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LAMINATED FABRIC
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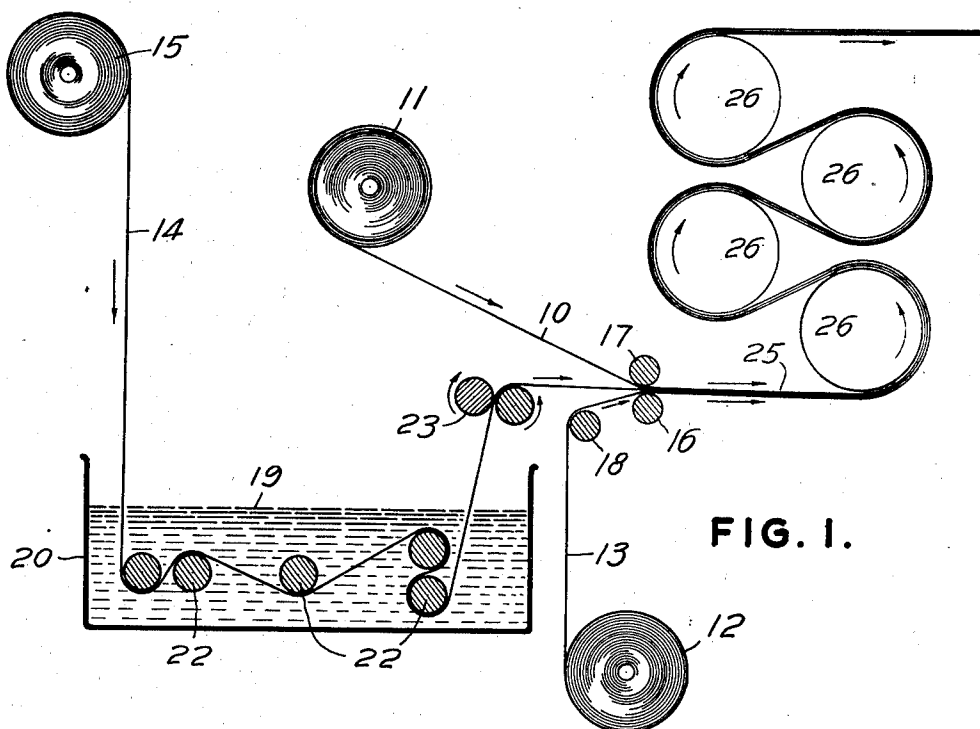


FIG. 1.

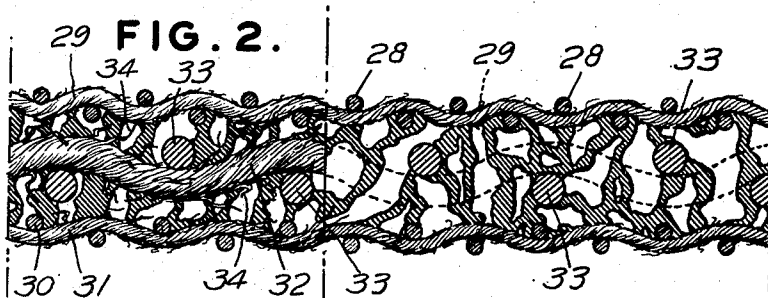


FIG. 2.

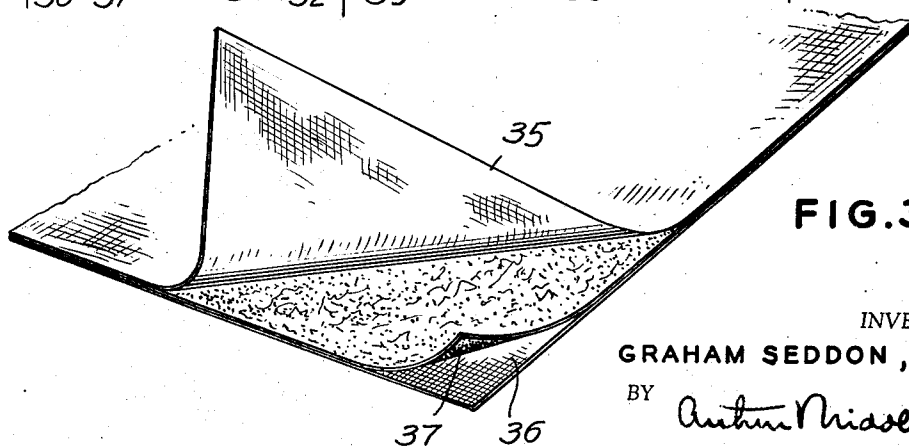


FIG. 3.

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LAMINATED FABRIC

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2 Claims. (Cl. 154—46)

This invention relates to the making of a reinforced fabric, or laminated cloth, and more particularly it relates to an improved method of combining and bonding together the various plies or webs which constitute the composite cloth. It also relates to an article of manufacture which consists of a laminated or compound interstitial cloth having improved characteristics of appearance of certain physical stability and workability, and also of stability with regard to certain other qualities.

This material may be said to be in the nature of a semi-finished product, inasmuch as it is usually passed on to other finishing industries where it goes into the manufacture of various individual articles for human needs, comfort or luxury.

One branch of a finishing industry may consume the material here under consideration for instance in the place of leather or its pliable substitutes, and largely so with a view to attractive surface appearance and surface character as a desideratum. So, one problem has been to produce a material or composite cloth that would be accepted by the finishing industries on the merits of its flawless or otherwise desirable surface appearance and to devise a production method that would not mar or impair a perhaps sensitive cloth surface which may be of a fancy or otherwise impressive nature appealing to the eye and touch.

More specifically, this material goes into the making of the uppers of shoes, or slippers, or it may also be found as an integral part of pocket books or the like. In the process of manufacturing these articles, the material must undergo the test and strain of moulding, stitching, cutting, turning, cementing and the like, as it passes through various operating and shaping steps, to all of which the material should yield readily, emerging therefrom with as far as possible an unchanged surface appearance and with a maximum of durability as in competition with other perhaps tougher materials. So, another problem is to supply the finishing industry with a composite material which is satisfactory as to its strength, body and other mechanical and physical qualities, and which has what may be briefly called the proper workability aside from attractive appearance.

In order to possess what may be called the body quality, the finished material should have a certain desired degree of pliability, but not to a degree where the material becomes lifeless, or altogether non-springy, or not sufficiently self-sustaining to maintain a desired shape into which it

has been formed. Such body quality also improves the general workability of the material in the steps to which it is subjected by the finishing industry.

Still another aspect is what may be called the stability of the material. Stability requires that the bond between the layers should be of uniform character throughout, that the bond should be reliable under many conditions and not weaken, and that the character of the material should not change with time through storage or wear, but retain the qualities acquired in the process of combining the webs. Stabilizing then also means that the characteristics of the adhesive substance forming part of the compound cloth are being made more or less permanent by treatment according to the method of this invention.

A material for this purpose may be typified as a combination of a face or outer cloth such as velvet, silk, satin, or other fancy or printed fabrics (for surface character and eye appeal), with a reinforcement or backing cloth of a rougher utilitarian type to give it the necessary body and strength, the two webs of cloth being usually held or tacked together by an interposed or intermediate layer of some suitable adhesive.

Much of the character, quality, and appearance of the product, and much of its workability depend upon the manner and thoroughness in which the adhesion is established, and last but not least upon the character of the substance or adhesive used.

In order to establish as firm an adhesion as possible and feasible between the respective layers it is customary to apply the adhesive to the respective surfaces and then to subject the media involved in this combination to a considerable mechanical pressure or compression as by the use of pressure rollers or calenders or the like, in order to mechanically force the respective cloth elements into as intimate a contact as possible with the interposed adhesive. Similarly there may be found to be added to the reinforcements or backing cloth an inner finishing lining. The resulting product then is triple ply cloth, whose fabric laminations are brought together under pressure, and held together by way of interposed layers of an adhesive such as, rubber compound, gutta-percha, or others. Also the process of lamination according to prior practice involves the steps of first sizing or coating the respective individual webs on one side, and thereafter combining them in a separate step into a compound material.

The present method of laminating fabrics is

to coat the back of each fabric with an adhesive and ply the two pieces together with pressure in one case and heat and pressure in the other. It evidently means that due to this pressure or heat and pressure the surface appearance of the face of the cloth is not improved, but has to be accepted as the best that can be done under present methods.

The present method of mechanically forcing individually preconditioned elements into contact appears to have been the accepted standard by which to effect a necessary degree of adhesion. As a consequence, no matter what degree of pressure be required in the performance of this step, the necessity evidently remains that along with this method of compression treatment there is to be accepted whatever change the compression step may cause in the surface appearance or texture of the cloth or whatever its results might be with regard to pliability, moldability, or general workability, and durability and stability of the end-product.

That is to say, antagonizing factors are at play: Where the pressure treatment has been too mild the effective strength of adhesion may prove to be altogether or regionally insufficient or spotty, and not substantial enough to endure the further treatment steps of the finishing industry. On the other hand a higher degree of pressure applied in order to enforce adequate and uniform adhesion may impair the surface and appearance, and especially where the face cloth is of a more sensitive character, affect the natural pliability and moldability and other desirable qualities.

Consequently the objects of the invention are to devise a method of producing composite cloth, by which there will be effected a satisfactory and superior bond of well controlled characteristics between the layers; to maintain the face of the cloth in flawless condition so that a greater range of more or less sensitive face cloths may be used; a method which will yield a product superior in pliability, moldability, durability, body characteristics and general workability, to be acceptable and welcome to the finishing industry for a possibly greater field and variety of uses. Another object is to simplify certain steps ordinarily necessary for the preparing and combining of the individual webs, and thereby to effect a saving of the total time required for compounding the cloth.

Another object is to produce an article of manufacture or compound cloth material of the character and for the purpose indicated, which substantially consists of an outer face layer and an inner lining, both held or bonded together by an adhesive substance which in turn is permeated and reinforced by the threads of a third or intermediate layer of cloth, in other words, an article of manufacture or material in which the bonding substance or adhesive is forced through the inner reinforcing cloth in such a manner that it is converted or stabilized more or less into a sponged or vesicular mass, for it is important that such a combined cloth shall be permeable to air so it can "breathe".

This invention therefore aims to establish a superior type of bondage between the respective webs of cloth having interstices therein, and does so not by exercising a corresponding squeezing pressure upon the assembly of webs, but by reversing the technological relationship and substantially causing an interposed adhesive or bonding substance to expand, subdivide, and

penetrate into the texture of the cloth, in a manner which provides substantial continuity of transition between the webs of cloth, so that it may be said that one element grows into the other.

To this end an assembly of alternating layers of interstitial cloth and a bonding substance is subjected to a suitable degree of heat in order to cause the substance to expand or diffuse deeper into the adjoining surfaces or loose fibers of the cloth. This step is to be carried out without the use of any appreciable pressure other than is necessary in order to sustain a required contact relationship of the layers.

More specifically this end is attained by employing a bonding substance which may be in the nature of a suitable initially viscous rubber emulsion for instance latex. Heat acting upon this emulsion tends to drive off liquid therefrom, and thereby to break up the gummy consistency of the emulsion allowing it to expand, subdivide, and penetrate beyond and into the surface of the cloth and even to enclose individual threads of the weave, eventually converting or stabilizing the initially viscous bonding substance or adhesive more or less into a sponged mass. The solids in the fluid adhesive are coagulated or agglomerated after application of the adhesive coating to the web by means of heat produced vaporization, thus forming the solids while in place in, on and around the carrying web into a stabilized, sponged mass of resilient bonds. The tendency of this bonding mass is to form in a multitude of discontinuous but contiguous bonds of more or less independent minute sponges, rather than in a sheet or continuous adhesive layer. Intimate contact and relative pervasion of the cloth is thus effected without the attempt to mechanically force the media into or onto each other. The bond thus effected may be called a merging or permeation of materials into each other and the bonding material is stabilized or otherwise has its characteristics made substantially permanent.

Separate features of this invention are found to reside in the step of preparatory treatment or conditioning of preferably continuous strands of component webs for adhesion and assembling the so conditioned webs; second in the step of intimately bonding the conditioned and assembled webs; and third is the characteristics of the product as an article of manufacture thus produced.

According to one feature, a continuously feeding intermediate web is conditioned with a suitable substance for interacting adhesion with the outer webs and thus in fact serves as a carrier medium for the bonding substance which is to be placed between the two outer layers of cloth. Consequently, the so conditioned web is drawn into simultaneous contact with the outer webs such as the outer or face covering and the lining.

Another feature adds the subsequent heating step designed to effect the actual bonding of the preconditioned webs. The attendant evaporation of entrained or emulsified water and the expansion, diffusion, or porous subdivision of the adhesive substance causes the intermediate or carrier web to become more or less completely permeated, while in turn by the same token other outer strata of the substance are urged into intimate bond with the outer or exposed layers or sheets. In performing this step, sections of the cloth or other material are alternately heated from each side in order to allow liberated and

expanding vapors to escape through the opposite side, and concomitantly to effect thorough bonding and promote effective mutual interlacing of the spines or fibers of the cloth with the other media involved. This establishes an interlacing

bondage relative to and between the outer webs. According to another feature the web assembly is bent or curved in alternate directions as it passes through each progressive stage of the heating or bonding step.

In the preferred embodiment of this invention a suitable arrangement conducts the webs from their individual sources such as reels into suitable composite contact relationship whereupon the assembled cloth is drawn in a zigzagging or rather meandering path over a staggering sequence or battery of heated bodies, rollers, or drums which are arranged in alternation so as to contact consecutively the inner and the outer face respectively of the composite web. The preferred arrangement of the heating rollers is such that instantaneously a substantial section of the web assembly is placed into heating contact with the roller circumference, to make for effective heating, evaporating, and stabilization of the inter-acting bond.

In feeding the individual cloth elements to the assembly rollers, the two outer strands or layers are drawn each directly from an individual reel, while the intermediate or carrier cloth after leaving its storage reel is guided through a preferably heated bath of a suitable adhesive or emulsion in which it is enveloped in a layer which subsequently may be controlled as to thickness by suitable doctor means. These three traveling webs converge upon a calender battery of heating rollers for final bonding.

The material or article obtained in this manner is characterized by the two exposed layers of cloth bonded together by an intermediate layer of reinforced adhesive substance. That is to say the bonding substance is permeated and reinforced by the threads of the third or intermediate or carrier cloth and interlaced with the fibers thereof. The respective zones or layers or components of the composite material are not defined against each other merely by straight surface contact as between adhesive substance and cloth, but fairly merge into each other by way of gradual transition or diffusion. With the nap of the carrier cloth made effective to promote such bond in the heating and evaporation step, the adhesive is found to be stabilized into a spongy mass which is vesicular or has therein a multiplicity of voids or vesicles, thus conferring upon the finished material its particular desired characteristics.

The invention possesses other objects and features of advantage, some of which with the foregoing will be set forth in the following description. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit. In the accompanying drawing there has been illustrated the best embodiment of the invention known to me, but such embodiment is to be regarded as typical only of many possible embodiments, and the invention is not to be limited thereto.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional ob-

jects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawing in which in particular it should be understood that the disclosure herein of a continuous method of operation as with continuously feeding webs does not exclude an intermittent or batchwise method of operation from the scope of protection.

In the drawing: Fig. 1 shows diagrammatically the general arrangement of reels, rollers, and calenders, embodying the steps of conditioning, combining, and heat-treating the component webs of material. Fig. 2 is a magnified diagrammatic cross-sectional view of the composite cloth produced according to this invention. Fig. 3 is a perspective view to illustrate more clearly the preferred triple ply organization of the composite material produced.

The method of this invention is preferably carried out in a web combining apparatus to which component webs may be continuously fed. Such apparatus arrangement is diagrammatically shown in Fig. 1, and in its essential parts it may be said to include a web conditioning and assembly section, and a section for heat treating and bonding the web assembly.

The component webs which constitute the composite material, are represented by a top strand 10 stored upon a reel 11, this being for instance the strand which serves as a face or top layer, which may be of some fancy design. A similar reel 12 carries the bottom ply or lining 13. A supply of intermediate web 14 is derived from a reel 15, and this ply 14 is what may herein be called the carrier web inasmuch as it is to carry an adhesive or bonding substance in between the outer webs 10 and 13. The adhesive used has as its essential characteristics a fluid mass containing solids therein which are capable of coagulation, agglomeration or stabilization upon having a major part of the liquid removed from association therewith, with a substantial portion of said solids having resilient properties. The intermediate web 14 is a fabric of preferably some utilitarian type for instance such as is known as cotton sheeting, drill, twill, duck, or the like.

An arrangement of certain guide and feed rollers conducts the three component webs to a point of assembly. That is to say that preferably all three webs converge as between a pair of feed rollers 16, 17, by which they are brought into contact or assembled relationship prior to entering the section in which the web assembly is subjected to heat treatment, bonding or stabilization. The top web 10 is shown to reach the assembly rollers 16, 17, directly from its reel 11, while the bottom web 13 may feed from its reel 12 over a guide roller 18 to the point of web convergence.

The intermediate web 14 which is to serve as a carrier web for the adhesive substance leaves its supply reel 15 in order to pass through a bath of a suitable fluid or viscous, or emulsified substance 19 which fills a container 20 and where the web is detained in positive and adequate submergence, for instance, through the submerged guide rollers 22. It is in this bath of adhesive that the intermediate web is conditioned for its subsequent function to carry adhesive between the outer webs, and to potentially form an inter-acting bonding element or multitude of such elements for the outer webs.

After its emergence from the bath the intermediate web 14 passes through or over a doctor

device which may be in the form of a pair of wringing or pressure rollers 23, 24, which operate to reduce the amount of adhesive carried by or enveloping the web 14 to a desired thickness and evenness, adapting the same to the subsequent heat treatment or bond-forming step.

Subsequently, the heat treating section of the apparatus arrangement receives the conditioned web assembly designated by the numeral 25 from the assembly rollers 16, 17. This section of the apparatus arrangement is diagrammatically indicated by a calender battery which includes the heated rollers or drums 26. These heated rollers or drums are shown to be arranged upwardly from the assembly section and in a closely staggered sequence so that the composite web 25 is forced to travel in a meandering path as each bend of the composite strand 25 appears to be stretched to hug a part of the circumference of each heating drum or roller 26. Obviously, in this manner the instantaneous area of sections or zones of the composite strand being heated, is kept relatively large as compared with the intervening unheated section or zones. Moreover, it is clear from the disclosure that, as the strand of material progresses over the heating drums 26 the cloth is alternately flexed and heated in opposite directions with vapors being liberated and driven off from the adhesive emulsion for bringing about coagulation and stabilization of the solids of said emulsion.

Fig. 2 illustrates the interacting character of the bondage which is effected between the component webs. This shows in a theoretical way the magnified cross-section of a triple ply material produced according to the method of this invention. Care has been taken to show in this magnified view the individual threads of the fabric as they are interlaced and bonded with and pervaded by the vesicular and stabilized rubber solids which serve as an adhesive bonding material.

The numerals 28 and 29 indicate the warp and weft of the upper web, 30 and 31 the thread elements of the bottom web, while 32 and 33 designate the thread elements of the interposed or carrier web upon which are also shown spine-like stray fibers 34 which constitute the fuzzy surface of the cloth.

The section in the lefthand portion of Fig. 2 shows transverse threads in full view; also shows the interlacing fibers while the righthand portion shows the transverse thread in dotted lines and merely the longitudinal threads in cross-section, giving, however, a clearer idea of the way in which a network of vesicular adhesive bonds pervades the intermediate web as well as interlacing with the fibers and with the outer plies of the material. It also indicates that individual threads of adjoining webs do not lie bare against one another but are partly or substantially enveloped in the spongy bonds, in other words, that there is a more natural diffusing, interlacing, and mutual pervasion of elements rather than an enforced surface contact.

Fig. 3 is a perspective to illustrate the fact that a preferred cloth combination includes an untreated top ply 35, an untreated bottom ply or lining 36, and an adhesive-conditioned intermediate ply 37.

With the aid of an apparatus arrangement substantially as shown, the method of this invention is practiced by first drawing feed supplies of component webs 10, 13 and 14 from their respective reels 11, 12 and 15. Then the webs are

prepared for interacting adherence in an adhesive-conditioning step as the intermediate web 14 passes over submerged guide rollers 22 through a suitable bath of fluid adhesive 19 and then between wringing rollers 23 and 24 to doctor up the layer of adhesive which envelops the web reducing that layer if necessary to a required thickness and evenness. The emerging web 14 then carries its layer of adhesive substance onto and between the outer webs 10 and 13 as all three webs converge upon and between the assembly and feed rollers 16 and 17 which may be adjusted to bring the webs into a desirable contact relationship without exerting an excessive or undesirable compression upon the web assembly. The web assembly identified by the numeral 25 now progresses through a number of special alternating heating phases as it passes on to the first rotary heating drum 26 or first heating phase of a battery where it is flexed in one direction while heating contact with the top web 10 liberates and drives off vapors from the adhesive substance, as well as producing the coagulation and stabilization of the solid components of the adhesive into the bonds made use of by this invention.

Due to the close staggering arrangement of the heating drums little time is lost until the strand leaving the circumference of the first drum tangentially reaches the next drum 26 where again it hugs a portion of the heating surface, however, bending in an opposite direction and also receiving its heat from an opposite direction, that is to say this time from the side of the lining web 13. A series of similar alternating heating phases may follow as indicated by a desirable number of additional heating drums 26, after which a finished and stabilized pliable composite strand may leave the apparatus for storage or immediate use.

The superiority of the bondage effected according to the present method over materials heretofore manufactured, may be demonstrated in an effort to separate an outer ply from the composite or laminated fabric. As one ply is pulled or torn off a substantial homogeneous resistance is felt which is explained by the fact that each infinitesimally small portion or element or pore of the cloth area is held individually tacked down by some correspondingly sized elemental portion or individual bond of the adhesive or spongy bonding substance. That is to say, instead of considering this problem of bonding as one which aims to cause a general or average adhesive surface effect between two webs as by the older compression method and which may involve regional insufficiencies, the present method seeks to establish a higher standard and evenly satisfactory and well controlled grade of bondage with respect to each infinitesimally small or differential bonding element of the total area. Consequently, the total of these elemental bonding elements raises the average quality of the bond over the area as a whole. Therefore, a relatively stronger resistance will be offered to separation of one ply from others of the bonded fabric, inasmuch as the tension of the multitude of small bonding elements must be progressively overcome in an initial stretching and final breakage of one ply from the laminated fabric, and at the same time, a combined sheet is realized which can "breathe" in all respects like leather because of its vesicular construction.

I claim:

1. As an article of manufacture, a pliable laminated cloth comprising a face cloth easily

rendered unsightly, a back cloth, a reinforcing intermediate layer, and an integral porous mass of a stabilized rubber-bearing substance permeating and encasing the intermediate layer, existing as a direct bond through the intermediate layer between the face and back cloths under conditions whereby said face and back cloths are not impregnated or penetrated by the rubber-bearing bond to be otherwise marred thereby.

2. As an article of manufacture, a stiffened pliable composite cloth, comprising a face cloth, a back cloth, an intermediate reinforcing layer of fabric, and a stabilized vesicular bonding mass

of rubber-bearing substance carrying and traversing said intermediate layer extending between the face and back cloths and through the intermediate layer existing as a direct unitary bond between the face and back cloths by virtue of being an integral porous mass attaching itself in a multiplicity of points to the inner side of the face and back cloths without impregnating or showing through the face and back cloths, thus providing a combined and rubber-reinforced cloth through the outer surface of which no rubber appears.

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