



US 20040026022A1

(19) **United States**

(12) **Patent Application Publication**
Toft

(10) **Pub. No.: US 2004/0026022 A1**

(43) **Pub. Date: Feb. 12, 2004**

(54) **METHOD AND DEVICE FOR PRODUCING A PACKAGING MATERIAL**

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(21) **Appl. No.: 10/433,436**

(22) **PCT Filed: Dec. 14, 2001**

(86) **PCT No.: PCT/SE01/02779**

(30) **Foreign Application Priority Data**

Dec. 18, 2000 (SE)..... 0004709-2

Publication Classification

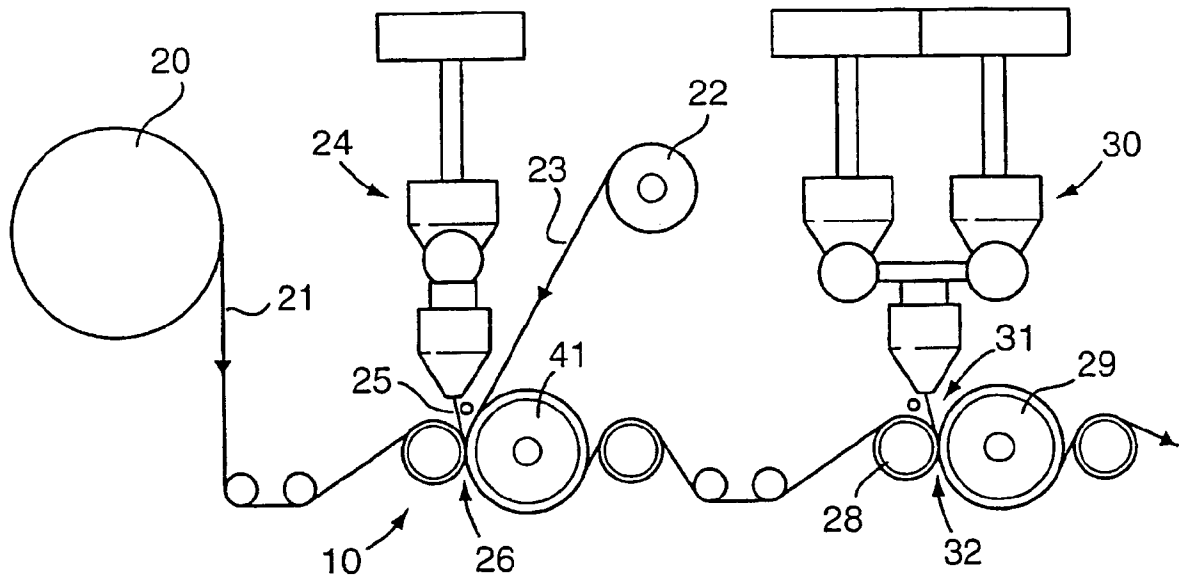
(51) **Int. Cl.⁷ B29C 47/06; B32B 3/10;**
B32B 29/00; B32B 31/06;
B32B 31/20

(52) **U.S. Cl. 156/244.22; 264/171.13; 156/244.27;**
156/244.24; 156/553; 156/555;
156/582; 428/537.5; 428/542.8

(57)

ABSTRACT

Press roll (10) for a laminating machine for producing a packaging material which comprises a carcass layer (42) consisting of paper or carton, and which carcass layer exhibits crease lines, through holes, openings or slits (43), which carcass layer exhibits, on one of its sides, a barrier layer (23), a plastic lining (31) which is arranged outside the barrier layer, and film (25) of laminant thermoplast which is arranged between the carcass layer and the barrier layer, with the said press roll (10) exhibiting a circular-cylindrical jacket surface having a facing (40) consisting of an elastic material. According to the invention, the said facing (40) comprises sections (44, 44') in the jacket surface, which sections exhibit local deformation ability in relation to the surrounding facing (40, 44). The invention also relates to a method for producing packaging material and to packaging material which has been produced using this method.



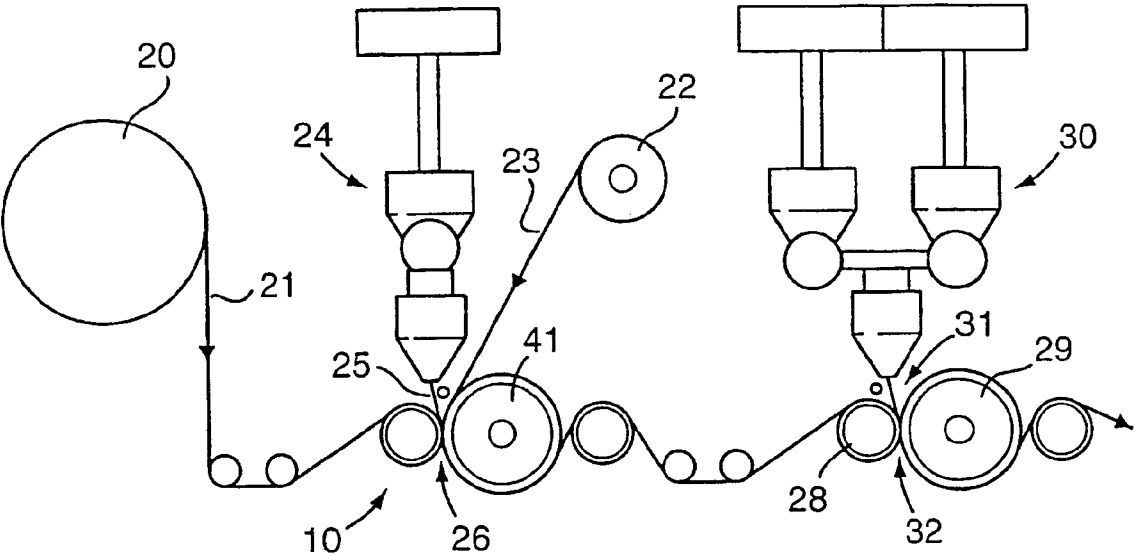


Fig 1

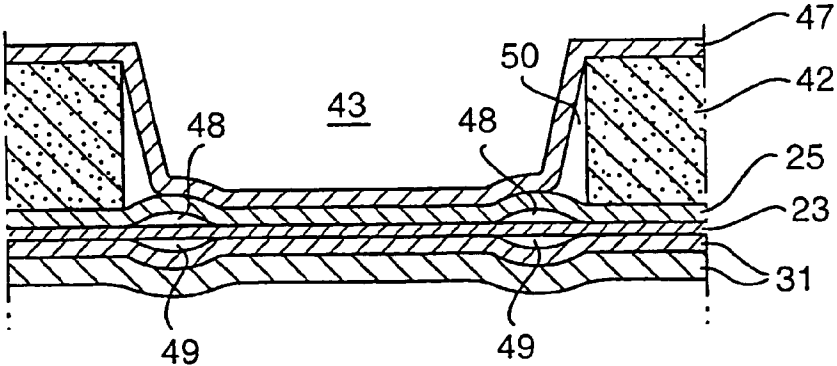


Fig 1a

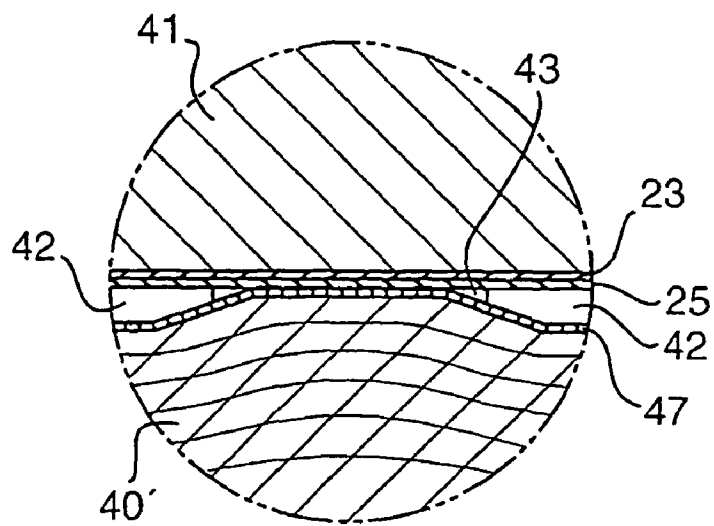


Fig 2

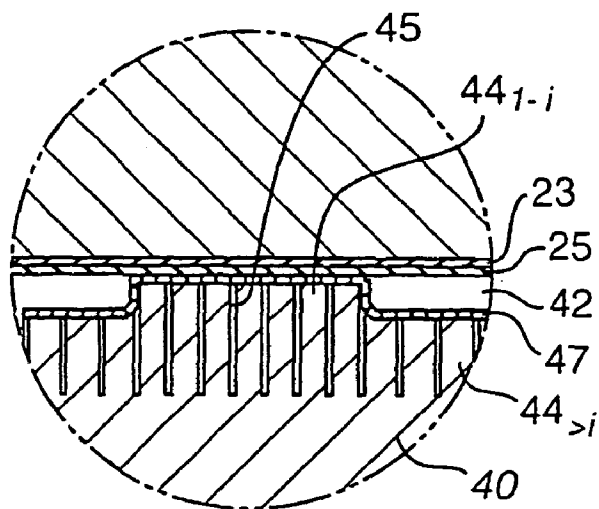
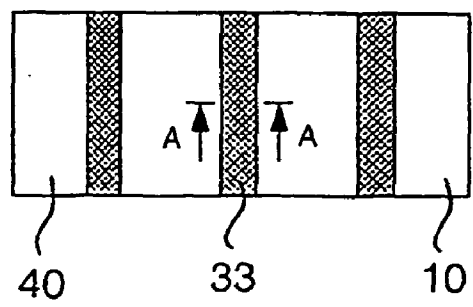
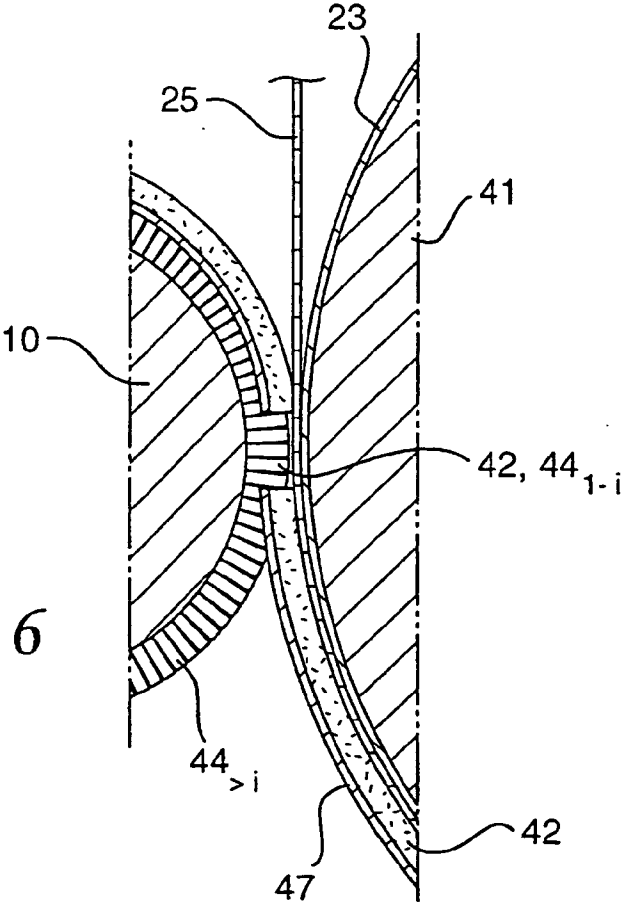
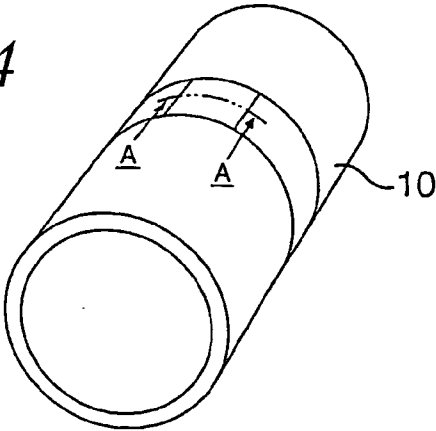
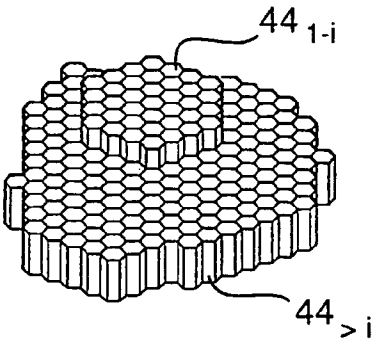
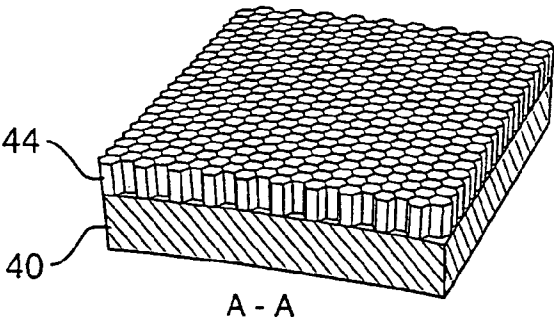


Fig 3 A - A





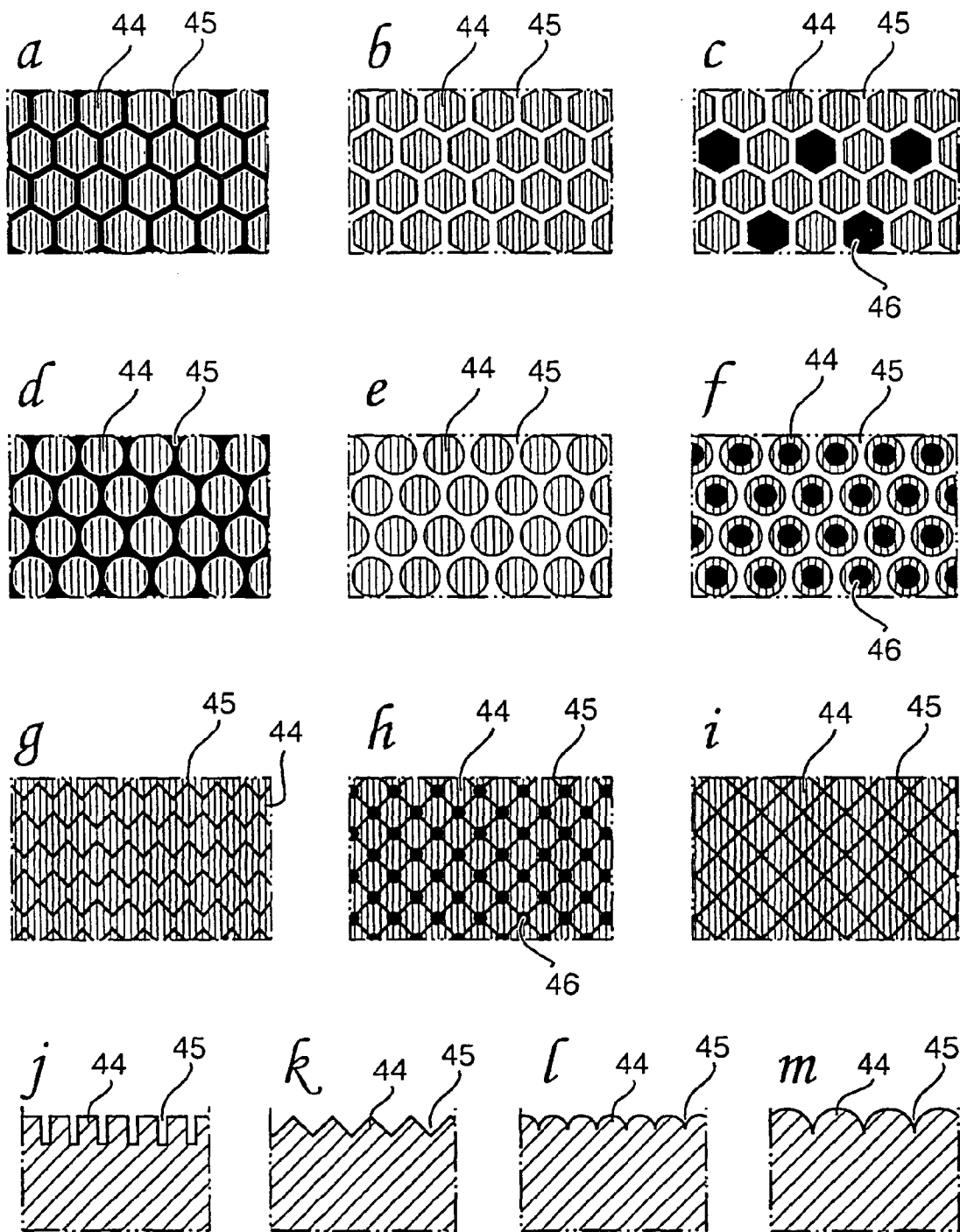


Fig 7

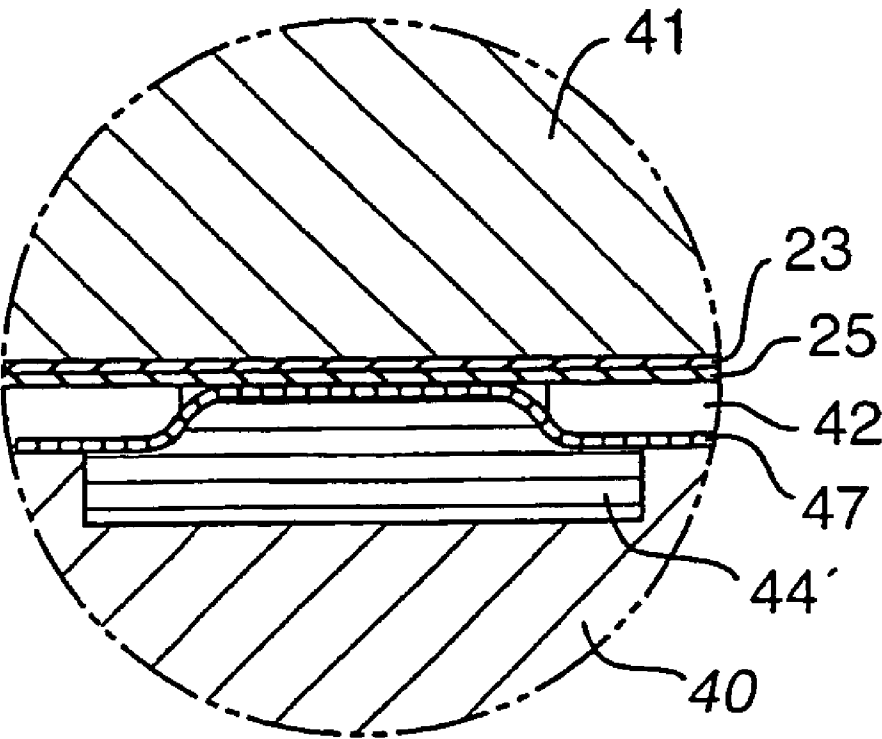
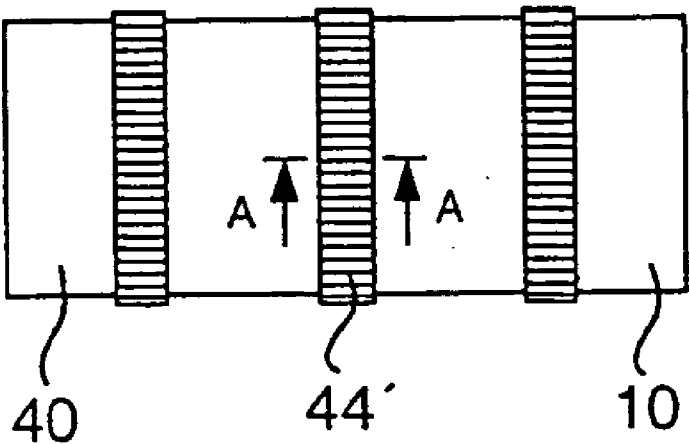


Fig 8

A - A



METHOD AND DEVICE FOR PRODUCING A PACKAGING MATERIAL

FIELD OF THE INVENTION

[0001] The present invention relates to a method for producing packaging material which is in the form of a continuous laminate web and is of the type which comprises a carcass layer made of paper or carton, one side of which exhibits a layer which is arranged outside the carcass layer and which comprises, on the one hand, a barrier layer and, on the other hand, a plastic lining which is arranged outside the barrier layer and which comprises one or more thermoplastic materials, with the carcass layer being covered by the said layer along the whole of its surface while the layer, along selected parts, extends beyond the edges of the carcass layer. In the present instance, a barrier layer means a layer which first and foremost constitutes a barrier to oxygen. A preferred layer consists of a metal foil layer, preferably an aluminium foil layer.

BACKGROUND OF THE INVENTION

[0002] Disposable packaging containers, particularly those for storing liquids, are frequently produced from a packaging material which consists of a carcass layer of paper, which layer is covered with thermoplastic materials and aluminium foil. The packaging material is frequently supplied in the form of webs which are reeled on storage reels and which, after having been unrolled from their storage reel, are converted, by means of folding, into packaging containers in automatic packaging machines. A commonly occurring packaging of this type is that which is marketed under the trade name TETRA BRIK and which is preferably used for liquid filling material of the milk, fruit juice, etc. type.

[0003] This packaging container is produced in automatic packaging and filling machines in such a way that the web which is unrolled from the storage reel is transformed into a tube by the edges of the web being joined in an overlap seam, after which the tube which has been formed is filled with the intended filling material and subdivided into individual packaging containers by means of repeated transverse seals, which are arranged at a distance from each other and at right angles to the tube. After the filling material which has been supplied has been enclosed in this way in sealed-off parts of the tube, these parts are separated from the tube by means of cuts made in the said transverse sealing zones. The subdivided tube parts are then shaped, by means of folding along crease lines which are arranged in the packaging material, to form packaging containers of the desired shape, for example a parallelepipedic shape.

[0004] Packagings of this type are frequently provided with opening notches in the form of holes, openings or slits which are made in the packaging material and which are covered with strips which can be torn off and which are normally termed "pull-tabs". Alternatively the packaging device is provided with an external opening device, for example in the form of a plastic pouring spout having a screw top for resealing, which opening device is only allowed to penetrate the packaging laminate in connection with the packaging being opened and the product being used. In this connection, the packaging laminate is provided with an opening which consists of a punched-out hole in the

carcass layer, over which hole aluminium foil and thermoplastic layers have been laminated. Thus, when the filling material consists of a sterile product, such as sterilized milk, or an acidic product, such as orange juice, the packaging container is frequently manufactured from a packaging laminate comprising an aluminium foil layer which makes the packaging extremely impervious to the penetration of gases, such as oxygen, which can oxidize the contents and impair its quality. In order to achieve the desired imperviousness, it is very important that the aluminium foil layer is not broken or damaged during the shaping of the packaging or when the packaging material is being manufactured and, for the function of the tear strip opening (the pull tab) or the penetrating opening device, it is of importance that the aluminium foil layer adheres extremely well to the area around the opening holes since otherwise the opening operation can easily fail. Thus when a covering strip has been affixed over the intended opening, this strip can be torn off in connection with this operation, without, for all that, the inner lining of plastic and aluminium foil being torn open. When a penetrating opening device is used, this opening device can fail to make a clean cut in the aluminium foil and thermoplastic layer, resulting in frayed edges.

[0005] An object of the invention is, in a simple and effective manner, to treat and prepare a packaging material web of the abovementioned type such that the edge of the packaging material web is effectively sealed off using an upper plastic film or a plastic film which is arranged around the edge zone. It is known to seal off liquid-absorbing material edges, which are exposed to the inside of a packaging container, with bridging thermoplastic strips or thermoplastic strips which are folded around the edges. It is also known, for the same purpose, to provide the packaging material web with what is termed a fixed plastic edge strip, i.e. with a plastic strip which projects from the edge of a carton web and which can be folded around the edge and sealed to its opposite side. Such a "fixed edge strip" is obtained by arranging carton webs alongside each other, such that they form a slit or gap between each other, after which the webs and the slits are jointly covered with a plastic foil or, in certain cases, with a plastic foil and an aluminium foil, after which the covered webs are separated by means of a cut made in the slit region, thereby forming a projecting, fixed strip. A drawback has hitherto been that it is not possible to obtain adherence, or it is at all events a poor adherence which is obtained, between, for example, an aluminium foil layer and a plastic layer in the region of the slits since the aluminium foil and the plastic layer cannot be pressed together within the region of the cut and, in particular, not right up to the boundary edges of the slits due to the varying thickness of the material and the resulting difficulty for the pressure rolls to compress the material within the slit region.

[0006] Packaging material of the type which is meant here can be produced by means of known technology, by applying the different layers, i.e. the aluminium foil layer, the inner plastic layer, etc., in several separate lamination operations, to the carcass layer consisting of paper or carton, and such a lamination procedure works very well when the carcass layer is not provided with holes, openings or slits, i.e. regions where the covering layers extend beyond or past edge zones of the carcass layer. It has been found that, when an aluminium foil is being layered onto a carcass layer web consisting of paper or carton, where the carcass layer is

provided with holes, openings or slits, difficulties arise due to the fact that, in connection with the lamination, where the binding laminating layer frequently consists of a thin extruded thermoplastic film, the aluminium foil has to be pressed against the carcass layer base using a press roll or soft pressure roll in order to achieve sufficient adherence between the aluminium foil layer and the carcass layer. Since the aluminium foil layer is as a rule very thin (from approx. 5 to 10 μm), it comes to be pressed, by the press roll, against the edges around the opening or the slits in the carcass layer and partially pressed into the said holes or openings. Since the perforations have a relatively sharp edge, there is a risk of the aluminium foil rupturing and, at all events, the risk arises of the aluminium foil becoming creased around the edges of the openings or the slits and, as a result, either being weakened or achieving poor adherence with the carcass layer precisely in the edge zones of the holes or openings. Furthermore, the adherence between the plastic layer and the aluminium foil layer is poor in the region of the said holes or slits since the pressure of the press roll in the said regions is limited due to the reduction in the thickness of the material in the said holes or slits.

[0007] The abovementioned circumstances have constituted a severe problem which has firstly caused ruptures in the aluminium foil layer, and consequently caused the gas-tightness of the packagings to be inadequate, secondly caused the opening function to be defective due to poor adherence between the aluminium foil layer and the carcass layer in the edge zones around the openings and thirdly caused poor adherence between the aluminium foil layer and the plastic layer along the parts where the aluminium foil layer and the plastic layer project outside the carcass layer and are consequently not supported by this layer when being pressed together.

[0008] The adherence between the aluminium foil layer and the film of laminant thermoplast which binds the aluminium foil layer to the carcass layer, and the adherence between the aluminium foil layer and the plastic lining which is arranged outside this layer (i.e. the plastic lining which comes to be in direct contact with the liquid which is to be stored in the finished packaging) are especially critical. In the region of the said holes or slits, this adherence is frequently poor since the material exhibits a reduction in thickness in the holes or slits, which reduction in thickness results in the pressure of the press nip being lower at these sites. In other words, the reduction in thickness means that the press nip, comprising a press roll and a cooled roll, is unable to press the aluminium foil layer and the different polymer layers together sufficiently for achieving the requisite adherence in essentially the whole of the region defined by the hole or the slit, particularly in the vicinity of the hole edges. This is expressed as air inclusions adjacent to the edges of the hole or slit, which in turn means that problems of fracture formation in the aluminium foil arise, leading to impaired gas-tightness and consequently problems with aseptis. The air inclusions also result in it being difficult to tear off or penetrate the membrane consisting of the aluminium foil and the polymeric films in the hole/slit, with the ability to open the packaging being restricted and/or with it not being possible to make a clean cut when penetrating, resulting in the formation of frayed edges.

[0009] The difficulty of solving the problem of poor pressure in the press nip in the region of the holes/slits is

aggravated by the fact that it is at the same time necessary, in the press nip, to pay regard to optimization aspects in relation to the adherence between the aluminium foil and the different polymer layers in the regions outside the regions of the holes/slits. The polymeric layer which is to be laminated to the aluminium foil is extruded in molten or semi-molten form directly into the press nip and has to be pressed together by the nip before the temperature of the polymeric material falls too much, in connection with which the material solidifies. This means that the line load in the nip is only effective for laminating during the course of a first, relatively short, press nip length. A press nip length which exceeds this effective press nip length only means that the line load is distributed over a greater area, something which is a disadvantage since the pressure in the press nip then becomes lower. For this reason, conventional press rolls are manufactured with a homogeneous surface facing of relatively high hardness, normally greater than 80-90 Shore A, giving a short press nip length. However, this relatively hard, homogeneous surface facing results in the adherence in the regions of the holes/slits being poor, as previously discussed.

[0010] Another problem in connection with laminating a polymer film to a carcass layer consisting of paper or carton, which carcass layer exhibits through holes, openings or slits, is that the polymeric material tends to accumulate in connection with these holes, openings or slits.

[0011] Problems with adherence between the different layers in the laminate can also arise in association with crease lines in the carcass layer consisting of paper or carton, with these problems being similar to those when holes, openings or slits are present.

SUMMARY OF THE INVENTION

[0012] The present invention aims to tackle the above complex of problems. In particular, the invention aims to offer a press roll which provides, in the hole regions or crease line regions of the carcass layer, improved adherence between the aluminium foil layer and one or more polymer layers which abut it, for example a plastic lining consisting of one or more thermoplastic materials and/or a film consisting of a laminant thermoplast, which layer(s) is/are extruded directly into a press nip which comprises the press roll in accordance with the invention. In this connection, the aim is that it should be possible to produce a press nip having an advantageously short press nip length and optimized line load at the same time as good adherence is achieved in the regions of the holes. Even in association with high line speeds, high line loads and short press nip lengths, the press roll according to the invention should be arranged such that it has time to penetrate into the hole regions or crease lines to laminate together the films and layers which are present at these locations.

[0013] These aims are achieved when use is made of the press roll according to the invention as defined in Claim 1.

[0014] The invention also relates to a method for producing a packaging material using the press roll according to the invention and to a packaging material which has been produced using the method.

[0015] The press roll comprises a metal core having a circular-cylindrical jacket surface, which jacket surface is faced with a facing consisting of an elastic material. Accord-

ing to the invention, the facing comprises sections which are located in the jacket surface and exhibit local deformation ability in relation to the surrounding facing. In this present instance, the expression "local deformation ability" means that a deformation within such a section is only propagated to the facing material outside of the section in question to a very limited extent as compared with the deformation spreading which takes place in an entirely homogeneous jacket material.

[0016] According to a preferred embodiment of the invention, the sections possessing local deformation ability are arranged in a large number, with what is mainly a uniform distribution over the whole of the jacket surface.

[0017] According to an alternative embodiment, the sections possessing local deformation ability are arranged as, or in, one or more regions which extend as cylindrical segments around the circumference of the roll in positions which correspond to the holes, the openings, the slits or the crease lines in the carcass layer of the packaging material. In this connection, each such segment can, in accordance with a first variant of this embodiment, constitute a homogeneous section having local deformation ability, with the said sections/segments being fashioned from a first elastic, polymeric material exhibiting a first damping and a first E-module, and with the surrounding facing being fashioned from a second elastic, polymeric material exhibiting a second damping and a second E-module, such that the said first damping and said first E-module are lower than the said second damping and said second E-module, respectively. Alternatively, according to another variant of the embodiment, each such segment around the circumference of the roll can comprise a large number of sections having local deformation ability and being distributed mainly uniformly over the whole of each respective segment.

[0018] As a result of the sections having local deformation ability, a desired penetration into the hole regions or crease line regions in the carcass layer is achieved when the carcass layer, the aluminium foil and the polymeric layer(s) pass through the press nip at the same time as a desired pressure can be maintained in the press nip, with the line load being retained, in the regions outside of the hole regions or crease line regions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The invention will be described in more detail below while referring to the figures, of which:

[0020] FIG. 1 shows a diagram of a line for laminating packaging material, which line comprises two press nips at least one of which uses a press roll in accordance with the invention,

[0021] FIG. 1a shows a packaging material which results from the line in FIG. 1, as seen in cross section,

[0022] FIG. 2 shows a section through the facing layer of a press roll according to the prior art, at a press nip against a cooling roll, with a packaging material having a hole in the carcass layer being located in the press nip,

[0023] FIG. 3 shows a press roll in accordance with a first, preferred embodiment of the invention as seen from the side, and also a section of the facing of this roll at a press nip

against a cooling roll, with a packaging material having a hole in the carcass layer being located in the press nip,

[0024] FIG. 4 shows the press roll according to FIG. 3 as seen in perspective and with an enlargement of a region of the facing of the roll,

[0025] FIG. 5 shows, in perspective, how a majority of the sections possessing deformation ability in FIG. 4 are able to be deformed locally at the same time as a smaller fraction of these sections resists deformation,

[0026] FIG. 6 shows the same principle as in FIG. 5, as seen in a transverse section through a press roll in abutment against a cooling roll, in a press nip through which a packaging material having a hole in the carcass layer is passing,

[0027] FIGS. 7a-m show different variants of patterns in the facing, which patterns provide location deformation ability in the jacket surface,

[0028] FIG. 8 shows a press roll in accordance with a second embodiment of the invention, as seen from the side, and a section of the facing of this roll, at a press nip against a cooling roll, with a packaging material having a hole in the carcass layer being located in the press nip.

DETAILED DESCRIPTION OF THE INVENTION

[0029] The line for producing a packaging laminate of the type which is referred to here, which line is shown diagrammatically in FIG. 1, comprises a storage reel 20 containing a web 21 of fibre material, i.e. paper or carton, which, on one of its sides, can exhibit a thin coating of a thermoplastic material, for example polyethylene. A storage reel containing a thin aluminium foil web 23 (5-20 μm) is designated 22 and an extruder for forming a film of molten laminant thermoplast 25 (preferably polyethylene) is designated 24. A press roll 10, in accordance with the invention, interacts, in a press nip 26, with a cooling counter roll 41 having a steel surface in the laminating machine which is formed from these elements and also the extruder 24. From this first laminating machine 10, 41, 24, the packaging laminate, which is now semifinished, proceeds onwards to a second laminating machine which comprises a press nip 32, having a press roll 28 and a cooling counter roll 29, and an extruder 30, which can be arranged to coextrude a double-sided film 31 consisting of two different thermoplastic materials. In the second laminating machine 28, 29, 30, the semifinished packaging laminate which comes from the first laminating machine 10, 41, 24 is laminated together with this double-sided film 31 on that side of the laminate which exhibits the aluminium foil. The double-sided film can, for example, comprise ethylene acrylic acid ester, EAA, which is laminated closest to the aluminium foil, and low density polyethylene, LDPE, on the outside of this. During operation of the lamination line which is shown in FIG. 1, the press roll 10 typically has a peripheral speed of up to 800 m/min, preferably 300-700 m/min, and even more preferably 400-700 m/min. The line load in the press nip 26 is typically 20-60 N/mm, preferably 20-50 N/mm, and the press nip length is at least 20 mm, preferably 20-35 mm, and even more preferably 20-30 mm. That which takes place in the press nip 26 as a result of the invention will be described in more detail in connection with FIGS. 3-8.

[0030] FIG. 1a shows the resulting packaging laminate from the line in FIG. 1 as seen in cross section. The carcass layer 42 plus its initial coating layer (decor) 47 correspond to the web 21 in FIG. 1. The designations of the remaining layers are the same as for the webs/films which are shown in FIG. 1. FIG. 1a also illustrates the problem of air inclusions 48, 49, 50 in the packaging laminate, which air inclusions can be decreased using the present invention. The air inclusions 48, 49 on either side of the aluminium layer 23 are most critical for the function of the laminate and are those which the invention is principally intended to decrease.

[0031] FIG. 2 shows a section through a facing layer 40' of an press roll in accordance with the prior art, at a press nip against a cooling roll 41, with a packaging material 42 having a hole 43 in the carcass layer being located in the press nip. The carcass layer 42, and consequently the side walls of the hole 43, typically exhibit a height (thickness) of about 0.2-0.5 mm. The hole 43 in the carcass layer can have any selected form whatsoever and normally exhibits a largest dimension (diameter or length) of at least about 10 mm and at most about 30 mm; however, it is also possible to conceive of smaller holes, for example for drinking straws. As can be seen, problems arise in the region of the hole 43 due to the fact that the facing layer 40', which is homogeneous and of a relatively high degree of hardness, is unable to be deformed locally around the edges of the hole. The facing of the press roll is therefore unable to satisfactorily penetrate down in the hole region in order to achieve perfect adherence between the different laminate layers which are present in this region, thereby leading to the problems which have been described above.

[0032] FIG. 3 shows a preferred press roll according to the invention, which roll is generally designated by 10. This roll typically exhibits an outer diameter of about 200-450 mm, in connection with which it should, however, be understood that the invention is not restricted to such diameters. While the core of the roll consists of a solid metal core, usually made of steel, it is naturally also possible to conceive of this core not being of a solid design. A facing 40 consisting of an elastic material (seen in the section) is arranged on the circular-cylindrical jacket surface of the core. This facing 40 comprises sections 44 possessing local deformation ability, in accordance with the invention. More specifically, these sections 44 possessing local deformation ability are formed by a pattern in the jacket surface of the press roll 10, i.e. in the outer part of its facing 40 but not right down to the core of the roll. In this connection, each section 44 consists of a unit which is free standing/delimited from the remainder of the facing material.

[0033] In the press nip, a certain number of sections/units 44_{1-i}, namely as many as correspond to the area of the hole 43, can penetrate down in the hole 43 in order, in the hole, to produce a pressure on the different lining layers of the packaging laminate, against the cooling roll 41, which lining layers extend over the hole 43 in the carcass layer 42 of the packaging laminate. The sections/units 44_{>i} which are located outside the area of the hole 43 are able, instead, to be deformed locally such that a desired line load is achieved over the remaining areas of the packaging laminate. Between the sections 44, there are spaces 45 (shown clearly in FIG. 7) in which a void is present. Alternatively, the spaces 45 are filled with a compatible material, for example

foamed rubber, which provides good adhesion to the sections possessing local deformation ability. This filler material expediently exhibits a lower E module and damping than the material of which the sections consist. Advantages of the spaces 45 being filled with a filler material are that the risk of damage to the free standing sections is decreased and that it becomes easier to remove any molten thermoplast which has happened to end up on the jacket surface after possible mishaps in the production.

[0034] In FIG. 3, the sections 44 are arranged in areas 33 which consist of cylindrical segments around the circumference of the roll, with the positions of the areas 33 corresponding to the positions of the holes in the carcass layer of the packaging laminate when the carcass layer runs over the roll. However, it is also very definitely possible to conceive of the sections 44 covering the whole, or essentially the whole, of the jacket surface with an essentially uniform distribution (not shown).

[0035] As a result of the jacket surface being profiled in this way, "deformation space" is created very locally. When the facing of the roll is deformed locally, the deformation will not be propagated in the same way as in a conventional, homogeneous jacket facing but, instead, be restricted locally due to the voids between the sections being filled by surrounding deformed sections or due to the filler material between the sections being compressed and breaking the force of the deformation of the sections. For this reason, it is possible to create large deformations very locally in the jacket facing without the surrounding contact surface being more than marginally affected.

[0036] FIG. 4 shows an press roll in accordance with FIG. 3 together with a magnified part of the facing material. FIG. 5 illustrates how a group of free standing sections 44_{1-i} is able, in association with a notional, but not shown, hole in the carcass layer 42 of the packaging laminate, to resist the deformation to which the surrounding sections 44_{>i} in the facing are subjected. FIG. 6 illustrates how the sections 44_{1-i} are deformed in the areas around a hole 43 in the packaging laminate while the sections 44_{1-i} in the area of the hole 43 resist deformation, as seen in a cross section through the press nip between the press roll 10 and the cooling roll 41.

[0037] FIGS. 7a-m show a number of different conceivable patterns in which the sections 44 are arranged. FIGS. 7a-c illustrate how the sections can exhibit hexagonal cross sectional profiles, with the spaces 45 between the sections in FIG. 7a consisting of voids while the corresponding spaces in FIG. 7b are filled with a compressible material. FIG. 7c shows how the facing can comprise through holes 46 which preferably extend right down to the core of the roll, which core is then expediently at negative pressure. FIGS. 7d-f show corresponding types of sections, with or without filler material and through holes, where the sections exhibit circular cross sectional profiles. FIGS. 7g-h show how the sections 44 can be arranged in a wave or zigzag pattern (with through holes 46 in FIG. 7h), it being possible for the spaces 45 between sections 44 to consist of voids or be filled with a filler material. The same applies, in a corresponding manner, to the design in FIG. 7i, which design corresponds to the cross section shown in FIG. 7j and shows a diamond pattern in which the sections 44 exhibit quadrangular cross sectional profiles. It is possible to conceive of other alternative patterns, for example with the sections consisting of

elevated hemispheres, as is illustrated in the cross sections shown in **FIG. 7l** and **7m**, or pyramids, as is illustrated in the cross section in **FIG. 7k**. It will be understood that it is also possible to conceive of using a number of geometries which are similar to those shown.

[0038] According to one aspect of the invention, the said sections **44** are arranged in a number amounting to 0.5-20 per cm, preferably 1-10 per cm, and even more preferably 3-6 per cm, in at least one extension direction in the jacket surface. Furthermore, the geometry should be such that an aggregate volume V_{se} of the sections **44** is related to an aggregate volume V_{sp} of the said spaces **45** between the sections such that $0.3 \cdot V_{sp} < V_{se} < 10 \cdot V_{sp}$, preferably $0.5 \cdot V_{sp} < V_{se} < 7 \cdot V_{sp}$, and even more preferably $V_{sp} < V_{se} < 5 \cdot V_{sp}$. In this connection, any through holes **46** are not included in the volume V_{sp} of the spaces **45**. In addition, a maximal height H of one of the said sections **44** should be related to a distance L such that $0.2 \cdot L < H < 3 \cdot L$, preferably $0.3 \cdot L < H < 2 \cdot L$, and, even more preferably $0.5 \cdot L < H < 1.5 \cdot L$, where L is the shortest distance between the bottoms of two spaces **45** on each respective side of the said section **44**.

[0039] The advantage of also having through holes **46** in the facing **40** is that this creates an additional expansion space for the sections **44** when the latter are deformed. If the core of the roll is additionally under negative pressure and the through holes **46** extend right down in the core, this then achieves an improved deaeration of the packaging laminate, thereby preventing or decreasing air inclusions in the laminate.

[0040] **FIG. 8** shows yet another alternative embodiment of the invention in which each locally deformable section **44'** consists of an area or segment which is essentially homogeneous both in a direction around the circumference of the roll **10** and in an axial direction of the jacket surface, preferably extending 3-15 cm in the axial direction. These sections **44'** are made up of a first elastic, polymeric material exhibiting a first damping and a first E module whereas the surrounding facing **40** is made up of a second elastic, polymeric material exhibiting a second damping and a second E module, with the said first damping and the said first E module being lower than the said second damping and the said second E module, respectively. Preference is given to the sections **44**, consisting of insertions in the facing **40**, which insertions exhibit a thickness which constitutes 5-25%, preferably 7-20%, and even more preferably 8-15%, of an aggregate thickness of the insertions **44'** plus the facing **40**, with the roll **10** preferably exhibiting, at these sections **44'**, a diameter which is greater than a diameter in association with the surrounding facing, meaning that the section **44'** projects a short distance outside the surrounding jacket surface.

[0041] In addition to the improved ability of the press roll to penetrate down in holes, slits, openings or crease lines in the packaging laminate, an advantage of the invention is that the nip force can be lowered in relation to a conventional press roll for the purpose of achieving the requisite contact surface and local deformation. An advantage of arranging the locally deformable sections in segments is that a high local deformation is achieved where this is required at the same time as the rigidity of the conventional press roll is otherwise retained. This means that, while the nip pressure

is high in general, it is locally lower in association with the holes in the packaging laminate, where the deformation is greater instead.

[0042] The invention is not limited by the above-described preferred embodiments. Thus, it should be understood, for example, that the press roll according to the invention can equally well be used as the press roll **28** in the second laminating machine in **FIG. 11** in connection with which the press roll in the first laminating machine can be of the type according to the invention or of a conventional type. It should also be understood that the press roll according to the invention can also be used in lamination lines in which the order in which the different layers of the packaging laminate are laminated together is different. In brief, it can be used when laminating packaging laminates which possess holes, slits, openings or crease lines in the carcass layer irrespective of the type of lamination line and irrespective of the order in which the different layers in the laminate are laminated together.

1. Press roll (**10**) for a laminating machine for producing a packaging material in the form of a web of the type which comprises a carcass layer (**42**) consisting of paper or carton, and which carcass layer exhibits crease lines, through holes, openings or slits (**43**), which carcass layer exhibits, on one of its sides, a barrier layer (**23**), preferably aluminium foil, a plastic lining (**31**) which is arranged outside the barrier layer and which comprises one or more thermoplastic materials, and a film (**25**) which consists of laminant thermoplast and which is arranged between the carcass layer and the barrier layer, with the said press roll (**10**) comprising a metal core exhibiting a circular-cylindrical jacket surface, which jacket surface exhibits a facing (**40**) consisting of an elastic material,

characterized in that the said facing (**40**) comprises sections (**44**, **44'**) in the jacket surface, which sections exhibit local deformation ability in relation to the surrounding facing (**40**, **44**).

2. Press roll according to claim 1, characterized in that the said sections (**44**) are arranged in large number, with an essentially uniform distribution over the jacket surface.

3. Press roll according to claim 1, characterized in that the said sections (**44**, **44'**) are arranged as, or in, one or more areas (**33**, **44'**) which extend as cylindrical segments around the circumference of the roll (**10**).

4. Press roll according to any one of the preceding claims, characterized in that the said sections (**44**) are arranged in a quantity amounting to 0.5-20 per cm, preferably 1-10 per cm, and even more preferably 3-6 per cm, in at least one extension direction in the jacket surface.

5. Press roll according to any one of claims 2-4, characterized in that a void is present in the spaces (**45**) between the said sections (**44**) or in that a compressible material, having a lower E module and lower damping than a material of which the said sections consist, is arranged in these spaces.

6. Press roll according to claim 5, characterized in that an aggregate volume V_{se} of the sections (**44**) is related to an aggregate volume V_{sp} of the said spaces (**45**) between the sections such that $0.3 \cdot V_{sp} < V_{se} < 10 \cdot V_{sp}$, preferably $0.5 \cdot V_{sp} < V_{se} < 7 \cdot V_{sp}$, and even more preferably $V_{sp} < V_{se} < 5 \cdot V_{sp}$.

7. Press roll according to claim 6, characterized in that a maximal height H of one of the said sections (**44**) is related

to a distance L such that $0.2 \cdot L < H < 3 \cdot L$, preferably $0.3 \cdot L < H < 2 \cdot L$, and, even more preferably $0.5 \cdot L < H < 1.5 \cdot L$, where L is the shortest distance between a bottom of two spaces (45) on each respective side of the said section (44).

8. Press roll according to any one of the preceding claims, characterized in that the said sections (44) are designed with a cross section which is circular, triangular, quadrangular or hexagonal, in that the said sections are designed as elevated hemispheres or pyramids, or in that the said sections are designed as extended, wave-shaped or zigzag-shaped profiles.

9. Press roll according to any one of the preceding claims, characterized in that the said facing (40) also comprises through holes (46) which extend from the jacket surface and down in the core of the roll (10), the roll also comprising means for creating a negative pressure in the said core.

10. Press roll according to claim 3, characterized in that each section consists of a section (44') which is essentially homogeneous in a direction around the circumference of the roll (10) and in an axial direction of the jacket surface, preferably having an extension of 3-15 cm in the said axial direction.

11. Press roll according to claim 10, characterized in that the said sections (44') are made up of a first elastic, polymeric material exhibiting a first damping and a first E module, and in that the surrounding facing (40) is made up of a second elastic, polymeric material exhibiting a second damping and a second E module, with the said first damping and the said first E module being lower than the said second damping and the said second E module, respectively.

12. Press roll according to claim 10 or 11, characterized in that the said sections (44') consist of insertions in the facing (40), which insertions exhibit a thickness which constitutes 5-25%, preferably 7-20%, and even more preferably 8-15%, of an aggregate thickness of the insertions plus the facing, with the roll (10) preferably exhibiting, at the said sections (44'), a diameter which is greater than a diameter at the surrounding facing (40).

13. Method for producing packaging material in the form of a web of the type which comprises a carcass layer (42) consisting of paper or carton, which carcass layer exhibits

crease lines, through holes, openings or slits (43), and which carcass layer exhibits, on one of its sides, a barrier layer (23), preferably aluminium foil, a plastic lining (31) which is arranged outside the barrier layer and which comprises one or more thermoplastic materials, and a film (25) of laminant thermoplast which is arranged between the carcass layer and barrier layer, with the said barrier layer being brought, at the same time as the said carcass layer, to adhere to the said plastic lining and/or to the said film of laminant thermoplast in a press nip (26; 32), to which the said plastic lining and/or the said laminant thermoplast is extruded, in molten or semimolten form, and in the form of a continuous film (25; 31), characterized in that the said press nip (26; 32) comprises an press roll (10; 28) in accordance with any one of the preceding claims.

14. Method according to claim 13, characterized in that the said press nip (26; 32) also comprises a cooling counter roll (41; 29).

15. Method according to either of claims 13 or 14, characterized in that the said press roll (10; 28) exhibits a peripheral speed of up to 800 m/min, preferably 300-700 m/min, and even more preferably 400-700 m/min.

16. Method according to any one of claims 13-15, characterized in that the said press nip (26; 32) exhibits a line load of 20-60 N/mm, preferably 20-50 N/mm, and a press nip length of at least 20 mm, preferably 20-35 mm, and even more preferably 20-30 mm.

17. Packaging material in the form of a laminate of the type which comprises a carcass layer (42) consisting of paper or carton, which carcass layer exhibits crease lines, through holes, openings or slits (43), and which carcass layer exhibits, on one of its sides, a barrier layer (23), preferably aluminium foil, a plastic lining (31) which is arranged outside the barrier layer and which comprises one or more thermoplastic materials, and a film (25) of laminant thermoplast which is arranged between the carcass layer and the barrier layer, characterized in that it is produced using the method according to any one of claims 13-16.

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