April 18, 1939. E. F. KING 2,154,943

METHOD FOR TREATING FIBROUS MATERIAL

Filed Oct. 29, 1936 2 Sheets-Sheet 1

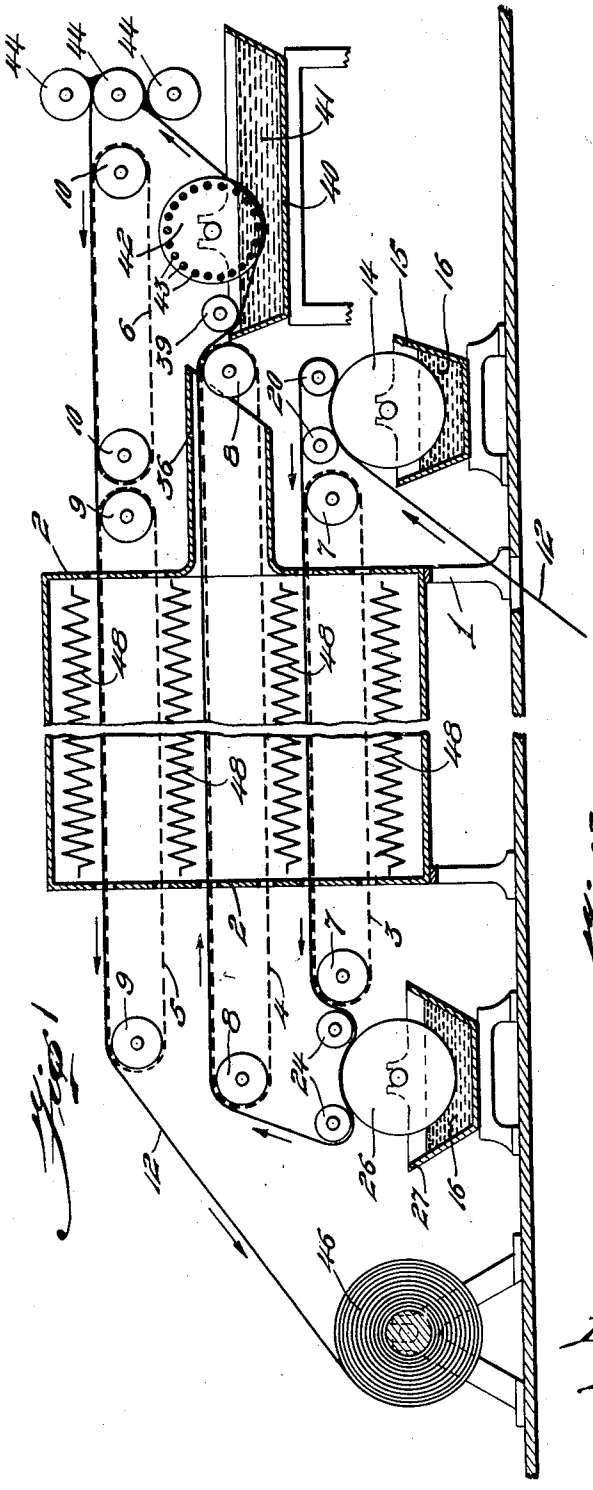


Fig. 1

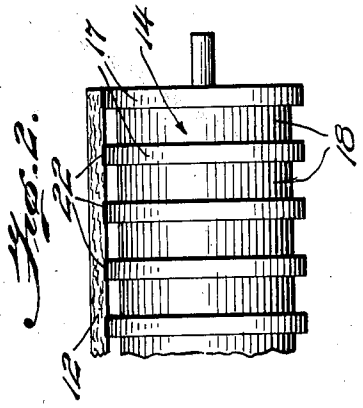


Fig. 2.

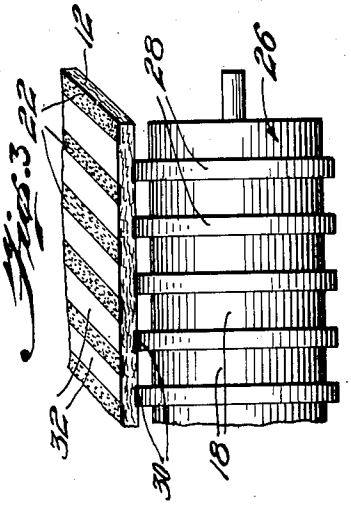


Fig. 3

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Fig. 6.

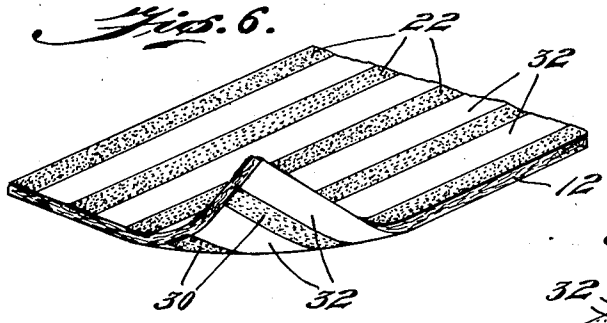


Fig. 7.

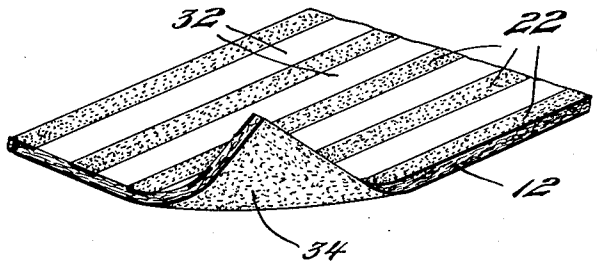


Fig. 5.

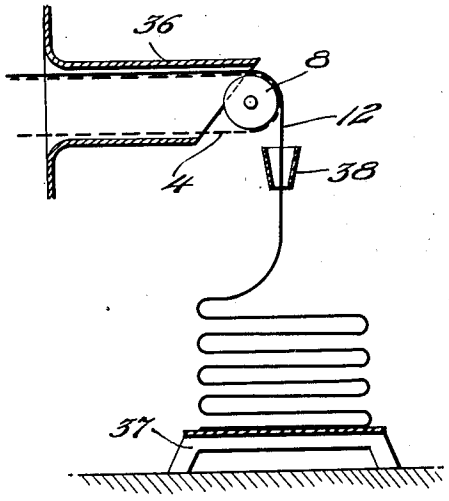
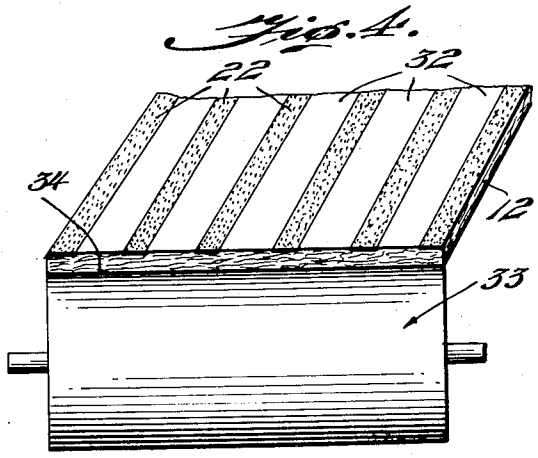


Fig. 4.



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METHOD FOR TREATING FIBROUS MATERIAL

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2 Claims. (Cl. 91—68)

This invention relates to an improved method for treating fibrous material, and more particularly fibrous material in an unwoven condition in the application thereto of substances such as rubber in the form of latex, rubber cement or other filler materials such as are adapted for application thereto in a liquid or plastic state.

Heretofore, various methods have been employed for the application of rubber, rubber compounds or the like to an unwoven fibrous material, such as the passing of the material through rolls for forcing the filler or filling substance into the material, or passing the fibrous material through a bath of the desired filler substance in a fluid state. In the first case, the degree of penetration obtained is extremely limited even with the most readily permeable filler by reason of the fact that the fibrous material is compacted simultaneously with the attempted penetration by the filler, thus causing a resistance to the penetration so great as to nearly neutralize the penetrative action and result in subjecting the outermost parts only of the fibrous material to the action of the filler. In the case of passing the material through a bath of the filler, absorption may take place more readily but by reason of the lack of coherence in the fibrous mass or the low tensile strength of the fibrous material, the absorption of even a small quantity of the filler places too great a strain on the fibrous material and it falls apart or sloughs off before it can be removed from the bath.

In order to effect a reasonably high degree of penetration of the fibrous material by the filler and at the same time prevent rupture or distortion of the fibrous material by the weight of the filler it is proposed to first treat the fibrous material throughout portions of its extent to provide at least temporary reenforcements capable of preventing substantial disruption or distortion of the material as it is drawn from the filler bath.

This may be accomplished in various ways and with different substances applied preferably to portions at or adjacent to the surface of the fibrous material to maintain the fibrous material substantially in its initial form and both prevent rupture of the material as a whole or the sloughing off of portions of its outer surface.

By passing the fibrous material through a bath of the filler (with or without the use of artificial means for securing added penetration while passing through the bath) a relatively high degree of penetration of the fibrous mass by the filler material may be obtained which serves to extend the treatment to the internal portions of the fibrous body even when the mass is later subjected to pressure to remove the surplus filler material.

One object of the invention is the provision of means for reenforcing a fibrous material to permit its passage through a bath of absorbable filler material without rupture or undue distortion due to the weight of the filler material taken up by the mass.

Another object of the invention is the provision of means for applying a substantially uniformly distributed quantity of filler material to an unwoven fibrous material in such a manner as to secure a relatively high degree of penetration, while at the same time rendering the fibrous material capable of being readily handled in carrying out subsequent steps in the treatment.

A further object of the invention is the provision of means for effecting a relatively high degree of penetration of a fibrous mass by a filler material in such a manner as to permit the expulsion of the surplus filler while retaining a more or less uniform dispersion of the same substantially throughout the interior portion of the fibrous material.

Another object of the invention is the provision of a surface reenforcement for a fibrous material adapted to maintain the same in its initial form when passed into a bath of absorbable filler material and to furnish a support for the fibrous material adapted to prevent substantial distortion or rupture of the same in removing it from the bath.

A further object of the invention is the provision of a form of surface reenforcement which is particularly effective in a direction longitudinally of the fibrous material body in order to resist the strain of raising the fibrous material from the bath, and at the same time locating the reenforcement areas in such a manner as to permit substantial penetration of the filler substance to all portions of the fibrous material when passed through a bath of the filler substance.

Other objects and advantages of the invention relate to various improved steps and arrangements of steps in carrying out the process as will be more fully set forth in the detailed description to follow.

Referring to the accompanying drawings, which it is understood are to be considered as illustrative of one means which may be employed in carrying out the process and not in a limiting sense;—

Fig. 1 is a side elevational view of a mechanism such as may be employed in carrying out

the process, the parts being shown more or less diagrammatically,

Fig. 2 is a side elevational view of one of the rolls shown in Fig. 1 of the drawings,

Fig. 3 is a side elevational view of another roll shown in Fig. 1 of the drawings, the same being combined with a diagrammatic illustration of a sheet of unwoven fibrous material as it is passed thereover, the opposite face of the sheet material showing a previous application of reenforcing material,

Fig. 4 is a side elevational view of a portion of another applicator roll, such as may be substituted for the form of roll shown in Fig. 2 of the drawings,

Fig. 5 is a detail side elevational view of a portion of the mechanism shown in Fig. 1, illustrating the manner of depositing the reenforcement treated material before being passed through a filler bath to permit its being later passed through a filler bath as a separate operating step, when desired.

Fig. 6 is a perspective view of a portion of a sheet of unwoven fibrous material, with one end portion turned back upon itself, to show the alternate positioning of reenforcement areas upon opposite sides of the fibrous sheet material, and,

Fig. 7 is a perspective view, similar to Fig. 6, showing an unwoven fibrous sheet material having one side thereof provided with reenforcement throughout substantially its entire extent, and the other side having spaced reenforcement areas to permit absorption of the filler material from that side and between the areas of the applied reenforcements.

In carrying out the present invention, as, for example, in connection with a continuous sheet of unwoven fibrous material, it is proposed to apply a suitable reenforcing substance to portions of opposite sides of the fibrous sheet material, the reenforcing substance being, for example, rubber latex, starch or a suitable wax or gum or other appropriate material dependent upon the character of the filler material to be used and whether or not it is desirable that the reenforcing substance be later eliminated or neutralized during the treatment subsequent to the absorption of the filler substance.

In applying the reenforcing substance to opposite sides of the fibrous sheet material, it may be so applied as to cover substantially entirely one side of the sheet material, while upon the opposite side it may be applied in the form of longitudinal strips or may be given a grid-work configuration. As an alternate form the reenforcing substance may be applied as longitudinally extending strips located upon opposite sides of the sheet material, in which case it is regarded as preferable that the strips upon one side be alternately arranged with respect to the strips upon the opposite side so as to more readily permit absorption of the filler from opposite sides of the fibrous sheet material through the untreated surface areas so as to permeate substantially the entire thickness of the fibrous sheet material and reach all portions thereof.

As stated, the reenforcing forming substance employed may vary with the character of the filler to be used, as well as with the ultimate purpose desired so that it may be of such a nature as to be effective only for a sufficient time to reenforce the fabric sheet during its passage through the bath, and then eliminated or neutralized or absorbed during the treatment of the sheet material, or it may be present in situ in the completed sheet.

After the application of the reenforcing substance to opposite sides of the sheet material as above described, the unwoven sheet material may be passed through a suitable bath containing the desired filler which should be in such a state of fluidity as to be capable of penetrating the fibrous sheet material to the depth desired, which may vary with the substance used and the purpose for which it is to be employed, but may be a substantially complete penetration of the fibrous mass by the filler.

The unwoven fibrous material to be employed may vary widely and may include cotton, wool, jute, ramie, asbestos fibers, wood pulp or other cellulosic material, or animal or vegetable fibers capable of being formed into an unwoven sheet material.

The filler substance employed may be of any suitable character which is capable of being reduced to and maintained temporarily in the state of substantial fluidity and which is capable of being absorbed or may be caused to be absorbed into the unwoven fibrous sheet, such as rubber latex, rubber cement, or any suitable form of oils, waxes, phenolic or resinous compounds such as may be capable of being absorbed into the unwoven fibrous mass and subsequently caused to harden or set either by coagulation, through removal of a solvent by drying or otherwise.

After the unwoven fibrous sheet material has been treated with the desired reenforcing substance so as to apply the same to opposite sides thereof, it is treated to cause an agglomeration, hardening or setting of the applied reenforcing substance which tends to bind the fibers of the surface areas of the unwoven sheet to which it has been applied together and prevent their separation due to the weight of the filler material. The unwoven sheet is then passed through a suitable bath containing the desired filler for the purpose of absorbing a portion of the filler material into the unwoven fibrous sheet. The absorption may be hastened, or the degree of absorption increased by the use of suitable wetting agents or dispersing agents, or it may be aided by raising the temperature of the sheet material prior to its entry into the bath, or by heating the bath, as may be desired and found practicable with the particular materials employed.

In passing the unwoven fibrous sheet material through the filler bath means may be provided for insuring complete immersion, and if desired means may be employed for effecting agitation of the filler substance or sheet material to increase the penetration of the sheet material. In either case, the filler contacts completely with the reenforcement free areas of the sheet through which it is capable of entry into the fibrous mass to obtain a degree of penetration dependent upon the character of the fibrous material and filler substance.

The presence of the hardened reenforcing material upon opposite sides of the unwoven fibrous sheet permits the sheet to be drawn upwardly after it passes through the bath without rupture of the sheet and without distortion or the sloughing off of portions of the material. After being drawn from the bath the fibrous sheet material may or may not be passed through pressure rolls for the removal of surplus quantities of the filler, and may be then treated in any suitable or

desired manner for the purpose of agglomerating, coagulating, setting, hardening or otherwise treating the absorbed filler substance within the fabric material to form a sheet of the impregnated fibrous mass which may be capable of direct use as a leather substitute or for the manufacture of a variety of articles such as rubber composition material, phenolic sheet material or the like capable of a variety of uses in the arts.

In the form of means shown herein for carrying out certain steps of the process, 1 designates the frame portion of a heater chamber or oven 2 such as may be employed in treating the reenforcing substance after its application to a sheet of unwoven fibrous material to agglomerate the substance, that is, to effect a setting or hardening of the applied substance so that the sheet may be handled freely and the reenforcing substance rendered effective for providing a support for the sheet material. The heater chamber or oven 2 may also be employed as a means for partially or completely setting or hardening the filler substance after its application to the sheet, and as a part of a continuous operation, although the steps of applying and treating the reenforcing susbtance and applying and treating the filler substance may be made as distinct and separate operations.

A plurality of endless belts 3, 4, 5 and 6 are each supported by rolls designated as 7, 8, 9, and 10 respectively, for conveying the unwoven fibrous sheet 12 through the heating chamber 2. As shown, the endless belts 3, 4, 5 and 6 are adapted for use both in treating the reenforcing substance after its application to the continuous sheet, and in treating the sheet after the application of the filler material.

In carrying out the process by means of the mechanism shown, the unwoven fibrous material, which is shown as being in the form of a continuous sheet 12, may be passed upwardly from a carding machine or the like (not shown) and over an applicator roll 14 rotatably mounted in a container 15, partially filled with a suitable reenforcing substance 16. The applicator roll 14 as shown is provided with raised circular ribs 17, spaced from each other longitudinally of the roll, and forming with the normal surface 18 of the roll alternate raised and depressed circular areas. As the fibrous sheet 12 is passed over the roll 14 it is pressed downwardly against the roll 14 by rolls 20 and into contact with the reenforcing substance carrying ribs 17 to deposit a film or layer of the reenforcing substance within the surface fibers of the sheet along areas 22 extending substantially longitudinally of the sheet. The sheet 12 then passes upwardly over the rolls 20 and to the endless belt 3 by which it is transported through the heater chamber or oven 2, to pass below pressure rolls 24 for forcing the opposite side of the sheet 12 into contact with a second applicator roll 26. The roll 26 is mounted for rotation in a container 27 partially filled with the reenforcing substance 16, and is provided with raised circular ribs 28 spaced from each other longitudinally of the roll and adapted to carry the reenforcing substance upwardly for deposit within the surface fibers upon the side of the sheet 12 opposite to that upon which reenforcing material from the roll 14 was deposited, thereby forming reenforcing areas 30 extending longitudinally of the sheet. In the applicator rolls 14 and 26 the raised circular ribs 17 and 28 respectively are of less width than the reduced areas 18 of the rolls which are alternately positioned relative thereto longitudinally of each roll, and the circular ribs 17 and 28 are so positioned upon each roll that the longitudinally extending areas of the deposit 22 and 30, formed by the two rolls upon opposite sides of the sheet are alternately positioned with respect to each other, and are preferably of less width than the reenforcement free longitudinally extending areas 32 upon each side of the fibrous sheet 12.

While in the present illustrative embodiment of means for carrying out certain steps of the process the applicator rolls 14 and 26 are so formed as to provide longitudinally extending reenforcement areas or strips upon opposite sides of the sheet 12 of the fibrous material it is to be understood that one or both of the applicator rolls may be so formed as to be capable of applying the reenforcing substance in the form of a grid-work to one or both sides of the sheet if necessary or desirable to provide a transverse reenforcement for the surface area of the sheet material, or the reenforcing substance applying portions of the applicator rolls may be given any other desired form for applying the reenforcement to the sheet material.

In Fig. 4 of the drawings there is shown an applicator roll 33 having a plain surface which may be substituted for the applicator roll 26 if desired, whereby the reenforcing substance is first applied to the sheet 12 along longitudinally extending areas 22 by the applicator roll 14 and then as the sheet is passed over the applicator roll 33 a substantially uniform and continuous coating of the reenforcing substance 16 is applied to the entire surface of the sheet 12 as indicated at 34.

In either case the unwoven fibrous sheet 12 after leaving the second applicator roll passes upwardly to a conveyor belt 4, with the surface to which the reenforcing substance was last applied uppermost, and then through the heater chamber or oven 2 from which it passes outwardly through a discharge spout 36, from which point the sheet material in which the reenforcing substance has been set or hardened by passage through the heater chamber, may be deposited in folded condition for later treatment, or may be passed immediately through a filler bath as shown in Fig. 1. In the detail view shown in Fig. 5 of the drawings the reenforced fibrous sheet 12 on passage from the discharge spout 36 and over the supporting roll 8 of the endless belt 4, is deposited upon a frame or truck 37 by means of a reciprocating guide 38 so as to be capable of being stored or transported to another mechanism for further treatment.

In the arrangement of mechanism shown in Fig. 1 of the drawings, the reenforced sheet 12 on passing from the discharge spout 36 of the heater chamber is led directly beneath a guide roll 39 and into a filler container 40 containing a substantially fluid filler material 41 into which it may be completely submerged for a greater or less degree of travel by means of a drum 42 rotatably mounted relative to the container 40 and provided with spaced arms 43 adapted to force the sheet material below the level of the filler and maintain it in contact therewith for a sufficient period to secure a substantially complete penetration of the fibrous sheet by the filler material.

From the filler container 40 the fibrous sheet material may be led through any desired number of squeeze rolls 44 placed in any desired location with reference to the point of emergency of the

sheet material from the bath, that is, directly upwardly therefrom or substantially horizontally with reference thereto. The squeeze rolls 44 may be positioned relatively to each other so as to exert any desired degree of pressure upon the sheet material dependent upon the character of the fibrous sheet, the character of the filler used and the character of product desired.

After passing through the squeeze rolls 44 the sheet material may be discharged upon and passed over the conveyor belt 6 to the conveyor belt 5 by which it is led through the heater chamber 2 and then wound upon a reel 46. In passing through the heater chamber the filler material applied to the sheet 12, remaining after passage through the squeeze rolls 44, is substantially completely agglomerated, hardened or set within the fibrous material by reason of the heat to which it is subjected in the heater chamber so that it is capable of being wound into a complete roll, although a spacing sheet may be used if desired to prevent contiguous surfaces of the sheet material from sticking together in the roll whenever it becomes necessary.

In Fig. 6 of the drawings there is shown a portion of a fabric sheet illustrating the manner of application of reenforcement areas thereto after passing through the applicator rolls 14 and 26 as above described, with the longitudinally extending reenforcement areas 22 and 30 upon opposite sides of the sheet shown in alternately arranged slightly spaced relation with each other, that is, the reenforcement areas 22 upon one side of the sheet being oppositely arranged with respect to the reenforcement free areas 32 on the opposite side of the sheet, and the reenforcement areas 30 similarly positioned with respect to the reenforcement free areas 32 on the other side of the sheet. In the use of certain filler material this alternative location of reenforcement areas on opposite sides of the sheet and their relation to the reenforcement free areas may facilitate the entry of filler material into the mass to secure a substantially uniform penetration of the filler material throughout the sheet material, since this alternate spacing of the reenforcement areas permits entry of the filler material without resistance by the reenforcement material through all reenforcement free areas, which are so arranged as to allow substantially complete penetration of the sheet material.

In that form of sheet shown in Fig. 7 of the drawings, in which the applicator roll 14 is employed in connection with the applicator roll 33 for applying the reenforcing material, the reenforcement areas 22 upon one side of the sheet alternate with the reenforcement free areas upon the same side of the sheet in the same manner as is shown in Fig. 6. The opposite side of the sheet material is completely or substantially completely covered by the reenforcing material to form a continuous reenforcement area 34. In this form of sheet all or substantially all of the filler material must enter through the reenforcement free areas 32 from one side of the sheet and through the edges of the sheet material. This is entirely feasible with a filler material of high fluidity or relatively small content of solids, and this form of reenforced sheet affords a somewhat higher degree of protection against rupture of the sheet when substantially saturated with filler material than does the form in Fig. 7.

It is to be understood that various substances and compounds may be employed as reenforcing substances, some of which may be adapted for complete or partial elimination during the setting or hardening of the filler material, or these substances may be selected with a view of their close relationship to the filler material to substantially amalgamate therewith and form a part thereof, in any case the reenforcing substances may be selected with particular reference to their relationship with the particular filler material to be used. Although a considerable number of substances have been mentioned previously as adapted for use in providing reenforcement areas, it is obvious that other substances and materials are capable of being employed for the purpose under certain conditions, and the reference to such substances and materials as contained herein is to be regarded as illustrative rather than as limiting the invention to the use of those particular substances which have been specifically mentioned.

In passing the unwoven fibrous sheet 12 from the applicator roll 14 through the heater chamber 2, as well as in passing the sheet from the applicator roll 26 through the heater chamber and in passing the sheet from the filler container 40 through the heater chamber the sheet material is subjected to the heating action of heater elements 48 which may be of any desired character or construction, for the purpose of effecting an agglomerating or hardening or setting action of the reenforcing substance and filler material within the fibers of the sheet. In passing the doubly reenforced sheet from the applicator roll 26 to the filler bath 40 it is regarded as desirable generally that the heat applied to the sheet material within the heater chamber be conserved therein to a substantial degree in order that the material as it enters the filler bath may be substantially free from moisture and at a temperature which will facilitate absorption of the filler material.

It will be understood that the filler material applied to the unwoven fibrous material may contain any desired modifying substances designed to hasten or render complete the impregnation of the fibrous mass by the filler material, such as, any suitable form of wetting or dispersing agents; or any filler modifying materials, such as, suitable coloring matter, drying or agglomerating agents, etc., as may be adapted for coloring, setting or otherwise modifying the filler material during treatment after it has been absorbed into the fibrous material.

The application of the desired degree of compression to the sheet material, when desired, after its passage through the filler bath both reduces the percentage of filler content in the material and at the same time insures a substantially uniform distribution thereof throughout the mass, and by employing different pressures, the percentage of filler content may be varied without loss in uniformity of its distribution throughout the fibrous mass, thus providing means both for controlling the percentage content of the filler material and insuring substantial uniformity of its distribution throughout the fibrous material.

What I claim is:

1. In a method of impregnating with a filler material in a substantially fluid state a web of carded textile fibres in a loose condition as coming from a carding machine, which web is characterized by low tensile strength and high absorbability to such an extent as to be adapted to disintegrate in whole or in part under the strain placed thereon by the weight of the absorbed filler material, successively and in a substantially continu-

ous order treating the fibrous web by applying a reinforcing substance to portions of the surface areas only of opposite sides thereof and setting the reinforcing substance in the material to provide surface reinforcement areas upon opposite sides thereof, said reinforcement areas on one side of the web being spaced from each other and covering materially less than the total surface area of that side of the web, and passing the surface reinforced web through a bath of absorbable filler material in a substantially fluid state to effect absorption of the filler material through the unreinforced surface areas and fill substantially the unreinforced interior portion of the web, and then setting the filler material within the fibrous material.

2. In a method of treating a web of carded, fibrous material in a loose condition as coming from a carding machine characterized by low tensile strength and high absorbability to such an extent as to be liable to lose its structural integrity in whole or in part through the weight of absorbed material, successively and in a substantially continuous order applying a surface impregnation of reinforcing material to a limited depth only and to limited and spaced surface areas of the web to leave unimpregnated surface areas of the material upon at least one side of said web communicating directly with the unimpregnated interior of the web throughout its extent, setting the reinforcing material in the fibres of the fibrous material throughout the impregnated areas thereof, and then passing a congealable filler material in substantially fluid form through the unreinforced surface areas of the material into and throughout the unreinforced interior portions of the web.

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