Oct. 2, 1956 L. F. EVANS ET AL 2,765,081

RECOVERY OF WOOL WAX

Filed Aug. 6, 1953 2 Sheets-Sheet 1

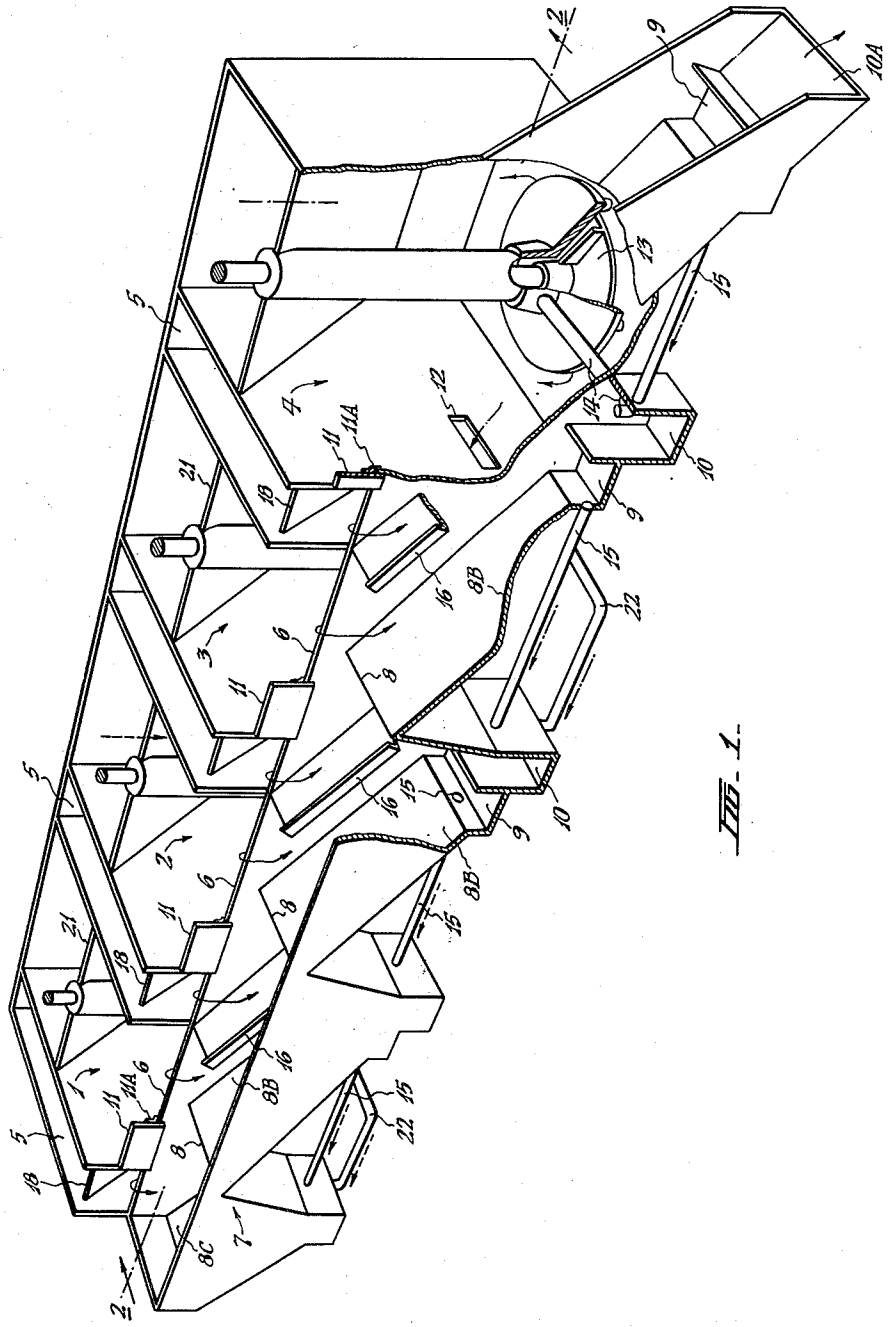


FIG. 1.

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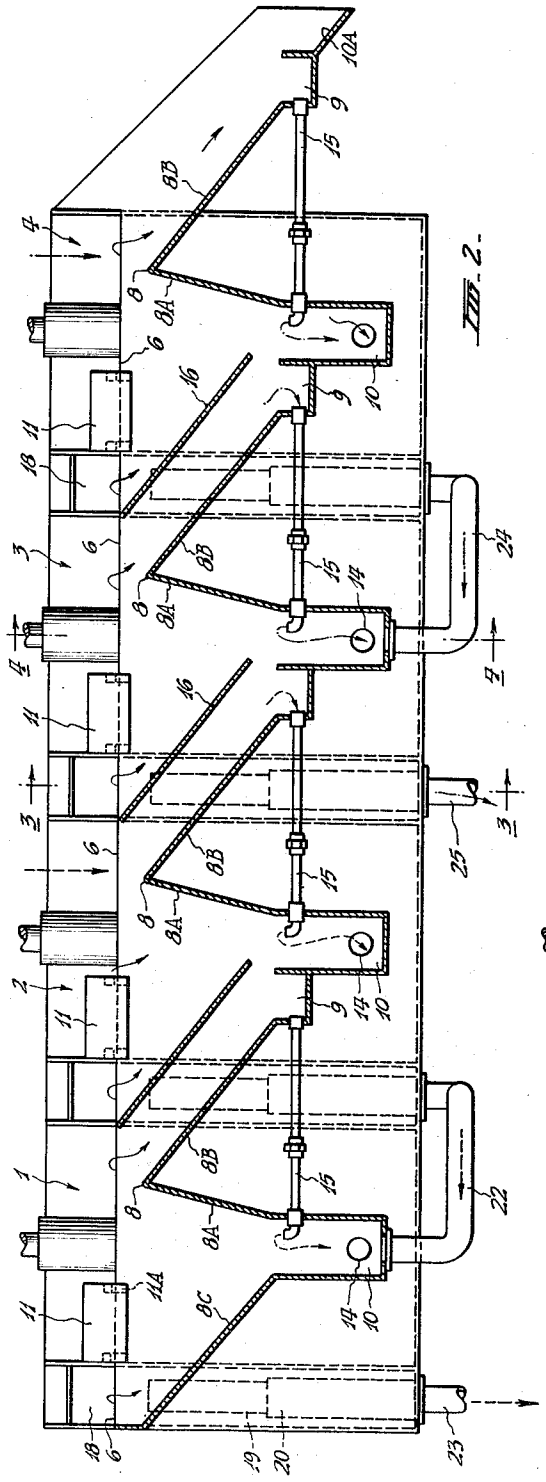


FIG. 2.

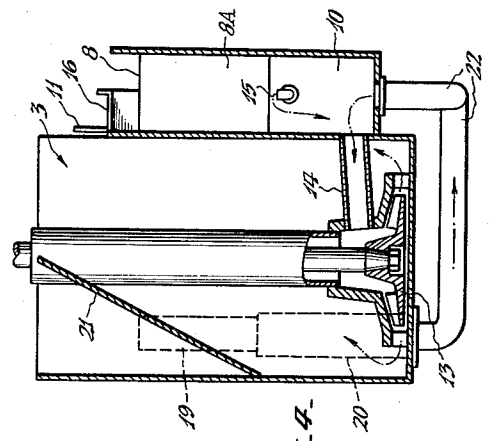


FIG. 4.

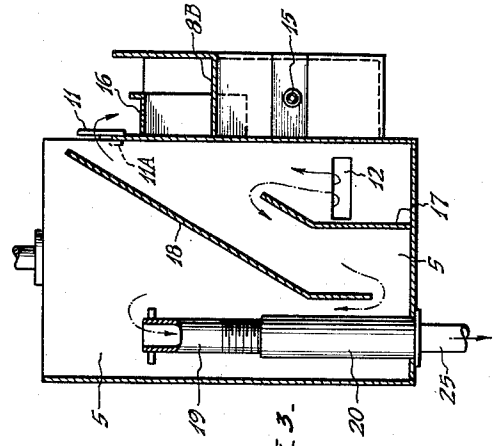


FIG. 3.

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RECOVERY OF WOOL WAX

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15 Claims. (Cl. 210—53)

This invention relates to the recovery of wool wax from wool scour liquors and its objects are to provide a process and apparatus which enables a higher proportion of wool wax than previously to be recovered readily, and which enables the wool wax to be recovered in the form of a froth from which the wool wax can be separated readily. Sometimes wool wax is known as wool grease or lanolin.

These objects are achieved by the process and apparatus according to this invention. This process for the recovery of wool wax from wool scour liquors comprises the feeding of the wool scour liquor into a wax-recovery sub-aeration flotation cell, the conversion therein of the wax into a froth by churning and aeration, the passage of the froth to a froth launder, the returning of a portion of the froth through this churning and aeration stage in the wax-recovery cell, the passing on of another portion of the froth to a washing sub-aeration flotation cell in which the froth is churned with washing liquor, the collecting of the resultant washed froth. Preferably, the returning of a portion of the froth to the churning and aeration stage is effected by arranging the air-inlet pipe of the cell so that it opens into the froth launder at such an elevation that froth will flow into it.

This flotation of the froth in order to recover the wax is different from the known flotation of minerals and the like in that the wax itself forms the froth and the froth is not merely the vehicle for the values but is comprised of the wax itself, and an important characteristic of the process is that, while there is a continuous flow of froth in one direction in the plant, a portion of the froth at each stage is returned to the same flotation cell as that from which it last emerged. In contrast with mineral flotation in which the froth is relatively unstable and collapses rapidly to a slurry which may be fed to the cleaner flotation circuit, in this process the wax froth is stable and will flow without collapsing from one flotation cell to another or to the intake of the cell in which it was formed. If wool scour liquor is treated in flotation machines of the kind used for mineral flotation, a very large bulk of stable froth is obtained which cannot be handled. Furthermore, the factor of enrichment over the concentration of wax in the original scour liquor is small. United States Letters Patent No. 2,352,365 to Booth draws attention to these difficulties and proposes chemical means for overcoming them. In accordance with the present invention, the large bulk of froth is reduced, and the concentration of wax is increased by physical means, that is, by recirculating the froth through the flotation cell in which it is produced and by subsequently washing and recirculating the froth in a washing flotation cell. This recirculation of the froth through the cell in which it was produced is for the purpose of churning up the wax so as to cause the wax films to be distorted, thus aggregating the wax into larger particles in a manner resembling the agglomeration and coalescence of fat globules in churning cream to form butter. In this way the volume of wool wax froth resultant from

the flotation of the wool wax, and hence the amount of water accompanying the wax, is progressively reduced as the froth passes through the plant.

The process has been described above in its simplest form employing a single flotation cell for the formation of the froth and a single washing cell for the cleaning and improvement of the froth, but a series of such cells may be provided and normally in accordance with this invention the waste liquor from the wax-recovery sub-aeration flotation cell to which the wool scour liquor is fed passes to a scavenging sub-aeration flotation cell for the recovery of residual wax from this waste liquor, and froth from the scavenging flotation cell is passed on to the wax-recovery flotation cell where it is again churned and floated. Preferably, only a portion of the said froth is so passed on from the scavenging flotation cell and the remainder of said froth is returned to that cell for re-treatment. Normally also, the froth from the wax-recovery flotation cell is passed through two washing sub-aeration flotation cells, and through these washing cells the washing water or like washing liquor is passed in series in counter-current to the froth, the washing liquor discharged from the last washing cell being supplied to the previous washing cell and the washing liquor from the latter cell being discharged to waste, a portion of the froth from each of these washing cells passing on further while a portion is returned to the cell in question for rechurning and flotation. The process at each stage may be made more efficient by draining that portion of the froth from each cell which passes to the next cell in the series before mixing it with the froth which is being returned to the adjacent cell for recirculation therethrough. This minimizes the contamination of the liquor in a cell with liquor from the preceding cell.

This process may be applied readily by means of the apparatus according to this invention. This apparatus will be described in relation to four flotation cells but it could embody a different number of flotation cells for the recovery or washing of the wax.

In the accompanying drawings:

Figure 1 is a perspective view of the apparatus with portion broken away;

Figure 2 is a longitudinal section through the launder on the line 2—2 of Figure 1, and

Figures 3 and 4 are cross-sections on the lines 3—3 and 4—4, respectively, of Figure 2.

Four sub-aeration flotation cells 1, 2, 3 and 4 are arranged in series, each being provided with a liquor-outflow chamber 5 which in the case of adjacent flotation cells is positioned between the two cells. If the progressive movement of the froth is regarded as being from left to right through the plant, the left-hand flotation cell 1 is the scavenging cell, the next flotation cell 2 is the main wax-recovery cell (which may conventiently be termed "the wax-recovery cell"), the next flotation cell 3 is the first froth-washing cell and the next flotation cell 4 is the second froth-washing cell. Each flotation cell is provided with an overflow weir 6 for the froth produced in that cell and the froth is delivered to a launder 7 which is positioned adjacent to the front or rear face of the series of flotation cells. The bottom of this launder extends upwardly and downwardly so that it provides a series of ridges 8 separated by a series of depressions. One ridge is positioned opposite to each flotation cell so that a portion of the froth flows down on the left-hand side 8A of the ridge into a sump 10 and is returned, as hereinafter described, to the flotation cell in which it was formed while another portion of the froth flows down the right hand side 8B of the ridge and forwardly into a froth-draining compartment 9, from which it flows over into the adjacent sump 10, and thence

into the next flotation cell and so on. Froth thus flows forward continuously from left to right, and liquor flows from right to left as hereinafter explained. The proportion of the froth recirculating in any cell to the froth passing to the next in the series is made variable by barriers adapted to block a part of the froth overflow weir to the left of the ridge. This may be achieved by fitting a plate 11 on the weir 6. These plates can be made of various sizes so as to provide for variable adjustments and should be readily attachable to, and removable from, the weir. From a lower portion of each flotation cell waste liquor, and some entrained froth, passes into a liquor outflow chamber through an opening 12 in the wall thereof and then the liquor is recirculated as hereinafter described, the froth being trapped and directed upwardly over the weir into the launder.

The preferred detailed construction of the apparatus and its operation will now be described in more detail.

Each flotation cell is provided with an impeller 13 which draws in air through an inlet pipe 14. Wool scour liquor, from which the wax is to be recovered as far as possible, is fed into the wax-recovery flotation cell 2 through any suitable pipe or conduit (not shown). The impeller aerates the wool scour liquor and forms a froth of wool wax which rises and is directed forwardly by a baffle 21 and flows over the weir 6 into the launder, a portion of it passing down on to the adjacent portion 8A thereof and thence into the adjacent sump 10, from which the froth is sucked back by the impeller into the flotation cell 2. Another portion of the froth, which falls on the downwardly inclined portion 8B of the launder, is carried on to the draining compartment 9 which is opposite the flotation cell 3. Some liquor drains out of the froth and returns through a pipe 15 to the sump 10 of the flotation cell 2. In each draining compartment some liquor drains out of the froth and is similarly returned to the flotation cell in which that portion of the froth was formed. To enable the froth which is passing forwardly from a cell to the next cell in the series to be drained before admixing with the froth from said next cell, an upper launder 16 extends down from the left hand side of the liquor-outflow chamber 5 of said next cell to a point above the sump 10 of said next cell. This prevents unnecessary overloading of the draining compartment 9 and also prevents the premature passing of liquor from a cell to the cell on its left. Obviously, a draining compartment is not required opposite the cell 1. The portion 8C of the launder opposite the left portion of the cell 1 is similar to the portions 8B. Liquor from a relatively low portion of the wax-recovery flotation cell 2 passes, as hereinbefore mentioned, through the opening 12 in the wall into the liquor-outflow chamber 5 in which the liquor flows upwardly and downwardly past baffles 17 and 18, then passes out through an outlet which is adjustable in height (as, for example, over the top of a pipe 19 which is in threaded engagement with a fixed pipe 20), and finally flows through a pipe 22 into the sump 10 of the scavenging flotation cell 1. The adjustable outflow controls the level of the liquid in the cell. Some of the residual wax in the liquor is formed in the scavenging flotation cell into a froth and passes over the weir 6, a portion of said froth returning to the cell 1 by way of the sump 10 opposite to that cell and the remaining portion passing onward to the draining compartment 9 opposite the cell 2. The liquor from the scavenging cell passes through a liquor-outflow chamber similar to that above-described and is discharged to waste through a pipe 23. Any froth entrapped by the baffle 18 of a liquor-outflow chamber of the plant passes upwardly and flows over the weir 6 to join the froth delivered directly from the cell in question into the launder. The froth which is returned from a sump 10 to the corresponding flotation cell is rechurned in the latter; by way of example, in the flotation cell 2 this rechurned froth passes up with the froth directly

formed in that cell and spills over into the launder, one portion of the froth passing back to the cell 2 and one portion passing on to that froth-draining compartment 9 which is positioned on the launder opposite the cell 3, which latter cell functions as the first washing cell. The flotation cells are similar to one another. There are, however, differences in the feed liquor and in the discharge of liquor; thus, the liquor in the wax-recovery cell 2 is the wool scour liquor, and the outflow liquor from that cell passes to the cell 1 and finally is discharged to waste from the cell 1 through the pipes 19, 20 and 23. The liquor in the cell 3 (apart from any liquor entrapped in the froth which is passed into that cell after leaving the wax-recovery cell 2) is the outflow from the second froth-washing cell 4 through a pipe 24. The outflow from the cell 3 passes to waste through a discharge pipe 25. The second froth-washing cell 4 is exactly similar to the first froth-washing cell but is fed with fresh water or other fresh washing liquor.

Any liquor that settles from the froth in a draining compartment 9 passes back into the sump of the flotation cell from which that portion of the froth has come, while any froth that flows over from the froth-draining compartment passes down into the sump adjacent to it, from which it is drawn into the corresponding flotation cell, in which it is to be retreated. There is thus a continuous flow of froth from left to right through the plant and a continuous rechurning of the froth. When the froth leaves the second washing cell the portion which passes onward is drained in the final froth-draining compartment 9 and passes down a chute 10A to a collecting vessel (not shown). There is no need for a sump 10 at this position.

The plates 11 may be fitted on the weir 6 by providing each plate with lugs 11A, so that the top of the weir fits between the lower portions of the lugs and the lower portion of the plate.

The wax may be recovered from the resultant froth by dispersion to form an emulsion and by subsequent centrifuging.

We claim:

1. A process for the recovery of wool wax from wool scour liquids which produce a stable froth when subjected to froth flotation comprising feeding wool scour liquid into a wax-recovery sub-aeration flotation cell, mechanically agitating and impelling and aerating the wool scour liquid adjacent the bottom of said cell to effect the production of froth, passing the froth from said wax-recovery sub-aeration flotation cell to a launder, feeding air and returning a portion of the froth from said launder to a point adjacent the bottom of said wax-recovery sub-aeration cell, passing another portion of the froth from said launder to a second sub-aeration agitating, impelling and aerating cell, and collecting the resultant washed froth.

2. A process for the recovery of wool wax from wool scour liquids which produce a stable froth when subjected to froth flotation comprising feeding wool scour liquid into a wax-recovery sub-aeration flotation cell, mechanically agitating and impelling and aerating the wool scour liquid adjacent the bottom of said cell to effect the production of froth, passing the froth from said wax-recovery sub-aeration flotation cell to a launder, feeding air and returning a portion of the froth from said launder to a point adjacent the bottom of said wax-recovery sub-aeration cell, passing another portion of the froth from said launder to a froth-washing sub-aeration flotation cell, mechanically agitating and impelling and aerating the froth in said froth-washing sub-aeration cell with washing liquid at a point adjacent the bottom of the last mentioned cell, and collecting the resultant washed froth.

3. A process as in claim 2; further comprising passing the waste liquid from said wax-recovery sub-aeration flotation cell to a scavenging sub-aeration flotation cell, mechanically agitating and impelling and aerating the waste liquid adjacent the bottom of said scavenging sub-

aeration cell to effect the production of froth, and returning a portion of the froth from said scavenging sub-aeration cell to said point adjacent the bottom of said wax-recovery sub-aeration cell.

4. A process as in claim 3; further comprising feeding air and returning another portion of the froth from said scavenging sub-aeration cell to the latter at a point adjacent the bottom of said scavenging sub-aeration cell.

5. A process as in claim 2; further comprising passing a portion of the froth from said froth-washing sub-aeration cell to a second froth-washing sub-aeration flotation cell, mechanically agitating and impelling and aerating the froth with washing liquid at a point adjacent the bottom of said second froth-washing sub-aeration cell, and feeding air and returning another portion of the froth from the first mentioned froth-washing sub-aeration cell to the latter at said point adjacent the bottom of said first froth-washing sub-aeration cell.

6. A process as in claim 5; further comprising collecting a portion of the resultant washed froth from said second froth-washing sub-aeration cell, and feeding air and returning another portion of the froth from said second froth-washing sub-aeration cell to the latter at said point adjacent the bottom of said second froth-washing sub-aeration cell.

7. The combination, in apparatus for the recovery of wool wax from wool scour liquors which produce a stable froth of unmanageable proportions when subjected to froth flotation, of a wax-recovery sub-aeration flotation cell, means for feeding wool scour liquor into said wax-recovery flotation cell, a froth-washing sub-aeration flotation cell, means for feeding washing liquor into said froth-washing flotation cell, a launder extending across adjacent faces of said wax-recovery flotation cell and said froth-washing flotation cell, alternate ridges and recesses in said launder, an overflow weir on said wax-recovery flotation cell and on said froth-washing flotation cell and above said launder, one of said ridges being so positioned in relation to said wax-recovery flotation cell that a portion of the froth flowing over the weir of said wax-recovery flotation cell will fall on one side of that ridge while another portion of said froth will fall on the other side of said ridge, another of said ridges being positioned in relation to the froth-washing flotation cell similarly to the position of the first-mentioned ridge in relation to the wax-recovery flotation cell, and one of said recesses communicating with the lower portion of said wax-recovery flotation cell and another of said recesses communicating with the lower portion of said froth-washing flotation cell.

8. The combination according to claim 7, further comprising an air-inlet pipe adapted to supply air to the lower portion of the wax recovery flotation cell, another air-inlet pipe adapted to supply air to the lower portion of the froth-washing flotation cell, and each air-inlet pipe opening into the adjacent one of the recesses in the launder at such an elevation that froth will flow into it from said recess.

9. The combination according to claim 7, further comprising froth-draining compartments one of which is adjacent to each of the recesses and is adapted to feed drained froth thereto.

10. The combination according to claim 7, further comprising a liquor-outflow chamber connected to each flotation cell, baffles in said chamber, a froth overflow weir on said chamber and leading to the launder, and a vertically adjustable liquor-outlet in said chamber.

11. The combination according to claim 7, further comprising a scavenging sub-aeration flotation cell adjacent to the wax-recovery flotation cell and adjacent to portion of the launder, a froth-overflow weir on said scavenging flotation cell, a ridge on said launder opposite to said scavenging flotation cell, and means for removing liquor from that froth-draining compartment of the launder which is positioned opposite to the wax-recovery flotation cell and for returning it to the scavenging flotation cell, and a liquor-outflow chamber connected to said scavenging flotation cell.

12. The combination according to claim 7, further comprising a second froth-washing cell constructed similarly to the froth-washing cell included in said claim and provided with a similar portion of the launder, means to supply washing liquor to said second froth-washing flotation cell, means for conveying washing liquor from the liquor-outflow chamber of second froth washing flotation cell and for delivering it to the recess in the launder opposite to the other of said froth-washing flotation cells, means for discharging liquor from the liquor-outflow chamber of said other froth-washing cell.

13. The combination according to claim 7, further comprising an upper launder extending from one end of the weir of the wax-recovery cell to a position beyond the froth-draining compartment positioned on the launder opposite to the said cell and another upper launder similarly positioned on the froth-washing cell.

14. The combination according to claim 7, further comprising a second froth-washing sub-aeration flotation cell, an upper launder extending from one end of the weir of the wax-recovery cell to a position beyond the froth-draining compartment positioned on the launder opposite to the said cell, and another upper launder positioned on said second froth-washing cell similarly to the upper launder on the wax-recovery cell.

15. The combination according to claim 7, further comprising a series of froth-overflow barriers of varying length adapted to regulate the flow of froth over the overflow weir of the flotation cells.

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