

Sept. 22, 1936.

E. HURST ET AL

2,055,410

WEB MATERIAL

Filed May 29, 1933

3 Sheets-Sheet 1

Fig. 1.

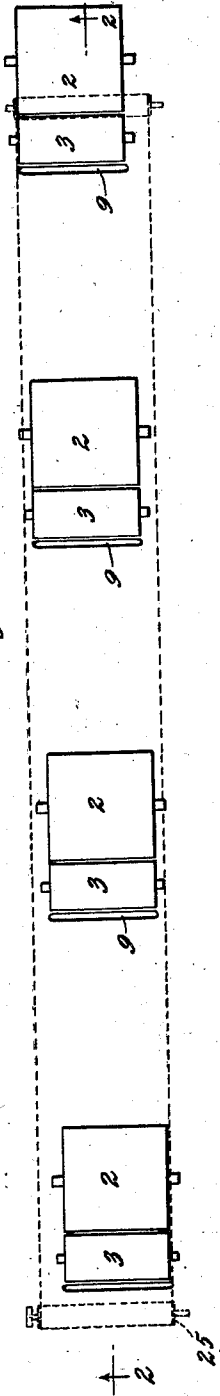
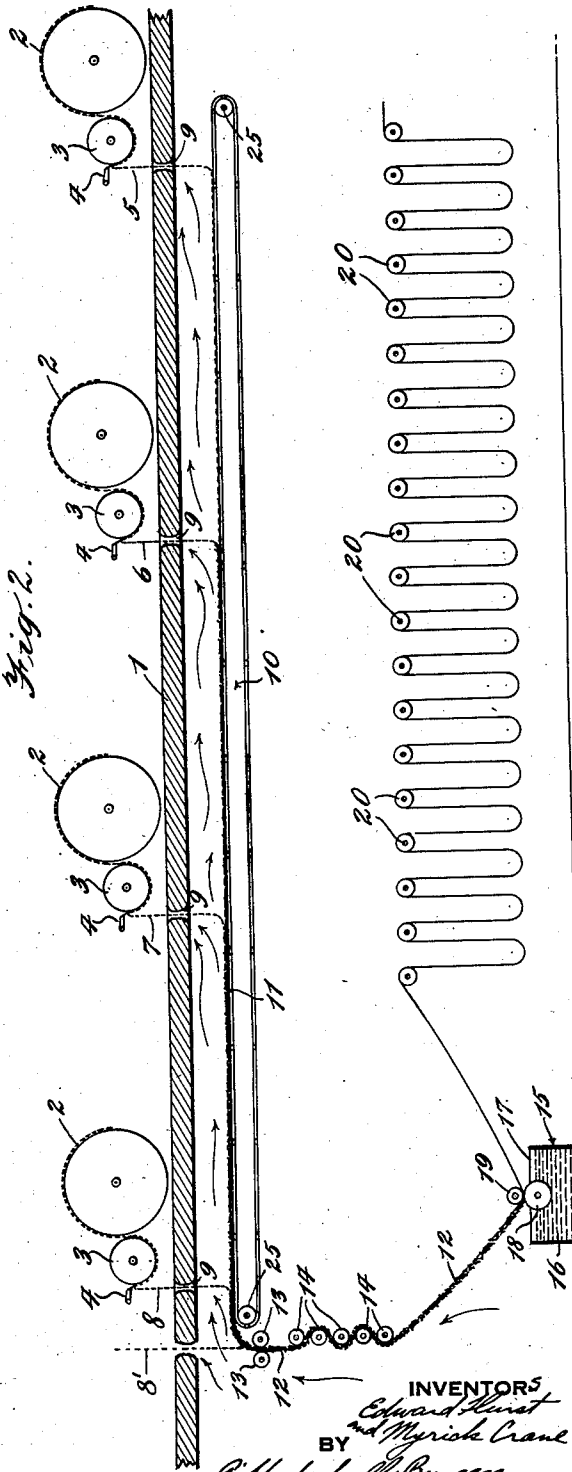


Fig. 2.



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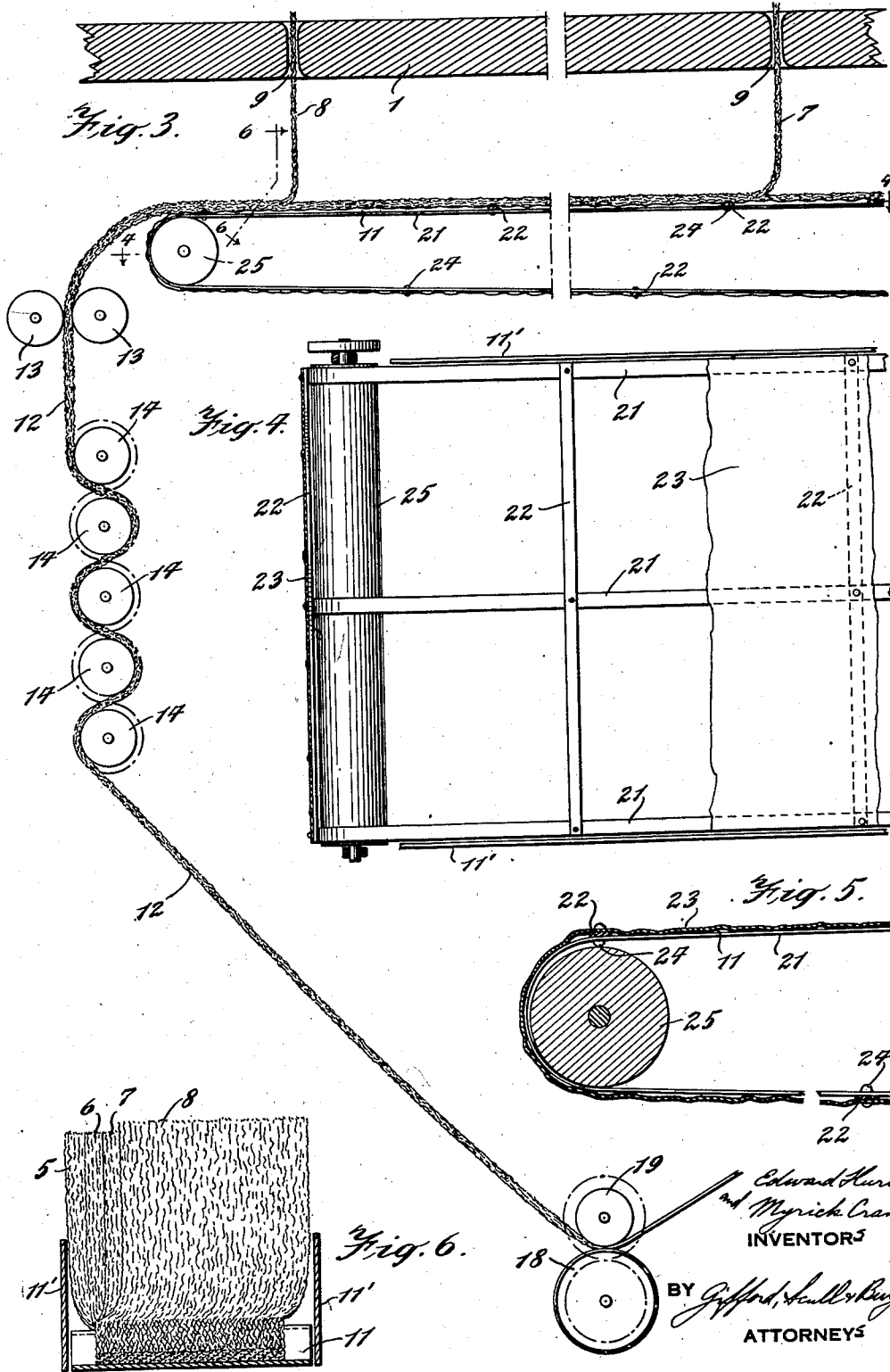
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WEB MATERIAL

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3 Sheets-Sheet 2



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WEB MATERIAL

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3 Sheets-Sheet 3

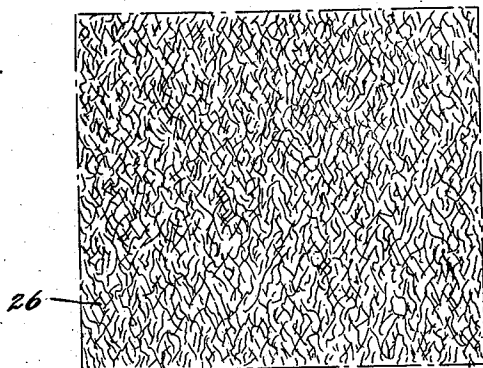


Fig. 7.

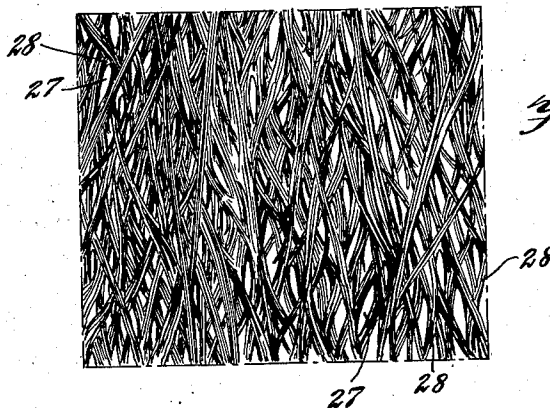


Fig. 8.

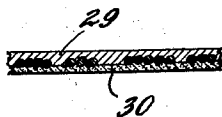


Fig. 9.

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UNITED STATES PATENT OFFICE

2,055,410

WEB MATERIAL

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Application May 29, 1933, Serial No. 673,392

7 Claims. (Cl. 91—68)

This invention relates to a novel and improved material usually made in the form of a continuous web, together with a novel method and apparatus for making that material. The material may be used for different purposes, some of which will be pointed out later.

In the accompanying drawings, we have illustrated certain characteristics of the novel material, and have also shown diagrammatically a method and apparatus by which it may be made. In those drawings:

Fig. 1 is a plan view of a portion of a floor upon which certain of the apparatus may be mounted and showing the relation of certain pieces of apparatus to each other;

Fig. 2 is a vertical sectional view along the line 2—2 of Fig. 1;

Fig. 3 is a view on the same plane as that of Fig. 2, but on an enlarged scale, showing certain parts of the apparatus in greater detail;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a view on the same plane as Fig. 3 but on a still larger scale and showing further details of construction;

Fig. 6 is a view on the line 6—6 of Fig. 3;

Fig. 7 is a view on a greatly enlarged scale of a fragmentary piece of the novel material before impregnation;

Fig. 8 is a view similar to Fig. 7 but showing certain structural characteristics of the material after impregnation;

Fig. 9 is a fragmentary section of a portion of the material after having a coating applied thereto.

In the making of the novel material, various fibrous material may be employed, but for the sake of convenience of illustration, we shall describe the material, method, and apparatus as though cotton were the raw material. In actual practice, we have used long fiber, American cotton with satisfactory results, and therefore, without intending to limit ourselves in any way, we will proceed with the description of our invention when using cotton.

In Figs. 1 and 2 we have shown a portion of the floor 1, which may be one of the floors of a mill, and upon which are mounted cards 2 of any suitable construction. Such mechanisms are well known in the art of cotton preparation, and no detailed description thereof is deemed necessary. We believe it is sufficient to say that cotton leaves a card in the form of a light, filmy lap, being removed from the doffer 3 by a comb 4. Ordinarily, the lap is then passed through a trumpet to form a sliver from which yarn is

formed. According to our invention, however, the trumpets are omitted and the lap from any one card is led directly from the comb downwardly through an orifice in the floor. In this instance, four cards are shown, having their longitudinal axes parallel to but offset from each other laterally of the cards, as will be plain from an inspection of Fig. 1. The laps 5, 6, 7, and 8, respectively, are shown passing through orifices 9 in the floor, all of the same general construction.

Beneath the floor 1, and running substantially horizontally, is an endless conveyor designated generally as 10 and which will be described more in detail presently. The cards are arranged above this conveyor and spaced apart longitudinally thereof. The longitudinal axes of the cards are those axes extending lengthwise of the conveyor and, as plainly seen in Fig. 1, these longitudinal axes are disposed generally parallel to the longitudinal axis of the conveyor, but offset from each other laterally of the conveyor.

The result of this arrangement is probably best evident from an inspection of Fig. 6, in which it will be seen that the conveyor has its upper reach 11 extending between vertical guides 11'. The lap 5 is first led carefully through the first orifice 9 and deposited upon the upper reach of the conveyor. In the arrangement shown, the lap 5 is offset laterally from the center of the conveyor, and it is shown as being led to the conveyor adjacent the center thereof. Then the next lap 6 is led through its orifice and likewise started on top of the lap 5, which is already on the conveyor. The same procedure is followed with the laps 7 and 8, and it will be seen that, as each lap reaches the conveyor, it is displaced laterally of itself so that the fibers in that particular lap, and which the card has caused to extend generally parallel to the length thereof, will be caused to be deposited on the conveyor diagonally to the length thereof. This may be caused by arrangements differing somewhat from what we have shown herein, and the amount of the offsets between adjacent cards will, of course, vary with different conditions. Ordinarily, a lateral displacement or offset of a few inches between adjacent cards is sufficient for our purpose.

As indicated by the arrows in Fig. 2, a light current of air is caused to flow against the movement of the conveyor and against the movement of the laps through the respective orifices 9. As noted above and as known in the art, the laps are very light in character, and the light current of air will cause a displacement and loosening of

the individual fibers in each lap as it passes through one of the orifices. The orifices are made of the form shown without sharp corners and with a Venturi-shape, which aids in the displacement of the fibers and the loosening up of the lap.

The cards are all discharging laps through the orifices at substantially equal speeds, and the conveyor is preferably operated so that the upper reach thereof is moving at substantially the same speed as the laps deposited thereon. The upper reach is preferably given a continuous, gentle vibration vertically, and preferably the upper surface of the conveyor is uneven so as to prevent matting down of the lap contacting therewith.

As the first lap 5 travels along the conveyor, it is thus shaken up by the vibration and the fibers rearranged at various angles, although, under most conditions, it will be found desirable to not disturb the fibers to such an extent as to have them extending at right angles across the length of the web. In other words, for most purposes, it is best to arrange as many fibers as possible so that they will extend generally lengthwise of the web but at an acute angle to the longitudinal axis thereof. By constant vibration of the lap 5 upon the uneven surface of the conveyor, and in the presence of a light current of air, the fibers of a lap reach a semi-suspended condition so that by the time the second lap 6 is deposited thereon, the fibers may blend with those of the first lap. The operation will be continued until the third or any subsequent laps are deposited on the traveling web.

In this semi-suspended condition of the fibers in each lap, they are in an unmatted state and are deliberately displaced from the positions which they occupied as they left the card. This displacement which they have undergone is partially in a direction normal to the surface of the lap, the direction of a fiber being a definite one, determined by the action to which it has been subjected. Therefore, when two or more laps have their adjacent surfaces brought together, these laps will readily blend or unify, as just noted above, by definite interengagement or interweaving of the fibers in adjacent laps. A larger number of fibers in a lap will project outwardly from the surface of that lap, at various and definite angles thereto, and will gently but actively work in between and interweave with the fibers in an adjacent lap.

By the time the laps reach the end of the conveyor, the individual laps have become blended in a single web, because of the interengagement and interweaving just mentioned, which is aided by the action of the conveyor, described above. This single web is still light in weight and without substantial tensile strength. The fibers are arranged diagonally with respect to each other, although a large majority of them are extending generally lengthwise of the web, as noted above. The web 12 formed by the laps is now permitted to pass downwardly through guide rolls 13, these rolls, however, exerting no pressure at all upon the web.

For the purpose of convenience, we have shown four laps, all deposited upon the traveling conveyor, although a greater or less number may be used if found desirable. While all the laps are shown as being deposited on the conveyor, it is possible, under some circumstances, to lead one or a plurality of laps directly to part of the web previously formed, between the end of the conveyor and the rolls 13. For example, in Fig. 2, the lap 8 is shown as being deposited on the con-

veyor closely adjacent the end thereof so as to blend with the other laps on the conveyor to a certain extent, although, obviously, this extent is a limited one. We have also shown a fifth lap 8' which is not deposited on the conveyor at all, this lap being formed by a card similar to the other cards 2. In Fig. 3 this additional lap 8' has been omitted. By providing a suitable vertical distance between the end of the conveyor and the rolls 13 and properly controlling the currents of air, it is possible to thus blend one or even a plurality of laps, with the laps already blended on the conveyor.

In any case, the result is a homogeneous web in which the fibers are interwoven and interengaged in a multiplicity of planes in which they have been deliberately placed. In this web there are no laminations as is the case when a plurality of laps are brought together by the various methods of the prior art. The web is of substantially uniform character throughout, whereas the prior art webs may be separated into their laminations.

After leaving the rolls 13, the web is then passed back and forth through rolls 14 arranged at successively lower levels. These rolls likewise exert no pressure upon the web and are preferably all driven at the same speed as the web, as are also the rolls 13, so as to avoid any tension being placed upon the web.

The back and forth or alternate bending of the web by the rolls 14 serves to alternately lengthen and contract opposite sides of the web, and this action seems to aid in blending the fibers together into one unlaminated and unfelted web. From the lowermost roll 14, the web is now conducted downwardly to an impregnating device 15. This device may comprise a vat 16 containing a latex glue, the level of which is indicated at 17. A lower roll 18 rotates in the liquid, and the web is pressed between that roll and the upper roll 19, this being the first step at which pressure of any kind is permitted to be exerted on the web. Preferably, these two rolls are driven together at substantially the same speed as the speed of the web passing therebetween.

After leaving the impregnating device, the web is dried, and for this purpose we have shown diagrammatically a festoon drier consisting of a plurality of roll supports 20 over which the web may be continually fed directly from the impregnating device. Other suitable drying arrangements may, of course, be used as found suitable.

In applying the latex glue or other material to the web, care should be taken to avoid contact of the web with the lower wetting roll 18 until it reaches the throat between the two rolls 18 and 19. Similar care should be exercised to prevent the web from remaining in contact with the lower roll after passing through that throat. For that purpose, the parts of the apparatus are so arranged with respect to each other that the web is led downward at such an angle that it will contact with the upper pressure roll 19 and by it be guided through the throat between that roll and the wetting roll. The web, after passing through that throat, is again led upwardly so as to follow around the pressure roll 19 rather than the wetting roll 18. Both rolls have blotting surfaces which may conveniently be formed by several layers of cheese-cloth, to take up the excess of the impregnating material.

It will be noted that the laps and the web into which the laps are formed are free of tension of any kind and are also free of pressure

until they reach the impregnating device. At no time is the web or one of the laps forming it caused to move upwardly, the movement always being either horizontal or in a downward direction. Therefore the force of gravity is never permitted to exert any tension upon the web or the parts thereof.

As also noted above, the conveyor and also the rolls 13 and 14 are all operating at such speeds that the parts thereof contacting with the web or its parts are moving at the same speed as the web or web parts contacting therewith. This avoids any tendency of the fibers to be worked back into a position parallel to the longitudinal axis of the web, but lets them remain in the diagonal positions which they have been given by the various steps already described. The web, during its movement downwardly from the conveyor to the impregnating device, is likewise subjected to the action of a gentle current of air passing upwardly, and this action aids in obtaining the proper arrangement of fibers in the web.

The conveyor may be of any suitable construction which will give the results set forth above, but one form which we have used comprises a plurality of longitudinally extending narrow belts 21 (Figs. 4 and 5) connected together by transversely extending tie bars 22. Secured to the tie bars is a sheet 23 shown as having an uneven surface which may be obtained, for example, by not stretching the sheet tight. The vibration of the conveyor may be obtained by any suitable means. In this instance, it is shown as being obtained by the fact that the rivets which secure the bars 22 to the belts 21 have heads 24 which project beyond the belts. The belts pass over rolls 25 at opposite ends of the conveyor, and when these rivet heads 24 engage and disengage the rolls, the conveyor is given an agitation which we have found serves the purpose.

The impregnating material is preferably a latex glue, such as is commonly known and which needs no further description. The glue may be diluted or not, and the amount of dilution may be varied between quite wide limits, all depending upon the results which it is desired to obtain and upon other factors, as will, of course, be obvious to those skilled in the art.

After leaving the impregnating device, the web is still wet and, as pointed out above, should be dried. It is still lacking in strength, although appreciably stronger than before impregnation. This strength, however, increases as it becomes drier. After drying, it will be found that the resulting web is one in which large numbers of fibers instead of being generally parallel to the length of the web as in the laps provided by the several cards, are arranged diagonally to the length of the web in such a way as to form a multiplicity of polygonal-shaped and usually diamond-shaped figures, and with a large number of those figures, the polygon formed by fibers defines a hole extending through the web from side to side. The fibers are thoroughly impregnated with and held together by the latex glue which acts as a binder to hold the fibers together.

In Fig. 7 is shown a view indicating the general appearance on close inspection of a web made according to our invention, and in which it will be seen that the individual fibers are arranged substantially as we have just described above and that a large number of diamond-shaped figures, one of which is indicated at 26, are provided.

In Fig. 8 we have shown a view similar to

that of Fig. 7 but after the impregnation with the latex glue. It will be seen here that there is a large number of openings 27 defined by diamond-shaped arrangements of fibers, with the long axes of the diamonds extending lengthwise of the web and with large numbers of gussets 28 formed by the films of the glue.

Because of the diamond-shaped arrangement, the web may stretch longitudinally and laterally, less longitudinally than laterally, the amount of stretch being determined by the amount to which the fibers become parallel to each other. The amount of stretch of the material is therefore limited. Within that limit, however, the material is elastic because of the tendency of the fibers to resume their positions and also because of the action of the latex which, as is well known, forms an elastic impregnating material.

After drying, the web may be given subsequent impregnating treatments if it is desired to do so, the number of these, of course, depending upon the use to which the material is to be employed.

The novel material described above may be used for different purposes, but we shall only describe one use as illustrative of the advantages of the material. That use is for making of a so-called "masking" tape for painting. In painting extended surfaces, such as automobile bodies, for example, it is customary to use a spray for applying the paint, masking out the parts of the body which it is not desired to paint by use of some material applied to those parts of the body.

In preparing our material for use as a mask, we use the material in some such form as shown in Fig. 8, and apply to one side thereof a coating indicated at 29 in Fig. 9. This coating forms a backing for the mask, and it will be seen that it extends through the openings in the web, engaging more than half the periphery of the fibers surrounding the holes. This results in a secure binding of the coating to the web so as to prevent its tearing away therefrom during the hard usage to which such material is subjected. For example, after applying the coating 29, a layer of adhesive material 30 may be applied to the opposite side of the web from that to which the coating 29 is applied. This adhesive material or plaster mass as it is sometimes called, is used to make the mask adhere to the surface to which it is applied. Oftentimes when a mask constructed according to prior art practice is attempted to be removed, it has been found that the coating forming the backing of the mask will separate from the fibers of the web itself, but with our construction we have found that the backing is so firmly bound to the fibers that this trouble is much less apt to occur.

Preferably, the coating 29 is a water-soluble, flexible glue. This material forms a protective coating which prevents the material in the paints, such, for example, as lacquer solvent, from striking through to the fibers and also to the latex upon which it would have a deleterious effect. Likewise, when the mask is rolled up in the form of a coil, the glue will shed the adhesive substance 30 contacting with it in the coil, so that the coil may be readily unrolled. Preferably, the glue, when applied, is in a viscous state and is scraped or spread by known methods so as to avoid complete penetration of the web, leaving exposed part of the peripheral surfaces of the fibers to form a bond with the material 30.

While we have described a specific kind of web and a certain method and apparatus for making it, it is of course to be understood that various

changes in details may be made without departing from the invention, and therefore we do not intend to limit ourselves except by the appended claims.

5 We claim:

1. A web adapted to have a coating applied thereto and comprising a plurality of carded laps each formed of a multiplicity of fibers, said laps being superposed one on another and the individual fibers being loosened and displaced from the positions they occupied in the laps as they left the cards, the fibers of the different laps being interengaged and interwoven to blend the laps into a substantially unlaminate web, and an adhesive holding said fibers in their interengaged and interwoven relation.

2. A web adapted to have a coating applied thereto and comprising a plurality of carded laps each formed of a multiplicity of fibers, said laps being superposed one on another and the individual fibers being loosened and displaced from the positions they occupied in the laps as they left the cards and extending in a multiplicity of different directions and located in a multiplicity of different planes, the fibers of the different laps being interengaged and interwoven to blend the laps into a substantially unlaminate web, and an adhesive holding said fibers in their interengaged and interwoven relation.

3. A web adapted to have a coating applied thereto and comprising a plurality of carded laps each formed of a multiplicity of fibers, said laps being superposed one on another and the individual fibers being loosened and displaced from the positions they occupied in the laps as they left the cards and extending in a multiplicity of different directions and located in a multiplicity of different planes, the fibers in the laps being interengaged and interwoven with each other and with the fibers of the other laps to approximately the same amount, to blend the laps into a substantially unlaminate web, and an adhesive holding said fibers in their interengaged and interwoven relation.

4. A web adapted to have a coating applied thereto and comprising a plurality of carded laps each formed of a multiplicity of fibers, said laps being superposed one on another and the individual fibers being loosened and displaced from the positions they occupied in the laps as they left the cards and extending in a multiplicity of different directions and located in a multiplicity of different planes, the fibers in the laps being interengaged and interwoven with each other and with the fibers of the other laps to approximately the same amount, to blend the laps into a substantially unlaminate web, and an adhesive holding said fibers in their interengaged and interwoven relation, said fibers within the web defining a multiplicity of minute angular openings in the web, and said adhesive forming gussets extending across the corners of many of said openings while leaving the central portion thereof open.

5. A web adapted to have a coating applied thereto and comprising a plurality of carded laps each formed of a multiplicity of fibers, said laps being superposed one on another and the individual fibers being loosened and displaced from the positions they occupied in the laps as they left the cards and extending in a multiplicity of different directions and located in a multiplicity of different planes, the fibers in the laps being interengaged and interwoven with each other and with the fibers of the other laps to approximately the same amount, to blend the laps into a substantially unlaminate web, an adhesive holding said fibers in their interengaged and interwoven relation, said fibers defining a multiplicity of minute angular openings in the web, and a coating material on one side of the web extending through said openings, to bind the coating to the web.

6. A web adapted to have a coating applied thereto and comprising a plurality of carded laps each formed of a multiplicity of fibers, said laps being superposed one on another and the individual fibers being loosened and displaced from the positions they occupied in the laps as they left the cards and extending in a multiplicity of different directions and located in a multiplicity of different planes, the fibers in the laps being interengaged and interwoven with each other and with the fibers of the other laps to approximately the same amount, to blend the laps into a substantially unlaminate web, an adhesive holding said fibers in their interengaged and interwoven relation, said fibers within the web defining a multiplicity of minute angular openings in the web, and said adhesive forming gussets extending across the corners of many of said openings while leaving the central portion thereof open, and a coating material on one side of the web extending through said openings, to bind the coating to the web.

7. A web adapted to have a coating applied thereto and comprising a plurality of carded laps each formed of a multiplicity of fibers, said laps being superposed one on another and the individual fibers being loosened and displaced from the positions they occupied in the laps as they left the cards and extending in a multiplicity of different directions and located in a multiplicity of different planes, the fibers in the laps being interengaged and interwoven with each other and with the fibers of the other laps to approximately the same amount, to blend the laps into a substantially unlaminate web, an adhesive holding said fibers in their interengaged and interwoven relation, said fibers defining a multiplicity of minute angular openings in the web, a coating material on one side of the web extending through said openings, to bind the coating to the web, and a second coating on the other side of the web and adhering to said fibers and adhesive.

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