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(54) METHOD FOR PROVIDING A WIRE FOR FORMING A PATTERNED FIBRE WEB, A WIRE AND A PATTERNED FIBRE WEB PRODUCED THEREBY

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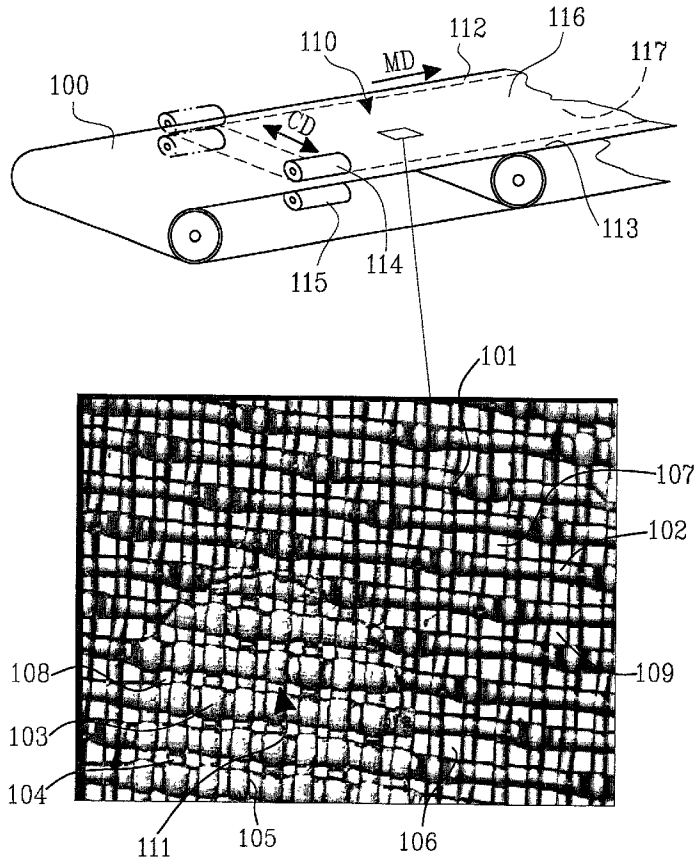
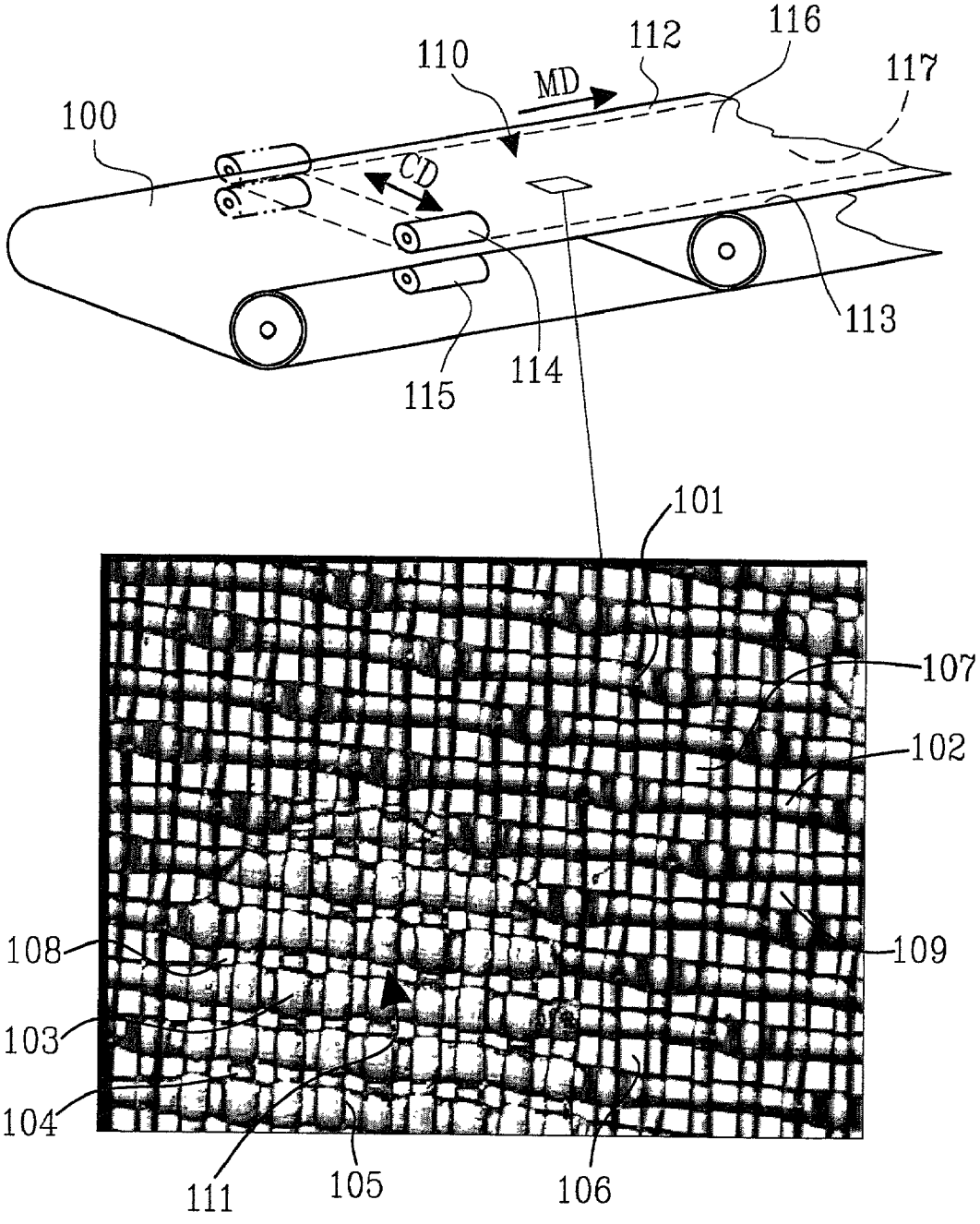
(57) **ABSTRACT**

A method for providing a wire for forming a patterned fiber web, a wire which has been provided by means of the method according to the invention and a patterned fiber web formed on the wire (**100**) according to the invention, which comprises a plurality of threads (**101, 102, 103, 104, 105, 106**) arranged in a wire structure with a plurality of drainage opening (**107, 108, 109**) and a patterning area (**110**) substantially in the plane of the wire, intended for the forming. In the method a number of the threads (**103, 104, 105**) are given a permanent deformation for forming one or several pattern creating surfaces (**111**) within the patterning area (**110**) at the forming. The invention may be applied in relation to production of soft tissue paper, wet pressed non woven materials, air laid non woven materials, or at the production of hydraulically patterned or entangled non woven materials. The patterned fiber webs may be converted to toilet paper, paper towels, household paper, facial tissues, napkins, wet napkins, handkerchiefs, dry towels for infants, flannels, wipes for industrial cleaning and the like. The fiber web or the webs may also be converted to or be a part of other sanitary articles, such as nappies, sanitary napkins, panty liners and incontinence guards.




100
110
MD
112
116
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CD
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105
106

FIG. 1

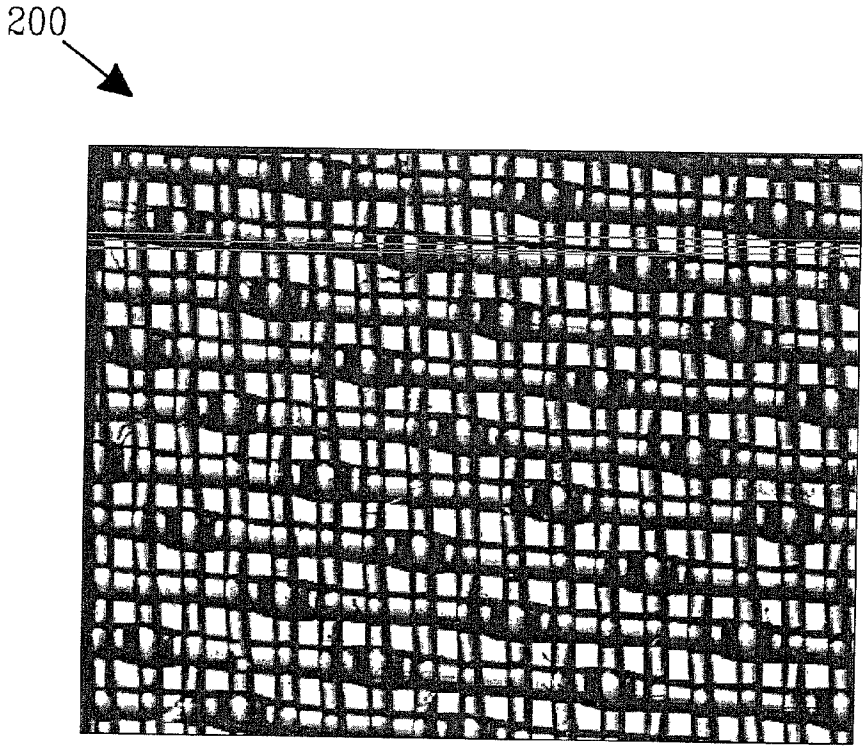

FIG.2a

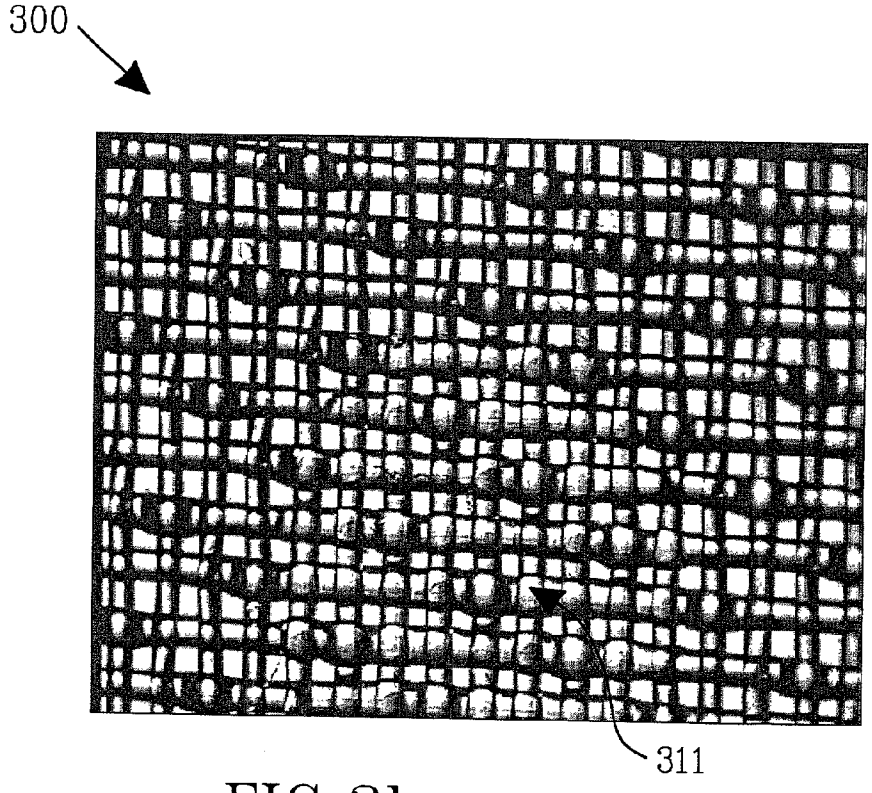

FIG.2b

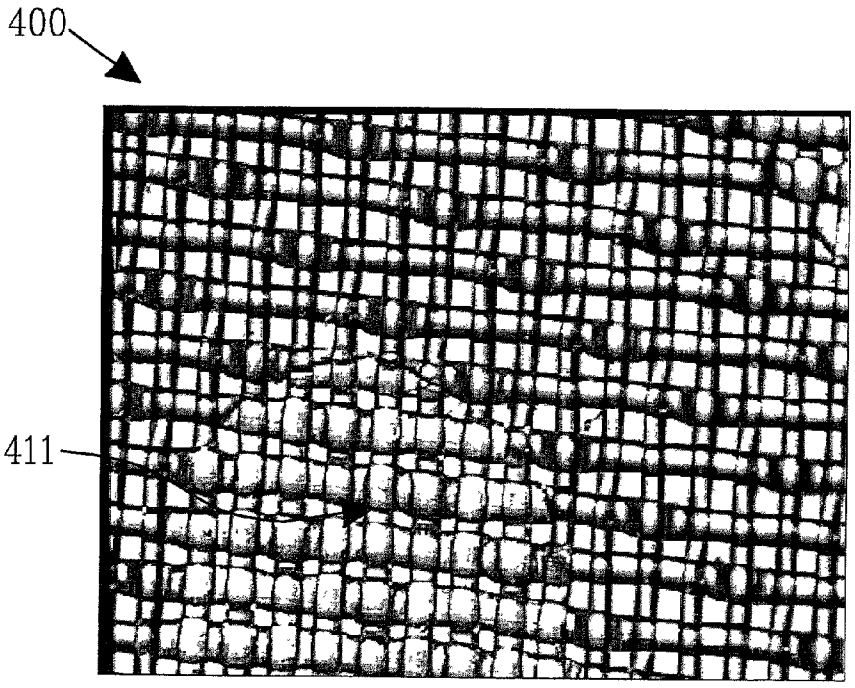

FIG.2c

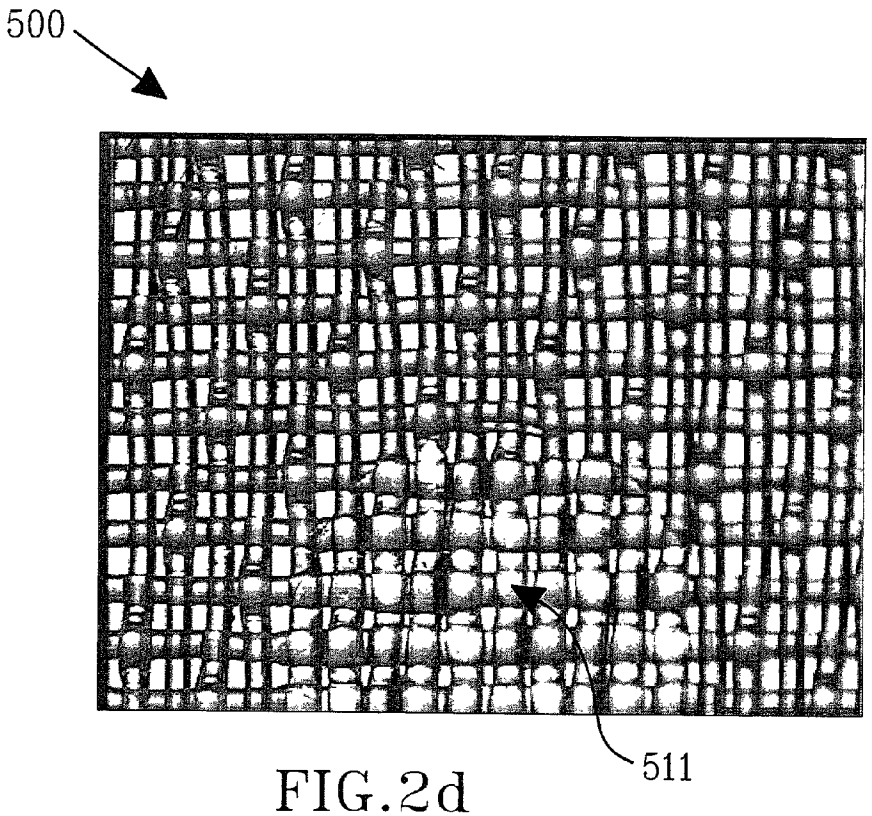

FIG.2d

FIG.2e

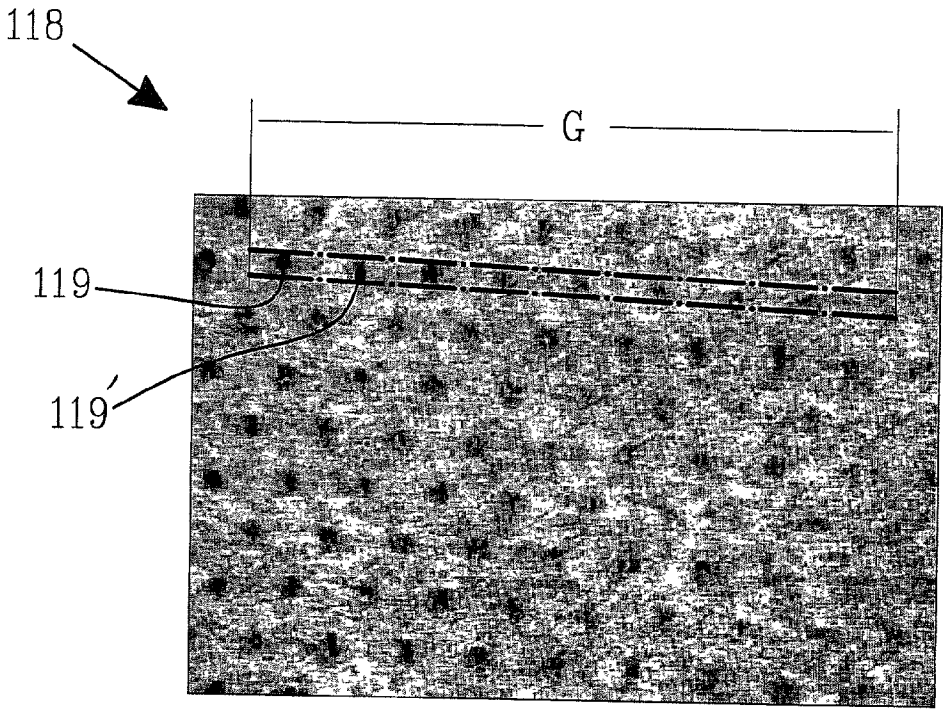

FIG.3

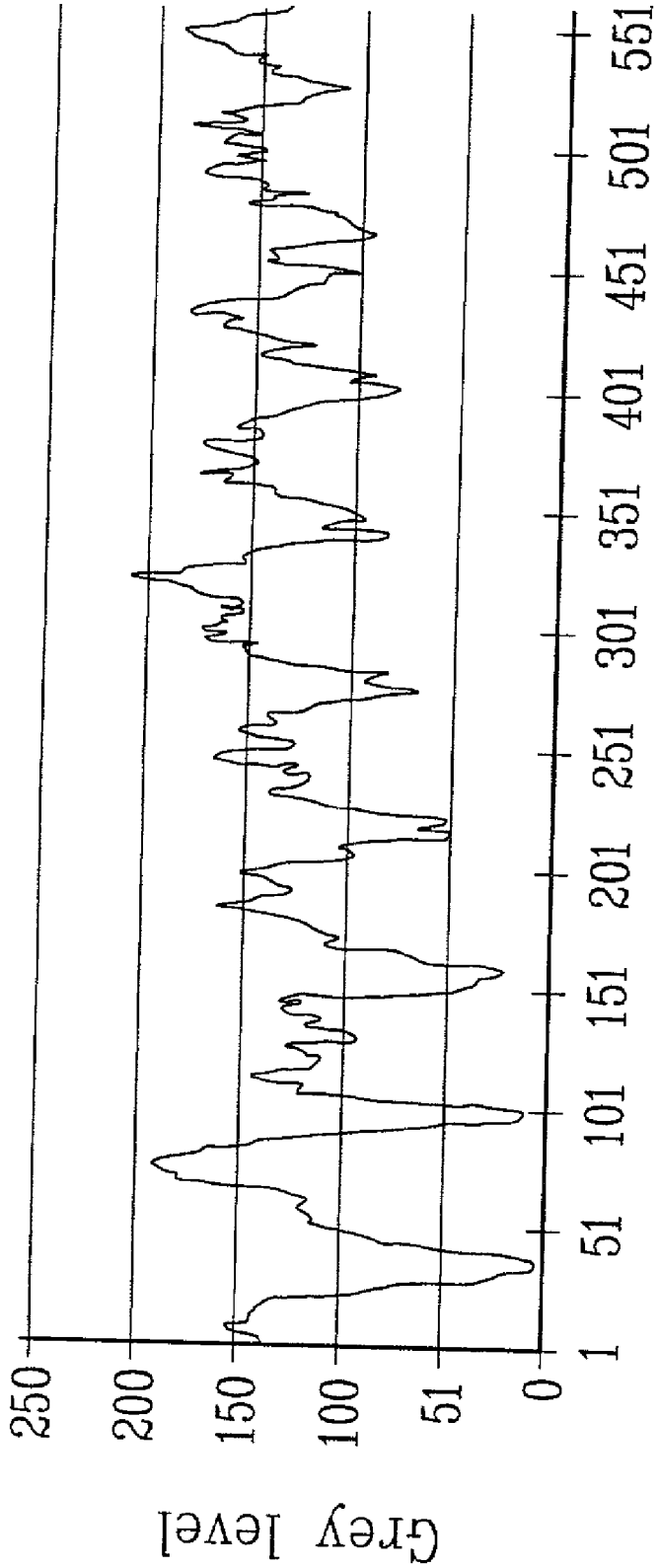
Grey level
250
200
150
100
51
0
1
51
101
151
201
251
301
351
401
451
501
551
Pixel position

FIG.4

METHOD FOR PROVIDING A WIRE FOR FORMING A PATTERNED FIBRE WEB, A WIRE AND A PATTERNED FIBRE WEB PRODUCED THEREBY

TECHNICAL AREA

[0001] The present intention relates to a method for providing a wire for forming a patterned fibre web. Further the invention relates to a wire, which has been provided by means of the method according to the invention, and a patterned fibre web formed on the wire according to the invention.

[0002] The invention may particularly preferably be applied in relation to production of soft tissue paper, wet pressed non woven materials, air laid non woven materials, or at production of hydraulically patterned or entangled non woven materials.

[0003] One or several fibre webs, according to the invention, may preferably be converted to toilet paper, paper towels, household paper, facial tissue, napkins, wet napkins, handkerchiefs, dry towels for infants, flannels, wipes for industrial cleaning and the like. The fibre web or the webs may also be converted to or be a part of other sanitary articles, such as nappies, sanitary napkins, panty liners and incontinence guards.

BACKGROUND OF THE INVENTION

[0004] At wet pressing of soft tissue paper and different non woven materials it is previously known to use so-called pattern wires for accomplishing a desired pattern in the fibre material deviating from the material structure which should normally be obtained after the forming. Pattern wires are used, where for some reason, it is desirable to create a two or three-dimensional pattern in the actual fibre material. The pattern may possess completely aesthetical qualities, or the purpose with the pattern may be to affect different physical material characteristics of the finished soft tissue paper or the non-woven material. Examples of characteristics, which may be considered to be affected by using a pattern wire is bulk, stiffness, characteristics of strength, stretching, characteristics of absorption and anisotropy.

[0005] It is well-known that pattern wires may be used for giving a pattern to a paper web or another fibre web in relation with wet pressing, by forming the pattern wire so that the dewatering of the actual fibre suspension by means of the wire is disturbed or controlled in such a way, that local basis weight variations or fibre length variations arise in the fibre web.

[0006] It is also previously well-known that in relation with treatment of different fibre materials with water jets under high pressure use different types of pattern wires as a support for the fibre web being treated. This type of treatment may be denominated hydraulic entangling or hydraulic patterning. Thereby the fibre web undergoing the treatment receives its pattern by means of the interaction of the water jets with the underlying wire structure.

[0007] In the patent publication GB-A-1,008,703 a method and an apparatus are described for producing a fibre web with assistance from a particular pattern wire and a fibre web which has been produced by the method with use of the apparatus. Thereby the used wire is provided with means for restricting the draining of a fluid through the wire in a given pattern, whereby a fibre web is formed on the wire according to the pattern and the means for restricting draining do substantially not extend beyond the upper surface of the wire.

[0008] According to GB-A-1,008,703 mentioned above, the pattern wire may be accomplished by blocking discontinuous areas of a conventional open wire with hardened gelatine, whereby the wire is stated to be of any appropriate material, for instance plastic. The blocked areas are also stated to be accomplished by means of supplying other materials than gelatine, such as thermoplastic, thermosetting plastic, solder metal or by electrolytic depositing. Further it is stated that the patterning may be accomplished by forming inside a nip between a normal wire and a pattern wire. In this embodiment the pattern wire is stated to be able to be replaced by a band of plastic or rubber, or by a roll with an engraved, cutout or moulded pattern. According to GB-A-1,008,703 a similar patterning effect may be obtained by means of incorporating a pattern in the wire at the weaving.

[0009] Further the international patent application WO 96/35018 describes a tissue sheet with a distinct decorative pattern embedded in the sheet at its initial forming, whereby the tissue sheet comprises both long and short fibres for paper production. Thereby the decorative pattern is defined of the areas with a greater mean fibre length and a lower basis weight than the surrounding neighbouring area of the tissue sheet.

[0010] Further WO 96/35018 describes a method for forming a such tissue sheet, comprising depositing an aqueous suspension of short fibres and long fibres on a wire for decorative forming, containing areas with deviating dewatering to other areas, the shapes of which define distinct decorative patterns. In another embodiment the forming occurs with the use of a normal wire and a pattern wire, whereby the two sheets are combined after forming, for forming an united, layered, decorative tissue sheet.

[0011] In WO 96/35018 a woven forming wire is also described, which has a plurality of areas having relatively slow dewatering, whereby the forms of these areas define visual distinct decorative patterns. The patterns are preferably stated to be composed of flowers, butterflies, leaves, animals, toys, words, monograms, laces, geometrical figures and the like. These patterns are stated to be able to be incorporated in the wire by means of a number of methods giving a relatively slow dewatering within the decorative areas of the wire. Thereby, as appropriate methods are indicated screen printing, sewing, application of sealing means, printing, application of a decorative material on top of a conventional wire for constructing a composite material, or to weave in a decorative pattern in the wire, for instance in a power loom of Jacquard type. A number of different wire types are stated to be able to constitute the base for the pattern wires described, for instance single, double, and triple layered wires of different manufacturers.

[0012] In the patent publication DE-1 461 082 a method and an apparatus are described for production of a non woven fibre material of an aqueous fibre suspension, and also a fibre material produced by the method with use of the apparatus. The apparatus described is stated to comprise a composed wire for receiving fibres, which consists of a lower or carrier wire and a modelling upper wire, whereby

the lower wire is formed to let through in the suspension agent and collect the fibres onto its surface, while the upper wire is formed for modelling and transferring its relief to the non woven fibre material.

[0013] The method described in DE-1 461 082 comprises bringing an aqueous suspension of fibres in contact with a composed wire, containing a lower wire retaining the fibres and a modelling wire arranged thereon, for forming a fibre web with the structure of the modelling wire, whereby the lower wire is formed to collect substantially all fibres of the fibre suspension brought in contact with the lower wire.

[0014] According to DE-1 461 082, the non-woven fibre material produced in this way, has a good tensile strength both in the machine and the crosswise direction, and is characterised in that it contains felted, substantially non oriented fibres, which are deposited from an aqueous suspension in the form of a continuous web showing a relief. Thereby the web is stated to show zones with higher or lower concentration of fibres, which have been received by means of nonuniform deposition on a composed wire in a paper making machine, whereby the zones with higher concentration have been received by deposition on a lower or carrier wire admitting the suspension means to pass through, and the zones with lower concentration have been received by means of depositing on a modelling wire applied on top of the carrier wire, so that the random oriented fibres form a three dimensional network.

[0015] Further the patent publication GB-A-1 447 933 describes all apparatus and a method for producing paper with watermarks. The apparatus described is stated to comprise an endless flexible carrier, which may be displaced around shafts at a distance from each other in a non circular path, and supporting means for producing a watermark, whereby the carrier is arranged so that the means for producing the watermarks may be brought in contact with gradual sections of the paper produced by the apparatus, either as the paper is formed or after the paper has been formed, and while it is still susceptible for water marking for producing a water mark at regular predestined intervals of a continuous web of the paper. According to GB-A-1 447 933 the means, for producing watermarks, comprise one or several sections on the carrier, and one/or several formed elements fixed at the carrier, whereby the embossed sections or formed elements are preferably placed at regular distances between each other on a wire.

[0016] In the patent publication GB-A-2 306 178 a method is described for producing safety paper with local areas with a homogeneous, low opacity in comparison with the opacity of the remaining paper sheet, whereby the areas with homogeneous, low opacity have a area of at least 0.4 cm^2. The method is stated to comprise arranging an aqueous fibre dispersion containing at least cellulose fibres on an embossed wire, if necessary which is placed on a cylinder form, by means of dewatering the water for forming the sheet, and to regain the sheet formed on a lift wire and dry the sheet. According to GB-A-2 306 178 the method is characterised in that the water marking wire is compressed, i.e. that the thickness of the wire is reduced in the embossed section.

[0017] However, the pattern wires previously known may seem to be associated with certain drawbacks.

[0018] The pattern wires produced by means of blocking the drainage openings in the wire structure with assistance from an added material, such as plastic material, glue, colour, etcetera, are generally sensitive for cleaning with wire sprays or wire cleaners, since the patterning material applied may have a tendency to be washed away. Therefore, for avoiding a far too high wire consumption the wire sprays must be run at a reduced pressure, while the wire cleaners may only be used in limited extent. This often leads to an insufficient wire cleaning, and a risk for collection of contaminations in the wire, such as resin deposits, stickies and the like, which may generate web break and an impaired runnability of the paper or non woven machine.

[0019] Pattern wires being composed of several different wires, or comprising a particular applied patterning material, are often complicated to produce and are often sensitive for formation of wrinkles and the like, in connection with wire changes. It is well-known that such formations of wrinkles generally leads to that the wire must be completely discharged or in case of that the wire is still used for further production resulting in an increased frequency of web breaks and an impaired runnability.

[0020] Another restriction of the technique previously known is that the weave structure (weave report) controls the dimensions and orientation in high degree for the patterns being possible to accomplish. Thereby the wire report often gives weak lines and holes in the formed fibre web, in the worst case functioning as indication of fractures and leads to an impaired runnability and impaired structural strength of the fibre web.

[0021] Pattern wires earlier known, which have been produced by means of embossing often comprise a pattern of embossing points or areas, being regularly distributed over all the surface of the pattern wire and with sharp changeovers between the embossing points/areas and the non embossed sections of the pattern wire. Such sharp changeovers may generate holes or other serious formation disturbances in the fibre web being patterned, and thereby are the cause of indication of fractures with subsequent impaired runnability. This type of indication of fractures are particularly serious, as they appear close to the rims of the patterned fibre web.

SUMMARY OF THE INVENTION

[0022] Thus a first purpose with the present invention is to provide a method for accomplishing a wire for forming a patterned fibre web, which method provides a wire having an improved runnability at forming of a patterned fibre web with a desired pattern, which may substantially be chosen independently of the basic wire structure.

[0023] This first purpose of the invention is obtained, according to claim 1, by the fact of the wire comprises a plurality of threads arranged in a wire structure with a plurality of drainage opening and a patterning area, substantially in the plane of the wire intended for the forming, whereby the method comprises that a number of the threads are given a permanent deformation for forming one or several pattern creating surfaces within the patterning area at the forming.

[0024] A second purpose with the present invention is to provide a wire admitting forming a patterned fibre web with good runnability.

[0025] This second purpose of the invention is obtained, according to patent claim 14, by means of the wire com-

prises a plurality of threads arranged in a wire structure with a plurality of drainage openings and a patterning area substantially in the plane of the wire intended for the forming, and wherein a number of the threads showing a permanent deformation which forms one or several pattern creating surfaces at the forming within the patterning area.

[0026] A third purpose of the present invention is to provide a patterned fibre web, which with good runnability has been provided with a desired pattern by means of the wire according to the invention.

[0027] This third purpose with the invention is obtained, according to patent claim 22, by means of the fact that the fibre web has been formed on a wire comprising a plurality of threads arranged in a wire structure and a patterning area, whereby the fibre web at least shows one pattern deviating from the wire structure, and wherein the pattern has been created by pattern creating surfaces formed by means of a permanent deformation of a number of the threads within the patterning area.

[0028] Further purposes with the invention appear in the following description, while the characteristics which enable to obtain these purposes appear in the enclosed dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The invention will be described in greater detail in the following with reference to the enclosed figures, in which

[0030] **FIG. 1** shows schematically a section of an appropriate arrangement for exercising a preferred embodiment of the method according to the invention, whereby the figure illustrates the arrangement during patterning in progress of a wire and an enlarged detail view of the wire having recently undergone the method,

[0031] **FIG. 2** in the under **FIG. 2A** schematically shows an enlarged section of the wire **200** before it has gone through the method according to the invention, and in the under FIGS. 2B-2D there are shown enlargements of sections within the patterning area of wires according to different preferred embodiments of the invention, and in the under **FIG. 2E** there is shown a 5 mm scale for comparison.

[0032] **FIG. 3** shows schematically a β-radiogram of a patterned fibre web according to a preferred embodiment of the invention, whereby the grey scale shown corresponds to the basis weight so that the darkest grey tone is the lowest basis weight and the brightest grey tone is the highest basis weight, and

[0033] **FIG. 4** illustrates in the form of a numerical graph the variations in grey tones from the left to the right along the line G in **FIG. 3**, whereby 0 corresponds to black and 255 to white.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0034] In the following a preferred embodiment of a method according to the invention will be described with reference to the enclosed **FIG. 1**.

[0035] The method according to the invention is intended for accomplishing a wire for forming a patterned fibre web. The wire **100** comprises a plurality of threads **101**, **102**, **103**, **104**, **105**, **106** arranged in a wire structure with a plurality of drainage openings **107**, **108**, **109**, and a patterning area **110** substantially in the plane of the wire, intended for the forming.

[0036] Forming is defined as depositing fibres on the wire with assistance of an appropriate fluid, such as water or air, but also the displacement of fibres occurring in a possible specific patterning process, for instance comprising a treatment with water jets under high pressure. The wire structure comprises the base structure of the wire **100**, which becomes the result of the type of weaving the wire has been produced by, dimensions of warp and weft, the number of threads etcetera. The patterning area **110** is defined as the area of the wire in the MD-CD plane, which at the forming/patterning is active in creating a pattern in the fibre web.

[0037] According to the invention and the preferred embodiment of the method, a number of threads **103**, **104**, **105** are given a permanent deformation for forming one or several pattern creating surfaces **111** at the forming within the patterning area **110**. Pattern creating surfaces **111** are defined as the surfaces which at the forming are active to create the desired pattern in the fibre web, which pattern should not be confused with the imprint which comes from the wire structure, which in lesser or greater extent is obtained by a conventional forming wire.

[0038] In the preferred embodiment the deformation is carried out so that substantially all threads within the rim sections **112**, **113** of the wire **100** outside the patterning area **110** avoid to be deformed. Thereby the non-deformed rim sections **112**, **113** preferably run in the intended machine direction MD of the wire **100** and ensure that the rims of the wire **100** are not grown weak and/or receives notches for folds which could come up for instance at a wire change, and after that give cause to web break at the forming of a fibre web.

[0039] In the preferred embodiment the deformation gives the pattern creating surfaces **111** a pattern extension with a division deviating from the wire structure, i.e. with a pattern report with a division deviating from the weaving report of the wire **100** or a multiple thereof. In this way the risk is decreased for that the pattern in the pattern fibre web disappears or becomes indistinct visually in the setting of the imprint of the wire structure which is normally visible in the fibre web after finished forming.

[0040] Further the method enables, according to the preferred embodiment, that the degree of deformation may substantially be chosen infinitely variable, i.e. from no whatsoever to a high degree of deformation of the wire. This enables to vary the local dewatering capacity from an unaffected, maximum dewatering capacity to a minimum or nonexistent dewatering capacity. At the forming/patterning local areas with a higher dewatering capacity of the wire will give the fibre web areas with a higher basis weight, while areas with a lower dewatering capacity of the wire will give areas with a lower basis weight of the fibre web.

[0041] The deformation may particularly preferably be carried out so that it gives the pattern creating surfaces **111** an extension pattern being substantially independent of the wire structure. This gives a wire with best possible ability to create a visible distinct pattern of a fibre web, without that

any long continuous lines with weakened zones occur in the fibre web after the forming/patterning.

[0042] The deformation is preferably completed while a majority of the threads **103**, **104**, **105** are still separated from each other, and thus moveable relative to each other within the wire sections which have been deformed, i.e. the pattern creating surfaces **111**. This ensures that the runnability of the wire is not affected all too much by the deformation. It is particularly preferably if the deformation is carried out so that the bottom threads in the machine direction MD substantially avoid to be deformed since the bottom threads contributes to the substantial tension strength of the wire and takes up the web tension of the wire in the machine direction.

[0043] According to particularly preferred embodiment of the method according to the invention, the index of density of the wire **100** within the pattern creating surfaces **111**, calculated according to $(A_o-A_d)/A_o$, may be varied infinitely between 0 and 1. Thereby $A_o$relates to the area of an individual wire opening before the deformation, while A_d relates to the area of the same wire opening after the deformation. By the fact that the index of density, mentioned above, may be varied infinitely between 0 and 1, for every individual wire opening, pattern wires for very detailed patterns may also be produced. The variation of the index of density may be accomplished for instance by appropriately adapted, casing housings of a patterning roll, exchangeable for different patterns or by a computer controlled ultrasonic horn with a proportionally small work zone.

[0044] The method according to the invention may principally be carried out on any type of wire, independent of wire structure and material of the wire threads. Thus it is possible to use simple, double or multilayered wires with different weaving patterns.

[0045] Thus the method may be carried out for instance on a wire of metal threads, but is according to the preferred embodiment carried out on a wire, in which the threads **101**, **102**, **103**, **104**, **105**, **106** comprise at least a thermoplastic polymer material with at least one softening temperature.

[0046] Thereby the deformation may be carried out at a temperature lower than the softening temperature, for instance in an arrangement comprising an unrolling device, a pair of squeeze rollers with a pattern roll and a counter roll, and a reeling device. By leading the wire at an appropriate compression pressure through the nip being formed by the pair of squeeze rollers, the pattern on the pattern roll is embossed into the wire for accomplishing the deformation aimed at, on the side of the wire being intended to compose the patterning area at the forming. However, it is also possible with outer embodiments of the method according to the invention, to carry out the deformation in another appropriate way.

[0047] In the preferred embodiment the deformation is carried out at a temperature close to or higher than the softening temperature. This ensures that the deformation does not damage the wire threads too much, and that the deformation becomes permanent after the thermoplastic material has cooled down again.

[0048] The thermoplastic material preferably comprises polyester or polyamide, but also other polymers or combinations of polymers may be used.

[0049] According to other preferred embodiments of the invention, the threads **101**, **102**, **103**, **104**, **106** comprise bi-component fibres or filaments of at least a first polymer with a first softening temperature and a second polymer with a second softening temperature, which is lower than the said first softening temperature. This ensures that the wire also maintains its dimensions and its structural stability after the deformation, since the filaments or the fibres of the first polymer are only inconsiderably affected by the deformation. It is also possible with embodiments of the invention in which wire threads of different polymers and softening temperatures are used, for instance so that the bottom threads in the machine direction are of a polymer with a higher softening temperature than the other wire threads.

[0050] The deformation preferably occur by means of from at least one embossing element **114** and a holder-on **115**, which form a press nip through which the wire runs. Thereby the embossing element may for instance be an embossing roll **114** provided with elevated sections (not shown in the figures) arranged in an intended pattern, or another appropriate embossing element. The holder-on may be for instance a counter roll **115**, or another appropriate holder-on. The nip pressure is adapted outgoing from the actual characteristics of the wire type and the deformation pattern which is desired.

[0051] In the preferred embodiment of the method according to the invention, the deformation occurs by means of the fact that the wire is intermittently lead in the machine direction MD between a traversing ultrasonic means in the transverse direction CD of the wire and a roll with elevated sections arranged in an intended pattern, whereby the ultrasonic means may be said to compose the holder-on and the roll the embossing element. This embodiment enables that the ultra sonic means or the horn is controlled in such a way that no visible division joints or the like appear in the distribution pattern formed of the pattern creating surfaces. The control of the traversing pattern of the ultrasonic means and the feeding of the wire during the deformation process may preferably be controlled by a computer program in a process computer. It is also possible with embodiments of the invention with traversing of the type mentioned above, but where the wire **100** is intermittently lead between an embossing element and a holder-on, which is not an embossing roll/an ultrasonic horn. As such a preferred embodiment of the method according to the invention is illustrated in **FIG. 1**, where the embossing element **114** is composed of an embossing roll and the holder-on **115** is composed of a flat counter roll.

[0052] The deformation of the method carried out according to the invention preferably occurs after or in relation with heating up of at least a number of the threads with the assistance of ultra sonic, one or several heated rolls, laser, microwaves, induction, or hot air.

[0053] At the patterning of a wire which comprises thermoplastic material, the patterning may preferably occur in relation with the fixing of the wire before or after splicing.

[0054] Further it is also possible with embodiments in which the deformation of the wire is carried out by all embossing element fixed in the cross-direction of the wire or an embossing element traversing diagonally over the wire. Within the scope of the invention, it is possible with embodiments where the wire is stationary, is gradually displaced or continuous moveable past the deformation zone.

[0055] In the following a preferred embodiment of a wire for forming a patterned fibre web according to the invention will be described with reference to the enclosed **FIGS. 1 and 2**. Thereby the under **FIG. 2A** shows an enlarged section of a wire before it has undergone the method according to the invention, while the under FIGS. 2B-2D show enlargements of the wires according to the invention having undergone the method.

[0056] The wire **100**; **300**; **400**; **500** comprises a plurality of threads **101**, **102**, **103**, **104**, **105**, **106** arranged in a wire structure with a plurality of drainage opening **107**, **108**, **109** and a patterning area **110**, substantially in the plane of the wire, intended for the forming. According to the invention and the preferred embodiment a number of the threads **103**, **104**, **105** thereby shows a permenant deformation which forms one or several pattern creating surfaces **111**; **311**; **411**; **511** at the forming within the patterning area **110**.

[0057] Thereby it is particularly preferably that a number of the drainage opening within the patterning creating surfaces are at least blocked as a consequence of the deformation, for giving a reduced drainage capacity being lesser than the original drainage capacity of the said drainage openings. Thereby the drainage capacity of the drainage openings within the pattern creating surfaces show a substantially infinitely variable distribution of magnitude between the reduced drainage capacity and the original drainage capacity (not shown in the FIGS. 2B-2D). In this way, the pattern creating effect of the wire, aimed at, is obtained without the dewatering characteristics being impaired to any considerable extent. Thereby close and adjacent openings or areas are blocked to a different extent. This enables that the wire may be given pattern creating surfaces with the ability to form distinct optional patterns in a fibre web which may also be given one or several infinitely variable changeovers from an unaffected basis weight (at non blocking dewatering openings) to a lower basis weight (at completely or partly blocked dewatering openings).

[0058] The wire **100** has a first side **116** intended to be facing a fibre web and an opposite second side **117**. Thereby it is particularly preferable if only the threads within the patterning area on the first side **116** is permanently deformed, while at least threads in the longitudinal direction MD of the wire on the second side **117** is substantially unaffected of the deformation. In this way it is ensured that the tensile strength of the wire in the machine direction may be maintained after the deformation.

[0059] In the preferred embodiment a majority of the patterning creating surfaces **111** have a minimum dimension between 1 and 2 mm, in the plane of the patterning area **110**. Tests have proven that this minimum dimension ensures that a visual pattern may be obtained. It is also possible with embodiments where the pattern creating surfaces have lesser dimensions in the case that the pattern wire is intended as be substantially used for affecting the physical properties of the fibre web, and not for accomplishing a visual distinct pattern.

[0060] The wire according to the invention is particularly preferably used as a forming wire at wet forming or foam forming of a fibre web intended for soft tissue paper or a non woven material.

[0061] The wire is also preferably used as forming wire at air laying of a fibre web.

[0062] In an alternative preferred embodiment the wire is used as support at hydraulic patterning or entangling at a preformed web. Thereby the preformed fibre web mentioned above may be wet formed, foamformed or air formed with the use of a conventional forming wire or a wire according to the invention.

[0063] The wire **100**; **300**; **400**; **500** according to the invention is accomplished by means of the method described above according to the invention.

[0064] In the following a preferred embodiment of a patterned fibre web according to the invention will be described with reference to the enclosed FIGS. **1** to **3**.

[0065] The patterned fibre web **118** is formed on a wire **100** comprising a plurality of threads **101**, **102**, **103**, **104**, **105**, **106** arranged in a wire structure and a patterning area **110**, and at least shows a pattern **119**, **119'** deviating from the wire structure. According to the invention and the preferred embodiment, the pattern **119**, **119'** has been created by pattern creating surfaces **111** formed by means of a permanent deformation of a number of threads **103**, **104**, **105** within the patterning area **110**.

[0066] The patterned fibre web comprises, within the patterning area **110**, first sections with a first basis weight unaffected by the pattern creating surfaces **111**, and second sections with a second basis weight affected by the pattern creating surfaces **111**, which is lesser than the first basis weight. Thereby it is particularly preferable if the pattern **119**, **119'** comprises one or several infinitely variable changeovers from the first basis weight to the second basis weight.

[0067] In the preferred embodiment the pattern **119**, **119'** has a division deviating from the weave report of the wire **100** or a multiple thereof. This ensures that the pattern may visually be distinctive from the normally occurring imprint in the fibre web, which comes from the actual wire structure.

[0068] The pattern is particularly preferably formed substantially independent of the weave report or another wire structure, for instance in the way, which is illustrated in the **FIGS. 3 and 4**. This characteristics of the present invention enables that patterned fibre webs are provided with patterns, which previous were impossible or hardly could be accomplished. An example of new patterns, which thanks to the invention may be incorporated in the patterned fibre web, according to the invention, is a pattern comprising greater connected surfaces with a basis weight deviating from the surrounding areas. Further distinctive patterns are enabled comprising for instance logotypes and/or letters.

[0069] Moreover the present invention enables to obtain a fibre web with a desired pattern with a minimum risk that holes or indications of fractures occur in the patterned fibre web, for example since the wire in an effective way can be held clean with assistance of wire sprays and wire cleaners without the need to consider some applied patterning materials, such as binders, which may be cleaned away.

[0070] Such as apparent of the **FIGS. 3 and 4**, the present invention enables amongst other things that a fibre web is given a desired web being substantially independent of the basic structure of the forming/pattern wire, and moreover which preferably comprises one or several infinitely variable changeovers between different basis weights of the fibre web.

[0071] In the fibre web **118** shown in **FIG. 3** the basis weight increases (expressed as grey tone, denoted "GREY LEVEL" not visible "holes"**119**, **119'** for the eye, or thinner

sections from ≈0 in pixel position **40** to ≈110 in pixel position **520**, while the basis weight in the areas between the thinner sections **119**, **119'** are substantially unchanged in the same range. Such a change in basis weight, in the plane of the fibre web, may by means of the present invention, when it is desirable be accomplished between the neighbouring sections of the patterned fibre web for providing a pattern with one or several infinitely variable basis weight changeovers.

[**0072**] The patterned fibre web **118**, according to the invention, is preferably wetformed or foamformed, but may also be air laid. The fibre web may also be hydraulically patterned or entangled, either in direct connection to or immediate after the forming, or in a separate subsequent treatment process.

[**0073**] The fibres, which are a part in the patterned fibre web **118**, may be of any appropriate type, and comprise chemical, semi chemical, chemical-mechanical or mechanically refined or recycled pulp fibres of soft wood or hardwood. The fibre web **118** may also comprise vegetable fibres or artificial fibres of natural or synthetic polymers with appropriate dimensions and characteristics for the application, or mixtures of several of the fibre types mentioned above.

[**0074**] Thus the pattern **119**, **119'** or the patterns of the patterned fibre web, according to the invention, has been created by means of forming and/or patterning on a wire **100**; **300**; **400**; **500** according to the invention. Within the scope of the invention, thus it may be possible form a patterned fibre web in a first step on a first wire according to the invention having a first pattern, and in a second step subject the fibre web to hydraulically patterning or entangling on a second wire according to the invention having a second pattern.

[**0075**] The present invention should not in any way be seen as restricted to what have been described above in relation with the different embodiments, or to what is shown in the enclosed drawings, but the scope of the invention is defined of the following claims.

[**0076**] Thus the present invention enable the accomplishment of patterned fibre webs with patterns of different types, such as:

[**0077**] aesthetical pleasing patterns,

[**0078**] continuous areas with higher basis weight, e.g. "framework" for obtaining higher tensile index,

[**0079**] patterns controlling the liquid spreading, e.g. "channels",

[**0080**] patterns improving the power of absorption, e.g. "reservoirs",

[**0081**] patterns giving a higher stretching/lower modulus of elasticity, "E module", e.g. "creping patterns",

[**0082**] patterns giving an improved drapability,

[**0083**] patterns giving a softer surface feeling,

[**0084**] patterns giving a higher bulk,

[**0085**] etcetera.

1. A method for providing a wire for forming a patterned fibre web, said wire (**100**) comprising a plurality of threads (**101**, **102**, **103**, **104**, **105**, **106**) arranged in a wire structure with a plurality of drainage openings (**107**, **108**, **109**) and a patterning area (**110**) substantially in the plane of the wire, intended for the forming, wherein a number of the threads (**103**, **104**, **105**) are given a permanent deformation for forming one or several pattern creating surfaces (**111**) at the forming within the patterning area (**110**), and the index of density (A0−Ad)/A0 of the wire (**100**) within the pattern creating surfaces (**111**) is between 0 and 1, whereby A0 is the area of an individual wire opening before the deformation and Ad is the area after the deformation.

2. A method as claimed in claim 1, wherein the deformation is carried out so that substantially all threads within the rim sections (**112**, **113**) of the wire (**100**) outside the patterning area (**110**) are not deformed.

3. A method as claimed in claim 1, wherein the deformation gives the pattern creating surfaces (**111**) a pattern report with a division deviating from the weaving report of the wire (**100**) or a multiple thereof.

4. A method as claimed in claim 1, wherein the deformation gives the pattern creating surfaces (**111**) an extension pattern being substantially independent of the wire structure.

5. A method as claimed in claim 1, wherein the deformation is completed while a majority of the threads (**103**, **104**, **105**) are still moveable relative each other within the pattern creating surfaces (**111**).

6. A method as claimed in claim 1, wherein the threads (**101**, **102**, **103**, **104**, **105**, **106**) at least comprise a thermoplastic polymer material with at least one softening temperature, and wherein the deformation is carried out at a temperature lower than the softening temperature.

7. A method as claimed in claim 1, wherein the threads (**101**, **102**, **103**, **104**, **105**, **106**) at least comprise a thermoplastic polymer material with one softening temperature, and wherein the deformation is carried out at a temperature close to or higher than the softening temperature.

8. A method as claimed in claim 6, wherein the polymer material comprises polyester or polyamide.

9. A method as claimed in claim 7, wherein the polymer material comprises polyester or polyamide.

10. A method as claimed in claim 1, wherein the threads (**101**, **102**, **103**, **104**, **106**) comprise bi-component fibres or filaments of at least a first polymer with a first softening temperature and a second polymer with a second softening temperature, which is lower than the said first softening temperature.

11. A method as claimed in claim 1, wherein the deformation occurs with assistance of at least one embossing element (**114**) and a holder-on (**115**), which form a press nip which the wire (**100**) runs through.

12. A method as claimed in claim 11, wherein the embossing element (**114**) and/or the holder-on (**115**) traverse in the cross direction (CD) of the wire, whereby the wire (**100**) is intermittently lead in the machine direction (MD) between said embossing element and said holder-on.

13. A method as claimed in claim 1, wherein the deformation occurs after or in relation to heating up of at least a number of the threads (**101**, **102**, **103**, **104**, **105**, **106**) with the assistance of ultrasonic, one or several heated rolls, laser, microwaves, induction, or hot air.

14. A wire for forming a patterned fibre web, said wire (**100**; **300**; **400**; **500**) comprising a plurality of threads (**101**, **102**, **103**, **104**, **105**, **106**) arranged in a wire structure with a plurality of drainage opening (**107**, **108**, **109**) and a patterning area (**110**) substantially in the plane of the wire, intended

for the forming, wherein a number of the threads (**103**, **104**, **105**) shows a permanent deformation forming one or several pattern creating surface (**111**; **311**; **411**; **511**) at the forming within the patterning area (**110**), and wherein a number of the drainage opening within the pattern creating surfaces are at least blocked as a consequence of the deformation for giving a reduced drainage capacity being lesser than the original drainage capacity of the said drainage openings, whereby the drainage capacity of the drainage openings within the pattern creating surfaces shows a substantially infinitely variable distribution of magnitude between the reduced drainage capacity and the original drainage capacity.

15. A wire as claimed in claim 14, wherein the wire (**100**) has a first side (**116**) intended to be facing a fibre web and an opposite second side (**117**), and wherein only the threads within the patterning area on the first side (**116**) are permanently deformed, while at least threads in the longitudinal direction (MD) on the second side (**117**) of the wire are substantially unaffected of the deformation.

16. A wire as claimed in claim 14, wherein a majority of the pattern creating surfaces (**111**) have a minimum dimension between 1 and 2 mm in the plane of the patterning area.

17. A wire as claimed in claim 14, wherein the wire is used as forming wire at wet forming or foam forming of a fibre web, intended for soft tissue paper or a non woven material.

18. A wire as claimed in claim 14, wherein the wire is used as a forming wire at air laying of a fibre web.

19. A wire as claimed in claim 14, wherein the wire is used as a support at hydraulic patterning or entangling at a preformed web.

20. A wire which has undergone a method according to claim 1.

21. A patterned fibre web, formed on a wire (**100**) comprising a plurality of threads (**101**, **102**, **103**, **104**, **105**, **106**) arranged in a wire structure and a patterning area (**110**), whereby the fibre web (**118**) at least shows one pattern (**119**, **119'**) deviating from the wire structure, wherein the pattern (**119**, **119'**) has been created by pattern creating surfaces (**111**) formed by means of a permanent deformation of a number of the threads (**103**, **104**, **105**) within the patterning area (**110**), and which within the patterning area (**110**) comprises first sections with a first basis weight unaffected of the pattern creating surfaces (**111**), and second sections with a second basis weight affected of the pattern creating surfaces, which is lesser than the first basis weight, and wherein the pattern (**119**, **119'**) comprises one or several infinitely variable changeovers from the first basis weight to the second basis weight.

22. A patterned fibre web as claimed in claim 21, wherein the pattern (**119**, **119'**) has a division deviating from the weaving report of the wire (**100**) or a multiple thereof.

23. A patterned fibre web as claimed in claim 21, wherein a pattern (**119**, **119'**) is formed substantially independent of the wire structure.

24. A patterned fibre web as claimed in claim 21, wherein the fibre web (**118**) is wet formed or foam formed.

25. A patterned fibre web as claimed in claim 21, wherein the fibre web is air laid.

26. A patterned fibre web as claimed in claim 21, wherein the fibre web is hydraulically patterned or entangled.

27. A patterned fibre web wherein the pattern (**119**, **119'**) has been created by means of forming and/or patterning on a wire (**100**; **300**; **400**; **500**) according to claim **14**.

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