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(54) **A DISCONTINUOUS PROCESS FOR DYEING AND/OR FINISHING A TEXTILE MATERIAL AND CORRESPONDING APPARATUS**

(57) The present inventive concept relates to a discontinuous process for dyeing and/or finishing a textile material. The discontinuous process comprises the steps of:

providing at least one textile material;
applying at least one mixture to at least one side of said at least one textile material, so that at least one treated textile material is obtained, wherein said step of applying said at least one mixture provides a first distribution of said at least one mixture to said at least one textile material;
rolling said at least one treated textile material around a beam so that a treated textile roll is obtained, wherein

said rolling of said treated textile material around a beam provides a second distribution of said at least one mixture to said at least one textile material;
placing said treated textile roll into a heating chamber;
heating said treated textile roll within said heating chamber until said fixation temperature of said treated textile roll is reached;
maintaining said fixation temperature of said treated textile roll within said heating chamber for a predetermined amount of time until said at least one mixture is set to said treated textile material;
cooling said treated textile roll below said fixation temperature.

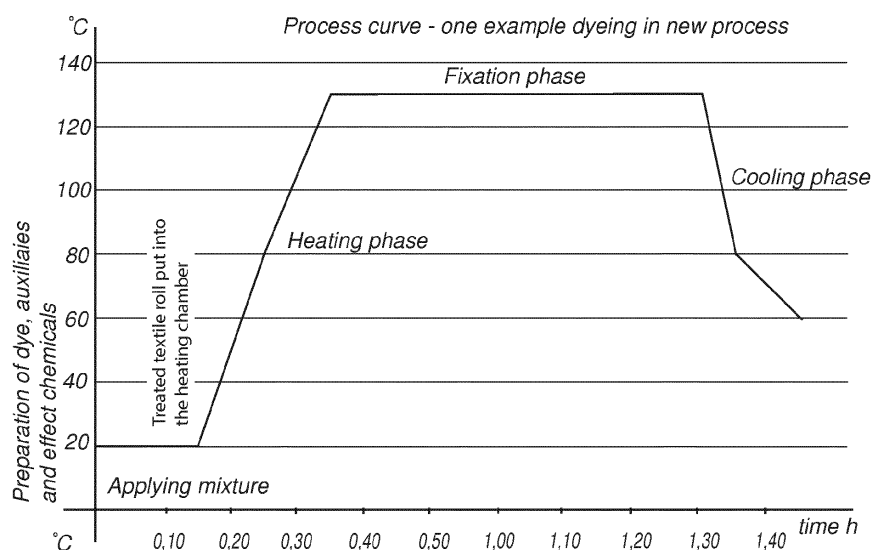


Fig. 1b

Description

Technical field of the Invention

[0001] The present inventive concept relates to a process for dyeing and/or finishing a textile material.

Background of the Invention

[0002] Dyeing and finishing a textile material is made to provide the textile material with one or several preferred features. Some examples of preferred features are colour, glaze, water-repellence, flame resistance, and softness. Often, different agents for different end purposes are applied to the textile material in the form of an impregnation liquid. There are several different methods for this impregnation, for example spraying, padding, roll coating, knife coating or screen coating.

[0003] A common discontinuous process for dyeing and finishing a textile material is beam dyeing. In beam dyeing, a textile material is rolled onto a perforated beam and transferred into a vessel that is closed and pressurized. The colour then impregnates the fabric as the dye liquor is pumped into the centre of the beam, out of the perforations, and through the textile material. The vessel used in beam dyeing is usually made to hold a large volume of dye liquor, all of which is heated in the dyeing process. This results in a very energy inefficient process for dyeing textiles.

[0004] The present inventive concept seeks to provide a process which is more efficient and easier to use for dyeing and/or finishing a textile material.

Summary of the Invention

[0005] An object of the inventive concept is to overcome the above problems, and to provide for a process for dyeing and/or finishing a textile material which, at least to some extent, is less complex than prior art solutions. This, and other objects, which will become apparent in the following, are accomplished by means of a process defined in the accompanying claims.

[0006] The present inventive concept is based on the insight that the process for dyeing and/or finishing a textile material can be made less complex, and more cost, time, and energy efficient, if the mixture used in dyeing and/or finishing the textile is applied to a textile material which is then rolled up to a beam followed by a fixation step in which the treated textile roll is placed in a heating chamber for a predetermined amount of time.

[0007] According to a first aspect of the present inventive concept, a discontinuous process for dyeing and/or finishing a textile material is provided. The discontinuous process comprises the steps of:

providing at least one textile material;
applying at least one mixture to at least one side of said at least one textile material, so that at least one

treated textile material is obtained, wherein said step of applying said at least one mixture provides a first distribution of said at least one mixture to said at least one textile material;

rolling said at least one treated textile material around a beam so that a treated textile roll is obtained, wherein said rolling of said treated textile material around a beam provides a second distribution of said at least one mixture to said at least one textile material;

placing said treated textile roll into a heating chamber;

heating said treated textile roll within said heating chamber until said fixation temperature of said treated textile roll is reached,

maintaining said fixation temperature of said treated textile roll within said heating chamber for a predetermined amount of time until said at least one mixture is set to said treated textile material,

cooling said treated textile roll below said fixation temperature.

[0008] Hereby, a discontinuous process for dyeing and/or finishing a textile material is provided which requires less energy in comparison with traditional dyeing and/or finishing processes. That is because the amount of mixture used in the claimed process is lower than in traditional dyeing and/or finishing processes. Because of the lower volume of mixture, the energy needed for heating the treated textile roll to its fixation temperature and maintaining the fixation temperature during is reduced. In other words, the energy used in swelling the fibre to render it more receptive and transferring for example dye molecules from the mixture to the fibre is reduced.

[0009] The step of heating the treated textile roll until the fixation temperature is reached can be performed with a fixed predetermined temperature for fixation in the heating chamber. This means that no gradual heating of the treated textile roll is necessary which saves time. The claimed process is thus time efficient.

[0010] It should be understood that fixation refers to the process when the mixture sets to the treated textile material. In other words, fixation is the bonding between the fibre and an active agent in the mixture, such as a dye. Reactive dyes generally fix to a textile by covalent bond, while in the case of acid dyes, fixation is often done by a variety of mechanisms such as hydrophobic forces and ionic bonding.

[0011] Disperse dyes are non-ionic. At higher temperature the amorphous part of the fibre expands and the dyes can diffuse into the fibre.

[0012] For most dyeing processes, the heating of the fibre and the dyebath is vital for proper diffusion, migration, and colour fastness.

[0013] Similarly, the mixture being set to said treated textile material is to be understood as meaning that the mixture has bonded or at least diffused and migrated into

the fibres of the textile material.

[0014] Furthermore, the temperature necessary for the fixation to take place is herein referred to as fixation temperature. The terms set, fixation, fixation temperature, and similar expression are used in their conventional meaning within the field of textile dyeing.

[0015] Since the mixture is applied to the textile material in a step before the treated textile roll is heated, the amount of energy needed for heating until the mixture is set to the treated textile material, i.e. the fixation, is less than when the application and fixation are conducted simultaneously in a batch, as in the beam dyeing process. The claimed process is thus beneficial in that only the mixture to be fixed onto the textile material must be heated.

[0016] Since the applied amount of mixture that must be heated is low, the fixation temperature of the treated textile roll in the heating chamber can be reached very quickly. In addition, the step of applying the mixture to the textile material, which often requires a gradual heating in traditional dyeing and finishing processes in order to obtain a good distribution of mixture, is completed prior heating.

[0017] The fact that the mixture is applied to the textile material before the treated textile roll is placed in the heating chamber is an advantage in that no step of gradual heating is needed. Consequently, a plurality of treated textile rolls may be placed in the heating chamber and heated until the mixture is set without intermediate cooling of the heating chamber. Furthermore, since the mixture is applied to the textile material before the treated textile material is rolled onto a beam and the treated textile roll is placed inside the heating chamber, no or a limited amount of mixture is in contact with the heating chamber. In other words, the heating chamber is not contaminated.

[0018] Hence, it possible to have the mixtures of several treated textile rolls set in the heating chamber sequentially without cleaning or cooling the heating chamber between each treated textile roll is placed or heated therein, even though the mixtures are of different kind for each treated textile roll.

[0019] According to one example embodiment, the heating chamber is an autoclave.

[0020] According to one example embodiment, the heating chamber is cylindrically shaped.

[0021] Hereby, the pressure distribution within the heating chamber is improved.

[0022] According to one example embodiment, the heating chamber is arranged to heat the mixture up to at least 105°C, or at least 130°C. These temperatures are suitable to open the polyamide fibres or the polyester fibres.

[0023] In the context of the present inventive concept, opening of fibres means that the amorphous parts of the fibres are above their glass-transition temperature.

[0024] Textile materials, which also could be referred to as textiles or fabrics, comprise textile materials man-

ufactured by different technologies such as weaving, knitting, crocheting, or nonwoven technologies.

[0025] The fibres used in the textile material can be synthetic or natural fibres or mixtures thereof. Some examples are polyester, cotton, nylon, viscous, wool etc.

[0026] The step of applying a mixture to the textile material could be referred to as a step of impregnating the textile material, i.e. application could be referred to as impregnation.

[0027] A mixture for dyeing purposes, also referred to as a dye liquor or dyebatch, may contain natural dyes and/or synthetic dyes. Natural dyes comprise dyes made from natural substances, usually from the bark, leaves, roots, flowers, or wood of a plant. Natural dyes could also originate from insects such as cochineal and lac.

[0028] According to at least one example embodiment, said mixture comprises an aqueous solvent.

[0029] The aqueous solvent penetrates the fibre and provides rapid wetting of the textile material. This provides a more efficient step of applying the mixture. Furthermore, the aqueous solvent increases the mixture's tendency to penetrate the textile material rather than staying at its surface. Consequently, the aqueous solvent has the effect that dyes or other chemical agents are efficiently transported into the fibres.

[0030] An aqueous solvent could be water or any other solvent comprising water. In addition to the aqueous solvent a wetting agent or surfactant may be added to the textile material if it has poor wetting characteristics. An alcohol is commonly added to the mixture to improve the wetting characteristics of the textile material.

[0031] A mixture comprising an aqueous solvent has low impact on the environment as well as on the operators involved in the claimed process. A mixture comprising an aqueous solvent such as water is less environmentally hazardous than a mixture containing a non-aqueous solvent. It is safer to handle and has less environmental impact than a mixture containing a non-aqueous solvent, such as toluene, trichloroethylene, and petrochemical solvents. The aqueous solvent reduces the impact on the environment and on the operating people of the claimed process. Hereby, the environmental effect of the mixture and the claimed process is minimised.

[0032] According to one example embodiment, a step of cleaning said heating chamber is performed after the treated textile roll is cooled and removed from the heating chamber. This cleaning step is easier to do when the step of applying a mixture to the textile material has been made with a mixture containing an aqueous solvent.

[0033] According to one example embodiment, the mixture comprises a non-aqueous solvent. Examples of non-aqueous solvents are toluene, trichloroethylene, and petrochemical solvents.

[0034] According to at least one example embodiment, said step of applying a mixture to at least one side of said textile material is such that said treated textile material has a wet pick-up of at least 5%, or at least 10%, or at least 15%, or at least 20%, or at least 25%. Additionally,

or alternatively, said step of applying a mixture to at least one side of said textile material is such that said treated textile material has a wet pick-up of at most 150%, or at most 130%, or at most 110%, or at most 90%, or at most 70%.

[0035] The wet pick-up is the weight of the untreated textile material in relation to the total weight of the textile material and the mixture applied thereon.

[0036] Preferably the wet pick-up should be around 50%. A wet pick-up that is too high may cause difficulties in handling the treated textile material or the treated textile roll, since the mixture applied to the treated textile material is prone to drop.

[0037] According to at least one example embodiment, said step of applying at least one mixture is performed by spraying, padding, knife coating, roll coating, or screen coating.

[0038] Spray application has the advantage that it is a non-contacting application method and requires low volume of mixture. Furthermore, spraying allows for an even distribution of the mixture regardless of potential absorption variances of the textile material. Spraying is thus an effective method of application. Additionally, spraying causes little spill of the mixture during application. The textile material can be sprayed with spill only at the edges of the textile material. By having the spilled mixture recirculated to the spray nozzles, the amount of lost mixture during application is kept on a low level.

[0039] The step of applying a mixture by spraying can be performed by means of a spray manifold comprising one or more spray heads, also referred to as spray nozzles, located in a row (in the case of a plurality of spray heads). With this spray manifold, the step of spraying is possible to conduct with an overlap of applied mixture. Hereby, the number of spray heads can be adjusted according to the width of the textile material.

[0040] In one example embodiment a spray system is used for spraying a mixture to the textile material. The spray system can use different techniques such as rotary disc, air atomizing, and ultrasonic or hydraulic nozzles.

[0041] According to one example embodiment, the spraying is conducted with an overlap of applied mixture wherein the concentration of mixture at the areas not overlapping are higher than concentration of mixture at the overlapping areas. Thus, an even concentration of mixture is applied over the entire surface of the textile material.

[0042] Furthermore, in comparison to the beam dyeing process, the amount of solvent in the mixture for spraying is reduced. This means that the concentration of for example dye in the mixture can be held higher than the concentration of dye in the mixture of the beam dyeing process. This also means that the concentration of agents in the mixture to be applied by spraying can be held higher than the concentration of agents in a mixture to be applied by beam dyeing. I.e. less solvent is used in the mixture which is to be applied by spraying than in beam dyeing. The reason for the high concentration of

agents in the mixture to be applied by spraying is, in comparison to beam dyeing, that the spray application is instant and non-circulating. On the contrary, beam dyeing needs a lower concentration of agents in the solvent because the application method requires that the agents are applied little by little stepwise.

[0043] According to one example embodiment, the spraying step is performed with the textile material placed in a vertical position such that the textile material is not in contact with the surface beneath.

[0044] Hereby, the mixture can be applied to both sides of the textile material.

[0045] According to one example embodiment, the spraying step is performed with the textile material placed in a horizontal position.

[0046] Applying said at least one mixture by means of spraying is such that the mixture level is substantially evenly distributed across the width of the textile material. This allows the textile material to be uniformly dyed or finished.

[0047] Padding, also referred to as pad batch or pad dyeing, is a contact application method. It refers to the use of a machine for impregnating textile materials with for example a mixture such as a dye. It consists essentially of a trough, which is filled with a mixture and through which a textile material is fed, followed by two or more pairs of squeeze rolls for distributing the mixture across the width of the textile material.

[0048] Padding is an application method that is suitable for pre-preparation of the textile material, such as pre-moisturizing, in which the trough is filled with water.

[0049] According to one example embodiment, said mixture has a viscosity of $0.1 \cdot 10^{-3}$ Pa*s to $1000 \cdot 10^{-3}$ Pa*s, measured at 20°C. Additionally or alternatively, said mixture has a viscosity of at least $0.1 \cdot 10^{-3}$ Pa*s, or at least $1 \cdot 10^{-3}$ Pa*s, or at least $10 \cdot 10^{-3}$ Pa*s, or at least $100 \cdot 10^{-3}$ Pa*s, or at least $1000 \cdot 10^{-3}$ Pa*s, measured at 20°C. Additionally or alternatively, said mixture has a viscosity of at most $1000 \cdot 10^{-3}$ Pa*s, or at most $100 \cdot 10^{-3}$ Pa*s, or at most $10 \cdot 10^{-3}$ Pa*s, or at most $1 \cdot 10^{-3}$ Pa*s, or at most $0.1 \cdot 10^{-3}$ Pa*s, measured at 20°C. Accordingly, the mixture may be in the form of liquid, foam or collapsed foam.

[0050] According to at least one example embodiment, said step of applying at least one mixture is performed to a surface of a first side of said textile material so that a first treated surface is obtained;

and wherein said step of applying at least one mixture is performed to a surface of a second side of said textile material so that a second treated surface is obtained.

[0051] With the mixture applied on both surfaces of the textile material the mixture is distributed on two surfaces of the textile material, i.e. a first treated surface and a second treated surface. With the mixture applied on both surfaces of the textile material, the distance the mixture and agents therein must migrate, to reach the fibers situated in the middle of the textile material, is decreased. Thus, a more even distribution of the mixture across the

thickness of the textile material is achieved.

[0052] The step of applying the mixture to the first and second side of the textile material may be conducted simultaneously or sequentially.

[0053] Furthermore, the textile material is in the step of rolling the treated textile material onto a beam subjected to the mixture applied on its own surface and the mixture applied onto the second side of the up rolled material.

[0054] According to at least one example embodiment, said mixture is evenly distributed over the surface of said textile material.

[0055] With an even distribution of the mixture to the textile material, the likelihood of a positive outcome from the dyeing and finishing process is increased. The better the distribution of mixture, the better the result of the dyeing and finishing process. With an even distribution of mixture, it is likely that the mixture will fix evenly to the textile material. Hereby, the risk of uneven dyeing is reduced and the risk of some parts of the textile material resulting in a darker shade or some parts of the textile material with a brighter shade is reduced.

[0056] According to at least one example embodiment, the variance of the wet pick-up of the treated textile material, measured in percentage points, is less than 400, preferably less than 100, and most preferably less than 25.

[0057] According to at least one example embodiment, said at least one textile material is at least a first and a second textile material.

[0058] Hereby, a plurality of treated textile materials may be rolled up onto the textile roll before the textile roll is placed in the heating chamber. Thus a plurality of treated textiles may be fixed simultaneously which saves both time and money.

[0059] Hereby, the claimed process is suitable for large as well as small batches of textile materials. In addition, the claimed process performed on small batches of textile material is both time and cost efficient in relation to traditional processes performed on small batches of textile material.

[0060] According to at least one example embodiment, said discontinuous process further comprises the step of: rolling at least one foil to said treated textile roll before at least one second treated textile material is rolled to said treated textile roll.

[0061] The foil between different batches of treated textile materials on the treated textile roll is advantageous for keeping the treated textile materials separated from each other, especially when the mixture of the first treated textile material is different from that of the second treated textile material. Hence, a plurality of treated textile materials can be fixed in the heating chamber at the same time, even if the different mixtures comprises different agents.

[0062] The foil applied between the first and the second treated textile material on the treated textile beam minimises the risk that the mixtures are mixed up with each other, neither during the step of rolling the treated textile

material onto the beam nor during the steps of heating or maintain the fixation temperature of the treated textile roll within the heating chamber. Since the first treated textile material is separated from the second treated textile material the mixture applied to the first treated textile material cannot migrate to the second treated textile material. Neither can the mixture of the second treated textile material migrate to the first treated textile material.

[0063] Hence a first colour of the first treated textile material is not able to contaminate a second colour of the second treated textile material.

[0064] The foil, which may be referred to as a seal or a sealing layer, could be a plastic foil.

[0065] According to at least one example embodiment, said second distribution is a pressure distribution.

[0066] The second distribution of the mixture to the textile material is obtained when the textile material is rolled up onto the beam. The pressure that is applied to the treated textile material during the step of rolling the treated textile material onto a beam promotes a second distribution of the mixture thereon.

[0067] By having a second distribution of the mixture to the textile material, it is more likely that the mixture will be evenly spread over the textile material. If the first distribution happens to be inappropriate, the second distribution makes the overall distribution sufficiently well performed to provide an even dyeing and treatment process of the textile material. Thus, the pressure distribution promotes a backup if the first distribution of mixture to the surface of the textile material is poor.

[0068] According to at least one example embodiment, a discontinuous process is provided, which further comprises the steps of:

placing said treated textile roll on a rotatable stand within said heating chamber; and
rotating said treated textile roll within said heating chamber.

[0069] Rotation of the treated textile roll within the heating chamber during the fixation step makes thermal impact uniform, hence improving the efficiency and quality of the fixation step.

[0070] In addition, the rotation of the treated textile roll may function as an internal fan, i.e. the rotation promotes natural convection of the air surrounding the treated textile roll. Thus, the use of an external fan is unnecessary which makes the claimed process silent.

[0071] According to at least one example embodiment, said step of applying at least one mixture to at least one side of said at least one textile material is performed in a temperature between 10 - 40°C.

[0072] Hence, the step of applying a mixture can be performed in room temperature without the influence of additional heating.

[0073] According to at least one example embodiment, said step of applying at least one mixture comprises at least a first application with a first mixture and a second

application with a second mixture.

[0074] Hereby, a first mixture comprising a dye can be applied to the textile material and subsequently a second mixture comprising a finishing agent can be applied to the textile material. Thus, the textile material can be both dyed and finished in the claimed process.

[0075] According to at least one example embodiment, said textile material is pre-moisturized before said step of applying at least one mixture to at least one side of said at least one textile material pre-moisturizing said textile material before said step of applying a mixture to at least one side of said at least one textile material.

[0076] The pre-moisturizing of the textile material contributes to a better absorption of the mixture, as the mixture may easily and thoroughly penetrate the textile fibers if the textile material is pre-moisturized before the step of applying a mixture. This is because water promotes the swelling of fibers, and therefore the transportation of dye into the fiber is facilitated and improved with a pre-moisturized textile material, especially if the fiber is of hydrophobic character. An example of a fibers that could be difficult to dye without being pre-moistened are wool fibers. By applying a mixture to a pre-moisturized textile material containing wool fibers, both fixation time and fixation temperature can be reduced.

[0077] Hence, the textile material must not be dry when the step of application starts. Consequently, the manufacturing or the preparation of the textile material before the claimed process starts is not dependent on drying of the textile material which saves time, money, and energy.

[0078] According to at least one example embodiment, said at least one mixture comprises an agent.

[0079] An agent could be a dye, dyestuff, dye compositions such as dye dispersions or other chemicals or finishing agents such as suitable for the corresponding type of fibre, if required chemical products necessary for their fixation as well as surface-active substances. For example, hydrophobic agents, hydrophilic agents, softeners, crease proof agents, anti-bacterial agents.

[0080] According to at least a second aspect of the present inventive concept, an apparatus for dyeing and/or finishing a textile material is provided. The apparatus comprises:

application means for applying at least one mixture to at least one side of at least one textile material, so that at least one treated textile material is obtained;

rolling means for rolling said at least one treated textile material around a beam so that a treated textile roll is obtained;

a heating chamber for heating said treated textile roll until a fixation temperature of said treated textile roll is reached, and maintaining said fixation temperature of said treated textile roll within said heating chamber for a predetermined amount of time until said at least one mixture is set to said treated textile material;

cooling means for cooling said treated textile roll below said fixation temperature.

[0081] The apparatus according to the second aspect of the present invention may be used in a method according to the different embodiments of the first aspect of the present invention. The advantages described above for any of these features are also valid for the second aspect of the present invention.

Brief description of the drawings

[0082] The present inventive concept will now be described in more detail, with reference to the appended drawings showing example embodiments, wherein:

Fig. 1a illustrates a diagram of a prior art process of dyeing a textile material according to at least one example embodiment of the inventive concept;

Fig. 1b illustrates a diagram of the claimed process according to at least one example embodiment of the inventive concept;

Fig. 2a illustrates, in perspective view, the step of applying a mixture to a textile material by spraying according to at least one example embodiment of the inventive concept;

Fig. 2b illustrates, in top view, the step of applying a mixture to a textile material by spraying according to at least one example embodiment of the inventive concept;

Fig. 3a-3c illustrates different application methods for applying a mixture to a textile material; spraying, padding or roll coating according to at least one example embodiment of the inventive concept;

Fig. 4 illustrates a plurality of treated textile rolls rotating in a heating chamber under the influence of heat according to at least one example embodiment of the inventive concept;

Fig. 5 illustrates a treated textile roll comprising a plurality of treated textile materials, each treated textile material separated from the others by a foil according to at least one example embodiment of the inventive concept.

Detailed description of the drawings

[0083] In the following description, the present inventive concept is described with reference to a discontinuous process for dyeing and/or finishing a textile material.

[0084] Fig. 1a is a diagram showing the process of dyeing a textile material according to the prior art process of beam dyeing. The first step is to provide a textile material to be dyed. After such a textile material is provided, the textile material is rolled around a perforated beam such that a textile roll is obtained. Next, the textile roll is placed in a beam dyeing machine together with a mixture. The mixture typically contains a dye and other chemicals used in the dyeing process, e.g. so-called auxiliaries. In the

beam dyeing machine, the mixture is applied and distributed to the textile roll in a step of applying a mixture to a textile material. During this step, the beam dyeing machine is filled with water and the textile roll is wetted before the dye and the auxiliaries are added to and dissolved in the mixture. Thereafter, the mixture and the textile roll therein are slowly heated until a fixation temperature is reached. At the same time as the temperature is raised, the mixture is pumped into the centre of the beam, out of the perforations, and through the textile material. Alternatively, the mixture is pumped through the textile material in reversed direction. The slow heating of the mixture and the textile roll is necessary to make the mixture evenly distributed onto the textile material and to achieve a low variance of wet-pick up. After the fixation temperature is reached, the step of applying a mixture to a textile roll is finished. Accordingly, a treated textile roll having a fixation temperature is obtained. In a subsequent step, the fixation temperature of the treated textile roll is maintained until the mixture is set. Finally, the treated textile roll is cooled below the fixation temperature. Finishing can be done as a final process step if chemicals with high fibre affinity are used.

[0085] Fig 1b is a diagram showing the process according to the present invention. The first step is to provide a textile material. Secondly, a mixture is applied to the textile material such that a treated textile material is obtained. The mixture typically contains dye, auxiliaries, and effect chemicals; typically dissolved in the mixture before it is applied to the textile material. The application of the mixture to the textile material provides a first distribution of the mixture to the textile material. In the next step, the treated textile material is rolled around a beam which provides a second distribution of the mixture to the textile material. The treated textile roll is then placed into a heating chamber and heated therein until the treated textile roll has reached a fixation temperature. The heating of the treated textile roll is typically a fast process since the mixture is already distributed on the textile material. Once the treated textile roll reaches the fixation temperature, the fixation temperature is maintained until the mixture is set to the treated textile material. Finally, the treated textile roll is cooled below the fixation temperature.

[0086] In comparison to the process illustrated in Fig. 1a, the process according to the present invention illustrated in Fig. 1b is quicker and less energy consuming since there is less need for heating a large amount of mixture. This is achieved by applying the mixture to the textile material before rolling the textile material into a roll.

[0087] Fig. 2a illustrates, in perspective view, a step of applying a mixture to a textile material. The textile material 1, partly unrolled and partly rolled around a beam 40, is vertically positioned. On the front and the rear side of the textile material 1 two spray manifolds 20 are shown, each spray manifold 20 is facing one side of the textile material 1. The spray manifold 20 comprises seven spray nozzles 22 attached to a rod 24, each spray nozzle 22

facing one side of the textile material 1. The spray manifolds 22 are arranged to spray a mixture 10 onto each side of the textile material 1 such that the mixture 10 is evenly distributed, and a treated textile material 5 is obtained. The treated textile material 5 is arranged to be drawn downwards and subsequently rolled around a beam 40 such that a treated textile roll 50 is obtained. The rolling of the treated textile material 5 around the beam 40 provides a second distribution of the mixture 10. That is because the textile material 1, having the mixture 10 applied to the at least one side, is pressed against the treated textile roll 50. Hence, the mixture is distributed a second time. The second distribution takes place when the mixture is already applied to the textile material 5.

[0088] Fig. 2b illustrates, in top view, a step of applying a mixture 10 to a vertically positioned textile material 1. On each side of the textile material 1 a spray manifold 20 is located. The spray manifold 20 comprises seven spray nozzles 22, facing the side of the textile material 1. The spray manifolds 20 are located such that the spray nozzles 22 on each spray manifold 20 are in a staggered position in relation the spray nozzles 22 on the opposite side of the textile material 1. The spray manifolds 20 are arranged to spray a mixture 10 to the textile material 1 with an overlap of spray areas 12.

[0089] Fig. 3a-3c illustrates alternative ways of applying a mixture 10 to a textile material 1. Fig. 3a illustrates spray application of a mixture 10 to a textile material 1. The images illustrate a spray manifold 20 comprising a plurality of spray nozzles 22 attached to a rod 24. By the spray manifold 20, the mixture 10 is sprayed onto the textile material 1 such that a higher concentration is sprayed in the middle of the spray area 12 and a lower concentration is sprayed on the periphery of the spray area 12. The spray areas 12 of lower concentration of mixture 10 supplied by two adjacent spray nozzles 22 overlap such that the amount of mixture 10 applied to the textile material 1 is at an even level across the width of the textile material 1.

[0090] Fig. 3b illustrates pad application of a mixture 10 to a textile material 1. Application by padding is a method known to the skilled person and not discussed in further detail herein.

[0091] Fig. 3c illustrates roll coating application of a mixture to a textile material 1. The textile material 1 is fed through a pad 12 comprising the mixture 10 and subsequent fed through magnetically controlled rods 16 which squeeze off excess mixture 10. Application by roll coating is a method known to the skilled person and not discussed in further detail herein.

[0092] Fig. 4 illustrates the step of heating a plurality of treated textile rolls 50 within a heating chamber 60 until the fixation temperature is reached and maintaining this fixation temperature until the active agents of the mixture 10 are set to the treated textile materials 5. The heating chamber 60 comprises heating elements 62. The treated textile rolls 50 comprise a beam 40 and an up rolled treated textile material 5. The treated textile rolls

50 are rotating inside the heating chamber 60 such that the temperature is evenly distributed of the treated textile material 5.

[0093] Fig. 5 illustrates a treated textile roll 50 comprising a first treated textile material 6, a second treated textile material 7, and a third treated textile material 8. Each treated textile material (6, 7, 8) has a mixture 10 applied to one or two sides of the textile material 1. A foil 52 is located between the first treated textile material 6 and the second treated textile material 7. The foil 52 is rolled up with an overlap, thus separating the first treated textile material 6 from the second treated textile material 7. In addition, there is a foil 52 located between the second treated textile material 7 and the third treated textile material 8. This foil 7 is also rolled up with an overlap, such that the second treated textile material 7 is separated from the third treated textile material 8. Hence, the mixture 10 applied to an up rolled treated textile material (5, 6, 7, 8) is not in contact with the mixture 10 applied to other up rolled treated textile materials (5, 6, 7, 8). This has the effect that there is low risk of cross-contamination of the mixtures 10 of the treated textile rolls 50.

Examples

[0094] Fig. 1a is a diagram showing the process of dyeing a textile material according to the prior art process of beam dyeing. First, a textile material to be dyed is provided. The textile material is a polyester, PES130. After the textile material is provided, it is rolled around a perforated beam such that a textile roll is obtained. Next, the textile roll is placed in a beam dyeing machine together with a mixture. The mixture contains a dye and auxiliaries. In the beam dyeing machine, the mixture is applied and distributed to the textile roll in a step of applying a mixture to a textile material. This step takes about 15 minutes. Thereafter, the mixture and the textile roll therein are slowly heated for one hour and five minutes from room temperature till a fixation temperature of 130°C. At the same time as the temperature is raised, the mixture is pumped into the centre of the beam, out of the perforations, and through the textile material. After the fixation temperature is reached, the step of applying a mixture to a textile roll is finished. Accordingly, a treated textile roll having a fixation temperature is obtained. In a subsequent step, the fixation temperature of the treated textile roll is maintained for 55 minutes until the mixture is set. Finally, the treated textile roll is cooled down from 130°C to 60°C for 35 minutes. The overall process takes two hours and 50 minutes.

[0095] Fig. 1b is a diagram showing the process according to the present invention. First, a textile material to be dyed is provided. The textile material is a polyester, PES130. Secondly, a mixture is applied to the textile material such that a treated textile material is obtained. The step of applying the mixture to the textile material takes 15 minutes. The mixture contains dye, auxiliaries, and effect chemicals dissolved in the mixture before it is ap-

plied to the textile material. The step of applying the mixture to the textile material provides a first distribution of the mixture to the textile material. In the next step, the treated textile material is rolled around a beam which provides a second distribution of the mixture to the textile material. The treated textile roll is then placed into a heating chamber and heated therein from 20°C till the treated textile roll has reached a fixation temperature of 130°C. The heating of the treated textile roll takes 20 minutes. Once the treated textile roll reaches the fixation temperature, the fixation temperature is maintained for 55 minutes until the mixture is set to the treated textile material. Finally, the treated textile roll is cooled from 130°C to 60°C. The overall process takes one hour and 45 minutes.

[0096] In comparison to the process illustrated in Fig. 1a, the process according to the present invention illustrated in Fig. 1b is one hour and five minutes quicker and less energy consuming since there is less need for heating a large amount of mixture.

Claims

1. A discontinuous process for dyeing and/or finishing a textile material which comprises the steps of:
 - providing at least one textile material;
 - applying at least one mixture to at least one side of said at least one textile material, so that at least one treated textile material is obtained, wherein said step of applying said at least one mixture provides a first distribution of said at least one mixture to said at least one textile material;
 - rolling said at least one treated textile material around a beam so that a treated textile roll is obtained, wherein said rolling of said treated textile material around a beam provides a second distribution of said at least one mixture to said at least one textile material;
 - placing said treated textile roll into a heating chamber;
 - heating said treated textile roll within said heating chamber until said fixation temperature of said treated textile roll is reached;
 - maintaining said fixation temperature of said treated textile roll within said heating chamber for a predetermined amount of time until said at least one mixture is set to said treated textile material;
 - cooling said treated textile roll below said fixation temperature.
2. A discontinuous process according to claim 1, wherein said mixture comprises an aqueous solvent.
3. A discontinuous process according to any one of

claims 1-2, wherein said step of applying at least one mixture to at least one side of said at least one textile material is such that said treated textile material has a wet pick-up of 5 - 150%, preferably 30-70%.

4. A discontinuous process according to any of the preceding claims, wherein said step of applying at least one mixture is performed by spraying, padding, knife coating, roll coating, or screen coating.
5. A discontinuous process according to any of the preceding claims, wherein said step of applying at least one mixture is performed to a surface of a first side of said textile material so that a first treated surface is obtained;
and wherein said step of applying at least one mixture is performed to a surface of a second side of said textile material so that a second treated surface is obtained.
6. A discontinuous process according to any of the preceding claims, wherein said mixture is evenly distributed over the surface of said textile material.
7. A discontinuous process according to any one of the preceding claims, wherein said at least one textile material is at least a first and a second textile material.
8. A discontinuous process according to claim 7, which further comprises the step of:
rolling at least one foil to said treated textile roll before at least one second treated textile material is rolled to said treated textile roll.
9. A discontinuous process according to any one of the preceding claims, wherein said second distribution is a pressure distribution.
10. A discontinuous process according to any of the preceding claims, which further comprises the steps of:

placing said treated textile roll on a rotatable stand within said heating chamber; and
rotating said treated textile roll within said heating chamber.
11. A discontinuous process according to claim 1, wherein said step of applying at least one mixture to at least one side of said at least one textile material is performed in a temperature between 10 - 40°C.
12. A discontinuous process according to claim 1, wherein said step of applying at least one mixture comprises at least a first application with a first mixture and a second application with a second mixture.
13. A discontinuous process according to claim 1,

wherein said textile material is pre-moisturized before said step of applying at least one mixture to at least one side of said at least one textile material.

- 5 14. A discontinuous process according to any of the preceding claims wherein said at least one mixture comprises an agent.
- 10 15. An apparatus for dyeing and/or finishing a textile material comprising:

application means for applying at least one mixture to at least one side of at least one textile material, so that at least one treated textile material is obtained;
rolling means for rolling said at least one treated textile material around a beam so that a treated textile roll is obtained;
a heating chamber for heating said treated textile roll until a fixation temperature of said treated textile roll is reached, and maintaining said fixation temperature of said treated textile roll within said heating chamber for a predetermined amount of time until said at least one mixture is set to said treated textile material;
cooling means for cooling said treated textile roll below said fixation temperature.

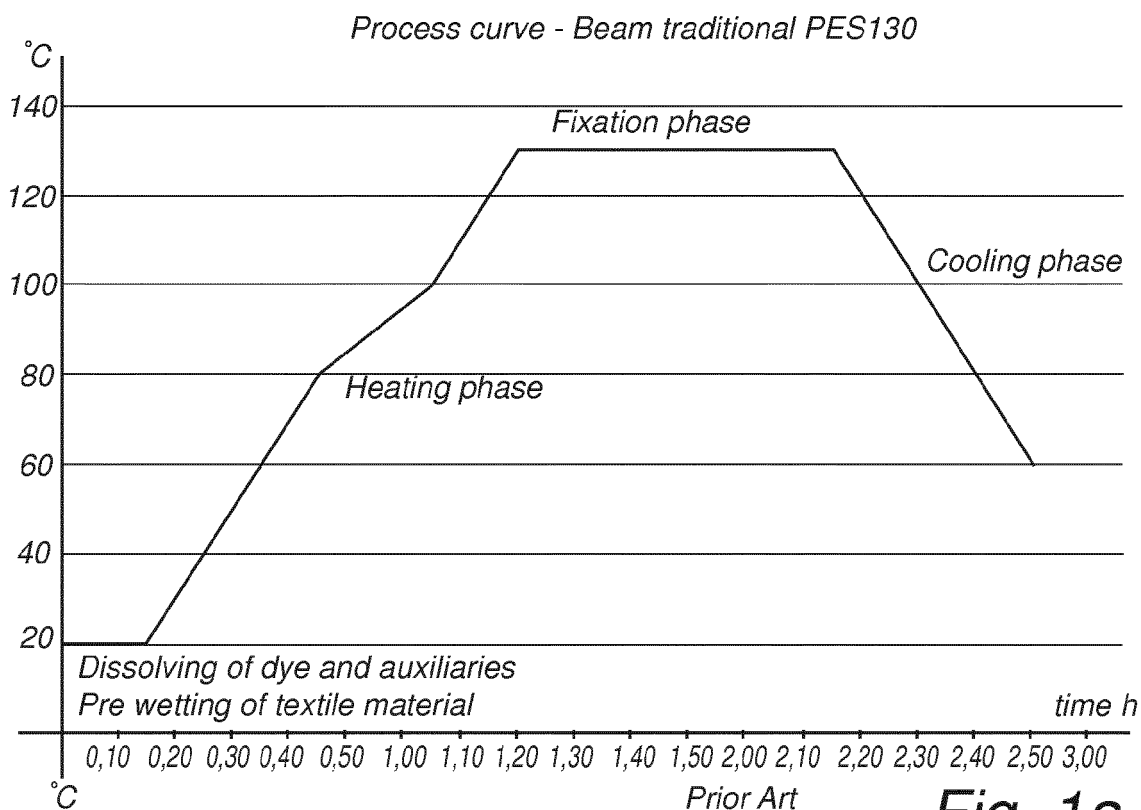


Fig. 1a

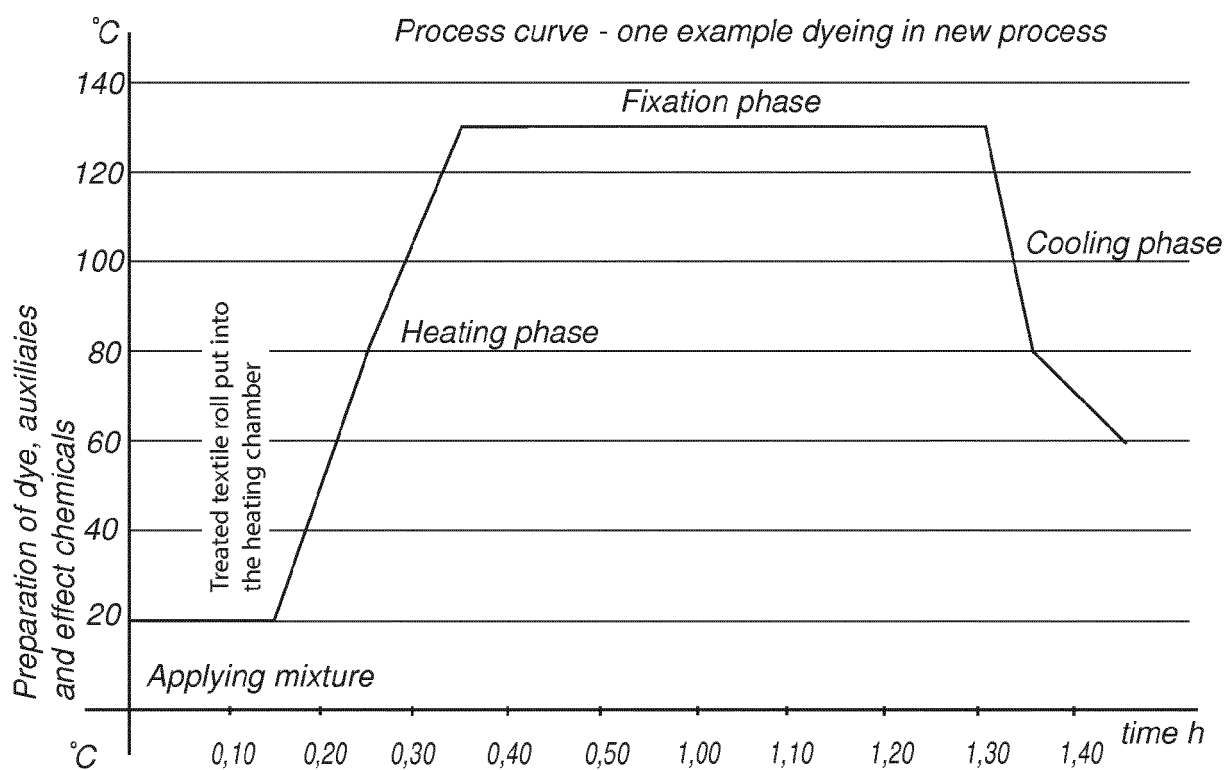
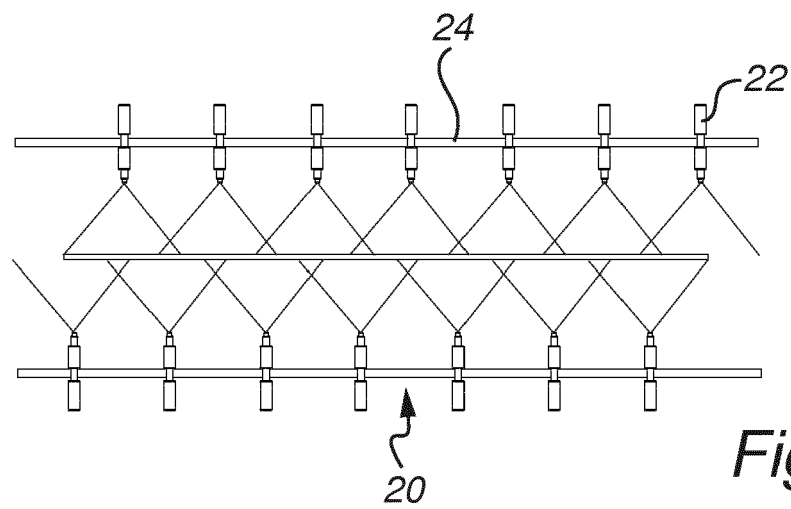
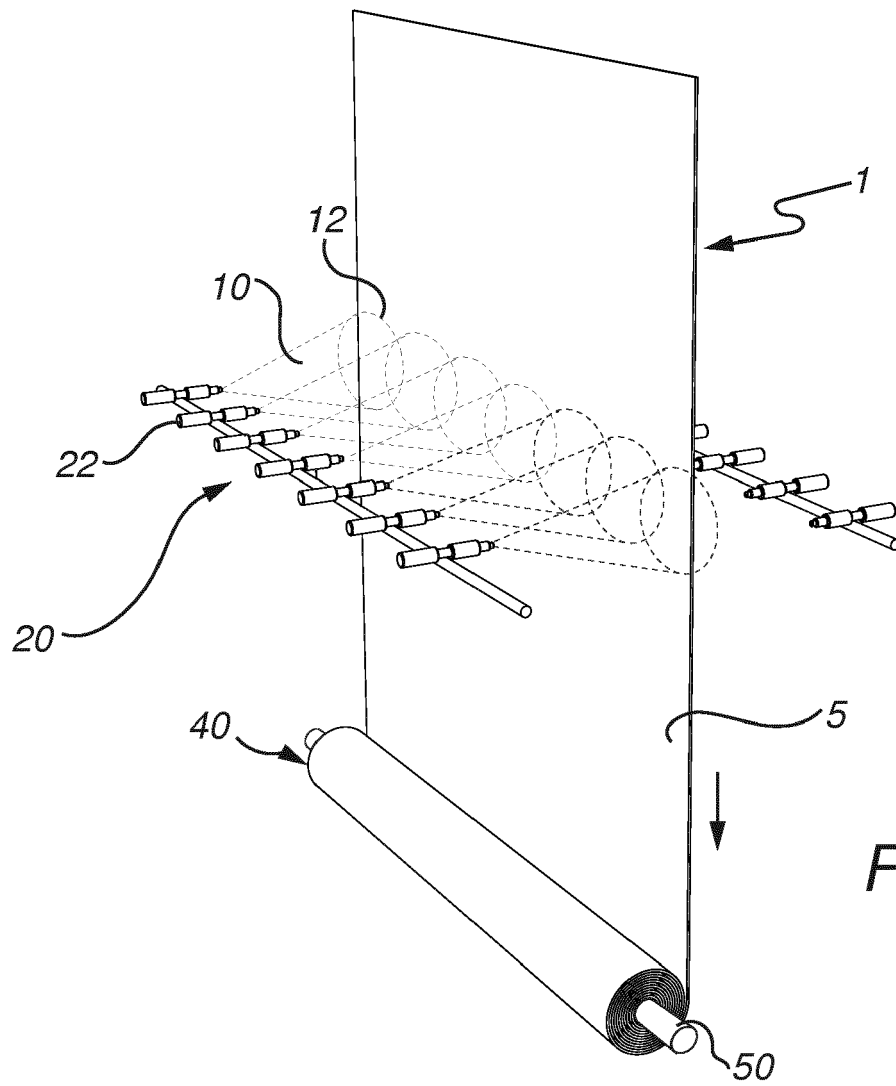
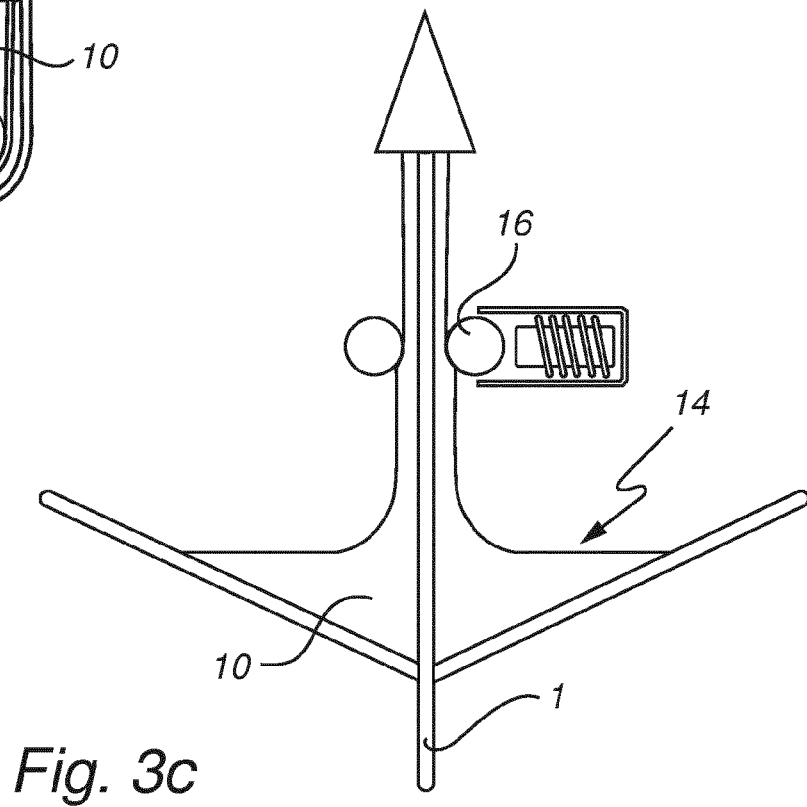
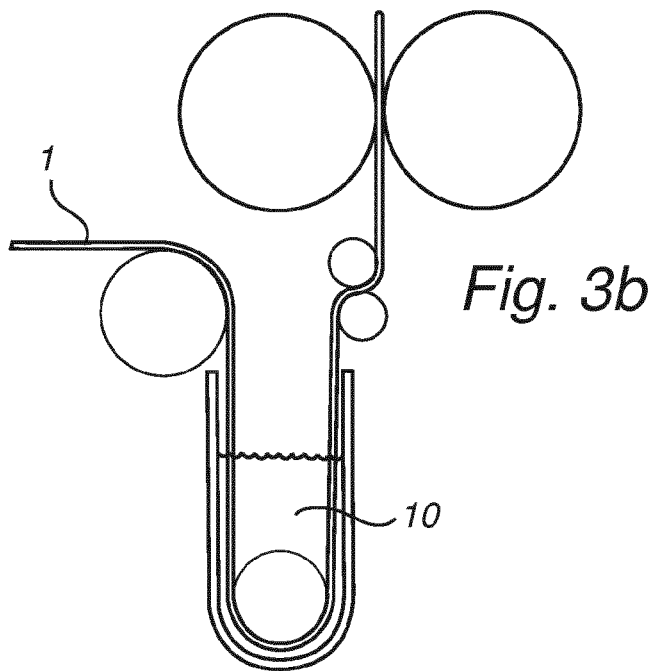
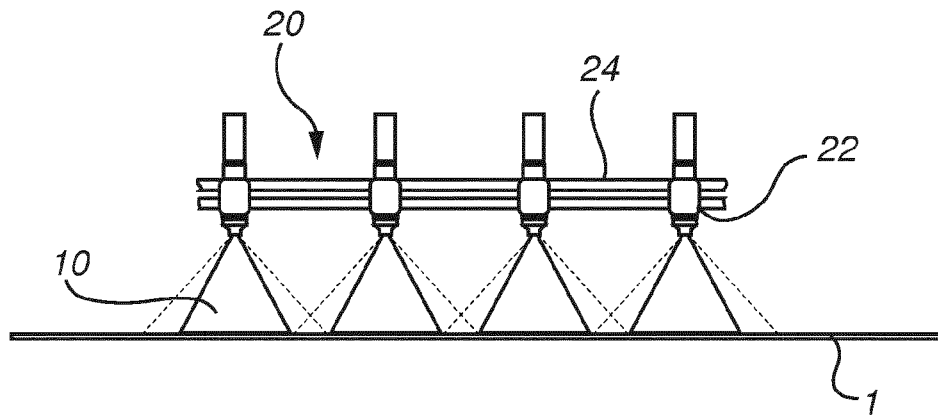


Fig. 1b





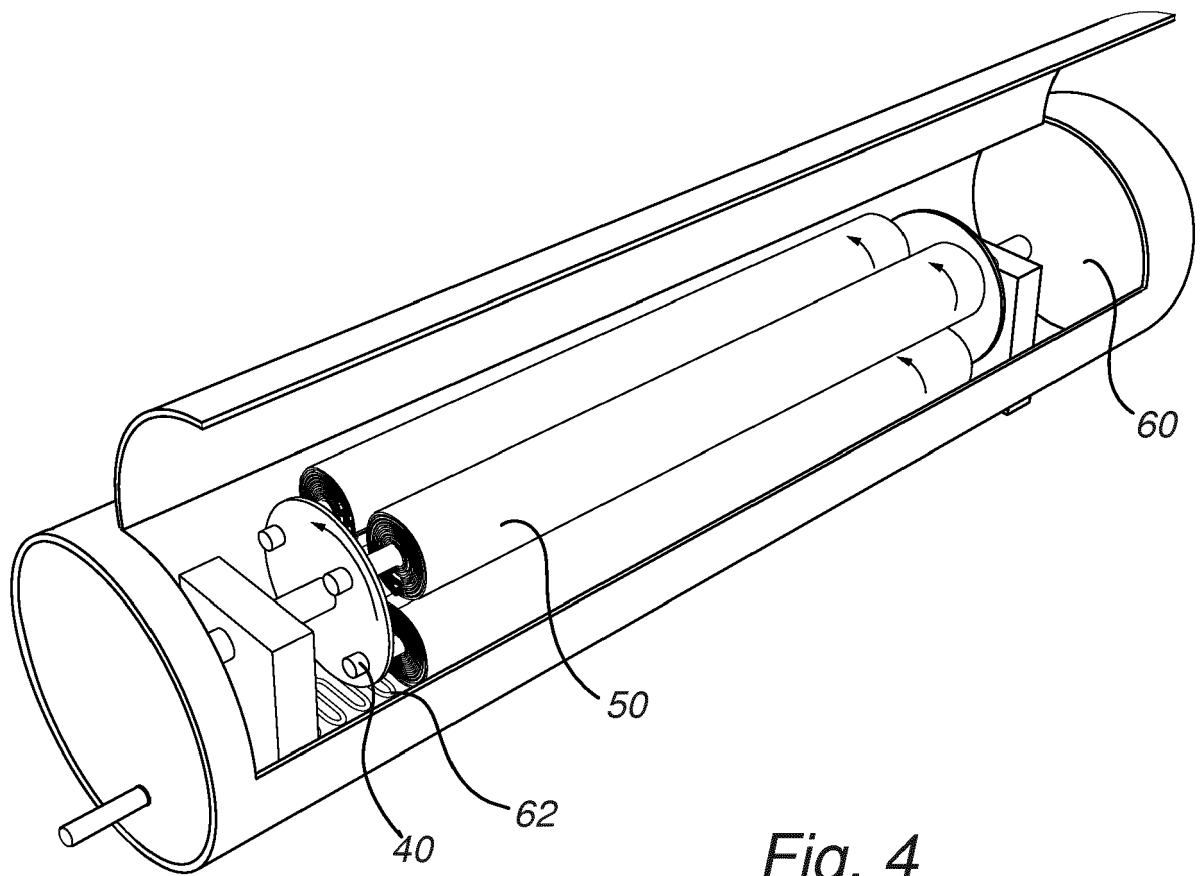


Fig. 4

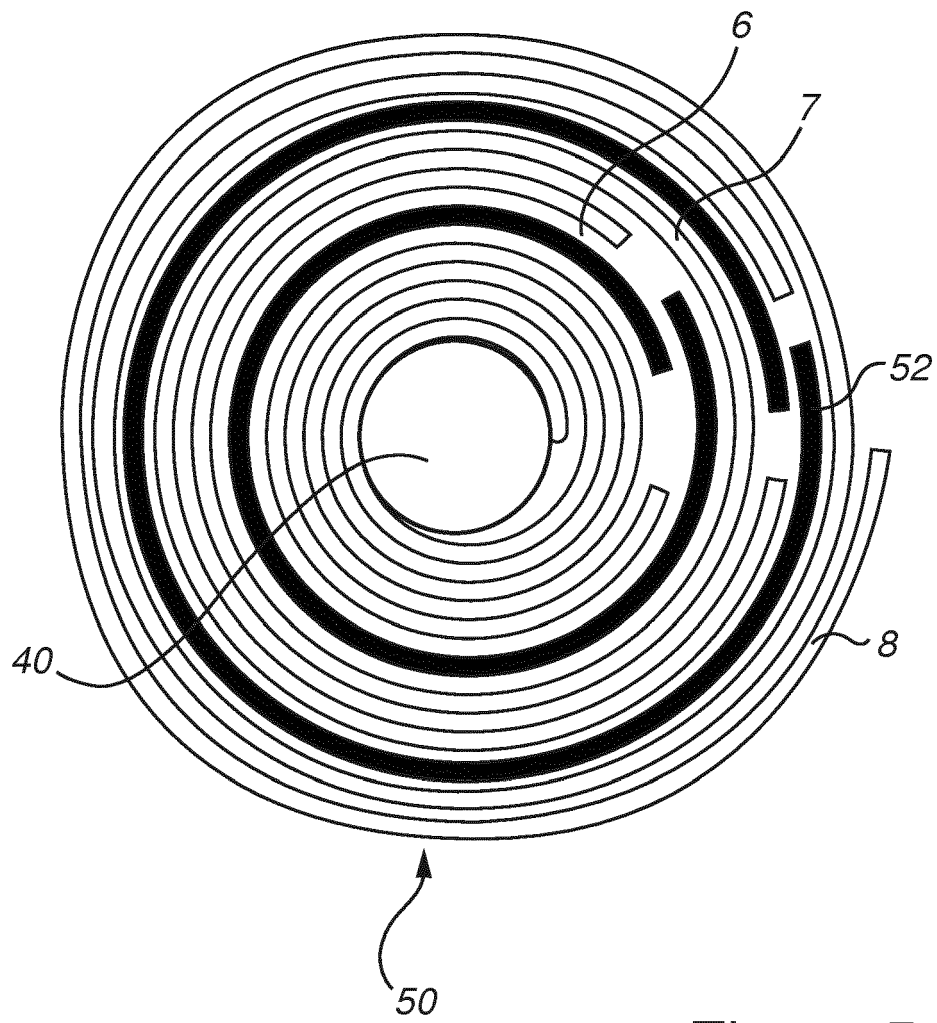


Fig. 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 17 9025

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Y	* column 1, lines 1,2,9,10 * * column 2, line 49 - column 3, line 1; figure * * column 3, lines 36-42,50,57 * * column 3, line 65 - column 4, line 27 *	1-7,9-14	
Y	----- KR 2004 0071815 A (CHUNG WOO TEXTILE CO LTD; KWON OH KYUNG) 16 August 2004 (2004-08-16) * page 1, line 14 - line 19; figures * * page 2, line 45 - page 4, line 19 *	1-7,9-14	
Y	----- DE 14 97 745 U (.) 13 December 1941 (1941-12-13) * claim 2; figures *	7	
A	----- DE 26 23 178 A1 (SANDOZ AG) 10 February 1977 (1977-02-10) * page 5, last paragraph - page 6, last paragraph * * page 11, paragraph 2 *	7,8	TECHNICAL FIELDS SEARCHED (IPC) D06B D06C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 22 November 2018	Examiner Uhlig, Robert
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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