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(54) **A method for the production of a decorated paper product, and product thus obtained**

(57) A method is described for chromatic decoration of a tissue paper web material, comprising the step of coloring at least one longitudinal band of said web ma-

terial with a polychromatic decoration, with a substantially gradual and repetitive variation of the density of each color along at least the longitudinal development of said band.

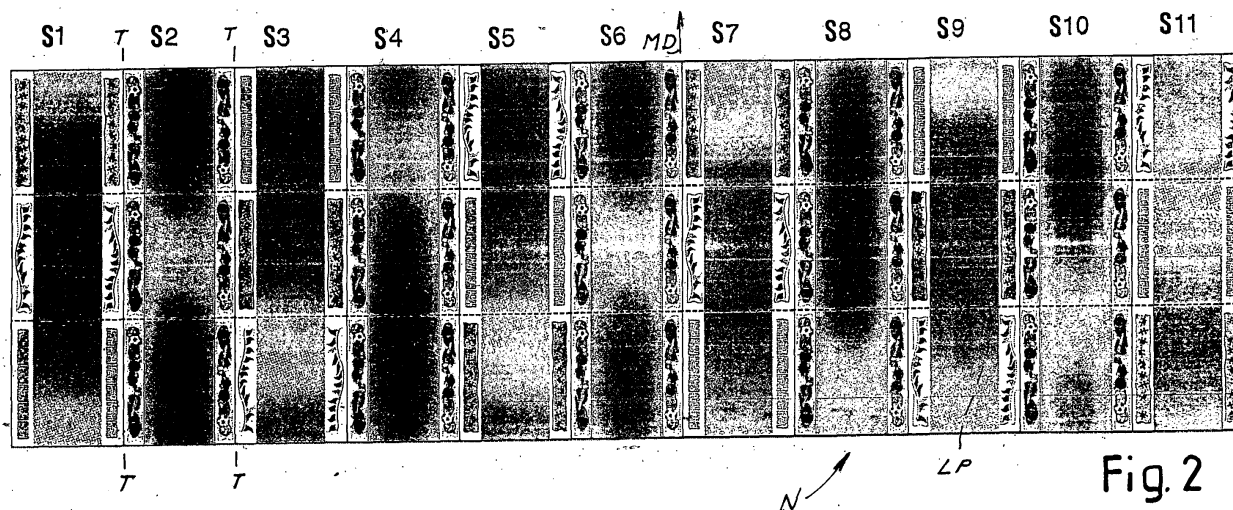


Fig. 2

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Description

Technical field

[0001] The present invention relates to the field of paper converting and decorating, in particular to the production of tissue paper products, such as toilet paper, kitchen towels, or the like.

State of the Art

[0002] In the production of paper products, in particular products in absorbent paper or tissue paper, such as toilet paper, kitchen towels household and professional use, paper handkerchiefs and napkins or the like, decoration of the products by embossing is well known, i.e. a process of permanent mechanical deformation of the cellulose fibers forming the material. In addition to create a raised decorative pattern on the finished product, embossing has also the function of modifying and improving the technical functional characteristics of the product, such as in particular the overall thickness, the softness, the liquid absorption capacity, the capacity of retaining dirty, etc.

[0003] The decoration of these products through color printing is also well known. In some cases, printing and embossing are combined to each other, so as to obtain a decorative effect and a technical functional change of the product. In some cases, printing is obtained by using a colored glue that, in addition to giving a chromatic decoration, is also used for mutually gluing to each other two or more plies that constitute the multi-ply finished product. In this case the product is not subjected to a real separate printing process, but it is chromatically decorated by means of the glue applied during the embossing phase of the plies that form it. In this case, the chromatic decoration cannot be chosen at will, but it is dependent upon the technical and functional requirements, as it is not possible to apply the colored liquid (glue) everywhere and in quantities at will, but only at the areas in which the embossing protuberances are located, which must be glued to obtain an adequate and efficient mutual gluing of the plies forming the product.

[0004] In other embodiments, printing is carried out with a working process upstream of the embossing and it is not linked to this latter. However, in this case again, the printed pattern cannot be chosen at will, as the inks applied on the tissue paper wet the paper, thus altering the strength characteristics thereof. In order to avoid the breakage of the paper during the subsequent embossing and in general along the converting line downstream of the printing unit, it is necessary to limit the quantity of ink applied to the paper. This therefore limits the freedom in the choice of the pattern which printed. For this reason, the tissue paper printed products currently have chromatic patterns of low visual impact with low impact on the aesthetical aspect of the product.

[0005] In other embodiments, printing is carried out

with a working process downstream of the embossing, and it is always not linked to this latter. In this case again, the printed pattern cannot be chosen at will, as the inks must be applied to the paper (mutually glued embossed plies) when the paper is spread out, and therefore the extensions of the inked areas must be small and thin in order neither to spoil significantly nor to destroy a great part of the voluminous areas obtained through embossing, thus jeopardizing in an irreparable manner the final aspect of the finished product.

Summary of the Invention

[0006] According to one aspect, an object of the present invention is a method for print decorating a tissue paper-web material, which fully or partially overcomes one or more of the drawbacks of the traditional techniques and methods.

[0007] According to a different aspect, the invention relates to a tissue paper product, specially and preferably a multi-ply web material made of tissue paper that has a chromatic pattern, preferably a printed pattern, with better visual impact that does not change the strength characteristics of the material under processing, or that at least allows a strength of the material sufficient to avoid the breakage during working downstream of the printing.

[0008] Substantially, according to one embodiment the present invention provides a method for chromatic decoration of a tissue paper web material, characterized by coloring at least one longitudinal band of the web material with a polychromatic decoration, with a substantially gradual and repetitive variation of the density of each color along at least the longitudinal development of the band of the material. The chromatic decoration can be preferably obtained with a polychromatic print, for example four-color print. However, in other embodiments the chromatic decoration can be obtained through the use of colored glues instead of inks, for example coloring the tops of embossing protuberances produced on the ply or on the plies of paper material. In one case, the converting line of the tissue paper web material preferably includes a printing unit and, as the case may be, an embossing unit, if it is required to combine a raised decorative motif with the chromatic decoration. In other cases, the printing unit can be removed and the chromatic decoration is obtained by using an embossing and laminating unit with a plurality of dispensers of glues colored with two or more colors, so as to obtain an effect of polychromatic pattern, even if not throughout the whole surface, but limited only to the dotting-effect resulting from the distribution of the embossing protuberances.

[0009] Specific reference will be made hereunder to the use of a printed decoration, but it should be understood that more in general this decoration will be a polychromatic decoration that can be obtained also with the combination of colored glues.

[0010] In some embodiments the web material is then converted in rolls (for example rolls of kitchen towels or

toilet paper) or packs of folded sheets, such as handkerchiefs and napkins or the like.

[0011] Practically, instead of applying a printed decoration according to given patterns and with a limited surface development in some areas of the tissue paper, the invention provides for applying the ink and therefore the color in a distributed and wide manner on at least one longitudinal band, preferably on the full surface, i.e. in such a manner to have the dye on each point visible to the naked eye of the surface of this band. In some embodiments the chromatic full-surface decoration can be limited to a portion of the overall area of the longitudinal band, for example at least 10%, preferably at least 30%, and more preferably at least 50%, for example 75% or more.

[0012] In order to obtain a better aesthetic effect than that of the traditional products and in particular an effect different than that which can be obtained by coloring the pulp cellulosic fiber, i.e. before the formation of the paper ply, the print is polychromatic, i.e. it occurs by applying at least two different colors on the longitudinal band of the material. The color is applied in small doses in variable quantity so as to obtain a gradual shading of the color along the development of the longitudinal band.

[0013] In some embodiments, two or more colors, with which the polychromatic print is carried out, is applied with a non constant density, but with a density variable from a maximum to a minimum in a cyclical manner, so as to obtain on the finished product an effect of substantially continuous and repetitive variation of the overall color of the longitudinal band. By varying the density of each of the two or more colors in an offset manner, i.e. by providing that the zones of maximum density of each color are mutually staggered (so that the zone with maximum density of a color does not match with the zone of maximum density of the other colors), a changing color effect along the longitudinal band of the product is obtained, with a color toned down gradually towards the other, i.e. an effect wherein a zone colored in a predominant manner with one of the used color gradually passes to a zone colored in a predominant manner with another of the above mentioned colors, passing along portions of surface where the colors overlap, thus creating intermediate colors, preferably without interruption, i.e. with a gradual change of the chromatic effect.

[0014] It has been surprisingly discovered that in this way, by dosing the quantity of each color in an accurate manner, it is possible to obtain a substantially continuous color changing with one color toning down in the other by using a limited quantity of ink of the one and of the other of the various colors used. The quantity of color or ink used in each zone, area or surface portion of the longitudinal band can be so limited, as to not jeopardize in a critical manner the strength of the paper and therefore to allow the subsequent processing thereof, for example through embossing and/or the subsequent converting operations to obtain the finished product from the printed semi-finished product.

[0015] According to some embodiments, the longitudinal band is printed with at least three primary colors, in particular yellow, magenta and cyan.

[0016] In this way, by varying in a cyclical manner the quantity and therefore the density of each primary color along the longitudinal development of the band, it is possible to obtain on it a substantially continuous and cyclical variation of the overall chromatic aspect, passing throughout all the colors visible to the human eye.

[0017] As mentioned above, the density of each color varies in a cyclical manner with a mismatch of the peaks of density of each color, so as to balance, with the increase in density of the one, the decrease in density of the other of the various colors, in order to obtain both a particularly pleasant aesthetic effect and a technical effect of maintaining the strength of the paper within acceptable limits so as not to jeopardize the possibility of working it downstream of the printing.

[0018] In some embodiments the density of each color of the longitudinal band can vary in a cyclical manner only in the longitudinal direction. In other embodiments the longitudinal band of the paper web material may be printed with a variation of the density of each color or at least of some colors used also in the cross direction, i.e. in the width direction of the above mentioned band.

[0019] At the sides of the longitudinal bands, longitudinal edged can be provided (on only one side or on both the sides), on which a printed pattern different from the pattern of the longitudinal band is obtained. According to some advantageous embodiments, the longitudinal band is printed simply by distributing more colors with a variable density with an application on the full surface or according to dots or areas, so as to obtain as a whole an effect of chromatic shading, without the definition of a given decorative object or pattern. The longitudinal edge or edges flanking said longitudinal central band can vice versa provide given patterns obtained through a preferably polychromatic print. The edges can be printed with the same three primary colors with which the central longitudinal band is printed and/or with different colors or with the same colors and additional colors not present in the central longitudinal band. For example, the edge or the edges flanking the longitudinal band may be printed with four colors, i.e. a four - color print, whilst the central band is printed with three primary colors.

[0020] The longitudinal edges flanking the longitudinal band have not only an effect of aesthetic decoration, but also an important technical function. Actually, the tissue paper products are typically destined to be converted in rolls, for example rolls of toilet paper or rolls of kitchen towels. As it is well known to those skilled in the art, according to the production process of these products a web of tissue paper formed preferably by two or more plies with great width, for example from 2 to 5 meters, is wound to form so called logs, i.e. rolls with great axial length corresponding to the width of the initial plies. The diameter of the logs is equal to the final diameter of the rolls to be placed on the market. Rolls or small rolls for

the final consumer are obtained from these logs by cutting the log crosswise. This cut is carried out in a manner preferably phased with the printed patterns and/or the embossing motifs provided on the material. According to the present invention, printed decoration is therefore possible of a ply coming from a parent reel with wide width (for example 5 meters) according to a plurality of longitudinal bands, adjacent to each of which longitudinal edges as defined above are arranged. These edges define the planes along which the log, obtained from wounding the web material, must be cut to form the single rolls. Therefore, the longitudinal edges also constitute elements for separating one roll from the other, and allow to correctly phase the cut and the printed decoration one with respect to the other, but without the need of high tolerances.

[0021] According to some embodiments of the method according to the present invention, the longitudinal band can be decorated also with a projecting pattern, for example an embossed pattern, in addition to a printed pattern as defined above. Instead of embossing, a mechanical process usually carried out on the paper ply after the drying thereof and during the converting phase, said projecting pattern may also be obtained during the formation of the paper ply, for example by using paper ply-forming fabrics or networks of adequate structure, typically constituted by a particularly rough weave of weft and warp yarns. However, the use of a projecting pattern obtained by embossing, advantageously downstream of the printing, allows to synchronize printing and embossing, combining the two effects of printing and embossing to obtain a particular aesthetic and technical functional result on the finished product.

[0022] When longitudinal edges flanking the central longitudinal band are provided, they can also be provided with a projecting motif or pattern obtained for example by embossing. This projecting motif or pattern of the longitudinal edges can be advantageously different from the projecting pattern of the central band, and this also with the purpose of obtaining particular technical functional effects. In particular when the material is a multi - ply material, the two or more plies which form it are joined together by gluing. The glue is typically applied at protuberances obtained by embossing. As the glue must be distributed in an adequate manner to obtain an efficient joining of two plies without however stiffening in an excessive manner the finished product, it could be advantageous to provide along the longitudinal edges of the finished product a quantity of glue greater than along the central zone. This can be advantageously obtained by using embossing patterns different for the longitudinal central band and for the lateral edges: along these latter a more dense embossing will be provided, i.e. a greater number of embossing protuberances per surface unit, or a greater percentage of embossed surface, than in the longitudinal central band, so that it is possible to distribute more glue in this area than in the central band where, vice versa, the embossing will be less dense, i.e. the

embossing protuberances distributed with a lower density, or in any case with a lower percentage of embossed surface, so as to apply a lower quantity of glue in the central zone of the finished product.

[0023] Further advantageous embodiments of the method and of the product according to the present invention are set forth in the appended claims and shall be described in greater detail hereunder with reference to some non limiting embodiment of the invention.

Brief description of the drawings

[0024] The invention will be better understood by means of the description below and the attached drawing, which shows a non-restrictive practical embodiment of the invention. More particularly, in the drawing:

figure 1 shows a diagram of a processing line for carrying out the method according to the present invention;

figure 2 shows a development of a portion of a web material obtained through the method according to the present invention;

figure 2A shows two portions of two bands of web material obtained by cutting the material of figure 2; figures 3 and 4 show embossing patterns that can be applied to two plies which can be processed according to the method of the present invention;

figure 3A shows a schematic enlarged section of a two-ply web material wherein the plies are bonded together in a nested arrangement;

figures 5 and 6 show different embossing patterns for the two plies;

figures 7A to 10 show possible methods for distributing the color on the web material;

figure 11 shows a table of the measurements of color density carried out on products obtained according to the method of the present invention; and

figure 12 shows a different method for distributing the color on the central or longitudinal band of the web material in a modified embodiment of the present invention.

Detailed description of embodiments of the invention

[0025] Figure 1 schematically represents a portion of a tissue paper converting line for the production of rolls of toilet paper, rolls of kitchen towels, paper napkins or handkerchiefs or other similar products to which the process described hereunder can be applied. More in particular, figure 1 shows the printing unit 1 and the embossing-laminating unit 3. Upstream of the printing unit 1 one or more unwinders (not shown) are provided, which unwind reels coming from the paper mill, i.e. parent reels, around which one or more plies are wound to form the finished tissue paper multi-ply web material N. Other converting machines are provided downstream of the embossing unit, for example and in particular a rewinding machine,

a unit for gluing the final edge of each log produced by the rewinding machine, intermediate storage units, as the case may be, one or more severing machines, etc., according to what is known by those skilled in the art of paper converting and not described herein.

[0026] The printing unit 1 comprises a central drum 5 around which four color units or printing units are arranged, indicated with 7A, 7B, 7C and 7D, as it is a machine for four-color print. It should be understood that the number of the printing units or color units 7 can vary depending upon the type of print which is desired on the web material.

[0027] A first tissue paper ply V1, coming from a reel and destined to be bonded to a second ply V2 which is fed directly to the embossing - laminating unit 3, passes across the printing unit 1.

[0028] In this embodiment the embossing-laminating unit 3 is a group which performs nested embossing and laminating, i.e. wherein the two plies V1 and V2 are embossed separately one from the other by means of two embossing rollers 9A and 9B, each combined to a corresponding pressure roller 11A, 11B. The two embossed plies are then bonded by means of a laminating roller 13. More in particular the ply V1 is embossed between the embossing roller 9A and the pressure roller 11A. The ply V2 is embossed between the embossing roller 9B and the pressure roller 11B. The embossed ply V2 is removed from the embossing roller 9B and placed on top of the ply V1 which is still engaged to the embossing roller 9A. The two plies V1 and V2 then pass through the nip between the embossing roller 9A and a laminating roller 13 where they are laminated and glued. The glue is applied by a glue dispensing unit 15 on the protuberances generated on the ply V1 by the embossing roller 9A, as it is well known to those skilled in the art.

[0029] It should be understood that in other embodiments the embossing-laminating unit 3 can be different, for example of the tip-to-tip type, i.e. wherein the protuberances of the embossing rollers 9A, 9B are arranged at least partially mutually in phase and opposite to one another in the nip between said two rollers. It should also be understood that the number of plies forming the finished web material N can be greater than two, the plies being suitably combined and bonded together according to known methods and techniques, not described herein.

[0030] As indicated in the forward, the plies V1 and V2 are usually plies with great width, i.e. with a dimension in the direction orthogonal to the plane of figure 1 much greater than the cross dimension of the finished product obtained by the longitudinal cut of the web material N exiting from the embossing-laminating unit 3. Cutting can be carried out in line before the winding or after the winding in individual logs, also depending upon the type of finished product required. For example when the web material N is wound in rolls with a relatively small diameter, such as rolls of toilet paper for household use, cutting is carried out on the already formed logs. Vice versa, when the finished rolls have great diameter, in some cas-

es it is preferable to cut the web material N in individual strips which are then wound in parallel in rolls with axial dimensions equal to the dimension of the finished product destined to the sale.

[0031] Figure 2 shows the plane development of a portion of the web material N obtained by means of the printing unit 1 and the embossing-laminating unit 3. More in particular, figure 2 shows the surface of the web material N formed by the ply V1 which has been printed by the printing unit 1. In figure 2, MD indicates the machine direction, i.e. the direction of feed of the web material N in the converting line. As shown in figure 2, in this schematic example the web material N is subdivided into eleven sections which develop longitudinally along the web material and which are indicated with the numbers from S1 to S11, corresponding to eleven strips of web material which will form eleven distinct finished rolls. Substantially, in this case the plies V1 and V2 have therefore a width equal to at least eleven times the axial width of the finished rolls which will be obtained by cutting the web material.

[0032] Figure 2A shows separately the first two strips S1 and S2. Each strip S1-S11 comprises a central longitudinal band F and two longitudinal edges B flanking the band F. As it will be described in greater detail hereunder, each longitudinal band F is printed by the unit 1, preferably a three-color printing with the primary colors cyan, magenta and yellow, as well as with an embossing motif generated by the embossing unit 3. Similarly, the edges B developing along the sides of the longitudinal band F are printed, preferably with a four-color print, by means of the printing unit 1 and they are embossed by means of the embossing unit 3. Figures 2 and 2A indicate perforation lines Lp, which can be generated on the material in cross direction, to subdivide the ply into individual sheets which can be detached during use, as known for example in the rolls of toilet paper, kitchen towels or the like. The perforation line Lp do not require to be phased with the decoration of the central longitudinal band F, but they are preferably phased with the decorations of the edges B.

[0033] For a better illustration of the printing and embossing motifs which can be applied to the longitudinal bands F of each strip S1-S11, as well as of the print applied on them, hereunder with reference to figures 4 to 10 the embossing patterns and the printing patterns will be illustrated and described separately. It should be understood that in the finished product printing and embossing are combined with each other. In other embodiments, not shown, embossing can be omitted, or it can be replaced by a three-dimensional working, i.e. a working which generates a projection on the ply analogously to the embossing, but which is carried out during the phase of formation of the paper ply.

[0034] In the illustrated embodiment, as it is shown in particular in figure 2, the strips S1-S11 are decorated in their central bands F with alternate embossing motifs: the strips in odd rows S1, S3, S5, S7, S9 and S11 are

provided with an embossing motif different than the strips in even rows S2, S4, S6, S8, S10, although this is not strictly necessary and is shown here purely by way of example. The embossing patterns of the strips of even position and of odd position will be described in greater detail with reference to figures 3 and 5.

[0035] In figure 2 it should also be noted that the edges B flanking each band F in each strip S1-S11 are printed with motifs which are mismatched between one strip and the other, and with different motifs for the strips in even position relative to the strips in odd position. Also in this case this is merely a non limiting example. However it should be understood the by mismatching the printing motifs a greater uniformity is obtained in the distribution of the inks and therefore a greater uniformity in the operation of the line.

[0036] Figure 3 shows an example of an embossing pattern which can be applied to the strips S1-S11. As it is visible in figure 3, the embossing motif has a central area G1 with a series of protuberances P1 that, in this embodiment, look like the scales of a snake skin. The lines P1 defining the individual scales are constituted by protuberances generated by projections of the embossing rollers and therefore on the finished product they look like protuberances facing the inner of the web material, i.e. facing the opposite ply. Two lateral embossing motifs G2 flank the central embossing motif G1; these are equal to each other and are formed by protuberances P2 with a simple geometric shape, arranged according to mutually intersecting lines. The embossing pattern G1 corresponds in each strip S2, S4, S6, S8, S10 to the central band F, whilst the embossing patterns G2 correspond to the edges B. The embossing patterns shown in figure 3 are those applied on the one or on the other of the two plies V1, V2 and, preferably, on the ply V1 which has been previously printed in the printing unit 1.

[0037] Figure 4 shows by way of example a possible embossing pattern of the opposite ply, i.e. of the ply V2 which will be glued to the ply V1. Here again a central embossing motif G3 and a lateral embossing motif G4 applied on the edge areas at the sides of the embossing pattern G3 can be seen. As it is well understood by comparing figures 3 and 4, the embossing patterns are designed in this case so as to be mutually joined according to the nested embossing technique, i.e. with the protuberances P3 and P4 of the patterns G3 and G4 (figure 4) nested between the protuberances P1 and P2 of the embossing pattern G1 and G2 of figure 3.

[0038] Figure 3 schematically shows a section of the web material N formed by coupling the plies V1 and V2, with mutually nested protuberances P1 and P3.

[0039] Figures 5 and 6 show the embossing patterns of the strips S1, S3, S5, S7, S9 and S11. More in particular, figure 5 shows the embossing of the ply V1 and figure 6 shows the embossing of the ply V2. The concept with which these two embossing are designed is the same as that described previously with reference to figures 3 and 4.

[0040] By observing figures 3, 4, 5 and 6, it should be noted that along the lateral areas (embossing patterns G2 and G4), the embossing density is greater than in the central area, and this allows to apply a greater quantity of glue along the edges B which flank each central longitudinal band F. This is advantageous as, when the web material N will be cut and subdivided into individual strips along planes according to T-T (figure 2), the edges B of each strip S1-S11 will form the respective outer edges of the web material of the finished rolls and therefore a greater density of glue in this area prevents the accidental detachment of the two plies forming the finished material, whilst the central area (band F) will have a lower quantity of glue and therefore it will be softer.

[0041] In figure 5, which shows preferably the upper ply V1, the embossing of the lateral bands has the same embossing pattern as the lateral bands of the ply V2 of figure 4. In this way, in addition to vary the embossing aspect of the central bands between the even rolls and the odd rolls, it is also possible to vary the aspect of the respective lateral bands. However, in an advantageous embodiment of the present invention the lateral bands of all the rolls (even and odd) have the same embossing pattern. For example, on the upper ply V1 the embossing pattern of figures 4 and 5 is always present, whilst on the lower ply V2 the embossing pattern of figures 3 and 6 is always present. In this way, an extreme accuracy in the position of cross cut when cutting the logs into rolls it is not required, as all the obtained rolls will have the same embossing decoration.

[0042] According to a particularly advantageous aspect of the present invention, the longitudinal central bands F of each strip S1-S11 are printed by the printing unit 1 with a distribution of color that allows to obtain a changing effect, i.e. a substantially continuous and repetitive shading of color in the area of said bands F. The repetition pitch of the shading can advantageously correspond to the circumferential development of the plates of the printing rollers, or to a fraction thereof, for example one half or one third.

[0043] To better understand the criterion according to which the various colors are applied, specific reference can be made to the figures 7A - 9C and to the table of figure 11. In figures 7A and 7B two mutually flanking portions of the web material N are shown, and more in particular the strips S1 and S2 (figure 2). Figures 7A and 7B show, in different tones of grey, the areas printed with the yellow color. The areas printed with the other two colors, magenta and cyan, are white. In other words, in figures 7A and 7B only the distribution of the yellow ink is shown for the strips S1 and S2. It should be noted for example in the strip S1 that the central band F is characterized by a distribution of the yellow color with a density variable between an area with a minimum density (lighter grey) to an area with maximum density (darker grey). The areas with variable density of yellow color in the central band F follow one another without interruption, i.e. in this case the yellow color is distributed through the

whole surface on the entire central band F. Alternatively, it may be distributed according to dots or discrete areas sufficiently dense to give to the eye preferably an effect of a substantially throughout coloration on the entire surface, at least when the product is observed from a certain distance.

[0044] Vice versa, along the edges B which develop at the sides of the longitudinal central band F, the yellow color is applied in a discrete manner, i.e. in defined and limited areas. In the illustrated example, in the central section of the two edges B small flags with triangular shape are printed, on the left there is no yellow printing and on the right there are prints with a shading, i.e. a gradual change in the density of yellow color, represented, in this black and white view, by a change of the grey tone. The edges B arranged at the sides of the central longitudinal band F in figure 7B are printed with a repetitive pattern.

[0045] Whilst in the strip S1 the yellow color is applied in the longitudinal central band F with a uniform density in the cross direction (arrow T), in the strip S2 (figure 7B) the central band F is characterized by a distribution of the yellow color with a changing density, i.e. a changing intensity, not only in the machine direction (arrow MD), but also at least partially in cross direction T.

[0046] For a better comprehension of the way in which the yellow color is distributed in the central longitudinal band F, reference should be made also to figure 7C. This figure shows a diagram with the longitudinal position of the central band F on the abscissa and a measurement of the density of the yellow color on the ordinate. Two curves Y1 and Y2 are shown, referring to two different possible distributions of the yellow color in two different embodiments of the invention. The length on the abscissas corresponds to the circumferential development of the printing roller. It should be noted that along this development both in one case and in the other case the density of the yellow color changes in a continuous manner and has a minimum and two maxima more marked in the case of the curve Y1 and less marked in the case of the line Y2. In the first case the overall quantity of yellow color or ink applied is greater than in the second case. Substantially, the curves Y1 and Y2 are obtained by measuring the color density along a line parallel to the MD direction in the longitudinal band F of one of the sections S1-S11.

[0047] In a completely similar manner, the figures 8A, 8B and 8C show the distribution of the magenta color on the same portion of each strip S1, S2 and the figures 9A, 9B and 9C show the distribution of the cyan color on the same portions of web material.

[0048] By comparing the various figures 7A to 9C it is clear that in each area of the central longitudinal band F a change in the density of each of the primary colors occurs, from a minimum to a maximum in longitudinal direction (and in the case of the strip S2 also in cross direction) with a misaligned position of the points of maximum and minimum density of the three primary colors

(as it is clearly apparent in particular by comparing the diagrams of figure 7C, 8C and 9C). In this way, in addition to having a shading effect, i.e. a color changing from the one to the other of all the colors visible to the human eye, obtained from the combination of the three primary colors, also the technical advantage is obtained of reducing the quantity of ink in each single portion of the web material, so as to maintain an adequate strength of the printed and subsequently embossed cellulosic fiber ply.

[0049] Practically, a printing effect is obtained which is very visible and efficient from an aesthetic point of view, suitable to appeal greatly the consumer and therefore with a much more significant aesthetic effect than that obtained thorough the traditional techniques, however maintaining the quantity of ink below the critical value which entails an excessive weakening of the cellulosic ply and therefore the impossibility of a subsequent working thereof. It has been surprisingly discovered that, by distributing the inks in this way it is not necessary to carry out drying of the cellulosic ply in the area between the printing and the subsequent embossing, as the strength of the cellulosic fibers of the ply is maintained within an adequate range to perform the mechanical embossing working downstream of the printing and/or the spontaneous drying which occurs due to the simple feed of the ply along its path is sufficient to reduce the content of liquid in the cellulosic structure of the material.

[0050] For a more efficient quantification of the distribution of the individual inks in the yellow, magenta and cyan colors, reference should be made to the table in figure 11, where individual readings are shown (for a total of fifty-nine readings on the longitudinal development of the band F corresponding to the circumferential development of the printing roller) in two different applications for the three colors. Also the reading is shown of the grey color which represents a calibration value of the measuring equipment.

[0051] By means of this distribution of colors, with variable density and mismatching between the points of maximum density of the various colors, for example cyan, magenta and yellow, in the central longitudinal bands F a changing polychromatic decoration is obtained, i.e. with a substantially continuous variation in color, thanks to the mutual combination of three primary colors with variable densities. With reference for example to the band indicated with S1 in figure 2A, and starting from the left of the diagrams of figures 7A, 8A and 9A, there will be a change, i.e. a variation of color from pure yellow which changes in green, then in blue, then in fuchsia, in red, in orange, and in yellow again. By varying the density curve of the primary colors and the mismatching between these curves it is possible to obtain various effects of color changing according to what is desired by the producer or by the seller of the finished product. A density curve which has a greater number of minima and maxima in the development of the plate roller can allow to obtain a more dense alternation of changing colors.

[0052] As mentioned above, the edges B flanking each

longitudinal band F of the strips S1-S11 can be four-color printed, i.e. using for example as fourth color the ochre color. Figure 10 shows the distribution of the ochre color on the strips S1 and S2, with a criterion similar to that used in the representations of figures 7A, 7B, 8A, 8B, 9A, 9B. It should be noted that the ochre color is applied exclusively along the edges B and not in the central longitudinal band F, which, in this embodiment, is printed only with the three primary colors with adequately mismatched densities along the development of the printing roller.

[0053] Figure 12 shows by way of example a distribution of color according to the same criteria, but with a dot-distribution instead of a distribution substantially throughout the whole surface. Actually, when the ink is applied by the various printing rollers of the printing unit 1 on the tissue paper, the capacity of absorption of this latter allows that the ink (which is in any way applied in a discrete manner through the screen which distributes the ink on the printing roller) imbibes all the fibers constituting the printed ply. In this way it is possible to obtain a coloration throughout the whole surface. However this is not strictly necessary, even if preferred. In figure 12 the ink is applied according to the same criteria of density variation of the three primary colors in order to obtain a shading effect, i.e. a chromatic changing effect. However, in this embodiment the inks are applied according to discrete zones, represented in this case by small square dots distributed in a geometrically uniform manner. The obtained effect can be somehow assimilated into that of the printing throughout the whole surface. Intermediate solutions can also be adopted, wherein the inks in the various colors are applied in the longitudinal central band F of each strip S1-S11 in some areas throughout the whole surface and in other in discrete areas or according to a dotting similar to that of figure 12.

[0054] In other embodiments the inks can be applied for example only on the surfaces of the embossing protuberances. In this case it can be provided for example for distributing glues colored with the three primary colors and thus using the glue as an ink, following the same criterion of gradual variation of the density of each of the three primary colors. In this case in the longitudinal central band F embossing patterns will be present, colored with a changing color, i.e. with a continuous shading throughout the various colors which can be obtained by combining the two or more colors used in combination. If, as described above, the three primary colors cyan, magenta and yellow are used, this allows to obtain in the central band in correspondence of the embossing protuberances a coloration changing in machine direction and, as the case may be, in cross direction, which covers all the visible spectrum. Preferably, in the case colored glues are used instead of ink printing groups, the screening will be less dense than when using inks, therefore also the not glued/colored areas will be much more visible to the naked eye, even if the overall optical effect on the tissue paper will be a toned down coloration.

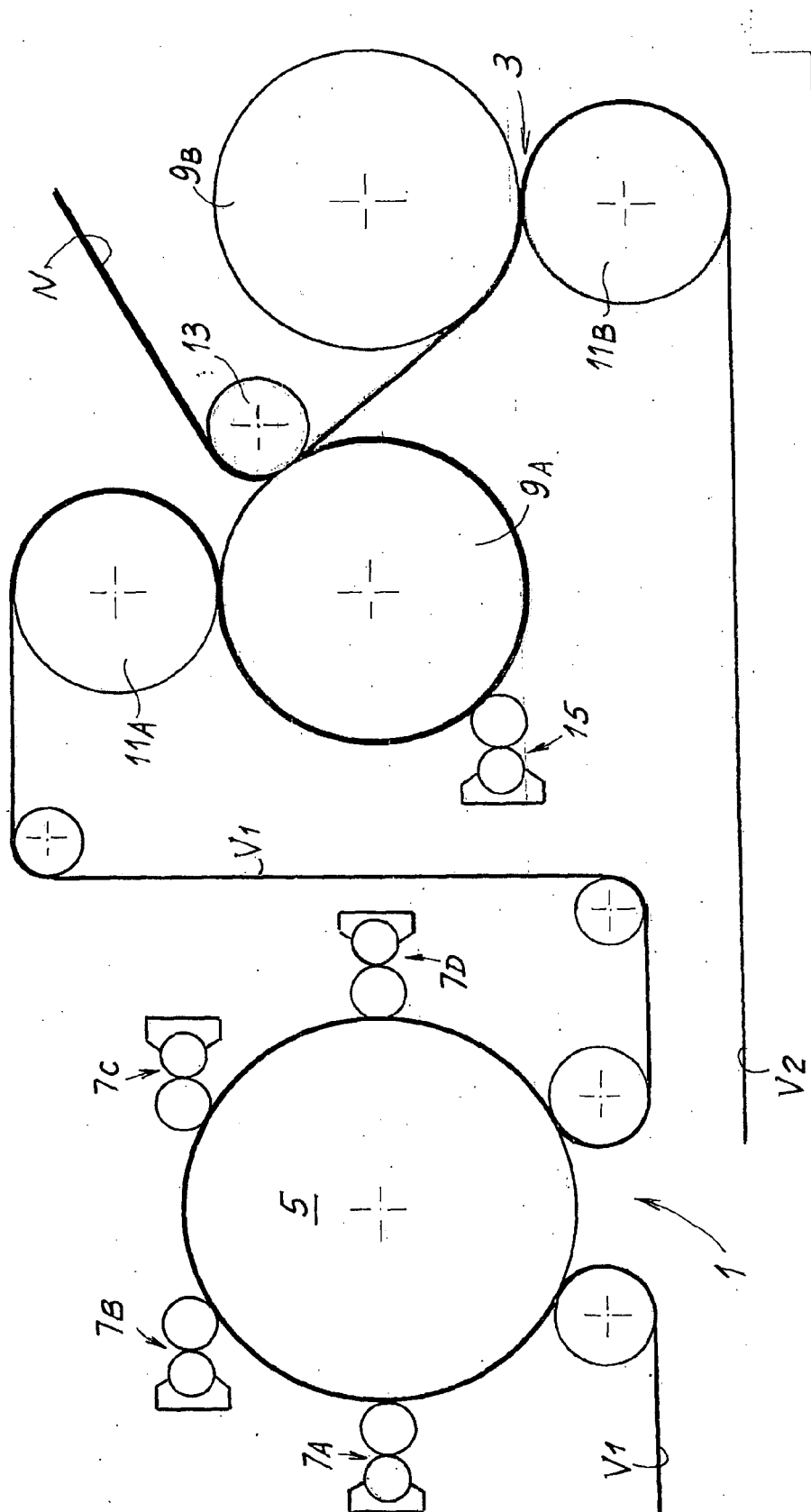
[0055] It is understood that the drawing only shows an example provided by way of a practical arrangement of the present invention, which can vary in forms and arrangements without however departing from the scope of the concept underlying the invention. Any reference numbers in the appended claims are provided for the sole purpose of facilitating reading of the claims in the light of the description and the drawing, and do not in any manner limit the scope of protection represented by the claims.

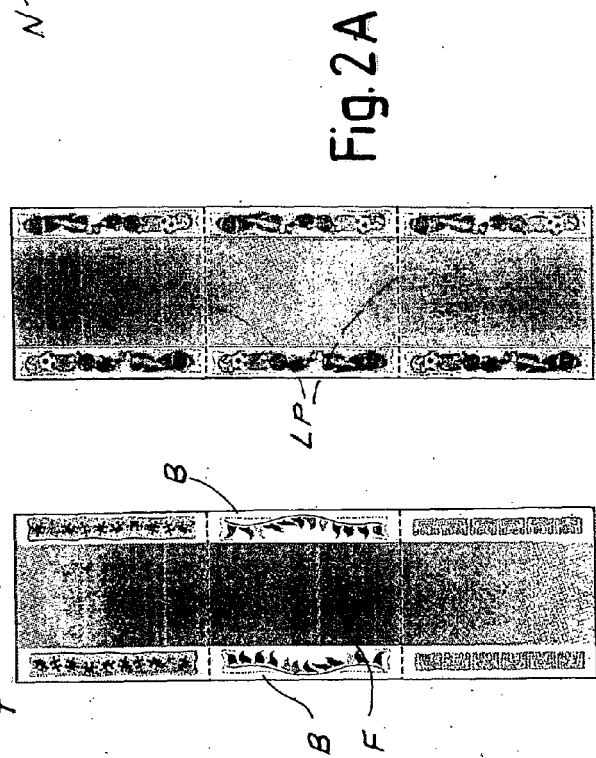
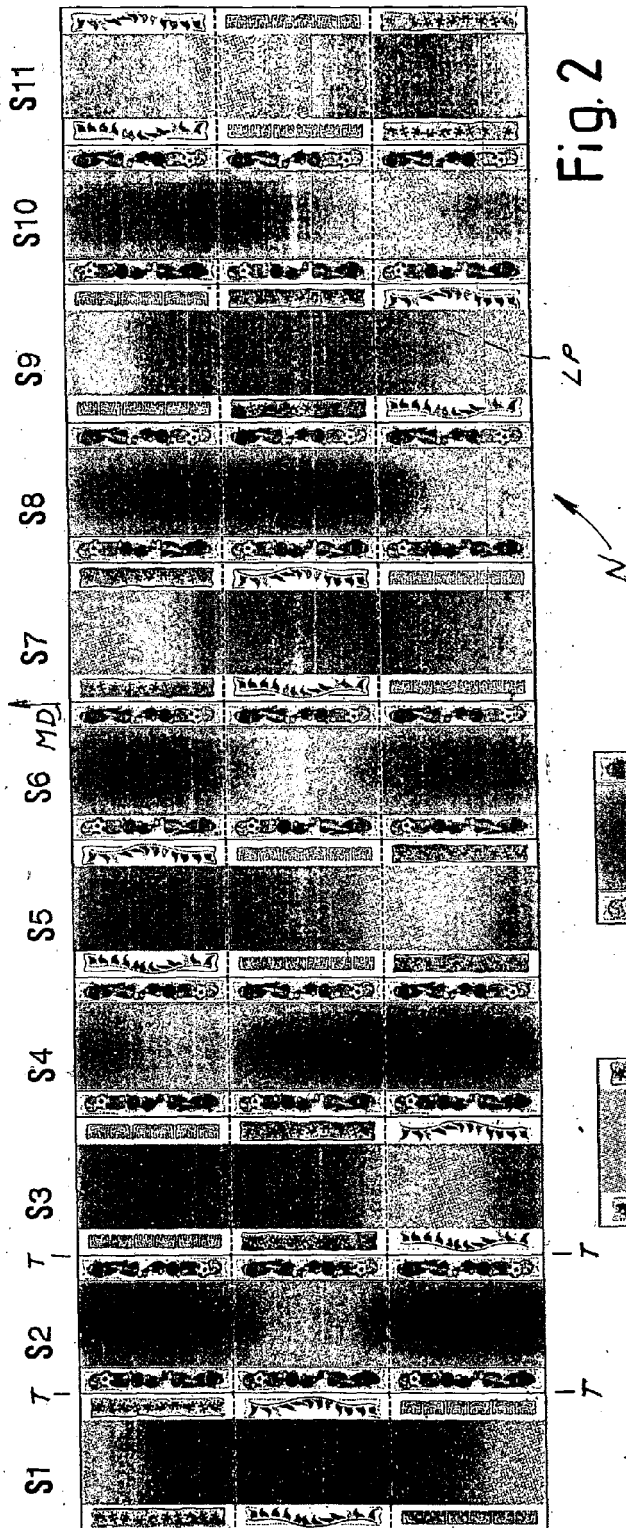
Claims

1. A method for chromatic decoration of a tissue paper web material, comprising the step of coloring at least one longitudinal band of said web material with a polychromatic decoration, with a substantially gradual and repetitive variation of the density of each color along at least the longitudinal development of said band.
2. Method as claimed in claim 1, wherein said chromatic decoration is obtained through printing.
3. Method as claimed in claim 1 or 2, comprising the step of transforming said web material into a roll or into a pack of folded products.
4. Method as claimed in claim 1, 2, or 3, wherein said longitudinal band is chromatically decorated with at least three primary colors.
5. Method as claimed in one or more of the previous claims, wherein the density of the colors used changes in a staggered manner, so that the density reduction of one or more colors balance at least partially the density increase of one other or other colors along said longitudinal band.
6. Method as claimed in one or more of the previous claims, wherein each color is applied throughout the surface on at least one portion of the longitudinal band.
7. Method as claimed in one or more of claims 1 to 5, wherein said longitudinal band is chromatically decorated with a distribution of colored dots or areas separated from one another by an area devoid of color.
8. Method as claimed in one or more of the previous claims, wherein each of said colors is applied with a density variable in a cyclic manner between a minimum value and a maximum value.
9. Method as claimed in one or more of the previous claims, wherein the color density in said longitudinal

- band changes gradually also in a transverse direction.
10. Method as claimed in one or more of the previous claims, wherein, along at least a longitudinal edge adjacent to said band, a chromatic pattern is obtained, different from the chromatic decoration of the longitudinal band.
 11. Method as claimed in claim 10, wherein said chromatic pattern has a longitudinal development substantially parallel to said band and comprises discrete decorative patterns in one or more colors and preferably in three or four colors.
 12. Method as claimed in one or more of the previous claims, wherein said longitudinal band is decorated with a raised pattern combined with said chromatic decoration.
 13. Method as claimed in claim 12, wherein said raised pattern is obtained by embossing.
 14. Method as claimed in claim 12 or 13, wherein, along at least one longitudinal edge adjacent to said longitudinal band, a raised decorative pattern is obtained, different from the raised decorative pattern of the longitudinal band.
 15. Method as claimed in claim 14, wherein said raised pattern of the longitudinal edge is an embossing.
 16. Method as claimed in one or more of the previous claims, wherein said web material is chromatically decorated on a plurality of adjacent longitudinal bands, and wherein the color distribution in adjacent bands is staggered in such a way to obtain a greater uniformity in the quantity of each color applied in each transverse area of the web material.
 17. Method as claimed in one or more of the previous claims, wherein two or more plies are bonded to each other by gluing, at least one of said plies being provided with at least one chromatically decorated longitudinal band.
 18. A tissue paper, preferably multi-ply, web material comprising at least one longitudinal band decorated with a polychromatic decoration, with a substantially gradual and repetitive variation of the density of each color along at least the longitudinal development of said band.
 19. Material as claimed in claim 18, wherein said longitudinal band is decorated by printing.
 20. Material as claimed in claim 18 or 19, packaged in a roll or a pack of folded sheets.
 21. Material as claimed in claim 18 or 19, wherein said longitudinal band is decorated with at least three primary colors.
 22. Material as claimed in claim 18, 19, 20, or 21, wherein along said longitudinal band the density of the used colors changes in a staggered manner, so that the reduction in the density of one or more colors balances at least partially the increase in the density of one other color or other colors along said longitudinal band.
 23. Material as claimed in one or more of claims 19 to 22, wherein each color is applied on said longitudinal band throughout the whole surface, or with a distribution of colored dots or areas separated from one another by an area devoid of color.
 24. Material as claimed in one or more of claims 18 to 23, wherein each of said colors is applied with a density variable along the development of said longitudinal band in a cyclic manner between a minimum value and a maximum value.
 25. Material as claimed in one or more of claims 18 to 24, wherein the color density in said longitudinal band changes gradually also in transverse direction.
 26. Material as claimed in one or more of claims 18 to 25, comprising at least a longitudinal edge adjacent to said band, and preferably a longitudinal edge along both the sides of said band, along said longitudinal band or bands a chromatic pattern being obtained, different from the chromatic decoration of the longitudinal band.
 27. Material as claimed in claim 26, wherein said chromatic pattern has a longitudinal development substantially parallel to said band and comprises discrete decorative patterns in one or more colors and preferably in three or four colors.
 28. Material as claimed in one or more of claims 18 to 27, wherein said longitudinal band is decorated with a raised pattern combined with said polychromatic decoration, preferably constituted by an embossing.
 29. Material as claimed in claim 28, wherein, along at least a longitudinal edge adjacent to said longitudinal band, a raised decorative pattern is provided, preferably constituted by an embossing, different from the raised decorative pattern of the longitudinal band.
 30. Material as claimed in one or more of claims 18 to 29, comprising a plurality of plies glued to each other.

Fig. 1





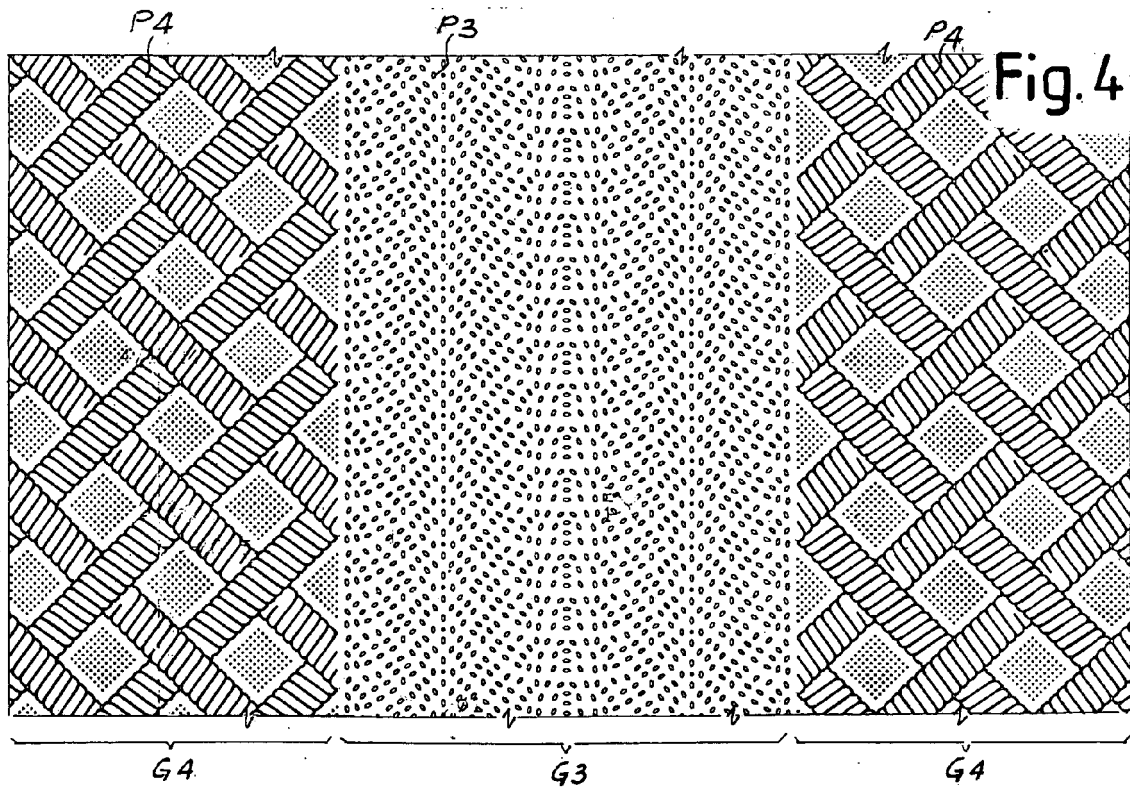
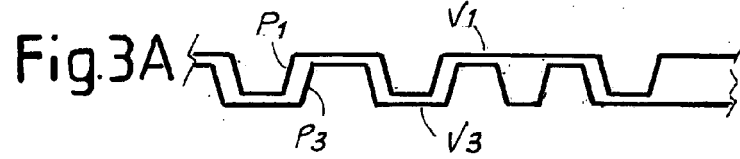
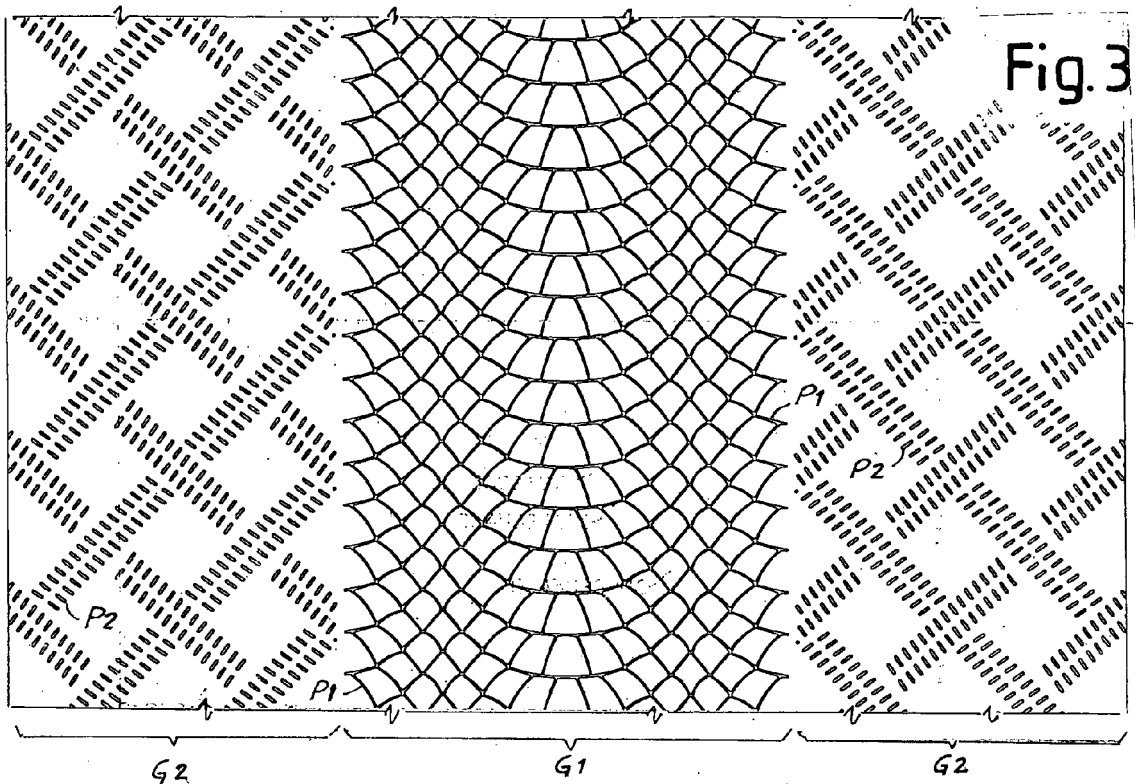


Fig.5

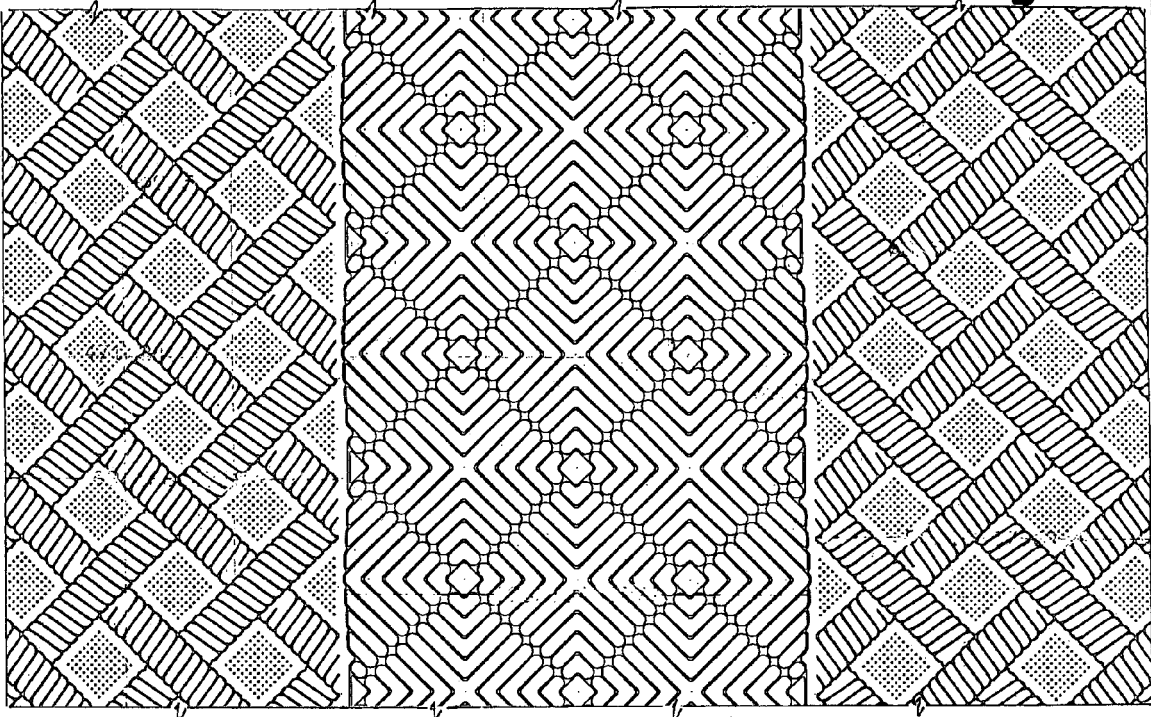


Fig.6

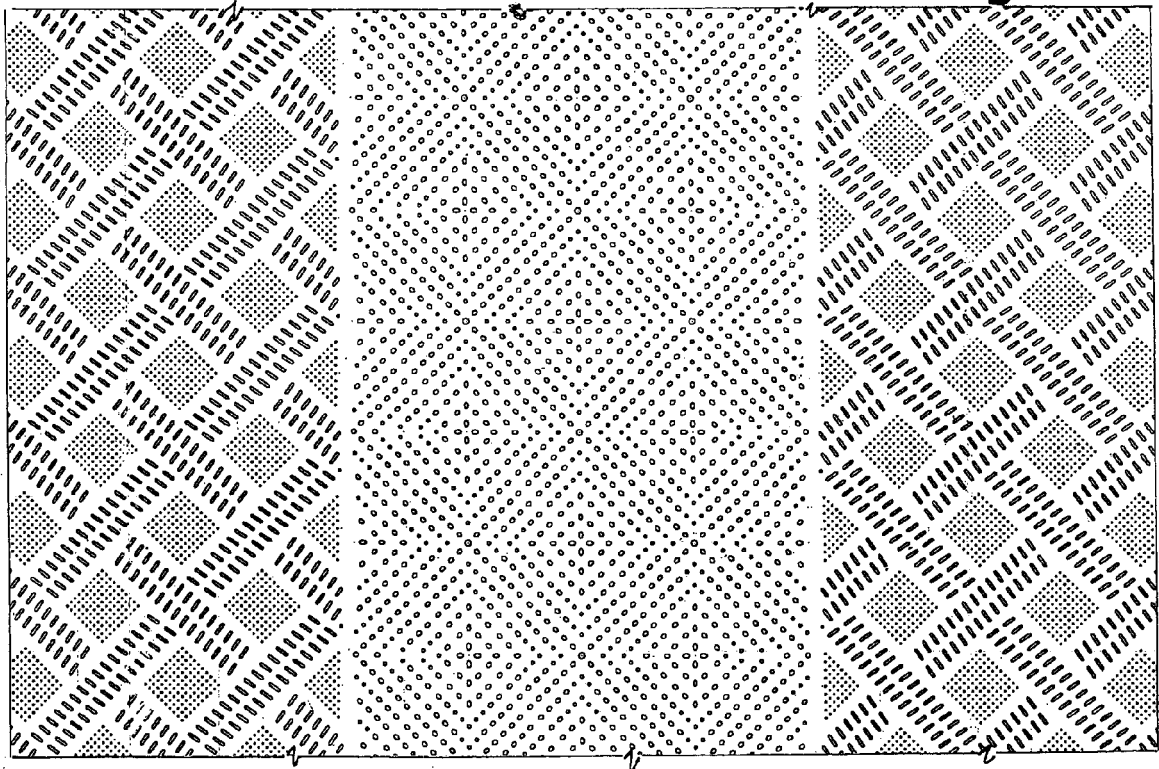


Fig.7A

GIALLO

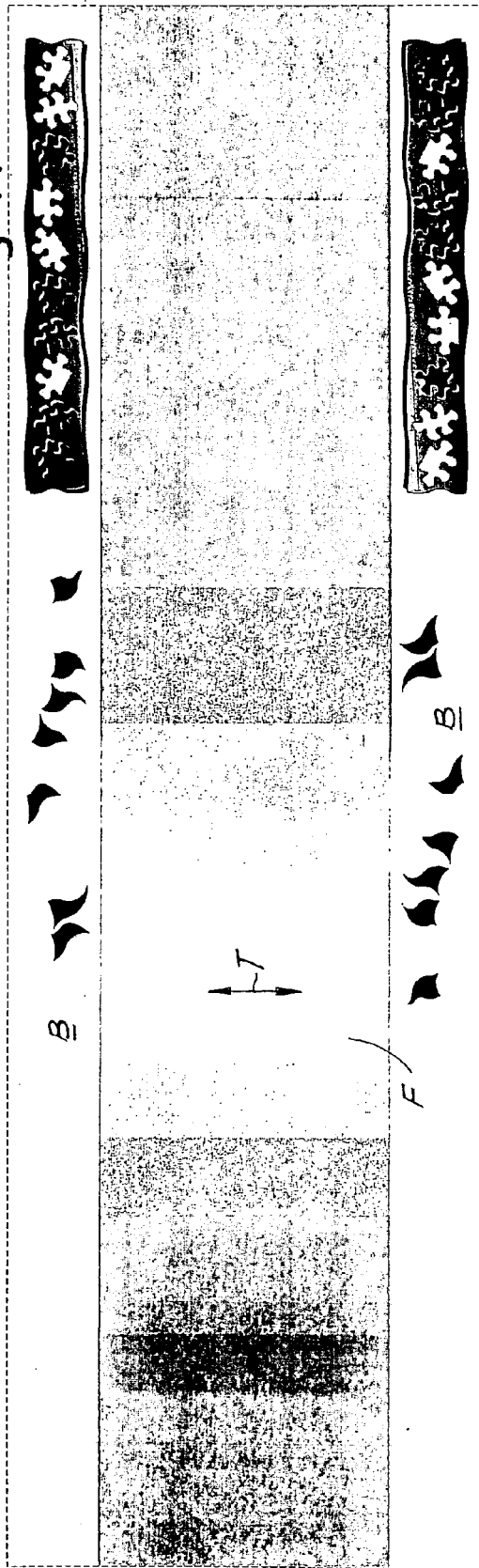


Fig.7B

GIALLO

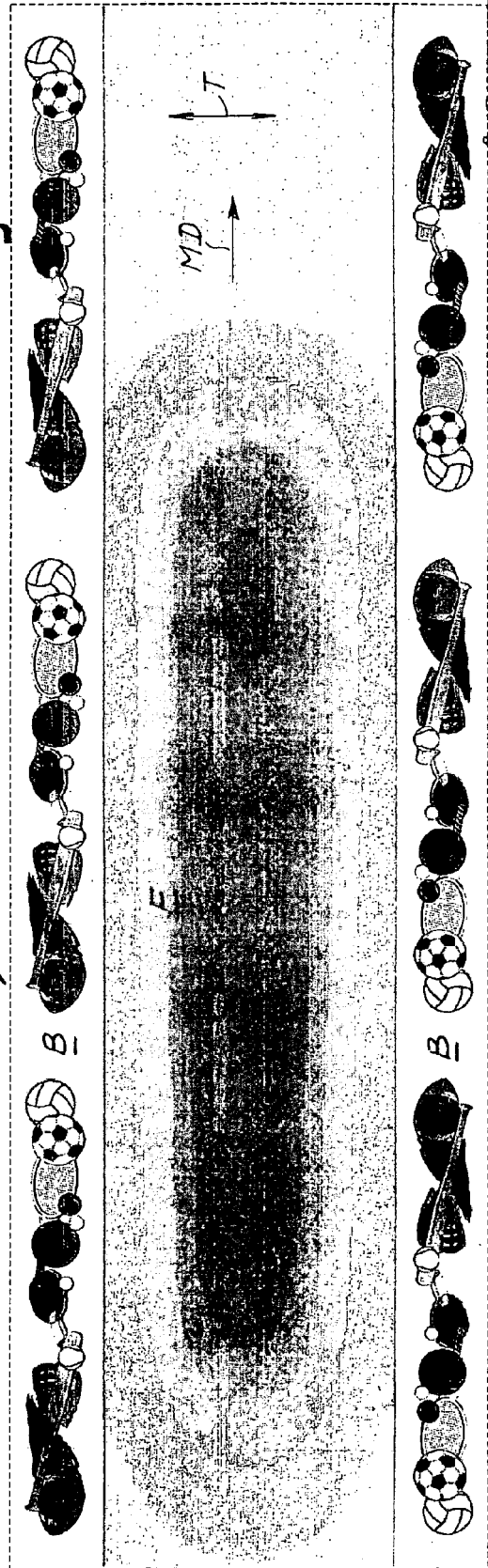


Fig.8A

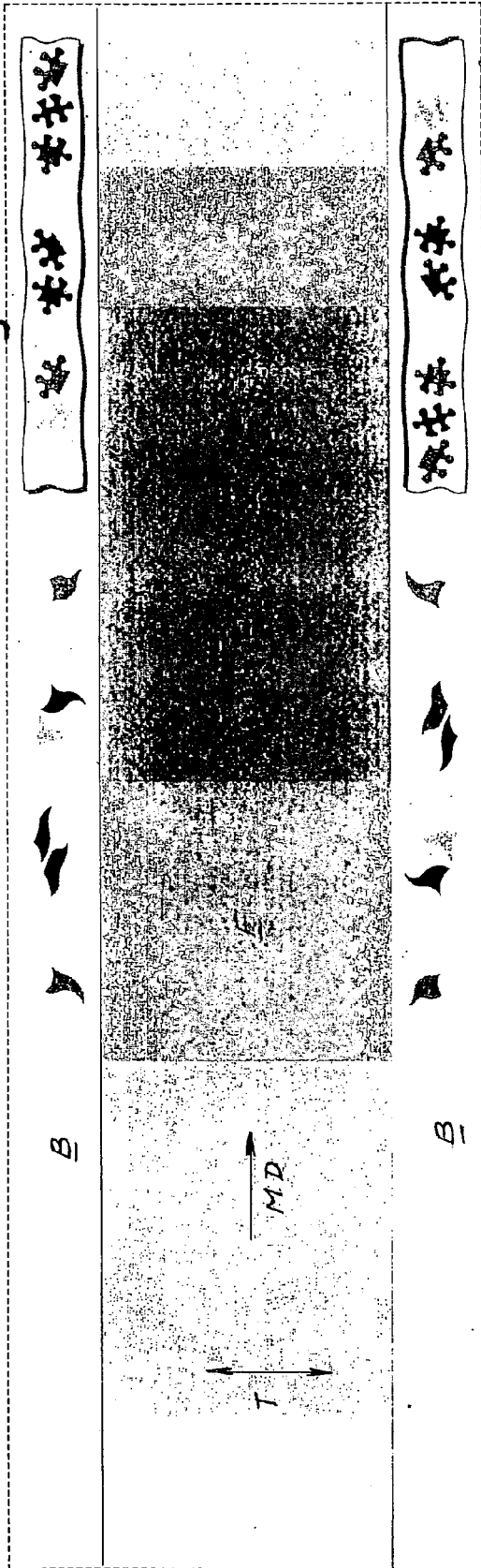


Fig.8B

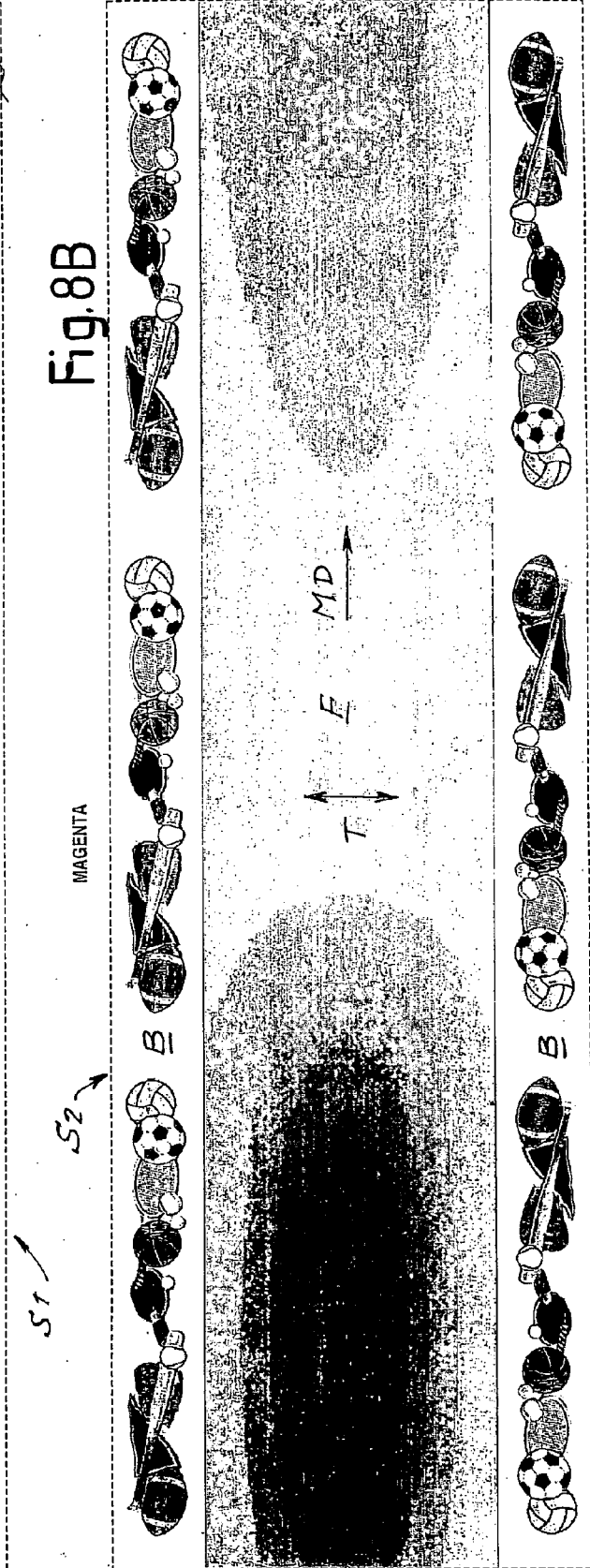


Fig.9A

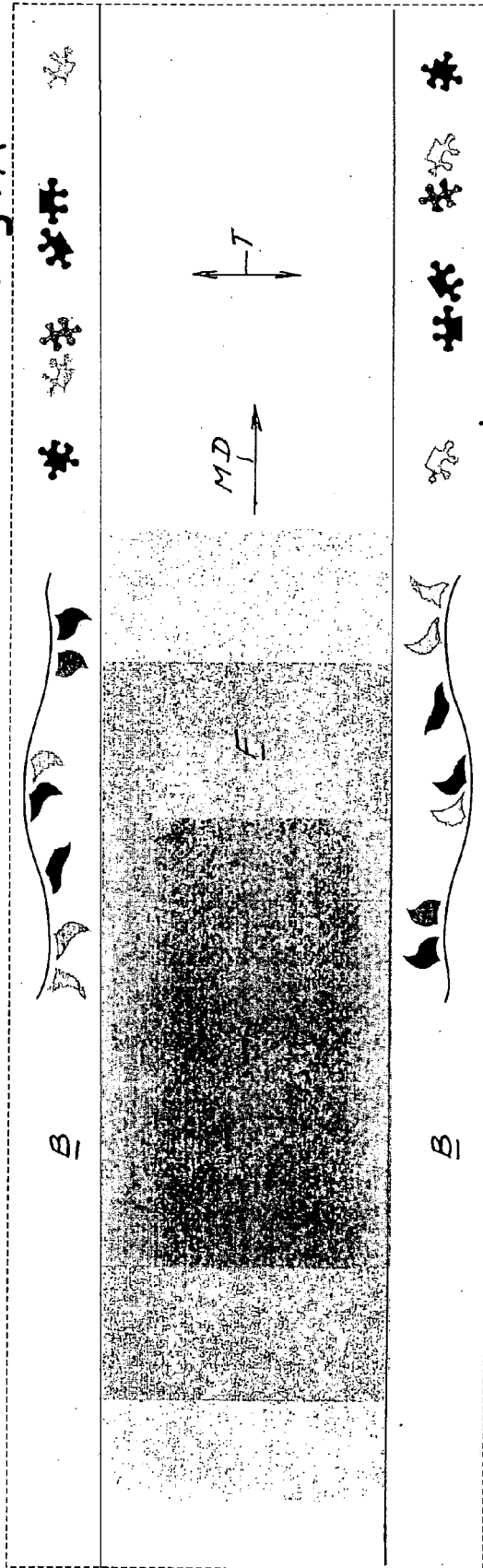
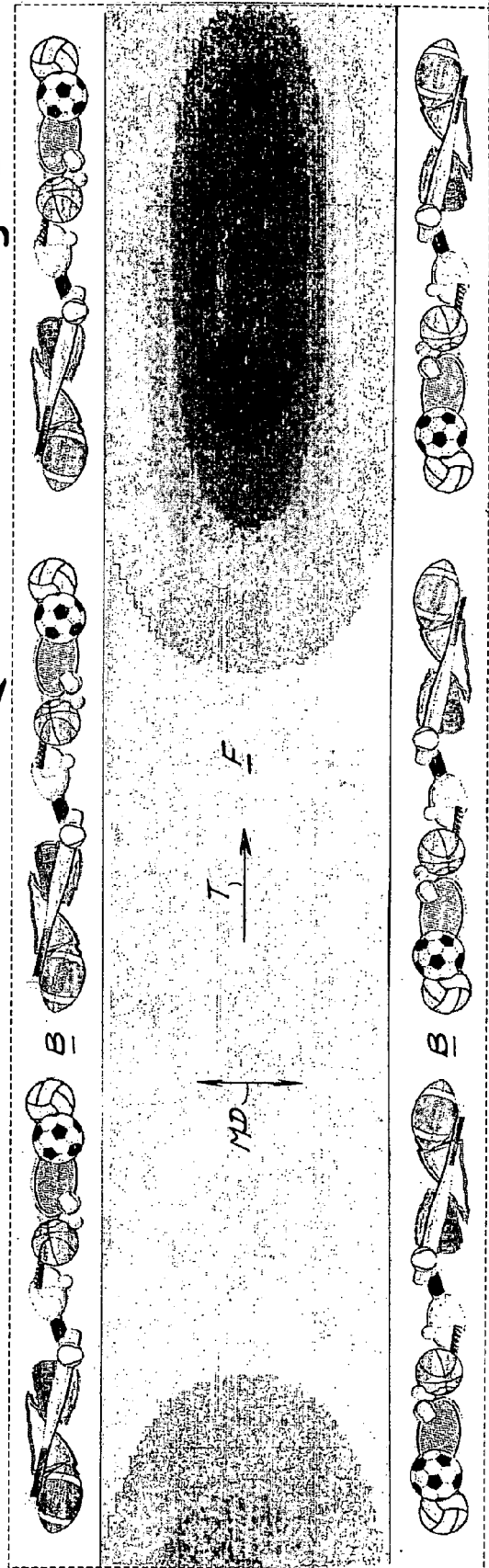


Fig.9B



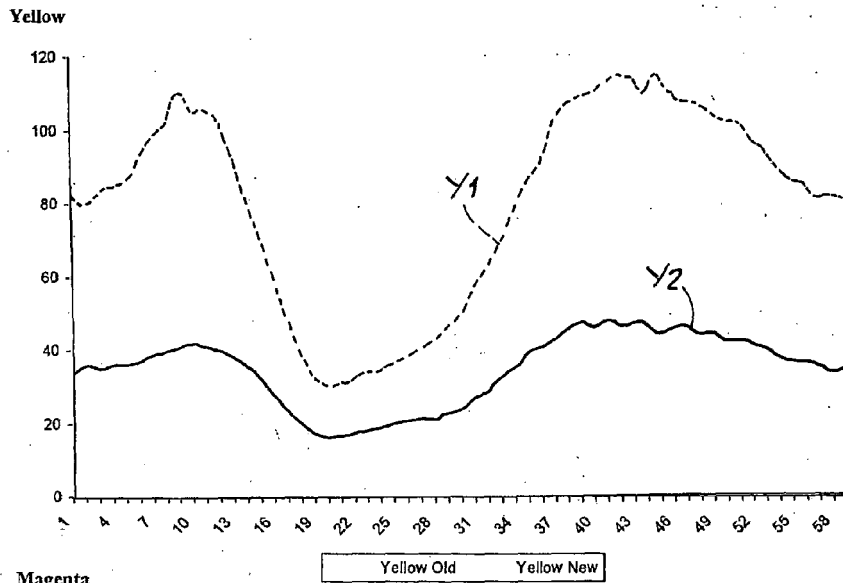


Fig.7C

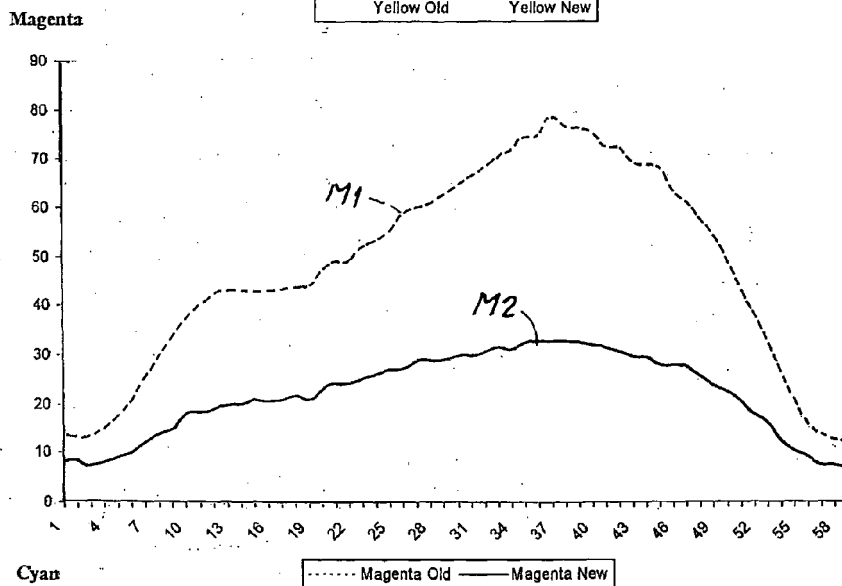


Fig.8C

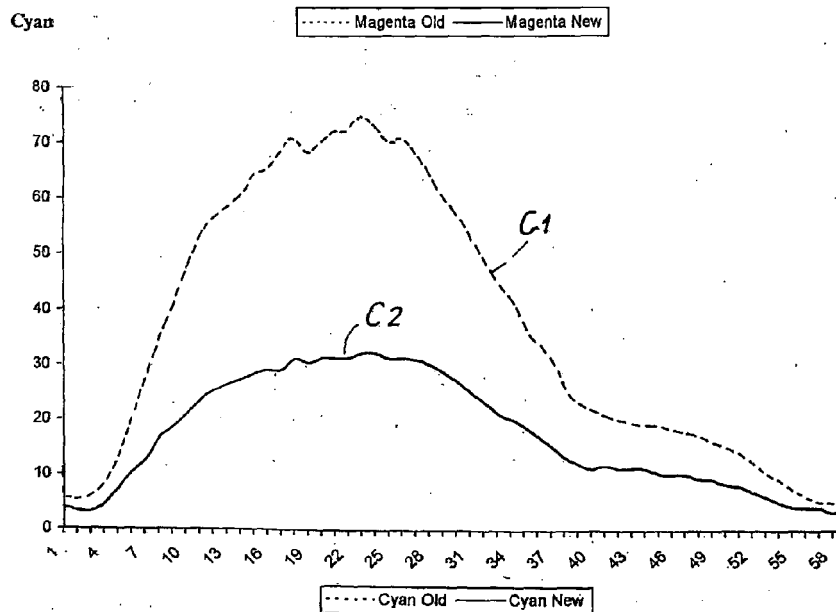


Fig.9C

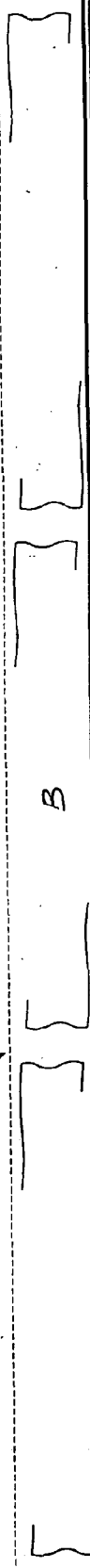
Fig.10

OCRA P.110



S_1 S_2

OCRA P.110



F

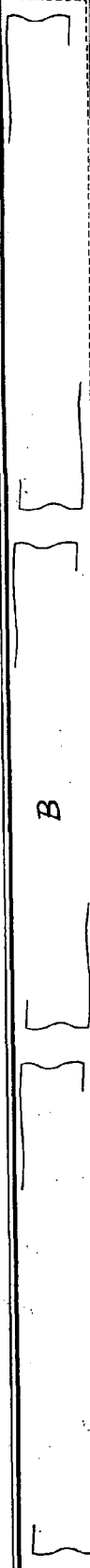


Fig.11

CASO 1

Lettura n.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Grigio	9	9	9	11	11	20	26	31	37	42	47	50	51	52	54	55	56	58	57	59	62	62	65	64	64	67	67	65	64	64
Magenta	14	13	13	15	17	20	25	29	33	37	40	42	43	43	43	43	43	44	44	47	49	49	52	53	55	59	60	61	63	65
Yellow	82	79	82	84	85	92	98	101	110	104	105	102	91	80	70	59	48	38	32	30	31	32	34	34	36	38	40	43	45	49
Cyan	5	5	6	8	13	20	27	34	40	47	53	56	58	60	64	65	68	71	68	70	72	72	75	73	70	71	68	64	60	57

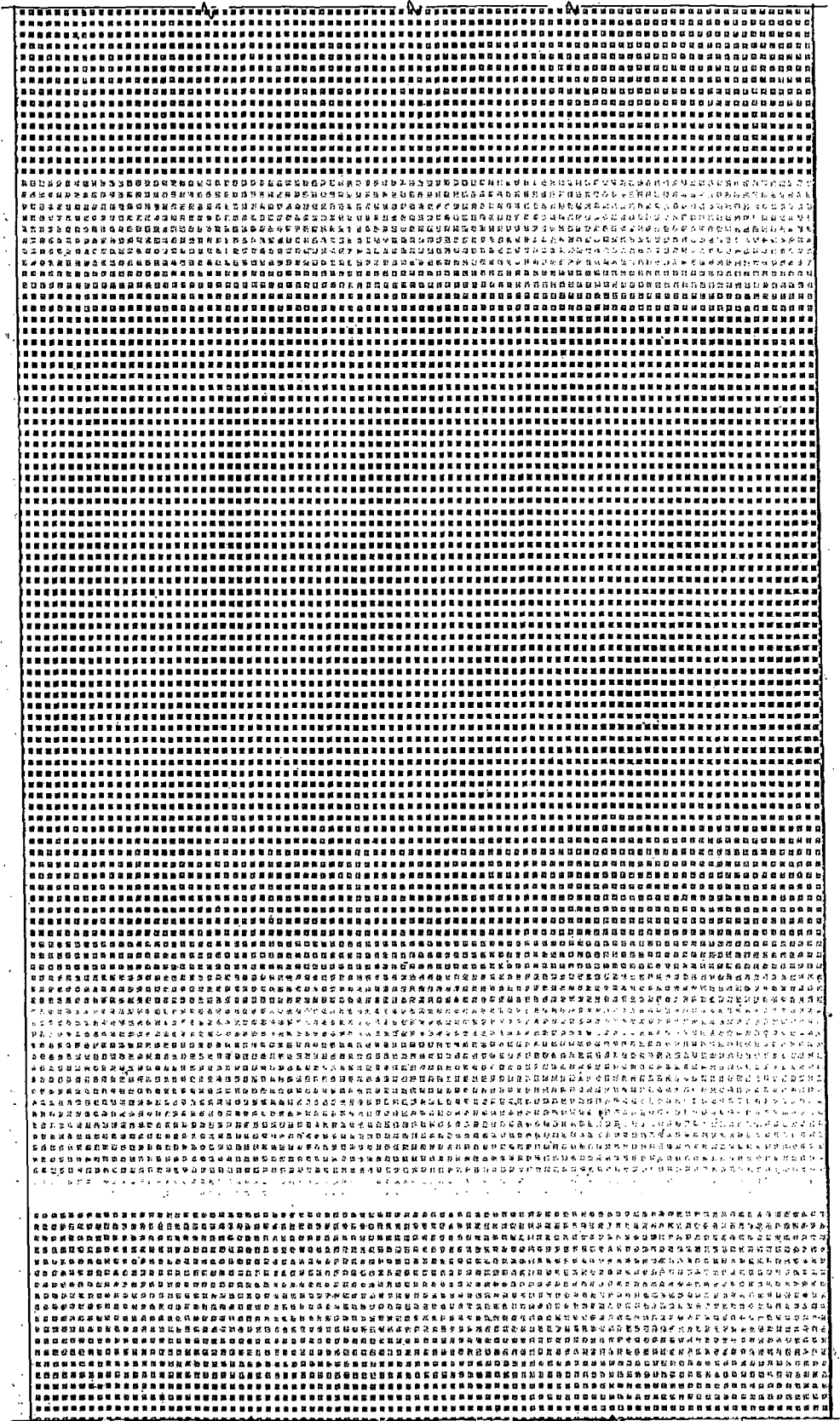
CASO 2

Lettura n.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Grigio	6	6	6	7	8	10	12	15	17	20	21	23	24	24	26	26	26	27	27	28	29	29	29	30	30	31	31	31	31	30
Magenta	8	8	7	8	9	10	12	14	15	18	18	19	20	20	21	21	21	22	21	23	24	24	25	26	27	27	29	29	29	30
Yellow	34	36	35	36	36	37	39	40	41	42	41	40	38	35	32	27	23	19	17	16	17	17	18	19	20	21	21	21	23	24
Cyan	4	3	3	4	4	7	10	12	16	18	21	23	25	26	27	28	29	29	31	30	31	31	32	32	31	31	31	30	29	27

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
63	61	60	59	57	55	54	50	48	47	45	44	43	42	42	40	39	37	35	32	29	26	22	18	14	11	9	8	9
67	68	71	72	75	75	79	77	77	76	73	73	70	69	69	64	62	58	55	49	43	38	32	26	21	16	14	13	13
57	62	69	77	86	90	100	106	108	109	111	113	112	108	113	108	106	106	103	101	101	96	93	88	85	84	81	81	80
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25	23	21	20	19	17	15	13	12	11	12	11		11	10	10	10	9	9	8	8	7	6	5	4	4	4	3	4

Fig.12





EUROPEAN SEARCH REPORT

Application Number
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Place of search Munich		Date of completion of the search 15 December 2009	Examiner Spyropoulou, E
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Application Number
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Place of search Munich		Date of completion of the search 15 December 2009	Examiner Spyropoulou, E
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