(19) DANMARK

(10) DK/EP 1911574 T4

Patent- og Varemærkestyrelsen

(12) Oversættelse af ændret europæisk patentskrift

(51) Int.Cl.: *B 31 F 1/07 (2006.01)* *D 21 F 11/00 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2019-07-01**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om opretholdelse af patentet i ændret form: **2019-03-20**

(86) Europæisk ansøgning nr.: **07425604.1**

(86) Europæisk indleveringsdag: **2007-10-01**

(87) Den europæiske ansøgnings publiceringsdag: **2008-04-16**

(30) Prioritet: **2006-10-11 IT FI20060245**

(84) Designerede stater: **AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR**

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(54) Benævnelse: **Papirmateriale med et forbedret præget mønster og fremgangsmåde til fremstilling deraf**

(56) Fremdragne publikationer:
WO-A-00/78533
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US-A- 3 961 119
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US-A- 6 109 326
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DESCRIPTION

Technical field

[0001] The invention relates to improvements to embossed web materials, especially based on tissue paper, of the multi-ply type, i.e. comprising four plies bonded together by gluing. The invention also relates to improvements to the processing methods to emboss materials made of tissue paper or the like, to obtain new and improved functional characteristics.

[0002] The invention also relates to a method for the production of a material of this type.

Prior art

[0003] Embossing is one of the operations that are normally performed on plies or sheets of tissue paper, to produce paper articles for personal and household cleaning and hygiene, and also for professional and industrial use, such as toilet paper, kitchen towels, paper napkins and handkerchiefs and the like.

[0004] Embossing is an operation that is performed for the dual purpose of improving aesthetic properties and increasing functional properties, in particular the softness, smoothness, absorption capacity or thickness of the finished material.

[0005] Normally, a tissue paper material, such as kitchen towel or toilet paper, is produced from two or more plies of paper embossed separately and subsequently bonded together by applying a glue and laminating the plies between counter-rotating rollers defining a lamination nip.

[0006] Embossing is, for example, performed by feeding each ply between an embossing roller, provided with protuberances, and a pressure roller with an outer surface coated in yielding material, such as rubber or the like. In some machines embossing is performed between two rollers made of steel or another hard material, one equipped with protuberances and the other with corresponding recesses. The protuberances of the embossing roller produce corresponding protuberances or projections in the paper ply. The protuberances formed in the two outermost plies are facing the inside of the finished product.

[0007] According to a possible technique (known as "tip-to-tip"), the two plies of paper web material are bonded by making at least some of the protuberances of one ply coincide with the protuberances of the other ply, having previously applied glue to the protuberances of one of the two plies, or to at least some of these protuberances. In practice, in tip-to-tip embossing machines two embossing rollers which emboss the two paper plies separately by means of respective pressure rollers, form therebetween a lamination nip, through which the two

embossed plies are fed before being detached from the rollers. In the lamination nip the protuberances of one roller coincide with the protuberances of the other roller and the reciprocal distance between the rollers is such as to cause localized compression of the plies at said protuberances.

[0008] A tip-to-tip embossing unit to obtain a product of this type is described in US-A-3,414,459. Further tip-to-tip embossing units are described in US-A-5,173,351; US-A-6,032,712; US-A-6,245,414; US-A-6,053,232.

[0009] US-A-3,961,119 discloses a method for the production of a two-ply embossed web or sheet material, wherein two plies are individually embossed between an embossing roller and a pressure roller. The embossing rollers are provided with helically developing projections and grooves. The first roller has projections with individual protrusions thereon, matching with indentations provided on the helical projections of the second embossing roller. Glue is applied on the first ply in correspondence of said individual protrusions, such that the two plies are spot-glued to one another in correspondence of said protrusions and indentations.

[0010] According to a different technique, known as "nested", the two plies are embossed separately, each between an embossing roller and a counter-roller or pressure roller, and then matched so that the protuberances of one ply are inserted between the protuberances of the other ply. Lamination of the two plies to obtain reciprocal bonding is performed between one of the embossing rollers an a laminating roller, while the two embossing rollers do not normally touch. Examples of embossing-laminating devices of this type are described in US-A-3,556,907; US-A-3,867,225; US-A-5,339,730.

[0011] US-A-5,686,168 describes a method of nested embossing, wherein the plies are bonded by lamination between two opposed embossing rollers.

[0012] US-A-6,578,617 and US-A-6,470,945 describe embossing units that can perform embossing according to both techniques, i.e. nested or tip-to-tip. To switch from tip-to-tip to nested embossing, the reciprocal angular position and/or the reciprocal axial position of the two embossing rollers can be modified.

[0013] US-A-6,261,666 describes an analogous device for alternatively performing tip-to-tip or nested embossing. Another similar device is described in US-A-6,109,326.

[0014] Initially, embossing was performed according to very simple geometric patterns, with uniform distribution of truncated-cone or truncated-pyramid shaped protuberances. These embossings had a prevalently technical function, and were used to produce a product of adequate thickness and with sufficient softness and absorption capacity.

[0015] Currently, embossing must increasingly achieve a dual function, both technical-functional and aesthetic. Therefore, embossing patterns and embossing devices have been developed which make it possible to obtain a product that is aesthetically pleasing and at the

same time suitable to satisfy the aesthetic requirements and increasing commercial requirements demanded of these products. Examples of complex embossing patterns with a technical and aesthetic function are described in US-A-6,136,413; US-A-5,846,636; US-A-6,106,928.

[0016] A new embossing technique that makes it possible to obtain particularly refined and easily interchangeable motifs is described in US-A-6,755,928 and in US-A-6,681,826.

[0017] The technical function of embossing tissue paper products has always been aimed at increasing the liquid absorption properties and apparent thickness of the product. In fact, embossing was, and continues to be, utilized prevalently in the field of kitchen towels, more than in the field of toilet paper.

Objects and summary of the invention

[0018] An object of the invention is to produce an embossing pattern that gives the tissue paper a different function from that of conventional products.

[0019] This object is achieved with a method according to claim 1 and with a product according to claim 3. Additional advantageous embodiments and features of the method and product according to the invention are set forth in the dependent claims.

[0020] Further advantageous features and embodiments of the method and of the material according to the invention are set forth in the dependent claims, which are incorporated in the present description, and will be described in more detail hereunder with reference to some non-limiting embodiments of the invention.

Brief description of the drawings

[0021] The invention will be better understood by following the description and accompanying drawing, which shows some non-limiting practical embodiments of the invention. More specifically, in the drawing:

Figure 1 shows a diagram of a first embossing-laminating unit not falling within the scope of the claims;

Figure 2 shows a diagram of a second embossing-laminating unit not falling within the scope of the claims n;

Figures 2A, 2B show enlarged details of Figure 2;

Figures 3 to 5 show sections and partial axonometric views of a portion of a web material not falling within the scope of the claims;

Figures 6 and 7 show schematic plan views of possible embodiments of the embossing pattern not falling within the scope of the claims;

Figure 8 shows a schematic section of a web material according to a further embodiment not falling within the scope of the claims;

Figure 9 shows a plan view of a fragment of a further embodiment not falling within the scope of the claims;

Figure 10 shows a schematic local section according to X-X in Figure 9;

Figures 11 to 13 show schematic plan views of further embossing patterns;

Figure 14 shows a schematic side view of an embossing device according to one embodiment of the invention;

Figure 15 shows an enlargement of the detail shown at XV in Fig.14;

Figures 16-18 show enlarged and diagrammatic cross sections of multi-ply products, wherein the embodiment of Fig. 16 is according to the invention, and the embodiments of Figs. 17 and 18 do not fall within the scope of the claims;

Figure 16A shows a top plan view of a multi-ply product according to the invention;

Figure 19 shows a top plan view of an intermediate ply of a multi-ply paper material in one embodiment of the invention;

Figure 20 shows a diagrammatic cross section of a multi-ply paper sheet including two intermediate sheets shaped as shown in Figure 19;

Figure 21 shows a diagrammatic side view of a modified embodiment of an embossing unit for the manufacturing of an embossed material according to the invention;

Figure 22 shows an enlargement of the detail shown at XXII in Figure 21; and

Figure 23 shows a further embodiment of an embossing arrangement for the production of an article according to the invention.

Detailed description of embodiments of the invention

[0022] Figure 1 shows a diagram of an embossing unit, also known as embossing-laminating unit, indicated as a whole with 2. The unit comprises a first embossing roller 1 and a second embossing roller 3, rotating about respective rotation axes 1A and 3A. The directions of rotation are indicated with f1 and f3. A nip G is defined between the two embossing rollers, through which two plies of tissue paper V1 and V3 are fed, which are separately embossed by

the rollers 1 and 3, respectively. Embossing takes place by feeding each of the plies between the respective embossing roller 1 or 3 and a corresponding pressure roller 5 or 7, the axes of rotation of which are indicated with 5A and 7A. The rollers 5 and 7 are coated with a layer of yielding material, such as rubber or the like, in which protuberances, indicated schematically and as a whole with 1P and 3P in Figure 1, with which the embossing rollers 1 and 3 are equipped penetrate. Possible configurations of these protuberances will be described in detail hereunder.

[0023] According to a possible embodiment, in a way known per se, the two rollers 1 and 3 can be phased to position the protuberances 1 P and 3P in the tip-to-tip or nested configuration. In the first condition, in the lamination nip G at least some of the protuberances of the roller 1 coincide with the protuberances of the roller 3 and the distance between the rollers 1 and 3 is such that sufficient pressure is exerted between the protuberances to cause lamination and bonding of the plies V1 and V3. In the second condition, the protuberances 1 P are intercalated between the protuberances 3P. In this case, reciprocal adhesion between the two plies V1 and V3 is obtained by lamination between the embossing roller 1 and a laminating roller 13. The two alternative paths of the web material N formed by the two plies V1 and V3 are indicated with Nn and Npp, said paths differing according to whether the material is processed with the tip-to-tip technique (path Npp) of with the nested technique (path Nn). It would also be possible for the embossing-laminating unit 2 to be suitable only to produce using the tip-to-tip technique or using the nested technique. In the first case, the laminating roller 13 can be omitted, while in both cases, the characteristic of being able to variably phase the rollers 1, 3 can be omitted. When, on the other hand, the unit is two-purpose and can operate both in tip-to-tip and nested mode, the rollers are reciprocally positionable with angular and/or axial phasing. The mechanical members and in particular the supports for the rollers 1 and 3 which allow adjustment are known per se and will not be described in greater detail herein.

[0024] A glue dispensing unit is indicated schematically with 17, and applies a glue to the radially projecting surfaces of the ply V1 embossed by the roller 1, when this ply is still engaged with the surface of said roller 1.

[0025] Figure 2 schematically shows the conformation of a different possible embossing machine or unit, of the type described, for example, in WO-A-99/44414. The two plies of tissue paper, again indicated with V1 and V3, are fed towards an embossing unit or embossing-laminating unit 100 comprising an embossing roller 101 equipped with protuberances 101 P and cooperating with a lamination or marrying roller 103, which can optionally be coated with a material which is softer, or more yielding than the material forming the surface of the embossing roller 105. A glue dispenser 107 cooperates with the embossing roller 105 to apply glue to the protuberances produced through embossing by the projections 101 P in the ply V1 through pressure between the embossing roller 101 and a pressure roller 109 coated in rubber or another yielding material.

[0026] According to a possible embodiment, before being guided about the pressure roller 109, the ply V1 is fed into a secondary embossing unit 111 with an embossing roller 113

cooperating with a pressure roller 115. The surface of the embossing roller 113 is equipped with micro-embossing protuberances 113P.

[0027] According to an advantageous embodiment, the ply V3 is fed through a second secondary embossing unit 114, comprising an embossing roller 117, the surface of which is equipped with projections or protuberances 117P, cooperating with a pressure roller 119 similar to the pressure roller 115.

[0028] The secondary embossing unit 111 can be omitted, as can the secondary embossing unit 114, depending on the type of pattern and machining to be performed on the paper material formed by the two plies V1, V3.

[0029] The glue applied by the dispensing unit 107 to the projections of the paper deformed between the pressure roller 109 and the embossing roller 101 is used to reciprocally bond the two plies, which for this purpose are laminated in the nip formed by the embossing roller 101 and the mating roller 103 to form multi-ply web material N delivered from the embossing unit 100.

[0030] Figures 3 to 8 schematically show, in various views and sections, portions of a multi-ply web material produced with one or other of the embossing units in Figures 1 and 2, or other equivalent embossing units.

[0031] Figure 3 represents a local section and partial perspective view of a portion of a multi-ply web material constituted by two plies V1 and V3 embossed and laminated in tip-to-tip configuration with a glue C to bond the two plies at the level of grooves produced on said plies by the protuberances 1 P and 3P of the embossing rollers 1, 3 of the device in Figure 1 or other equivalent device.

[0032] As can be seen in Figure 3, the grooves, indicated with 201 for the ply V1 and with 203 for the ply V3, have a substantially linear extension and defined therebetween are bulging portions 205, 207 of the web material formed by the outwardly projecting plies V1, V3 of the web material defining projections with an elongated extension delimited by adjacent grooves 201, 203. Figure 6 schematically shows in a top view a portion of the web material N, i.e. observed from the side of the ply V1, embossed as described above. In this example, the projections 205 and the grooves 201 have a slightly undulating linear shape and the width of the portions 205 is much greater than the width of the grooves 201.

[0033] By passing a web material with this conformation over a surface to be cleaned, e.g. when the web material N forms a sheet of kitchen towel, a very efficient cleaning effect is obtained on the surface, due to the fact that the portions 205 of material project outward to form contact and cleaning surfaces, while the grooves 201 define areas to collect the substances or products located on the surface to be cleaned and which must be removed. The rounded convex conformation of the outwardly projecting portions 205 of the ply V1 and of the outwardly projecting portions 203 of the ply V3 make the product soft and pleasing to the

touch. In this embodiment, the cleaning effect is provided to the same degree on both faces of the web material.

[0034] According to an advantageous embodiment of the invention, on both faces the portions 205, 207 project from the base plane of the original ply, i.e. from the surface on which the first ply lies before deformation by embossing. In fact, in relation to this plane the grooves 201, 203 project towards the inside of the web article and the protuberances 205, 207 project outward to form bulges or embossings with positive effect. Embossing with positive effect is intended as an effect of deformation through embossing wherein the cellulose ply has been deformed to project from the surface of the original ply in relation to the shape thereof prior to embossing.

[0035] To ensure that the outwardly facing convex portions 205, 207 are not compressed, above all when the web product is wound in rolls, according to an advantageous embodiment each ply V1, V3 is in actual fact composed of a plurality of cellulose layers, to provide adequate consistency and mechanical resistance to the finished product.

[0036] According to a different embodiment, resistance to compression can be obtained by producing the web material N with an embossing technique of the nested type, as indicated schematically in Figure 4. In this case, the web material N is again formed by the plies V1 and V3, where the ply V1 is embossed to obtain grooves, again indicated with 201, having a linear extension, defined between which are areas 205 with outwardly projecting convex profiles, i.e. areas of positive embossing.

[0037] Conversely, the ply V3 is embossed to form thereon projections 209 facing the inside of the web material N and inserted in the empty space defined by the portions 205 of the ply V1. The protuberances 209 therefore form supports for the convex areas 205 of the ply V1 preventing or in any case reducing compression thereof. In the example shown in Figure 4, the protuberances 209 facing the inside of the web material are approximately in the shape of truncated cones, but it must be understood that they can also have a conformation with linear extension like the grooves 201 produced on the ply V1. The two plies V1 and V3 are bonded by a glue 5 applied to the surface of the ply V1 facing the ply V3 at the level of the grooves 201.

[0038] The conformation of the surface of the ply V1 can substantially be identical to the one illustrated in Figure 6, with grooves 201 with an undulated linear extension and corresponding convex projections 205 with a width preferably greater than the width of the grooves 201. The article N configured as shown in Figure 4 will have a preferred active surface defined by the ply V1, with a cleaning capacity, i.e. capacity to remove dirt from the surfaces to be cleaned, substantially equivalent to that of the web material N in Figure 3. Conversely, the lower surface of the material, defined by the ply V3, has a lesser cleaning capacity, substantially equivalent to as that of conventional products.

[0039] Figure 5 shows a local section and partial perspective view of a web material N obtained, for example, with an embossing-laminating device of the type illustrated in Figures 2,

2A and 2B. In this case, the ply V1 is still embossed as described with reference to Figures 3 and 4, with the formation of convex projections 205 with a substantially linear extension delimited by grooves 201. The glue C with which the ply V1 is bonded to the ply V3 below is applied at the level of the grooves 201. The ply V3 has micro-embossing obtained with the embossing unit 114. In the example shown in Figure 5, the ply V1 has no micro-embossing, and therefore the secondary embossing unit 111 substantially remained idle or is not present. It would also be possible for the ply V1 to have micro-embossing over which the embossing forming the projections 205 and the grooves 201 is positioned.

[0040] The surface conformation of the ply V1 can be the same as that shown in Figure 6.

[0041] Figure 7 shows a top view of a different embossing pattern of the ply V1 and/or of the ply V3. The same numbers indicate the same or equivalent parts to those shown in Figure 6. The pattern is characterized by a more marked undulation of the protuberances and of the grooves on the surface of the ply.

[0042] Figure 8 shows a local section of an embossed web material obtained, for example, with an embossing-laminating unit as shown in Figure 1. The same numbers indicate the same or equivalent parts to those in Figure 4. In this case, inside the empty space produced under the projections 205 are several adjacent protuberances or projections 209 produced on the ply V3.

[0043] Figure 9 shows a top view of a fragment of an embossed web material with a different surface structure. In this case grooves, again indicated with 201, are produced on the surface of the ply V1, arranged to at least partly surround raised areas, i.e. outwardly facing convex areas, indicated with 205. These areas 205 form projections embossed according to a positive embossing as defined above.

[0044] Figure 9 shows a fragment of the web material with one of these projecting portions 205, surrounded by grooves 201 divided into four contiguous portions. It must be understood that on the surface of the web material there can be a plurality of grooves 201 defining the same number of projections 205 arranged according to a suitable pattern. The grooves can have a different conformation, e.g. they can fully surround the projecting portions 205, and/or they can have a different geometrical shape in relation to the one shown.

[0045] Figure 10 shows a local section of a portion of the web material shown in Figure 9, in which it can be seen that arranged under the convex projection 205 are protuberances, still indicated with 209, produced in the ply V3 and arranged in nested configuration in the empty space inside the web material below the convex projections 205. It must be understood that also in this case the lower ply V3 can be embossed with micro-embossing as shown in Figure 5, or with a similar pattern to that of the ply V1 in a tip-to-tip embossed configuration as shown in Figure 3 or in any other suitable way.

[0046] Therefore, in the embossing pattern in Figure 9 the projections 205 are constituted by

areas almost closed and surrounded by grooves 201, which no longer extend for a substantially indefinite length like those in Figures 6 and 7. In any case, the convex projecting portions 205 again define contact and cleaning surfaces, while the grooves 201 define spaces to collect the dirt and debris removed from the surface cleaned with the web material N.

[0047] Figures 11 and 13 schematically show further possible embossing patterns according to the invention. The lines represented in the drawings indicate embossing motifs or patterns with linear extension, according to closed lines. In particular, Figure 11 shows embossing patterns characterized by embossed lines with double lobes, delimiting an inner surface forming an outwardly facing convex projection of the web material. Figure 12 shows an embossing pattern characterized by groups of closed, V-shaped embossing lines with a wide aperture, arranged to produce a sort of flower. Figure 13 shows closed embossing lines similar to the lines in Figure 12, but arranged according to parallel and intercalated alignments.

[0048] In any case, the ply embossed with the embossing lines defining the outwardly projecting areas of the web material can also have conventional embossing, intercalated with these embossing lines forming the grooves, to "embed" the areas embossed with positive embossing in areas embossed according to a conventional embossing motif.

[0049] Figure 14 shows a diagrammatic side view of an embodiment of an embossing unit for manufacturing a multi-ply embossed paper sheet according to the invention in a particularly preferred embodiment. The unit, designated 301 as a whole, includes a first embossing roller 303 and a second embossing roller 305, defining a lamination nip 307 therebetween. An enlargement of the lamination nip 307 is shown in Fig.15. Each embossing roller 303, 305 co-acts with a corresponding pressure roller 309, 311. The pressure rollers 309, 311 are provided with an outer pliable cover, made of elastically yielding material, such as rubber or the like, shown at 309A and 311A respectively. Each embossing roller forms, along with the corresponding pressure roller, an embossing nip, through which a respective first and second outer ply V1 and V3 are fed. A glue applicator 313 applies glue on the top surface of the embossing protrusions generated on ply V1 by the coaction of rollers 303 and 309. A similar glue applicator can be arranged around the embossed roller 305.

[0050] A first and a second intermediate plies V5, V7 are fed into the lamination nip 307 between embossing rollers 303, 305. Each ply V5, V7 is embossed in a respective auxiliary embossing device 315, 317. Each auxiliary embossing device includes an embossing roller 315A, 317A provided with outwardly oriented protrusions (see enlargement of roller 315A), co-acting with a pressure roller 317A, 317B provided with an elastic yielding surface.

[0051] As shown more specifically in Fig. 15, the two embossing rollers 303, 305 are provided with protrusions 303P and 305P. In a preferred embodiment, the protrusions 303P, 305P are arranged in a tip-to-tip arrangement as shown in detail in Fig.15. This means that the protrusions of one roller are substantially in phase with those of the opposing roller. The four plies V1, V3, V5, V7 are laminated together at the mutually corresponding top surfaces of the opposing protrusions 303P, 305P, so that they are glued together by means of the adhesive

applied by the glue distributor 313 and possibly by the second glue distributor 313A (if present).

[0052] Fig 16 shows an enlarged diagrammatic cross section of a product which can be obtained with the unit of Figs. 14, 15. The outer plies V1, V3 are embossed such as to form bubbles or bulging protrusions B and B1 extending towards the outside. Inwardly oriented depressions or grooves D and D1 are generated in the two plies by the protrusions 303P, 305P of the rollers 303 and 305. The two inner plies V5, V7 are arranged within the outer plies V1, V3 and their protrusions (generated by auxiliary embossing devices 315, 317 protrude towards the outer plies V1, V3, such as to form a supporting structure, which limits the risk of the bulging protrusions B, B1 collapsing towards the interior of the product. The height H of the bulging protrusions extending towards the outside of the product can be larger than the height h of the inner protrusions formed in the intermediate plies. For example the height H can range from 1.2 to 1.6 mm and preferably around 1.4 mm, while the height h can range between 1.0 and 1.4 and preferably between 1.1 and 1.3 mm. It shall be understood that these values are given by way of example only and are not to be considered limitative of the invention.

[0053] Fig.16A shows a top plan view of a fragment of a product according to the invention. Bulging protrusions are shown again at B, each protrusion being surrounded by a closed inwardly oriented linear groove or depression D. The bottom portions of the grooves or depressions D (or at least part thereof) are provided with glue. In the example shown each protrusion B is entirely surrounded by a groove or depression D extending along a closed line. This line can be however only substantially closed, i.e. it can partly but not entirely surround the protrusion B. According to some embodiments of the invention, a substantially closed line shall be understood as a line, which covers at least 60% and preferably at least 70% and most preferably at least 80% of the linear perimeter of the protrusion B.

[0054] The bulging protrusions B extend towards the outside forming a sort of bubble. The bubble is at least partly prevented from collapsing by the linear glue distribution along the partly or entirely closed groove or depression line D surrounding the protrusions B, in combination with the protrusions of the intermediate plies V5, V7.

[0055] A similar embossing pattern and a similar effect can be achieved in other embodiments of the product according to the invention as described above.

[0056] Fig.17 shows a modified embodiment of a product not falling within the scope of the claims. In this case only one intermediate ply V5 is provided and the second outer ply V3 is substantially smooth, i.e. not embossed. This product can be achieved by removing or making the auxiliary embossing device 313 inactive and by replacing the roller 305 with one which is substantially smooth, i.e. not provided with protrusions. As an alternative, the roller 305 can be moved away from roller 303, such that the two rollers are not pressed one against the outer in the lamination nip 307 and a further marrying or lamination roller with a smooth surface is arranged e.g. downstream of the nip 307, said marrying or lamination roller being pressed against the protrusions of roller 303.

[0057] Figs. 19, 20 show a further embossing pattern according to the invention. More specifically, Fig.19 shows a top view of a fragment of one of the inner plies V5, V7. In this embodiment the or each one of the inner plies has embossing lines surrounding bulging protrusions BP in the shape of elongated projections. Fig. 20 shows the four-ply product resulting from the embossing and lamination of plies V1, V3, V5, V7 with the embossing unit 301 of Fig. 14 using inner plies embossed according to the pattern in Fig.19. According to some embodiments the inner plies V5, V7 are arranged randomly, as shown in Fig.20, i.e. there is no pre-established correspondence between the protrusions of one ply and those of the other ply.

[0058] Fig.18 shows still a further embodiment of a product not falling within the scope of the claims. In this embodiment only one inner ply V5 is provides, said ply being provided with protrusions which project from both surfaces towards both outer plies V1 and V3. The product of Fig.18 can be obtained with an embossing and laminating unit shown in Figs, 21 and 22, and again designated 301 as a whole. The same reference numbers are used to indicate elements and parts of the unit which are identical or equivalent to those of Fig.14. The main difference between the two embodiments is that in Figs 21, 22 the auxiliary embossing unit 315 is comprised of two embossing rollers each provided with protrusions (see Fig.22, showing an enlargement of the embossing nip between rollers 315X, 315Y). The protrusions of the two rollers mesh with each other such as to generate protrusions on both surfaces of the ply V5.

[0059] In all embodiments where inner plies are laminated along with outer plies as shown e.g. in Figs. 16-20 the protrusions generated in the inner ply or plies are flattened in correspondence of the depressions, i.e. the inwardly oriented grooves D of the outer plies V1, V5.

[0060] According to a preferred embodiment of the invention, the inner plies are arranged in a tip-to-tip arrangement, wherein at least part of the protrusions of the two plies are opposing each other such as to increase the overall thickness of the product.

[0061] In a further embodiment, schematically shown in Fig.23, the two inner plies are embossed in a tip-to-tip embossing and laminating unit 401 combined to the embossing and laminating unit 301. The same reference numbers are used in Fig.23 to designate the same or equivalent parts and elements as in Fig.21. The two inner plies V5, V7 are fed in respective embossing nips formed by first and second embossing rollers 401, 403 and two pressure rollers 405, 407. The two embossed plies V5, V7 are then fed through a lamination nip between embossing rollers 401, 403 where they are bonded together. Glue can be applied e.g. by means of a glue applicator 409 arranged around the periphery of embossing roller 401 or alternatively around embossing roller 403. The unit 401 is quite the same as unit 301, but the protrusions of the embossing rollers 401, 403 are smaller in size and preferably of simpler shape. For example they can have the shape shown in Fig.19. The protrusions of the embossing rollers 401, 403 can be distributed with a density higher than 15 protrusions per square centimeter, and preferably between 20 and 300 protrusions per square centimeter,

more preferably between 30 and 150 protursions per square centimeter or any range within the values mentioned above.

[0062] It is understood that the drawing merely shows an example provided by way of a practical arrangement of the invention, which can vary in forms and arrangement without however departing from the scope of the concept underlying the invention.

REFERENCES CITED IN THE DESCRIPTION

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- US3414459A **[0008]**
- US5173351A **[0008]**
- US6032712A **[0008]**
- US6245414A **[0008]**
- US6053232A **[0008]**
- US3961119A **[0009]**
- US3556907A **[0010]**
- US3867225A **[0010]**
- US5339730A **[0010]**
- US5686168A **[0011]**
- US6578617A **[0012]**
- US6470945A **[0012]**
- US6261666A **[0013]**
- US6109326A **[0013]**
- US6136413A **[0015]**
- US5846636A **[0015]**
- US6106928A **[0015]**
- US6755928A **[0016]**
- US6681826A **[0016]**
- WO9944414A **[0025]**

P A T E N T K R A V

1. Fremgangsmåde til fremstilling af et præget flerlagstissuepapirark (N) indbefattende i det mindste et første ydre lag (V1) og et andet ydre lag (V3), hvilket første ydre lag har en første udadvendende overflade og en anden indadvendende overflade, hvor det første ydre lag præges for at opnå overfladedele, der definerer udadragende fremspring af laget dannet af udbulende dele af arkmateriale og i det mindste delvist omgivet af i det væsentlige lineære riller (201), der rager ud mod indersiden af arket, og hvor lim (C) påføres på den anden indadvendende overflade af det første ydre lag i overensstemmelse med de lineære riller for at forbinde det første ydre lag (V1) med det andet ydre lag (V3); hvor det andet ydre lag (V3) præges til at danne et tredimensionalt overflademønster indbefattende udadragende, udbulende, prægede fremspring, som er defineret ved dele af det andet ydre lag (V3) og i det mindste delvist omgivet af i det væsentlige lineære riller og strækkende sig mod indersiden af arkmaterialet (N); og hvor der mellem det første ydre lag (V1) og det andet ydre lag (V3) arrangeres et første mellemliggende præget lag (V5) og et andet mellemliggende præget lag (V7), hvor det første og andet mellemliggende prægede lag (V5, V7) hvert forsynes med prægede fremspring, der vender mod henholdsvis det første ydre lag (V1) og det andet ydre lag (V3); hvor prægede fremspring af det første mellemliggende prægede lag er arrangeret i overensstemmelse med de udbulende, prægede fremspring af det første ydre lag (V1) og det andet ydre lag (V3).

2. Fremgangsmåde ifølge krav 1, hvor det andet ydre lag (V3) er forsynet med lim påført på en indadvendende overflade af det andet lag i overensstemmelse med de lineære riller.

3. Tissuepapirsflerlagsarkmateriale indbefattende i det mindste et første ydre lag (V1) og et andet ydre lag (V3) af tissuepapir forbundet ved limning, hvilket første ydre lag (V1) har en første udadvendende overflade og en anden indadvendende overflade, hvor i det mindste det første ydre lag (V1) har et tredimensionalt overflademønster indbefattende udadragende, udbulende, prægede fremspring, som er defineret ved dele af det første ydre lag (V1) og i det mindste delvist omgivet af i det væsentlige lineære riller og strækkende sig mod indersiden af arkmaterialet; hvor det andet ydre lag (V3) har et tredimensionalt overflademønster indbefattende udadragende, udbulende, prægede fremspring, som er defineret ved dele af det andet ydre lag og i det mindste delvist omgivet af i det væsentlige lineære riller og strækkende sig mod indersiden af arkmaterialet; hvor det første ydre lag (V1) er forsynet med lim (C) påført på den anden indadvendende overflade af det første ydre lag (V1) i overensstemmelse med de lineære riller; og hvor der mellem det første ydre lag (V1) og det andet ydre lag (V3) er arrangeret et første mellemliggende præget lag (V5) og et andet mellemliggende præget lag (V7); hvor det første og det andet mellemliggende prægede lag (V5, V7) hvert er forsynet med prægede fremspring dannet af udbulende, prægede fremspring, der vender mod henholdsvis det første (V1) og det andet ydre lag (V3); og prægede fremspring af det første mellemliggende prægede lag

(V5) er arrangeret i overensstemmelse med de udbulende, prægede fremspring af det første ydre lag (V1) og det andet ydre lag (V3).

4. Flerlagsarkmateriale ifølge krav 3, hvor de udadragende, udbulende, prægede fremspring af det første ydre lag (V1) er afgrænset af de lineære riller, der danner i det væsentlige lukkede linjer, som omgiver de udbulende fremspring.

5. Flerlagsarkmateriale ifølge krav 3 eller 4, hvor det andet ydre lag er forsynet med lim påført på en indadvendende overflade af det andet ydre lag i overensstemmelse med de lineære riller.

6. Flerlagsarkmateriale ifølge krav 4, hvor de udadragende, udbulende, prægede fremspring på det andet ydre lag (V3) er afgrænset af de lineære riller, der danner i det væsentlige lukkede linjer, som omgiver de udbulende prægede fremspring.

7. Flerlagsarkmateriale ifølge et hvilket som helst af krav 5 eller 6, hvor de udbulende, prægede fremspring af det første ydre lag (V1) er arrangeret i et flade-mod-flade-arrangement med de udbulende, prægede fremspring af det andet ydre lag (V3).

8. Flerlagsarkmateriale ifølge ét eller flere af kravene 5 til 7, hvor de indadvendende lineære riller af det første ydre lag (V1) og af det andet ydre lag (V3) er afstemt i et spids-mod-spids-arrangement.

9. Flerlagsarkmateriale ifølge krav 3, hvor det første og det andet mellemliggende prægede lag (V5, V7) hvert har prægede fremspring dannet af udbulende, prægede fremspring, der vender mod henholdsvis det første og det andet ydre lag (V1, V3), hvilke udbulende, prægede fremspring er omgivet af lineære riller, der vender væk fra det første og det andet ydre lag.

10. Flerlagsarkmateriale ifølge krav 3, hvor det første og det andet mellemliggende prægede lag (V5; V7) er arrangeret i et spids-mod-spids-arrangement.

11. Flerlagsarkmateriale ifølge ét eller flere af kravene 3 til 10, hvor det første mellemliggende prægede lag (V5) er udglattet i overensstemmelse med de i det væsentlige lineære prægede riller af det første ydre lag (V1).

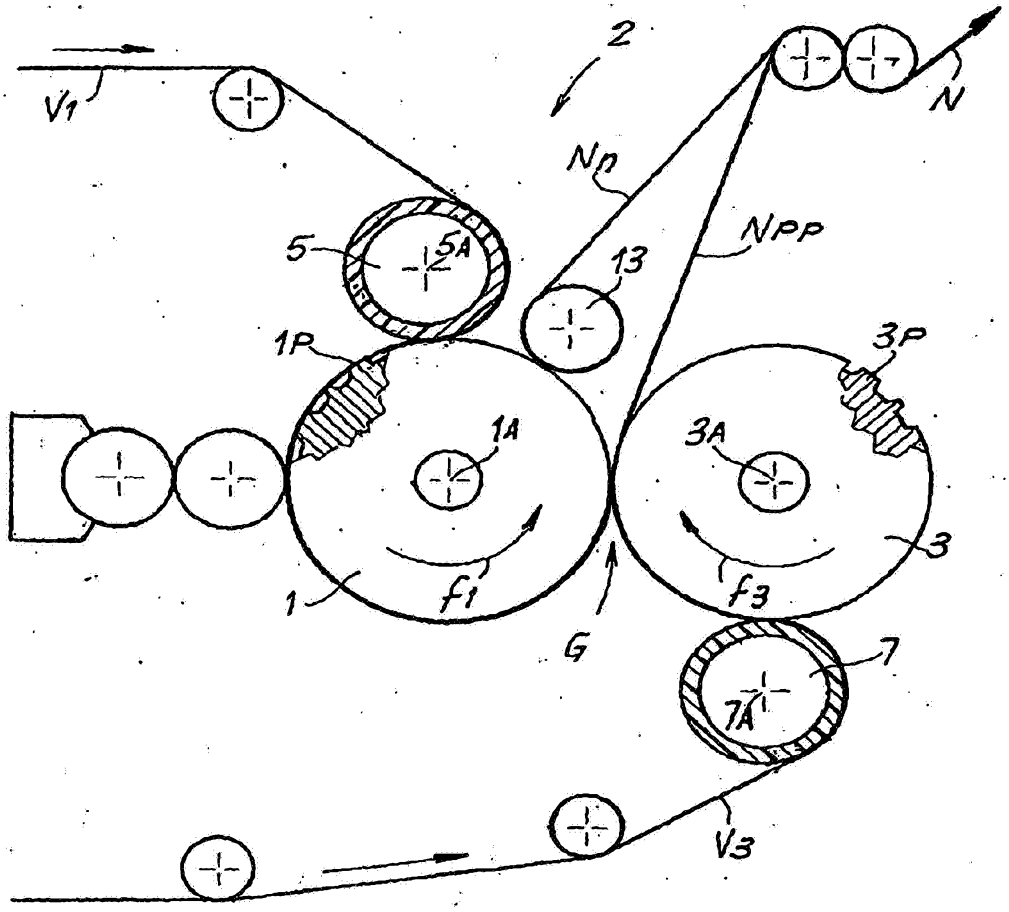
12. Flerlagsarkmateriale ifølge ét eller flere af kravene 4 til 16, hvor de udadragende, udbulende, prægede fremspring hver er omgivet af limede områder, der rager indad inden i arkmaterialet.

13. Flerlagsarkmateriale ifølge ét eller flere af kravene 3 til 12, hvor de udadragende, udbulende, prægede fremspring er bobleformede.

14. Flerlagsarkmateriale ifølge ét eller flere af kravene 3 til 13, hvor det tredimensionale overflademønster er dannet ved deformation gennem prægning, hvor det prægede lag er blevet deformeret til at rage udad fra overfladen af det originale lag.

DRAWINGS

Fig. 1



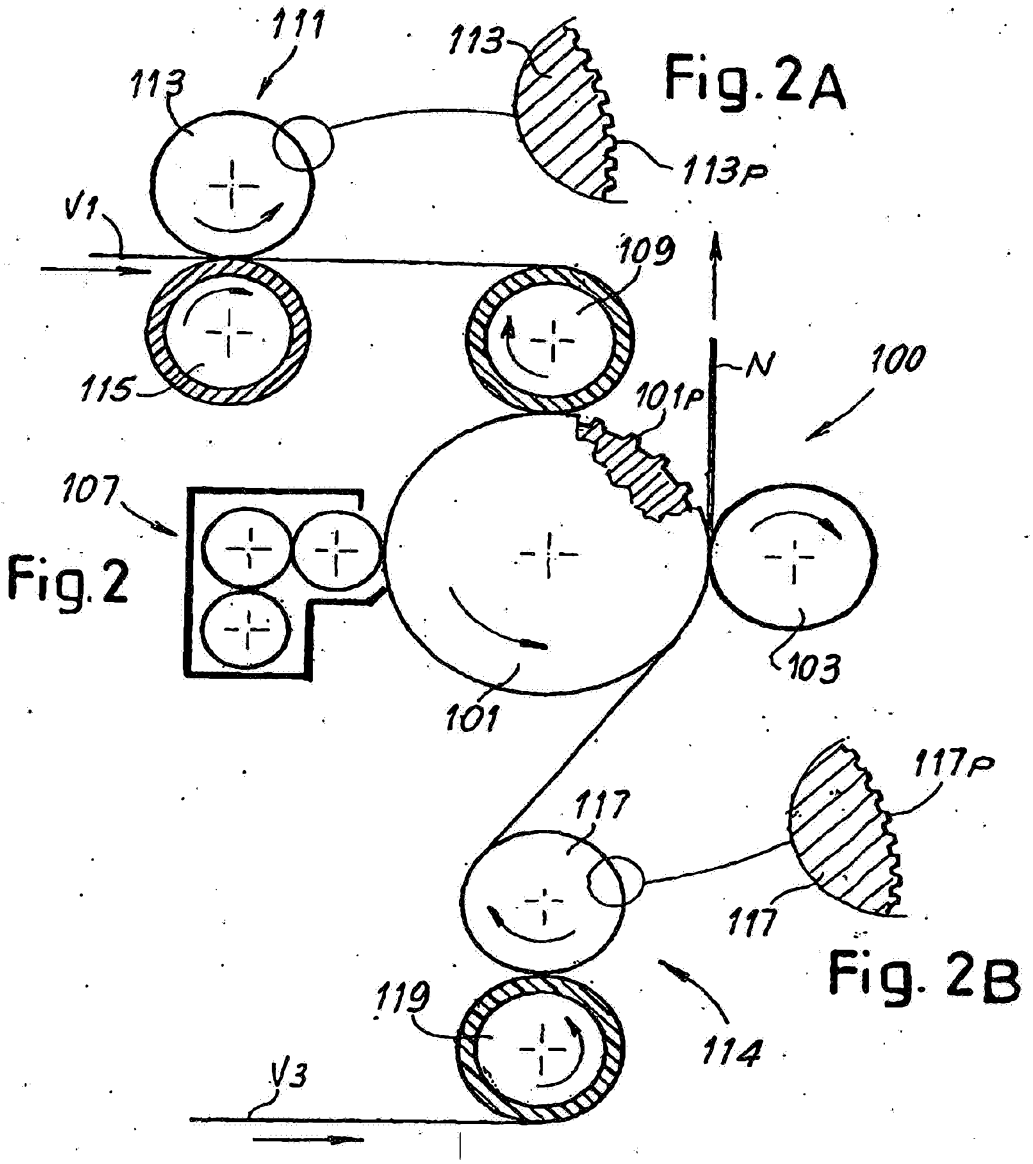
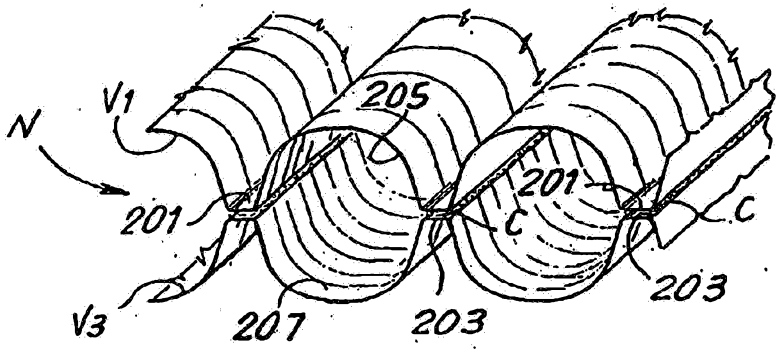


Fig. 2A

Fig. 2

Fig. 2B

Fig. 3



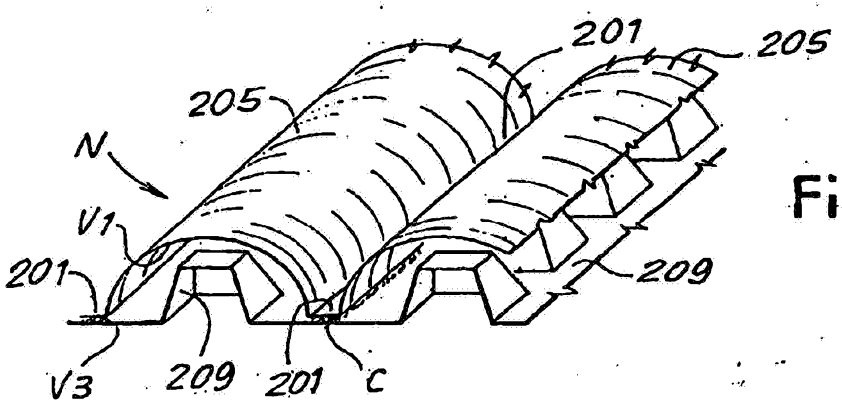
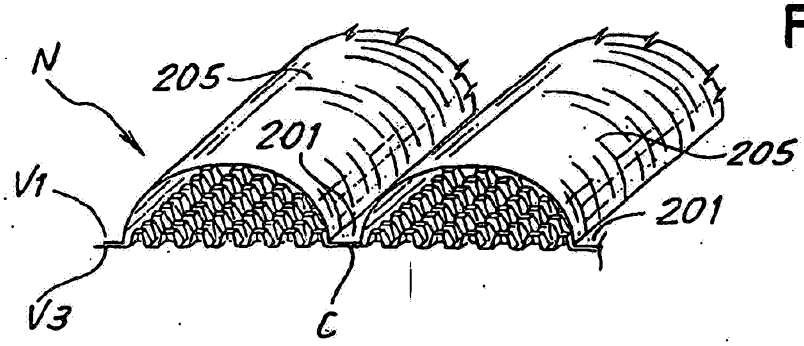


Fig. 4

Fig. 5



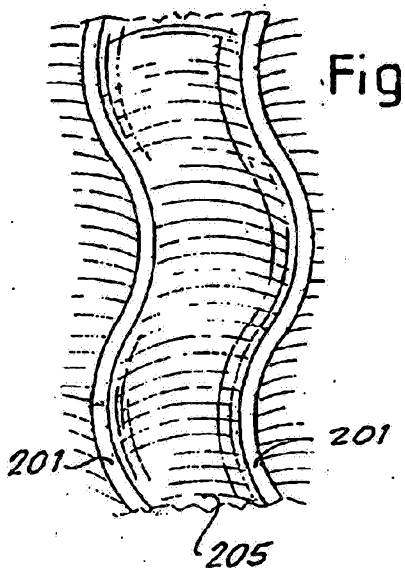


Fig. 6

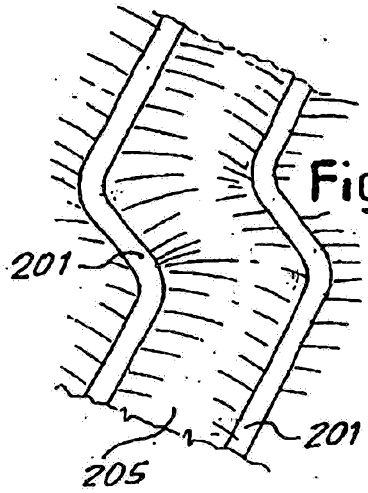


Fig. 7

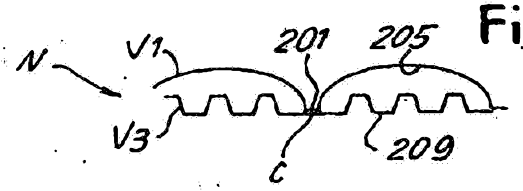


Fig. 8

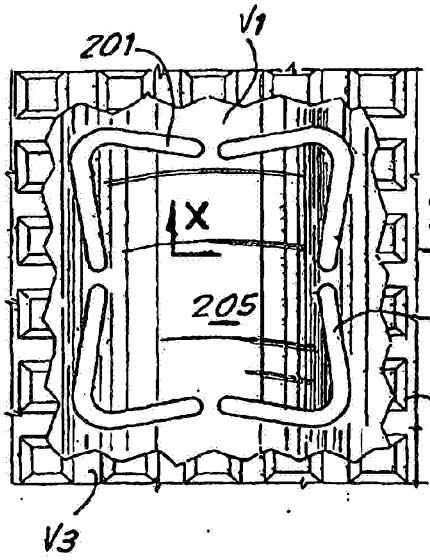


Fig. 9

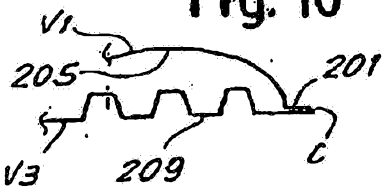


Fig. 10

Fig. 11

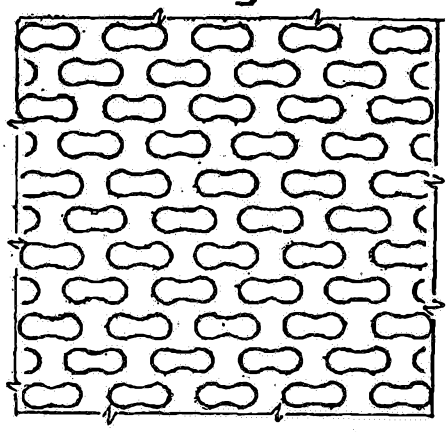


Fig. 13

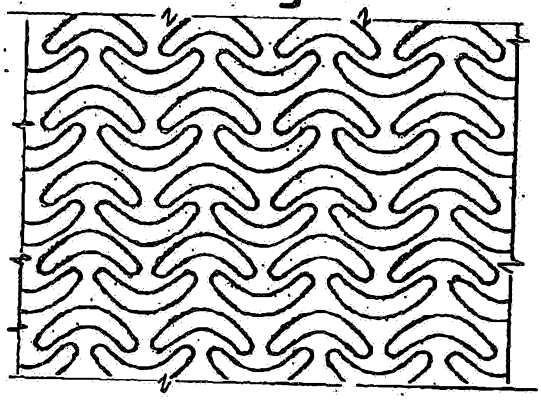
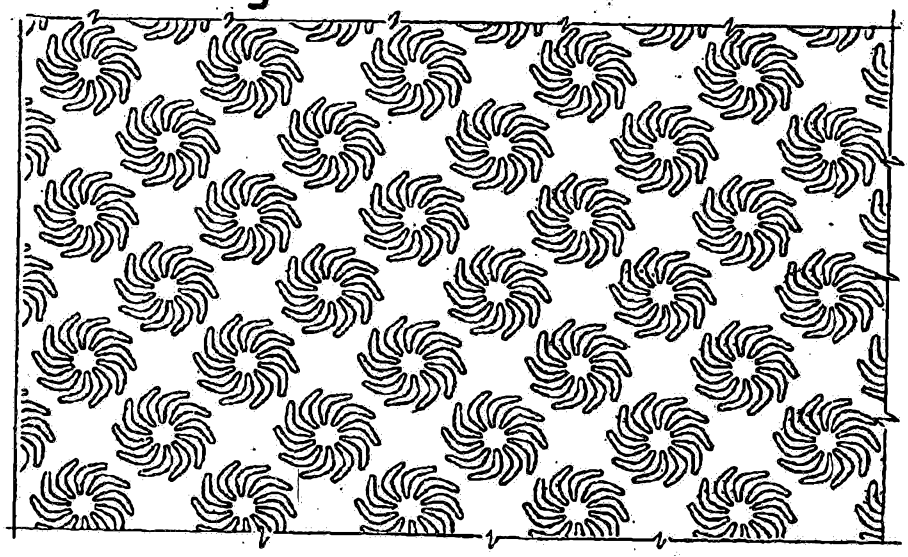


Fig. 12



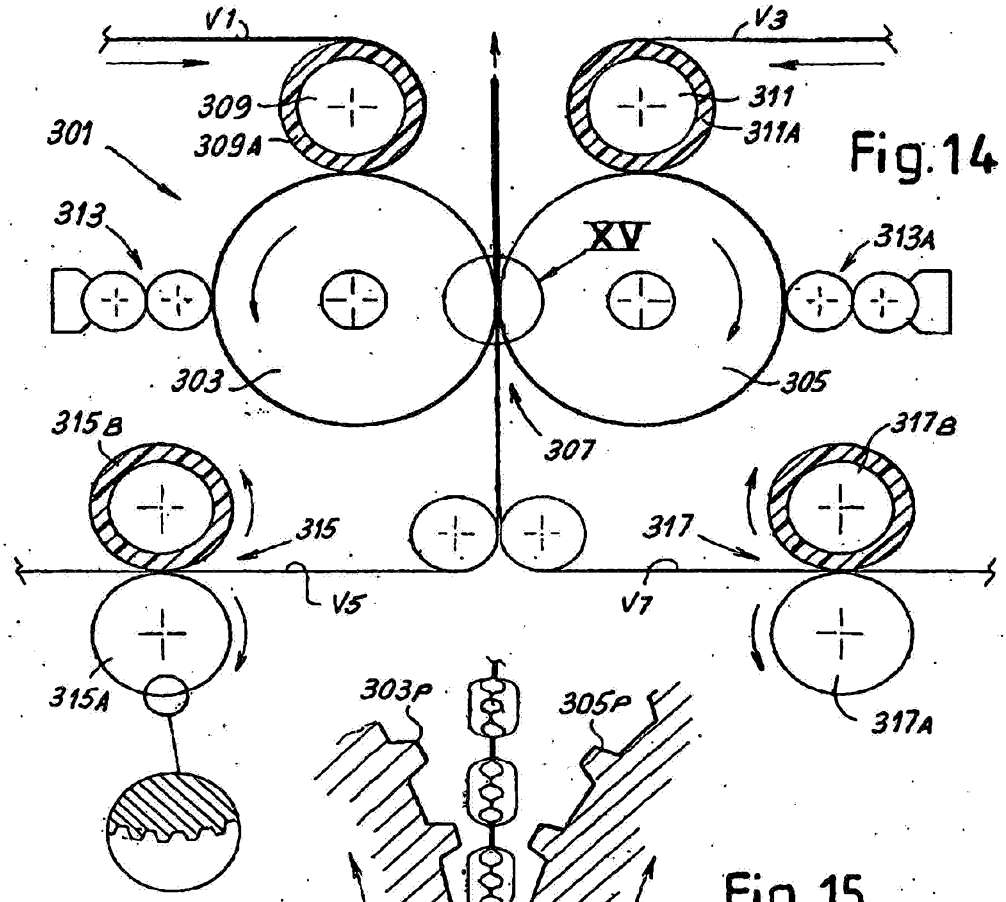

V1
V3
309
309A
311
311A
301
313
313A
XV
303
305
307
315B
317B
315
317
V5
V7
315A
317A

Fig.14

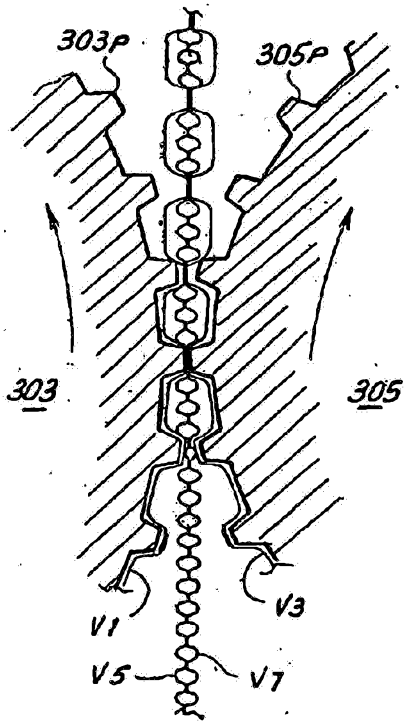

303P
305P
303
305
V1
V3
V5
V7

Fig. 15

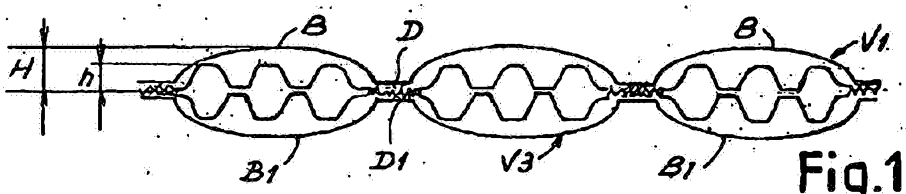


Fig.16

Fig.16A

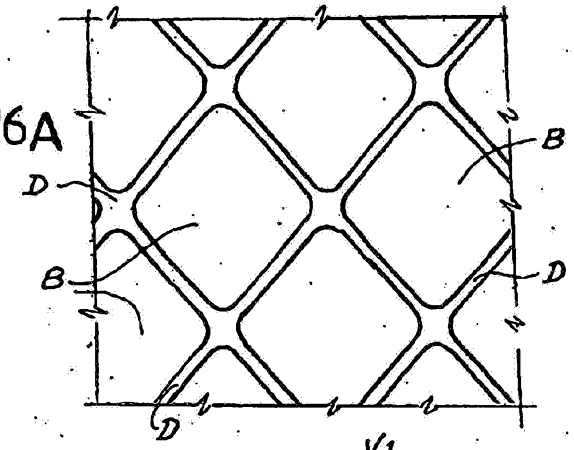


Fig.17

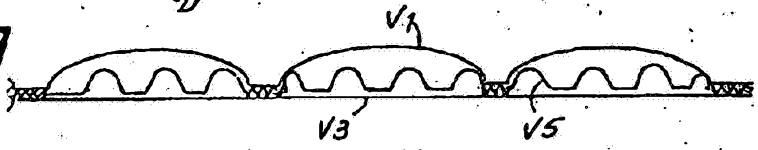


Fig.18

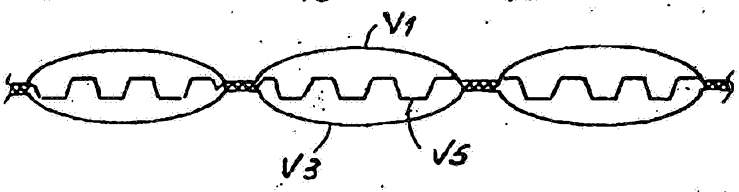


Fig.19

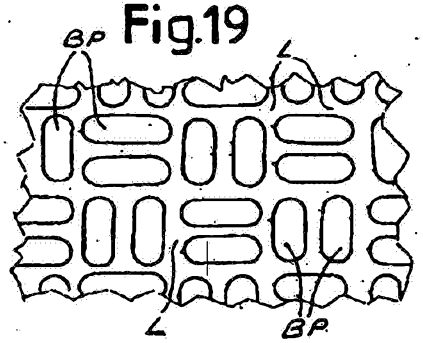
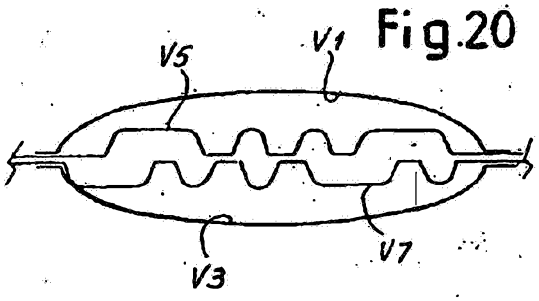


Fig.20



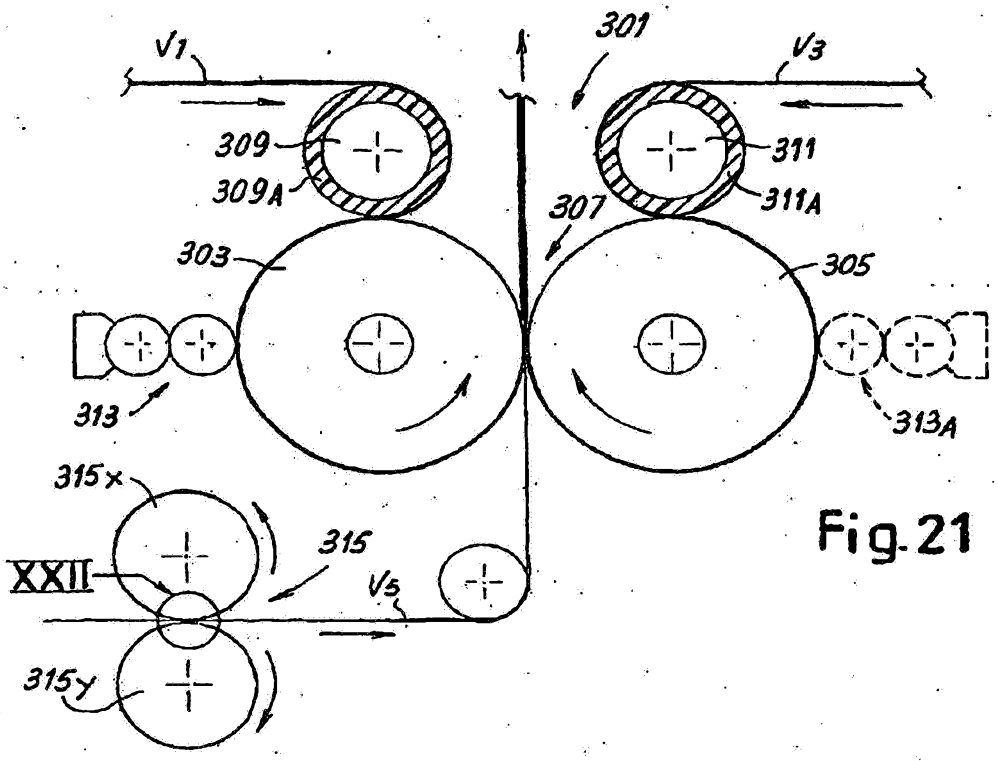

V1
301
V3
309
309A
311
311A
307
303
305
313
313A
315x
315
XXII
V5
315y

Fig.21

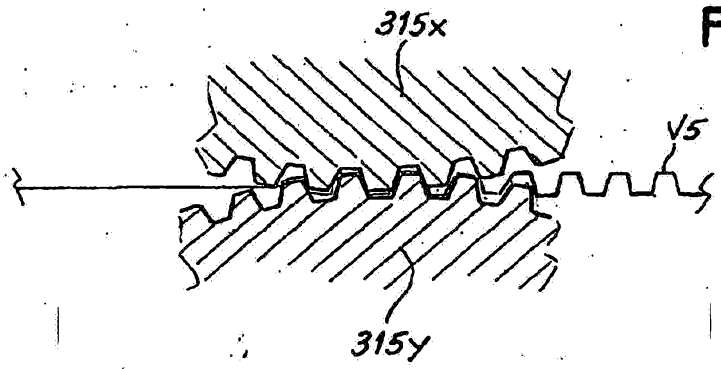
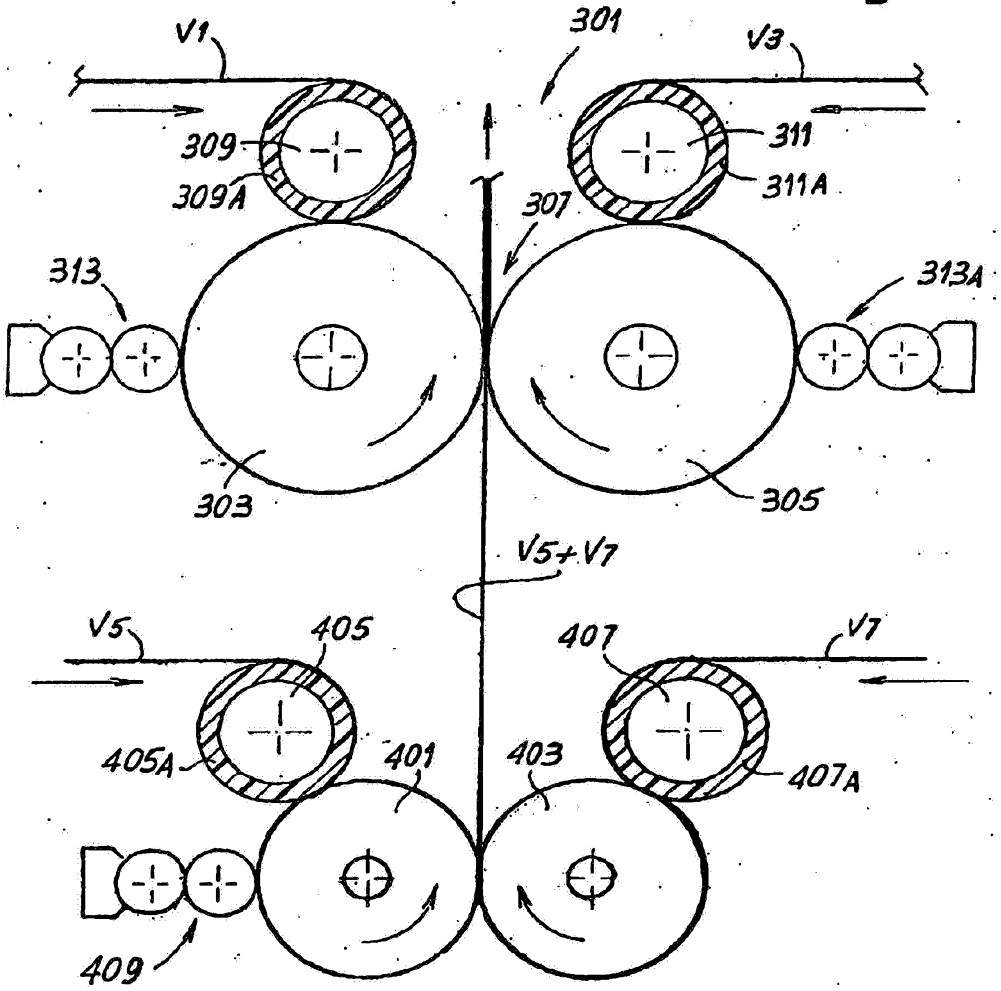

315x
V5
315y

Fig.22

Fig.23


V1
301
V3
309
309A
311
311A
307
313
313A
303
305
V5+V7
V5
405
407
V7
405A
401
403
407A
409