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

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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
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. patent 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 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 lower rejects. However, the 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 a useful function. They adjust the acidic-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 shiny. As was the case in unhairing, the amount of bathing material, the temperature, and the length of time are critical to the extent to which bathing 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 preliminary step called pickling must be completed before the actual tanning 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 tanning 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-
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trolled a poorly tanned, non uniform leather will result. The

tanning agent includes chromium sulfate which imparts a bluish

color to the hides and also the hides and also the chromate of this

color characteristic is made use of in assessing the extent to

which penetration has been achieved. When it is deemed

necessary, 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 a leather the resulting leather will be. In addition to regulat-

ing 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. There-

fore, it is an important object of this invention to provide the

means for controlling 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 in-

vention 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 horizon-

tal 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 ad-

jacent 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 vari-

ous 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 com-

bine with further working means of a baffle member separat-

ing the fins 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 illus-

trating the internal fins in the processing chamber;

FIG. 5 is a front sectional view of the drum taken substan-

tially 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.

Refracting 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 ap-

proximately 16°, however, this can be varied slightly by

hydraulic hoist means (not shown) mounted on the front sup-

port 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 in-

cludes a rear tubular axle or shaft member 17 which is sup-

ported 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 vari-

ous operations are maintained. While the various specifica-

tions of the above elements can be varied without deviating

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 cor-

rosion 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

dispersed 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 lowermost hides, except in 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 "scurding" or removal of hair roots and further aids in the removal of other undesirable constituents such as flesh and non-skinning 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 dispersion 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 spaced corrugations 35 with a plurality of horizontally spaced holes 36 extending laterally across the plane between the corrugations 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 whereby 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 to 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 for heating when desired liquids pumped into the drum. A line 51 having an off-on valve 52 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 to the pump 49 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
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. Liquid brine solutions lead to 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 the use of better mechanical agitation imparted on the hides and through a better control of the chemical solutions used in the operations. An efficient drainage and recirculating system speeds 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,
   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 downwards towards said closed end when said drum is rotated in one direction and upwards 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; and
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 whereverupon 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.