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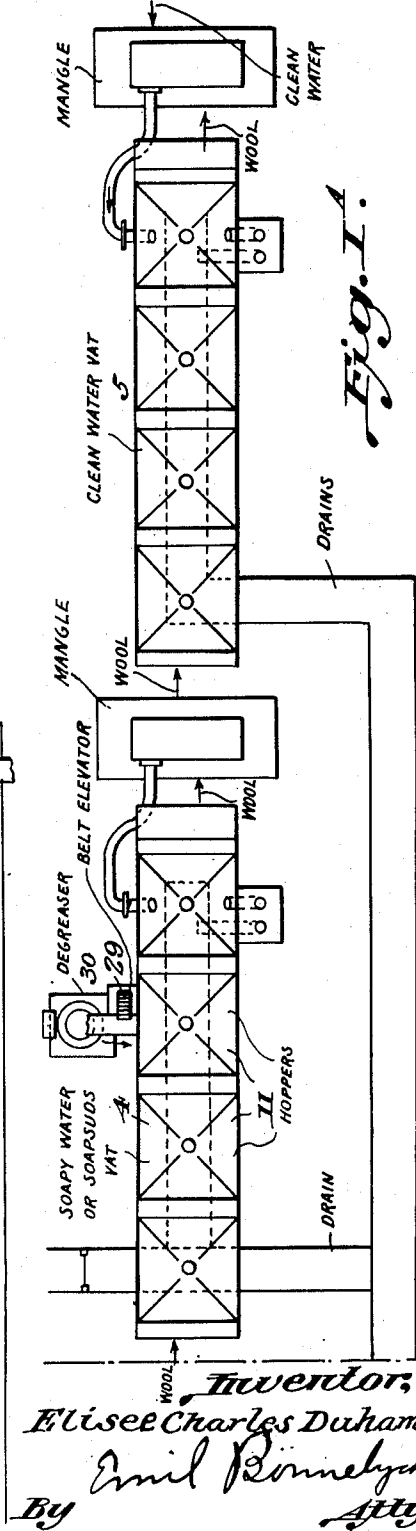
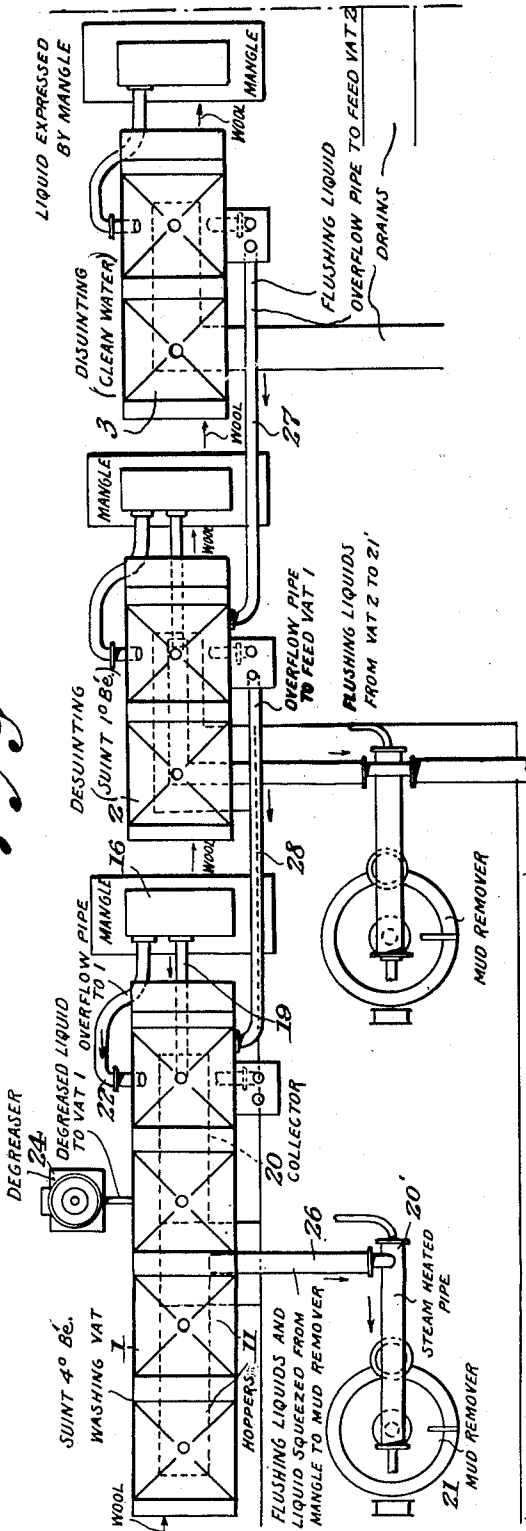
E. C. DUHAMEL

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PROCESS FOR WASHING WOOL

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Fig. I.



Inventor,  
 Elisee Charles Duhamel,  
 Emil Ronnelyshe  
 Atty.

# UNITED STATES PATENT OFFICE.

ELISEÉ CHARLES DUHAMEL, OF ROUBAIX, FRANCE.

## PROCESS FOR WASHING WOOL.

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The present invention relates to a method of washing wool and other textiles involving the use of apparatus embodying a battery of column of washing vats followed by presses and equipped with devices for purifying the feed water from one or more baths; the invention having special reference to the washing of wool in flocks with suint—that is to say, a concentrated aqueous solution of the soluble salts carried by the raw wool.

Among the characteristics of the invention, it is to be noted first of all that one of the baths receives merely a quantity of fresh liquid approximately equal in weight to the weight of the dry wool introduced into the apparatus; this liquid being capable of lixiviating either wool which has previously been treated in another bath or the impurities carried by the wool to be washed, or both, and, if desired, of being concentrated by regular treatments or by re-use after purification or even by evaporation. The aforesaid purification can be effected by subjecting all or some of the baths to a suitable treatment, for instance, the action of centrifugal force or to filtration, etc.; and it is also possible, moreover, after having removed the dirt by decanting or centrifuging, to whip up the liquid so as to form a froth which can be removed and which will contain part of the greasy materials of the liquid.

All these expedients may be adopted either separately or in combination; mud removed by centrifuging might, for example, be resorted to. In the case of a detergent agent which preserves its washing power after filtration, filter cloths can be used after such mud removal which have been treated with silicate, for example, or with collodion, and through which the liquid is filtered under pressure; these cloths being interposed between finely-ribbed circular disks of rubber which are strung centrally upon a horizontal shaft or rod around which they are caused to turn when it is desired to clean them, the filter then being half-empty.

The present invention provides for increasing the efficiency of the centrifuging action by reducing the viscosity of the liquid to be treated, by applying, between the baths and the centrifuge, the heat necessary to maintain the temperature proper for the baths; such heat application taking place in front of either the mud remover or the degreasing apparatus, or both. This same application of

heat between the baths and the purifying apparatus is also contemplated by the invention for any method of purifying wherein viscosity plays a part.

There will now be considered the special case in which the wool is first washed with suint of about 4° Bé., and then with soap, the consumption of the soap decreasing more and more as the washing action of the suint has been more and more thorough. It is advisable not to pass the soapy waters through the suint vats, because:

1. The soap still free in the bath liquid, like that which may be released by the particles in suspension, would be rapidly adsorbed by the suint and the impurities;

2. The presence of soap in the suint would hinder the separation of impurities;

3. It is important, from the standpoint of by-product recovery, to keep the soapy waters separate;

4. Pollution of rivers, which is often caused at the present time by wool washing, can be completely avoided.

As the wool carries off suint with it, it is much better to de-suint the wool thoroughly before it enters the soap vat in order to prevent the suint from consuming the soap, to rid the wool entirely and with more certainty from all suint smell and, finally, to recover the suint; the last-named object requiring methodical circulation of the liquids. This systematic circulation is always advisable; but it becomes the more important according as the proportion of wools without suint contained in the batches to be washed increases. It is not merely a case of recovering the potash from the suint but of reducing losses of all sorts, including adsorption, in order that the suint carried by the suinty wools may be sufficient for treating all kinds of wools and for maintaining in all cases the great saving in soap afforded by the new process.

It may likewise be of importance to recover by lixiviation the adsorbed or imbibed suint contained in the muds eliminated.

By washing with suint, softness and naturalness are restored to wools that have been altered in a prior treatment, as for instance lined wools, wools washed in sea water, wools treated with acids, and wools de-greased by solvents; and the present invention is applicable likewise to wools which have been washed in any way whatever and then subjected immediately to the suint treatment. The aforesaid softening effect is felt even on

suinty wools when they have been treated, during their washing, with hot suint, and on the other hand it is important to cause the suint to exert its full deterative action. That is why the invention provides, as to raw wool washing, for the use of suint not only in a 4° Bé. bath but also according to the following arrangements:

1. The wool is soaked in the hot suint before it enters the battery or column; and for this purpose it is sprayed with purified or unpurified suint drawn from the column. The liquid with which the wool is soaked can be expelled therefrom immediately by a press or mangle; and in order to obtain a better result, the wool can be arranged in thin layers. This operation of soaking followed by mangling, may be carried out a second time before the wool enters a vat.

2. The wool is passed through two vats containing suint of about 4° Bé., the suint in the second vat being more completely cleaned (in order to increase its deterative power) than that in the first vat.

3. When the purifying of the wool can be carried out far enough—for instance, by utilizing filtration—the wool passes through three vats containing suint of about 4° Bé. The third vat can be supplied with suint from the first vat, but perfectly purified; the dirtiest suint from the third vat flowing into the second vat, and the dirtiest suint from the latter vat flowing into the first vat. The liquid in the third vat can also be purified for return thereto, while the purified liquid from the first vat feeds the second vat, and the dirtiest liquid from the second vat flows into the first one. Obviously, more than three suints vats can be used. Thereafter, the wool may or may not be treated in a soapy bath, and finally, in either case it is simply rinsed in water as usual.

In the case where the wool is subjected several times to the washing action of suint liquor, the suint liquor of a bath containing relatively clean wool is given a greater washing power than that of the liquor of a bath containing relatively dirty wool. For instance the cleaner suint liquor coming from a bath containing relatively clean wool is subjected to at least one more purifying operation than the dirtier liquor. The purified suint liquor can be delivered to a cleaner washing bath than the one from which it was taken.

The suint liquor can be circulated in counter-current with the wool while treating the raw wool with cold water to cause it to give up its suint and supplying the bath containing the cleanest wool with the suint obtained from the said cold water treatment. Moreover, the impurities, both separable and non-separable by simple natural decantation, are removed from contact with the suint, and the portions of the suint bath containing the

impurities which have settled down by gravity are automatically removed during the washing operation, then subjected to a purifying treatment, and then reused for washing, these steps being carried out in a substantially continuous manner. The suint bath can operate indefinitely and without stoppage for cleaning, if supplied with regulated amounts of water.

The heavier impurities separated from the suint liquor by centrifuging are extracted from the centrifuge while the latter is running at full speed. Preferably, the bath liquid is treated to extract the heavier muds, and then is centrifuged to extract the colloidal muds, the grease being removed either during the same operation or by a different operation.

From the point of view of the length of the wool fibers, it is important to reduce the action of the soap during the washing by increasing the action of the suint. Indeed, the soap baths have a tendency to felt the wool and form it into buttons, whereas the suint baths open out the wool by separating the fibers farther from one another. Hence, there is less wool broken during carding and, therefore, less waste occurs in the combing operation, and the comb contains fewer short fibers and has a more regular length.

In the accompanying drawings:—

Figures 1 and 1<sup>A</sup> conjointly form a general diagrammatic plan view of an apparatus embodying the invention and for carrying out the same.

It is to be assumed that in the following description, the washing of wool is involved; but such description can, of course, apply, with slight modifications, to the washing of materials other than wool. The description, moreover, involves the employment of suint as the washing agent, followed by a finishing treatment with soap.

Referring more particularly to the drawing, it will be seen that the structure illustrated diagrammatically therein comprises a battery or column of successive vats (five, in this instance) designated 1, 2, 3, 4 and 5. Wool is suitably fed to the first vat 1 which contains, for instance, 4° Bé. suint. This Baumé degree is usually sufficient to insure a good deterative action, but it can be increased to about 10° Bé. when difficultly-cleaned wools are to be treated, such as those which have been dried after an imperfect washing.

In the plants hitherto in use, the washing vat had to be of great volume in order to reduce the number of outlets; but according to my invention the vat 1 is, like the other vats of the set or battery, a vat of reduced volume, owing to the fact that below each vat there is provided a pyramidal chamber or hopper 11 having sharply inclined walls. These hoppers permit the mud separated

from the wool or other material under treatment to collect therein and be discharged by automatic flushing devices, which form no part of the actual process and, hence, are not illustrated. The shape thus given the washing vat not only facilitates the removal of the mud but also answers the desired requirement for reduction of the volume of the bath liquid in order to render the purifying treatment more effective.

The wool is caused to travel through the bath by suitable devices and is ultimately delivered to a mangle 16; the liquid expressed by the mangle being delivered either into a pipe 19 leading to a collector 20 that feeds a mud remover 21, or, when the inlet end of said pipe is closed by a slide valve, into the vat 1 by way of an overflow pipe 22.

The liquid squeezed out by the mangle joins the flushing liquids in the double-slope collector 20 which is located beneath the washing vat and feeds by gravity into the mud remover 21, the latter being necessarily arranged at a slightly lower level than the collector. The collector 20 discharges directly into a pipe 26 which, in turn, discharges into a pipe 20' of sufficiently large diameter to contain a steam coil or other suitable device for heating the liquid in order to decrease its viscosity; such heating action also serving to keep the liquids hot enough to maintain the standard working temperature in the washing vat into which they are returned. The pipe 20' is connected to the mud remover 21, and the presence of its coil or other contact-heating device has, of course, the advantage that the Baumé degree of the suint is not lowered, as would be the case if the suint were heated by having steam injected into it.

The muds deposit on the walls of the solid basket of the mud remover 21 which turns at high speed, and this necessitates their removal. The liquid from which the mud has been removed can be transported and handled without any danger of stopping up or causing wear of the parts through which it passes, since it contains infinitely-minute particles of earth. Due to the momentum which it acquires while in the mud remover, the liquid will be discharged therefrom under pressure through suitable piping to feed a degreasing apparatus 24. The degreasing apparatus 24 is preferably one similar to an ordinary centrifugal separator, with a vertical axis and a small diameter. The grease flows continually through a suitable nozzle out of the degreasing apparatus, and the degreased liquid (which is about 4° Bé. suint) returns to the vat 1. In the case of a protracted stoppage of the operation, a greasy froth may form on top of the vat which should preferably be removed before the operation starts again; and for this pur-

pose, in order to facilitate scraping the vat, one of its longitudinal sides is made slightly lower than the other one. By adding suint to the first vat, the greasy froth can be caused to rise and flow off over the top of the shorter wall into the discharge gutters that are provided beneath the pyramidal hoppers 11 on the vat.

The set consisting of the mud remover and the degreasing apparatus may advantageously be replaced by an apparatus that will act both as a mud remover and as a degreaser, with continuous removal of muds and greases. Mud removal may be effected in two operations: the first one consisting in removing the larger bits of earth, for example by means of a centrifuge of large diameter, and the second one consisting in removing the colloidal earths by means of a small-diameter centrifuge either before or after degreasing. The small-diameter centrifuge is analogous to the degreasing apparatus in that it also has a high rotary speed; its walls being of conical form to assemble the colloidal muds at the inlet ends of the discharge pipes which, being of small section, would become obstructed in receiving the liquid just as it comes from the first vat of the battery. The mud can be carried away by a further supply of water which may, at the same time, be used to recover the suint contained in the muds removed. The liquid is preferably heated—for instance, by means of the device 20' previously described—after it has left the vat and before it leaves the last purifying device. This heating assists purification so that if the heat necessary to the bath were applied in the bath, the temperature of the liquid at the time of purification would be lower, and purification would then be less thorough. During centrifuging, it is advisable to prevent the liquid from cooling; and since such cooling chiefly takes place when the liquid is atomized by air, a device of some sort which will prevent entrance of air should be used.

The wool is delivered by the mangle 16 of the first vat 1 to the second vat 2 which contains suint of about 1° Bé. This second vat is of the same kind as the first one but of reduced length, having only two hoppers instead of four through which the wool is moved. The mud-removing centrifuge 21' associated with this second vat, which latter, however, does not generally require a degreasing apparatus, may serve for several vats of the same order in various batteries. There is no occasion to fear that coarse or colored wool will find its way to a bath for treating fine or white wool because, during centrifuging, every staple of wool is separated from the liquid and stuck against the wall. By spacing the flushing operations at sufficient intervals, the liquid from the flushings

of the said second vat 2 can also be sent, by way of a pipe 28, into the collector 20 that feeds the mud remover 21.

The third vat 3 is identical with the second one, and contains clean water to free the wool completely from suint. The flushing liquid passes to the discharge conduit, drain or gutter or, if preferred, it may pass either to centrifuge 21' or to centrifuge 21; the liquid expressed by the mangle returning to the vat. In this third vat, however, the flushing operations do not take place automatically but are effected by hand whenever required. The three vats 1, 2 and 3 constitute a unit in the battery, as regards circulation of their liquids; the second and third vats 2 and 3 having for their function to free the wool from suint while it is being washed. Regardless of the shape of these two desuinting vats, the feature of taking from them the dirtiest liquid and delivering it to a preceding vat, either directly or through a centrifuge or a purifying apparatus, remains always within the scope of this invention.

The third vat 3 receives clean water or, in order to save heat and water, it may receive water from the last vat which, as will be hereinafter seen, contains no soap. This vat may be placed a little higher than the second vat and may be provided with an overflow pipe 27 to feed the second vat 2; though such feeding may also be effected by delivering the flushings from the third vat to the mud-removing centrifuge 21'. In order to rid the wool of every trace of suint smell, it may be advisable to introduce into the said vat more liquid than is taken into the preceding vats, the excess liquid passing into the discharge conduit. The second vat 2 may likewise be positioned a little higher than the first vat and be fitted with an overflow pipe 28 leading to the first vat, or such feeding may be effected by delivering the flushings from the second vat to the mud remover 21'.

The wool issuing from the third vat 3 is delivered to the fourth vat 4 which is identical with the vat 1, excepting that it has no automatic flushing, this fourth vat being filled with soapy water or soap suds. A belt elevator 29, located in a receptacle at one side of vat 4, feeds a degreasing apparatus 30 that gushes its liquid into the fourth vat, which latter vat is always quite clean, for only very little dirt deposits in the bottom of the hoppers. Flushing should, therefore, be effected by hand when required, for the apparatus is no longer stopped for vat-cleaning except when part of the batch of wool is being changed. The waters from vat 4 may be sent untreated to the discharge conduit, or through a special duct to be treated both for purifying them and for recovering the fatty acids of the soap mixed with some wool grease.

The wool then enters the last vat 5 which is identical with vat 4 but contains clean water only. This fifth or last vat, which has no degreasing apparatus, is positioned a little higher (about 10 centimeters) than the fourth vat so as to feed the same when flushing occurs, and it is kept clean by clean water suitably supplied to it and by flushing it by hand at the proper times.

In the event of sufficient suint being available to disregard as negligible the recovery of the suint carried away after mangling by the wool coming from the 4° Bé. bath, it will be possible to use only one suint-removing vat before beginning the treatment with soap-suds. The expressed liquids and the flushing liquids from vat 2 will then be sent to the discharge gutter or conduit. The last vat, termed the rinsing vat, may receive an abundance of clean water and may transmit it to vat 2, thereby effecting a thorough rinsing of the wool between its treatments with suint and with soap. The washing action of vat 2 is particularly effective; every impurity in the wool being enveloped in a strong solution of suint, becomes detached from the wool and drops into the clean water in the vat, and the liquid which saturates the wool after having passed through the mangle of vat 2 is clean since the said vat receives an abundance of clean water.

If no consideration has to be paid to river pollution, and if wools which, like "Africans", are less greasy but contain much sand or dirt are being treated, only a mud remover without a degreasing apparatus need be employed for centrifuging. As a matter of fact, the Baumé degree of the suint in the first vat becomes higher, and suint must, therefore, be removed, which thus carries off grease. On the other hand, the mud removed in the mud remover also carries away grease, so that the suint in the first vat keeps in a not too greasy state. Only a little grease remains on the wool when it leaves the mangle of the first vat; and this grease, which is in emulsion in the suint and still keeps the same moist despite mangling, easily separates off in vat 2 and is discharged into the gutter together with the flushing waters and the water expelled by the mangle of said vat, which latter, as stated, is kept clean by the large quantity of clean water it receives.

As the purifiers may have to work during stoppage of the washing machines, it may be advisable to provide for them a special electrical or other drive. When the washing machine remains at a standstill all night, this special drive permits wool to be washed with suint, in the vats hitherto used, by purifying, if need be, the liquids from the mangle during the working of the column, while the muds of the bath accumulate under the false bottoms; then, after the factory has been shut down, the whole contents of the vat,

including what is found in the false bottoms, is subjected to centrifuging. When the factory works 24 hours a day, the electric drive of the purifying apparatus permits the first vat in each successive column or battery to be completely emptied on Sunday mornings and filled up again after purification of the bath, thus facilitating the starting of work on Mondays.

10 If wools containing much lime, or wools treated by acids, have to be washed with suint, it will be found advantageous, as regards consumption of suint, to adopt the following expedient: The wool is first treated in a vat containing a solution of sodium carbonate, and then the waters squeezed out by the mangle and the flushing waters from this vat are purified by centrifuging to permit their re-use. The vat may or may not be preceded by a sprinkling funnel or conduit in which, however, the sodium carbonate solution will be used, and the said funnel may or may not be followed by a mangle. The wool coming from the sodium carbonate washing bath is delivered to one of the hereinbefore-described washing systems in which suint is used; lowering of the Bé. degree of the suint in the 4° vat being prevented by bringing thereto additional quantities of, say, about 10° Bé. suint obtained from other wools.

Suint washes the better the more concentrated it is—a concentration of about 4° Bé. is generally sufficient—but the wrong methods adopted in the past involved bringing back into the first or inlet vats either during operation or during draining (except for the losses involved by mud removal) the whole of the liquids from the following vats, so that a concentration suitable for a good washing with suint could never be effected hitherto merely with the suint from the wools subjected to the said washing, even when attempts were made to re-introduce, after centrifuging in the inlet vats, part of the liquid from their outflow.

This invention, therefore, covers the production and maintenance of the desired concentration of the suint in the washing machines by additions of suint from the raw wools, combined with purification of the baths and re-use thereof, as well as combined with the feature that the vat containing 4° Bé. suint receives only a number of liters of liquid about equal to the number of kilograms of raw wool feeding the column, whether the said purification is or is not effected by centrifuging, or by formation of greasy froth which is subsequently eliminated, or by electricity, or by filtering, or by any other process or method; the same also holding good in the case of alkaline carbonates having been added to the bath.

The invention likewise covers the feature of transporting from the column liquids containing the suint carried off by the wool on

issuing from the vat or vats containing suint for washing, before or after mangling, in order to clean the said suint with a view to re-using it for washing, or for concentrating it with or without purification, or even for the purpose of throwing it away in any form whatever.

I claim:

1. In a method of washing uncarded wool, the steps of sprinkling the wool, at the beginning of its treatment, with hot suint while causing it to advance slowly; uniformly subjecting the wool, after the sprinkling treatment, to a squeezing action; and then delivering the squeezed wool to a washing bath of suint having a concentration at least as high as 3° Bé.

2. 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 concentrated suint, the steps of subjecting the wool to the action of a single bath of soap, and then to a rinsing bath to reduce the adsorption of soap by the wool.

3. In a method of washing uncarded wool, the steps of subjecting the wool at least once to the washing action of an aqueous bath of concentrated suint, admitting to the suint bath about one liter of aqueous liquid per kilogram of dry wool to be washed, and maintaining said bath in a sufficiently clean state for washing by preventing its excessive enrichment in impurities.

4. 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 which has undergone a concentrating treatment.

5. In a method of washing uncarded wool, in which the washing liquids are purified for reuse, and in which the wool is subjected several times to the washing action of suint liquor, the step of subjecting the suint liquor from a bath containing relatively clean wool to at least one purifying operation more than the suint liquor from a bath containing relatively dirty wool.

6. In a method of washing uncarded wool, in which the wool is subjected several times to the washing action of suint liquor, the steps of circulating suint liquor having a concentration at least as high as 3° Bé. in counter-current within the wool, treating the raw wool with cold water to cause it to give up its suint, and supplying the bath containing the cleanest wool with the suint obtained from said cold water treatment.

7. 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 treating the bath liquid to extract the heavier muds, and then centrifuging it to extract the colloidal muds.

8. 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 treating the bath liquid to extract the heavier muds, then centrifuging it to extract the colloidal muds, and subjecting said liquid to a grease-extracting treatment.

9. 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 which, during the washing operation, is purified for reuse, the step of augmenting the efficacy of the purifying operation by heating the suint liquor at a point in its travel outside of the bath and before the completion of the purifying operation so as to decrease its viscosity and to maintain the bath at the required temperature.

10. 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 withdrawing the suint liquor from the washing bath, purifying it, and then delivering the purified suint liquor to a cleaner washing bath than the one wherefrom it was taken.

11. In a method of washing uncarded wool, in which the wool is subjected at least once to a washing action of a bath of suint liquor, the steps of removing from contact with the suint liquor the impurities both separable and non-separable by simple natural decantation, automatically removing during the course of the washing operation the portions of the suint liquor bath containing the impurities which have settled down by gravity, subject-

ing said portions to a purifying treatment, and re-using the purified suint liquor for washing; said steps being carried out in a substantially continuous manner.

12. 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, automatically removing during the course of the washing operation the portions of the suint liquor bath containing the impurities which have settled down by gravity, subjecting said portions to a purifying treatment, and re-using the purified suint liquor for washing; whereby said bath can operate indefinitely and without stoppage for cleaning, if supplied with regulated amounts of water.

13. 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 centrifuging the bath liquid at least once, and extracting at regulated speed and at a point outside the centrifuge the heaviest impurities separated from the suint liquor by the centrifuging treatment.

14. In a process of washing uncarded wool, in which the wool is subjected several times to the washing action of suint liquor, the step of imparting to the suint liquor of a bath containing relatively clean wool a greater washing power than that of the liquor of a bath containing relatively dirty wool.

In testimony whereof I affix my signature.

ELISEÉ CHARLES DUHAMEL.