 **[0032]**

FIG. 1 is a cross sectional view of the tray raw material in the first embodiment.

FIG. 2 is a cross sectional view of the tray in the first embodiment.

FIG. 3 is a schematic view of the packaging apparatus in the first embodiment.

45 FIG. 4 is a view for explaining the packaging operation of the first embodiment.

FIG. 5 is a view for explaining the packaging operation of the first embodiment.

FIG. 6 is a plan view of the tray, stretch film, and heat rollers in the first embodiment before packaging.

FIG. 7 is a plan view showing the seal operation of the heat rollers in the first embodiment.

FIG. 8 illustrates the close contact of the stretch film Fm with respect to the flange 13 in the first embodiment before
50 scaling.

FIG. 9 illustrates the condition of the heat roller, tray, and stretch film in the first embodiment during sealing and thermal cutting.

FIG. 10 illustrates the condition of the stretch film during the sealing operation for a conventional tray and for a tray in accordance with the first embodiment.

55 FIG. 11 illustrates the condition of the heat roller, tray, and stretch film of the third embodiment during sealing and thermal cutting.

FIG. 12 illustrates the condition of the heat roller, tray, and stretch film of the fourth embodiment during sealing and thermal cutting.

(Best Modes for Working the Invention)

[Embodiment 1]

5 <Raw Material of Tray>

[0033] FIG. 1 shows a cross sectional view of the raw material of the tray (packaging container) that embodies the present invention. This raw material is a plastic sheet. This plastic sheet 90 is formed into a tray by pressure and vacuum forming.

10 **[0034]** The plastic sheet 90 shown in FIG. 1 comprises thermally meltable plastic material layers 91, 93 joined to a foamed plastic material layer 92.

[0035] Thermally meltable plastic material layer 91, which serves as the upper surface of the tray, is thermally bonded to a stretch film by a hot body (heat roller 3, discussed later) and must be made of a material that can be thermally bonded to the stretch film. Here, the stretch film has a three-layer structure comprising ethylene vinyl acetate copolymer, polypropylene "Catalloy (Montell Polyolefins)", and ethylene vinyl acetate copolymer, respectively. Therefore, a material having similar qualities to that of the stretch film is used for the thermally meltable plastic material layer 91. More specifically, ethylene vinyl acetate copolymer, polypropylene, or polyethylene is used as the thermally meltable plastic material layer.

[0036] Polystyrene, polypropylene, or other foamed body is used for the foamed plastic material layer 92.

20 **[0037]** For plastic material layer 93, which serves as the outer surface of the tray, a material having roughly the same heat shrinkage rate as plastic material layer 91 is used. Thus, deformation of the tray after forming is suppressed because the raw material is a material with plastic material layers 91, 93 having similar shrinkage rates joined to both surfaces.

[0038] When it is important that the raw materials of the stretch film and tray serve as a gas barrier, it is good to use a multiple layer structure that includes at least one layer of a film made of ethylene vinyl alcohol copolymer, polyvinyl alcohol, or the like. When it is important for the raw materials to be aroma proof, it is good to use a multiple layer structure that includes at least one layer of a film made of a polyester (polyethylene terephthalate, polyethylene naphthalate, or the like). Materials and the thickness thereof should be selected based on the gas for which the material is to serve as a barrier. It is also possible to add a gas barrier property by depositing aluminum or a ceramic by vapor deposition. Aluminum foil, iron foil, or other metal can also be used as a barrier layer; in the case of the tray, such a layer can be used for a layer other than the innermost layer, which is the bonding layer. However, if a metal barrier layer is used in a stretch film, the transparency will be hindered and there will be situations where the film is difficult to use.

35 <Shape of the Tray>

[0039] Using a plastic sheet 90 like that described above and shown in FIG. 1 as the raw material, a tray 10 is formed into the cross sectional shape shown in FIG. 2.

[0040] As shown in FIG. 2, tray 10 comprises a rectangular bottom panel 11, four wall panels 12, and a flange 13. The four wall panels 12 extend upward from the four sides of bottom panel 11 such that they surround the bottom panel. Flange 13 is the portion that extends outward from the upper end part of wall panels 12.

[0041] Flange 13 comprises a curved part 13a on the wall panel 12 side and a slanted part 13b positioned on the outside of curved part 13a.

[0042] Curved part 13a is formed such that wall panel 12 and slanted part 13b blend with an uninterrupted shape. In view of making the stretch film contact the tray closely, the radius of curvature of curved part 13a is in the range from R2 (radius 2 mm) to R10 and preferably in the range from R3 to R8.

[0043] As shown in FIG. 2, the cross section of the upper surface of slanted part 13b is substantially a straight line and extends in a slanted direction from the outside edge of curved part 13a. The slant angle α (see FIG. 2) between the slanted part 13b and the bottom panel 11 is set to an angle in the range from 20 to 60 degrees so that the heat rollers (hot bodies) 3 (discussed later) achieve planar contact when they contact the slanted part of the flange. Although slant angles α can be between 5 and 90 degrees, the range from 20 to 60 degrees is preferred in view of the slant of the heat rollers 3 and other factors. As mentioned earlier, it is not necessary for the slant angle of heat rollers 3 to be identical to the slant angle α of slanted part 13b of flange 13. In fact, it is preferable to set the slant angle α of slanted part 13b and the slant angle of heat rollers 3 such that these angles are only roughly aligned when heat rollers 3 are pressed against the flange during sealing.

[0044] Flange 13 is provided with width dimension D (see FIG. 2) in order to secure a prescribed seal width. Width dimension D of flange 13 is assumed to be in the range from 1 to 15 mm and preferably in the range from 3 to 10 mm. It is also preferred that the width dimension of slanted part 13b of flange 13 be 2 mm or greater.

<Thermal Bonding Operation of the Tray and Stretch Film>

[0045] Next the operation of the packaging apparatus that thermally bonds the stretch film to the tray is explained. The packaging apparatus 1 is the same as the packaging apparatus disclosed in Japanese Patent Application H11-137025.

[0046] As shown in FIG. 3, tray 10 is placed on holding member 2 and then stretch film Fm is fed from delivery section 51 of film feeding mechanism 5. The fed stretch film Fm is held between two belts B that traverse transport rollers 52a, 52b and two belts B that traverse presser rollers 52c, 52d; these belts are moved in a direction perpendicular to the transport direction (horizontal direction in FIG. 6) so that the stretch film Fm is stretched in the widthwise direction (vertical direction in FIG. 6). As a result, tension is generated in the stretch film Fm in the widthwise direction.

[0047] Next, moving section 63 of lift mechanism 6 rises, pushes tray 10 up against the stretch film Fm, and stops (see FIG. 4). Here, the upward pushing of tray 10 produces tension in the stretch film Fm in the transport direction. As shown in FIG. 8 (enlarged view), the stretch film Fm is in close contact with the slanted part 13b and outside portion of the curved part 13a of flange 13 of tray 10.

[0048] Then, the downward force applied by lever mechanism 74 against presser plate 73 is released and link mechanism 72 is released so that heat rollers 3 move into contact with tray 10 due to their own weight (see FIG. 5). Since heat rollers 3 are independent of one another, each heat roller 3 contacts tray 10 with roughly the same pressure.

[0049] Next, motor 82 rotates shaft 81 through a prescribed angle, thus causing heat rollers 3 to rotate as shown in FIG. 7. Heat rollers 3 move along the periphery (flange 13) of tray 10 and thermally weld stretch film Fm to tray 10, thus forming a seal. Here, heat rollers 3 roll along flange 13 as they move.

[0050] FIG. 9 shows an enlarged view of the contact area between heat rollers 3 and tray 10 when the former move along the periphery of the latter. The upper opening of tray T is covered by stretch film Fm, which is tensioned in both the lengthwise and widthwise directions, and stretch film Fm is pressed firmly against slanted part 13b and the outside portion of curved part 13a of flange 13 of tray 10. Heat rollers 3 touch diagonally against the portion where stretch film Fm contacts flange 13 and apply both heat and pressure. This heat and pressure cause stretch film Fm and flange 13 to fuse together thermally.

[0051] At the same time, stretch film Fm melts and is cut away at the edge portion (which is, in this case, the outside edge part of slanted part 13b of flange 13 where heat rollers 3 are touching) of tray 10 because the heat and pressure are concentrated on stretch film Fm and stretch film Fm is in tension at the edge portion of tray 10 (see FIG. 9). More specifically, the angle of the heat rollers 3 with respect to the horizontal plane is set to be slightly larger than the angle of the slanted part 13b of flange 13, as shown in FIG. 8. As shown in FIG. 9, when heat rollers 3 touch against flange 13, the pressure of the heat rollers is largest at the outside edge part of flange 13 and, consequently, the tension in stretch film Fm causes stretch film Fm to be thermally cut at the outside edge part of flange 13. Since the pressure is largest at the outside edge part of flange 13, a pressure gradient exists across flange 13 from curved part 13a to the outside edge part. Therefore, the pressure on film Fm is smaller in the vicinity of flange curved part 13a than at the outside edge part and the load of pressure and heat are reduced at the boundary of the inner edge part of flange 13, which is to be sealed. Thus sealing is accomplished without placing a load on the stretch film Fm. Upon viewing a cross sectional photograph of the flange 13 after sealing tray 10 with stretch film Fm, it was found that at the inside seal end part of tray 10 there were no cracks in the film caused by heat and pressure and there was no degradation of the film. This fact, too, results in suppressing the occurrence of pinholes and cracks.

[0052] After heat rollers 3 have finished sealing stretch film Fm to tray 10, heat rollers 3 are raised and lift mechanism 6 lowers tray 10. Then the sealed tray 10 is removed from holding member 2. When the next cycle begins, stretch film Fm - of which a portion has been thermally cut away in the process of sealing tray 10 - is taken up by driving take-up section 53.

<Comparison with Seal Operation of Conventional Tray>

[0053] FIG. 10 shows a case where a stretch film Fm is sealed to a conventional tray 100 and a case where a stretch film Fm is sealed to a tray 10 in accordance with the embodiment.

(Conventional Tray)

[0054] FIG. 10(a) is an expanded view of the vicinity of the flange 113 when heat rollers 3 thermally weld stretch film Fm to conventional tray 100. Flange 113 of tray 100 comprises a first curved part 113a, a horizontal part 113b, a second curved part 113c, and a vertical part 113d. As is clear from the figure, the contact of heat roller 3 with second curved part 113c of flange 113 causes stretch film Fm to be sealed to tray 100. An air layer S1 is formed between flange 113 and stretch film Fm in the space to the outside of vertical part 113d near second curved part 113c. Because air layer S1 serves as thermal insulation, the heat from heat rollers 3 concentrates on the stretch film Fm at the boundary line

between second curved part 113c and vertical part 113d and the stretch film Fm is thermally cut.

[0055] However, with conventional tray 100, air layer S2 tends to form in a similar manner between stretch film Fm and the horizontal part 113b of flange 113. Air layer S2 serves as thermal insulation with respect to the heat from heat rollers 3 and causes a high risk of pinholes developing on the inside of the seal portion due to heat. If such pinholes develop, the inside of tray 100 cannot be kept in a sealed state. Furthermore, if the pinholes are large, the packaging itself cannot be accomplished.

(Tray of This Embodiment)

[0056] FIG. 10(b) illustrates thermal sealing of a stretch film Fm to a tray 10 in accordance with this embodiment. Since tray 10 has slanted part 13b disposed to the outside of curved part 13a, stretch film Fm makes close contact with slanted part 13b and the outside portion of curved part 13a of flange 13 when stretch film Fm covers curved part 13a. Heat rollers 3 touch chiefly against slanted part 13b and hardly touch curved part 13a at all. Therefore, the air layers S1, S2 shown in FIG. 10(a) do not form and stable sealing is accomplished without the development of pinholes.

[0057] When heat rollers 3 thermally weld stretch film Fm to tray 10, which has a flange 13 as just described, curved part 13a deforms slightly so that the slant angle of heat rollers 3 and the angle of flange 13 are roughly the same and heat rollers 3 rotate as they move. Since the thermal welding is conducted in this manner, the seal is formed over roughly the entire width of flange 13. Also, in addition to thermally welding stretch film Fm to slanted part 13b, the heat from heat rollers 3 travels through curved part 13a and radiates away. As a result, the risk of pinholes developing is avoided.

<Comparison of Test Results with Conventional Tray>

[0058] The results of tests comparing an operative example of a tray 10 in accordance with this embodiment and an operative example (comparative example) of a conventional tray 100 are discussed.

[0059] Regarding the raw material of tray 10, undrawn polypropylene films (CCP) of thickness of 40 μm were used for both surface layers. A foamed polystyrene sheet (thickness 1.5 mm, weight 260 g/m²) was used for the base material sandwiched between the surface layers. Both materials were formed by coextrusion into a sheet comprising three layers made of CCP (40 μm), foamed polystyrene (1.5 mm), and CPP (40 μm), respectively. The sheet was then set into a mold and made into food tray 10 using a vacuum pressure forming machine.

[0060] The dimensions of the tray were as follows: external dimensions 130 mm x 180 mm, depth 30 mm, flange angle α35 degrees, flange width 5 mm, and radius of curvature of curved part 5 mm (R5).

[0061] Tray 10 was placed in a heat roller type stretch film packaging apparatus like that described previously and a stretch film Fm was heat scaled to the opening of the tray.

[0062] For the stretch film Fm, a stretch film Fm having a thickness of 15 μm and three layers made of the following materials, respectively, was used: linear low-density polyethylene (LLDPE), polypropylene "Catalloy", and linear low-density polyethylene (LLDPE).

[0063] The sealing temperature (hot roller temperature) was set to 190C.

[0064] Tray 100 of the comparative example used the same material as was used for tray 10 and was given similar dimensions and a flange 113 shaped like that shown in FIG. 10 (a).

[0065] The seal strength and pinhole development of both trays were checked and the results are shown in Table 1.

[Table 1]

| Sample | Seal strength (gf/15 mm) | Pinhole development |
|----------|--------------------------|----------------------------|
| Tray 10 | 578.7 | None |
| Tray 100 | 361.1 | Two or more in all samples |

* The seal strength was measured using a Strograph V1-C universal tester made by Toyo Seiki Seisakusho, Ltd.

* The number of samples N was 10. After cutting the sample into 15-mm wide portions, the seal strength was measured using a tensile tester.

* The seal strength is the average value for the entire perimeter of the tray.

[0066] As the results indicate, tray 10 (the operative example of the present invention) had a stable seal strength of at least 500 gf/15 mm.

[0067] Conversely, in the case of tray 100 (comparative example), almost every tray showed pinholes and there were no samples that did not develop pinholes.

[0068] The following statements are clear based on these results. Since flange 13 of tray 10 is formed with a slanted part 13b that has a slant angle corresponding to the slant angle of heat rollers 3 and a curved part 13a that allows stretch film Fm stay in contact with the surface of tray 10 (i.e., surface of curved part 13a) up to the place in the inward direction of the tray where heat rollers 3 no longer touch, the heat from heat rollers 3 never concentrates on the stretch film Fm only and is always transmitted to tray 10 as well. Thus, the thermal stress on stretch film Fm is reduced and the development of pinholes is suppressed.

[Second Embodiment]

<Raw Material and Shape of Tray, Application of Bonding Agent, and Pinholes>

[0069] For this embodiment, the tray was made by vacuum pressure forming a 0.8-mm thick polypropylene sheet.

[0070] The tray dimensions were as follows: external dimensions 140 mm x 210 mm, depth 25 mm, flange angle α 35 degrees, and flange width 10 mm. A bonding agent called Hot Lacquer Heat Sealing Agent AD-1790-15 made by Toyo-Morton, Ltd., was applied to the flange.

[0071] Because this was a test, a prescribed amount of the bonding agent was applied to the flange in a non-automatic manner and dried thoroughly.

[0072] After the bonding agent was completely dry, the tray was placed in the heat roller type stretch film packaging machine and the stretch film was heat sealed to the tray.

[0073] The stretch film used for the scaling had a thickness of 15 μ m and a three-layer structure comprising layers made of ethylene vinyl acetate copolymer, polypropylene "Catalloy", and ethylene vinyl acetate copolymer, respectively.

<Seal Strength Measurement and Check for Pinhole Development>

[0074] Similarly to the first embodiment, the heat seal strength was measured for samples comprising a tray to which a stretch film had been heat sealed.

[0075] The measurement results indicate that a completely secure bond was obtained. The number of samples N was 10 (i.e., there were 10 test trays) and the measurement results showed that the strength was at least 500 gf/15 mm for all samples. It was also observed that no pinholes developed.

[0076] These results indicate that the bonding agent melted upon absorbing heat from the heat rollers and welded the stretch film thoroughly to the flange. The results also indicate that the concentration of heat from the heat roller on the stretch film is suppressed and thus the development of pinholes is suppressed.

[0077] In both of the embodiments discussed thus far, the flange comprises a slanted part whose slant angle is roughly aligned with the slant angle of the heat rollers and a curved part that enables something other than an air layer, e.g., the tray itself or a bonding agent, to exist in addition to the stretch film in the vicinity of the heat rollers. As the seal strength measurements indicate, these embodiments suppress the problem of heat from the heat rollers being concentrated on the stretch film and thus reduce the occurrence of pinholes and other defects. These embodiments also make it possible to achieve a more safe and reliable seal.

[Third Embodiment]

[0078] In the previous embodiments, the stretch film Fm was thermally cut by concentrating heat and force on the stretch film Fm at the outer edge part of slanted part 13b of flange 13. It is also acceptable to shape the flange 13 as shown in FIG. 11 in order to apply more pressure and cut the film more reliably.

[0079] In the flange 13 of tray 10 in FIG. 11, a protruding part 13c is formed on the outer perimeter of slanted part 13b. Protruding part 13c protrudes toward heat rollers 3 and serves in the thermal cutting of stretch film Fm. The tip of protruding part 13c is pointed so that high pressure acts on the stretch film Fm where it is pinched between protruding part 13c and heat rollers 3. As a result, stretch film Fm is reliably cut at this portion.

[0080] It is also possible to use a foamed hot melt type bonding agent as the bonding agent. When bonding is conducted by melting the surface of the packaging container and the inside surface of the film, the heat supplied from the heat rollers is radiated into the air and the thermal efficiency declines. If a foamed hot melt type bonding agent is applied to the flange, the foamed bonding agent will absorb the heat from the heat rollers and melt, thus serving its function as a bonding agent.

[Fourth Embodiment]

[0081] FIG. 2 shows a case where the slant angle of the heat roller 3 is roughly the same as the slant angle α of the slanted part 13b of flange 13. However, it is also preferable to take advantage of a structure like that shown in FIG.

12, in which the slant angle β of heat roller 3 is slightly larger than the slant angle α of flange slanted part 13b of tray 10.

<Relationship between the Tray and Heat Roller>

5 **[0082]** FIG. 12 illustrates stretch film Fm being tensioned and set on the upper surface of tray 10 and then sealing being conducted by heat roller 3. As shown in FIG. 12 (a), at this stage heat roller 3 has a slant angle β that is slightly larger than the slant angle α of slanted part 13b of flange 13.

<Sealing Operation>

10 **[0083]** When heat roller 3 (having slant angle β) seals the stretch film to slanted part 13b of flange 13 (having slant angle α), the sealing is accomplished as shown in FIG. 12 (b). The pressure applied by heat roller 3 (having slant angle β) causes flange 13 of tray 10 to deform and the slant angle of slanted part 13b to shift from α toward the slant angle β of heat roller 3. When this occurs, the vertical centerline of curved part 13a of flange 13 tilts through angle γ and the slant angles of heat roller 3 and flange 13 become roughly equal. Flange 13 of tray 10 possesses elasticity; slanted part 13b tilts and its slant angle changes when heat roller 3 applies pressure.

15 **[0084]** When heat roller 3 applies pressure and the slant angle of slanted part 13b of flange 13 roughly aligns with that of heat roller 3, the straight-line portion of the slanted part is planar-sealed with stretch film Fm. The width of the seal is at least 2 mm and corresponds to the width of the portion where stretch film Fm and heat roller 3 contact the flange. Meanwhile, the outside edge part of flange 13 is positioned at the top of the pressure gradient that develops along the portion where heat roller 3 is touching. In addition to the pressure applied by heat roller 3, the heat from heat roller 3 and the tension of stretch film Fm directed outward from the tray cause stretch film Fm to be thermally cut at the outside edge part of flange 13.

20 **[0085]** On the inside portion of flange 13, there exists a portion of length r (see FIG. 12 (b)) where stretch film Fm contacts the flange but heat roller 3 does not.

<Features>

(1)

30 **[0086]** After seal sealing is completed and heat rollers 3 move away from flange 13, flange 13 returns from its elastically deformed state to its original slant angle as shown in FIG. 12 (c). At this stage, there exists on the outside portion of curved part 13a of flange 13 a section of length r (see FIG. 12 (c)) that is not thermally bonded to the flange but is in close contact with stretch film Fm. This section of length r maintains the tension of the stretch film Fm covering tray 10 and reduces the load on the inside end face of heat sealed section d, thus serving to prevent poor sealing.

35 **[0087]** If the seal is formed up to a position that was further inward than the vertical centerline of curved part 13a of flange 13 before sealing, the seal portion will reach the inside edge part of the portion where stretch film Fm is in close contact with flange 13 and be directly heated by heat rollers 3. Therefore, the tension in stretch film Fm will act directly on the portion of stretch film Fm at the inside end face of the seal portion, i.e., a portion of stretch film Fm that has been bonded but has not completely cooled. Before stretch film Fm hardens, the portion of stretch film Fm at the inside end face of the seal portion (i.e., the inside edge part of the closely contacting portion) will develop such defects as tears or pinholes.

40 **[0088]** Conversely, this embodiment suppresses the development of such defects as tears or pinholes in stretch film Fm because the slant angle β of heat rollers 3 is set such that, during sealing, the area to the outside of the vertical centerline of curved part 13a of flange 13 is sealed and the area to the inside is not sealed.

(2)

50 **[0089]** Tray 10 is made by molding a sheet into a specified shape using vacuum air-pressure forming and then cutting off the edges to obtain a specified flange dimension. During this molding process, a mold is set on the outside of tray 10 and the outside dimensions can be molded accurately. The inside dimensions, however, are quite difficult to mold accurately and precisely. It is also extremely difficult for the cutting blade to cut all four edges of flange 13 uniformly; a portion of the formed sheet may remain on flange 13 such that a flat part is formed on the end face of flange 13. Thus there are cases where slant angle error occurs during molding and cutting error occurs during cutting of the edges.

55 **[0090]** Therefore, even in the same tray, all four flanges 13 will not have slanted parts 13b with completely identical slant angles α and cutting error will result in a horizontal flat part on some of the edges.

[0091] In order to prevent poor seal sealing from occurring because of such errors during molding, it is necessary to have a sealing mechanism that allows a certain degree of error. In view of this necessity, it is preferable to adopt a

structure, such as that of this embodiment, in which the slant angle β of heat rollers 3 is slightly larger than the slant angle α of flange 13.

(3)

[0092] If molding error were to cause the slant angle α of slanted part 13b of flange 13 to be larger than the slant angle β of heat rollers 3, it is feasible that heat rollers 3 might not contact the outer edge part of flange 13 and thermal cutting could not be accomplished. However, if the slant angle β of heat rollers 3 is slightly larger than the slant angle α of flange slanted part 13b as in this embodiment, then molding error will almost never cause the slant angle α of slanted part 13b of flange 13 to be larger than the slant angle β of heat rollers 3.

(Industrial Applicability)

[0093] If this invention is used, a slanted part will be formed on the flange and, since the upper surface of the slanted part is straight, a planar seal will be formed between the film and the packaging container when the slanted hot body is touched against the flange. Consequently, a stronger bond with higher sealing performance is obtained.

[0094] Furthermore, since a curved part is formed to the inside of the slanted part, the film makes close contact with the curved part and the heat from the hot body travels through the curved part and is radiated away. As a result, the pinholes that occur in conventional packaging containers are suppressed and packaging with good sealing performance is possible.

[0095] In another mode of the present invention, the hot body is pressed against the slanted flange of the packaging container at a slant angle that is slightly larger than the slant angle of the flange. The deformation of the flange allows a planar seal to be made between the packaging container and the film. Meanwhile, the pressure applied at the outside edge part of the seal portion is larger than the pressure in other sections and the film can be thermally cut easily at the outside edge part of the seal portion. Since there is almost no bonding of the stretch film at the apex of the flange, such trouble as holes developing in the film is suppressed.

Claims

1. A packaging container, comprising:

a bottom panel for placing an article to be packaged,
 a wall panel having an upper end part, said wall panel extending upward from said bottom panel such that said wall panel surrounds said bottom panel; and
 a flange extending outward from said upper end part of said wall panel, said flange having a curved part on said wall panel side and a slanted part positioned outside of said curved part, said curved part having an upper surface of which a cross section is substantially straight, said curved part being formed such that said wall panel and said slanted part define a continuous shape.

2. A packaging container as recited in claim 1, wherein
 said slanted part is at a slant angle in a range from 20 to 60 degrees with respect to said bottom panel.

3. A packaging container as recited in claim 1 or 2, wherein
 a width of said slanted part is 2 mm or greater.

4. A packaging container as recited in any one of claims 1 to 3, wherein
 a bonding agent is applied to a surface of said flange.

5. A packaging body, comprising:

a packaging container as recited in any one of claims 1 to 4; and
 a film covering an upper surface of said packaging container, a periphery of said film being bonded to said flange.

6. A packaging body as recited in claim 5, wherein
 the periphery of said film follows said curved part of said flange without any air gaps and is bonded to said slanted part of said flange.

EP 1 193 179 A1

7. A packaging body as recited in claim 5 or 6, wherein said flange further has a protruding part that is positioned on an outer peripheral side of said slanted part for cutting the film.

5 8. A packaging body as recited in any one of claims 5 to 7, wherein
said film is thermally bonded to said flange by pressing a slanted hot body against said slanted part while the periphery of said film is in close contact with said curved part and said slanted part.

9. A packaging method, comprising:

10 a first step in which an article to be packaged is placed in a packaging container having a slanted flange at its periphery,

a second step in which a film is supplied above the packaging container and tension is applied to the film,

a third step in which the packaging container is raised and the flange is made to touch against the tensioned film; and

15 a fourth step in which a hot body is pressed against the flange touching the film at a slant angle larger than the slant angle of the flange.

10. A packaging method as recited in claim 9, wherein

20 the hot body is pressed against the flange such that a width of a portion where the flange and the hot body contact each other is 2 mm or greater in said fourth step.

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Fig. 1

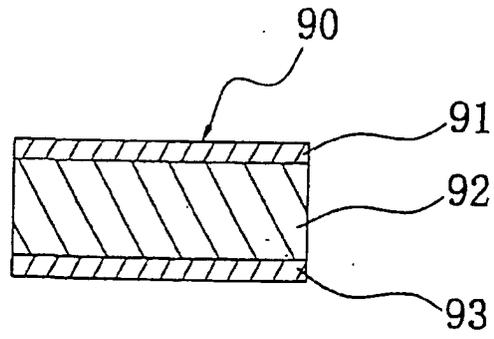


Fig. 2

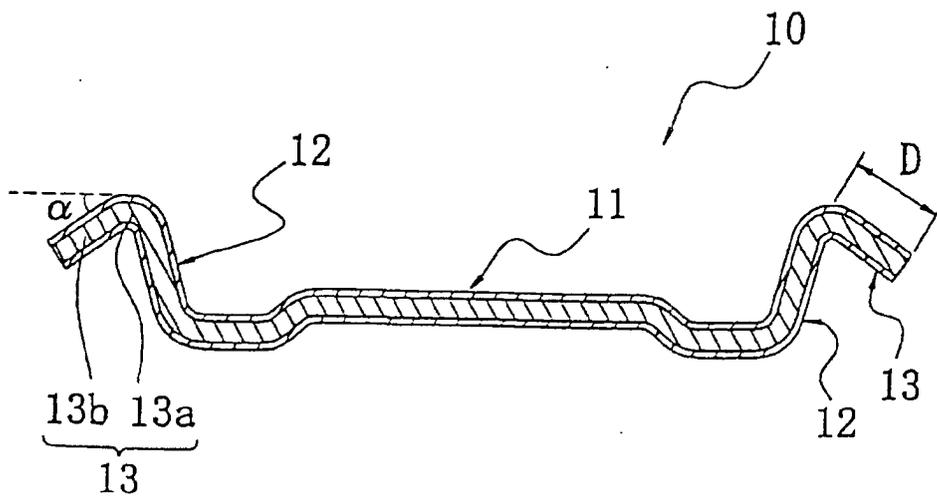


Fig. 3

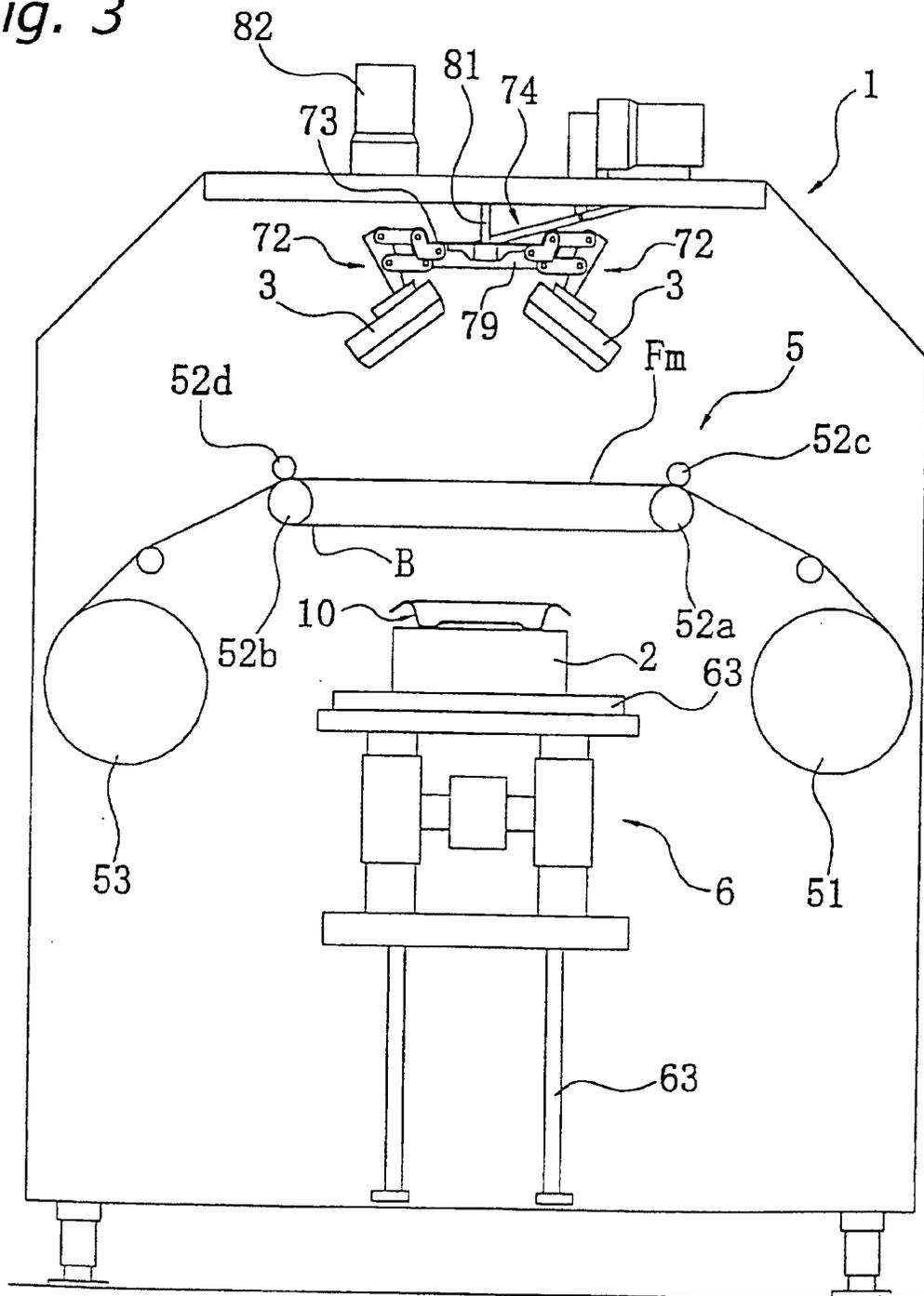


Fig. 4

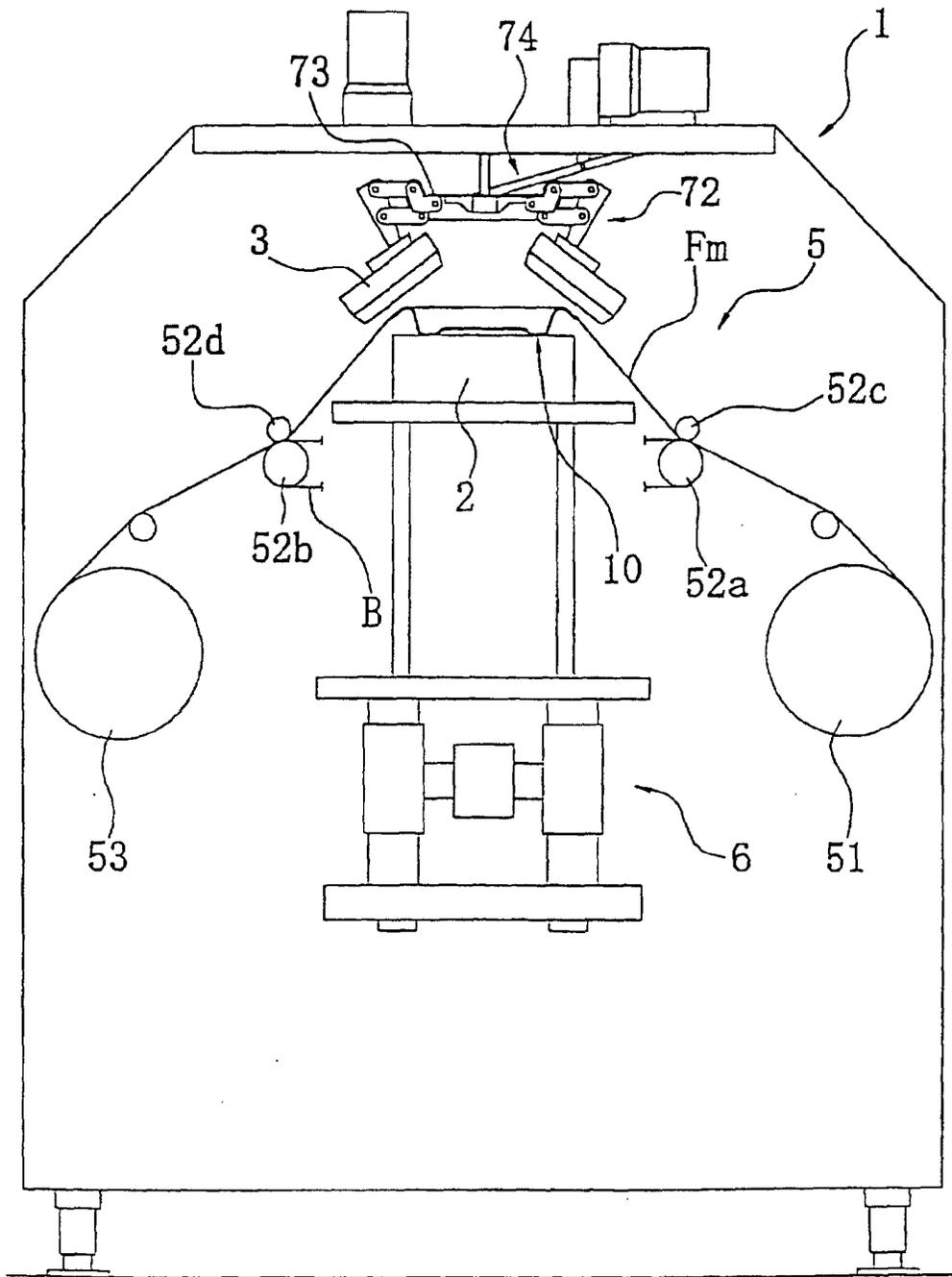


Fig. 5

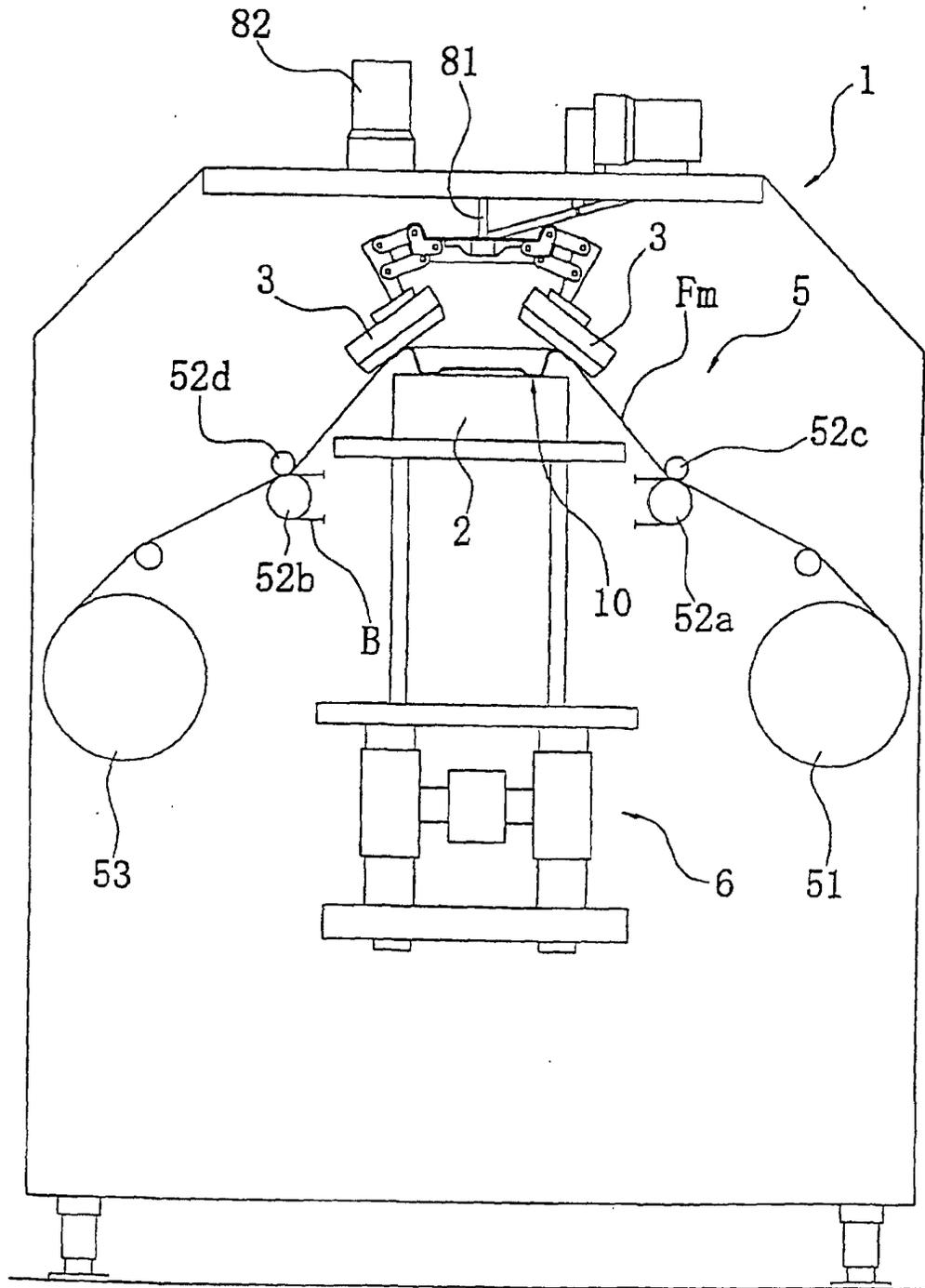


Fig. 6

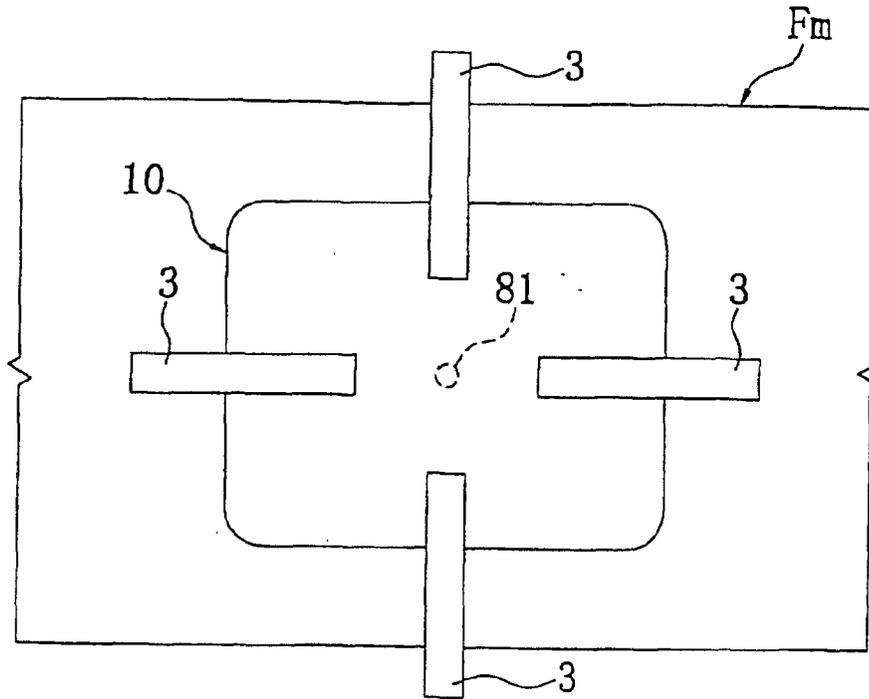


Fig. 7

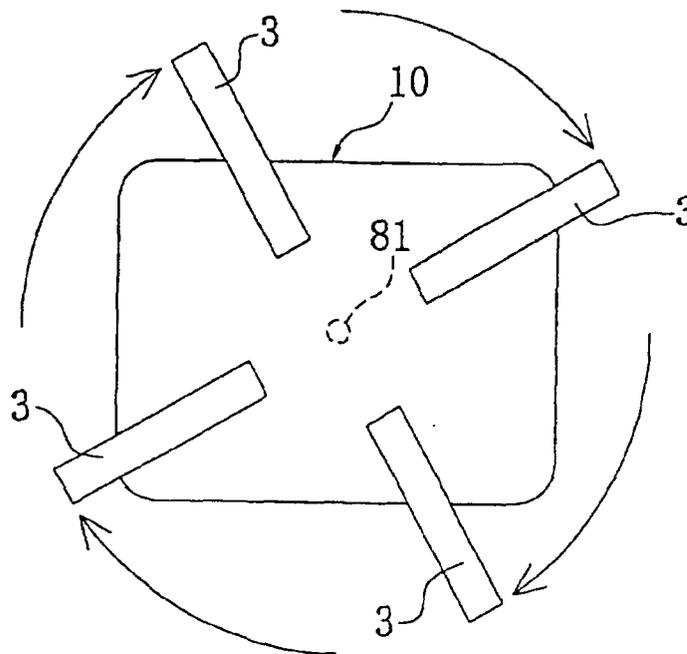


Fig. 8

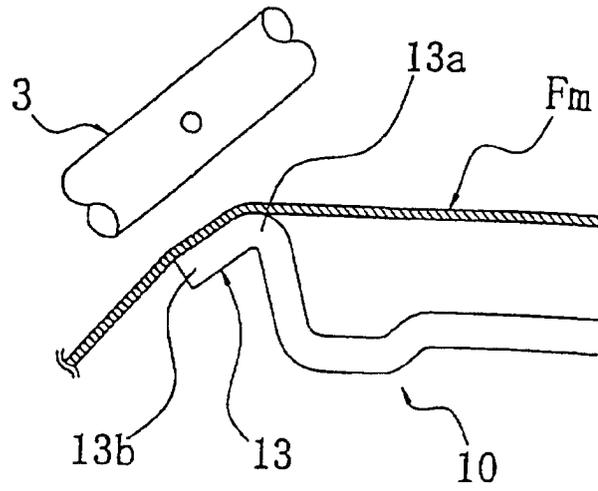


Fig. 9

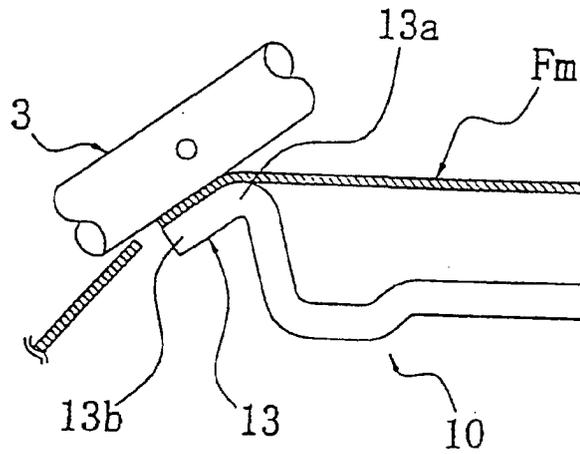


Fig. 10

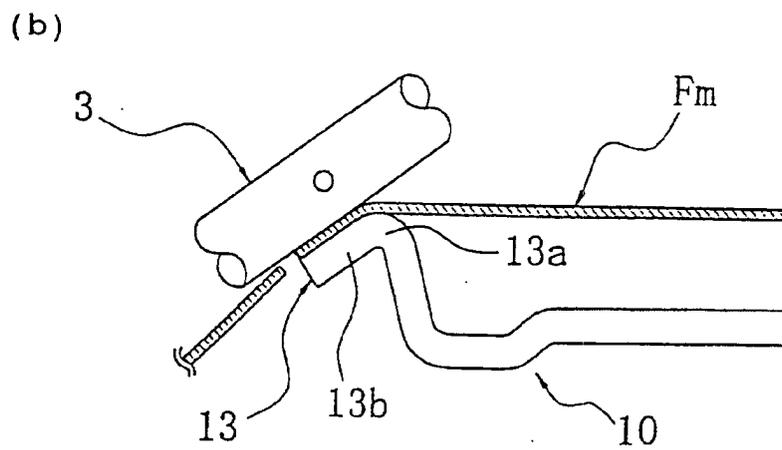
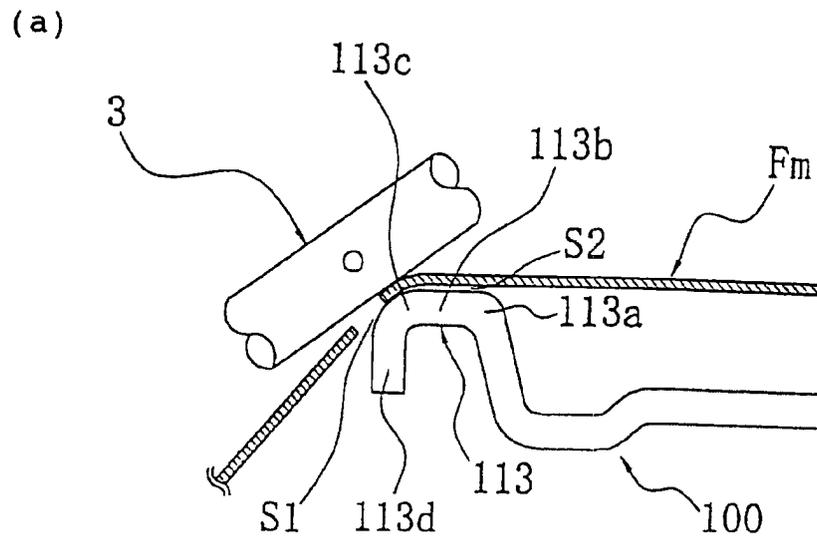


Fig. 11

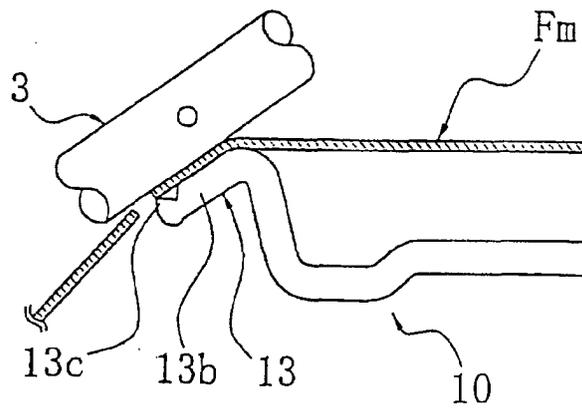
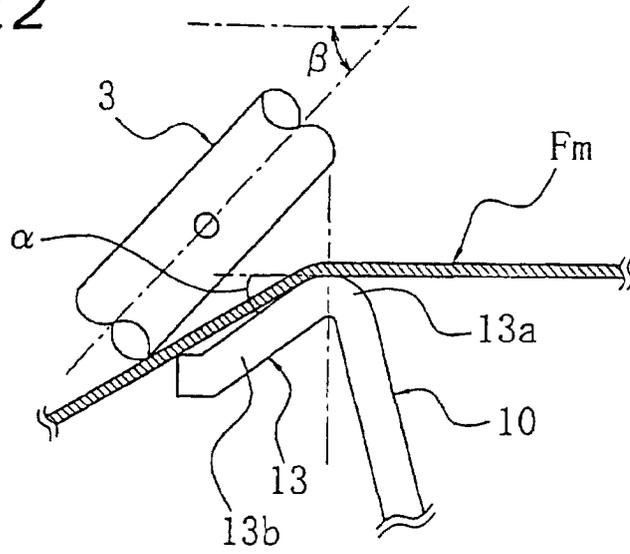
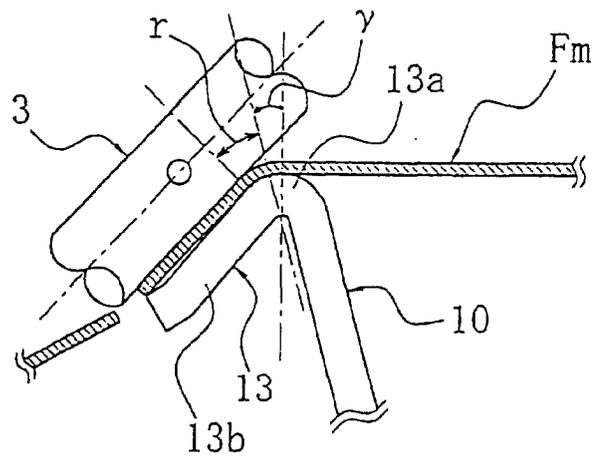


Fig. 12

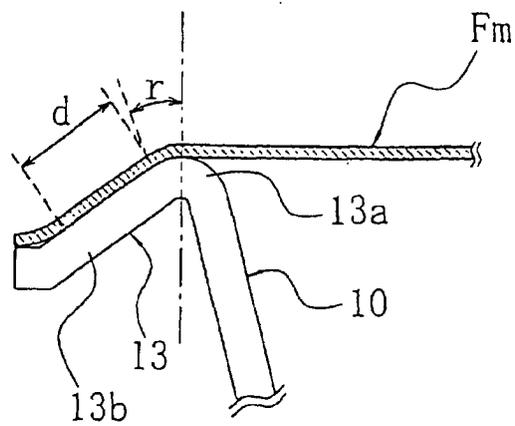
(a)



(b)



(c)



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP01/02180

| A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ B65D1/34, B65B7/28 | | |
|--|---|---|
| According to International Patent Classification (IPC) or to both national classification and IPC | | |
| B. FIELDS SEARCHED | | |
| Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁷ B65D1/34, B65B7/28 | | |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2001 Kokai Jitsuyo Shinan Koho 1971-2001 Jitsuyo Shinan Toroku Koho 1996-2001 | | |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) | | |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| Y | Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No.123758/1984 (Laid-open No.53537/1985) (Dainippon Printing Co., Ltd.), 15 April, 1985 (15.04.85), Full text; Fig. 1 (Family: none) | 1-10 |
| Y | JP, 4-182125, A (Yamato Esuron K.K.), 29 June, 1992 (29.06.92), Full text; Figs. 2 to 3 (Family: none) | 1-10 |
| Y | JP, 3-176378, A (Showa Aluminum Corporation), 31 July, 1991 (31.07.91), Full text; Figs. 1 to 4 (Family: none) | 4-8 |
| A | JP, 4-72135, A (Kureha Chemical Industry Co., Ltd.), 06 March, 1992 (06.03.92), Full text; Figs. 1 to 4 (Family: none) | 9-10 |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex. | | |
| <p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p> | | |
| Date of the actual completion of the international search 09 May, 2001 (09.05.01) | | Date of mailing of the international search report 22 May, 2001 (22.05.01) |
| Name and mailing address of the ISA/ Japanese Patent Office | | Authorized officer |
| Facsimile No. | | Telephone No. |

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