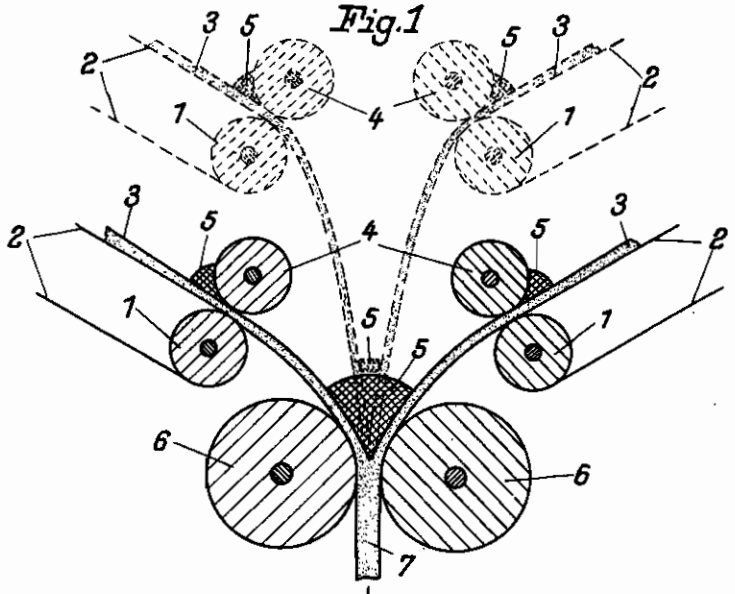
PUBLISHED
MAY 11, 1943.
BY A. P. C.

C. L. NOTTEBOHM
PROCESS AND APPARATUS FOR THE IMPREGNATION OF FIBRE FLEECES WITH BINDING AGENTS
Filed April 14, 1938

Serial No. 202,136
2 Sheets-Sheet 1

Fig.1



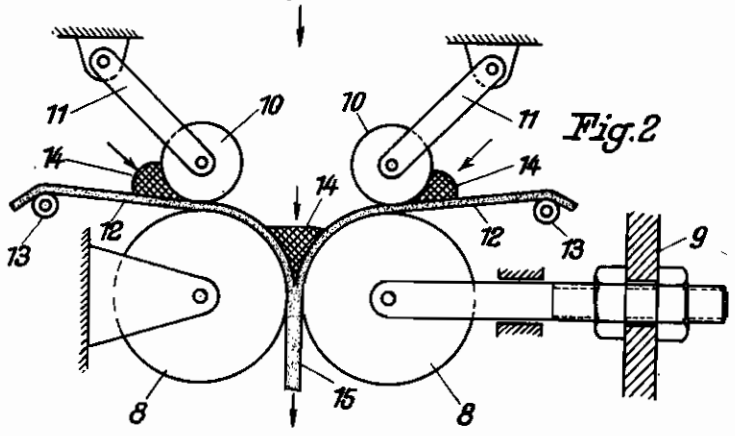
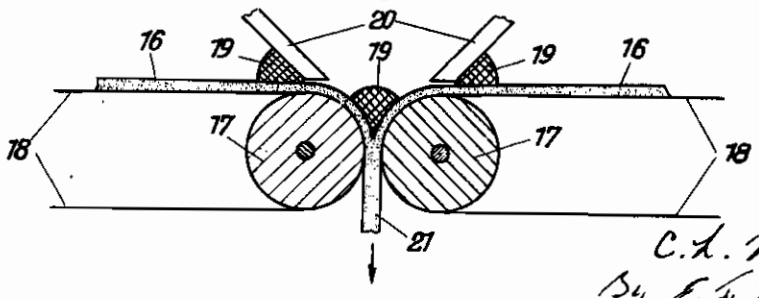


Fig.2

Fig.3



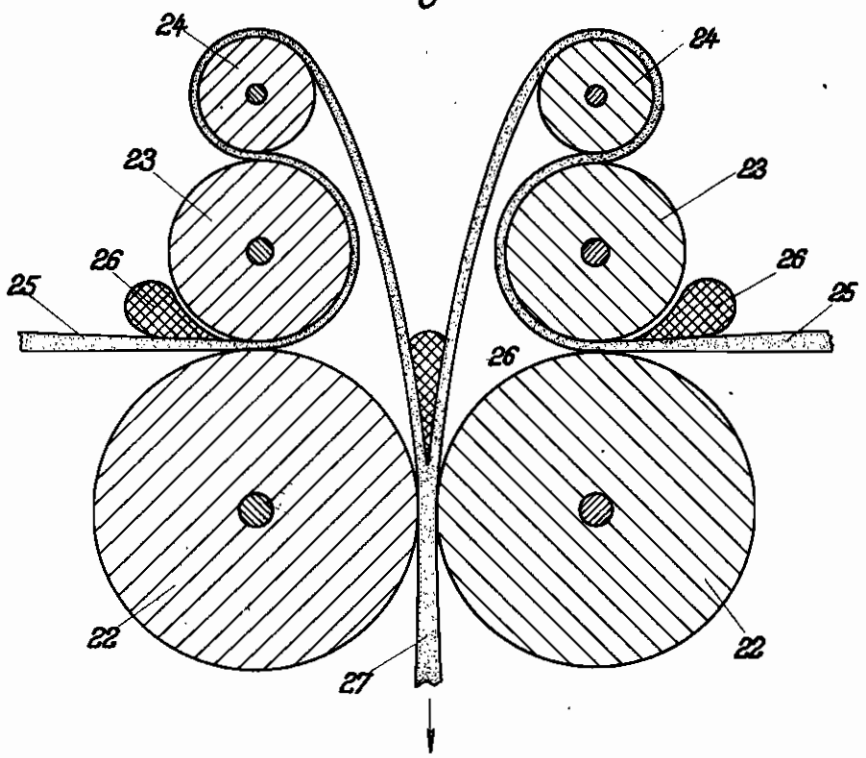
Inventor.
C. L. Nottebohm
By E. H. Rinderoth
Atty

PUBLISHED
MAY 11, 1943.
BY A. P. C.

C. L. NOTTEBOHM
PROCESS AND APPARATUS FOR THE IMPREGNATION OF FIBRE FLEECES WITH BINDING AGENTS
Filed April 14, 1938

Serial No.
202,136
2 Sheets-Sheet 2

Fig. 4



Inventor:
C. L. Nottebohm
By E. A. Neuderoth
Atty

Published May 11, 1943

Serial No. 202,136

ALIEN PROPERTY CUSTODIAN

PROCESS AND APPARATUS FOR THE IMPREGNATION OF FIBRE FLEECES WITH BINDING AGENTS

Carl Ludwig Nottebohm, Weinheim/Baden, Germany; vested in the Alien Property Custodian

Application filed April 14, 1938

The invention relates to a process and apparatus for the impregnation of fibre fleeces with binding agents in the form of foam. The processes known heretofore for the treatment of fibre fleeces with impregnating agents beaten to a foam possess the disadvantages that they produce irregular products owing to the formation of bubbles and folds during impregnation, and in addition are not suitable for the manufacture of impregnated fibre fleeces of any desired thickness.

It has now been found that fibre fleeces can be impregnated with binding agents in the form of foam, while avoiding these disadvantages, by impregnating two fibre fleeces at first each independently with the binding agents in the form of foam, and thereupon assembling and pressing them together, further binding agents in the form of foam being introduced between the assembled fleeces. Expediently, the process is carried out by combining in one working operation the impregnation of the individual fleeces and the assembling thereof, accompanied by further impregnation.

As starting materials for the new process, fleeces or the like structures of natural or artificial fibres are employed. It is possible to employ animal hair, for example wool, animal fibres, for example silk, skin fibres or leather fibres, vegetable fibres, for example cotton, bast fibres, wood fibres, mineral fibres, for example asbestos, or artificial fibres, for example artificial silk. The fibres may be subjected to various pre-treatments according to the nature or quantity of the impregnating agent to be absorbed by the fibre fleece. It is possible, for example, to open up the fibres by boiling, to treat them with oxidising or reducing agents or to impregnate them with wetting agents.

The fibres, pre-treated or not pre-treated, are passed through a carding machine or like apparatus and worked up into a continuous fleece. The fibres may be carded loose or wide and after carding may be more or less strongly pressed.

As binding agent, use is made of solutions, emulsions or suspension, beaten to a foam, of natural rubber, such as latex, or of reclaimed rubber, of rubber-like substances, of nitro-cellulose, of artificial, in particular thermoplastic and reversibly thermoplastic resins, such as polymerisation compounds or mixed polymerisation compounds of unsaturated organic compounds, in particular poly-acryl compounds, polyvinyl compounds or polystyrols, of drying or semi-drying oils, of bitumens, of water-soluble adhesives, such as glue, gelatin tragacanth and other proteins, of binding agents of an inorganic nature, such as water glass or their mixtures. Such foam mixtures may be made from the aqueous solutions of the binding agents or from solutions of organic solvents. It is particularly advantageous to use emulsions or dispersions.

In order to facilitate the foam formation, it is possible to add to the binding agent mixtures substances which reduce the surface tension of the solution or of the disperse phase, for example saponins, glucosides, proteins, decomposition products of carbohydrates and glue, for example mixtures of highly heated sugar with gum arabic, alkali lactates and the like.

If necessary, it is possible to add to the binding agents additional substances, vulcanisation agents, vulcanisation accelerators, softeners, coagulators, for example substances imparting sensitiveness to heat, such as ions of di- or trivalent metals, fillers, such as kaolin, bentonites and the like, which have a consolidating or stiffening action on the foam mass. Furthermore, thickening substances, such as gelatin, methyl cellulose, glue, tragacanth, tragesol and the like may be added.

The binding agents and the additional substances are beaten to a foam in a planet agitator or similarly acting apparatus.

The use of the binding agents in the form of foam possesses considerable advantages. By employing foam, the emulsions or dispersions or even solutions may be mixed with very much less, approximately up to 25% less liquid, without impairing the impregnating properties. By this means, the drying time of the impregnated fibre fleeces can be considerably reduced. In consequence of the light weight of the masses in the form of foam, volumetrically larger quantities of binding agents can be introduced between the fleeces than in the case of the use of liquid binding agents. The feeding of the binding agents in the form of foam can be effected much more easily. Also, there is only a slight loss of impregnating substance during the impregnating operation, because the binding agent in the form of foam cannot flow away so easily at the outer edges of the fleeces. Finally, less attention has to be paid to uniform impregnation than in the case of liquid dispersions or emulsions. In order fully to utilise these advantages, care will preferably be taken to see that the foam structure of the binding agent is preserved during the entire impregnating operation.

The fleeces are impregnated with the binding agents in the form of foam in an apparatus in

which, according to the invention, they are impregnated first each independently and then jointly and assembled. Such apparatus comprises fundamentally at least two movable supports, each of which serves for receiving and carrying a single fleece, spreading devices disposed above said supports for impregnating the individual fleeces and a pressing device comprising two elements pressing against one another, between which elements the individual fleeces are assembled. As movable supports for receiving the individual fleeces, it is possible to employ in the first place rollers, furthermore, conveyor bands or slat type conveyors. As spreading devices, rollers or spreading bands or spreading doctors wil preferably be employed. The pressing device comprises a pair of rollers or a pair of conveyor bands. If rollers are used, they may be heated if desired. They are expediently constructed in the form of sieve rollers in order to carry off excess of binding agent during the pressing operation.

The fibre fleeces may be moved towards one another, for example, on endless conveyor bands arranged horizontally or obliquely at any desired angle to one another, or on rollers, and impregnated in such a manner with the binding agent beaten to a foam that the binding agent is first brought on to each individual fleece, and then introduced between the assembled fleeces.

An apparatus according to the invention is shown in Figure 1. Here fibre fleeces 3 are carried towards one another on endless conveyor bands 2 disposed obliquely to one another and guided over rollers 1. Above the conveyor bands 2 are spreading rollers 4 by means whereof the binding agent 5 in the form of foam is pressed into the fibre fleeces. The individually impregnated fleeces are assembled and pressed together in the gap between the rollers 6, further impregnating agent 5 in the form of foam being introduced between the fleeces. The fleeces, jointly impregnated and pressed together, are carried away from the roller gap in the form of a continuous band 7. More than two fibre fleeces may also be impregnated in this way. For example, as indicated in the dotted part of Figure 1 it is possible, in place of two fibre fleeces, to impregnate four fibre fleeces first each independently on conveyor bands by means of spreading rollers and thereupon to unite them in the pressing device 6.

In a particularly expedient construction of the apparatus according to the invention, the elements of the pressing device, for example rollers or conveyor bands, serve simultaneously as supports for the impregnation of the individual fleeces. This construction is shown in Figures 2 and 3. In Figure 2, the impregnating apparatus comprises two adjacent horizontal rollers 8 adapted to be moved towards and away from one another by means of the adjusting device 9 and two smaller rollers 10 which are mounted vertically above the first-mentioned rollers and which are held loosely in the guide 11 and rest on the large rollers 8. The two fibre fleeces 12 are passed over rolls 13 and in each case between two superimposed rollers 10 and 8, the rollers 10 pressing the impregnating agent 14 in the form of foam into the fleeces. The individually impregnated fleeces are then united between the adjacent rollers 8 to form a total fleece 15, further binding agent 14 being introduced between the individual fleeces. The width of the gap between the large rollers 8 may be adjusted according to the desired pressure of application. The small rollers 10 press the binding agent into the fibre fleece only by their own weight. They may be exchanged for rollers of different weight, in which case, according to the weight, the impregnating agent penetrates the fibre fleece to a greater or less depth. With a working width of the rollers 10 of 140 centimeters, for impregnating fleeces of about 40 grams weight per square meter, rollers weighing 6 to 10 kilograms are used, for impregnating fleeces of 80 grams weight per square meter, rollers weighing 30 to 50 kilograms are used and for impregnating fibre fleeces of 100 grams weight per square meter, rollers weighing 80 to 120 kilograms are used. The upper rollers 10 may be driven not only by friction on the underlying rollers, but also by a separate driving device.

Figure 3 shows another construction in which the elements of the pressing device simultaneously serve as supports for the individual fleeces. Here, the two fleeces 16 are brought together on two endless conveyor bands 18 carried over rollers 17. The impregnating agent 19 is introduced in the first place between the spreading doctors 20 and the individual fleeces 16 and is distributed on the surface of the latter, and in the second place is introduced between the two assembled fleeces. A uniform, homogeneously impregnated fleece 21 is led away from the roller gap.

The process and devices according to the invention ensure numerous advantages. The repeated impregnation results in very uniform products, the combined impregnation of the assembled fleeces serving to complete the impregnation of the individual fleeces. The individually impregnated fleeces are applied smoothly to the surface of the pressing device, any formation of bubbles or tongues through air inclusions being avoided. Finally, the invention permits the simultaneous impregnation of a plurality of fleeces with different binding agents. In this case, for example, one, for example, the upper surface of the impregnated fibre fleece may be treated with certain binding agents imparting adhesion of lacquer or coloured binding agents, closing the surface as far as possible, and the other, for example the lower surface, may be treated with colourless or differently coloured binding agents, more particularly adhesive binding agents.

Frequently, the fibre fleeces to be impregnated do not possess sufficient strength, and may be damaged in their fibre structure in the impregnating mechanism. In such cases, it has been found expedient, before impregnation, to treat the fleeces with strengthening and adhesive agents in quantities such that, after drying, there is formed a surface which is close as possible and which, on the one hand, imparts to the fleece a certain firmness and, on the other hand, prevents the binding agent employed during impregnation from passing through and hence prevents soiling of the supports carrying the fleeces. Preferably adhesives which are water-insoluble or even water-repellent are employed. If such pretreated and dried fleeces are employed as starting material, it is possible during the impregnation with binding agents in the form of foam to ensure that impregnation only takes place on the outer surface closed by the pre-treatment. In this case, the pre-treated fleeces are assembled in such a manner that the pre-treated sides of the fleeces are on the outside. In this case also, the fleeces are first impregnated individually and thereupon assembled and pressed together, fur-

ther binding agents in the form of foam being introduced between the assembled fleeces.

In general, double impregnation is sufficient for ensuring uniform products. In some cases, however, it has been found that, despite double impregnation, the binding agent does not penetrate sufficiently deeply and uniformly the fibre fleeces to be impregnated. This is to be attributed to the fact that the binding agent in the form of foam, which is applied to the individual fleeces in the first impregnation, does not wet the surface of the fleeces sufficiently.

It has now furthermore been found that for the purpose of ensuring good and thorough impregnation even with the first impregnation, the individual fleeces, after impregnation, should each be pressed independently and only then assembled. This may be done by arranging between the spreading device and the pressing device, in which the fleeces are assembled, at least one further pressing device for the individual fleeces. According to this construction, each fleece impregnated by means of a spreading roller or spreading doctor is introduced into a pressing device, for example is passed between two rollers, before being assembled with another fleece. The device to be employed for this purpose is particularly expediently constructed in such a manner that the spreading device for the individual fleece is formed at the same time as an element of the pressing device for the individual fleece. Such a device may, for example, comprise three superimposed, horizontal pairs of rollers **22**, **23** and **24**. The fibre fleeces **25** are first passed between the rollers **22**, **23**, the impregnating mass in the form of foam being introduced between the rollers **23** and the fibre fleeces. The binding agent is pressed into the fleeces by the spreading rollers **23**. Thereupon, each fleece is passed round substantially half the upper roller **23** and is taken off by a superimposed counter-running roller **24** after the manner of the clearer of a carding machine. By this means, a pressure is also exerted on the outwardly turned side facing away from the impregnating agent during individual impregnation, said pressure effecting a more intimate impregnation of the fibre fleece with the impregnating material. The individual fleeces passed round the rollers **24** are then assembled between the rollers **22**, further binding agent being introduced between them. A uniformly impregnated total fleece **27** is led away from the gap between the rollers **22**.

The various rollers of such an impregnating apparatus will expediently be selected differently. In some cases, the diameters of the rollers diminish upwardly as shown in the figure. In other cases, conversely, it is preferable to arrange the rollers with the largest diameter at the top. The mounting of the rollers will preferably be such that the angle included by the assembled fleeces is as acute as possible. A better distribution of the foam material on the surface of the assembled fleeces is thereby ensured, which again produces a more uniform impregnation and prevents the forming of pouring folds or creases.

Of course, other pressing devices may be provided instead of the top rollers **24**. Likewise, it is possible to mount a plurality of pressing rollers one above the other and the individually pre-impregnated fleeces may be passed between pressing rollers and turned repeatedly.

If the fleeces according to the construction last described are pressed individually between the individual impregnation and the combined impregnation, it is advisable to pre-impregnate the fleeces more strongly, so that they will be better able to withstand the stresses during their passage round the rollers.

Example

For uniformly impregnating two fibre fleeces 135 centimeters in width and about 140 grams weight per square meter without creases and without tongue formation, they are introduced into an apparatus according to Figure 2. The horizontally mounted pair of rollers **8** have a diameter of 30 centimeters. The upper horizontally mounted pair of rollers have a diameter of about 10 centimeters, a width of 1.40 meters and a weight of about 120 kilograms. The two fibre fleeces are introduced respectively from the sides between a pair of rollers **10** and **8**. Between the fleeces and the rollers **10**, the binding agent in the form of foam of the following composition is introduced:

	Parts
40% emulsion of a poly-acrylic acid ester (marketed under the trade name of Corealgrund	250
Gelatin	20
50% solution of a lauryl alcohol solution	250
Tricresyl phosphate	13
50% saponin solution	50
Emulsifier, 10% casein solution	1

From 10 litres of this solution, 35 litres of foam are produced after beating for 5 minutes in a planet agitator.

The individually impregnated fleeces are now brought together between the rollers **8**, further impregnating agent being introduced between the fleeces. It is possible to use for this combined impregnation the same binding agent as for the individual impregnation. It is also possible, however, to use another binding having for example the following composition:

	Parts
60% latex	160
Accelerator	2
Sulphur	1
Zinc oxide	2
3% wetting agent solution	400
50% saponin solution	15
Indanthrene dyes	5
5% vultamin solution	10

10 litre of this mixture produce about 25 litres of foam after beating for about 5 minutes. The fleece impregnated for a second time leaves the rollers **8** at a rate of about 2 meters per minute and can be passed thence to further treatments. It is completely impregnated throughout and is conspicuous for its smooth surface and freedom from creases.

The resulting impregnated product, if desired after further pressing and dressing, may be employed as artificial leather, floor covering, furniture covering material or motor car covering material.

CARL LUDWIG NOTTEBOHM.