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A. R. OLSON ET AL
METHOD OF DRYING LEATHER TO
ULTIMATE CLEAN CONDITION
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2,586,985

Fig. 1

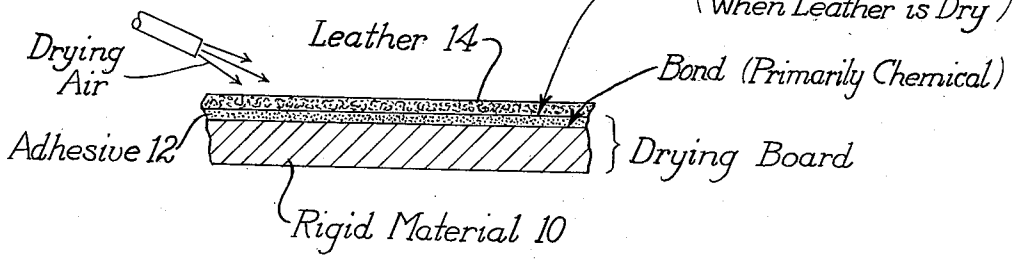


Fig. 2

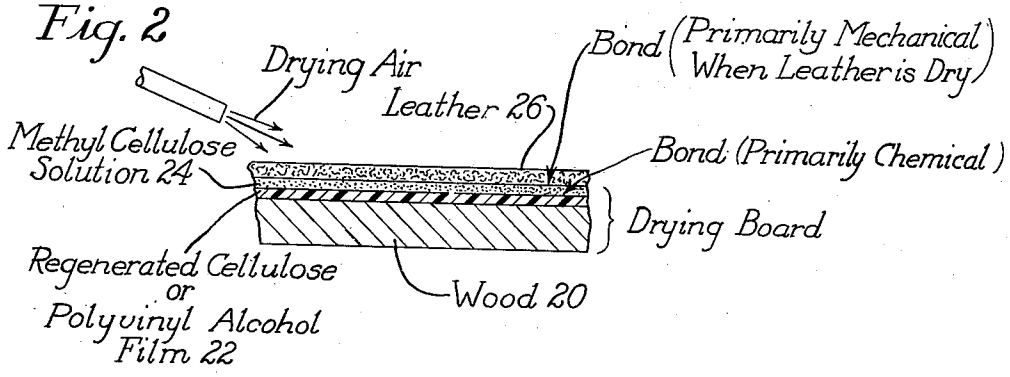
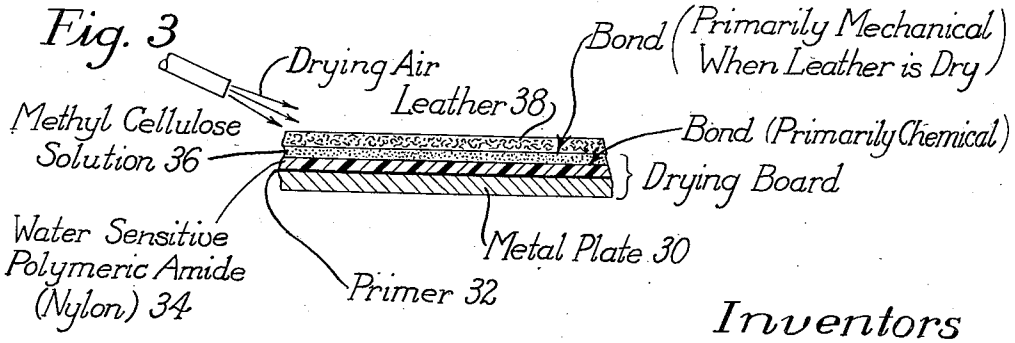


Fig. 3



Inventors
Arthur R. Olson
Edward B. McMillan
William H. Davis, 3rd
By their Attorney
Thomas J. Ryan.

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METHOD OF DRYING LEATHER TO ULTIMATE CLEAN CONDITION

Arthur R. Olson, Wakefield, Edward B. McMillan, Marblehead, and William H. Davis, III, Beverly, Mass., assignors to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

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2 Claims. (Cl. 69—21)

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This invention relates to methods of drying leather work pieces such as tanned hides or skins using backing members or drying boards for holding the same during the leather drying operation.

The improper physical handling during drying of tannery stock, whether it be chrome or vegetable tanned, may completely ruin or at least minimize the value of leather which will otherwise be of excellent quality. Pasting, tacking or toggling are methods commercially practiced for holding the work in extended condition upon suitable supports for drying. These methods all have obvious disadvantages as heretofore practiced. They are customarily used to bring leather to an "air-dry" condition in which the content of water by weight is in the neighborhood of 10% to 12%. Usually the water content is reduced to below that of the air-dry condition after which mere exposure to the atmosphere will cause the stock to become air dry. Before drying, chrome tanned calfskins are usually given a uniform water content of about 34% by a samming operation immediately after which they are staked and then dried in smooth and extended condition on backing members or supports to which they are temporarily affixed by paste, tacks or toggles, as is done in the case of vegetable tanned leathers. In all tanning procedures, one or more drying operations are necessary.

The pasting method, above referred to, is the preferred method as drying has heretofore been practiced. That method results in an increased yield as there is a greater extension of the shanks in each work piece and no scalloping of the work contour occurs to necessitate wasteful trimming. Another advantage of the method is the smoothness of the grain surface on the dried leather due to the elimination of the fat wrinkles. The method is usually carried out after fat-liquoring, coloring, and setting out the individual work pieces and it is customary to paste and slick them out, grain side down, on smooth surfaced supports or backing members such as boards, plates or frames for the drying step. The backing members or so-called "drying boards" are made of wood, paper, metal, porcelain, plate glass or other smooth suitably rigid materials so that each work piece is adequately supported and held in extended condition despite the tension and shear forces set up in the drying operation. The paste is generally made from dextrine or some other suitable material which exhibits adhesive properties toward both leather (wet or dry) and the board. The wet leather is placed on the backing member or board with its grain side toward

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the smooth surface of the backing member and with a layer of the paste interposed. The leather is slicked out so that the grain surface adheres smoothly and firmly to the plate, frame or board. Little or no localized shrinkage or concentrated stress results in the leather area as the drying proceeds, for the leather adheres firmly to the plate during the entire drying period and after the drying operation is completed the dried work piece is separated from the plate.

Unfortunately, as paste drying of leather has heretofore been carried out, either a buffing operation must be employed or a small amount of water must be used to remove the paste from both the board and the leather and a substantial portion of the paste adheres to the dried leather. Subjecting the leather to a buffing operation disturbs the grain and it is obvious that if water is used the amount should be limited in order to avoid unduly wetting the dried work piece. This necessity of removing residual paste from the dried leather when the grain is to be preserved is a definite disadvantage in drying calfskin and side leather, and, for all practical purposes, prevents the use of the conventional pasting method for the drying of thin leathers such as kid, light-weight calfskins, snakeskins or sheepskins. This type of leather, if washed to remove paste, becomes as wet as if it had not been dried for the wash water penetrates thin leathers quickly.

It is an object of the present invention to provide a method for drying leather as such leather is held in spread out condition upon a support or backing member by adhesive and cohesive forces which permit ultimate separation of the dried leather from the support in a clean condition—i. e.—free from any adhesive and thereby avoiding the difficulties above mentioned. It is a further object of the invention to cause wet leather to bond to a backing member by means of an adhesive which ultimately adheres more strongly to the backing member than to the leather, particularly after the leather has been dried to an appreciable extent, the strength of bond of the adhesive to both the backing member and the leather being sufficient to exceed the shearing forces set up as an effect of the drying operation.

The term "primarily mechanical" is used herein to describe the characteristics of the adhesive relative to the leather in the final stage of being dried and with respect to the type of bond formed. Much has been written in technical literature as to what constitutes adhesion in particular

instances and in considering this complex question it is believed correct to state that in every case of adhesion a chemical as well as a physical or mechanical aspect is present. Van de Waal's forces, small as they are, are, in one sense, physical in nature but they definitely are not mechanical and, indeed, they may be considered as being chemical in nature and the same may be said of residual valency, polar, or hydrogen bonding forces. It is impossible, therefore, for any given adhesive bond to state that such bond is strictly physical or strictly chemical. It is clear, however, that the union of two structurally different materials, such as dry fibrous leather and fluid or semi-fluid adhesive which are relatively unreactive, is a bond which necessarily is almost wholly mechanical, as illustrated by the marks or pores and indentations of the leather grain being reproduced on the adhesive when the bond is broken. The indentations become apparent to visual observation when the two materials (the adhesive and dry leather) are forcibly and cleanly separated. Such a bond may accurately be termed and is herein referred to as a "primarily mechanical" bond.

It is also clear that the firm bond between the adhesive and the smooth surface (with no indentations whatever) of a metal board does not arise because of any predominant interlocking or mechanical forces but is primarily chemical in nature. The term "primarily chemical" is used herein to describe the nature of the bond which is effected at all times between the adhesive and the adjacent material of the drying board or backing member. With reference to this bond, the quoted term is used to indicate that the bond is more cohesive than adhesive in nature and that the adhesive joins or wets the adjacent material of the board to a greater extent than it does substantially dry or dry leather.

In the following explanation of the invention the adhesive, in all cases, is considered to be a part of the backing member or drying board but it is to be understood that the invention in its more general aspects contemplates that the adhesive may be applied either to the backing member or to the wet leather or to both before the leather is slicked out upon the backing member.

The invention will now be more particularly described by reference to the accompanying drawings and thereafter pointed out in the claims.

In the drawings,

Fig. 1 is an enlarged cross section of a drying board with dry leather adhering to it and means for directing a drying fluid all in accordance with the present invention; and

Fig. 2 is a similar cross-sectional view but the drying board is referred to as including not only a specific adhesive but also two alternative materials adjacent to the adhesive; and

Fig. 3 is a cross section of a drying board and leather using preferred board materials for practising the present invention.

In Fig. 1 the backing member comprises a rigid plate or board **10** of a single composition or material which is chemically similar or compatible with the material of an adhesive layer or film **12** applied thereto. Leather **14**, while wet, is slicked out upon the backing member and held thereon in extended condition by the adhesive until the leather is dried. The leather **14** and the adhesive **12** are joined in a primarily chemical bond at their interface during the first stages of the drying operation and the adhesive

is selected so that it will hold the wet leather at least until the latter has been dried to the desired extent—i. e.—it will hold with sufficient strength to withstand the shearing stress set up during the drying operation. After the leather **14** is suitably dried by passing air over it, the bond between the leather and the adhesive becomes primarily mechanical and the leather is stripped in clean and smooth condition from the backing member portions **10** and **12**. The adhesive **12** remains a part of the backing member because of its primarily chemical bond therewith. The weaker bond is at the interface between the chemically incompatible adhesive **12** and the dry leather **14** (preferably the grain side) and that bond is primarily mechanical so that clean dry leather results. The backing member may be reconditioned by mechanical or chemical means preparatory to receiving the next work piece. Such means would be selected according to the identity of the adhesive as will be explained in connection with examples given below.

Fig. 2 shows a backing member of wood **20**, a film **22** of regenerated cellulose or polyvinyl alcohol attached to the wood by tacks, cement or other means (not shown), an adhesive **24** (methyl cellulose solution) applied to the film **22** and chemically bonded therewith, and a work piece **26** of leather (wet when applied) slicked out with its grain side in contact with and bonded to the adhesive **24**. The methyl cellulose solution, being chemically bonded at all times with the film **22** or adjacent material of the backing member, remains a part of the backing member when the work piece **26** has been dried and is eventually stripped from the backing member. The dried leather is therefore clean and there is no need for buffing or washing of the dry product to remove any residual adhesive. The surface of the backing member may be washed with water, replaced or renewed after each work piece or a number of such pieces has or have been treated.

A number of specific examples for carrying out the invention are given below:

Example 1

A vinyl resin solution is made up as follows:

	Parts by weight
VYNS	20.0
Di-2-ethylhexyl phthalate	3.0
Methyl ethyl ketone	100.0

The VYNS is a copolymer of vinyl chloride and vinyl acetate produced by the Carbide & Carbon Chemical Corp., New York, N. Y.

The above solution is prayed to form a coating or film on one side of a plywood board to form a backing member or drying board. After drying, a permanent coating or surface remains on the board.

A vinyl solution in a solvent is then utilized and is of the following composition:

	Parts by weight
VYNS	10.
Triethylene glycol di-2-ethylhexoate	1.5
Acetone	50.
Methyl ethyl ketone	50.

The latter solution is sprayed on the grain side of a wet tanned calfskin.

The wet freshly sprayed skin is thent slicked out (grain side down) upon the resinous dry coating previously applied to the plywood and it is held to that coating by the primarily cohesive bond existent between the coats during the drying

operation. The bond between the skin and the coating sprayed on the skin is primarily cohesive during the first portion of the drying step but it becomes primarily adhesive or mechanical as the proper degree of dryness in the leather is achieved.

After the skin has become dry (the drying step itself is carried out in a conventional manner—i. e.—by passing air over the skin) it is stripped away in a clean condition from the backing member, and the two coherent vinyl coatings or films remain together and on the backing member.

The vinyl coatings multiply on the board as consecutive skins are treated and the board is ultimately replaced by a new board or its surface must be made smooth by some mechanical means in order to continue with the treatment of other skins.

The primarily cohesive or chemical bond formed at the interface between the hard coating of the board and the adhesive sprayed on the leather is great and the primarily adhesive or mechanical bond formed between the dried skin and its sprayed coating, on the other hand, is relatively weak as there is only a slight mechanical penetration of the vinyl resin into the skin. The solvents in the adhesive readily penetrate the wet skin but do not increase the bond strength and the resin precipitates because of the water diluting the solvent. The resin therefore does not penetrate sufficiently into the leather to result in a too secure bond during or subsequent to the last portion of the drying operation.

Example 2

Regenerated cellulose (non-moisture-proof) is joined to a paper board by means of a suitable cement.

A wet tanned calfskin is coated (on its grain side) with a 3% solution of 4000 cps. methyl cellulose. This material is a paste of high viscosity.

The coated side of the wet skin is then placed on the cellulosic covering of the board and is slicked into extended condition.

The leather, while extended or stretched out, is dried to an air-dry condition after which it is separated or stripped from the board in a clean state.

The board may be restored to its original condition by washing with water.

Example 3

A polyvinyl alcohol film (#4301 made by the Reynolds Metals Co., Gary, Indiana) is stretched across the face of a metal plate and mechanically attached to the margins only of the plate.

A wet tanned calfskin is treated with a paste as in Example 2 but the paste is changed to a 3% solution in water of a sodium salt of carboxymethyl cellulose and the skin is slicked out upon the polyvinyl alcohol film.

After the skin is dried it is stripped off in clean and smooth condition.

The cellulosic material of the paste is made by the Du Pont Co. and is called CMC Grade 4WH.

Example 4

A rigid plate or sheet of hardened casein ($\frac{3}{16}$'' thick) is sprayed with a solution of casein and ammonia in water in the following proportions (mixed cold):

Casein	gms.	10
Concentrated ammonia	cc.	20
Water	cc.	200

The grain side of a wet tanned calfskin is placed on the sprayed surface and the skin is slicked out and dried while thus extended.

After drying, the skin may be stripped off the plate in clean condition and the plate may be washed off with water.

Example 5

A rigid sheet of polyvinyl alcohol resin is molded of the following composition:

	Parts by weight
Elvanol Type 72-51	50
Elvanol Type 50-42	50
Glycerine	10

Various grades of polyvinyl alcohol are provided by the E. I. du Pont de Nemours & Company Inc. of Wilmington, Delaware, under the trade name of Elvanol.

Water is sprayed upon a smooth surface of the rigid sheet and a wet tanned calfskin is slicked out upon the wet sprayed surface.

Air is passed over the skin until the moisture has been removed from the latter to a satisfactory extent.

The dried skin is then easily stripped from the rigid sheet or backing member with a minimum loss in shrinkage and with a clean and smooth grain surface.

The rigid sheet of polyvinyl alcohol may be reused for subsequent skins until the surface of the sheet becomes rough after which it must be made smooth or a new sheet provided.

Example 6

A piece of plywood is covered with a thin coating of Geon polyblend latex 550 x 20 and the coating is dried thereon. This latex is a water dispersion of polyblend particles produced by the B. F. Goodrich Chemical Company of Cleveland, Ohio.

A wet tanned calfskin is then sprayed with the same latex and before the latter has dried the skin is slicked out with its latex coating in contact with the dried latex coating on the plywood. If desired, the latex coating may be sprayed or placed on the dried coating of the plywood board instead of on the wet skin.

When the skin has been brought to an air-dry condition by passing air over it, it is stripped from the plate in clean condition.

The latex coatings will multiply on the board as consecutive skins are treated until the surface of the plate becomes unduly irregular in which event a new board should be substituted or the coatings should be removed before additional skins are dried.

Example 7

This example is best understood with reference to Fig. 3 of the drawing.

A rigid stainless steel plate is lightly sprayed with a primer coating **32**. A solution of chlorinated rubber and neoprene containing conventional mineral filler is used for the primer but any primer may be used which will adhere to the type of material used in the drying board. The primer coating is dried.

An alcohol water solution of water sensitive polymeric amide (Type 8A1 DV45 Nylon of the du Pont Co.) is then sprayed over the primer coating and dried in the form of a smooth layer **34**.

A paste **36** is then applied by brush to the grain side of wet calfskin. (It may be applied to the

layer **34** only or to both the skin and the layer **34**.) The paste is a 3% solution of 4000 cps. methyl cellulose.

The calfskin or leather **38** (when wet) is slicked out on the board so that the paste **36** holds it in extended and smooth condition.

Air is passed over the leather **38** until the latter is dried.

The leather is then stripped from the board in a dry and clean condition.

The board may be washed and cleaned of the paste **36** and a new coating of paste applied for the next skin to be dried.

The conditions of temperature and humidity during the drying step in any of the examples may be varied and are not critical except to secure optimum conditions but the present method appears to operate most advantageously for all examples tried when the humidity of the air in the drying chamber is about 40 to 80% and when the temperature is approximately or in the neighborhood of 140° F. These two conditions are the ones usually deemed necessary in the conventional methods of drying leathers.

The unique advantages of applicants' method of paste drying and their novel drying board may be said to be due to the bonding characteristics of the adhesive employed with relation to wet and dry leather on the one hand and to the drying board on the other. Applicants have used the terms "chemically compatible," "chemically incompatible," and "mechanical bond" in the description of the invention as given above. The matter may be considered from a different but consistent viewpoint. In the earlier stages of part of the drying operation the liquid in the paste (which liquid may in some cases be water) adsorbs approximately equally well to the leather and to the drying board surface. This provides the cementic property essential for the holding of the wet skin. As the liquid or water gradually evaporates from both the leather and the paste during the leather drying operation, it withdraws first from that material to which it is held by the smaller affinity or energy of adsorption. During the early stages of the drying operation, the leather and the adhesive are both wet. At that time, water alone would serve as an adhesive and it would continue to so serve until the free water content of the leather has approached 30% by weight. At later stages water alone obviously would not serve because it evaporates off. The colloidal adhesive necessarily used, because of its plasticity when first applied, retains its holding power on the gradually drying leather by virtue of its mechanical interlocking with the leather surface. The plasticity of the adhesive during the early stages may be increased by the addition of solvent, plasticizer or resin or by a dispersion of the adhesive in water or some other medium. The higher the plasticity the better the penetration of the leather surface ultimately to form the necessary mechanical bond. As the liquid withdraws from the leather and the adhesive, the mechanical bond referred to forms and is increasingly relied upon to hold the leather and adhesive together. Simultaneously and at the other interface, the bond between the board surface and the adhesive remains strong and is relatively unaffected by the loss in plasticity in the adhesive as the nature of the materials involved gives rise to a permanent and molecular cohesive bond which is primarily chemical.

The essence of the invention resides in the firm or strong adherence of the paste or cement first to the leather and board and then to the board only. It is a cementing by wetting whereby the wetting material would first withdraw from the less wettable surface. There is some similarity in theory of operation to the well-known procedure of transferring ornaments from so-called transfer papers to other surfaces. Being essentially based on differential wettability, the process is not limited to aqueous pastes. Any number of colloidal liquids of suitable viscosity to be termed adhesives or pastes may be used which would wet leather appreciably less than the board. The wetting ability may be determined, as is usual in the applications of surface chemistry, by the so-called "contact angle." It may be seen, therefore, that cements should be selected from those of suitable viscosity to serve as adhesives and which fall within the proper ranges of cements of differential contact angles.

The above explanations of the theory or theories involved are offered and advanced better to explain the nature of the invention but it is to be understood that the validity of the invention in no wise depends upon the correctness or incorrectness of those explanations.

When "skins" are referred to herein it is understood that either hides or skins are included within the meaning of that term. The single term is used in order to avoid excess verbiage.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. A method of drying leather which comprises providing a rigid drying board having a dried under coating applied in the form of a solution of chlorinated rubber and neoprene and a second dried coating of a water-sensitive polymeric amide, slicking out a wet leather work piece upon said second coating with an interposed coating in the form of a paste of methyl cellulose, passing air in contact with said work piece to dry the same, and stripping the dried work piece from the board in clean condition.

2. A method of drying leather which comprises providing a rigid drying board having a dried under coating applied in the form of a solution of chlorinated rubber and neoprene and a second dried coating of a water-sensitive polymeric amide, slicking out a wet leather work piece upon said second coating with an interposed coating in the form of a cellulosic paste, drying the said work piece thereby lessening the cementic property of the cellulosic paste with respect to the leather, and thereafter stripping the dried work piece in clean condition from the board.

ARTHUR R. OLSON.
EDWARD B. McMILLAN.
WILLIAM H. DAVIS, III.

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