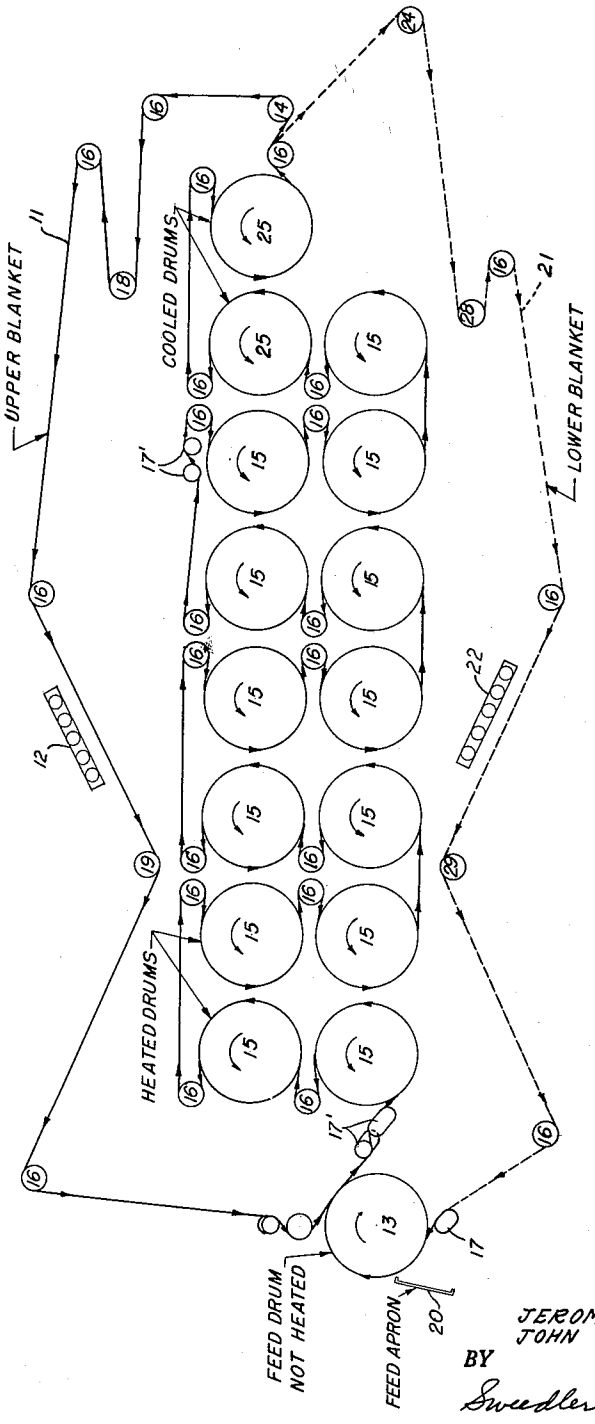
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PROCESS FOR DRYING AND FLEXING OF LEATHER

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PROCESS FOR DRYING AND FLEXING OF LEATHER

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This invention relates to a process for drying and flexing animal skins and hides which are to be mechanically treated to produce soft, pliable and flexible leathers.

It is the present practice to stabilize the protein constituents of animal skins by a suitable vegetable, chrome or other mineral, synthetic or aldehyde tannage in the presence of water. Tanning of those skins utilized to produce soft, pliable leathers, in contra-distinction to the tanning of thick, inflexible cow hides used for sole leather, produces a soft, easily deformable, flaccid material. Such material is thereafter subjected to a "setting-out" operation wherein the aqueous surface liquid is wrung out of the limp skins. In the case of leathers which are to be grain finished, such as fine kid or calfskin, or those to which a grain is to be applied as with cowhide splits, the soft material is dyed to desired hues after setting-out, by immersion in suitable dyestuff baths. In the conventional procedure the leather is thereafter set-out again and dried in an oven such as a tunnel drier wherein the skins are draped over rods or clipped to supports which are slowly moved through the drier. In such driers temperatures substantially below the boiling point of water are employed, higher temperatures being avoided for fear of damaging the leather. Average temperatures of 140° to 145° F. are commonly employed to dry light leathers, the operation requiring about three to four hours, as a rule.

Since leather dried in tunnel driers first loses moisture from its outer surfaces, those strata have been found to become stiff and "boardy," apparently as a result of fusion of the leather fibers as water is removed. Additionally, the aforesaid drying operation results in shrinkage of the skins and consequent loss of usable leather. In order to partially restore the moisture content of the skins to facilitate mechanical treatment of the leather, it has been the practice to "recondition" the leather. The first such conditioning operation, which is known in the field as "crusting," entails piling the dried tanned skins in a room, exposed either to the ambient atmosphere or to an artificially humidified atmosphere, for periods of time varying from 2 to 7 days, depending on the type of leather, to restore and distribute moisture throughout the skins. Conventionally, the skins are then taken out of crust and dampened by a spray or dipping operation termed "wetting back" or "mulling." The dampened skins are piled overnight and are thereafter ready for mechanical flexing operations.

In order to separate the fibers and soften the leather, it has been necessary to flex the moist skins in a "staking" machine. The operation of staking involves the insertion of each skin between two mechanically actuated jaws, one having a rubber roll at its end and the other possessing a bladed opening into which the roll may sink. The skin must be inserted between the open jaws as they approach the operator; as the jaws pull back away from the operator they close and force the leather to flex over the blades and around the rubber roll. After each movement of the jaws, the operator must shift the position of the skin to flex or stake it uniformly. Such operation is extremely difficult and dangerous, necessitating a practised eye and hand to flex and stretch the leather between the jaws of the staking machine, while exerting the correct amount of pressure for the varying skin thicknesses

manipulated. It is not uncommon to fracture the leather grain or to cut the skin by the application of too much pressure between the two moving jaws, thus resulting in costly material losses.

Where leather is to be sueded, the foregoing post-tannage treatments have been conventionally applied to skins prior to dyeing, while in the original "pearl" condition. Thereafter a nap is produced by abrading the flesh side of the skin, the sueded leather is dyed, set-out, crusted, wet back and "milled." The milling operation, which is not applicable to grain leathers, involves dry tumbling a large number of the surface-dampened sueded skins for several hours to soften the skins and to bring up the nap. Milling involves a small shrinkage of the skins and consequent loss of usable area.

It has also been proposed to flex leather while subjecting the material to the action of a treating liquid by passing the wet skins over and under a plurality of rollers which squeeze the surface moisture from the skin in much the same manner as in setting-out. The wet material in such operation is held between a pair of open mesh metal conveyor belts through which may be passed currents of air to partially dry the flexed leathers. Such drying operations, as in tunnel drying, remove water from the surface layers of the leather, thus creating a dried out surface which must be reconditioned and staked. Additionally, the leather must be dried at temperatures well below the boiling point of water to avoid irreparable damage to the skins.

It is among the objects of the present invention to provide a process for drying leather skins quickly and uniformly, without damaging the skins.

It is a further object of this invention to provide a process for drying leather at higher temperatures than hitherto considered possible while retaining on the surfaces thereof sufficient moisture to produce a flexible skin exhibiting mellowness with tightness of grain.

Still another object of this invention is to provide a novel process for drying dyed leather, which will result in the production of color intensities equal to those heretofore obtained upon leather treated with greater concentrations of dyestuff forming reagents.

Yet a further object of this invention is to provide a novel process for simultaneously flexing and drying leather materials, which will produce greater usable quantities of leather than those heretofore obtained, the leather being substantially free of creases and grain breaks, as in the case of grain leathers, and with an improved nap in the case of suede leathers.

Another object of this invention is to provide a process for producing leather which will not require crusting, wetting back, staking or milling operations preparatory to finishing. Accordingly, it is an object of this invention to eliminate the expensive, time-consuming operations of crusting, wetting back and staking or milling.

Other objects and advantages of this invention will appear from the following detailed description thereof.

According to the present invention, the surprising discovery has been made that soft, wet, pliable leathers may be subjected to temperatures well in excess of the boiling point of water to dry and surface condition the leathers without harm thereto, and with many attendant advantages, including the elimination of staking or milling, greater dyeing efficiency, greatly reduced processing time and higher yields of useful leathers. In the process of this invention, sufficient free moisture is first evaporated from the leather to dry it, by exposure to high temperature heat sources, preferably above the boiling point of water, and moisture is then condensed back onto the leather surfaces, preferably by exposure to sources of sub-ambient temperatures, while the leather is simultaneously continuously moved in a sinuous path and maintained

in a wrinkle-free, smooth condition separated from both the ambient atmosphere and the heat sources by thin barriers. The barrier adjacent to the heat source should be heat transmissive, that adjacent to the ambient atmosphere porous and moisture absorbent. Preferably, both barriers possess these properties.

The process of the invention is preferably practiced by pressing wet, flexible leather skins between a pair of porous, heat transmissive, moisture absorbent blankets, conveying the leather between the blankets over a plurality of heated drums to dry the skins while simultaneously continuously flexing and bending the blankets, and conveying the skins over a plurality of cooled drums, while simultaneously flexing and bending the blankets, to restore sufficient moisture to the leather surface layers to facilitate mechanical treatment thereof.

The apparatus preferably employed for practicing the process comprises a series of rotatably mounted internally heated drums, a series of rotatably mounted internally cooled drums, drive means for rotating all of said drums at a predetermined uniform controlled speed, a pair of endless heat transmissive and moisture absorbent belts or blankets between which the leather skins are carried, threaded in superposition, around all of said drums and driven under controlled tension thereby, and guide means for continuously varying the direction of travel of the superposed blankets.

Preferably, means are provided to run the two blankets at different speeds so that a controlled small longitudinal slippage may be instituted in order to create a smoothing or polishing of the leather by the relative motion of the blankets. Such smoothing action acts to eliminate much of the further smoothing operations heretofore necessary during the leather finishing operations.

It is desirable that the blankets be threaded so that the same blanket is always against the source of high temperatures or sub-ambient temperatures whereby the side of the skin to be worked can be in the most desirable condition for working. With grain leathers, the skins are fed with the grain side away from the source of higher temperatures; with suede leathers, the flesh side is kept away from the source of high temperatures.

Reference may be had to the accompanying schematic drawing showing a preferred drying apparatus for purpose of illustration, for practicing the process of the invention.

In the drawing, a feed drum **13** is arranged in sequence with a plurality of internally heated drums **15** and one or more internally cooled drums **25**. The aforesaid drums are suitably mounted for rotation and may all be driven at the same predetermined, uniform speed by gears, chains, belts or direct coupled variable speed motors. A pair of porous drying blankets **11** and **21**, preferably composed of felt or similar heat transmissive, moisture absorbent material, are passed over a feed drum **13** and threaded together over the heated drums **15** and the cooled drums **25** with the assistance of idler rolls **16**. The two blankets are separated by the guide rolls **14** and **24** and are guided back toward the feed drum **13** over a number of idler rolls **16**.

The tension of the two blankets may be regulated by the tension rolls **18** and **28**, controlled by suitable air, hydraulic or other means, not shown. It is preferable to adjust the tension so that the relative longitudinal motion between the drying blankets approximates 0.1% to 2% of the blanket length. Tracking means in the form of the centering rolls **19** and **29**, suitably activated by air, hydraulic or other means, are provided to prevent excess relative lateral movement between the upper and lower drying blankets, as well. The blankets **11** and **21** may be heated in their return passage toward the feed drum **13** by suitable means, as, for example, the infrared heaters **12** and **22**, respectively. The heaters act to drive off the water absorbed by the blankets during their passage over the drums. Additionally, a blanket spreading expander roll **17** or double blanket spreading expander rolls **17'** may be supplied to remove creases or wrinkles in the drying blankets. Conventional Mount Hope rolls may be used for this purpose.

In operation, leather skins, which have been set-out to spread them and wring out excess moisture, are fed over the feed apron **20** onto the feed drum **13**, which drum may rotate at a variable tangential velocity equal to that of the heated drums **15** and the cooled drums **25**. The leather is pressed between the two drying blankets **11** and **21** and is conveyed over the heated drums **15**. The last mentioned drums, which may be axially heated in any conventional manner, are rotated at a uniform speed in a counter-clockwise direction, as may be seen in the accompanying drawing. As the leather passes around each drum and around each idler roll **16**, it is reversed 180° in direction; this continuous change in direction results in considerable flexing and stretching of the leather fibers, preventing the stiffening of the leather as it is dried.

The prototype of the specific embodiment described was operated with 16 drums, each having a 23 inch diameter and about a 60 inch width. The drums were internally heated to approximately 300° F. and rotated at speeds varying from 4 to 20 feet per minute when threaded with a pair of 60 inch wide drying blankets whose total length each approximated 136 feet. It will be understood that the foregoing details are illustrative only, the values being subject to infinite variation depending upon economic as well as technical considerations.

It may be noted that, in the illustrated embodiment, the heat emanating from the interior of the drums **15** always passes through the upper blanket **11** and thence through the side of the leather adjacent thereto, thereby driving the moisture contained in the moist skin through the leather, and removing the water from the surface adjacent the blanket **21**. Thus, the moisture is not initially removed from both leather surfaces as heretofore accomplished, but is rather first removed from one side of the skin treated. Accordingly, it is desirable to place the side of the skin to be finished adjacent the lower blanket **21**.

As the leather passes over the drums it is polished both longitudinally and laterally by the slip induced between the blankets **11** and **21** by the tension rolls **18** and **28** and the centering rolls **19** and **29**, respectively. This polishing action serves to smooth the grain of the leather and minimizes creases therein.

The temperature of the heated drums **15** and the rate of speed of the drying blankets **11** and **21** may be varied in accordance with the type of leather treated, the thickness thereof, the desired wet skin—dry skin weight ratio, etc. When the heated drums **15** are operated at 300° F. while moving the drying blankets at a speed of only 4¾ feet per minute, drying has been achieved in 22 minutes in place of the 3 to 4 hours required by the tunnnel driers formerly used. Higher temperatures permit higher speeds and lower times with the same number of heated drums. Temperatures above 350° F. should be avoided to minimize any possibility of damage to the leather. Temperatures below 212° F. give rather long drying cycles, and are hence economically unsound.

After passing over the heated drums, the leather skins are conveyed to and over the cooled drums **25**, which serve to terminate the evaporative process and retain or restore sufficient moisture to the heated leather skin surfaces. These drums may be cooled in any convenient manner, as, for example, by passing ice water axially therethrough. Alternatively, the drums may be cooled to sub-ambient temperatures or to ambient temperatures when in contact with an artificially humidified atmosphere.

Thereafter, the dried, flexible skins exit from the apparatus at the guide roll **24**, and the drying blankets **11** and **21** are reconveyed to the feed drum **13**.

As illustrative of the improved results achieved by the utilization of the apparatus and process of the present in-

vention, the following non-limiting examples are set forth below.

EXAMPLE I

Approximately 180 dozen pearled goat skins were divided into two groups, each weighing 1500 pounds and including approximately the same number of skins.

The first group of skins was taken from the tannage, set-out, dried in a tunnel drier, crusted, wet-back, and staked. After the staking the total surface area of the skins was measured with a conventional integrating planimeter.

The second group of skins was taken from the tannage, set-out and passed through the drum drier of this invention. Thereafter, the total skin surface area was measured with the aid of a planimeter.

The first group numbered 1,061 skins and averaged 3.63 square feet of surface area per skin.

The second group numbered 1,089 skins and averaged 3.99 square feet of surface area per skin.

Thus, a pearl pack dried and flexed by the system of this invention thereafter averaged approximately 9.92% greater surface area per skin than a pearl pack of the same initial weight, conventionally tunnel dried, crusted, wet back and staked.

EXAMPLE II

Treatment of Tunnel Dried Pearl Skins

The tunnel dried and staked first group of skins of Example I was separated into two sub-groups, each of the same total surface area, aggregating about 2,000 square feet of area in each sub-group.

The first sub-group of skins was sueded (by abrading the flesh side of each skin), dyed, set-out, dried in a tunnel drier, crusted, wet back and milled. Thereafter, the total skin surface area was measured with a planimeter.

The second sub-group of skins was sueded in the same manner as above, dyed, set-out and passed through the drum drier of this invention. Subsequently, the total skin surface area was measured with a planimeter.

The first sub-group averaged 3.28 square feet of surface area per skin whereas the second sub-group averaged 3.47 square feet per skin.

Thus, the color pack dried and flexed by the system of this invention, after drying, averaged approximately 5.8% greater surface area than the color pack of the same initial surface area conventionally tunnel dried, crusted, wet back and milled.

EXAMPLE III

Treatment of Drum Dried Pearl Skins

The drum dried second group of skins of Example I was separated into two sub-groups, each of the same total surface area, aggregating about 2,000 square feet of area in each sub-group.

The first sub-group of skins was sueded (by abrading the flesh side of each skin), dyed, set-out, dried in a tunnel drier, crusted, wet back and milled. Thereafter, the total surface area was measured as in the above examples.

The second sub-group of skins was sueded in the same manner as above, dyed, set-out and passed through the drum drier of the present invention. The total skin surface area was then measured.

The first sub-group averaged 3.34 square feet of surface area per skin whereas the second sub-group averaged 3.65 square feet per skin.

Thus, the color pack dried and flexed by the system of this invention, after drying, averaged approximately 9.28% greater surface area than the color pack of the same initial surface area conventionally tunnel dried, crusted, wet back and milled.

Analysis of the data of the foregoing examples reveals that the leather skins, after drum drying in both pearl and dyed states, averaged 3.65 square feet of surface area per skin while those skins having the same initial surface area (assuming that skins of the same initial weight possess approximately equal initial total surface areas), after tunnel drying in both pearl and dyed states and after subjection to staking, milling and other subsidiary operations, averaged only 3.28 square feet of surface area per skin. Use of the process of this invention throughout the drying and flexing operations performed upon suede leather can therefore be seen to have resulted in an aggregate increase of 11.28% of useful leather surface area produced.

EXAMPLE IV

Dyestuff solutions were prepared to dye suede an intense black. After immersion at 140° F. in dye baths containing the quantities of dyestuffs indicated below, two suede samples were dried, one in the conventional tunnel drier and one in the drum drier of the invention. It was found that the color intensities produced on the dried skins were identical.

In a dye bath made up to dye 2,000 square feet of suede (250 pounds dry weight) the following dye amounts were employed:

	Bath for Suede Dried in Tunnel Drier, lbs.	Bath for Suede Dried in Drum Drier, lbs.
Pontamine Black AWG (C.I. Direct Black 37)	19	13
Pontamine Blue 3 BX (C.I. 23850)	7	4
Xylene Milling Navy 4B (C.I. 27070, 27075, 26690)	10	6
Pontacyl Blue Black SX (C.I. 20470)	4	5
Total Dyestuffs employed	40	28

It may thus be observed that equal color intensities were produced on suede dried by the apparatus of this invention while utilizing approximately 30% less total dyestuffs than that required for suede dried in the tunnel drier.

EXAMPLE V

The procedure of Example IV was repeated to dye suede leather red. In a dye bath employed for the dyeing of 2,000 square feet, the following dyestuff quantities were utilized:

	Bath for Suede Dried in Tunnel Drier, lbs.	Bath for Suede Dried in Drum Drier, lbs.
Crocein Scarlet N (C.I. 27290)	10.25	6.75
Pontacyl Fast Red AS (C.I. 15620)	10.25	6.25
Orange II (C.I. 15510)	6.75	4.75
Total Dyestuffs Employed	27.25	17.75

Dyestuff saving=54.1%.

EXAMPLE VI

The procedure of Example IV was repeated to dye suede leather medium brown. In a dye bath employed for the dyeing of 2,000 square feet, the following dyestuff quantities were utilized:

	Bath for Suede Dried in Tunnel Drier, lbs.	Bath for Suede Dried in Drum Drier, lbs.
Leather Brown EBN (C.I. 20,110)	18	12
Pontachrome Brown RH (C.I. Mordant Brown 70)	6	2½
Milling Black B (C.I. 27070, 27075, 26690)	3	2
Pontacyl Fast Red AS (C.I. 15620)	½	¼
Total Dyestuffs Employed	27.5	17.75

Dyestuff saving=54.9%.

EXAMPLE VII

The procedure of Example IV was repeated to dye suede leather town brown. In a dye bath employed for the dyeing of 2,000 square feet, the following dyestuff quantities were utilized:

	Bath for Suede Dried in Tunnel Drier, lbs.	Bath for Suede Dried in Drum Drier, lbs.
Leather Brown EBN (C.I. 20,110)	13½	9
Milling Black B (C.I. 27070, 27075, 26690)	6	4
Pontachrome Brown RH (C.I. Mordant Brown 70)	5	3
Total Dyestuffs Employed	24.5	16

Dyestuff saving=53.1%.

It is believed that the foregoing phenomenon may be explained in terms of a color developing occurring during the drying operation. The greatly increased temperatures attained in accordance with this invention accelerate reaction between the leather fibers and the dyestuffs applied thereto, thus producing the same hues as those obtained on leather dried in the tunnel driers after immersion in higher concentration dye baths.

The process of this invention may be used, where desirable, for the drying of thick, flexible cowhides or other animal skins. It may be used for side leather, for example, as well as for the thinner goat and calfskins discussed above. Since other changes may be made in the above-described process for drying leather, within the scope of this invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A process for drying and flexing soft, pliable leathers comprising the steps of inserting moisture laden soft leather between a pair of superposed, porous, heat transmissive, moisture absorbent blankets, thereby forming a sandwich-like structure, applying heat to said blankets to evaporate moisture from said leather to dry it while simultaneously continuously bending and flexing said sandwich-like structure, cooling said blankets while simultaneously continuously bending and flexing said sandwich-like structure in order to restore moisture to the surface strata of said leather, and removing said leather from said sandwich-like structure to produce dried, flexible and soft leather.

2. A process for drying and flexing soft, pliable leathers comprising the steps of inserting moisture laden soft leather skins between a pair of superposed, porous, heat transmissive, moisture absorbent blankets, thereby forming a sandwich-like structure, applying heat to one of said blankets to drive the moisture contained in said skins through the leather and removing said moisture from the surface of said skin adjacent the other of said blankets, while simultaneously continuously bending and flexing said sandwich-like structure, cooling said one of said blankets to condense moisture on the surface of said skin adjacent said other of said blankets, while simultaneously continuously bending and flexing said sandwich-like structure, and removing said skins from said sandwich-like structure to produce dried, flexible and soft leather.

3. A process for drying and flexing soft, pliable leathers comprising the steps of pressing moisture laden soft leather skins between a pair of superposed heat transmissive, moisture absorbent blankets, conveying said skins between said blankets over a plurality of heated drums

while simultaneously continuously flexing and bending said blankets to flex the leather fibers, evaporating moisture from said leather during passage over said drums, thereafter conveying said skins between said blankets over a plurality of cooled drums cooled to sub-ambient temperatures while simultaneously continuously flexing and bending said blankets to flex said leather fibers, cooling the leather surfaces to trap moisture therein sufficient to produce dried yet pliable leather skins, and removing said skins from between said blankets.

4. In the process of drying dyed leather skins, the improvement consisting in effecting the drying by pressing said skins between a pair of superposed, porous, heat transmissive, moisture absorbent blankets, conveying said skins between said blankets over a plurality of heated drums heated to temperatures in excess of the boiling point of water, while simultaneously continuously flexing and bending said blankets whereby to flex the leather fibers, evaporating volatile materials from said skins during passage over said drums, and heat developing the color of said dyed skins to produce a vigorous reaction between said dyestuffs and the leather fibers to obtain high color intensities.

5. A process for drying moisture laden leather which is characterized by disposing the leather between a pair of thin endless moving barriers, at least one of which is of heat transmissive moisture absorbent material, moving the assembly of said barriers with the leather interposed therebetween through a sinuous path with the leather held in a smooth condition by said barriers, heating said assembly during its movement through at least the initial portion of said sinuous path to evaporate sufficient free moisture from said leather to dry the leather, and thereafter and while still moving said assembly through said sinuous path cooling said assembly, to restore sufficient moisture to the heated leather surfaces to facilitate mechanical treatment thereof.

6. A process for drying and flexing soft, pliable leathers comprising the steps of pressing moisture laden soft leather between a pair of superposed heat transmissive, moisture absorbent blankets, conveying said leather between said blankets over a plurality of heated drums while simultaneously continuously flexing and bending said blankets to flex the leather fibers, evaporating moisture from said leather during passage over said heated drums, thereafter conveying said leather between said blankets over a plurality of cooled drums cooled to sub-ambient temperatures while simultaneously continuously flexing and bending said blankets, thereby cooling the leather surfaces to trap moisture therein and flexing the leather fibers to produce dried yet pliable leathers, one of the blankets of said pair being conveyed over said heated and cooled drums at a different rate of speed than the other, thereby producing a longitudinal slippage between said blankets and polishing and smoothing said leather pressed between said blankets by means of the friction produced by said slippage, and removing said leather from between said blankets.

7. The process as defined in claim 6, wherein said slippage produced between said blankets varies from about 0.1% to 2.0% of the length of one of said blankets.

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