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ARTIFICIAL LEATHER MANUFACTURE

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This invention relates to the manufacture of artificial leather and more particularly an artificial leather which, besides possessing in large measure many of the attributes of natural finished leathers, such as calfskin, kidskin, sheepskin, etc., is characterized more especially by its remarkable simulation of the natural product in its appearance, feel, and ability to recover its leather-like appearance after being subjected to rumpling, folding, flexing, and similar rough treatment such as it may receive while being fabricated into various finished articles or afterwards. An important sphere of use of the artificial leather hereof is in the fabrication of women's handbags, many types of which are put through rough treatment, such as turning, during fabrication and all of which are apt to be seized by their side walls and repeatedly flexed at their walls and bottom during opening and closing and to bulge out or cave in, depending upon the volume of the bag contents, its construction, the location of the handle, the seizing pressure applied thereto, etc.

Many artificial leathers as heretofore made have looked like natural leather and have otherwise resembled the natural product sufficiently to be acceptable for various uses, but even the best artificial leathers that have come to my attention after many years of familiarity with artificial leather manufacture on a large scale and extensive research thereon have fallen down for some important uses by reason of the fact that they were too easily marred during fabrication into ultimate articles or afterwards and could not be worked or handled with the same degree of satisfaction as natural leather. On the other hand, some artificial leathers remain unmarred to a certain degree even after rough handling and/or respond satisfactorily to fabricating operations but are not sufficiently faithful reproductions of the natural product in appearance or feel. It will, of course, be appreciated that such latter artificial leathers hardly meet with approval in such articles as better grade women's handbags, since such articles are constantly handled or felt and a non-leathery feel or appearance is repulsive and bespeaks cheapness. The artificial leather hereof fulfills surprisingly well those exacting requirements heretofore fruitlessly sought for such articles as handbags in that it is quite mar-proof or wrinkle-proof when subjected to the same stresses of manufacture and use as those endured by natural leather and at the same time is astonishingly like natural leather in appearance, "handle" or feel, and workability, for instance, capability of being tucked or pleated, stitched, and turned at normal production speeds without extra precaution in working and without special machinery. The artificial leather hereof possesses important advantages over natural leather, including more especially its much lower cost and its uniformity, which latter quality means that large sheets may be cut or died out even in multiple layers by unskilled labor into the parts of a handbag or other article, whereas, on the other hand, natural leather skins, because of their non-uniformity even within a single skin, must be handled individually by experienced operators.

The artificial leather hereof comprises a binder-impregnated body of interfelted fibers and more especially one whose binder is of a springy or elastic nature and occurs in a highly porous felted fiber base or web in such amount relative to the fiber that the impregnated body is possessed of very high residual porosity, namely, a porosity or void space volume preferably greater than that of the solid substance of such body. At least one face of the artificial leather hereof is provided with a very thin wear-resistant layer or skin strongly adherent thereto and penetrating but very little into its very porous body. An artificial leather of such structure answers the purposes of the present invention in the various respects hereinbefore noted especially for women's handbags. One modification thereof presently to be described has the further advantage that, when put through the "boarding" operation customary in the finishing of natural leather skins, it assumes a leather-like grain on its wear-resistant layer virtually belying its synthetic character. It might be further noted that the artificial leather hereof when flexed or creased has the familiar "break" characteristic of fine leathers and that this desirable quality is attributable to the thinness of the wear-resistant layer and its existence practically wholly on the surface of the artificial leather body and also to the ability of the artificial leather body to develop only fine crease lines by reason of its resiliency and its high residual porosity or sponge-like structure. Related to the ability of the artificial leather hereto to recover without noticeable unleatherlike marring or wrinkling after rough handling is its ability to recover like fine natural leathers more or less rapidly and nearly completely from locally applied pressure or indentation, as, for example, the imprint of a fingernail deliberately impressed thereon, which latter ability also arises from the resiliency thereof and its high residual porosity or sponge-like

structure. It will be appreciated that, although under some circumstances the artificial leather product hereof may be marked by crumpling, the marks are leather-like, that is, they are made up of numerous very fine, characteristic wrinkles of rounded, soft contour rather than of the coarse or sharp, hard-looking wrinkle or wrinkles characteristic of paper and artificial leather in general. The expression "unleatherlike marring or wrinkling" as used herein should be construed in the light of the foregoing explanation.

Before dwelling upon particular procedures for producing the artificial leather hereof or upon the particular materials entering thereinto, I shall give the procedures generally and the principles underlying them. To begin with, I use a felted fiber base of unusually high porosity, for instance, a felt or web such as is formed on a paper making machine, from so-called free papermaking stock, preferably with little or no application of pressure at any stage of web formation prior to drying. In some instances, the highly porous felt might be one produced in other ways, for instance, on a carding machine, in which case, the felt may be composed of wool or comparatively long textile fibers, such as cotton. In speaking about a highly porous felt or web, I mean one whose volume of interstitial or void space vastly exceeds that of its fibrous or solid substance, for instance, is in the order of magnitude of 4 to 10 times that of its fibrous substance. When such a web or felt is formed on a papermaking machine from comparatively short fibers, such as wood pulp, it is usually quite weak and tender, being of even lower tensile strength than ordinary paper of much lower basis weight. If desired, the wood pulp may be blended with other or much longer fibers, such as wool, manila pulp, cotton, linen fiber, fiberized leather, etc., so that the web formed from the blend may be desirably modified in such qualities as resiliency and tensile strength; or the web may be formed from any one or a mixture of such fibers. In any event, however, the web should have the very high porosity already mentioned.

The very highly porous web or felt is impregnated with a solution or liquid dispersion of a resilient binder in amount to retain in very large measure, after the binder-solvent or dispersing medium has been evaporated, a high porosity. It might be remarked that, by reason of the extremely high initial porosity of the web, it is possible to strengthen it enormously with a relatively large amount of binder, based on the weight of fiber, while still preserving to the desired degree the void space in the web; and it is usually desirable to infuse into the web a large amount of binder so as to impart to the resulting artificial leather body the toughness and tear-resistance requisite therein. Satisfactory leathers may be produced hereby whose residual porosity or void space is in the order of magnitude of at least about 30 to 75 percent, and preferably above 50 percent, of the total volume of the impregnated and dried sheet. In attaining such final or residual porosity in the binder-impregnated web, should pressure be exerted on the web while still wet with the binder-solution impregnant or dispersed binder impregnant, such pressure should be controlled to avoid excessive reduction in porosity. The particular pressure that can be tolerated in such circumstance depends, among other factors, upon the initial porosity or volume of voids relative to fiber in the web. At this point, it might also be noted that the extent to which the dry, binder-impregnated web may be permissibly pressed depends very materially upon the particular binder employed. Thus, although both albuminous solutions, such as casein, glue, and gelatine solutions, and properly compounded aqueous rubber dispersions or solutions, such as rubber latex and rubber-benzol compositions, might serve as the impregnants herein, the dried, albuminous binder-impregnated web may be tolerably pressed to a decidedly greater extent than the ordinary rubber-impregnated web; for, whereas the dried, albuminous binder-impregnated web tends to recover gradually practically all its original bulk or thickness after being pressed, the dried, rubber-impregnated web ordinarily does not recover to the same extent after being similarly pressed. Accordingly, the rubber compounding must be such as to impart to the binder-impregnated web the feel of fine natural leather such as calf-skin plus the capacity of recovering, to a very large extent, the high original residual void space in the binder-impregnated web after it has been pressed, either by direct pressure, as in a plating-glass or by wrinkling or crumpling, as in handling. It is the soft, spongy character of natural leather plus its capacity for recovery which differentiates it markedly from the artificial leathers hitherto made.

The felted fiber base used herein is apt to be irregular on its surface even when care is exercized in its manufacture, for instance, even when wood pulp or other comparatively short-fibered stock is used in its formation and the stock is deposited from exceedingly dilute aqueous suspension on the forming wire or fine wire cloth of the papermaking machine. Moreover, surface blemishes or irregularities of a more conspicuous kind may be developed in the course of forming the web, or in its drying, accumulation, or handling; and the web may also acquire surface markings or irregularities in the course of its impregnation. While such surface irregularities could be eliminated by calendering or plating the binder-impregnated sheet under substantial pressures, this should not be done herein by reason of the fact that such pressure would do away with the pore or void space necessary in the ultimate artificial leather product hereof, unless the sheet is one capable of regaining its original unpressed thickness, or very nearly so, in which case the surface irregularities will manifestly be but little reduced. Pursuant to one aspect of the invention hereof, the impregnated web produced herein while still wet with the binder solution or binder dispersion is dried in contact with a smooth surface and thus made to acquire a smooth face regardless of such adventitious irregularities as may be presented by the original or starting web. Because of the softening effect of the binder solution on the fibrous web or felt and because of the strong adhesion of the wet impregnated web to the smooth surface against which it is dried, the web surface assumes substantially the smoothness of the surface against which it is dried and to which it strongly adheres as it is being dried. It is thus possible to realize in the dried, binder-impregnated web an exceedingly smooth surface while substantially avoiding compaction of the web or undue reduction of the void space therein. Drying of the impregnated web may be effected against all sorts of smooth surfaces, so long as they are substantially non-absorbent. For instance, when the drying of a progressively

moving impregnated web is to be effected as it issues from an impregnating bath or spray, the web may be transferred to and laid down on a smooth surface-presenting carrier or belt, for instance, an endless belt of suitable sheet metal, such as stainless steel, or one of sheet Celluloid or other material adaptable for belt or carrier use. On the other hand, the wet impregnated felt may be cut into sections or pieces which may be laid down individually against smooth surface-presenting plates, such as glass or metal plates. Irrespective of whether the impregnated web is dried continuously or as separate sections or pieces, drying may be effected under controlled temperature conditions, as will presently be described.

The dried, binder-impregnated web or felt is highly porous, cellular, and sponge-like in its structure and is hence readily absorptive of liquids applied thereto. When removed or peeled from the surface against which it is dried, it is necessary properly to finish the smooth face in order to make it simulate natural leather in its appearance and wear qualities. Were the smooth surface treated as usual with liquid finishing or coating materials with a view toward imparting smoothness and wear-resistance thereto, the finish would penetrate or sink into the highly porous impregnated body; and it would hence be necessary to use so much liquid finishing or coating material as would fill to an appreciable degree the pores or void spaces in the impregnated web or felt and would develop a wear layer of undue thickness, that is, one lacking the "break" characteristic of finished fine leather. Thus, the spraying or spreading thereon of liquid finishes or coating materials as ordinarily would give rise to the faults just mentioned. Moreover, the appearance of the dried coating is apt to be spoilt by the presence of numerous pinholes caused by the air in the surface voids being displaced by the coating and working up through it. It hence becomes necessary to finish the binder-impregnated felt or web hereof in a special way. A simple and effective finishing treatment found to be preferable for the purpose hereof is to apply to the face of the impregnated web to be coated a preformed skin or pellicle of the finish itself or a preformed skin or pellicle capable of masking such web surface and of serving as the base for receiving one or more finishing coats. Various preformed skins or pellicles to constitute the thin wear-resistant layer of the artificial leather product hereof may be employed. Thus, the skin may be a composite one prepared by depositing exceedingly thin coats on a smooth impermeable surface in a sequence reverse to that in which the coats are to occur on the product hereof; and such a composite skin as deposited may comprise first a finishing coat, for example, one imparting the required degree of lustre, then a color coat relatively rich in pigments to ensure proper color coverage, and then a tie or bond coat preferably containing a slow-evaporating solvent and presenting stickiness or tackiness for a sufficient period of time to permit transfer of the preformed composite skin or pellicle to the base impregnated felt. In lieu of using a slowly evaporating lacquer as a tie or bond coat, it is possible to dispense with such a coat and merely to use slowly evaporating thinner, or thinner plus suitable plasticizer, to soften or to gel the preformed and dried skin and thereby to develop sufficient stickiness or tackiness on its surface to enable its transfer with strong adhesion to the base impregnated felt. In other instances, the tie or bond coat may be of a thermoplastic composition so that tackiness may be quickly developed therein by exposure to moderate heat or hot air currents, whereupon while such coat is still tacky the preformed pellicle in which it exists may be transferred bodily to the binder-impregnated felt. Rather than forming the entire wear-resistant layer as a composite preformed film or pellicle, only a priming component of such a skin need be preformed and transferred to the binder-impregnated felt, whereupon, it becomes possible to finish the primed base in the conventional way, as by spraying or spreading one or more coats of liquid-finishing material onto the primed coat, for instance, a succession of coats including first tie-coat material, then color-imparting or pigmenting material, and finally lusterizing material. An illustration of a good priming background for the reception of a lacquer wear layer containing organic solvents is a preformed skin or pellicle of gelatine or glue, as such a skin is not dissolved or etched away when such lacquer is applied in liquid form as one or more coats on top of the impregnated felt base primed with such a skin. Another possible preformed skin for such lacquer applied in liquid form is one composed of "Cellophane" or regenerated cellulose. In transferring a preformed gelatin or glue film to the impregnated felt base, all that need be done is to moisten the film slightly with water or steam, or to gel the film with cold water and then to impress it upon the base, in consequence of which the pellicle adheres tenaciously to the base and primes it against penetration by liquid finishes without penetrating it to a significant extent. The weight or thickness of such a pellicle may be so controlled that subsequently applied liquid finishes, such as lacquer finishes, may anchor or bond themselves with the desired strong adhesion to the base. When a gelatine or glue priming film is thus transferred to the artificial leather base to be finished, it is not so important that the face to receive he film be predried against a smooth-surfaced glass plate or the like as in the case of a transferred lacquer film. The reason for this is that a gelled glue film is more readily conformable to surface irregularities than a lacquer film, which latter film tends to become disrupted or spoiled when in solvent-softened condition it receives the base under the comparatively heavy pressure of application needed for conforming a comparatively imperfectly-surfaced base thereto. It will be appreciated that there are other ways in which high residual porosity or sponginess may be preserved in the binder-impregnated felt while finishing it with a thin, wear-resistant layer of the appropriate characteristics and that I regard the product hereof as being novel irrespective of the exact method which may now be available or which may be devised for so doing.

I shall now give a specific inventive procedure that gives an artificial leather product useful to advantage in lieu of natural leather in women's handbags. In making the felt base, I used a refined wood pulp of high alpha cellulose content, that is, one of an alpha cellulose content of about 93%. The pulp was admixed with water while substantially preserving the original fiber length; and the resulting comparatively free pulp suspension was delivered at very dilute consistency, namely, at a fiber content of about .002 to .005%

to the feltmaking or papermaking machine. The machine was operated without the use of the heavy press rolls customarily relied upon in producing papers and felts so as to enable the realization of a finished web or felt of extremely high porosity and sponginess. Under the conditions described, I formed a web of excellent formation or texture at a thickness of 0.028 inch and a compactness of 28. The compactness value given represents the basis weight of the web in pounds divided by its thickness in inches multiplied by the factor 10^{-2}. The expression "basis weight" as used herein means the weight in pounds of 480 sheets whose dimensions are 24" x 36". By calculation the web was found to consist on a volume basis of 12% fiber substance and 88% voids.

The fluffy or bulky web thus produced was floated on a bath of glue solution, specifically a solution containing 9% glue solids, 18% glycerine, and a small amount of dye corresponding to the color desired in the finished artificial leather. Because of the high absorptivity of the web, it became quickly saturated with the solution in the amount of about 700%, based on the dry weight of fiber, which amount of solution corresponds to a glue-glycerine mixture content in the saturated web of about 190%, based also on the dry weight of fiber. The glycerine used in the glue solution contributes importantly to the realization of the artificial leather product hereof in that it softens or flexibilizes the fibers and imparts to the artificial leather product a mellowness or pliancy very much like that of a natural leather skin, such as calf-skin. Moreover, the glycerine also functions as a plasticizing agent for the set and tanned glue content of the artificial leather product, the setting and tanning of the glue in the saturated web being effected as will presently be described.

The saturated web carrying its charge of impregnating binder solution was not squeezed as it was taken from the bath but was laid down as individual sections or sheets next to a non-absorbent, smooth surface against which its drying was to be effected. More particularly, I laid each wet saturated sheet against smooth plate glass to which it immediately adhered. The sheet was gently rolled onto the glass plate so as to avoid the inclusion of air pockets between the plate and sheet surface. The plate carrying the solution-soaked sheet was then put into an air-drying chamber whose atmosphere was at about 135° to 155° F. In about one hour, the sheet was found to be substantially completely dried.

The dried, binder-impregnated sheet while still stuck to the plate was then placed in a steaming chamber whose atmosphere was charged with formaldehyde vapors gradually raised in temperature to 120° to 130° F. After exposure to such an atmosphere for about one hour, whereby tanning of the albuminous binder was effected, the sheet while still carried by the plate was removed from such atmosphere. The impregnated sheet was then peeled from the plate; and it peeled readily and cleanly therefrom. The impregnated sheet presented a very smooth and almost glassy appearance on the face that was dried next to the glass plate. It had high bulkiness and resiliency, which qualities, as already indicated, are a reflection of its tremendous internal void space and the resiliency of its tanned glue impregnant plasticized with the glycerine.

In finishing the smooth face of the dried, binder-impregnated web, the following steps were performed. A smooth glass plate was sprayed thinly and substantially uniformly with a nitrocellulose lacquer coat of relatively low pigment content so that it could advantageously serve as the lusterizing component of a composite preformed wear-resistant skin or layer to be transferred from the plate to the binder-impregnated fiber base. When the gloss or lusterizing coat was substantially dry, a nitrocellulose lacquer coat relatively rich in pigment was sprayed thinly and substantially uniformly thereon, which pigment-rich coat was designed to be the color-imparting or pigmenting component of the composite skin. When such second coat was substantially dry, it was sprayed thinly and substantially uniformly with a substantially clear or pigment-free nitrocellulose lacquer containing slow-evaporating solvent so as to afford a tie or bond coat for the composite skin, which remained tacky for a period of time enabling transfer of the composite skin from the glass to the binder-impregnated felt.

The dried, binder-impregnated felt was then applied smoothly, as with gentle rolling, to the composite skin carried by the glass plate while the top or tie-coat was still tacky. It is interesting and important to note at this point that extreme care was now not necessary to avoid air pockets between the skin and the base sheet, since the latter was so porous that air promptly escaped therethrough. The felt as applied to the composite skin was kept on the glass plate and was dried in air for a few hours to induce sufficient drying of the tie-coat and sufficiently tenacious adhesion of the felt thereto so that peeling or stripping of the felt with the skin or wear layer transferred thereto could be safely effected. The addition of a small amount of free water at the region where peeling of the felt and the preformed composite skin attached thereto is started facilitates a clean and rapid stripping of the resulting finished artificial leather sheet from the glass plate. The smoothness of the surface of the coated artificial leather is practically perfect despite the coarsely porous surface of the base sheet and the thinness of the coating, yet the adhesion of the coating is excellent and the extent of its penetration into the base is minute.

When the finished artificial leather sheet is "boarded", as is customary in the treatment of natural leather skins, it is found that it acquires a grain remarkably akin to that of boarded natural leather skin, for instance calf-skin. Such a "boarding" operation is hence preferably performed on the finished artificial leather product hereof. It is pertinent to note that the characteristics of the finished artificial leather product may be modified by varying the temperature at which the felt base impregnated with albuminous binder solution is dried. Thus, when a felt is impregnated with albuminous binder solution in the very same way as hereinbefore described but the impregnated felt is dried at room temperature, say, about 65 to 80° F., it is found that there is greater tendency for the impregnated felt to shrink and pucker or wrinkle on its surfaces. Accordingly, when drying at room temperature is effected, it becomes more important in producing the product hereof to dry the impregnated sheet against a smooth glass plate or other smooth surface-presenting, substantially impermeable background. Moreover, the albuminous binder-impregnated felt predried at room temperature may not so readily assume a leather-

like grain when finished with a thin layer or skin of wear-resistant material and "boarded".

In drying the felt after saturation with binder solution next to an impervious surface so as to do away with irregularities or imperfections in the felt surface, it may be desirable to use in lieu of a smooth surface, such as plate glass, an engraved or embossed impermeable background or base, for instance, etched glass plate, engraved stainless steel plate, or similar ornamentally inscribed backgrounds so as to create in the surface-perfected, binder-impregnated felt ornamental impressions, for instance ornamentation like that presented by such fancy natural leathers as alligator and reptile skins, embossed natural leathers, etc. So, too, the wear-resistant layer or skin may be preformed against similarly engraved or inscribed ornamental surfaces or backgrounds to impart, if desired, a decorative appearance other than that of the usual or plain natural leather grain to the artificial leather product hereof.

It may be reiterated that properly compounded rubber and other resilient or semi-resilient binders might constitute the binder content of the felted fiber base thereof and that the impregnant might be a mixture of binders. It is possible, for instance, to impregnate the felted fiber base with a mixture of glue and rubber latex; rubber latex and viscose; rubber latex, viscose and glue; glue and viscose, etc. Moreover, the binder might be incorporated into the felted fiber base at any suitable stage of its formation, for instance, into the bulk fiber before it is felted, or into a felt or web while it is freshly formed and still wet on the so-called wet end of the papermaking machine. In those instances when binders or binder-mixtures other than glue are used as the impregnant for the web, it is also important that glycerine, ethylene glycol, or other agents that function to soften or flexibilize the fibers be employed in order to impart to the finished artificial leather product hereof the natural leather-like mellowness or pliancy desired therein. The amount of glycerine or its equivalent added to the web or to the impregnant incorporated thereinto, for instance, to the glue solution, the rubber latex, the glue-rubber latex mixture, etc. may vary, depending upon the kind of fiber constituting the web, and the particular impregnant used, but in all cases the glycerine or its equivalent is used in amount sufficient to render the artificial leather product hereof sufficiently soft or pliant but not to the point where it feels wet or soggy. Thus, a wool or wool-containing web may require less fiber-softening agent than an all-cellulosic fiber web, such as a cotton or wood pulp web; and a web impregnated essentially only with rubber as the binder may require less fiber-softening agent than one impregnated with casein, glue, or other albuminous binder.

It is also possible to use various liquid coating materials for developing the wear-resistant layer on the artificial leather product hereof; and, as hereinbefore indicated, rather than preforming the wear-resistant skin or layer, one might by resorting to other than conventional practices apply such liquid coating or coatings directly to the binder-impregnated felt. In any event, however, one must adhere to the inventive principles hereinbefore emphasized in attaining the artificial leather product hereof, for one may repeatedly use the very same raw materials and in the very same proportions as are herein employed while failing utterly in the production of such a product.

The invention hereof extends not only to the finished or coated artificial leather product but to the artificial leather base comprising a felted fibrous web of considerable thickness and high initial porosity (i. e. a web falling outside the category of ordinary papers) impregnated with a large amount of preferably plasticized and tanned albuminous binder but, nevertheless, possessed of high residual porosity, namely, a pore or void space at least about 30 to 70% of its total volume. Thus, the felted fibrous web for the artificial leather base hereof may be of a thickness ranging from about 0.02 to 0.10 inch and of a compactness ranging from about 20 to about 55 and be impregnated with an aqueous glue-glycerine composition or equivalent plasticized albuminous binder solution in such amount that when the impregnated web is dried and its plasticized binder insolubilized or tanned, the impregnant deposited therein amounts to about 100% to 250%, based on the dry weight of fiber, and the pore or void space left therein amounts to at least about 30 to 70% of the total volume occupied by the resulting artificial leather base. As already indicated, the albuminous binder occurring in the finished product may be associated with various amounts of glycerine or other plasticizer, depending upon such factors as the kind of fiber employed; and of the total weight of albuminous binder-plasticizer composition occurring in the finished artificial leather base, about, say, 35% to 65% by weight may be glue or other albuminous binder and the rest glycerine or equivalent plasticizer. This means that the web is impregnated with plasticized albuminous binder composition in amount to produce a substantially uniformly impregnated web containing at least about 35% albuminous binder solids, based on the dry weight of fiber.

I claim:

1. A process of making artificial leather possessed of resistance toward permanent unleatherlike marking or wrinkling upon being crumpled, which comprises forming a web of interfelted fibers of sponge-like structure wherein the void space vastly exceeds that occupied by fibrous substance, impregnating the web with a liquid composition containing resilient binder and capable of being set to strengthen said web, the amount of substance deposited by said composition upon its being set in said impregnated web being at least about 35%, based on the dry weight of fiber while leaving in the web void space comprising at least about 50% of the total volume, bringing the impregnated web while wet into facial contact with a substantially impermeable, smooth background, setting the impregnant content of the impregnated web while such web is in facial contact with such background, and surfacing the face of the web previously in contact with such background with a thin, strongly adherent, preformed skin of wear-resistant finishing material while avoiding material penetration of said material into the body of said web, thereby producing a surfaced, impregnated sheet characterized by its high residual body sponginess and its ability to recover from crumpling without acquiring permanent unleatherlike markings or wrinkles on said skin.

2. A process of making artificial leather possessed of resistance toward permanent unleatherlike marking or wrinkling upon being crumpled, which comprises forming a web of interfelted

fibers of sponge-like structure wherein the void space vastly exceeds that occupied by fibrous substance, impregnating the web with aqueous albuminous binder composition containing a plasticizing agent for said binder and of such binder content as to deposit upon being dried in said impregnated web at least about 35% binder, based on the dry weight of fiber while leaving void space in the dried web comprising at least about 50% of the total volume, drying said impregnated web in facial contact with a substantially impermeable, smooth background at a temperature of about 135° to 155° F. and insolubilizing said binder, surfacing the face of the web dried next to said background with a thin, strongly adherent, preformed skin of wear-resistant finishing material while avoiding significant penetration of said material into the body of said web, thereby producing a surfaced, impregnated sheet characterized by its high residual body sponginess and its ability to recover from crumpling substantially without acquiring permanent unleatherlike markings or wrinkles on said skin, and boarding the resulting product to impart to said skin a natural leather-like grain.

3. A process of making artificial leather possessed of resistance toward permanent unleatherlike marking or wrinkling upon being crumpled, which comprises forming a web of interfelted fibers of sponge-like structure wherein the void space vastly exceeds that occupied by fibrous substance, impregnating the web with aqueous albuminous binder composition of such binder content as to deposit upon being dried in said impregnated web at least about 35% binder, based on the dry weight of fiber while leaving therein at least about 50% voids, drying said impregnated web in facial contact with a substantially impermeable, smooth background, transferring and adhesively bonding to the surface of the web dried next to said background a preformed skin of a finishing material insoluble in volatile organic solvent solutions of lacquer finish to be applied to the web, and applying said solutions of lacquer finish to the transferred skin surface, thereby producing a finished, impregnated sheet characterized by its high residual body sponginess, and its ability to recover from crumpling substantially without acquiring permanent unleatherlike markings or wrinkles on its finished surface.

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