

# UNITED STATES PATENT OFFICE

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## WATERPROOFING TREATMENT OF TEXTILE MATERIALS

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This invention relates to the treatment of textile materials to render them waterproof, water-repellent and fast to soap.

A considerable number of processes have been known for many years for rendering textile fabrics waterproof or water-resistant, or both by the application of reagents other than india rubber, or other than reagents which are obviously equivalent to india rubber. Such known processes, however, have the drawback that the materials treated by them do not retain their water-resistant or water-repellent properties after the goods treated by them have been subjected to ordinary processes of washing and laundry cleaning.

The main object of the present invention is to provide a process by which textile fabrics may be rendered waterproof or water-repellent or both in such a way that these properties may be retained after the goods have been repeatedly washed and subjected to laundering operations without the use of india rubber or equivalent reagents, and so that woven goods may be left freely permeable to air.

The process according to the present invention consists in impregnating the material to be treated with a solution containing an animal or vegetable albumen, or both, or globulin alone, or globulin with the animal albumen or vegetable albumen, or both, and in subsequently coagulating the albumen or globulin, or both, by the action of heat, while in order to render the material fast to soap, the treatment is associated with the action on the material of a higher fatty acid, or of soap, or both.

After the goods have been steeped or padded through the solution of albumen or globulin, preferably when the latter has been brought to its iso-electric point by means of a buffer solution, excess of the impregnating solution may be removed so that the amount of it remaining in the material is equal to 60 to 100 per cent of the weight of the material, and then the coagulation of the albumen or globulin or both is preferably carried out at a temperature above the boiling point, and in fact at a temperature corresponding to that of saturated steam at 20 pounds gauge pressure. This method of using high pressure steam for short periods may be employed if the fabric to be treated should be a cotton fabric, either plain or dyed with a fast dyestuff. The result, however, can be obtained by steaming at lower pressure, or even by introducing the goods into boiling water. Thus, in the case of the treatment of delicate materials such as real silk or acetate rayon, it is convenient to increase the

period of steaming and to reduce the temperature so that the coagulation may in that case be produced by a longer period of steaming at 100° C., or even by a very long period at a lower temperature in the so-called "cottage" steamer.

When the first part of the process is carried out as described above, the material is further treated by being "boiled" with soap. For this purpose it is preferable to use a soap containing at least 50 per cent of the fatty matter in the form of the higher fatty acids—stearic or palmitic acid—and it is desirable that the amount of free alkalinity should be reduced to a minimum. In fact, it is found that the best results are obtained by reducing the pH value of the soap solution to between 7.0 and 7.5 by the addition, for example, of a little acetic acid.

The boiling may be carried out in open vats, and the soap solution may be, and preferably should be, boiling, although good results may be obtained if the soap solution is not actually boiling, but is, for example at 200° F. Boiling should be carried out for not less than one minute and for a longer period with advantage, and it is preferred to carry out the boiling operation for 15 minutes. After this boiling operation, the goods are freed from excess of the soap solution, washed in water and preferably then "soured" with a dilute solution of formic or acetic acid. They may then be dried and finished as usual.

In the methods referred to above, the sequence of the different steps of the process is fundamental since it has now been found out experimentally, and in fact quite surprisingly, and in direct contradiction to the views generally held, that the properties of an albumen directly coagulated by heat, and the properties of an albumen obtained by "denaturation" by heat at a pH value remote from the iso-electric point, and subsequently coagulated by restoring the pH value to the iso-electric point at temperatures lying in the range between 1° C. and 120° C., are very different, the former being insoluble or substantially insoluble in boiling soap solutions, while the latter are freely and quickly dissolved in soap. This is the reason why the methods of treatment according to the invention referred to above, must of necessity be carried out in two successive stages since, if it is attempted to avoid the operation of steaming the impregnated fabric by previous heat denaturation of the albumens at extreme pH values, and to apply such solutions to a fabric, the latter acquires no waterproofing qualities, even after boiling with soap. If such a solution is coagulated in situ, for example by

bringing the materials to the iso-electric point, the coagulated mass is soluble in soap. Conversely, if it is attempted to combine the steaming and soaping in one operation, the albumen either remains soluble in water and uncoagulated, or it coagulates into the form which is soluble in soap solutions.

However, the process of the present invention can be carried out without a separate and subsequent boiling with soap by employing an emulsion of a free fatty acid in the place of the soap referred to above, and this may be employed in the solution of the albumen or globulin, or both. The free fatty acids customarily employed as constituents in commercial soaps may be employed; that is to say, in general the higher fatty acids, either saturated or unsaturated and containing ten or more carbon atoms may be employed in media adjusted to correspond with the iso-electric point of the albumen. With such conditions, not only can all the effects obtainable according to the invention when separate boiling is utilised, be obtained, but naturally, the proofing treatment from the point of view of commercial mass treatment of textile fabrics can be much simplified owing to the possibilities of including all the necessary constituents for the reaction in the one solution, and the necessary manipulations are reduced to an impregnation of the textile material with that single solution, followed by the moist heat coagulation of the mixture in situ.

As regards the higher fatty acids to be employed, in general those of low carbon content, for example, as occurring in coconut and palm kernel oils are inferior in effect for the purpose of the present invention to those of higher carbon content, for example such as found in largest quantity in tallows, palm oil and the like, and though there is little to choose in the effect produced by the various normal soap makers' raw materials, it is found that a mixture having the general nature of a mixture of 50 per cent oleic acid with 50 per cent stearic acid gives entirely satisfactory results. The extremely unsaturated acids, such as occur in linseed and untreated fish oils, are best avoided since owing to their unsaturated nature, they can cause the finished goods to develop undesired yellow colourations and unpleasant smell.

Further, according to the present invention, the repellent properties of the fabric as distinct from its water-proof property, may be improved by emulsifying the albumen solution, or the albumen solution containing the emulsion of free fatty acid with water-repellent bodies such as waxes, before the solution is applied to the fibre. The waxy constituents are then carried into the fabric and maintained there by the insoluble complex of the albumen and fatty acid, or of the albumen, soap and fatty acid which is produced in carrying out the novel process. The wax, when employed in this way, is resistant to the action of volatile solvents as used in dry cleaning, and to the action of soap, to a degree entirely incomparable with the resistance obtained when wax is deposited in the fabric from the ordinary well known wax emulsions which are much used.

The present process may also be applied to fabrics which have already been subjected to waterproofing processes which do not render them fast to soap, for example to such processes as depend upon the deposition of waxes and the like from positively charged emulsions containing

such waxes, and as are described, for example, in the specifications of British Patents Nos. 380,076, 380,065, 380,052, 394,816 and 421,519; the invention may also be applied to fabrics which have been subjected to processes depending upon the deposition of amphoteric albumenoid metal complexes, as described in my U. S. patent application Serial No. 205,818, filed May 3, 1938. The present process imparts fastness to soap to such fabrics, but in this case, it is necessary to free the fabric from any traces of free undecomposed amphoteric metal salts by washing with water.

In carrying out the invention, owing to the properties of the albumen solutions used in general, permanent emulsions of waxes may be made with these solutions by the simple mechanical action of ordinary emulsifying machines, the only precaution necessary being that the temperature during the emulsification process should not, even momentarily, be allowed to reach the temperature of coagulation of the albumen employed, and in general the temperature should not be allowed to exceed 60° C.

At the same time, emulsifying or wetting agents, or both may be introduced with the waxes when making the emulsion if such a procedure should be preferred, although in general such conditions have been found to be unnecessary.

It is convenient to prepare the emulsions in concentrated form for economy in transport where they are prepared remote from the place of use.

The effects produced by treatment of the fabric according to the invention, with the albumen solutions, or with emulsions of wax or wax mixtures in these solutions, are roughly speaking, directly proportional to the concentration of albumen they contain, but generally concentrations below 0.5 per cent of albumen will give effects too weakly developed for waterproofing as such, although sufficient to protect, for example, colours on the fabric which are not fast to soap. For waterproofing the fabric as distinct from protecting it, or the colours on it, concentrations of albumen of from 1 to 3 per cent are in general sufficient, although somewhat higher concentrations are preferred when a stiffer finish is required. In general, light fabrics give the best effects with the lower concentrations, say of about 1 per cent, whereas heavy fabrics do not develop the maximum effect until concentrations up to 5 per cent are employed. Concentrations above 5 per cent have been found to give no advantage on any normal fabric. Of course, for commercial reasons, the lowest concentration which is effective would be selected for each particular fabric.

In order that the invention may be clearly understood and readily carried into effect, certain examples of modes of carrying the new process into effect will now be described in greater detail.

#### Example 1

Dried egg albumen is dissolved in cold water to a concentration of 20 per cent. Then 5 per cent sodium chloride solution is added to the solution to reduce it to 1 per cent concentration and to assist in the solution of the globulines, and the solution is then buffered to pH 4.5 approximately by means of sodium acetate and acetic acid. A suitable anti-putrefying agent such as salicylic acid, thymol or the like is added.

The resultant solution is used in the tank of a padding machine, the goods to be proofed being

passed through the solution in the known manner so that upon emerging they contain between 60 per cent and 80 per cent of their weight of the albumen solution. The goods pass direct through the padding machine to an open steamer in which they are submitted to the action of steam at a temperature of approximately 120° C. This steam need not be saturated but may be steam at atmospheric pressure heated up to 120° C. The goods then pass immediately forward into a jigger containing an 0.5 per cent solution of soap, such as for example the substance known in the trade under the registered trade-mark "Lux." If its pH value is greater than 7.5, a quantity of acid may be added so that the pH value stands between 7 and 7.5 or rather less than more than this. For this purpose unneutralised Turkey red oil may be used. The goods are worked on the jigger and are kept at the boil for five minutes.

The goods are then washed, dried and finished in the customary manner and will then be found to be waterproof in such a manner that the waterproofing is fast to boiling with soap. This is in fact clear since the final treatment which gives the treated cloth the waterproofing properties is actually a violent boiling with soap.

#### Example 2

As an example of the process in which all the necessary reagents are incorporated in a single solution, the following may be given.

100 lbs. paraffin wax of melting point 42° C. are mixed with, and by the application of heat, incorporated with, 100 lbs. of liquid paraffin (boiling point over 300° C.) and 6½ lbs. of the mixed fatty acids isolated from beef tallow.

The mass is brought to a temperature of within 5 degrees on either side of 50° C. and incorporated in an emulsifying machine with 200 lbs. of egg albumen which has been allowed, at the ordinary temperature, to dissolve in 600 lbs. of water containing 0.75 part per thousand of thymol or equivalent antiputrescent, has then been pressed through filter cloth and also raised, with precautions against local superheating, to the temperature within 5 degrees of 50° C. A single passage usually suffices and the emulsion is stable and remains, if protected from evaporation, practically indefinitely undeteriorated. For use, this emulsion is diluted with cold water, preferably containing 0.75 part per thousand of thymol (though this latter is unnecessary if the diluted solution is to be used up within 24 to 48 hours). For example, 1 part by weight of the emulsion to 9 parts by weight of water, and sufficient acetic acid added to give a pH value of 4.5.

Into such a diluted emulsion, a cotton poplin is padded so as to emerge containing from 80-100 per cent of its weight of the liquid, and is then directly passed to a high temperature continuous steamer by way of the usual pre-drying and heating "tins" so as to be acted upon by the steam at the temperature corresponding to a steam pressure of 20 lbs. above atmospheric pressure for 3 to 4 minutes. On emergence, the fabric is directly in the condition for finishing operations, for example in the stenter, callender, and so forth.

If the padding arrangements be adequate, as is common practice in the art, for example, by sequent immersions in successive holes of an open soaper, continuous throughput of the fabric from rough dry raw material to finished article

at rates of the order of 180 yards a minute, can be readily realised.

#### Example 3

Under the precautions described in Example 2, 10 lbs. of albumen dissolved in 300 lbs. of water at a temperature of within 5 degrees of 50° C., are added simultaneously and proportionately into an emulsifying machine (maintained at the same temperature) with 8 lbs. of paraffin wax of 39° C. melting point, also at the temperature of about 50° C.

The emergent solution is diluted to a total weight of 1,000 lbs. with a solution obtained by dissolving 4 lbs. of 62 per cent soap made from beef tallow in 100 lbs. boiling water, diluting this to 2,000 lbs. by the addition of cold water, adding 1½ lbs. thymol (which for convenience of addition may be introduced as its sodium salt) and then treating with acetic acid, or its equivalent, until the mixture shows a pH value of 4.5 and consequently becomes an emulsion of free fatty acids.

The diluted mass is employed as a treating bath in which viscose yarn is impregnated, as for example in a hank dyeing machine. The saturated yarn is hydroextracted so as to retain about 80 per cent of its weight of liquor and is then submitted to the action of steam in a steam chest at 100° C. for 25 minutes. The yarn is then water repellent and waterproof and is not deprived of these properties by boiling soap solutions.

#### Example 4

50 lbs. of albumen is dissolved in 300 lbs. of water containing 0.21 lb. of thymol (or an equivalent antiputrescent) in the cold, that is at temperatures between 15 and 25° C., and the solution pressed through cloth to free it from gross impurity. To this filtered mass is now added a solution obtained by dissolving 2½ lbs. of 62 per cent curd soap in 250 lbs. of boiling water and pouring this into 450 lbs. of cold water containing ½ lb. of thymol, which solution is brought to a pH value of 4.5 by the addition of acetic acid. The resultant mix is employed as a padding liquor for the treatment of woolen tweed tissue in the known manner so as to cause the fabric to carry away approximately its own weight of the liquor. The impregnated fabric is partially or completely dried and is then submitted to the action of moist heat at 70-80° C. for 2 hours, whereafter the goods are finished as usual.

#### Example 5

10 lbs. of albumen are dissolved in 100 lbs. of water and the filtered solution brought to a temperature within 5 degrees of 50° C. with the previously described precautions against superheating. Into this mass is stirred 0.1 lb. of commercial stearic acid and 0.2 lb. of commercial oleic acid, which have been mixed and warmed to 50° C. and the whole passed through a homogenising machine.

The emergent emulsion is diluted with 400 lbs. of water, the mixture brought to a value of pH 4.5 by the addition of acetic acid, and employed to treat a silk fabric, for example in a padding machine provided with suction boxes so regulated as to leave 60-80 per cent of the liquor in the goods.

The saturated fabric is now dried, for example in the stove at an appropriate temperature as is customary in the art, and then introduced

into a discontinuous vertical Indanthrene steamer where it is submitted to the action of steam at a pressure of 2 lbs. gauge for 5 minutes. It is then ready for finishing as usual.

#### Example 6

Felt hat shapes are wetted out in a 5 per cent solution of sodium acetate, hydroextracted, and then immersed in a bath prepared by dissolving 100 parts of the emulsion prepared as described in Example 2, in 300 parts of water at 30° C. to which solution enough acetic acid (or its equivalent) has been added to give a pH value of 4.5.

The goods after thorough impregnation are again hydroextracted so as to leave 80 to 100 per cent of their weight of liquor within them. They are now dried at 100° C. and submitted to steam at this temperature for 15 minutes, when they may be at once submitted to the customary finishing processes.

#### Example 7

100 pounds of a concentrated emulsion of 20 pounds albumen, 10 pounds of paraffin wax and 10 pounds of liquid paraffin, to be described later, is diluted with 900 pounds of 5 per cent salt solution buffered with acetic acid and sodium acetate to a pH value of 4.5 and containing 0.07 of thymol. A cotton poplin is padded through this solution, the excess of liquor is expressed, or hydroextracted leaving 80 to 100 per cent on the fabric. The fabric thus impregnated is run in open width by way of the customary drying "tins" through a continuous steamer at 120° C. at such a rate that each part of the cloth is exposed to the steam for three minutes. Upon emergence from the steamer, the piece passes direct in open width through a continuous soaper containing a neutral soap solution of a pH value not above 8.0 and preferably from 7 to 7.5, at the boil and thereafter as, for example, in the last compartments of the same machine, through clean water. The piece is then mangled and passed direct to drying or finishing or both, as usual.

#### Example 8

An acid-dyed crepe de Chine is padded into a solution of albumen of 1.5 per cent strength, either containing emulsified wax or not, and the material is suction-boxed so as to leave 80-100 per cent of its weight of liquor in it. The goods are then dried in the usual manner. When dried they are passed to the Indanthrene steamer and steamed at 2 pounds pressure for ten minutes; they are then removed and run in open width through the lukewarm solution of soap at a pH value of 7 or less, and of a concentration of one per thousand and passed at once in the usual way to the Indanthrene steamer where it is again subjected to the action of steam at two pounds pressure for ten minutes. After this steaming, the goods are run, preferably in open width, through warm water rendered just acid by acetic acid, suction-boxed, and dried as usual. The result is that the fabric is waterproof, and the acid dyestuff which was previously fugitive to soap is proof to soap solutions, as is also the cloth itself.

#### Example 9

An acetate rayon fabric which has been proofed according to the method set forth in my pending U. S. application No. 205,818, above referred to, without allowing it to dry, is washed in cold water till free from aluminium salts. It

is now padded through a solution containing 2 per cent of albumen, 1 per cent paraffin wax, and 1 per cent liquid paraffin, as in Example 7, and after mangling to a content of 80-100 per cent solution, is dried at a low temperature, as is necessary for such fabrics. The dried fabric is then exposed to steam at or near 100° C. in a cottage steamer for two and a half to three and a half hours. After the steaming, the fabric is allowed to steep for thirty minutes in a neutral soap solution of 0.05 per cent strength at 90° C., and then washed in water, preferably just rendered acid with acetic acid, dried and finished as usual.

Reference has already been made to the making of permanent emulsions of waxes with the albumen solution, and it has been said that the emulsions may be prepared in concentrated form for convenience in transport.

One example of the preparation of such a concentrated emulsion consists in dissolving 20 lbs. of egg albumen in the cold in 80 lbs. of water, and then filtering the gross impurity from the syrup. A solution of 1.6 lbs. of 80 per cent acetic acid dissolved in 38.4 lbs. of water is added to the filtrate, and the mass raised to a temperature within 5 degrees of 50 degrees C. while precautions are taken against local overheating. This solution is incorporated in an emulsifying machine into a solution prepared separately, also at a temperature within 5 degrees C. of 50 degrees C. by incorporating 20 lbs. of paraffin wax having a melting point of 38 degrees C. with 2.25 lbs. of soap, calculated as 100 per cent, and 0.14 lb. of thymol in 37.75 lbs. of water.

The emulsion emerging from the machine has a pH value not above 5.0 and consists of an emulsion in water of albumen, wax, and free fatty acid, together with sodium acetate and thymol. As already indicated, such an emulsion is particularly suitable for transport, and it actually can be used when diluted, in the methods described in any of the preceding examples.

Another method of preparing a concentrated emulsion for use in the invention is as follows: 20 lbs. of dried egg albumen are mixed at 10 to 25 degrees C. with 80 lbs. of water, to which an anti-putrefying agent such as thymol has been added to the amount necessary to produce a concentration of 0.75 part of thymol per thousand of water. The mixture is allowed to stand with occasional stirring until a uniform thick syrup is produced which generally occupies something of the order of six hours. This syrup is then filtered through a cloth, with pressure if necessary, to remove insoluble impurities, and is then raised to a temperature of 50 degrees C., the conditions being carefully arranged to prevent local overheating, that is to say, preferably with good and constant agitation by employing, for example, a vessel heated by warm water, the temperature of which is controlled by a thermostat, or by employing a jacketed vessel in the jacket of which there is the vapour of a liquid having, or caused to have by regulation of the pressure, a boiling point within 5 degrees on either side of 50 degrees C. Ten pounds of paraffin wax of a melting point of 42 degrees C., melted into 10 pounds of liquid paraffin having a boiling point above 300 degrees C. is added to the warmed mass, the mixture added preferably also being at 50 degrees C., and must not be above 60 degrees C. The whole is well mixed and passed through an emulsifying machine, the

portions of which coming into contact with the material being kept within 5 degrees above or below 50 degrees C. A single passage through the machine will usually suffice. Alternatively, the syrup and the mixture of paraffin oil and wax may of course be run simultaneously and continuously into the feeding hopper of the emulsifying machine. The emulsion so produced is very stable and may be preserved almost indefinitely without deterioration. It may be diluted with plain water to the desired concentration for use. Better results, however, are obtained if the diluting agent is an aqueous salt solution of 5 to 10 per cent strength brought to the iso-electric point of the albumen by being buffered, for example by acetic acid and sodium acetate containing 0.08 per cent of thymol which ensures stability of the dilute emulsion.

I claim:

1. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing a member of the group consisting of albumen and globulin, coagulating said member by the action of moist heat and treating the textile material with a hot aqueous solution of soap containing free higher fatty acid.

2. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing a member of the group consisting of albumen and globulin, coagulating said member by the action of moist heat and treating the textile material with hot solution of soap containing at least 50 per cent of the fatty matter in the form of free higher fatty acid.

3. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing a higher fatty acid and a member of the group consisting of albumen and globulin, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

4. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing a member of the group consisting of albumen and globulin, coagulating said member by the action of moist heat and boiling the textile material with soap containing free higher fatty acid.

5. The process for the treatment of textile materials which consists in emulsifying a water-repellent agent in a solution containing a higher fatty acid and a member of the group consisting of albumen and globulin, impregnating the textile material with the resulting emulsion, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

6. The process for the treatment of textile materials which consists in emulsifying a wax in a solution containing a higher fatty acid and a member of the group consisting of albumen and globulin, impregnating the textile material with the resulting emulsion, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

7. The process for the treatment of textile materials which consists in emulsifying a water-repellent agent in a solution containing a higher fatty acid and a member of the group consisting of albumen and globulin, while taking precautions to prevent the temperature rising to the coagulation point of said member, impregnating

the textile material with the resulting emulsion, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

8. The process for the treatment of textile materials which consists in making a solution containing a higher fatty acid and a member of the group consisting of albumen and globulin, buffering said solution near to the iso-electric point thereof, impregnating the textile material with said buffered solution, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

9. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing a member of the group consisting of albumen and globulin, coagulating said member by the action of moist heat and treating the textile material with hot solution of soap containing free higher fatty acid, the pH value of which has been adjusted to between 7.0 and 7.5.

10. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing a member of the group consisting of albumen and globulin, coagulating said member by the action of moist heat and treating the textile material with hot solution of soap, the pH value of which has been adjusted to between 7.0 and 7.5 and containing at least 50 per cent of the fatty matter in the form of free higher fatty acid.

11. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing a member of the group consisting of albumen and globulin, coagulating said member by prolonged heating at a relatively moderate temperature, and treating the textile material with a hot aqueous solution of soap containing free higher fatty acid.

12. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing a higher fatty acid and a member of the group consisting of albumen and globulin, and coagulating said member and effecting reaction of the same with the higher fatty acid by prolonged heating at a relatively moderate temperature.

13. The process for the treatment of textile materials which consists in subjecting the textile material to a waterproofing process without rendering same fast to soap, impregnating the textile material with a solution containing a higher fatty acid and a member of the group consisting of albumen and globulin, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

14. The process for the treatment of textile materials which consists in the preparation of a concentrated emulsion comprising a coagulable member of the group consisting of albumen and globulin, and a higher fatty acid, subsequently diluting said emulsion, impregnating the textile material with said diluted emulsion, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

15. The process for the treatment of textile materials which consists in the preparation of a concentrated emulsion comprising a coagulable member of the group consisting of albumen and globulin incorporated with a water-repellent substance and a higher fatty acid, subsequently diluting said emulsion, impregnating the tex-

tile material with said diluted emulsion, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

16. The process for the treatment of textile materials which consists in the preparation of a concentrated emulsion comprising a coagulable member of the group consisting of albumen and globulin incorporated with a wax and a higher fatty acid, subsequently diluting said emulsion, impregnating the textile material with said diluted emulsion, and coagulating said member and effecting reaction of the same with the higher fatty acid by the action of heat.

17. The process for the treatment of textile materials which consists in the preparation of a concentrated emulsion comprising a coagulable member of the group consisting of albumen and globulin and a water-repellent substance, subsequently diluting said emulsion, impregnating the textile material with said diluted emulsion, coagulating said member by the action of moist heat and treating the textile material with a hot aqueous solution of soap containing free higher fatty acid.

18. The process for the treatment of textile materials which consists in the preparation of a concentrated emulsion comprising a coagulable member of the group consisting of albumen and globulin and a wax, subsequently diluting said emulsion, impregnating the textile material with said diluted emulsion, coagulating said member by the action of moist heat and treating the textile material with a hot aqueous solution of soap containing free higher fatty acid.

19. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing an albuminous substance selected from the group consisting of albumen and globulin, subsequently coagulating the said albuminous substance by the action of heat, and reacting said coagulated albuminous substance upon the fibre with a higher fatty acid.

20. The process for the treatment of textile materials which consists in emulsifying a water-repellent agent in a solution containing an albuminous substance selected from the group consisting of albumen and globulin, impregnating the textile material with the resulting emulsion, subsequently coagulating said albuminous substance by the action of heat, and reacting said coagulated albuminous substance upon the fibre with a higher fatty acid.

21. The process for the treatment of textile materials which consists in emulsifying a wax in a solution containing an albuminous substance selected from the group consisting of albumen and globulin, impregnating the textile material with the resulting emulsion, subsequently coagulating said albuminous substance by the action of heat, and reacting said coagulated albuminous substance upon the fibre with a higher fatty acid.

22. The process for the treatment of textile materials which consists in emulsifying a water-repellent agent in a solution containing an albuminous substance selected from the group consisting of albumen and globulin, while taking precautions to prevent the temperature rising to the coagulation point of said albuminous member, impregnating the textile material with the resulting emulsion, subsequently coagulating said albuminous substance by the action of heat, and reacting said coagulated albuminous substance upon the fibre with a higher fatty acid.

23. The process for the treatment of textile materials which consists in making a solution containing an albuminous substance selected from the group consisting of albumen and globulin, buffering said solution near to the isoelectric point thereof, impregnating the textile material with said buffered solution, subsequently coagulating said albuminous substance by the action of heat, and reacting said coagulated albuminous substance upon the fibre with a higher fatty acid.

24. The process for the treatment of textile materials which consists in impregnating the textile material with a solution containing an albuminous substance selected from the group consisting of albumen and globulin, subsequently coagulating said albuminous substance by prolonged heating at a relatively moderate temperature, and reacting said coagulated albuminous substance upon the fibre with a higher fatty acid.

25. The process for the treatment of textile materials which consists in depositing a water-repellent substance, not fast to soap, within the textile material, impregnating the textile material with a solution containing an albuminous substance selected from the group consisting of albumen and globulin, subsequently coagulating said albuminous substance by the action of heat, and reacting said coagulated albuminous substance upon the fibre with a higher fatty acid.

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