SPIRAL DRAIN SCOOP FOR ROTATING DRUM

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ABSTRACT

This invention relates to a spiral drain scoop to be located along the end wall of a rotating processing drum to separate the liquids from the solids in the drum and expel the liquid from the drum through an outlet centrally located in the end wall on the axis of rotation of the drum. The drain scoop has an outer cylindrical portion extending at least partially around the drum adjacent the cylindrical wall of the drum, and an inner spiral portion connecting the outer cylindrical portion to the outlet in the end wall. The passage formed by the drain scoop between the cylindrical wall of the drum and the outlet has corresponding outer pick-up and spiral shaped inner conductive portions. The outer pick-up portion is perforated to receive the liquid from the drum which is then passed through the inner conductive portion and expelled from the central outlet without the use of a separate power source or any moving parts. The cross sectional area of the inner spiral portion of the drain scoop is constricted to provide a venturi section to assist in the expulsion of the liquid from the drum. The central outlet is connected through a rotating union to suitable piping having a valve which controls the flow of liquid from the drum.

13 Claims, 9 Drawing Figures
SPIRAL DRAIN SCOOP FOR ROTATING DRUM

BACKGROUND OF THE INVENTION

This invention relates generally to a drain for a rotating drum such as a hide processing drum, and more particularly to a spiral drain scoop which acts to expel liquid from the drum through a central outlet on the axis of rotation of the drum as the drum rotates.

There are two general types of drums presently in widespread use to process hides in the tanning industry; those having a horizontal axis of rotation, and those having an inclined axis of rotation. In both types, the liquid (float) and hides together may be easily removed from the drum. With horizontal axis drums this is done by opening a central door as the drum rotates, while with inclined axis drums the direction of rotation is reversed and the liquid and hides are lifted out through a front opening by inclined shelves in the drum. However, as is well known in the art, in several stages of hide processing it is necessary to drain the liquid from the drum while retaining the hides in the drum, and this requirement has provided considerable difficulty for some time for both manufacturers and users of hide processing drums. In the past, it has been known to provide a perforated cylindrical wash ring around the inside wall of the drum to overcome this problem. The wash ring is provided with several radial outlets which are opened in order to drain the liquid from the drum. This structure is illustrated and described in the applicants' Canadian Pat. Ser. No. 908,654 dated Aug. 29, 1972 entitled Fiberglass Processing Tank. While providing for rapid draining of the drum, this structure has the disadvantage that even though a catch ring may be provided beneath the drum, the liquid normally spills or splashes widely onto the floor of the processing room as the drum rotates during each draining stage. Furthermore, it is necessary to supply a plurality of shut off valves (preferably automatically controlled) for the various outlets which increase the initial capital cost of the drum and are subject to malfunction. It is also previously known to utilize a pump with a separate power source to pump the liquid through an outlet on the axis of rotation of the drum. However, this arrangement has the disadvantages that it is relatively expensive to install, requires regular maintenance and is subject to malfunction.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to at least partially overcome these disadvantages by providing a spiral drain scoop which is adapted to be located in a rotating drum to expel the liquids from the drum through an outlet on the axis of rotation of the drum without a separate power supply or any parts which move relative to the drum. To this end in one of its aspects the invention provides a spiral drain scoop adapted to be attached to an end wall of a rotating drum to expel liquid from the drain through an outlet in said end wall, the outlet being co-axial with the axis of rotation of the drum, the spiral scoop defining a continuous passage having an outer pickup portion and an enclosed inner conductive portion extending between the outer periphery of the drum and the outlet in said end wall.

In another of its aspects, the invention further provides a spiral drain scoop adapted to expel liquid from a rotating cylindrical drum with an inclined axis of rotation through a central outlet on the axis of rotation in the rear wall of the drum, the scoop comprising an inner spiral portion extending outward from said opening forming a central venturi section and an outer cylindrical wash ring portion extending from the inner portion around the outer cylindrical wall, the inner portion of the scoop being substantially U-shaped in cross section and bonded along its length to the rear wall of the drum and the outer portion of the scoop being substantially L-shaped in cross section and bonded along its length to the rear wall and outer cylindrical wall of the drum, thereby providing corresponding enclosed continuous inner and outer liquid passages.

Further objects and advantages of the invention will appear from the following description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation view of a rotating drum of the type having a horizontal axis;
FIG. 2 is a sectional view taken along line II—II in FIG. 1, showing a first embodiment of the invention;
FIG. 3 is a sectional view taken along line III—III in FIG. 2;
FIG. 4 is a cross section view taken along line IV—IV in FIG. 2;
FIG. 5 is a cross sectional view taken along line V—V in FIG. 2;
FIG. 6 is a front elevation view of a drum of the type having an inclined axis;
FIG. 7 is a sectional view taken along line VII—VII in FIG. 6, showing a second embodiment of the invention;
FIG. 8 is a sectional view taken along line VIII—VIII in FIG. 7; and
FIG. 9 is a cross sectional view taken along line IX—IX in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference is first made to FIGS. 1 and 2 which show a rotating drum 10 having an axis of rotation 12 which is horizontal and a spiral drain scoop 14 according to a first embodiment of the invention. The drain scoop has an inner spiral portion 16 which is bonded along its length to the end wall 18 of the drum 10 and an outer cylindrical portion 20 which is bonded along its length to the end wall 18 and the outer cylindrical wall 22 of the drum 10.

The inner spiral portion 16 of the drain scoop 14 is generally U-shaped in cross section and the outer cylindrical portion 20 of the drain scoop 14 is generally L-shaped in cross section to provide a passage 24 having an outer pick-up portion 26 and an inner conductive portion 28. As may be seen, the passage 24 is enclosed and extends from the outer cylindrical wall 22 of the drum 10 to a central circular outlet 30 through the end wall 18 of the drum 10 on the axis of rotation 12 of the drum 10. The outlet 30 is formed by a pipe 32 which extends through the gudgeon 34 of the end wall 18, the drive sprocket 36 and the necessary bearings 38 to connect with a rotating union 40. The rotating union 40 is connected in a conventional manner to stationary piping (not shown) to provide for disposal or recirculation of the liquid from the drum. A shut-off valve (not shown) is located in the piping to provide for control of the flow of liquid from the drum. The outer portion 20 of the spiral drain scoop 14 has a plurality of small holes 42 to provide for effective straining of the liquid.
from the drum 10 into the outer pick-up portion 26 of the passage 24. In order to provide for effective pick-up of the liquid, the number and size of the holes 42 and the size and length of the outer portion 20 of the drain scoop 14 may vary with different types of drums for different applications, although the outer portion 20 normally extends around the outer wall 22 of the drum 10 through an arc of at least 90°. As may be seen, the inner spiral portion 16 of the scoop extends through an arc of greater than 360°. In the first embodiment of the invention the cross sectional area of the outer cylindrical portion 20 of the scoop 14 remains constant over its length, while the cross structural area of the inner spiral portion 16 of the scoop 14 gradually decreases to a minimum approximately in the location shown by sectional FIG. 5 and then gradually increases again towards the central outlet 30. As clearly seen by comparing FIGS. 4 and 5, in this embodiment of the invention this construction in cross sectional area along the length of the inner spiral portion 16 of the scoop 14 results from changes in both the width and height of the scoop 14. In this way, the inner conductive portion 28 of the passage 24 is provided with a venturi section approximately midway along its length. As may be seen, the outer extremity 44 of the scoop is tapered, the connection between the outer cylindrical portion 20 and the inner spiral portion 16 of the scoop 14 is gradual, and a contoured filled portion 46 is provided adjacent the inner end 48 of the scoop 14 to avoid excessive disruption of the movement of liquid in the drum and to avoid forming material catching recesses. The inner end 48 of the scoop 14 is provided with a removable clean out cover 50 substantially opposite the outlet 30. In this embodiment, the drain scoop 14 is formed of moulded fiberglass resin laminate and may be bonded along its length to an existing drum 10 by a resin bonded fiberglass laminate. Flanges 51 are provided along the length of the scoop 14 to ensure that the bonding of the scoop 14 to the end wall 18 and cylindrical wall 22 is structurally secure and liquid tight. In use, the drum 10 is rotated about horizontal axis 12 at a desired speed by motor drive 52 to process the hides in the drum in a number of successive stages. The hides are loaded and unloaded from the drum 10 through door 54 in the outer cylindrical wall 22 of the drum 10. At the first stage when it is desirable to move the liquid from the drum while leaving the hides in the drum, the valve (not shown) is opened in the piping connected to the outlet 30. As the drum 10 continues to rotate in its normal direction (clockwise in FIG. 2) the liquid is separated from the hides in the drum by passing through the holes 42 in the outer, portion 20 of the scoop 14 into the pick-up portion 26 of the passage 24. As the drum rotates, this liquid flows along the pick-up portion 26 into the inner conductive portion 28 of the passage 24. As described above, this inner portion 28 of the passage 24 gradually constricts to a venturi section through which the liquid passes and is expelled from the drum through the central outlet 30. While this provision of this venturi section is not essential to remove the liquid from the drum through the scoop, it does considerably improve the rate of expulsion of the liquid from the drum. When all of the liquid has been expelled from the drum, the valve in the piping connected to the outlet is closed and fresh or recirculated liquid is introduced into the drum in the next stage of processing.

FIGS. 6 to 9 illustrate a drum of the type having an inclined axis of rotation provided with a spiral drain scoop according to a second embodiment of the invention. As many of the features of this embodiment are identical to those of the first embodiment, features common to both embodiments are described and illustrated using the same reference numerals. This type of drum 10 has a front opening 56 and the axis of rotation 12 is inclined to the horizontal. The spiral drain scoop 14 similarly has an inner spiral portion 16 and an outer cylindrical portion 20 respectfully secured along their lengths to the rear end wall 18 and the outer cylindrical wall 22 of the drum 10.

In this embodiment, the passage 24 formed by the drain scoop 14 similarly has an outer pick-up portion 26 extending around the drum 10 adjacent to the outer cylindrical wall 22 and an inner conductive portion 28 extending from the outer pick-up portion 26 to central outlet 30 on the axis of rotation 12. The outer cylindrical portion 20 of the drain scoop 14 is provided by a wash ring as known in the prior art and described in Canadian Pat. No. 908,654 referred to above, and may also be referred to as the wash ring portion 20 of the drain scoop 14. As may be seen, this wash ring portion 20 of the drain scoop 14 has a uniform L-shaped cross section and extends completely around the inside of the wall 22 of the drum 10. As shown in FIGS. 7 and 9, the wash ring portion 20 and the inner spiral portion 16 of the drain scoop 14 join over an arc of substantially 77 degrees and a sloping barrier 58 is provided across the wash ring portion 20 of the spiral scoop 14 to deflect the liquid from the outer pick-up portion 26 of the passage 24 into the inner conductive portion 28 of the passage 24. The outer wash ring portion 20 of the spiral scoop 14 is perforated on both sides with a plurality of small holes 42, other than in the area where the two portions of the spiral scoop 14 join. The inner end 48 of the scoop 14 similarly is provided with a removable clean out cover 50, a contoured fill portion 46, and in addition has a number of small holes 60 extending therethrough. The cross sectional area of the inner conductive portion 28 of the passage 24 provided in this embodiment of the invention, similarly gradually decreases to a minimum to provide a venturi section midway along its length. The operation of this embodiment of the invention is substantially similar to that of the first embodiment, and need not be repeated in detail. It is apparent to those skilled in the art that the hides may be removed from the drum 10 through the front opening 56 by reversing the direction of rotation of the drum. However, the liquid may be separated from the hides and removed from the drum while normal rotation of the drum is continued by opening a valve (not shown) in the piping connected to the outlet 30 of the drum, as described above. From the structure of the drum, it is apparent that it is advantageous to have the outlet 30 of as small a size as possible, and in a test conducted with one embodiment of the invention it was found possible to expel 200 gallons per minute of liquid through a 4 inch disk water outlet with the drum rotating at 12 revolutions per minute. The holes 60 are provided adjacent the inner end 48 of the drain scoop 14 to maintain limited circulation of the liquid in the drum during the processing stages, to avoid a dead spot of uncirculated liquid.

Although the disclosure describes and illustrates two preferred embodiments of the spiral drain scoop ac-
According to the invention, it is not to be construed in a limiting sense. Many variations and modifications of the drain scoop will now occur to those skilled in the art. For a definition of the invention, reference is made to the appended claims.

What I claim is:

1. A spiral drain scoop to expel liquid from a rotating cylindrical drum with an inclined axis of rotation, an outer cylindrical wall, and a rear wall, through a central outlet on the axis of rotation in the rear wall, the scoop comprising an inner spiral portion extending outward from said outlet forming a central venturi section and an outer cylindrical wash ring portion extending from the inner portion around the outer cylindrical wall, the inner portion of the scoop being substantially U-shaped in cross section and bonded along its length to the rear wall of the drum and the outer portion of the scoop being substantially L-shaped in cross section and bonded along its length to the rear wall and outer cylindrical wall of the drum thereby providing corresponding enclosed continuous inner and outer liquid passages.

2. A spiral drain scoop attached to an end wall of a rotating drum having a central axis of rotation and a cylindrical outer wall to expel liquid from the drum through an outlet in said end wall, the outlet being co-axial with the axis of rotation of the drum, the spiral scoop defining a continuous passage having an outer pick-up portion extending along the outer wall of the drum and a spiral shaped enclosed inner conductive portion extending between the outer pick-up portion and the outlet in said end wall, the cross-sectional area of the inner conductive portion of the passage gradually varying along its length to a minimum substantially midway between the outlet in the end wall and the outer pick-up portion of the passage.

3. A drain scoop as claimed in claim 2 wherein the passage is substantially rectangular in cross section.

4. A drain scoop as claimed in claim 2 wherein the drain scoop is bonded along its length to the end wall of the drum in a liquid tight manner to form said passage.

5. A drain scoop as claimed in claim 2 wherein the outer pick-up portion of the passage is enclosed except for a plurality of small liquid receiving holes extending through the drain scoop along at least a portion of the length of the outer portion of the passage.

6. A drain scoop as claimed in claim 2 wherein the inner spiral portion of the passage extends through an arc of at least 360° and the outer portion of the passage extends through an arc of at least 90°.

7. A drain scoop as claimed in claim 2 formed of moulded fiberglass resin laminate.

8. A drain scoop as claimed in claim 2 formed of moulded fiberglass resin laminate and bonded to the drum by a resin-bonded fiberglass laminate.

9. A drain scoop as claimed in claim 2 wherein the scoop includes an inner spiral portion which forms the inner portion of the passage and an outer cylindrical wash ring portion which forms the outer portion of the passage and gradually extends into the inner portion, the outer portion of the passage being enclosed except for a plurality of holes therethrough along at least a portion of its length.

10. A drain scoop as claimed in claim 2 wherein the outlet through the end wall is located centrally in the end wall and is substantially 4 inches in diameter.

11. A drain scoop as claimed in claim 2 wherein the structure of the scoop is contoured to avoid the formation of material catching recesses adjacent the end wall of the drum.

12. A drain scoop as claimed in claim 2 wherein the scoop has an inner end and a plurality of small holes therethrough towards its inner end adjacent the outlet in said end wall.

13. A drain scoop as claimed in claim 2 wherein the scoop has a removable cleanout cover substantially opposite the outlet in said end wall.

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