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WASHING WOOL AND OTHER TEXTILE MATERIALS
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The present invention relates to improvements connected with the washing of wool and other textile materials, as hereinafter fully described.

It has been proposed, hitherto, to circulate the liquids employed in the opposite direction to the movement of the material under treatment, in consequence whereof they are caused to pass through several baths in which the ratio of the quantity of impurities to the quantity of bath liquid progressively increases. On the other hand, it has also been proposed to utilize apparatus for washing and cleaning wool in which the wool is propelled mechanically through a number of washing vats, each followed by a press; but such apparatus, as is also the case with the so-called "leviathans", requires that the liquid which gradually becomes more and more dirty, be transferred from time to time from one vat to another, thereby occasioning interruption of the operation. In order to reduce the number of such interruptions as much as possible, it has been customary to utilize washing vats containing large volumes of water; but this expedient involves the disadvantage that the soap, which is introduced in great quantity into the aforesaid vats, is absorbed, due to its prolonged stay therein, by the impurities which are present and, at the same time, changes its physical state, with a resultant decrease in its detergente power.

This invention involves an improved washing system or installation comprising a plurality of units each embodying a vat or other soaking device and an extractor individual thereto; such system working on the above-mentioned counter-current principle and being designed to overcome the necessity for transferring the bath liquids from one vat to the next and, hence, the consequent stoppages, which were unavoidable at intervals in the known procedures.

The essential feature of the improved system is the fact that the tanks or vats which are located in advance of the extractors or presses are of very small volume; that is to say, they contain only so much liquid as is necessary for saturating the material; and that each vat is kept filled by the liquid expelled by the press belonging to the vat which immediately follows it. In this way, the washing is carried out in baths of constant or unchanging composition, and the impurities which are discharged very rapidly from the system remain, accordingly, only for a few minutes in contact with the detergente agent, which, of course, is a most economical proceeding as regards the latter. According to the invention, the result desired is accomplished primarily by reason of the fact that the press associated with the vat where the wool enters the system discharges the squeezed-out liquid into the drain, whereas the liquids extracted by the other presses are delivered in each case directly to the vat containing the next dirtier water in order.

In the accompanying drawings:

Figures 1 and 2 are diagrams representing the circulation of the water in series and in parallel, respectively; the arrows designating the direction of flow, and the presses being indicated by dots and the vats by vertical lines.

Fig. 3 is a plan view, somewhat diagrammatic in character, of an apparatus embodying the invention.

Fig. 4 is a longitudinal section thereof.

As shown in Figs. 1 and 2, the circulation of the bath liquids may take place in series, or in parallel, as described hereinafter in connection with Fig. 3; and, if desired, the operation can be so regulated, due to the construction and arrangement of the piping system and other parts of the apparatus, as likewise explained, as to enable the circulation to take place in parallel in the first or upper stages and in series in the last or bottom stage. In the figures mentioned, the circulation of the liquids is entirely in series in the first case, and entirely in parallel in the second case, with six and three pressing or extracting operations, respectively, so that twice as much liquid is used in the second case as in the first. The wool or other textile material to be treated enters the apparatus at the bottom stage in a dry state and in ribbon form, while the liquid enters at the top stage, the two proceeding in counter-current. The apparatus represented is of the duplex type; that is to say, the vats are arranged in pairs, in effect, one at the side of the other, and each separate vat can be mounted in such a way that the corresponding vats of each stage are placed side by side in the system. The bath liquids will then travel through each half of the apparatus in the manner explained above, either in parallel or in series.
known installations, i.e., about 300 liters, and the clean liquid from this vat cannot cause any considerable adsorption of soap. All the necessary soap is introduced hereinto, the relatively-large size of the vat insuring a stabilization of the temperature and of the percentage of detergent agents. This percentage is so regulated that the water is almost non-laundry on arriving at the lower stage which serves for the entry of the wool. There are two presses 1 and 2 associated with this vat, and beneath them are arranged trays or collectors 1’ and 2’ which catch the liquid extracted by the presses and deliver it to the

vats B and C of the middle stage, as hereinafter explained; and because of that fact, and of the fact that the presses and their collectors are independent of each other and are separately supplied with the wool, it will be apparent that vat A, while actually a single vat as regards its structure, is nevertheless a duplex vat in its action or effect.

A roller B (Fig. 4) arranged in front of the presses 1 and 2 of vat A may be employed to compress the wool before it reaches said presses, so that it carries less water with it. This presents hardly any difficulty because the water is clean (and that is necessary) when the extracted water of said vat circulates to the middle stage, as shown in Fig. 1. There are two vats B and C in the middle stage, as previously stated, and two vats D and E in the lower or bottom stage where the wool enters, all connected together by piping; presses 3, 4, 5 and 6 being associated with the respective vats.

In the construction illustrated, pipes t' and t lead from the trays or collectors 2’ and 1’ to the vats B and C, connection being made by means of passages b’ and b’, the latter of which can be opened and closed by a suitable plug (not shown); and there is a gate r’ or the like in the channel A’ between the two trays which is opened for series-circulation and closed for circulation-in-parallel. Similarly, the presses 3 and 4, which are fed with wool from vats B and C, are equipped with trays 3’ and 4’ which communicate by way of passages b” and b”’ and pipes t” and t”’ with vats E and D; the latter vats being arranged adjacent the presses 6 and 5 and their trays 6’ and 5’. Plugs are provided for the passages b” and b”’ as well as for the passages b’ and b’’ that lead from the trays 5’-6’ and control the flow of the liquids through the hereinafter-mentioned pipes t” and t”. The tray 3’ of press 3’ of the middle stage is connected by a pipe t” with the vat C of that stage, as well as by the pipe t”’ with the vat E of the lower stage. The trays 5’ and 6’ are emptied through the pipes t” and t”’ into outlet channels D’ and E’ which discharge alternatively into drains C’ and C”, and for that purpose said channels are furnished with plug or other outlet valves b”, b”, b”’, b”. Finally, pipes t” and t”’ are also provided for feeding the liquids extracted by the presses 3 and 5 to vats C and E, respectively; and there is a gate or other valve r” in the connecting channel B” between the vats B and C.

Circulation in series throughout the entire apparatus is effected by opening the gate valve r” in channel A’ and closing the passages b’, b”, b”. The liquids extracted by the two presses 1 and 2 will then flow through channel A” and pipe t” into vat B which, as previously stated, has a constant level, and which feeds the wool or other textile material under treatment to press 3; the liquid extracted by said press being delivered to vat C by pipe t’.

The press 4 receives the strands of wool leaving vat C and delivers the extracted liquid through pipe t” into vat D; and the presses 5 and 6 fed by said vat supply the vats D and E through the pipes t” and t”. Finally, the presses 6 and 5, which are fed by vats E and D, empty through pipes t” and t”’ into the channels E” and D” and thence into the drains. The upper ends of the passages t” and t”’ should occupy a sufficiently elevated position to enable the liquids to escape by gravity through pipes t” and t”’ when the plugs of passages b” and b”’ are removed.

Besides the all-parallel and all-series circulations just described, it is also possible to operate the apparatus in a manner to obtain a circulation which is partly in parallel and partly in series. This can be effected readily by simply closing gate r” in connecting channel A” and opening passages b” and b”’, passages b” and b” remaining closed. Working will then take place in parallel in the upper stage, and in series in the middle and lower stages in accordance with the operations as explained above in connection with the first or upper stage of the parallel circulation and the middle and lower stages of the series circulation, respectively. In other words, the liquids from presses 1 and 2 will pass through channel A’ and passages b’ and b’’ into pipes t” and t”’ and thence into vats C and B; and the press 3 associated with vat B will deliver the extracted liquid through pipe t” to vat C, from which it will pass, together with the liquid from vat C, to press

In parallel-working gate r’ is closed and passages b’, b” and b” are opened, whereupon circulation proceeds as follows: The presses 2 and 1 separately supply the vats B and C immediately below them through the pipes t” and t”; and the presses 3 and 4 fed by said vats supply the vats D and E through the pipes t” and t”. Finally, the presses 6 and 5, which are fed by vats E and D, empty through pipes t” and t”’ into the channels E” and D” and thence into the drains. The upper ends of the passages t” and t”’ should occupy a sufficiently elevated position to enable the liquids to escape by gravity through pipes t” and t”’ when the plugs of passages b” and b”’ are removed.
4 and thence through passage $b_{12}$ and pipe $e'$ to vat D, and then to and through press $b$, pipe $e'$, vat $E$, press $b$, pipe $e'$ and channel $E'$ to the drain.

As the wool or other material to be washed enters the vats $D$ and $E$ in a dry state, these vats will empty more quickly than the others; and it is to avoid this that the above-described parallel-series circulation is employed. By adopting the series-circulation in the bottom stage, only half as much liquid is needed as is required for circulation in parallel and, moreover, the detersive agent is completely exhausted because it meets twice, one time after the other, the material in its dirtiest state.

It will be apparent, of course, that in the installation described, the circulation of the liquids between the little vats can also be carried out in such a way as to utilize overflows which collect the liquid squeezed out by the presses. These overflows are indicated at $P'$, $P''$, $P'''$, and $P'$, which lead, respectively, from vat $A$ to vat $B$, from vat $C$ to vat $D$ (by way of connecting channel $B'$ and gate $r'$), from vat $D$ to outlet channel $D'$, and from vat $E$ to outlet channel $E'$. Of the two vats $B$ and $C$ of the middle stage, the latter contains the dirtier liquid, whereas the vat $D$ on the same side in the lower stage contains liquid which is less dirty than the other lower stage vat $E$. Pure water is introduced into vat $D$ through a pipe $M$, and some liquid can also be introduced into vat $E$ (after having been withdrawn from the apparatus and subjected to centrifuging) through a second pipe $N$.

The two drains $C'$ and $C''$ for evacuating the liquids discharged from the apparatus by way of the outlet channels $D'$ and $E'$ are intended to receive, respectively, the liquids which, on being centrifuged, produce an oil that can be reused for oiling, and the remaining liquids. The passages $b'$ and $b''$, empty into drain $C'$, and the passages $b'$ and $b''$, empty into drain $C''$; the discharge being controlled by plugging the proper passages.

I claim as my invention:

1. A process of washing wool and other textile materials with detersive agents, comprising the steps of subjecting the material to a succession of very brief and very rapid soaking treatments with just enough detersive liquid to saturate the material, extracting the liquid from the material after each soaking operation, and transferring the liquid obtained at each extracting operation to another bath containing dirtier liquid for reuse therein.

2. A process according to claim 1, in which the material, after undergoing each soaking operation and before being subjected to the succeeding extracting operation, is compressed slightly to reduce the quantity of liquid which it contains.

3. A process of washing wool and other textile materials, comprising the steps of soaking the material in a succession of pairs of baths each utilizing detersive liquid; transferring the material from one pair of baths to the next at the conclusion of each soaking operation; and circulating the liquid in series through certain of the baths, the circulation of the material proceeding in parallel and in the opposite direction to the liquid.

4. A process according to claim 3, in which the circulation of the bath liquids in series occurs at least in the lower stage.

5. A process of washing wool and other textile materials, comprising the steps of soaking the material in a succession of pairs of vats each containing detersive liquid; transferring the material from one pair of vats to the next at the conclusion of each soaking operation; and circulating the liquid in series through certain of the vats, the circulation of the material proceeding in parallel and in the opposite direction to the liquid.

6. Duplex apparatus for washing wool and other textile materials, comprising a succession of pairs of soaking vats for containing detersive liquid; pressing means associated with each pair of vats to expel liquid from the steeped material; means for transferring the material from the vats to the associated pressing means; a system of piping interconnecting the vats and pressing means; and valve means associated with the piping system for selectively circulating the liquid therethrough in series or in parallel.

7. A process of washing wool and other textile materials with froth-forming detersive agents, comprising the steps of subjecting the material to a succession of very brief and very rapid soaking treatments with just sufficient detersive liquid to saturate the material, extracting the liquid from the material after each soaking operation, and circulating the extracted liquids between the baths.

In testimony whereof I affix my signature.

ELISÉE CHARLES DUHAMEL.