

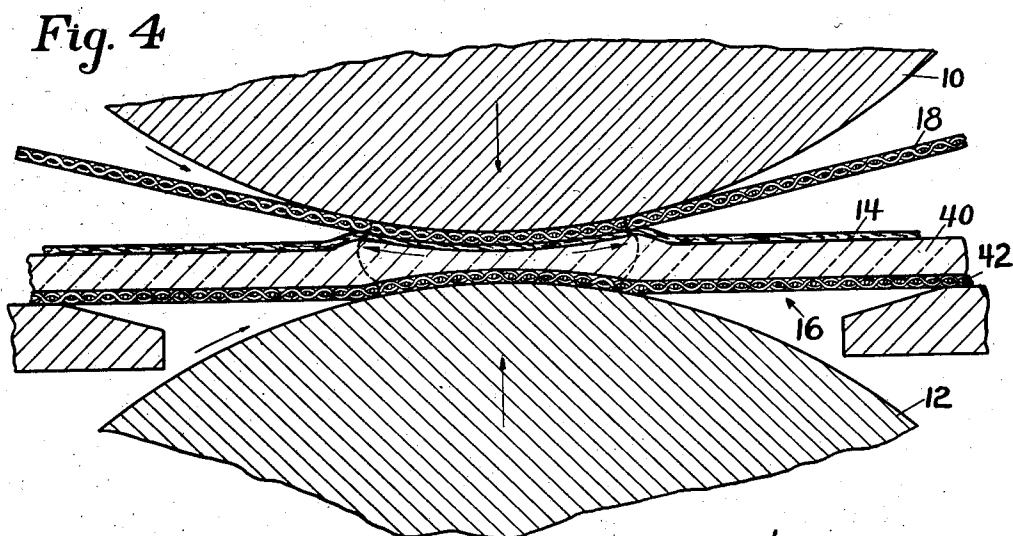
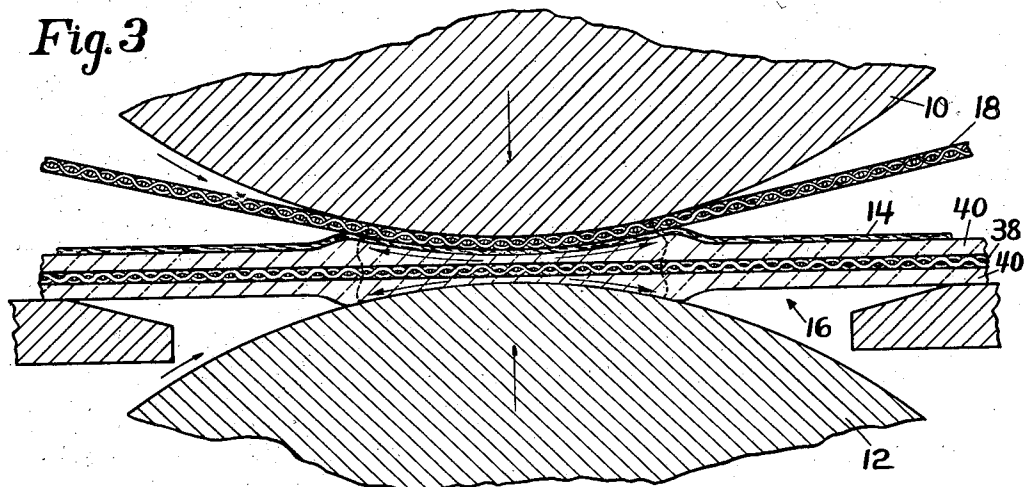
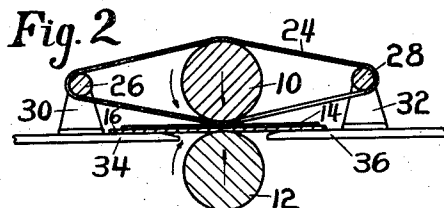
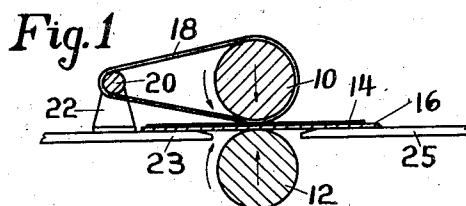
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METHOD OF REMOVING LIQUIDS FROM HIDES, SKINS, AND LEATHER

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METHOD OF REMOVING LIQUIDS FROM
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This invention relates to the removal of liquid material such as water and oils or fats from hides and skins either tanned or untanned. While the invention will be described with reference to the drying of tanned pieces of leather it is to be understood that the invention and various important features thereof may have other applications and uses.

In finishing operations upon skins as heretofore performed, it is common practice to subject the skins, following tanning and/or fat-liquoring operations, to putting-out or wringing operations to remove water therefrom, this being accomplished by means of a suitable machine or, in the case of light skins, by means of a hand slicking tool. In any case the purpose is to smooth out the leather and remove a considerable proportion of the water remaining after the tanning and/or fat-liquoring operations. The skins are then commonly subjected to a drying operation by suspending them from slats carried by a suitable conveyor passing through a drying tunnel or chamber through which hot air is circulated. The purpose of this drying is to set the fiber of the leather. However, in drying, the leather becomes thin, harsh, and stiff and quite unleather-like to the touch. The tanner refers to the leather at this stage as being "in the crust" which clearly connotes the harsh and board-like qualities of the dried leather. This crusty condition of the leather I believe to be due in large part to the speed of drying by evaporation at relatively high temperatures by which a definite amount of case-hardening occurs so early that the skins dry thin and hard. Because of this crusty condition, the leather, before it can be subjected to the necessary finishing operations, must first be dampened back either by dipping it in warm water and then packing down in pits overnight or by placing the pieces of leather in piles with damp sawdust between them and leaving them so overnight. In using either of these methods the purpose is to make the leather uniformly damp without containing an excess of moisture in any part. The next day this leather is staked, utilizing the well-known staking machine which operates to stretch and soften the leather. To conserve as much as possible of the area obtained by the staking operation and to produce a smooth piece of leather the latter is now tacked upon stretching boards or frames by driving tacks all around the periphery of each piece of leather. In carrying out the operation a skin is placed flat on the stretching board and several tacks placed in the

butt end. The neck is then pulled tight and tacked in position following which tacks are driven along the sides, two men usually working together on each skin on opposite sides thereof in order to stretch the skin in opposite directions during the tacking operation. After the tacking operation the skins are allowed to dry. This drying usually takes place in a loft where the frames are supported in a vertical position so that heated air may circulate freely around each skin. The labor required and time consumed in carrying out this work, involving two drying operations, are very considerable and add substantially to the cost of leather manufacturing operations. Furthermore, the drying tunnel or chamber and the loft require much space and the provision of quantities of heated air to effect drying of the skins. Added to this expense is the very considerable one of maintaining the necessary equipment including large numbers of drying frames.

One reason for the large amount of apparatus now being used in the drying of hides and skins resides in the fact that only a relatively small amount of water is removed from hides and skins by wringing or putting-out operations as heretofore practised, and no way of increasing the extraction of the water by these operations was known. Wringing machines as heretofore constructed have usually had burlap wrapped around one or both of the wringing rolls to assist in taking up the water from the surface of the leather. These rolls have always been rotated to pass the work at a rate of at least fifteen feet per minute, and much more often at twenty to thirty feet per minute which were supposed to be the most effective speeds of treatment of the work. However, only a moderate amount of water was expressed from the hides or skins by such wringing operation. This, of course, left a great deal of water to be removed by evaporation, accounting for the use of heating chambers and tunnels and immense amounts of hot air circulated at relatively high speed throughout the drying chamber. So also, where putting-out machines were used, they were operated at a speed of approximately thirty feet per minute and secured the removal of only a moderate amount of the watery content of the hide or skin.

Objects of the invention are to effect the removal of liquid material from sheet material in an improved and novel manner, and more particularly to effect the drying of leather following tanning and/or fat-liquoring operations in an economical and expeditious manner, and to simplify

the method of drying in such a way as to render unnecessary a great deal of the costly and space-consuming apparatus now considered necessary in drying operations. It is a further object of the invention to eliminate entirely a number of time-consuming operations including one drying operation and all of the tacking so necessary in the second drying operation described above. It is a still further object of the invention to improve the quality of the leather and to secure drying thereof in a flat or smooth condition without the use of drying boards.

To these ends and in accordance with an important characteristic of the invention, pieces of leather, which are to have liquid material removed therefrom, are subjected to pressure applied locally, as in such putting-out or wringing machines, but at a relatively very low rate which I have discovered will have the effect of extracting a very large percentage of the liquid, far larger than ever has been done before, and large enough to make unnecessary much of the drying apparatus heretofore used. Conveniently the desired pressure will be applied by a tool moving progressively over the surface of the hide, skin or piece of leather, at a rate not substantially greater than three feet per minute. I have found, for instance, that a piece of leather direct from a tanning vat or drum will have at least 80% of the water expressed therefrom if subjected to rolling by pressure rolls operating at a pressure of about two thousand pounds per square inch and traveling to progress the work therethrough at the rate of about three feet per minute. In some cases, in heavy hides for instance, the rate may be not more than one foot per minute. Of course the speed may be varied somewhat and possibly increased with the application of increased pressure, but in any case at so slow a rate as to express substantially more than 50% of the liquid content of the hide or skin. The important point about the slow rate is that time is given for the water in the hide or skin substance or in the leather to escape from both surfaces thereof, whereas at the speeds at which wringing and putting-out operations have been heretofore performed but little water is expressed and most of the moisture must be taken out in the drying loft by evaporation. While wringing and putting-out operations upon hides, skins, and leather have been carried out by generations of tanners, there has been complete failure to recognize the possibilities of removing water and other liquids in any large amounts from hides, skins and leather through the operation of wringing and putting-out machines. This fact accounts for all the extensive equipment and costly operations that have been universally employed in drying operations upon hides and skins following wringing and/or putting-out operations.

After the hide or skin has been rolled to express the water to the desired amount, it is hung up to dry in a chamber at ordinary room temperatures, the hide or skin being simply suspended at several points from one edge thereof, that is, without tacking and/or stretching on drying boards. Furthermore, the drying proceeds preferably without the application of heat and of currents of air to expedite evaporation from the surfaces of the hides or skins. In other words, evaporation is permitted to take place slowly with a corresponding absence of shrinkage and hardening of the surfaces of the hides or skins.

Not only is much more water removed from the hide, skin or piece of leather by the use of

my method but a highly improved product is obtained as compared to the drying obtained by evaporation in the heated chamber and loft. Apparently the water obtained by pressure treating a hide or skin or piece of leather according to my method is removed not from the hide or skin fibers but from the intercellular or interfibrillar spaces. These spaces are understood to be filled, in the untreated hide or skin, with a "cement-substance", of which the nature is unknown, but which seems to be removed in the liming performed as a preliminary to the unhairing operation. Hence in the drying operation, as I practise it, which takes place by evaporation while this piece of leather is suspended at ordinary temperatures in a suitable room, the moisture comes from the fibers and is given up only gradually through a slow process of equalization of moisture content from the innermost to the outermost layers of fibers upon the surfaces of the leather. It is likely that the fibers and fibrils are surrounded by water vapor in the intercellular or interfibrillar spaces so that drying of the leather takes place under ideal conditions with the moisture uniformly distributed throughout the leather substance and decreasing uniformly in amount until the desired state of dryness is reached. It is thought likely that the water vapor in the said spaces tends to expand the spaces during the slow drying of the leather at room temperatures, thus returning the leather to its normal thickness. In any event it is certain that the leather dries in a remarkably soft, plump, and flexible condition far removed from the thin and crusty leather obtained by drying in accordance with prior methods so long practised in the tanning industry.

In practising my method a hide or skin is spread out, with reasonable care, grain surface down upon a sheet of rubber-like resilient material and both hide or skin and the sheet of resilient material passed through the presser rolls at a relatively low speed. Not only is a very large percentage of water expressed from the hide or skin during its passage through presser rolls but it is stretched to a certain degree through the action of the rubber-like material which is displaceable in opposite directions in and from the seat of greatest compression between the rolls. Since the grain surface is in contact with the sheet of rubber-like material there is a distinct tendency to extend the grain surface of the hide or skin to an extent greater than the flesh surface thereof. This preliminary stretching of the grain surface of the hide or skin offsets the tendency of the grain surface to contract more than the flesh surface during the drying operation. Hence, the hides or skins dried in accordance with this method remain at the end of the drying operation in a flat condition in marked contrast to the curling and folding of hides or skins toward the grain surfaces thereof when dried in accordance with prior methods and unattached to stretching boards.

Preferably, a sheet of canvas or other suitable fabric or sheet material non-resilient under ordinary pressures, is used in engagement with the exposed flesh surface of the hide or skin, spread out on the sheet of resilient material, while the hide or skin is subjected to the rolling operation, the purpose of the canvas or other sheet material being to permit adjustment of the hide or skin to the action of the presser rolls, and particularly of the upper roll, whereby folds or slack places and minor wrinkles in the hide or skin are ef-

faced during the rolling operation through spreading out of the hide or skin under the upper layer of canvas or other non-resilient sheet material. It is usually preferable promptly to lift the fabric away from that portion of the upper surface of the skin to which pressure has been applied, to permit free escape of the expressed liquid and to limit the amount taken up by the fabric layer so that the latter may be used over and over again.

In certain cases it is preferable to begin the rolling operations at or adjacent to the backbone line of the hide or skin and move toward the thinner flank portions, since by this operation the water is removed more uniformly and expeditiously by being caused to move progressively from the denser and thicker portions of the hide or skin toward the lighter- and looser-textured portions of the flanks. Having completed rolling operations on one-half of the hide or skin, the rolls may be separated and the hide or skin reintroduced with its middle portion between the rolls to treat the other half of the hide or skin, the rolling being started so as to overlap somewhat the path of the rolls in the first operation whereby the denser portions of the hide or skin along the backbone line receive two pressing and rolling operations to insure removal of watery contents to the same degree as in the lighter portions of the same hide or skin.

These and other important characteristics of the invention 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 sectional view through a presser roll machine suitable for practising the method described and claimed herein;

Fig. 2 is a view similar to Fig. 1 showing a modification of the upper work engaging member;

Fig. 3 is an enlarged section showing a piece of work in position between upper and lower work contacting members; and

Fig. 4 is an enlarged view of the presser rolls of Figs. 1 and 2 showing the action of the resilient rubber-like material on the work.

For practising the invention there will conveniently be provided a machine comprising two presser rolls 10 and 12 suitably mounted in the frame of a machine (not shown). These rolls are hard-surfaced and may be made of steel. The rolls will be driven in opposite directions to feed pieces of work therethrough at a rate of substantially three feet per minute. Means (not shown) is also provided for adjusting the roll 10 toward or from the roll 12 to determine the pressure at which rolling operations will be performed upon different classes of work.

In performing a rolling operation upon a hide or skin 14, the latter will be spread out upon a sheet of rubber-like resilient material such as that provided by a sheet 16 of rubber composition. Extending around the upper roll 10 is a fabric belt 18 which may be of canvas or of other material having sufficient tensile strength and substantially non-resilient at ordinary pressures. As shown, this belt passes around an idler roll 20 (Fig. 1) supported by brackets one of which is shown at 22, the idler roll 20 being so positioned as to lift the fabric belt 18 away from the upper surface of the piece of work 14 shortly after said belt has passed off of the roll 10 in the direction of travel of the work. This arrangement is for the purpose of facilitating escape of liquid from the upper surface of the

piece of work closely adjacent to the roll 10, and for the additional purpose of limiting the amount of liquid taken up by the fabric belt 18 so that the latter may not become unduly filled with moisture. The purpose of the fabric belt 18 is primarily not to take moisture from the upper surface of the piece of work 14. It fulfills a more important function is assisting to spread out the piece of work 14 in advance of the rolls 10 and 12.

In Fig. 2, a belt 24 extends around two idler rolls 26 and 28 supported by brackets indicated at 30 and 32, respectively. By having the belt 24 supported by two idler rolls on opposite sides of the presser roll 10, the belt is lifted away from the work on each side of the presser roll 10 so that it is immaterial in which direction the work is fed through the machine.

After a piece of work 14 has been spread out upon the sheet or mat 16 the assembled work and sheet are shoved over a table 34 until the forward edge of the assembled work sheet is engaged by the rolls 10 and 12. During the rolling engagement of the presser rolls 10 and 12 with the work, water and/or other liquid material is expressed from the piece of work due to the pressure of the rolls upon the work. By having the rolls 10 and 12 travel at a relatively low rate of speed, time is given for the liquid material to escape from the upper and lower surfaces of the piece of work. After the work has passed entirely through the presser rolls 10 and 12 it is removed and a fresh piece substituted therefor, the new piece of work and the sheet 16 being properly assembled with respect to each other upon a work support 36 positioned to receive the work as it passes from left to right through the presser rolls 10 and 12. With the new piece of work in place the latter and the sheet 16 are shoved to the left (in Fig. 1) to engage the rolls 10 and 12 which are now revolving to feed the work in the opposite direction. For a more detailed description of a machine embodying presser rolls arranged to be driven alternately in opposite directions see application Serial No. 610,918, filed May 12, 1932, in the names of John H. Connor and Matthew M. Merritt.

In some classes of work, as for instance, with fine kid and goat, it may be desirable to express the water or other liquid material from the skins by having presser rolls 10 and 12 travel always in the direction from the denser backbone portions of the skin toward and over the softer and looser flank portions of the skin. In order that this may be readily accomplished the lower roll 12 will be so mounted, as for instance by a toggle, that it may be lowered at the will of the operator to permit the piece of work to be shoved into place on the sheet 16 with the backbone line of the skin closely adjacent to or in the plane joining the axes of the rolls 10 and 12. Upon restoring the lower roll 12 to its work gripping position, the presser rolls 10 and 12 are started in rotation and the work fed in one direction or the other to express the liquid progressively in a direction from the denser portions to the looser flank portions of the skin. When this operation has been completed the lower roll 12 is again dropped, by breaking the toggle, and the assembled work replaced with the central portion thereof between the rolls 10 and 12, care being taken to have the work so positioned that the rolls 10 and 12 will engage a treated portion of the work adjacent to the backbone line, the purpose being to insure that no untreated space is left. Furthermore, the denser portions may thus be rolled

a second time to insure removal of the liquid content thereof. When the work has been properly positioned, the roll 12 is restored to position by straightening the toggle after which the presser rolls 10 and 12 are again set in rotation but in the opposite direction to operate upon the remaining portion of the work.

It has been found that upon passing skins through presser rolls 10 and 12 set to give a pressure of approximately two thousand pounds per square inch and rotating at a rate not substantially greater than three feet per minute the liquid content of the skin is removed in the amount of about 80%. With somewhat greater pressure and with a slower rate of travel a greater percentage of the liquid content of the skin may be removed. The pressure should not be so great, however, as unduly to compact the skin since in that case the skin is apt to remain in its compacted or thin condition during drying. It will be understood, furthermore, that there is a distinct relationship between the amount of pressure exerted by the rolls 10 and 12 upon the work and the speed at which the work is operated upon to secure the desired results without unduly limiting production. Hence, it is to be expected that for different classes of work there will be some adjustment of the pressure at which the presser rolls are operated and of the speed of operation, it being understood that in all cases the speed should be such as to permit the liquid content of the hide or skin to escape from the surfaces thereof in an amount substantially greater than 50% of the total liquid content. In the past, as stated above, wringing and putting-out operations have been conducted at too great a speed with the result that only a relatively small amount of water was expressed from the hides or skins. Hence, it was found necessary to remove subsequently a large amount of water by evaporation. In removing this water by evaporation it was the practice to use a great deal of heat and provide for active circulation of the air in order that the drying might be accomplished within some reasonable time. But the use of heat and rapidly circulating air resulted in such rapid evaporation from the surfaces of the hides or skins as to case-harden the surfaces with consequent shrinkage of the hide or skin substance. This prevented any tendency of the hide or skin to expand, as it had a tendency to do due to water vapor pressure therein, and kept the hides or skins thin and crusty. In strong contrast to the results heretofore obtained, the hides or skins dried by applicant's method are relatively soft, plump, and flexible. Since a relatively small amount of water is left in the hide or skin after passing through the described operations for removing the water or other liquid, it is not necessary to hasten the drying by evaporation at high temperatures. It is not only unnecessary but undesirable. If the hides or skins be hung up to dry, after having substantially 80% of the moisture removed therefrom, they will dry slowly at ordinary room temperatures and will become plump, and therefore soft, through expansion of the water vapor in the intercellular and/or interfibrillar spaces, no case-hardening taking place to prevent such expansion of the hide or skin during drying.

Upon passing a hide or skin resting upon a sheet or mat of rubber-like resilient material through presser rolls 10 and 12 the resilient material is displaced laterally in opposite directions

in and from the seat of pressure. This mat 16 may have a layer of fabric 38 (Fig. 3), such as canvas, in the middle plane thereof leaving a layer of rubber 40 to be placed in contact with the hide or skin. Alternatively, the layer of fabric may be on the under surface of the mat 16 as shown at 42 in Fig. 4. Since the hide or skin is resting on the resilient material 40, it is also displaced in opposite directions in and from the line of greatest pressure through the frictional drag of the resilient material in contact with the under surface of the hide or skin. Since the grain surface will be placed in contact with the rubber mat, that surface will get the greater amount of stretch as compared with the flesh surface of the same hide or skin. This is advantageous for the reason that in drying operations upon hides or skins, the latter curl, or tend to curl, invariably toward the grain surface since the latter with its finer and denser fibers tends to contract or shrink more than the flesh surface. But by having the grain surface extended slightly as compared with the flesh surface, as described above, the tendency of the grain surface to contract or shrink more than the flesh surface is offset and hence the hides or skins, treated according to this method, dry practically smooth and flat even while hung up along one edge portion thereof without being supported by drying boards. There is an advantage in using for a work support, instead of a rubber-covered bed roll, for instance, a sheet of rubber-like resilient material to support the hide or skin during rolling pressure thereon in that the resilient material in the sheet expands to a greater degree and more uniformly than the rubber layer on a bed roll. The layer of rubber on a bed roll is arranged on a convexly curved surface and develops stresses and strains of its own when put under pressure.

After a hide or skin has had the desired amount of water removed therefrom, approximately 80% of the total water content of the hide or skin, it is hung up to dry by being suspended along one edge thereof. Since so much water was removed in the pressing operation, there is only a very moderate amount left to remove by evaporation. Hence there is no need for hot air circulated in large amounts to dry the hide or skin in a reasonable time. Preferably the hide or skin is allowed to dry at ordinary room temperatures. In so drying, there is avoided any tendency to case-harden the surfaces of the leather. Time is given for proper evaporation of the moisture content from the fibers of the hide or skin during which the water vapor pressure in the intercellular or interfibrillar spaces maintains the spaces in proper volume whereby the hide or skin remains soft and plump instead of becoming hard and thin as when dried by prior methods. The water vapor in the spaces surrounds the fibers and fibrils of the hide or skin and maintains during the drying operation a "mulled" condition thereof by which the moisture present in the hide or skin remains uniformly distributed. This condition eliminates the tendency to develop stresses and strains due to unequal drying and contributes greatly to the fine results obtained—a soft, plump hide or skin showing little or no shrinkage or distortion.

It is evident that by this method a great deal of the extensive apparatus including drying chambers, tunnels and stretching boards may be discarded and that the process of drying is greatly simplified and performed in a shorter time. Most important of all, the product obtained is better in that it is softer, plumper and more flexible.

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 removing liquids from hides, skins, and leather which comprises the step of passing a hide or skin or other piece of leather between presser rolls at a relatively high pressure and at a relatively low rate of speed timed to permit the liquid content of the hide or skin to escape in the desired amount.
2. That improvement in methods of removing liquids from hides and skins which comprises passing a hide or skin through a pair of presser rolls at a pressure not substantially greater than two thousand pounds per square inch and moving at a rate of speed not substantially greater than three feet per minute to express the liquid content of the hide or skin in the desired amount.
3. That improvement in methods of removing liquids from hides and skins which comprises spreading a hide or skin out in extended condition upon a sheet of resilient rubber-like material, covering the hide or skin with a sheet of canvas, and then passing the assembled hide or skin, canvas and sheet of resilient material through a pair of presser rolls rotating at a relatively low rate of speed timed to permit expression of the desired amount of liquid content of the hide or skin.
4. That improvement in methods of removing liquids from hides and skins which comprises spreading a hide or skin out in extended condition upon a sheet of resilient rubber-like material, placing a sheet of canvas in contact with the upper surface of the hide or skin, and then subjecting the assembled canvas, hide or skin and sheet of resilient material to the action of presser rolls traveling at a relatively low rate of speed timed to permit expression of the liquid content of the hide or skin in the desired amount.
5. That improvement in methods of removing liquids from hides and skins which comprises interposing a hide or skin between a pair of widely spaced presser rolls with the backbone line of the hide or skin in or adjacent to the plane joining the axes of the rolls, causing the hide or skin to travel between the presser rolls, adjusted to exert the desired pressure, in a direction from the backbone line to a side margin of the hide or skin, reintroducing the hide or skin, between the presser rolls while spaced widely to a position where the rolls may engage a part of the denser portion along the backbone line which has already received treatment, and then causing the hide or skin to pass between the readjusted presser rolls in a direction to effect treatment of the other half of the hide or skin.
6. That improvement in methods of removing liquids from hides and skins which comprises passing a hide or skin through presser rolls traveling at a relatively low rate to permit the liquid content to escape in the desired amount, and then hanging the hide or skin up to dry relatively slowly at ordinary room temperatures.
7. That improvement in methods of removing liquids from hides and skins which comprises spreading a hide or skin out in extended condition upon a sheet of resilient rubber-like material, covering the hide or skin with a sheet of fabric and then passing the assembled hide or skin, substantially non-resilient fabric, and sheet of resilient material through a pair of presser rolls rotating at a relatively low rate of speed designed to permit expression of the desired amount of liquid content of the hide or skin.
8. That improvement in methods of removing liquids from hides and skins which comprises spreading a hide or skin out in extended condition upon a sheet of resilient rubber-like material, placing a sheet of substantially non-resilient fabric in contact with the upper surface of the hide or skin, then subjecting the assembled fabric, hide or skin, and sheet of resilient material to the action of presser rolls traveling at a relatively low rate of speed designed to permit expression of the liquid content of the hide or skin in the desired amount, and lifting the fabric away from the upper surface of the hide or skin progressively with the movement of the work through the presser rolls.
9. That improvement in methods of removing liquids from hides and skins which comprises placing a hide or skin, grain surface down, upon a sheet having a layer of rubber-like resilient material in contact with said grain surface, and passing the assembled work between presser rolls at a relatively slow rate of speed timed to permit the liquid content of the hide or skin to escape in the desired amount, the pressure of the presser rolls being such as to displace the rubber-like layer in opposite directions in and from the seat of greatest pressure by which the grain surface of the hide or skin is extended more than the flesh surface thereof, whereby, upon subsequent drying of the hide or skin, the tendency of the grain surface to shrink or contract more than the flesh surface is offset by the described extension of the grain surface.
10. That improvement in methods of removing liquids from hides and skins which comprises placing a hide or skin, grain surface down, upon a sheet having a layer of rubber-like resilient material in contact with said grain surface, and passing the assembled work between presser rolls at a rate not substantially greater than three feet per minute to permit the liquid content of the hide or skin to escape in the desired amount, the pressure of the presser rolls being such as to displace the rubber-like layer in opposite directions in and from the seat of greatest pressure by which the grain surface of the hide or skin is extended more than the flesh surface thereof, and hanging the hide or skin up to dry relatively slowly.
11. That improvement in methods of removing liquids from hides and skins which comprises placing a hide or skin, grain surface down, upon a sheet having a layer of rubber-like resilient material in contact with said grain surface, and passing the assembled work between presser rolls at a rate not substantially greater than three feet per minute to permit the liquid content of the hide or skin to escape in the desired amount, the pressure of the presser rolls being such as to displace the rubber-like layer in opposite directions in and from the seat of greatest pressure by which the grain surface of the hide or skin is extended more than the flesh surface thereof, and hanging the hide or skin up to dry while suspended along a marginal portion thereof.