June 18, 1929. E. C. DUHAMEL 1,717,439

PROCESS FOR WASHING OR CLEANING TEXTILE MATERIALS

Filed Sept. 2, 1924 2 Sheets-Sheet 1

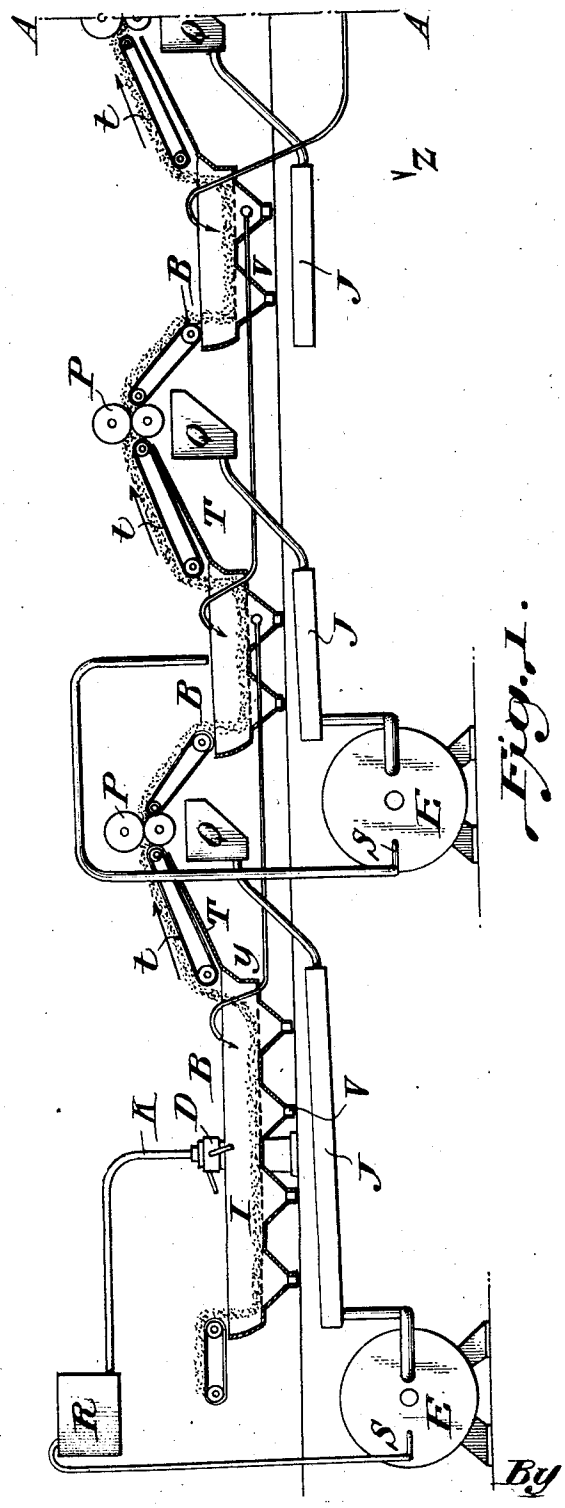


Fig. 1.

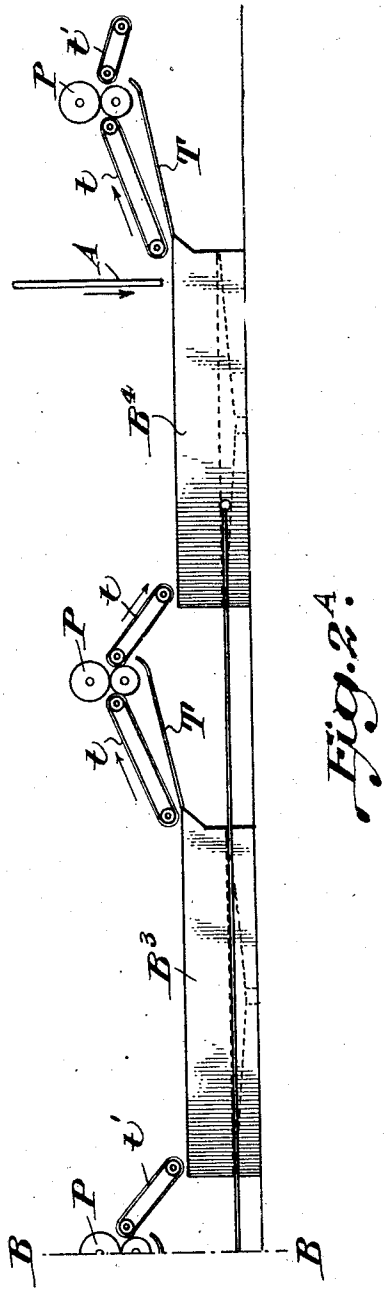


Fig. 2.

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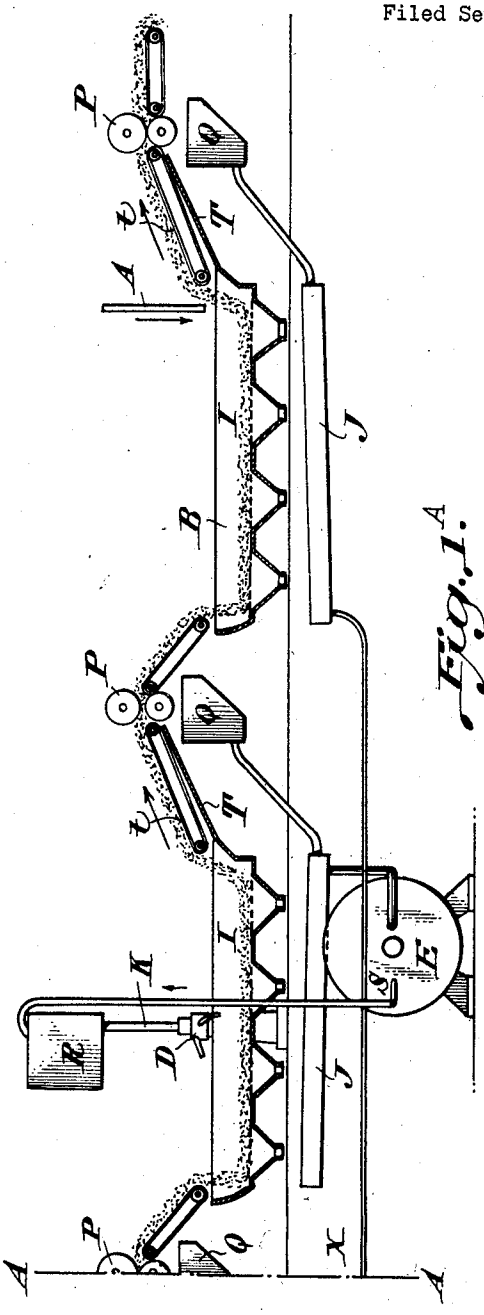


Fig. 1.

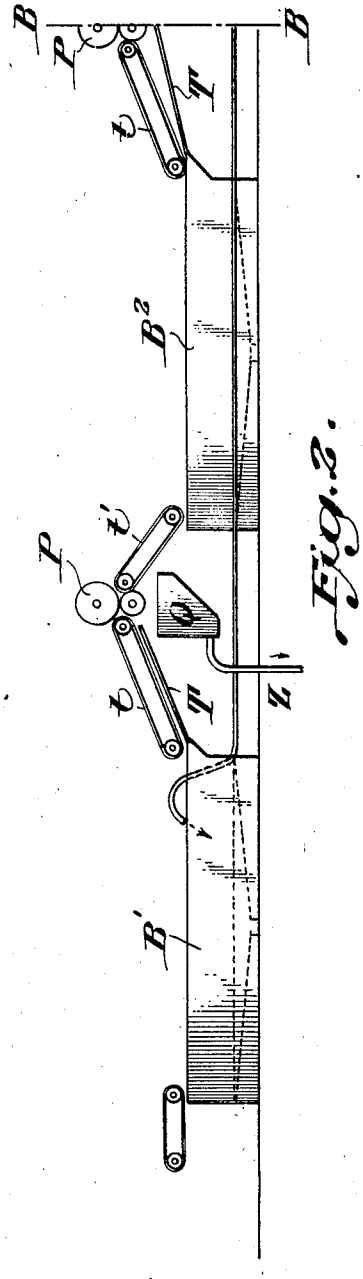


Fig. 2.

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Patented June 18, 1929. 1,717,439

UNITED STATES PATENT OFFICE.

ELISÉE CHARLES DUHAMEL, OF ROUBAIX, FRANCE.

PROCESS FOR WASHING OR CLEANING TEXTILE MATERIALS.

Application filed September 2, 1924, Serial No. 735,521, and in France September 7, 1923.

This invention relates to a process for washing, cleaning or otherwise treating wools in any condition, silk, soiled fabrics, or other fibrous textile materials, which process is particularly applicable to the washing of raw wool, to the removal of sericin from silk and to the degreasing or cleaning of soiled fabrics.

The invention aims at reducing the consumption of the detersive agents used for the treatment, at increasing the output of the washing apparatus and at diminishing or even preventing the pollution of public watercourses by the foul washing liquors.

To this end, the invention contemplates the liberation and recovery of a part of the detersive agent adsorbed by the impurities in the bath for re-use in the washing process.

The invention further contemplates a process for improving certain kinds of wools, soiled fabrics and like textile materials by treating same with a concentrated suint liquor obtained from raw wool.

Moreover the invention contemplates the use, if desired, of two detersive agents in succession and not simultaneously as heretofore.

A still further object of the invention is the prevention of the detrimental consequences of fermentation set up in the baths in washing or like processes, so as to enable such baths to be used for a considerably longer period than hitherto.

Further objects and advantages of the invention will become apparent as the description proceeds.

The process of the present invention may be carried out in a plurality of containers containing different (for example, successively cleaner) baths or in a single container traversed by successively cleaner liquids each of which may be purified for re-use.

It is well known that wool-washing columns have to be periodically stopped for the washing baths to be transferred by injectors from vat to vat and finally to the aqueduct. This changing over takes a considerable time (about 45 minutes) and gives rise to variations in the quality of the washed product. In order to lengthen the intervals between such stoppages, very large vats are generally used.

The detergent, such for example as soap, added to a washing bath enables the washing liquor to penetrate between the fibres of the wool or other material to be cleaned and to detach the impurities. The soap thereupon enevelops the particles of impurities like a coat of paint, being adsorbed by the impurities and rendered useless for further washing while in this adsorbed condition.

The particles of impurities in the material to be cleaned are extremely fine and, consequently, present a very large total superficial area for adsorption of the soap, which superficial area is thus an important factor in determining the consumption of soap.

According to the present invention, the adsorption effect of the impurities is decreased by reducing the duration of contact between the impurities and the detersive agent; and at the same time, a part of the adsorbed detersive agent is recovered for use over again in the washing process, this reduction of duration of contact and partial recovery being effected in practice in either or both of two ways, viz:—

(*a*) By purifying the liquids from at least one container or vat by centrifugal treatment during the course of the actual washing operation, that is to say in a substantially continuous manner, or

(*b*) By diluting one or more washing baths through which the material passes, by the addition of water, thereby disturbing the adsorptive equilibrium and liberating a certain amount of soap from its adsorptive combination with the impurities, for re-use in the washing process.

By these means, also, the intervals between stoppages are considerably lengthened or the process is even rendered practically continuous and all stoppages are avoided.

The purifying action may be supplemented by the introduction of a gaseous medium, such as air, in any suitable manner, while the material is being propelled through the bath by mechanical means, said introduction serving to gently agitate the material under treatment and thereby facilitate the removal of the impurities. This introduction of air also has the effect of disturbing the equilibrium in the bath by modifying the surface tension, the viscosity and the electric charge of the particles in suspension in the liquid, which results in an increase in the detergent power of the bath.

In order to understand the invention more clearly, the same will hereinafter be more fully described with reference to the accompanying drawing which illustrates diagrammatically in Figures 1 and 1A an installation

for washing raw wool in bulk by means of two successive detersive agents, viz: suint and soap; and in Figs. 2 and 2A in similar manner an installation in which soap alone is used.

In the following description, the term "suint" is intended to denote those components (excluding earthy substances) of the matter found on raw wool in its natural state which are adapted to be extracted therefrom by water.

In one embodiment of apparatus for carrying out the process of the invention as applied to the washing of raw wool in bulk by means of two successive detersive agents, viz: suint and soap, the washing set or column comprises five vats B, the first of which contains a suint liquor of about 4° Bé. concentration; the second vat a suint liquor of about 1° Bé. concentration; the third vat contains water supplied from the fifth vat; the fourth vat contains soap solution; and the fifth vat contains water which is supplied thereto by a pipe A.

The wool is propelled mechanically through the consecutive vats, being mechanically charged onto a conveyor *t* on issuing from each vat and conveyed through a press P to the next following vat; and beneath the false bottom of each vat, there are arranged pyramidal chambers V having widely inclined walls, a measure which reduces the volume of the vat. These pyramidal chambers enable the mud to collect therein and to be removed by automatic flushing devices. On leaving the first vat, the wool reaches the press P where most of the bath liquor it contains is squeezed out. A part of this liquid, however, drains off before the wool reaches the press, while a part remains in the wool after it has passed through the press.

Beneath each conveyor *t* carrying the wool to the press P is arranged a sheet metal member T adapted to catch the liquid draining from the wool and to return it to the vat, while the liquid expelled by the press,—which is dirtier than that draining off from the wool prior to its entry into the press— is collected in a small container Q provided with a perforated sheet metal member adapted to retain the wool fibres contained in the liquid. The liquid which passes through the perforated fibre-retaining sheet is subjected to a purification process as will hereinafter be more fully described, while the wool remaining on the perforated sheet is removed by hand.

The liquid obtained by flushing the chambers V beneath the false-bottom of the vat is also subjected to the purification process together with the expressed liquid. Nevertheless, the liquid expelled by the press may be run back into the vat beneath the false bottom and be flushed out of the pyramids. All the liquids of a bath which it is intended to purify are collected in a duct or channel J and may pass through a fibre-collecting device before reaching the purifying apparatus.

The purification of the liquors is effected in two stages in a manner known per se. For this purpose, two types of centrifugal apparatus are used, one apparatus E serving for the mechanical removal of the heavy particles (hereinafter referred to as a "mud remover"), while the other apparatus D, which is of smaller diameter and rotates at high speed, serves to remove the grease.

The mud-remover E may be of any type, for instance of the vertical axis type. The mud deposits on the walls of the solid basket and this would ordinarily necessitate its removal by hand after a few hours working, the apparatus E is, however, preferably such that the removal is effected automatically by mechanical devices. This apparatus E may be placed at a lower level than that of the vat, and by virtue of its acquired velocity the liquid can be forced up a pipe S to a height of several meters into a storage tank R whence it is returned through a pipe K to the vat B after having passed through the centrifugal grease separator D.

The washing liquids of the same degree of concentration from several washing columns may be mixed together and supplied to the same mud remover, the purified liquid being subsequently distributed among the several vats from which it was taken. This may be advantageous in the case of mud removers owing to their large output capacity. There is no risk of coarse or coloured fibres that are carried away by the liquids finding their way into baths where fine and white materials are being treated, because the fibres are separated from the liquid in the mud remover and adhere against the sides of the latter.

Where the liquids from several baths of the same kind are mixed together, a battery of grease separators can be arranged to feed the series of vats through a pump if the battery is on the same level as the mud remover, or without the use of a pump if said battery is on a sufficiently high level above the vats to enable pipes to be installed without being in the way.

Up to the present time, the liquids have been circulated from vat to vat in a washing column, from the last vat which contains the clear rinsing water to the first vat which is the dirtiest. The wool travels through the column in the opposite direction to the water.

The column described comprises a front portion or section which is represented in Fig. 1 and which, in the present instance, embodies three vats, and a second or rear portion or section which is represented in Fig. 1A and which embodies two vats. The third or last vat of the first section receives its fresh liquid (which is water), not from the succeeding vat of the column (the first vat of

the second section), but from the last vat of the column (the second vat of the second section), as indicated by arrow X. Thus, it can receive, without waste, all the water from the rinsing vat; but it discharges almost the entire amount into the conduit Z with the liquid expelled by its press or squeezer or with the flushings that occur beneath the false-bottom, because, due to the purifying of the baths during working, it is possible with the present process to reduce the consumption in liters of the water from the first vat of the column to about the number of kilograms of wool delivered to it.

The first vat loses liquid with the wool that leaves it, as well as with the muds and grease extracted; and in the case where the detersive agent selected is suint concentrated, for instance, to about 4° Bé., it is important, in order to maintain the concentration of the bath, that such muds and grease carry a little of the liquid away with them; whereas, if the concentration increases, some of the suint can be removed and utilized for other purposes—recovery of the potash, for example. It is only necessary to introduce into the first vat a volume of liquid equal to the afore-mentioned losses; and this liquid will come from the second vat of the first section, as indicated by arrow Y, and it will preferably have been taken previously from the dirtiest points. The liquid from the second vat can be purified for re-use, and the portion of the liquid supplied to the first vat may contain the impurities collected as a result of purifying the liquid of the second vat. The latter vat is supplied with liquid taken from the third vat, and in the case of the suint mentioned above it will have a concentration of about 1° Bé. The said third vat, as previously stated, terminates the first section of the column.

The next to the last vat (which is the first vat of the second section) contains, as usual, a soap solution which is purified by centrifuging as washing proceeds and returns to its original vat for re-use. The small amount of soap needed is added regularly, and the bath can last for more than fifty hours; said bath, moreover, being the only one that consumes soap. The fifth or last vat is supplied with clear water.

As can be seen from the foregoing description, two distinct detersive agents are used in succession for treating the material and are kept entirely separate.

The first detergent (suint) is relatively cheap and is affected by the impurities present in the material only to a slight extent, while the second detergent (soap) is more expensive. However, as the material is already washed comparatively very clean before treated by the second detergent, the consumption and cost of this latter are very considerably reduced.

It should be well understood that the two detersive agents hereinbefore described are given merely by way of example and that any other suitable detersive agents or mixtures thereof may be employed instead of suint and soap.

By virtue of the continuous circulation of the detergent solutions and the impurities therefrom, the present process prevents fermentation of the bath liquids. But if the bath liquids are not purified for some time, however, or are kept in reserve, or during holidays, they are liable to ferment with the resultant formation of detrimental metallic sulphides and potassium carbonate and at the same time giving rise to evil odours which adhere to the wool subsequently treated therein, for a considerable time. In order to overcome this drawback, a substance or substances which will act to prevent such fermentation, or the detrimental consequences thereof, may be added to the washing or scouring liquids either in the actual washing baths or when in reserve. Substances which may be employed for this purpose are, for example, thymol, chloroform, potassium cyanide and similar known antiputrefactive agents which may be used for instance in the proportion of 1 part of antiputrefactive agent to 10.000 parts of wool washing liquor.

The hereinbefore-described washing process is of particular advantage for improving or reconditioning wools, soiled fabrics or other fibrous textile materials which are poor in suint owing to their having previously undergone a liming, washing, chemical or other treatment. When wool has been subjected to certain washing, chemical or other treatments (such, for example, as liming, petrol-washing, dyeing and the like) it may lose some of its inherent principles and may even adsorb others which adversely affect its qualities. Concentrated suint, however, is a powerful detergent and completely cleans wool irrespective of the state which it is in. In a treatment with concentrated suint solution, therefore, the wool not only is cleaned but at the same time it is returned to its natural medium where it is enabled to readsorb any principles it may lack and thus to recover in softness, elasticity and solidity.

The process of the invention has thus been employed for improving scoured, Mazamet, and limed wools, wools washed in sea water and these treated with grease-solvents, with remarkably good results.

In order to more clearly understand that part of the invention which relates to the dilution of the washing liquids, the same will be more particularly described in connection with an installation for washing wool in bulk by means of soap alone.

This installation or column (Figs. 2 and 2^A) comprises four vats, B^1, B^2, B^3, B^4. The wool is propelled mechanically through these vats

and, after leaving each vat, is mechanically charged onto a conveyor t which conveys it to a press P through which it passes, falling on the other side onto a second conveyor t'.

Beneath each conveyor t is arranged, as before, a sheet metal member T adapted to catch the liquid draining from the wool and to return the same to the vat. The members T beneath the conveyors appertaining to the second vat B^2, third vat B^3 and fourth vat B^4 are further extended to collect also the liquids expelled by the presses and to return them, together with the drainings, to their respective baths. The collector associated with the first vat B^1, however, is different from those of the remaining vats, this collector being arranged to catch only the liquid draining from the wool. The liquid expelled by the press is separated from the drainings and is collected in a small container Q provided with a perforated sheet metal member adapted to retain the wool fibres contained in the liquid. The liquid collected in the aforesaid small container may either be returned to the first vat B^1 or may be run to the discharge conduit Z.

When the liquor in the first vat B^1 has become too foul to be used, it is discharged into the drain and the liquid from the second vat B^2 is transferred to the first vat by means of injector apparatus. Similarly, the liquid of the third vat B^3 is transferred to the second vat, while the fourth vat B^4 is filled with clean water through pipe A. The liquids remaining beneath the false bottoms of the second, third and fourth vats which the injector apparatus is unable to transfer, are evacuated by opening suitable manually-operable valve devices. The column is thereupon ready for further operation and is supplied regularly with the wool to be desuinted.

For about one hour the liquor squeezed out by the press is allowed to return to the first vat, after which this liquor is run to waste. The liquid level in the first vat B^1 then tends to sink, owing to losses of liquid carried away by the wool, but is kept constant therein, however, by the introduction of liquid supplied from the last vat of the column or by clear water.

The vat B^4 is kept at constant level by the clear water delivered thereto by pipe A, while the second and third vats B^2 and B^3 retain their liquids until it is necessary to empty the liquid from the first vat into the drain, as explained above. The liquid from the second vat B^2 can be purified by centrifuging during the actual washing operation and can be restored thereto, the same also applying to the third vat.

This step of supplying fresh water to the first or inlet vat is entirely different from that which consists in passing the water from the fourth vat into the third during the washing, and the water from the third vat to the second and from the second vat to the first. As a matter of fact, the liquid in the second vat is extremely rich in soap; and if it is admitted into the first vat, the soap will be adsorbed immediately by the impurities. The addition of clear water, on the contrary, effects an impoverishment of the first vat in soap, in consequence whereof the impurities are caused to give up part of the soap which they had adsorbed. This amounts to recovery for immediate re-use.

I claim as my invention:—

1. A process of washing fibrous textile material in at least one detersive bath of water and alkaline salts of fatty acids, comprising the step of removing rapidly and in a substantially continuous manner from the detersive bath, during the washing operation, the impurities both separable and non-separable by simple decantation.

2. A process of washing fibrous textile materials in at least one detersive bath of water and alkaline salts of fatty acids, comprising the steps of removing rapidly and in a substantially continuous manner from the detersive bath, during the washing operation, the impurities both separable and non-separable by simple decantation; and introducing air into the bath while the material under treatment is travelling therethrough to assist the detersive action of said bath.

3. In a process of washing wool containing suint, in which the wool is subjected at least once to the washing action of a bath of suint liquor, the step of collecting in such bath the suint carried by the wool under treatment, while keeping away from the bath the impurities carried by the wool and supplying water in regulated quantities, thereby to maintain the detersive power of the bath uniform and its suint concentration at at least 3° Bé.

4. A process of treating fibrous textile material with liquids containing detersive agents, which comprises withdrawing at least a part of the liquid during the course of the actual treatment, centrifuging such part to purify the same and returning the purified liquid to the process, in a substantially continuous manner, and introducing air into the treating liquid during the treatment to assist the detersive action.

5. A process of washing fibrous textile materials in at least one detersive bath of water and alkaline salts of fatty acids, comprising the steps of subjecting the bath liquid, during the course of the actual washing operation, to a two-stage centrifugal purification for the removal of earthy matter and subsequently of grease, and re-utilizing the purified liquid in the process.

6. In a process of treating wool, in which the wool is subjected at least once to the washing action of a bath of suint liquor, the steps of feeding such bath with suint liquor so as to maintain its concentration at at least 3°

Bé., while purifying the bath to remove therefrom the impurities given off by the wool under treatment.

7. In a process of washing uncarded wool, in which the wool is subjected at least once to the washing action of a bath of suint liquor, the steps of removing from the bath liquid, for purification, during the washing operation, both the earthy impurities present in the bath, both separable and non-separable by simple decantation, and the fats, and returning the purified liquid to the process for re-use.

8. A process of washing uncarded wool, comprising the steps of steeping the wool in a bath of suint liquor, drawing off the dirtiest liquid from the bottom of the bath, purifying the liquid drawn off, and then returning the purified liquid to the bath for re-use.

9. A process of washing uncarded wool, comprising the steps of steeping the wool in a bath of suint liquor, drawing off the dirtiest liquid from the bottom of the bath, subjecting the liquid drawn off to at least one centrifuging treatment to extract the dirt and fats, and then returning the purified liquid to the bath for re-use.

10. A process of washing uncarded wool, comprising the steps of steeping the wool in a bath containing a detersive agent, drawing off the dirtiest liquid from the bottom of the bath, purifying the liquid drawn off, and then returning the purified liquid to the bath for re-use.

11. In a process of washing fibrous textile materials, the steps of subjecting the material at least once to the washing action of a bath of suint liquor, then subjecting it to a rinsing bath to extract as completely as possible from it the suint which it carries, and then subjecting the rinsed material to an aqueous bath of a deterisve agent other than suint.

12. In a process of washing fibrous textile materials, the steps of subjecting the material at least once to the washing action of a bath of suint liquor, then subjecting it to a rinsing bath to extract as completely as possible from it the suint which it carries, and then subjecting the rinsed material to an aqueous bath of soap.

13. In a process of washing fibrous textile materials, in which the material is subjected at least once to the washing action of a bath of suint liquor, the steps of immersing the material in the minimum quantity of suint liquor necessary to insure saturation thereof with the liquor, expressing the imbibed liquor, and purifying the expressed liquor for re-use in the process.

14. In a process of treating fibrous textile materials, in which the material under treatment is subjected to the action of at least one detersive bath of water and alkaline salts of fatty acids, the steps of immersing the material in the minimum amount of detersive liquid necessary to insure saturation thereof with the liquid, expressing the imbibed liquid, and immediately purifying the expressed liquid for re-use in the process, in a substantially continuous manner.

15. In a process of washing wool containing suint, in which the wool is subjected at least once to the washing action of a bath of suint liquor, the steps of maintaining in such bath a suint concentration of at least 3° Bé. by collecting in said bath the suint carried by the wool and supplying water in regulated quantities, while separating from the bath the impurities of the wool.

16. In a process of washing uncarded wool, in which the wool is subjected at least once to the washing action of a bath of suint liquor, the steps of circulating water through the installation in a manner to increase the suint concentration of such water by the suint retained by the water, and withdrawing liquid from the circuit so as to remove the impurities both separable and non-separable by simple decantation, and then returning the purified liquid to the circuit.

17. A process according to claim 16, in which suint is recovered both from the impurities separated from the wool and from the wool already washed in the suint liquor bath.

18. In a method of washing uncarded wool, in which the wool is subjected at least once to the washing action of an aqueous bath of suint, the steps of desuinting the wool, passing it through a bath containing little or no suint to separate from the wool the greater part of the earthy matters carried thereby, and then passing the wool through at least one bath of suint having a concentration at least as high as 3° Bé. which is supplied with suint from the desuinting treatment.

19. In a method of washing uncarded wool, in which the wool is subjected to the washing action of at least one aqueous bath of concentrated detersive agent, the steps of purifying the bath liquid of a bath, and admitting to a bath liquid which has been used to recover the detersive agent contained in the earthy matters removed during the purification of the first bath.

20. In a method of washing uncarded wool, in which the wool is subjected at least once to the washing action of a bath of suint liquor, the step of supplying such bath with suint liquor derived from the suint recovered from the wool which has left said bath and from the suint recovered from the impurities carried by the wool to be washed, said suint liquor being subjected to a concentrating treatment.

21. In a method of washing uncarded wool, in which the wool is subjected at least once to the washing action of a bath of suint liquor, the steps of collecting the suint in such bath and maintaining the suint concen-

tration therein at least as high as 3° Bé. by means of the suint in the wool under treatment, while separating from the bath the impurities carried by the said wool under treatment by reducing, approximately to the weight of the dry wool to be treated, the losses of suint due both to the wool leaving the bath and to the impurities separated from the bath.

22. In a method of washing uncarded wool, in which the wool is subjected at least once to the washing action of a bath of suint liquor having a concentration at least as high as 3° Bé., the steps of subjecting the wool, after it has undergone such washing action, to the action of a single bath of soap, and then to a rinsing action to reduce the adsorption of soap by the wool.

23. In a method of washing uncarded wool, in which the wool is subjected at least once to the washing action of a bath of suint liquor, the steps of purifying the liquid from a bath, and admitting to a bath liquid which has been used to recover the suint contained in the earthy matters removed during the purifying treatment.

In testimony whereof I affix my signature.

ELISÉE CHARLES DUHAMEL.