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Brennan

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[54] METHOD AND APPARATUS FOR THE BULK PROCESS OF HIDES OR THE LIKE

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[52] **U.S. Cl.** **69/30**

[51] **Int. Cl.** **C14c 15/00**

[58] **Field of Search** 69/30

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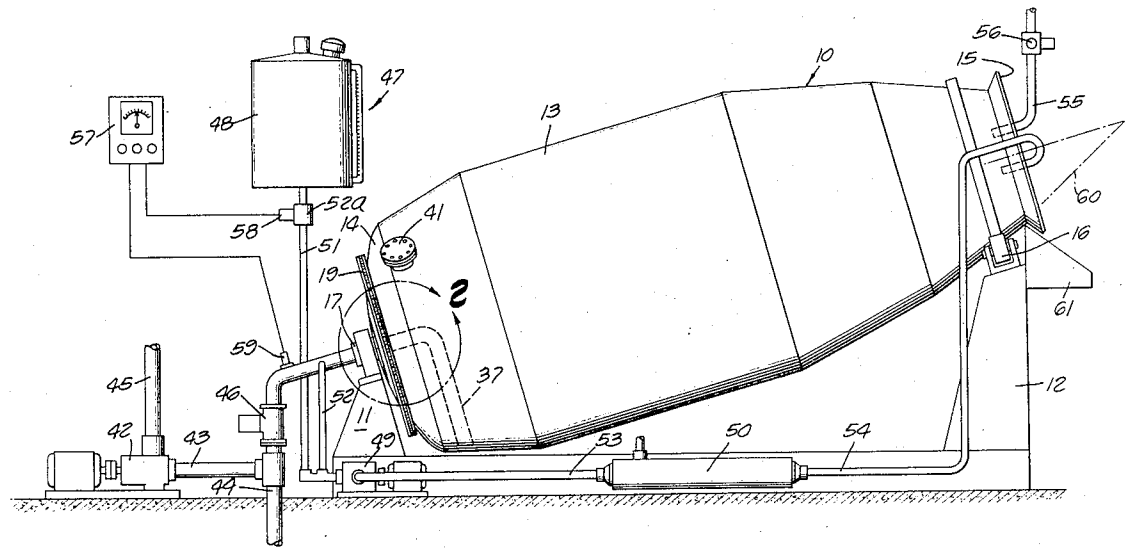
[57] **ABSTRACT**

Hides or similar sheet materials of a porous and absorbent nature are processed in a liquid bath contained within a drum mounted for rotation about an axis inclined from the horizontal. The drum includes a drainage chamber proximate a lower closed end and a processing chamber adjacent an upper open end. Drainage means extending into the drum along the drum axis are adapted to drain the liquid in the drum from the drainage chamber and liquid supply means are adapted to pass liquids into the drum whereby various baths having different chemical ingredients may be added and discharged during the process of the material. Spiral fins affixed to the inner wall of the drum and extending radially inward therefrom are adapted to work and treat the material maintained in the processing chamber when the drum is rotated in one direction and are adapted to move the material towards the open end when the drum is rotated in the other direction.

17 Claims, 7 Drawing Figures



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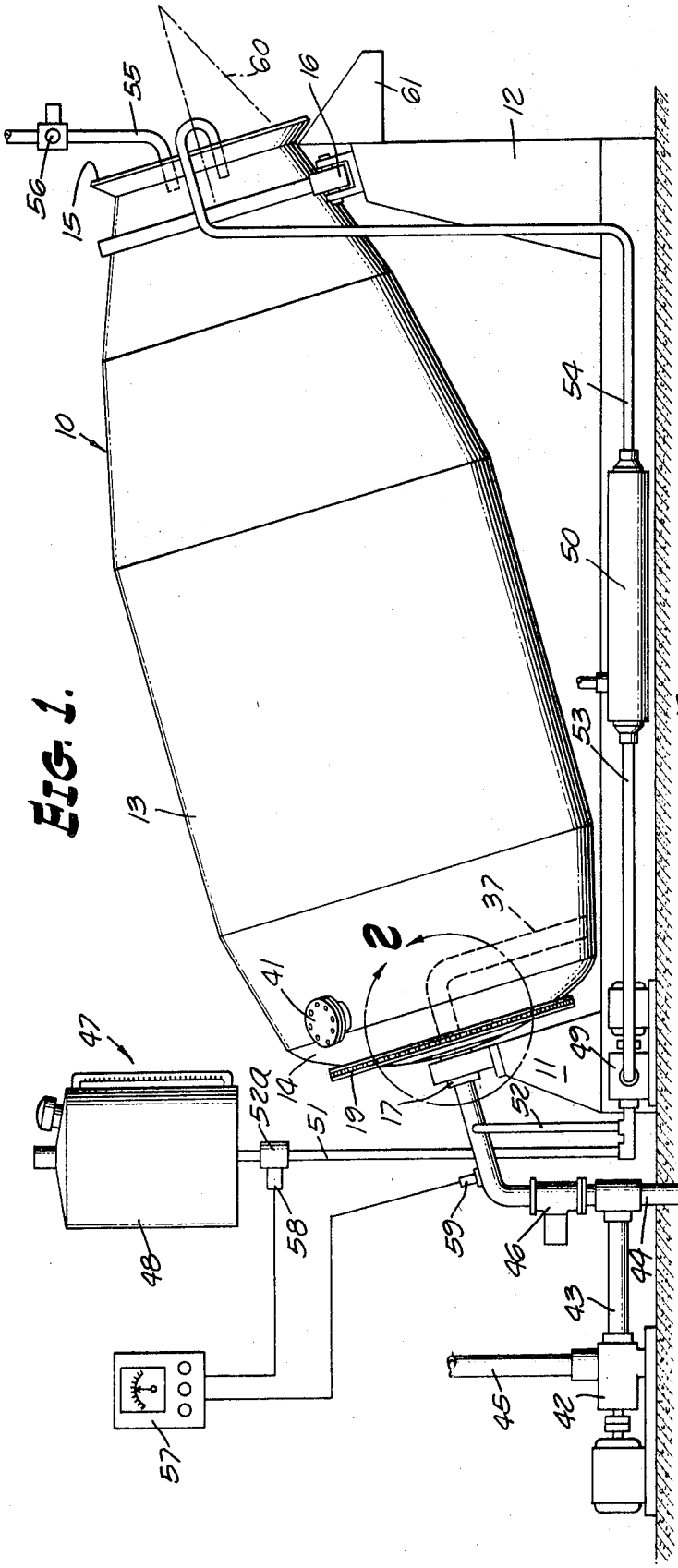

FIG. 1.

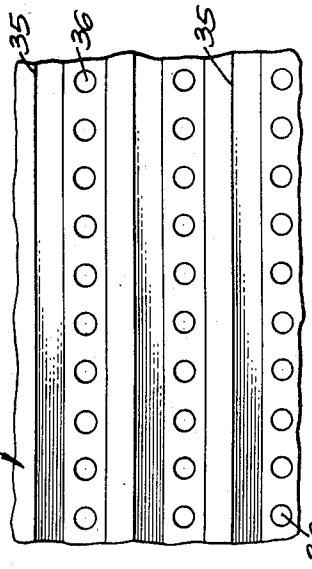

FIG. 3.

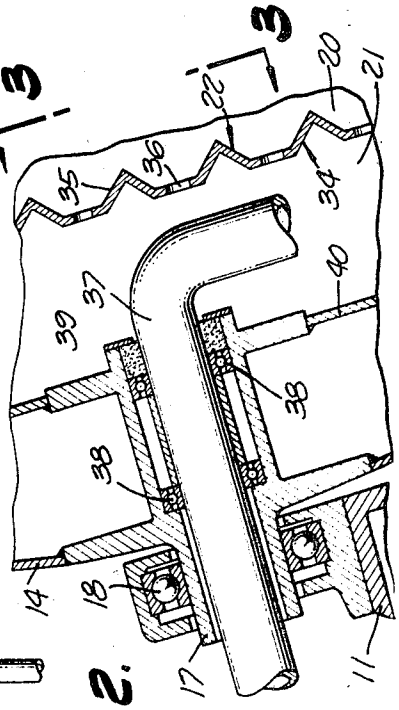

FIG. 2.

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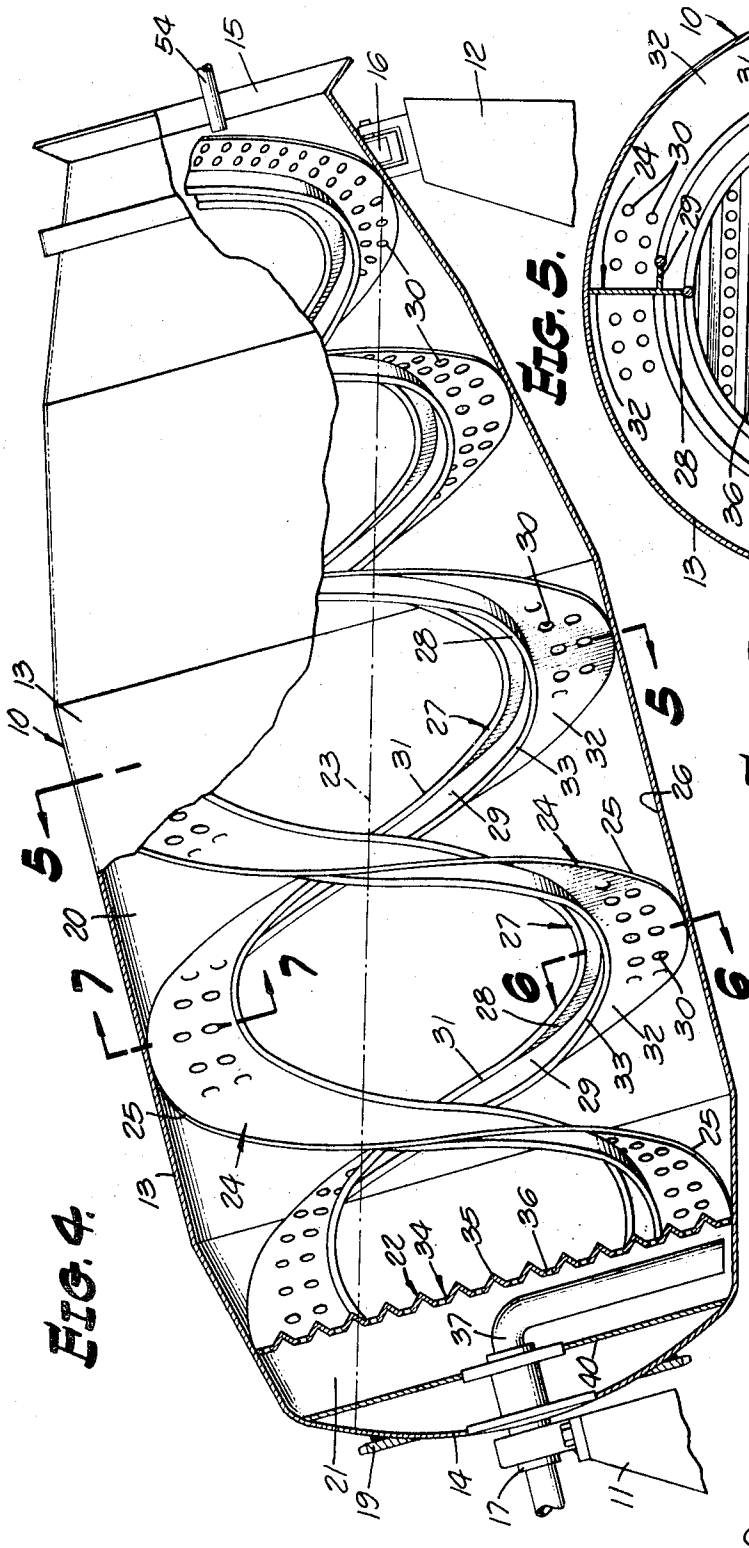

FIG. 4.

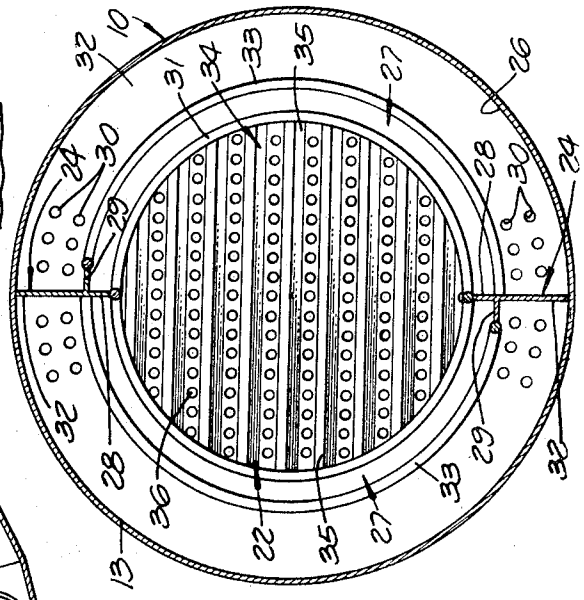

FIG. 5.

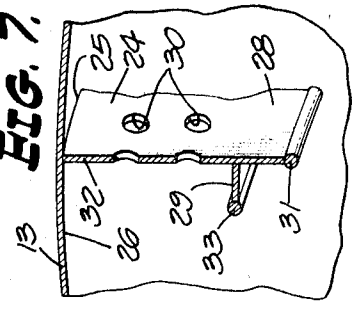

FIG. 7.

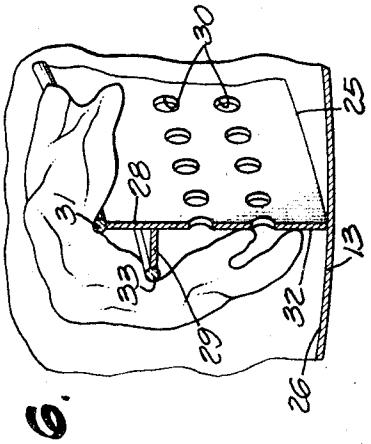

FIG. 6.

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METHOD AND APPARATUS FOR THE BULK PROCESS OF HIDES OR THE LIKE

This invention relates to a method and apparatus for the bulk process of hides or similar sheet materials of a porous and absorbent nature and more particularly relates to the process of such materials in a drum having internal fins and mounted for rotation about an axis which is inclined from the horizontal. A similar such method and apparatus for the process of hides is disclosed in a now pending U.S. Pat. application, Ser. No. 779,036 filed on Nov. 26, 1968 by William S. Eggleston. The present invention represents an improvement over the Eggleston hide processing method and apparatus.

The processing of animal hides and skins into leather involves several distinct so-called "wet operations" including brine-curing, washing, unhairing, bating, pickling, tanning, coloring and fatliquoring. All of which require various chemical solutions or baths and traditionally in the past a multiplicity of equipment. Eggleston has disclosed the means for carrying out several of these operations in a single unit while at the same time obtaining improved results. However, these means are not particularly adapted for changing or controlling the various chemical baths required and furthermore, there is still room for further improvement in the working of the hides during the various operations.

The following brief description of these operations illustrates the present need for an improved apparatus for accomplishing several of the wet operations used in the process of hides in which the chemical solutions or baths can be controlled and readily and easily modified or changed and for a method and apparatus which will decrease the processing time for hides and which will achieve results which are superior to those contemplated before. The first operation involved in processing hides after removal from the carcass is a protective treatment. Hides begin to decompose and lose leather-making substance within hours after their removal from the carcass. This protective treatment is known as brine-curing and it has in the past typically involved the use of mechanical means, generally known as raceways, which cause the hides to swim around in a concentrated salt solution to effect a complete penetration of the hides with the salt solution. After the hides are cured, they are soaked in water to which chemical wetting agents are usually added. Previously, the soaking has been accomplished in half-round cylindrical vats into which a paddle wheel dips. As the paddle rotates in the bath it causes the hides to move about and flex whereby they gradually absorb water and become cleaner and softer as a result. At the completion of the soak, the hides are washed by introducing fresh water into the vat while discharging the effluent. This washing removes excess salt, dirt and blood from the hides.

One of the next operations involved in the process of the hides involves the removal of the hair from the hides. This is primarily a chemical process, although mechanical means also effect complete removal of the hair after it has been loosened. The chemical, or dipilatory agents, actually have a three-fold purpose. They must (1) destroy the hair or attack the hair roots so that it will come free of the hide; (2) loosen the epidermis, a hard outer layer covering the grain; and (3) remove certain soluble skin proteins that lie within the hide substance. At the same time, it is essential that these agents have little or no affect on the leather-making constituents of the hide. Quite fortunately, there are certain chemicals that are specific in their attack on the undesirable components while leaving the desirable collagen (leather-making) substance pretty much alone. The most commonly used system employs calcium hydroxide (hydrated lime) and sodium sulfide. The apparatus used in performing this operation has in the past been a wooden drum having on its inside surface shelves and pegs which produce a tumbling action on the hides loaded in the drum. The hides are loaded into the drum through a door in the peripheral surface of the drum and the usual capacity of the drum is less than one half of the total capacity. These drums contain water and the dipilatory chemicals and the concentration of these materials, the water temperature, and the amount of agitation all have a direct bearing on the rate at which the unhairing proceeds.

After the hides are free of hair and are moderately clean, the alkaline materials used in the unhairing operation are still present in relatively large amounts and must be removed In addition, there are still some non-leather making constituents in the grain and throughout the thickness of the hide; removal of these are necessary to improve the appearance and resiliency of the resultant leather. Bating accomplishes these objectives. The first phase of the bating process, termed deliming, eliminates the lime and alkaline chemicals present. The excess of these is removed by washing the hide in the large cylindrical drums. In these previously used drums, there is on one side a mixing tank in which chemicals that are to be added may be prepared. A pipe leads from this tank into the drum through one of the hollow axles and through the other axle a water pipe is inserted. Whenever the process calls for washing the hides, a perforated door is fastened into the place normally occupied by a solid door and as the drum rotates, water is introduced through the water pipe and the fluid discharges through the perforated door.

The vast network of collagen fibers in a hide tend to hold on to the last portions of lime. To speed up the deliming operation additional chemicals are employed at this point. Salts such as ammonium chloride are added to convert the residual lime into soluble compounds which later can be washed free of the system. The deliming chemicals also perform another useful function. They adjust the acid-alkaline conditions (pH) to the proper point for receiving the bate. Bates are enzymes similar to those found in the digestive systems of animals. The second phase of this operation commences with the addition of the bate itself. It attacks and destroys most of the remaining undesirable constituents of the hide, such as hair roots and pigments. Their removal creates a softer, less harsh feeling to the grain surface and gives it a cleaner appearance. Also attacked are glue-like protein substances that are located between the leather-making fibers. If allowed to remain they would tend to cement the fibers together to the point of making the resultant leather hard and tinny. As was the case in unhairing, the amount of bating material, the temperature, and the length of time are critical to the extent to which bating takes place. When the bating chemicals have completed their job, the hides are washed thoroughly to rid them of all the substances which this operation has loosened or dissolved.

After the previous operations have removed all of the undesirable constituents (flesh, hair, non-leather making substances) from the hides, a final preparatory operation called pickling must be completed before the actual tannage operation is performed. Pickling places the hides in an acid (low pH) environment ready to accept the tanning materials. This operation is necessary because the chrome tanning agents that are to follow are not soluble under alkaline conditions. Thus, if they were added to non-pickled skins, they would precipitate from solution and therefore not effect a tannage. Any of a number of different acids can be used for this purpose, although the most common used is sulfuric acid. The pickling process first calls for the addition of common salt, or brine, to the system. If acid was added alone, a condition called acid swelling would soon develop, and tanning a hide in this condition would produce inferior leather. The purpose of the common salt is to attack and tie-up the excess moisture that would otherwise cause the fibers to swell.

The next operation is the tannage itself. The primary function of any tanning agent is to convert the raw collagen fibers of the hide into a stable product which is no longer susceptible to putrefaction or rotting. Tanning has previously been accomplished in the same drums used for the unhairing, bating, and pickling operations. During tanning, the hides are floated in a brine solution rather than a water solution in order to guard against the possibility of acid swelling. A proper amount of chrome tanning agents is introduced into the brine bath. Considerable attention is given to the chemical state of the solution in the drum. If the chemical bath is not properly con-

trolled a poorly tanned, non uniform leather will result. The tanning agent includes chromium sulfate which imparts a bluish-green color to the hides and visual observation of this color characteristic is made use of in assessing the extent to which penetration has been achieved. When it is deemed adequate, the pH conditions of the system are slowly altered to increase the fixation of the chromium sulfate, popularly referred to as chrome, with the skin protein. This is done by adding a mild alkaline substance such as sodium bicarbonate which reduces the acidity and increases the affinity of the protein for the chrome.

Additional operations traditionally carried out in the drum apparatus include coloring and fatliquoring. Coloring is accomplished with aniline-type dyestuffs which are derived in many cases from products of coal. They are dissolved in very hot water and added to the rotating drum. The dyestuffs combined with the skin fibers to form an insoluble compound which becomes part of the skin or hide itself. pH control is again an important factor and it permits the tanner to regulate the affinity of the chosen dyestuffs with the leather fibers. Fatliquoring is an operation by which the fibers are lubricated so that after drying they will be capable of sliding over one another. Fatliquoring has the most pronounced effect on how firm or soft the resulting leather will be. In addition to regulating the pliability of the leather the fatliquor contributes greatly to its tensile strength. The basic ingredient in fatliquors consists of oil and related fatty substances which represent products of the animal, vegetable and mineral kingdom. These oily substances are not soluble in water and chemical reagents added to the solution are used to impart water solubility to them.

It is evident from the above description, that the control and variation of the chemical baths during the various operation is an important factor in processing the hides to leather. Therefore, it is an important object of this invention to provided the means for completing various wet operations involved in the process of hides whereby the chemical baths or solutions can be readily controlled and varied as desired according to the particular operations being carried out.

It is further evident, that the mechanical action on the hides during the wet operations has a marked effect on the results of each operation and therefore it is a further object of this invention to provide means for working the hides during the various operations which will achieve improved results.

In accordance with these and other objects of this invention, various wet operations involved in the process of hides or other similar sheet materials of a porous and absorbent nature are performed in a substantially cylindrical drum apparatus mounted for rotation about an axis inclined from the horizontal and adapted to contain a liquid chemical bath which is varied according to the various operations being performed in the drum. The drum apparatus includes a drainage chamber proximate a lower closed end of the drum from which liquids in the drum can be extracted and a processing chamber adjacent an upper open end in which the hides are maintained during the operations. A drain pipe extending into the drainage chamber through the axis of the drum at the lower end is adapted to discharge a relatively high volume of liquid from the drum when desired without interference from the hides being processed which are maintained apart from the drainage chamber and a supply pipe is adapted to add the various chemical solutions to the drum when desired. Spiral fins within the processing chamber affixed to the inner wall of the drum and extending radially outward therefrom including working means which are adapted to work and move the hides in the processing chamber in a desired manner to improve the results of the operations. The working means of the fins combine with further working means of a baffle member separating the chamber to provide further improved results.

These and other objects and advantages of this invention will be made readily apparent from the following detailed description and the accompanying drawings.

In the drawings:

FIG. **1** is a side view of the drum apparatus illustrating the liquid supply, discharge and control means;

FIG. **2** is a fragmentary view taken substantially on the lines **2—2** of FIG. **1** illustrating the connection of the drain pipe with the drum;

FIG. **3** is a fragmentary front view taken substantially on the lines **3—3** of FIG. **2** illustrating the baffle member;

FIG. **4** is a side view of the drum partially broken away illustrating the internal fins in the processing chamber;

FIG. **5** is a front sectional view of the drum taken substantially on the lines **5—5** of FIG. **4** illustrating the fins and the baffle member;

FIG. **6** is a fragmentary view taken substantially on the lines **6—6** of FIG. **4** and illustrating the working of a hide in the processing chamber; and

FIG **7** is a fragmentary view taken substantially on the lines **7—7** of FIG. **4** illustrating the working means of the fins.

Referring now in detail to the drawings, the apparatus includes a generally cylindrical elongated drum, generally designated **10**, mounted for rotation about an axis inclined from the horizontal and supported on rear and front supports **11** and **12**, respectively. The normal angle of inclination is approximately 16°, however, this can be varied slightly by hydraulic hoist means (not shown) mounted on the front support **12**. The drum includes a generally cylindrical wall **13**, a lower closed end **14** and upper open end **15**. Rollers **16** secured to the front support member **12** support the upper end portion of the drum **10** and the rear end of the drum **10** includes a rear tubular axle or shaft member **17** which is supported on bearing members **18** mounted on the rear support **11**. A drive motor (not shown) is operably connected to a drive pulley member **19** on the drum and is adapted to drive the drum in either direction of rotation and at different speeds of rotation.

As seen in FIG. **4**, the drum **10** includes an internal processing chamber **20** and an internal drainage chamber **21**, with a baffle member **22** separating the two chambers. The drainage chamber **21** is defined by the lower closed end **14**, the sidewall **13** and the baffle member **22** and the processing chamber **20** is defined by the sidewall **13** and the baffle member **22**, with the upper open end **15** of the drum adjacent the upper portion of the processing chamber **20** and providing communication thereto. The portion of the drum below the level of the open end **15** forms the liquid bath zone **23** wherein substantially all of the chemical solutions used during the various operations are maintained. While the various specifications of the above elements can be varied without diviating from the scope of the invention, a drum having a total volume of 700 cubic feet and a liquid bath capacity of 3,000 gallons has been found to be desirable. A drum constructed of corrosion resistant, high tensile steel has also been found to be desirable for several reasons, including its heat transfer characteristics and its ability not to react with certain of the chemicals used in the various operations.

Within the processing chamber **20** are a pair of spiral fins **24** which are affixed along one edge **25** to the inner surface **26** of the sidewall **13** and extend radially inward therefrom. The fins **24** are circumferentially spaced from one another and are disposed in spirals as illustrated, with each fin **24** beginning at the open end **15** of the drum, running continuously the length of the processing chamber **20** and terminating at the baffle member **22**. Each fin **24** includes working means, generally designated **27**, which comprise a pair of so-called "scudding blades" **28** and **29** and each fin **24** further includes a plurality of circulating bleed holes **30**. Blade **28** is an integral extension of the fin **24** and includes at its leading edge a round bead **31**, whereas blade **29** extends from the working side **32** of the fin and is normal thereto with its leading edge also having a round bead **33**.

The spiral fins **24** move through the hide treatment zone with components of axial and transverse motion. When the drum **10** is rotated in one direction the fins are adapted to move the hides floating in the liquid bath and within the

processing chamber 20 downwardly towards and subsequently against the baffle member 22. During rotation of the drum 10 in this direction the fins 24 impart to the hides all the necessary mechanical actions previously effected by the pegs in the drums and paddles in the vats used in the past, and in addition impart a kneading action. When operated at low speeds, the fins 24 create an agitation similar to that of a paddle and at high speed the hides at the surface of the mass adjacent to the rising side of the drum are lifted from the liquid bath and then dropped back into the bath in a less pronounced manner than the pounding action created by the shelves or pegs of the drums used in the past. The kneading action is an action of working a substance while it is subjected to pressure and it is created by the rotation of the drum in a direction to cause the internal fins therein to progress downwardly through the lower most of the mass of hides in the processing chamber. The progression of the fins includes both axial and transverse components of movement and as the fins progress they convey the lowermost hides with them, while at the same time carrying them under the mass of hides above. This mass exerts a substantial force on the lower most hides by virtue of its weight and this force resists the motion of the lower most hides, causing a portion of them to override the fins, as shown in FIG 6. In this instance the two blades 28 and 29, which are perpendicular to each other, have a double acting effect on the hides whereby the hide is worked simultaneously in two spaced apart areas between which the liquid is in complete communication The rounded beads 31 and 33 of the blades prevent tearing of the hides during this override. The bleed holes 30 also aid in the communication of the liquid with the hides during this working action. By this action the hides are flexed, or worked by the passage of the fins while being subjected to the pressure of the load. This action aids considerably in "-scudding" or removal of hair roots and further aids in the removal of other undesirable constituents such as flesh and non-leather-making substances from the hide. Moreover, it effects a complete penetration of the hide with the solution in the liquid bath. The motion of the fins also aids in establishing and maintaining an even dispersement of chemicals in the liquid bath, thereby avoiding strong and weak pockets which is particularly important when it is desirable to vary or change the chemical nature of the bath.

The baffle member 22 positioned at the end of the spiral fins 24 and separating the drainage chamber 21 and the processing chamber 20 comprises a circular plate which is peripherally mounted to the inner surface 26 of the sidewall 13. The baffle member 22 in itself comprises in part a working means for the hides, but in addition it includes working elements, generally designated 34, which comprise horizontally disposed and vertically spaced corrugations 35 with a plurality of horizontally spaced holes 36 extending laterally across the plate between the corrugations 35 which permit liquid to pass therethrough.

The fins 24 and the baffle member 22 co-act to impart a still further and entirely new action of squeezing the hides. The squeezing action occurs when the fins 24 move the hides against the baffle plate 22 and it displaces from the hides a certain amount of fluid previously absorbed by the hides and because the baffle member is inclined, a major portion of the displaced fluid is passed through the holes 36 into the drainage chamber 21 and not directly onto the hides immediately below. This feature is of particular significance whenever the operation being carried out involves a washing of the hides to remove impurities or chemicals absorbed by the hides in a previous operation. A further working of the hides occurs when the hides are forced against the baffle member 22 and lifted towards the top of the drum whereafter the hides fall with a scrubbing action on the corrugated baffle member 22. The corrugations 35 serve a still further purpose in that they prevent the hides from packing against the baffle member 22 during rotation of the drum 10.

It should be further noted that when the drum is rotated in the opposite direction from that previously described the fins 24 auger the hides in the processing chamber 20 upwardly towards the open end 15 and finally out of the opening 15 thus providing a time saving advantage whenever it is desirable to remove the hides from the drum 10.

The drainage chamber 21 located proximate the lower closed end 14 is adapted to be substantially filled with the liquid but is maintained free of the hides by the baffle member 22. A drain pipe 37 extends from the lower most portion of the drainage chamber 21 perpendicularly to the center axis of the drum 10 and then out from the drum axially through the hollow shaft 17, as seen best in FIG 2. The drain pipe 37 is supported in the shaft 17 on bearing members 38 to permit rotation of the drum 10 about the drain pipe 37 and a seal 39 mounted at the forward end of the shaft 17 surrounds the drain pipe 37 and prevents leakage therebetween. An internal support web 40 extends radially outward from the shaft 17 to inner surface 26 of the drum and may be provided with agitating blades (not shown) for maintaining circulation of the liquid in the drum. The drum 10 also includes at least one drain-out port 41, which when the drum 10 is rotated to a predetermined position is adapted to provide communication from the lower most area within the drum and within the drainage chamber 21 to the outside of the drum and when opened can be utilized to completely drain the drum 10.

The drain pipe 37 is connected to a drain pump 42 by a pipe 43 and to another pipe 44 which leads to the sewer (not shown). A second pipe 45 connected to the drain pump 42 leads either to holding tanks (not shown) or the sewer and a valve 46 is positioned in the drain pipe 37 just prior to the pipe connections 43 and 44. By means of this drainage system, liquid in the drum 10 can be pumped out of the drum from the drainage chamber 21 through the drain pipe into the sewer or into the holding tanks for subsequent return to the drum through the drain pipe 37, either of which is determined by the valve 46.

A recirculating and supply system, generally designated 47, includes at least one reservoir 48 for mixing and storing the various chemical solutions, a recirculating pump 49 for pumping the solutions and liquids from the reservoir 48 or drum 10 into the drum, and a heater 50 fro heating when desired liquids pumped into the drum. A line 51 having an off-on valve 52*a* connects the reservoir 48 to the suction side of the pump 49 and a line 52 connected at one end to the drain pipe 37 and connected at the other end to the suction side of the pump 49 is adapted to communicate liquids from the drum by way of the drain pipe 37 to the pump 49. A line 53 connects the pump 49 to one side of the heater 50 and a line 54 communicates fluid from the heater 50 to the drum 10 through the open end 15. Fresh water is supplied to the drum 10 through the open end 15 by a supply line 55 having a water meter and cut-off valve 56.

An electronic pH meter 57 connected at 58 to the line 51 leading from the reservoir 48 and at 59 to the drain pipe 59 is used to determine the acidity or alkalinity of the liquids passing through these conduits 51 and 37 thereby provides the tanner a valuable tool in controlling the rate at which various chemical reactions take place.

A loading chute 60 is provided adjacent the open end 15 for fast loading of the hides into the processing chamber 20 and an apron 61 positioned beneath the open end 15 receives the hides from the processing chamber 20 when the drum 10 is rotated in the proper direction. It should also be noted that while the apparatus is shown permanently mounted the entire drum portion of the apparatus can be mounted on a portable frame and made mobile when proper pipe and line connections are provided for the drainage supply and recirculating systems whereby the drum can be transported, as for example to the slaughter-house for the pick-up of hides just removed from the carcass in order to begin processing of the hides before they have a chance to deteriorate.

Once the hides have been received from the slaughterhouse and the connection of the drum apparatus with the drainage system, supply system and recirculating system is complete, the various wet operations of the hides can commence with

this above-described apparatus carrying out the brinecuring, soaking and washing, unhairing, bating, pickling, tanning, coloring and fatliquoring operations. During brinecuring the liquid bath zone **23** of the drum is filled with a concentrated salt solution typically mixed in a reservoir **48** and added to the drum through the line **54**. The drum **10** is rotated at a relatively low speed in a direction whereby the fins **24** cause the hides placed in the processing chamber **20** to swim around in the salt solution and thus effect a complete penetration of the hides with the salt solution. After curing is completed the brine solution is discharged into the sewers through the drain pipe **37**. After curing, the hides are removed from the drum **10** and stored if desired. Removal of the hides is accomplished by merely rotating the drum **10** in the opposite direction which causes the fins **24** to auger the hides out from the processing chamber **20** through the open end **15** onto the apron **61**. Thereafter, the hides are prepared for subsequent operations by trimming off the heads, long shanks, and other perimeter areas which would interfere with the later processing of the hides. The hides are then sorted and gathered into batches and a batch of hides is then put back into the drum **10**.

This batch of hides is received by a bath of fresh water added to the drum **10** from the supply line **55** and chemical wetting agents added from the line **54** to soak the hides. The drum **10** continues to rotate and the fins **24** cause the hides to move about and flex in the solution whereby they gradually absorb the water. When soaking in this solution is completed to a sufficient degree, this solution is flushed from the drum **10** through the drain pipe **37** and fresh water is simultaneously added from the supply line **55** to wash the hides of excess salt, dirt and blood. It should be noted that the squeezing action imparted to the hides through the co-action of the fins **24** and the baffle plate **22** acts to improve this washing operation.

The hides are then again removed from the drum **10** and by a mechanical operation rid of excess flesh, fat, and muscle that is to be found on the inside or flesh side of the hides. After this so-called "fleshing" operation is completed the hides are ready for the unhairing operation. Chemical or dipilatory agents in solution are mixed in the reservoir **48** and pumped into the bath zone **23** of the drum **10** through the line **54**. The hides are placed in the bath and the drum is rotated and the working elements of the fins **24** and the baffle **22** impart to the hides the kneading and scrubbing actions described above both of which have an effect on the unhairing of the hides. At the end of this operation, the alkaline solution used during the unhairing process is discharged from the drum **10** through the drain pipe **37** while fresh water is added through the supply line **55** to the drum **10** to wash the hides and remove the alkaline elements.

This washing of the hides, is the initial phase of the bating or de-liming operation. Salts, such as ammonium chloride, are added in solution through the line **54** to adjust the pH conditions of the bath and when the pH conditions reach the proper point, as indicated by the meter **57** measuring the pH of the liquid being discharged through the drain pipe **37**, bates or enzymes in solution previously mixed in a reservoir are added to the drum. When the bating chemicals have completed their job, this solution is drained from the drum **10** through the drain pipe **37** and fresh water is added to again wash the hides.

After the hides are washed, a brine solution is added to the drum and then an acid is added to pickle the hides and prepare the hides for tanning. Complete penetration of the hides with this pickling solution is desirable and such a complete penetration is aided by the two blades **31** and **33** and the circulating bleed holes **30** of the fins **24**. The next operation is the tanning operation. A brine solution having tanning agents including chromium sulfate is added to the bath zone **23**. This tanning solution must be carefully controlled or a poorly tanned, nonuniform leather will result. Moreover, it is often necessary during this operation to alter the pH conditions of the bath. Both the control of the bath and the alteration of the pH condition can be accomplished by use of the re-circulating and drainage systems.

The fatliquoring and coloring operations can also be performed by the apparatus of this invention. Heat control and pH control of the coloring solutions are both important factors and recirculating and drainage systems with their pH measuring means and their heating means are an aid to this operation. Both operations require a complete penetration of the solutions with the hides and the working elements of the fins **24** and the baffle member **22** act to achieve this penetration.

This invention provides a method and apparatus for use in the process of hides or other similar sheet materials of a porous and absorbent nature which achieves improved results during various wet operations on the hides through new and better mechanical actions imparted on the hides and through a better control of the chemical solutions used in the operations. An efficient drainage and recirculating system speed the transition from one operation to another and reduces the amount of sewage by storing liquids for subsequent use and by recirculating the liquids. This invention also reduces operating and labor costs and the processing time needed to produce the leather.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claims.

I claim:

1. A batch process apparatus for sheet material of a porous and absorbent nature, comprising:

a substantially cylindrical drum mounted for rotation about an axis inclined from the horizontal having an upper open end and a lower closed end and defining a bath zone therebetween adapted to be filled with processing liquids;

a processing chamber within said drum adjacent said open end adapted to receive the sheet material and defining a portion of said bath zone;

a drainage chamber within said drum proximate said lower closed end and defining the rest of said bath zone;

separating means between said chambers adapted to prevent the movement of the sheet material into said drainage chamber from said processing chamber;

spiral fins in said processing chamber affixed to the inner surface of said drum and extending radially therefrom, said fins adapted to move the sheet material in said processing chamber downwardly towards said closed end when said drum is rotated in one direction and upwardly towards said open end when said drum is rotated in the other direction; and

each said fin having working elements adapted to work the material in said processing chamber, said working elements including a pair of blades, one of said blades extending from the inner edge of said fin and said other blade extending from the side of said fin towards said lower closed end whereby each said blade works a separate portion of the sheet material passing over said fin.

2. The apparatus of claim **1**, wherein said separating means comprises a baffle member peripherally mounted on the inner surface of said drum normal to the axis of said drum and having means for communication of liquid therethrough, said fins terminating at said baffle member whereby when said drum is rotated to move the sheet material downwardly the sheet material is worked by said fins against said baffle member.

3. The apparatus of claim **2**, wherein said baffle member is an inclined circular plate and said liquid communicating means comprise a plurality of openings whereby the working of the sheet material against said baffle member causes liquid previously absorbed by the sheet material in said processing chamber to be displaced, with a major portion of the displaced liquid passing through said openings into said drainage chamber.

4. The apparatus of claim **2**, wherein said baffle member includes working elements comprising corrugations whereby when the rotation of said drum causes said fins to lift the sheet material against said baffle member to the top of the drum whereafter the sheet material falls downwardly said corrugations work the sheet material.

5. The apparatus of claim 1, wherein said fins extend continuously from said open end to said separating means, each said blade being continuous over the length of said fin, with said one blade extending from the inner edge normal to the axis of the drum and said other blade extending from the side of the blade parallel to the axis of said drum.

6. The device of claim 5, wherein each said blade includes a rounded bead at its extended edge.

7. The device of claim 5, wherein each said fin is provided a plurality of bleed holes for communication of liquids therethrough.

8. The device of claim 1, wherein drainage means are provided, said drainage means extending into said drainage chamber through said closed end along said axis of rotation, said drainage means adapted to pump liquid from said drainage chamber without interference from said material.

9. An apparatus for the batch process of sheet material of a porous and absorbent nature in a liquid bath, comprising:

a substantially cylindrical drum mounted for rotation about an axis inclined from the horizontal having an upper open end and a lower closed end and defining a bath zone therebetween adapted to be filled with processing liquids;

a processing chamber within said drum adjacent said upper open end adapted to receive the sheet material;

a drainage chamber within said drum proximate said lower closed end;

said processing chamber and said drainage chamber each adapted to be partially filled with the liquid in said bath zone;

separating means between said processing chamber and said drainage chamber adapted to maintain said drainage chamber free of the sheet material;

spiral fins in said processing chamber affixed to the inner surface of said drum and extending radially therefrom, said fins adapted to move through said bath zone with components of axial and transverse movement and work the sheet material when said drum is rotated;

drainage means extending from said drainage chamber out of said drum through said closed end along said axis of rotation; said drainage means adapted to pump processing liquids out of said bath zone from said drainage chamber without interference from the sheet material in the drum; and

supply means adapted to communicate processing liquids into said bath zone whereby the chemical concentrations of the processing liquids in said bath zone can be varied and controlled during the process of the sheet material.

10. The apparatus of claim 9, wherein recirculating means are connected to said supply means and said drainage means whereby processing liquids in said bath zone can be pumped from said bath zone and then pumped back into said bath zone.

11. The apparatus of claim 9, wherein said supply means includes at least one reservoir tank for mixing and holding the processing liquids before they are communicated into said bate zone and said drainage means includes at least one storage tank for storing the processing liquids pumped from said drainage chamber for subsequent use in said bath zone.

12. The apparatus of claim 9, wherein determining means are provided, said determining means operably connected to said drainage means and said supply means for determining the chemical concentrations of the processing liquids pumped from and into said bath zone.

13. The apparatus of claim 10, wherein said recirculating means and said supply means are provided with a heater to heat the processing liquids communicated into said bath zone.

14. A batch process apparatus for sheet material of a porous and absorbent nature, comprising:

a substantially cylindrical drum mounted for rotation about an axis inclined from the horizontal having an upper open end and a lower closed end and defining a bath zone therebetween adapted to be filled with processing liquids;

a processing chamber within said drum adjacent said open end adapted to receive the sheet material;

a drainage chamber within said drum proximate said lower closed end having draining means extending from a lower portion of said drainage chamber out of said drum through said closed end along said drum axis, said draining means adapted to pump liquids from said bath zone;

supply means adapted to pump liquids into said bath zone;

a baffle member peripherally mounted to the inner surface of said drum separating said chamber and adapted to maintain said drainage chamber free of the material;

spiral fins in said processing chamber affixed to the inner surface of said drum terminating at said baffle member and extending radially therefrom, said fins adapted to move through said bath zone with components of axial and transverse movement during the rotation of said drum and adapted to move the sheet material downwardly toward and against said baffle member when said drum is rotated in one direction;

working elements on each said fin, said working elements including a pair of blade members, one of said blade members extending from the inner edge of said fin and said other blade member extending from the side of said fin towards said lower closed end whereby each said blade member simultaneously works a separate portion of the sheet material passing over said fin; and

second working elements on said baffle member adapted to work the material move against and across said baffle member.

15. A method for use in the batch process of hides or the like, the steps comprising:

filling with processing liquid a bath zone defined by an elongated drum mounted for rotation about an axis inclined from the horizontal;

loading a substantial weight of the hides into a processing portion of said bath zone having an elongated spiral fin therein;

rotating said drum to cause the axial and transverse components of motion of said fin to convey the lowermost of the hides downwardly towards the lower end of said drum; and

kneading simultaneously separate areas of some of these lowermost hides which are caused to overrun working elements on the fin by the weight of the remaining hides above the lowermost hides; and

squeezing some of these lowermost hides by causing them to be conveyed against an inclined working member at the end of the fin.

16. The method of claim 15, wherein some of the hides conveyed against said working member are lift by said fin whereupon they fall on the inclined working member and are scrubbed thereby by working elements on said working member.

17. The method of claim 15, wherein processing liquid is pumped out of said bath zone from a drainage portion of said bath zone maintained free of the hides.

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