

[54] **METHOD FOR THE CONTINUOUS
HIGH-GRADE FINISHING OF TEXTILE
MATERIALS**

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117/138.8 A, 139.5 CQ, 139.5 A, 139.5 F,
138.5, 33.5 T, 161 L, 143 A; 34/115

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ABSTRACT

The present disclosure relates to a method for the continuous high-grade finishing of materials, for example textile materials such as cellulose fibers, synthetic fibers, and the like which can be dried and cured by the influence of heat. More particularly, the present disclosure relates to a method for the high-grade finishing of textile materials which comprises impregnating a textile with a desired chemical preparation and heat-treating said textile material by passing there-through a gas which has been heated to a temperature of about 140°–190° C.

23 Claims, 2 Drawing Figures

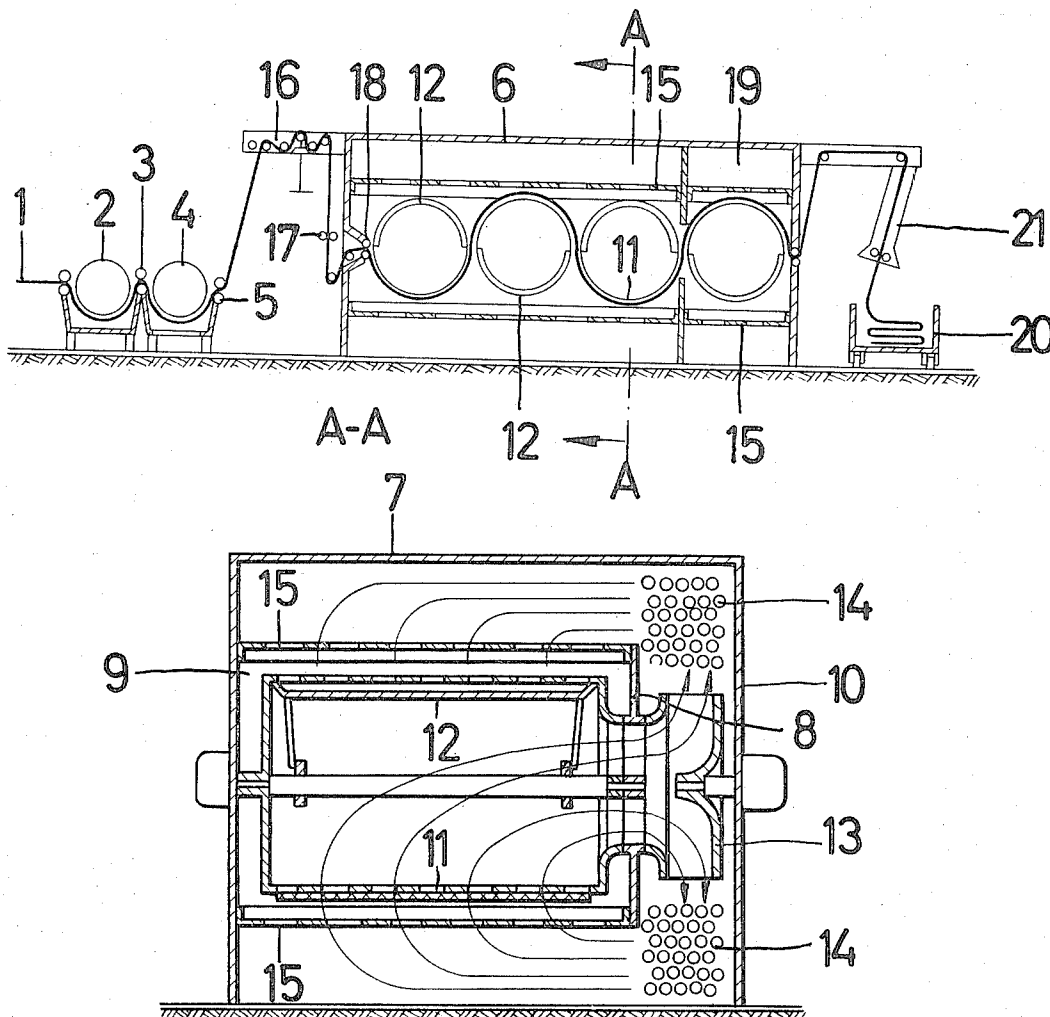


Fig. 1

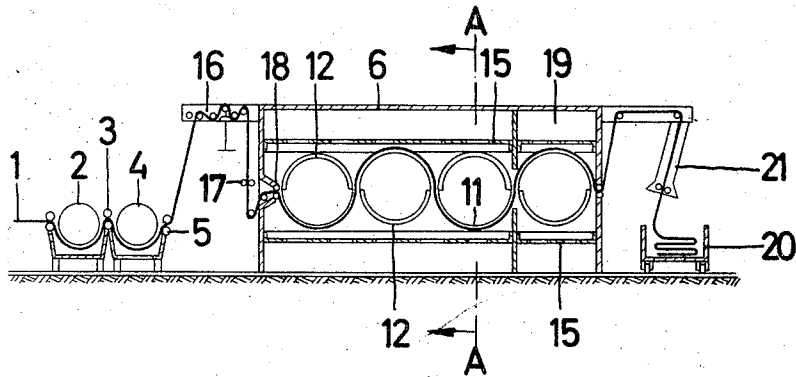
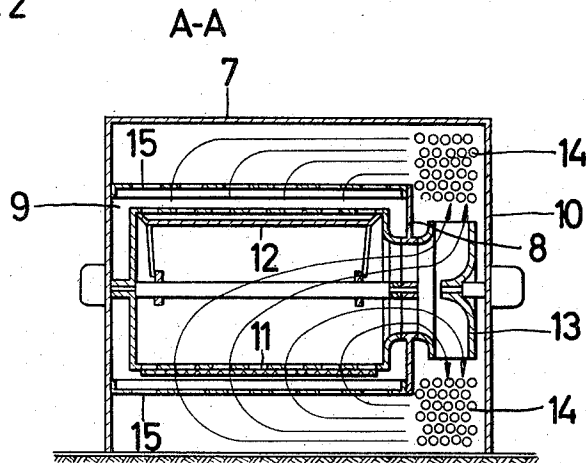


Fig. 2



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METHOD FOR THE CONTINUOUS HIGH-GRADE FINISHING OF TEXTILE MATERIALS

This application is a continuation of abandoned application Ser. No. 651,849 filed July 7, 1967.

BACKGROUND OF THE INVENTION

The present invention relates to a method for the continuous high-grade finishing of materials, for example textile materials such as cellulose fibres, synthetic fibres or such fibres which contain materials which can be cured by the influence of heat.

High-grade finishing is primarily applied to finished products, such as woven and knitted fabrics, nonwovens and the like. With high-grade finishing the following results are attempted to be obtained:

1. Stiff finishing of textiles comprising synthetic fibers with and without a cellulose fibre portion, for example lace petticoats and nettings;
2. Permanent fixation of textiles of cotton and viscose staple fibre, possibly also containing a synthetic fibre portion;
3. Crease-resistant finish of textiles, especially of fabrics made of cotton and viscose staple fibres, for example a wash and wear finish;
4. Chemical shrinkproofing and wash-fast fixation of chemical finishing agents;
5. Improvement of the water-repellent effect and the permanence of hydrophobic finishes.

It is well known to pad the dried material with a liquor which contains a synthetic resin product and suitable additives. A subsequent squeezing effect dehydrates the textile material generally between about 70 and 100 percent BDW. The material is then dried at a moderate drying temperature, preferably below about 100°C. This low drying temperature is used in order to treat the fibers gently, to reduce a migration of the liquor to the surfaces of the fabric and to improve in this way the handle and the softness as well as the durability of the finish.

Drying is generally effected on tenter frames and in some cases short-loop dryers can also be used. However, in order to work economically a higher temperature must be applied. As a result, the quality of the material is reduced, that is, the material shows marked board-like effects. For curing a subsequent heating for about 3 - 5 minutes at a temperature of about 140° - 150°C. is also required. At present, this heating step is also conducted on the aforementioned devices. With contact heat-transfer as well as with jetting of the material, the heat generally reaches only the two outer faces of the fabric or the other textiles. The outer faces therefore dry more rapidly than the fibre particles in the interior of the material and thus there is a migration of the liquor which has not yet been dried towards the two surfaces and consequently the surfaces are enriched with the synthetic resin and the additives. The material thus becomes flat and board-like. In order to improve the handle of the material, that is to obtain a softer handle, a rolling calender treatment with cold rollers is frequently used between drying and curing, or a rewash, or a mechanical after-treatment (breaker) is carried out after curing.

A further disadvantage of the tenter frames, mentioned above, is that the clips are heavily contaminated and in addition, it is extremely difficult to remove the synthetic resin which has been cured on the clips.

An object of the present invention is to avoid the prior art disadvantages in the continuous high-grade finishing of materials.

- Another object of the present invention is to provide an improved method for the finishing of textile materials wherein a substantial uniform drying of the textile material is effected thus substantially eliminating the migration of an impregnated liquid containing synthetic resins and other additives to the surface of said material.

A further object of the present invention is to provide an improved method for the high-finishing of textile materials wherein the softness as well as the durability of the finished material is improved.

- A still further object of the present invention is to provide an improved method for the continuous high-grade finishing of textile materials wherein a very uniform curing is obtained over the old fabric with as well as throughout the whole material thickness and also an extremely short treatment time is achieved which improves production and reduces cost.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description given hereinafter: it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

SUMMARY OF THE INVENTION

Pursuant to the present invention, it has been found that the above-mentioned disadvantages may be eliminated and a much improved method for the continuous high-grade finishing of textile materials may be obtained if a gas which has advantageously been heated to a temperature of about 140 - 190° C, preferably air or air-stream mixtures is passed through the textile material which has been padded with chemical preparations. It has now been founded that by utilizing the teachings of the present invention, a migration of the padding liquor which contains the products which are cured under the influence of heat to obtain high-grade finishing, towards the surfaces of the textile material can be substantially avoided. The chemical preparations contain materials for curing and also additives such as softeners, fillers, water-repellents, optical brighteners and other common auxiliary agents. The handle of the materials dried and cured in this manner is substantially softer. Special after-treatments are no longer required and also it has been surprisingly found that the desired effects are substantially more pronounced with the same liquor concentration and liquor absorption. In this treatment the synthetic resin and the additives do not only deposit on the surface of the fabric but an equal amount also penetrates the interior of the fabric. In this way an improved weighting and a fuller handle is obtained. Also the crease-resistance and the bacteria-resistance of the material are substantially improved.

Furthermore, it was surprisingly found that it is possible to support the textiles by sieve means which serve as carrying and conveying elements and to pass the heated gas through the textile material in such a way that it is forced against the sieves. This treatment offers

the advantage that the material can be guided without any tension during the treatment process. In this way it is also possible to properly treat textiles which are susceptible to textile stress, e.g., rayon fabrics and crepes. A tensionless throughput of the material is also possible if the material shrinks during the treatment process. It is only necessary to overfeed the textile material to the sieves up to the amount of shrinkage.

Up to now, it was feared that the sieves would be quickly soiled and clogged with the synthetic resin material using such a gas guidance, preferably air guidance. However, it has been found that the sieves are not contaminated if the material is adequately squeezed. Thus the liquor absorption of the textile material should preferably be below about 100 percent BDW.

Furthermore, it was surprisingly discovered that the required heating time for a complete curing is substantially shorter using the present process compared to the conventional curing methods at the same temperature. With the process according to the present invention and with the passage of heated gas through the textile material, curing times of up to about 1 minute generally suffice, depending on the product to be cured and the particular textile material. With light-weight textiles which are very permeable to air the curing times are even shorter than 20 seconds. The curing temperatures to be maintained in the process according to the present invention are to be adapted to the respective conditions. They depend, above all, on the textile materials used, especially on the cellulose fibre portion. In general, the curing temperatures can range between about 140° and 190°C which are higher than those used in the known processes. Due to the substantially shorter heating times these high temperatures can be applied without fibre damage.

It is advantageous to effect curing on a rotating sieve drum over which the material is passed or, in the case of higher working speeds, on several rotating sieve drums which are connected one behind the other. In the latter case, the textile material is alternately penetrated by the hot gas on the individual sieve drums. In order to avoid a possible marking of the perforations of the sieves on the textile material, sieves with small perforations can be chosen. However, in many cases it is more desirable to cover the perforated drum jacket with a seamless fine wire mesh on which the textile material rests. Also several layers of wire mesh can be utilized. Surprisingly, it has also been found that drying and curing can be done in one single process on sieve drums. Furthermore, it is also possible to effect curing and fibre setting of the synthetic fibre portion in one single stage if fibre setting has not been effected in one of the preceding treatments.

According to another embodiment of the present invention one drying process step can be eliminated by carrying out the high-grade finishing immediately after the washing process, by dehydrating the textile material down to a residual moisture content of about 35 - 60 percent by means of squeezing or vacuum extraction, by padding the material in a highly concentrated liquor containing the desired preparations, and by drawing and curing the material by passing the heated gas through said textile material.

For higher textile finish requirements the handle can be further improved by treating the textiles after curing preferably on a sieve drum with steam or moist air and/or by conditioning the material. An intense impregnating

effect of the textile materials with extremely short impregnating times is obtained if the textiles are penetrated by the padding liquor containing the preparations for high-grade finishing in a suction drum bowl.

The textile materials which can be treated by the method of the present invention include any of the material or synthetic fibres including the glass and metallic fibres. The natural fibres can include cotton, wool, silk, cellulose, etc., and the synthetic materials may comprise the thermoplastic or thermo setting synthetic polymers such as polyolefins, e.g., polyethylene, polypropylene, etc., polyamides, e.g., the polycondensation of caprolactam, the condensation of hexamethylenediamine with adipic acid, etc., polyesters, e.g., polyethylene terephthalate, etc., phenolic resin, e.g., phenol formaldehyde resins, urea formaldehyde resins, etc., polyvinyl material, e.g., polyvinyl chloride, polyvinyl acetate, etc., acrylate resins, e.g., polymethylmethacrylate, copolymers of these materials with one another or with ethylenically unsaturated monomers, and similar type polymers.

For carrying out the method of the present invention, the apparatus which can be effectively used comprises a closed treatment chamber in which sieve means, preferably sieve drums, are provided as the conveying elements, said sieve drums being subjected to a suction draft by a blower means. The sieve means are covered with at least one fine-meshed wire mesh. The apparatus serves for the simultaneous drying and curing of the textile materials. A conditioning compartment with a sieve drum subjected to a suction draft may be correlated to this apparatus.

Favorable treatment effects are obtained if a bath with a suction drum subjected to a suction draft and a squeezer means connected there behind is used as the impregnating device, and also a chamber with sieve drums subjected to a suction draft for the treatment of the textile materials with hot air, steam-air mixtures. Behind this chamber a conditioning compartment with one conditioning drum may be used which provides the residual moisture content in the textile material, which is very desirable in achieving a good material finish. The material which has been finished in this way may then be batched or packed and shipped in this condition. Together with the conditioning or instead of the conditioning, the material may also be cooled down. By using the method according to the present invention a very uniform curing is obtained over the whole fabric width as well as throughout the whole material thickness. Another essential advantage of the method according to the present invention is the extremely short treatment time which permits high production speeds.

The following examples are given as illustrative of the present invention and not to be considered as limiting.

Example 1

"Stiff-finish of woven and knitted fabrics of synthetic fibres with and without a cellulose fibre portion."

The textile material to be finished is padded with a liquor which contains about 30 - 80 g/l of a partially etherified melamine-formaldehyde product in the liquid state, about 2 - 8 g/l of softeners about 5 - 8 cm³/l of a catalyst substantially free of water, for example zinc chloride or another similar catalyst and optionally

about 2 g/l of an optical brightner. The material is squeezed to a moisture content of between about 80 and 100 percent. The padded material is then dried and cured in one stage at a temperature of about 150 – 190°C in about 20 – 90 seconds. The heat-treatment is effected by passing air through the material on a heat-treating and setting device of the type described above. The same setting device is used for drying and curing the materials finished according to examples 2 – 4.

Example 2

“Crease-resistant finish of cotton and viscose staple fiber fabrics.”

The finishing process of this example is particularly suitable for fast-colored wovens, e.g. dress and pinafore materials, in the case of cotton fabrics, and for high-grade viscose staple fibre materials, e.g. for raising articles, where much stress is placed on a good abrasion resistance material. The material to be treated is impregnated with a padding liquor containing about 70 – 120 g/l of a partially etherified melamine-formaldehyde product or similar product of the reactive type, about 10 – 15 g/l of a softener optionally about 60 – 100 g/l of urea-formaldehyde, 50 percent and about 10 – 15 cm³/l of a catalyst substantially free of water, for example zinc chloride or another suitable catalyst. The material is then squeezed to a moisture content of between about 70 and 90 percent. The drying and curing of the material is effected in a single stage at a temperature of about 140 – 170°C. A cold rolling calender treatment to improve the handle, as is usually required with conventional methods, is not necessary. Depending on the weight of the fabric the curing time ranges between about 30 and 90 seconds as compared with a pure curing time of about 3 minutes at a temperature of about 140 – 150°C with the conventional methods.

Example 3

“Chemical shrinkproofing and wash-fast fixation of finishing agents.” Finishing agents such as starch products, cellulose ether, polyvinyl alcohol, polyacrylamide and partially saponified polyvinyl acetate are fixed, wash-fast with a synthetic resin product, for example with a partially etherified melamine-formaldehyde product. The tendency for shrinkage is reduced by the reduction of fibre swelling, and since finishing can be carried out without any tension on the material as described in the present application, substantially shrink-proof fabrics and other textile products can be obtained. According to the present example about 30 – 60 g/l of a partially etherified melamine-formaldehyde product is added as a curing agent to a finishing bath containing one of the above-mentioned finishing agents. The finishing bath also contains about 4 – 8 cm³/l of a catalyst substantially free of water, for example zinc chloride or another similar catalyst, as well as other additives. The material is dried and cured in a single process stage at temperatures of about 140 – 180°C. The heat-treatment time ranges between about 20 – 180 seconds depending on the weight of the material being processed and its air-permeability.

Example 4

“Improvement of the effect and permanence of hydrophobic finishes.” The water-repellent effect and the permanence of hydrophobic finishes can be substantially improved by the process according to the present

invention. At the same time the crease-resistance of the finished material is also improved. To achieve this effect about 50 – 100 g/l of a liquid curing agent, for example a partially etherified melamine-formaldehyde product and about 4 – 10 cm³/l of a catalyst substantially free of water, e.g. zinc chloride or a similar catalyst is added to the usual finishing agent on the basis of paraffin or silicone emulsions. The heat-treatment is effected in the same manner as any of the aforementioned examples.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become fully understood from the detailed description hereinbelow and the accompanying drawings which are given by way of illustration only and are thus not limitative of the present invention and wherein

FIG. 1 is a longitudinal section of the apparatus of the present invention; and

FIG. 2 is a cross sectional view of the drying and curing chamber of the apparatus of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings wherein like reference numerals are used throughout the various views to designate like parts the apparatus of the present invention comprises a material length 1 which is to be treated by being washed in a wash bowl 2, squeezed in a high-dry squeezer 3 down to a residual moisture content of about 35 – 40 percent and then impregnated in another bath 4 with a liquor containing the preparations for high-grade finishing. In the embodiment of the invention shown, the baths and impregnating devices are provided with one suction drum each subjected to a suction draft. Instead of a suction drum bath 4, the padding liquor may be also applied to the textile length on a padder. A subsequent squeezer 5 dehydrates the textile length 1. The squeezing effect should be below about 100 percent BDW, if possible.

The textile length 1 is then passed on to a drying and setting device 6. This device has a heat-insulated housing 7 which by means of a length-wise partition 8 is subdivided into a treatment chamber 9 and a fan chamber 10. In the treatment chamber 9 sieve drums 11 subjected to a suction draft are provided as conveying elements on which the material is guided alternately and penetrated by gas, preferably air, steam or air-steam mixtures. The suction draft is interrupted at those drum portions which are not covered with the material being treated by means of baffles 12, so that the whole volume of recirculated air is passed through half of the drum jacket and thus through the textile material with an increased efficiency. For producing the suction draft fan wheels 13 are correlated to the faces of the sieve drums in the fan chamber. The air drawn out of the drum is heated again by being blown by the fan wheel 13 into heater means 14, for example heater batteries which are arranged above and beneath the fan wheel. Then the air is returned to the treatment chamber 9 where it is slightly retained by sieve sheets 15 arranged above and beneath the sieve drum and equalized before it is returned to the sieve drum. The air is thus circulated several times before it is discharged near the inlet. Fresh air is generally drawn in at the delivery end of the

apparatus, so that the exchanged is effected in a well known way on the counter current principle.

For guiding the material to be treated a creel 16 with a cloth guiding device 17 is arranged at the inlet. The inlet opening proper is sealed by means of a pair of rollers 18 which are driven by a driving mechanism. The drive of the pair of rollers 18 is infinitely variable and independent of the sieve drum drive, so that it is possible to pass the material to the first drum 11 with a predetermined overfeed and thus to guide even material which shrinks during the treatment without any tension on the sieve drums. This is of particular importance for obtaining a shrinkproof fabric. At the outlet, the apparatus as shown is provided with a conditioning compartment 19 in which the fabric is cooled down and provided with a predetermined residual moisture content. The design of the conditioning compartment corresponds to that of the preceding chamber. It is also possible to use this conditioning compartment 19 for curing, in addition, if conditioning is not required. By means of a plaiting device 21 the high-grade finished textile material can be finally packed on to a wagon 20. However, it may be also rolled by means of one of the well-known devices.

The diameter of the sieve drums may be adapted to the respective conditions and technical requirements. In general, drums with a diameter of about 20 - 350 cm are chosen. However, larger drums for example with a diameter of up to about 10 m may be also used. The width of the sieve drums depends on the textiles to be treated. In general, drums with a width of about 90 - 200 cm can be effectively used. However, if necessary, the width may be enlarged at option. The process of the present invention is not disturbed if beside the textile lengths part of the perforated drum jacket remains uncovered. However, in extreme cases with wide drums and narrow textile lengths the lateral jacket area which is not covered with the textile material may be baffled by means of a well-fitting collar. The time of material passage depends on the time required for the respective heat-treatment. By the shock-like drying and the uniform heating-up of the outer and inner zones of the textile materials a migration of the synthetic resins and the residual additives is avoided.

It is also possible to establish different speeds of the drums connected one behind the other so that the subsequent drums rotate at a slightly lower speed than the preceding ones. In this way it is possible to obtain a material overfeed and to allow for a shrinkage of the textile materials in the warp direction during the heat-treatment, and thus avoid material tension. This overfeed may be done in addition to the overfeed obtained by means of the pair of intake rollers 18.

Furthermore the drying and curing time and thus the production speed is influenced by the speed with which the heated gas is passed through the textile material. The gas speed can be controlled by the proper selection of the fan means and the setting of the fan speed. The gas speed is furthermore influenced by the density of the textile material resting against the drums. In general, it is set to about 0.5 - 5 m/sec., although preferably the gas speed is at least about 2 m/sec.

Of course, it is also possible to subdivide the heat-treatment plant into a drying chamber and a curing chamber and to work with different temperatures in the two chambers. However, such a subdivision is generally not necessary.

Since modifications of this invention will be apparent to those skilled in the art, it is not desired to limit the invention to the exact constitution shown and described. Accordingly, all suitable modifications and equivalents may be resorted to which follows in the scope of the appended claims.

It is claimed:

1. A method for effecting continuous high-grade finishing of textile material which comprises:

1. impregnating a textile material with a liquid finishing preparation containing a heat-curable synthetic resin,
2. removing excess liquid finishing preparation from the textile material without the application of heat to provide a liquid content of less than 100 percent bone dry weight,
3. passing the impregnated textile material over and in contact with a perforated surface of a sieve drum means subjected to a suction draft, and
4. drawing a gas heated to a temperature of about 140°C. to 190°C. through the perforated surface and through the material at a rate of about 0.5-5m./sec. to dry the textile material and to cure the resin rapidly within said material, said resin being cured in about 20 to 90 seconds to thereby prevent migration of the resin to the surface of the material during said drying.

2. The method of claim 1 wherein the gas is selected from the group consisting of air, steam and air-steam mixtures.

3. The method of claim 1 wherein the finishing preparation additionally contains softeners curing agents, fillers, catalysts, water-repellents, optical brighteners or mixtures thereof.

4. The method of claim 1, wherein the heated gas drawn through the textile material to force the textile material against the sieve drum means.

5. The method of claim 1, wherein the excess liquid finishing preparation is removed from the impregnated textile material by squeezing the impregnated textile material.

6. The method of claim 1 wherein the impregnated textile material is squeezed to the liquid content of less than 100 percent bone dry weight.

7. The method of claim 1, wherein the textile material is washed prior to being impregnated with the liquid finishing preparation by drawing a washing medium through the textile material.

8. The method of claim 1 wherein curing is effected on the surface of a plurality of sieve drums subjected to a suction draft, the penetration of the textile material with hot gas being effected by drawing the hot gas through the textile material, alternately on individual sieve drums from each side of said material, thereby penetrating the material a plurality of times in opposite directions with said hot gas.

9. The method of claim 6 wherein after curing the textile material is conditioned with steam or moist air on a sieve drum subjected to a suction draft.

10. The method of claim 1 wherein after the textile material is squeezed, it is conveyed through a creel and a guiding means to the inlet of the heat-treatment zone.

11. The method of claim 1 wherein the material to be treated is overfed to the sieve drums in the heat-treatment zone.

12. The method of claim 1 adapted to forming a stiff-finish on woven and knitted fabrics of synthetic fibres with or without a cellulose fibre portion wherein the material is padded with a finishing preparation containing about 30 - 80 g/l of partially etherified melamine-formaldehyde, about 5-8 cm³/l of a catalyst, about 2 - 8 g/l of softeners, and about 2 g/l of an optical brightener, squeezed to a moisture content of between about 80 and 100 percent and dried and cured in a single stage with a gas heated to a temperature of about 150 - 190°C.

13. The method of claim 1 adapted to forming a crease-resistant and abrasion-resistant finish on cotton and viscose staple fiber fabrics wherein the material is padded with a finishing preparation containing about 70 - 120 g/l of partially etherified melamine-formaldehyde, about 60 - 100 g/l of ureaformaldehyde, about 10 - 15 cm³/l of a catalyst, and about 10 - 15 g/l of a softener, squeezed to a moisture content of between about 70 and 90 percent and dried and cured in a single stage at a temperature of about 140 - 170°C.

14. The method of claim 1 adapted to chemical shrinkproofing and wash-fast fixation of finishing agents wherein the textile material is padded in a finishing bath with a finishing preparation containing about 30-60 g/l of partially etherified melamine-formaldehyde resin, a finishing agent selected from the group consisting of starch products, cellulose ether, polyvinyl alcohol, polyacrylamide and partially saponified polyvinyl acetate, and about 4 - 8 cm³/l of a catalyst and dried and cured in a single stage with a gas heated to a temperature of about 140 - 180°C.

15. The method of claim 1 adapted to improving the effect of crease-resistance and permanence of hydrophobic finishes wherein the material is padded with a finishing preparation containing about 50 - 100 g/l of partially etherified melamine-formaldehyde, and about 4 - 10 cm³/l of a catalyst, squeezed to a moisture content of between 70 and 100 percent and dried and cured in a single stage with a gas heated to a temperature of about 140 - 190°C.

16. The method of claim 7 wherein after washing the textile material is squeezed or vacuum extracted to the residual moisture content of about 35 - 60 percent.

17. A method for the high-grade finishing of textile materials wherein said materials are provided with a softer finish, an improved weighting and fuller handle and an improved crease resistance and bacteria resistance which comprises washing the textile material by drawing the washing medium through the textile mate-

rial, impregnating the textile material with a finishing preparation containing a heat curable resin, squeezing said textile material to a liquid content of less than 100 percent bone dry weight, and drying the textile material and curing the resin in about 20 to 90 seconds by conveying the material through a heat-treatment zone in contact with and on a perforated surface, wherein a gas selected from the group consisting of air, steam and air-steam mixtures, heated to a temperature of about 140 ° to 190°C., is drawn through said material whereby migration of the resin to the surface of the material is prevented; the penetration of the textile material by the various treatment media being effected on sieve drums subjected to a suction draft and the material being conveyed without tension during the treatment process.

18. The method of claim 17, wherein prior to being impregnated with the finishing preparation, the textile material is washed by drawing a washing medium there-through and then squeezed or vacuum extracted to a residual moisture content of about 35-60 percent.

19. The method of claim 17 wherein the heated gas is drawn through the textile material at a rate of about 0.5 - 5 m/sec.

20. A method for the continuous high-grade finishing of textile materials containing cellulosic materials synthetic fibers or blends thereof which comprises padding the textile material with a liquor containing a heat-curable synthetic resin, removing excess liquor from the textile material, conveying the textile material over and in contact with the perforated surface of sieve means and curing the synthetic resin in about 20 to 90 seconds by drawing a gas selected from the group consisting of air, steam and air-stream mixtures, which has been heated to a temperature of about 140° to 190°C., through the textile material and said perforated surface in an amount and at a rate sufficient to cure the synthetic resin without causing migration thereof in the fibers.

21. The method of claim 20, wherein the textile material is conveyed on the surface of sieve means subjected to a suction draft and the heated gas is drawn through the textile material in a direction such that said material is forced against the sieve means.

22. The method of claim 20, wherein the heated gas is drawn through the textile material at a rate of about 0.5-5m./sec.

23. The method of claim 22, wherein the textile material is squeezed or vacuum extracted to remove excess liquor from the textile material to provide a liquid content of less than 100 percent bone dry weight.

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