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

(11) EP 0 797 060 A2

(12) # EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.09.1997 Bulletin 1997/39

(51) Int. Cl.[6]: F25D 23/06, B32B 31/10

(21) Application number: 96202034.3

(22) Date of filing: 17.07.1996

(84) Designated Contracting States:
DE ES FR IT

(30) Priority: 20.03.1996 IT MI960540
31.05.1996 IT MI961105

(71) Applicant: Fieramonte, Luigi
20094 Corsico (Milano) (IT)

(72) Inventor: Fieramonte, Luigi
20094 Corsico (Milano) (IT)

(74) Representative: Robba, Eugenio et al
Studio "INTERPATENT"
via Caboto 35
10129 Torino (IT)

(54) A process for applying a metal sheet to the outer surface of a refrigerating container

(57) A process for applying a length of aluminum sheet to the outer surface (2) of a refrigerating container (1), by using a metal ribbon and a layer of adhesive applied between said aluminum ribbon (10) and said refrigerating container (1), pressing said ribbon against the surface (2) of the refrigerating container (1) and cutting (7) the desired length of the ribbon (10),

The adhesive (8, 28, 29) can be incorporated in a composite ribbon (10), or directely deposited over the refrigerating container (1), or over an intermediate support (22).

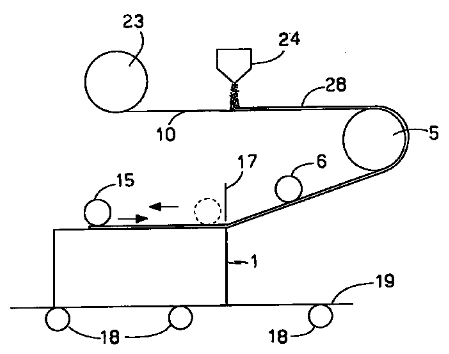


FIG. 4

EP 0 797 060 A2

Description

La present invention relates to the manufacturing of refrigerating apparatuses, freezers and the like, that is refrigerators in a broad sense, and more precisely to a process for applying a heat-conductive metal sheet to the outer surface of a refrigerating container or freezer.

Moreover the invention concerns a composite or multi-layer ribbon adapted to be deposited onto the outer surface of a refrigerating container for lowering the temperature thereof in cooperation with a refrigerating coil. The invention is further concerned with a process for applying a portion of such a composite ribbon material to the outer surface of white goods (appliances) for cooling foodstuffs such as refrigerators and the like.

In these kind of white goods the refrigerating coil is (usually) located outside the back wall of the plastic material container forming the refrigerating apparatus.

To refrigerate the inside space, over the surface beneath the cooling coil there is provided a thin sheet of a heat conducting material such as a metal, and more recentely a thin metal sheet of aluminum, sticked to the outer wall of the apparatus and in relation of thermal exchange with the cooling coil. When a gas is expanded within the cooling coil the so generated cold is uniformely spread over the whole surface of the aluminum foil acting as a medium for transferring it inside the container housing the foodstuff to be conserved.

Such metal sheet materiale is made to adhere to the plastic material wall of the refrigerator by means of a suitable adhesive or a glue, e.g. by previuously applying a bi-adhesive tape or by spreading an adhesive over the wall surface and pressing the metal sheet onto the former.

There are known methods for applying such heat-conductive metal sheet.

In accordance with a first method, to the external surface of the refrigerating container there is applied a sheared (punched) sheet di aluminum having a thickness of about 0.4 mm. which is coupled through a bi-adhesive tape. This method is presently almost completely abandoned.

According to another method, to the refrigerating container there is applied a sheared or punched sheet of aluminum provided with a bi-adhesive tape or a layer of spread adhesive on one or both faces.

The known methods require that the aluminum be manually deposited, both for separating the foil protecting the adhesive and for the deposition operation of the aluminum sheet over the container. Therefore, the precise positioning of the sheet depends on the operator and is often unsatisfactory.

Moreover a stock of previously punched metal sheets has to be maintained for the different sizes of the refrigerating containers to be manufactured.

Thus, the application of a previuosly sheared or punched aluminum sheet, although allowing for a sufficient reliability in respect of the heat distribution and a long resistance to the various stresses (mainly thermal, mechanical and caused by moisture) to which the apparatus is subjected, requires manual operations that are rather expensive and appreciably increase the overall manufacturing cost.

Moreover, in the use of the refrigerating apparatus, when the adherence to the wall that generate the cold is not perfect, or an improper adhesive has been used, the heat transmission (removal) is hindered with a consequent lowering of the cooling efficiency.

It is an object of the present invention to overcome the above illustrated drawbacks, and more particularly to provide a process for applying a layer of heat conducting material to the outer surface of the wall of a refrigerating container in a refrigerating apparatus that is inexpensive and does not require to store a supply of previously cut metal sheets.

A further object of the invention is to realize a process of the above type that can be performed in line and in a continuous (uninterrupted) manner.

Another object of the invention is to realize a ribbon-like article of heat-conductive material adapted to be quickly and easily applied to the outer surface of a refrigerating container.

The invention accomplishes the above objects through the processes as claimed in claims 1, 2 and 3 and a composite material ribbon as claimed in claim 9.

In accordance with an first aspect, the invention consists of a process for applying to the outer surface of white goods (appliances) for cooling foodstuffs such as refrigerators and the like, an aluminum covering layer acting as a heat distributor for the refrigerating coil that is in thermal contact with such layer.

In accordance with a second aspect, the invention consists of a composite ribbon to be applied to the outer surface of a refrigerating container, with the composite ribbon incorporating a layer of an adhesive resistant both to low temperatures (<-55°C) and to high temperatures (> 125°C). The composite ribbon can be supplied with the width required by the refrigerator manufacturer and this latter can apply the desired amount of aluminum through a simple depositing and cutting apparatus in a continuous process, without the additional costs coming from having to shear and/or punch the blanks in advance.

This way it is possible to use a single-face or double-face adhesive aluminum ribbon directly supplied from a feeding roll, and the following advantages are achieved.

1. Refrigerating containers of a very large number of sizes and models can be manufactured without storing the heat distributing sheets cut to the corresponding sizes.
2. A considerable reduction of the manufacturing costs is achieved, as well as of the stocking investments.

Further advantageous features are claimed in the dependent claims.

The concept underlying the present invention is that of using a simple thin aluminum ribbon and to deposit a suitable layer of adhesive either over the sheet or over the refrigerator surface, or over an intermediate support.

Preferred but non limiting embodiments of the invention will be disclosed with reference to the attached drawings in which:

Fig. 1 is a perspective schematic view showing a refrigerating container incorporating a heat-distributing ribbon according to the invention;
Fig. 2 shows the construction of a composite ribbon according to the invention;
Fig. 3 illustres a first embodiment of a process according to the invention;
Fig. 4 shows another embodiment of a process according to the invention;
Fig. 5 shows another embodiment of a process according to the invention;
Fig. 6 shows a further embodiment of a process according to the invention; and
Fig. 7, 7A and 7B illustrate an alternative embodiment of the refrigerating container.

In all the Figures the same references have been used to indicate equal or substantially equivalent components.

Fig. 1 schematically depicts a refrigerator or refrigerating container 1 provided with a layer 4 of metal sheet applied over the outer surface of the back wall 2. A refrigerating coil 3 is arranged over the metal sheet 4 and for simplicity sake the protective coating covering the coil 3 has been omitted in the Figure. The layer 4 is made up by an aluminum thin sheet or foil glued onto the outer wall 2 of the refrigerating apparatus 1. After the aluminum sheet has been applied, the coil 3 is superimposed and secured to it in a conventional manner so as to be in thermal contact with the sheet over its whole extension.

Fig. 2 schematically shows a roll 8 of a heat-conductive ribbon material according to the invention, formed by a laminated or composite sheet 9 comprising an aluminum sheet 10 having the properties and characteristics specified later on, an adhesive or biadhesive tape including a support 11 and an adhesive layer 12 applied to a face of the aluminum sheet, and a ribbon of a protective and separating material 13, typically silicone treated paper, for preventing the sticking of the adhesive layer when the ribbon is wound to form the roll 8. As an alternative, other protection means can be provided such as a plastic sheath, a heat meltable adhesive, etc. Moreover the adhesive ribbon can be applied, if desired, on both faces of the aluminum sheet 10.

The material of the sheet 10 is aluminum with a purity higher than 98%, and preferably higher than 99%, and with a density from 2 to 3,5 g/cm^3. The thickness of the aluminum sheet is generally comprised between 80 and 200 microns, and preferably between 140 and 160 microns.

In the temperature range from 0 to 100°C, the thermal conductivity of the material forming the sheet is larger than 200 W/m°C, and its specific heat is about 950 J/kg°C.

The melting temperature of the aluminum forming the sheet 10 is comprised between 630 and 670°C, and preferably between 640 and 660°C. In the temperature range from 0 to 100°C the coefficient of thermal expansion is comprised between 20 and 25x10^{-6} °C.

The layer or liner 11 has a weight of about 80 gr/cm.

The material forming the adhesive layer 12 è preferably an acrilic self cross-linking adhesive with a glass temperature (Tg) not lower than -50° and higher than 250°. The adhesive material is applied with a basis weight comprised between 20 and 60 g/cm^2 and its adhesion characteristics are listed in the following Table 1.

Table 1

ADHESIVENESS		SHEAR (N/inch)
on steel	on polystyrene	
9.53 - 10.23	8.56 - 9.73	56.25 - 57.97

where the dynamic shear test indicates the force exerted by the adhesive against the slipping over the object on which the aluminum ribbon has been applied.

From adhesiveness and aging tests it has been found that the sheet according to the invention does not show any sign of degradation or peeling off from the support. More particularly the peeling force in a peel test according to FINAT standard, between -55° and +125°C, was higher than 14 N/inch on polystyrene after the aging tests.

With reference to Fig. 3 it is now disclosed a first embodiment of the process according to the invention for applying the above disclosed aluminum ribbon to the outer surface of a refrigerating container.

The refrigerating apparatus or container 1 is horizontally positioned over a supporting plane 10 in a conveyor system 20 and a predetermined length of the composite ribbon 9, rotatably mounted on a support (not shown), is unwound from the roll 8 while the silicone treated paper 13 is removed and wound on a collecting roll 16.

The leading edge of the ribbon 9 is applied onto the surface 2 of the refrigerator, at the desired location, and then a rubber idle roll 15 is brought into contact with the deposited ribbon in correspondence of the leading edge. Then the roll 15 is firstly moved towards the roll 8, thus pressing the ribbon 10 and squeezing out the air trapped therebetween. The return movement of the rubber roll 15 achieves the complete adhesion of the ribbon 9 and positions the roll for the next application cycle. The hardness of roll 15 is higher than 60 Shore A and the application takes place under a pressure of at least

1,5 kg/cm^2.

Preferably, after the detachment of the silicone treated paper and before the deposition over the container, a thin flow of hot air is directed across the aluminum ribbon in order to soften the layer of adhesive 12, thus improving the preliminary sticking to the container. Such hot air flow, produced by means not shown in the drawings, can be directed to lick either the upper face of the ribbon or the lower one (i.e. directly over the adhesive).

Then a cutter 7 shears the ribbon at a predetermined length and the refrigerating container is moved to the next step of the manufacturing process.

Fig. 4 illustrates another embodiment of the process of the invention. A horizontally positioned refrigerating container 1 is advanced over a conveyor line comprising a conveyor belt 19 and rolls 18, with the back surface 2 facing upwards. A roll 23 of a simple aluminum ribbon 10 having predermined width and thickness is unwound by means of driven rolls (not shown). The ribbon 10 runs horizontally for a first section where a dispenser 24 uniformely applies a predetermined amount of a suitable adhesive 28. A return roll 5 and an idle roll 6 reverse the advancing direction of the ribbon before and overturns it so that is can be directly applied onto the surface 2 of the underlying refrigerating container 1.

A cutter 17 accomplishes the cut of the desired length of ribbon 10, and a pressing roll 15 is moved back and forth (as indicated by the arrows) for causing the ribbon 10 to adhere to the surface of the refrigerating container. When the adhesive 28 is a temperature sensitive adhesive, i.e. it has to be heated for becoming sticking, the roll 15 can be internally heated, or alternative means can be provided for generating a laminar flow of a hot fluid in correspondence of the refrigerating container. Such means can be employed also in the other embodiments of the present invention.

In the process schematically illustrated in Fig. 5, the refrigerating container 1 is horizontally advanced on a conveyor belt 19 located beneath a dispenser 24 of an adhesive 28.

The dispenser 24 deposits a uniform layer of adhesive 28 over the back surface 2 of the refrigerating container 1, and then the refrigerating container 1 is advanced to a next station under a roll 6 of an aluminum ribbon 10.

The aluminum ribbon 10 is unwound and a length thereof is positioned over the refrigerating container 1 in correspondence of the area covered by the deposited adhesive 28. Then the aluminum ribbon 10 is pressed over the surface 2 of the refrigerating container 1 by the bidirectional movement of a roll 15 applying a predetermined pressure. Thereafter the aluminum ribbon is cut by the cutter 17 and the refrigerating container is advanced to the next stage of the manufacturing process.

A fourth embodiment of the process according to the invention is schematically illustrated in Fig. 6 on which there is no longer shown the conveyor system.

This embodiment of the process according to the invention provides for positioning the refrigerating container 1 firstly under a roll 21 formed by an anti-adhesive ribbon 22, i.e. of a material preventing the sticking or from which a sticking film can be easily removed.

The unwound ribbon runs substantially horizontal for a given length, and a layer of adhesive 29 is uniformely deposited over the surface of such anti-adhesive ribbon 22 by a dispenser 24.

The ribbon 22 is then turned upside down around a roll 5 and guided by a roll 6, so that the surface carrying the adhesive 29 is facing downwards and the assembly formed by said anti-adhesive ribbon 22 and by the adhesive 29, is applied at the desired location onto the surface 2 of the refrigerator, in a manner similar to that of the above disclosed second embodiment.

The composite ribbon formed by the ribbon 22 and the (weakly) attached adhesive 29 is then pressed over the surface 2 by the reciprocating movement of the roll 25 applying a predetermined pressure over them, and the desired length of the assembly 22-29 is cut by the cutter 27.

Next the refrigerating container 1 is advanced and the anti-adhesive material 22 is removed or peeled away, e.g. by means of a blade (not shown). Then the refrigerating container 1 is advanced below a roll 6 of aluminum ribbon, from which a length of ribbbon is unwound and disposed over the refrigerating container 1 in corrispondence of the area covered by the adhesive 29.

The metal ribbon 10 is then pressed over the surface 2 by a pressing roll 15 similar to the preceding roll 25 and the aluminum ribbon is then cut at the proper length by the cutter 7. Finally the refrigerating container is advanced to the next stage or station of the manufacturing process.

Preferably the anti-adhesive material comprises a ribbon of silicone treated paper or other sheet materiale having anti-sticking properties.

The adhesive used in the various embodiments of the process can be formed by a glue plus a solvent, such as a rubber or acrilic base, or a glue partially using a solvent, or a water glue, or even a glue without solvent, such as a hot melt adhesive.

Although not expressely described, the step of applying a laminar flow of a hot fluid for softening the adhesive layer can be incorporate in any of the above disclosed processes.

From the above description it is evident that several process steps are common to all the embodiments of the invention, and therefore the various embodiment of the process are easily accomplished - with a minimum of changes - through a same plant.

In the partial cross section view of Fig. 7 there is shown a refrigerating container 31 having the back outer wall 32 shaped with grooves 34 for receiving the refrigerating coil 33 in such a manner that it does not protrude from the flat surface of the wall 2. The aluminum sheet 10 is applied and secured to both the outer wall 2 and the coil thanks to an adhesive 38.

Fig.s 7A and 7B illustrate a detail of the refrigerating coil that can have either a circular or a semicircular cross section.

Claims

1. A process for applying a sheet of aluminum to the outer surface (2) of a refrigerating container (1), characterized by the steps of:

    a) horizontally positioning said refrigerating container (1) on a conveyor line (19, 18)
    b) applying a layer of adhesive and a predetermined length of an aluminum ribbon (10) onto the outer surface (2) of said refrigerating container (1),
    c) pressing said ribbon against the surface (2) of the refrigerating container (1) through a reciprocating movement of a pressing member (15) exerting a predetermined pressure over the ribbon;
    d) cutting (7) the ribbon (10) and advancing the refrigerating container (1) to the next stage of the manufacturing process.

2. A process as claimed in claim 1, characterized in that it further comprises the steps of:

    b1) unwinding a length of aluminum ribbon (10) from a roll (3);
    b2) uniformely depositing said adhesive (28) over the surface of said unwound aluminum ribbon (10);
    b3) turning downwards the ribbon surface carrying said adhesive (28);
    b4) applying said ribbon (10) with the adhesive (28) deposited thereon onto the surface (2) of said refrigerating container, at the desired location. (Fig. 4).

3. A process as claimed in claim 1, characterized in that it further comprises the steps of:

    b5) unwinding a roll (22) of an anti-adhesive ribbon material (22);
    b6) uniformely depositing said adhesive (29) over the surface of said unwound anti-adhesive ribbon (22);
    b7) turning downwards the antiadhesive ribbon surface carrying said adhesive (29);
    b8) applying the assembly formed by said anti-adhesive ribbon (22) and by the adhesive (29) at the desired location over the surface (2) of the refrigerating container (1);
    b9) pressing said assembly against the surface (2) of the refrigerating container (1) through a reciprocating movement of a pressing member (25) exerting a predetermined pressure over the ribbon;
    b10) cutting (27) a desired length of said assembly (22, 29);
    b11) removing said anti-adhesive material (22). (Fig. 6).

4. A process as claimed in claim 1, characterized in that it further comprises the steps of:

    b12) uniformely depositing said adhesive (28) over the surface of said refrigerating container (1);
    b13) unwinding a length of aluminum ribbon (10) from a roll (6);
    b14) applying said aluminum ribbon (10) over said deposited adhesive (28) on the outer surface (2) of said refrigerating container (1). (Fig. 5).

5. A process as claimed in claim 1, characterized in that it further comprises the steps of:

    b15) unwinding a predetermined length of a composite ribbon (9) formed by a laminated sheet comprising an aluminum sheet (10), an adhesive tape including a support (11) and an adhesive layer (12), applied to a face of said aluminum sheet (10), and a ribbon of a protective and separating material (13);
    b16) removing said protective and separating material (13) and winding it on a collecting roll (16);
    b17) applying the remaining composite ribbon at the desired location onto the surface (2) of the refrigerating container (1). (Fig. 3).

6. A process as claimed in any of the preceding claims, characterized in that it further comprises the step of applying a laminar flow of a hot fluid for softening the adhesive layer and improving the initial sticking.

7. A process as claimed in any of the preceding claims, characterized in that said pressing means comprises an idle roll (15, 25).

8. A process as claimed in claim 2 or 3, characterized in that said adhesive (28, 29) is deposited over the ribbon (10) when this latter runs substantially horizontally.

9. A composite ribbon article (9) to be applied to the outer surface of a refrigerating container (1) or the like in relation of thermal exchange with the refrigerating coil of said refrigerating container (1), characterized in that said ribbon (9) comprises a sheet (10) of aluminum, a layer of adhesive (12) applied on at least one of the faces of said aluminum sheet

(10), and a ribbon (13) of protective and separating material, said aluminum sheet having a thickness between 80 and 200 microns, and a thermal conductivity larger than 200 W/m°C.

10. A composite ribbon as claimed in claim 9, characterized in that said adhesive material (12) is a self cross-linking acrilic adhesive with a glass temperature (Tg) not lower than -50° and higher than 250°, applied with a base weight from 20 to 60 g/cm^2.

11. A composite ribbon as claimed in claim 9, characterized in that the material of the said sheet (10) is aluminum with a purity higher than 98% and a density between 2 and 3,5 g/cm^3, a specific heat of about 950 J/kg°C, a melting temperature comprised between 630 and 670°C, and in that said a protective and separating material (13) is silicone treated paper.

12. An apparatus for producing cold, such as a refrigerator, a freezer or the like, characterized in that its outer surface is provided with a metal sheet applied in accordance with one of the processes claimed in claims 1 to 8.

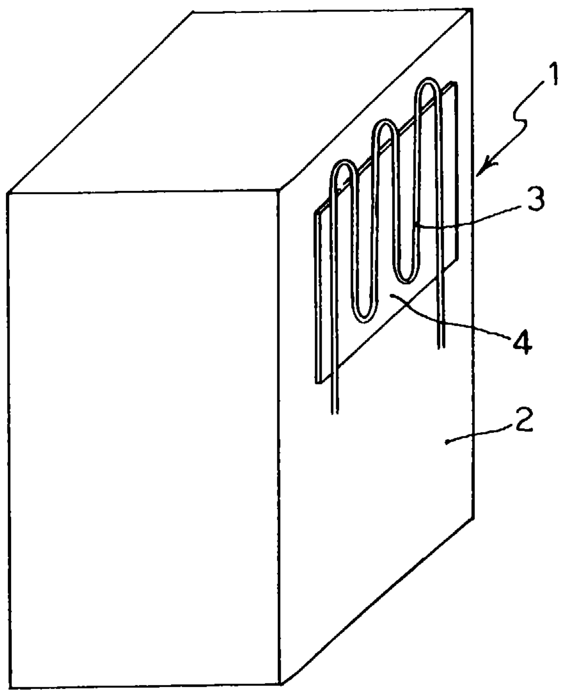


FIG. 1

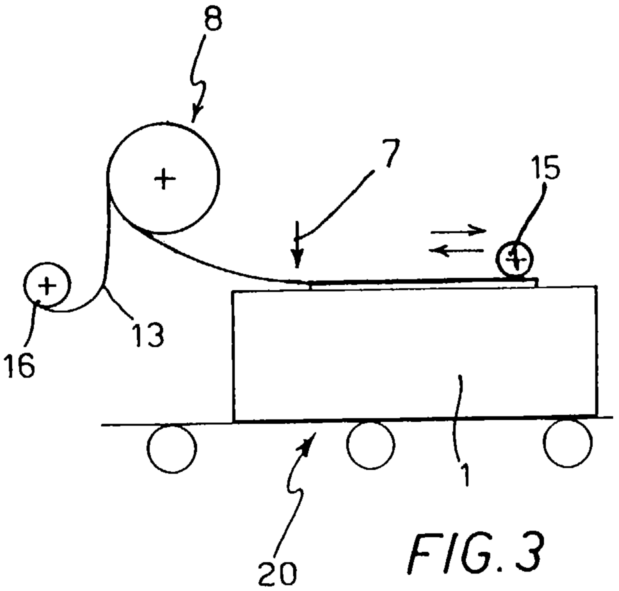


FIG. 3

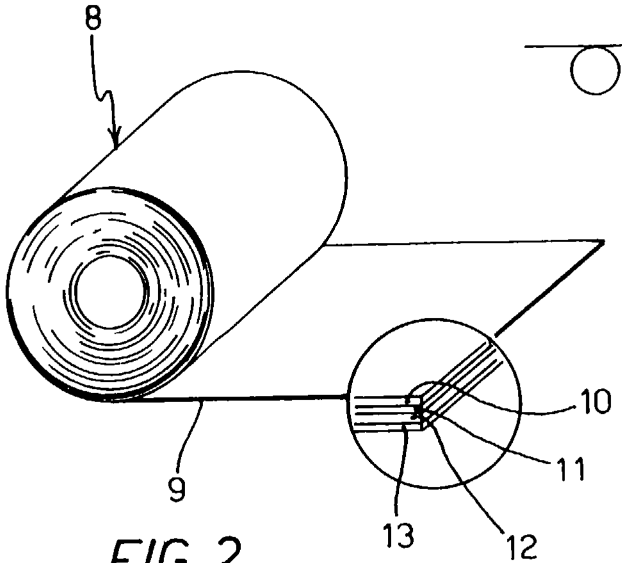


FIG. 2

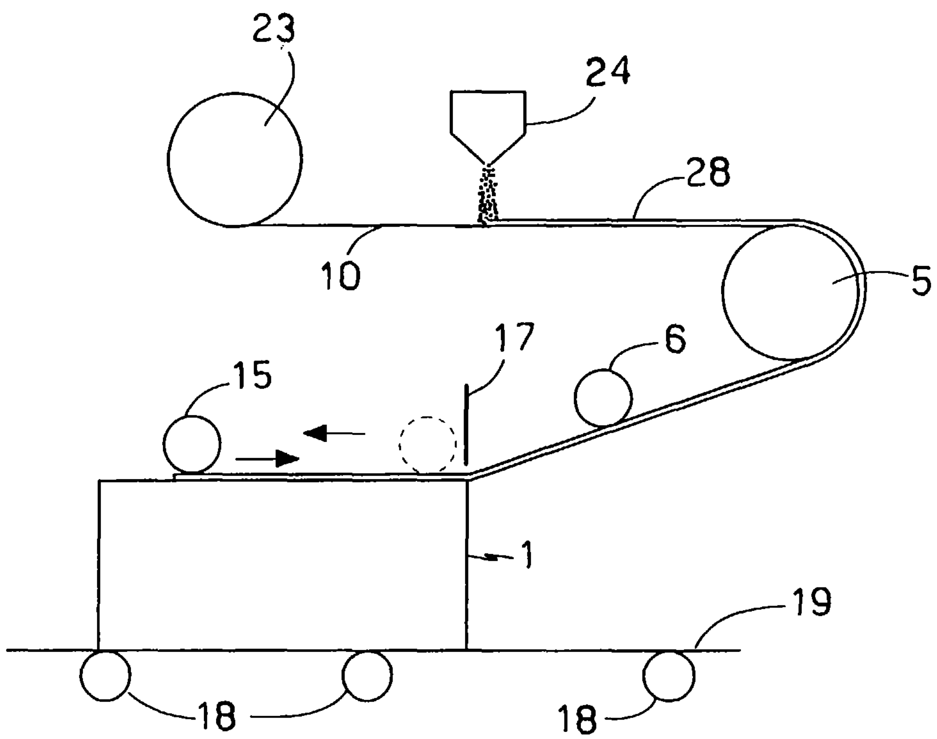
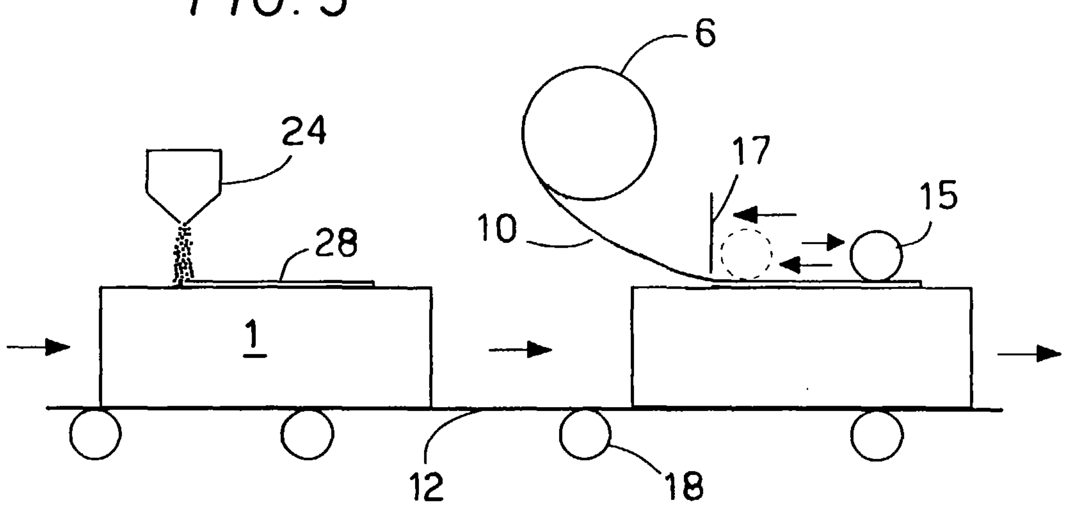


FIG. 4

FIG. 5



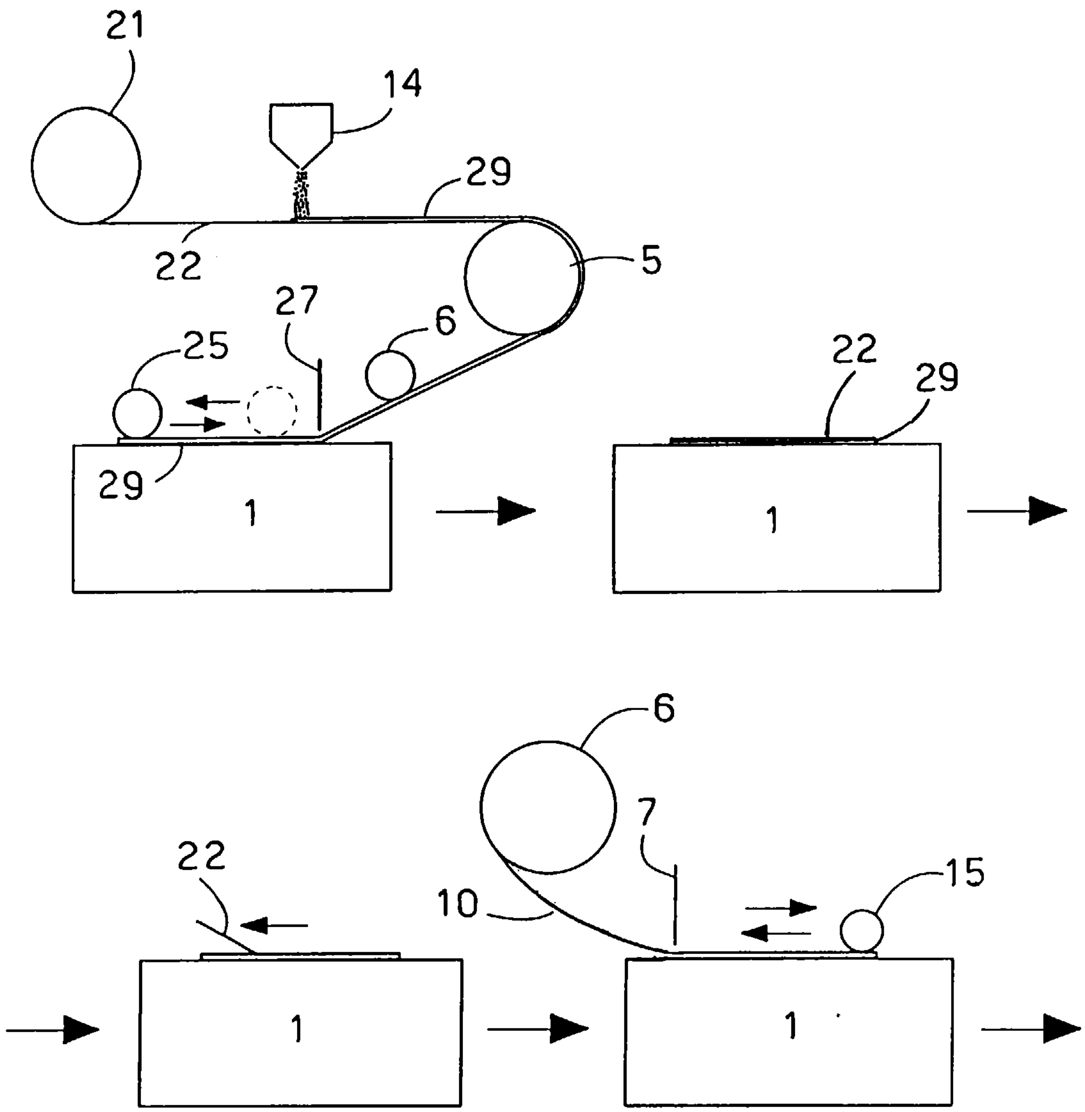


FIG. 6

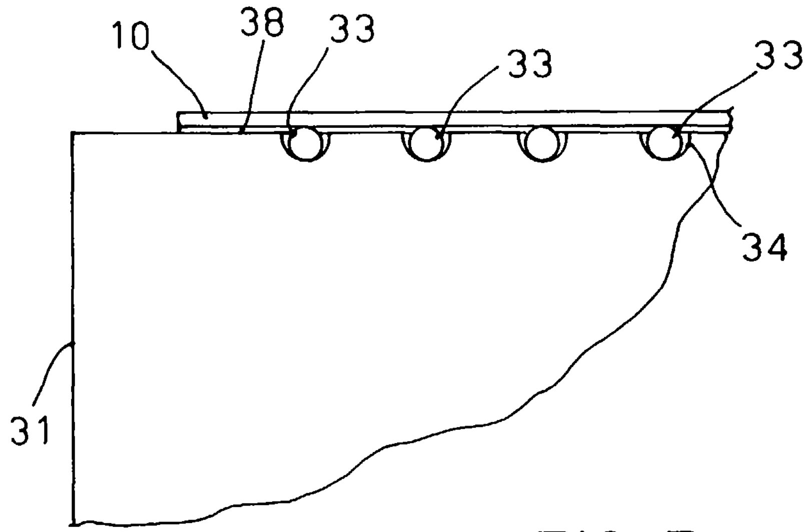


FIG. 7

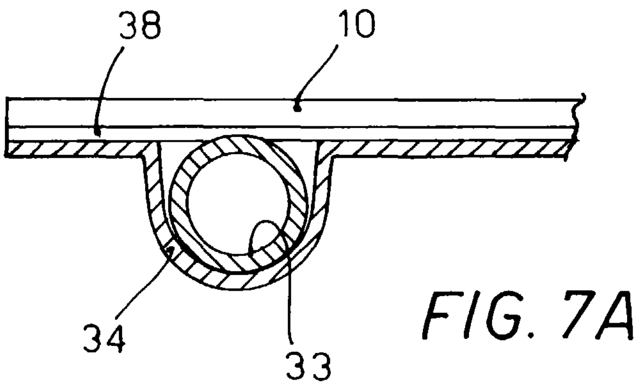


FIG. 7A

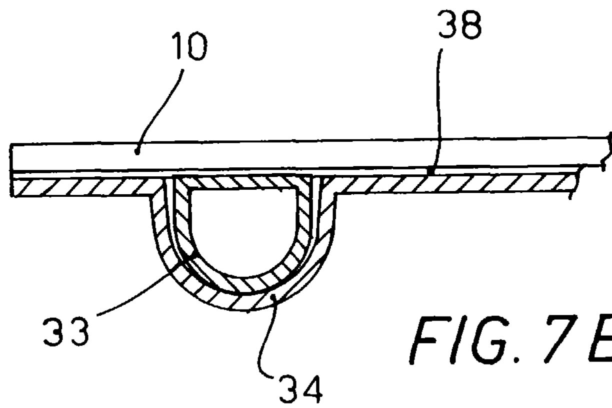


FIG. 7B