July 25, 1944. W. M. CUTLER 2,354,200

METHOD OF DRYING HIDES AND SKINS

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Fig1

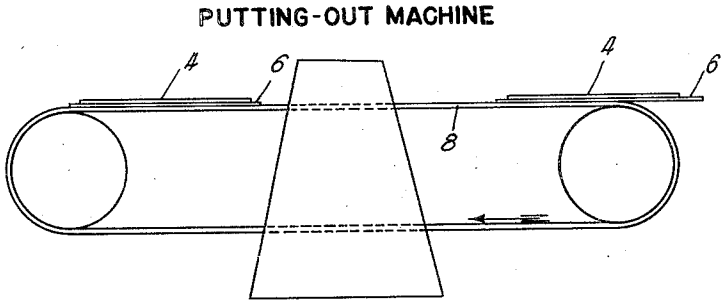


Fig2

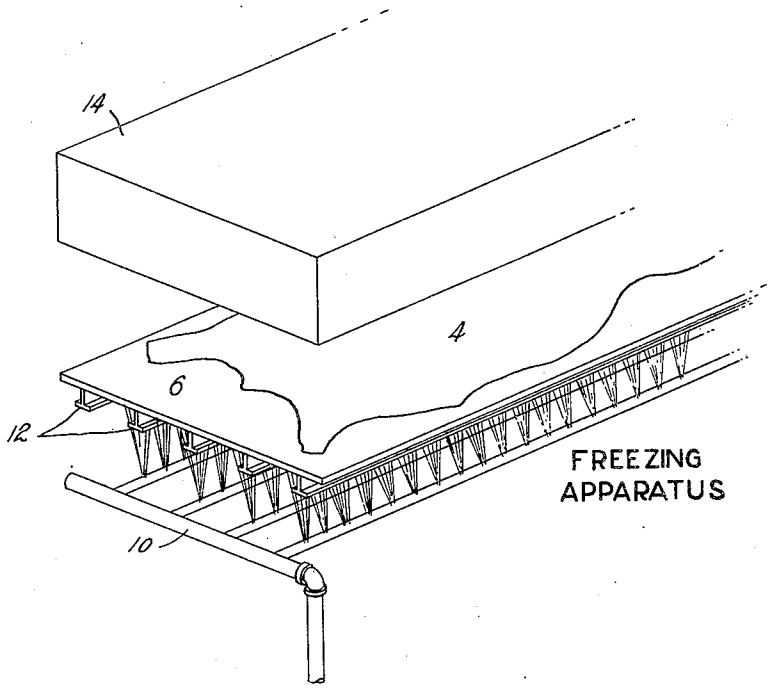
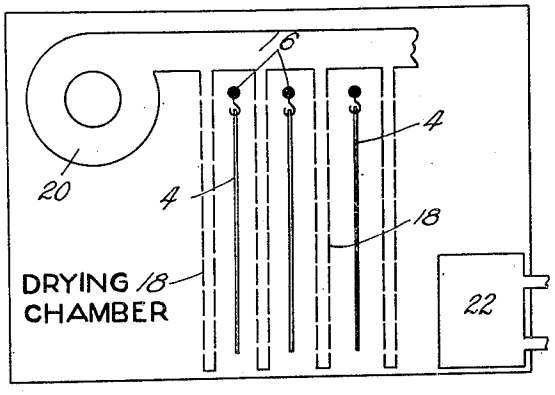


Fig3



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METHOD OF DRYING HIDES AND SKINS

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14 Claims. (Cl. 69—21)

This invention relates to drying operations upon tanned hides and skins. More specifically, the invention relates to methods of drying leather which involve the step of freezing moist or wet leather and then drying it at sub-freezing temperatures. Invention is also to be recognized as residing in tanned hides or skins prepared as articles of commerce in accordance with the new method. While the invention is illustrated with reference to certain special means for preliminarily removing excess moisture, then freezing the tanned hide or skin, and subsequently removing moisture from the hide or skin while the latter is still in frozen condition, it is to be understood that machines and/or apparatus other than those disclosed in the drawing may be employed for carrying out the method.

It is an object of this invention to dry tanned hides and skins to any desired degree and at the same time to minimize loss of area by shrinkage. Another object is to improve the quality of the leather in matters of color, flexibility, softness and thickness. It is a further object of the invention to control the various steps of the method in such manner as to secure variations in the quality and characteristics of the leather and in the degree of moisture present therein at the end of the operation.

In the practice of my invention, a tanned hide or skin is provided which is maintained wet or damp to a degree which is usual in conventional pretanning steps, tanning and the usual subsequent steps such as fatliquoring or coloring. The damp hide or skin is frozen at a temperature, regulatable to secure the desired results, and such hide or skin is then dried while it is still at a sub-freezing temperature. As a result of the freezing operation the hide or skin substance is expanded, due to the presence of water crystals formed in the spaces or interstices between the fibers and fibrils of the hide or skin substance. Apparently the slower the freezing operation the larger the ice crystals will be and hence the greater the expansion of the interstices or spaces in the hide or skin substance, with the result that the slowly frozen leather is usually plumper and softer than a similar piece of leather subjected to quick freezing. In any case, leather which is frozen and then dried at sub-freezing temperatures will be lighter in color, since there is little if any tendency for the tanning material to travel to the surface of the leather, as often occurs, particularly in air-drying of heavy leather such as hides intended for sole leather and belting. Since the tanning material does not, by my method of drying, become concentrated in and on the grain surface of the hide or skin, the latter is distinctive for its fine appearance and good quality and does not exhibit any tendency to brittleness and cracking.

I have found that leather frozen at a temperature of about —110° F. contains relatively small ice crystals and that such leather is of a softness and flexibility which makes it especially desirable for use in shoe uppers and as garment leather. It is to be understood, however, that in all cases the frozen leather should be dried while maintained at sub-freezing temperatures, it having been found that drying at a temperature in a range between about 15° F. and about —22° F. produces very satisfactory results.

The advantages of this method of drying leather apply equally as well to heavy hides as to the lightest skins, it being understood that variations in the freezing temperatures of predetermined extent are utilized to secure certain desirable qualities in the different kinds of leather.

In order to secure a fine appearance on the grain surfaces of the hides or skins undergoing treatment, the latter are preliminarily slicked out upon smooth plates of a suitable size. Since it is now contemplated to apply a refrigerant to the plate, the latter is made of a suitable heat-conducting material such as metal, so that the temperature of the hide or skin thereon may be quickly reduced to the desired freezing point. During the freezing operation, it is preferably in most cases to use a presser member to maintain the hide or skin in a flat condition and with the grain surface thereof smoothed out in good contact with said presser member or said plate to obtain a grain surface having desirable characteristics. It is to be understood, however, that the hide or skin may be placed on a board of wood or other insulating type of material and then frozen by passing over the exposed surface thereof air at sub-freezing temperatures.

While the water content of the leather may be removed at sub-freezing temperatures by any one of several methods, it is contemplated to blow dry air over both surfaces of each hide or skin while the latter is supported in a drying chamber wherein the temperature is in a range between about 26° F. and about —20° F., it being understood that a suitable dehumidifier will be provided within the chamber to extract the moisture from the air substantially as rapidly as it is taken up from the hides or skins. For this purpose, a compound compression dehumidifying system may conveniently be provided.

It will be noted that, in the foregoing para-

graphs, the advantages of the method are stated in terms of improvements in the qualities and characteristics of the leather produced in the practice of the method. From another viewpoint then, the invention resides also in a new and improved article of manufacture produced in practising the method.

These and other important advantages and characteristics of the method and of the product will now be described in detail in the specification and then pointed out more particularly in the appended claims.

In the drawing,

Fig. 1 is a diagrammatic view of one type of putting-out machine useful for spreading hides and skins out in extended condition upon metal plates, considerable moisture also being removed during the putting-out or slicking-out operation;

Fig. 2 is a diagrammatic representation of a freezing apparatus in which a hide or skin on a metal plate is frozen while in extended condition; and

Fig. 3 is a diagram of a drying chamber in which the hides or skins are dried at subfreezing temperatures.

In tanning operations upon hides and skins, the latter are commonly subjected to treatment by tanning solutions in stationary tanks or in rotary drums. At the end of the tanning operation, in which the hide or skin is thoroughly permeated with the tanning solution, there remains in each hide or skin a substantial quantity of water. Commonly, skins are removed from the tank or drum at the end of the tanning operation and are then horsed up for a number of hours, usually overnight, thus securing the advantage of a setting of the tanning material on the hide or skin fiber. In some cases these damp or wet skins are reintroduced into a drum or tank for treatment by coloring solutions and in other cases they are dried and stored away in the "crust" until orders are received for leather of a certain color. When the skins are to be dried, following tanning or tanning and coloring operations, they are taken from the drum and passed through a putting-out machine of any of the well-known types.

In the practice of the present method, these skins 4 will be put out upon metal plates 6 carried under suitable putting-out devices (not shown) by an endless belt 8, as indicated in Fig. 1 of the drawing. Large skins and heavy hides will, as usual, be put out on large metal plates by hand-slicking operations.

Each hide or skin on its plate is then introduced into a freezing apparatus which may conveniently be of the type indicated in Fig. 2 of the drawing, wherein a brine solution at about —45° F. is sprayed by a spraying device 10 upon the lower surface of each metal plate 6 to freeze the hide or skin quickly. As shown, the plate 6 is supported by T-shaped rods 12 and said hide or skin is preferably held flat on the surface of the metal plate by a presser member 14 which operates also to secure uniformly good contact between the hide or skin and the metal plate. Somewhere at temperatures well below freezing, the hide or skin separates from the metal plate, due apparently to contraction of the metal plate and expansion of the frozen hide or skin, so that it may be readily lifted from the plate to be placed in a drying chamber (Fig. 3). The freezing operation may be quickly performed (in about three minutes or less) at temperatures of about —45° F., although such operation may be conducted anywhere in the range between about 10° F. and about —110° F. depending on the thickness of the leather, its density and other characteristics, and the results desired.

In order that the hides or skins may be dried as quickly as possible within the range of temperatures mentioned, it is desirable so to dispose them that both surfaces of each hide or skin are exposed for drying purposes. Conveniently, therefore, the hides and skins are taken from the plates 6 and are hung up on conveyors 16 in spaces between perforated members 18 through which air at sub-freezing temperatures is directed against the opposite surfaces of each hide or skin. Since hides and skins contain certain salts and organic matter in solution, the freezing point for any given hide or skin varies somewhat from others, even in the same batch, but is always substantially below 32° F. As shown, the air is circulated inside of the closed drying chamber by means of a blower 20, and the moisture taken from the leather is removed from the air by a dehumidifier 22, such as a unit or units of the well-known compound compression dehumidifying system.

In order to insure that the moisture is removed from the leather by a process of sublimation, that is, of evaporation while the moisture is maintained in the solid form, the temperature in the chamber is kept at about 15° F. However, this temperature may vary within a range between about 26° F. and about —20° F. It is likely that drying performed at a temperature or temperatures relatively high in the given range will prove to be more economical than at a lower temperature. It will be readily understood that the rate at which hides or skins are dried may be regulated by the amount, and the temperature, of air circulated in the drying chamber, by the rapidity of its circulation, and by the amount of the dehumidifying agent or the effect of the latter in whatever form it may be provided. It will be understood also that the drying of leather by this method will not usually be continued to the point where it may be said to be "bone-dry," this for the reason that all hides and skins readily take up moisture from the atmosphere and vary in their water content from day to day. Hence, ordinarily, leather will be dried to a point where at it contains moisture in the range of about 8% to 12%, that is, until it reaches what is commonly termed an "air-dry" condition.

As indicated above, the resulting leather, whether a heavy hide or a light skin, is unusually soft and flexible, with a good quality grain surface, plump to the feel, and light in color. It is unusually light in color and free from stains or brittle spots due to the fact that there is no migration of salts or other substances in the hide or skin during drying thereof by sublimation, since there is no travel of water soluble substances by capillary action as in all prior drying methods applied to hides and skins. These characteristics of the leather make it suitable for special purposes. In the case of light skins, the leather therefrom is suitable for upper leather in shoes and for garment leather. In the case of heavy hides, the leather, when otherwise suitable, makes excellent soles for shoes since it is flexible and thus far removed from the hard, board-like sole leather so commonly produced for the market and which must subsequently be subjected to special treatment to provide the desired flexibility. Hides tanned for belting are also especially suited by this method of drying for the purposes intended

since belts made from these hides are of a uniform light color and have sufficient flexibility to avoid cracking of the grain surface and to provide a leather which hugs the pulleys and gives maximum traction effect. In the case of both hides and skins, the slicked-out area is maintained during the described drying by sublimation, the result being a gain in area by this method over similarly tanned hides and skins dried by commonly practiced methods of about 2%. In the case of tanned skins, this gain extends to about 10% over the results secured in drying by the so-called dry tack or toggle method.

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

1. That improvement in methods of drying wet freshly tanned hides and skins which comprises, freezing such a hide or skin quickly, and removing water from such frozen hide or skin while the latter is kept at sub-freezing temperatures until it is dried to an air-dry condition.

2. That improvement in methods of drying wet freshly tanned hides and skins which comprises, putting out such a hide or a skin on a heat-conducting supporting plate, thereby to spread out the hide or skin in extended condition on the plate and to remove a substantial portion of the water content thereof, freezing such hide or skin while in spread out condition on the plate, and then removing about 90% of the water from such frozen hide or skin while the latter is maintained at sub-freezing temperatures.

3. That improvement in methods of drying wet freshly tanned hides and skins which comprises, putting out such a hide or a skin on a smooth metallic supporting plate, thereby to spread out the hide or skin in extended condition on the plate and to remove a substantial portion of the water content thereof, freezing such hide or skin at temperatures within a range between about 32° F. and —20° F., whereby the hide or skin is not only frozen to a stiff boardlike condition but due to contraction of the metallic plate and expansion of the hide or skin under such condition and at such temperatures the latter becomes free from its supporting plate so that it may be readily removed therefrom, and then removing water from such frozen hide or skin while the latter is still at sub-freezing temperatures.

4. That improvement in methods of drying wet freshly tanned hides and skins, which comprises putting out such a hide or skin upon a smooth heat-conducting plate, thereby to spread out the hide or skin in extended condition on the plate and to remove a substantial proportion of the water content thereof, freezing such hide or skin while in spread out condition on the plate, removing the hide or skin from the plate, and blowing air at subfreezing temperatures over both surfaces of such hide or skin to remove nearly all of the water therefrom.

5. That improvement in methods of drying a freshly tanned or a freshly tanned and colored hide or skin, which comprises putting out such a hide or skin on one surface of a smooth metal plate, thereby to spread it out in extended condition and to remove a substantial proportion of the water content thereof, subjecting the opposite surface of the metal plate to the action of a refrigerant, thereby to freeze the hide or skin on the plate, removing the hide or skin at the end of the freezing operation, and then subjecting both surfaces of such frozen hide or skin to treatment by a process of evaporation at a sub-freezing temperature, thereby drying such hide or skin.

6. As a new article of manufacture, a tanned dried hide or skin prepared in accordance with the method of claim 1.

7. In a process of treating hides or skins to minimize the loss of area by shrinkage, which comprises maintaining the hides or skins in a damp or wet condition during the conventional pretanning and tanning steps and subsequent steps such as fatliquoring and coloring, subsequently freezing the said damp or wet hides or skins under controlled temperature conditions, removing frozen moisture in the hides or skins by sublimation by subjecting them to a flowing medium under a sub-freezing temperature whereby loss of area is minimized in the drying of the hides or skins, and then removing the hides or skins from the flowing medium after they have reached a substantially air-dry condition.

8. In a process of treating hides or skins to minimize shrinkage, which comprises providing a tanned hide or skin maintained in a wet or damp condition throughout the tanning and subsequent steps such as coloring, putting out the wet hide or skin upon a smooth plate thereby to spread out the hide or skin in extended condition on the plate and to remove a substantial proportion of the water content thereof, freezing such hide or skin while in spread-out condition on the plate, removing the hide or skin from the plate, and then removing water in the hide or skin by sublimation to reduce shrinkage by subjecting the hide to a flowing medium under sub-freezing temperature.

9. The process of claim 8, including the step of maintaining the hide or skin in firm contact with the smooth plate by applying pressure thereto, and freezing the hide or skin while under such pressure.

10. In a process of treating hides or skins, which comprises keeping a hide or skin in a wet or damp condition during the tanning step and subsequent finishing steps, and in a subsequent operation putting out the wet or damp hide or skin with the grain surface upon a smooth heat-conducting plate, thereby to spread out the hide or skin in extended condition on the plate and to remove water therefrom, applying pressure to the moist hide or skin on said plate whereby the grain surface of the hide or skin takes its appearance from said plate, freezing such hide or skin while in spread-out condition on the plate, removing the hide or skin in frozen condition from the plate, and removing moisture from the hide or skin by sublimation by subjecting the hide or skin to a flowing medium under sub-freezing temperature.

11. In the process of treating hides or skins to minimize the loss of area by shrinkage, which comprises maintaining the hides or skins in a wet or damp condition during the conventional pretanning and tanning steps, subsequently freezing the said damp or wet hides or skins under controlled temperature conditions, removing frozen moisture in the hides or skins by sublimation by subjecting them to a flowing medium under a sub-freezing temperature whereby loss of area is minimized in the drying of the hides or skins, and then removing the hides or skins from the flowing medium after they have reached a substantially air-dry condition.

12. In a process of treating hides or skins to minimize shrinkage, which comprises providing

a tanned hide or skin maintained in a wet or damp condition throughout the conventional steps of tanning, putting out the wet hide or skin upon a smooth plate thereby to spread out the hide or skin in extended condition on the plate and to remove a substantial proportion of the water content thereof, freezing such hide or skin while in spread-out condition on the plate, removing the hide or skin from the plate, and then removing water in the hide or skin by sublimation to reduce shrinkage by subjecting the hide to a flowing medium under sub-freezing temperature.

13. The process of claim 12 including the step of maintaining the hide or skin in firm contact with the smooth plate by applying pressure thereto, and freezing the hide or skin while under such pressure.

14. The process of treating hides or skins, which comprises keeping a hide or skin in a wet or damp condition during the preliminary steps of tanning and the tanning step, and in a subsequent operation putting out the wet or damp hide or skin with the grain surface upon a smooth heat-conducting plate, thereby to spread out the hide or skin in extended condition on the plate and to remove water therefrom, applying pressure to the moist hide or skin on said plate whereby the grain surface of the hide or skin takes its appearance from said plate, freezing such hide or skin while in spread-out condition on the plate, removing the hide or skin in frozen condition from the plate, and removing moisture from the hide or skin by sublimation by subjecting the hide or skin to a flowing medium under sub-freezing temperature

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