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IMPARTING STIFFENING, BODY, OR FINISH TO TEXTILES AND THE LIKE IN LAUNDERING AND OTHER OPERATIONS

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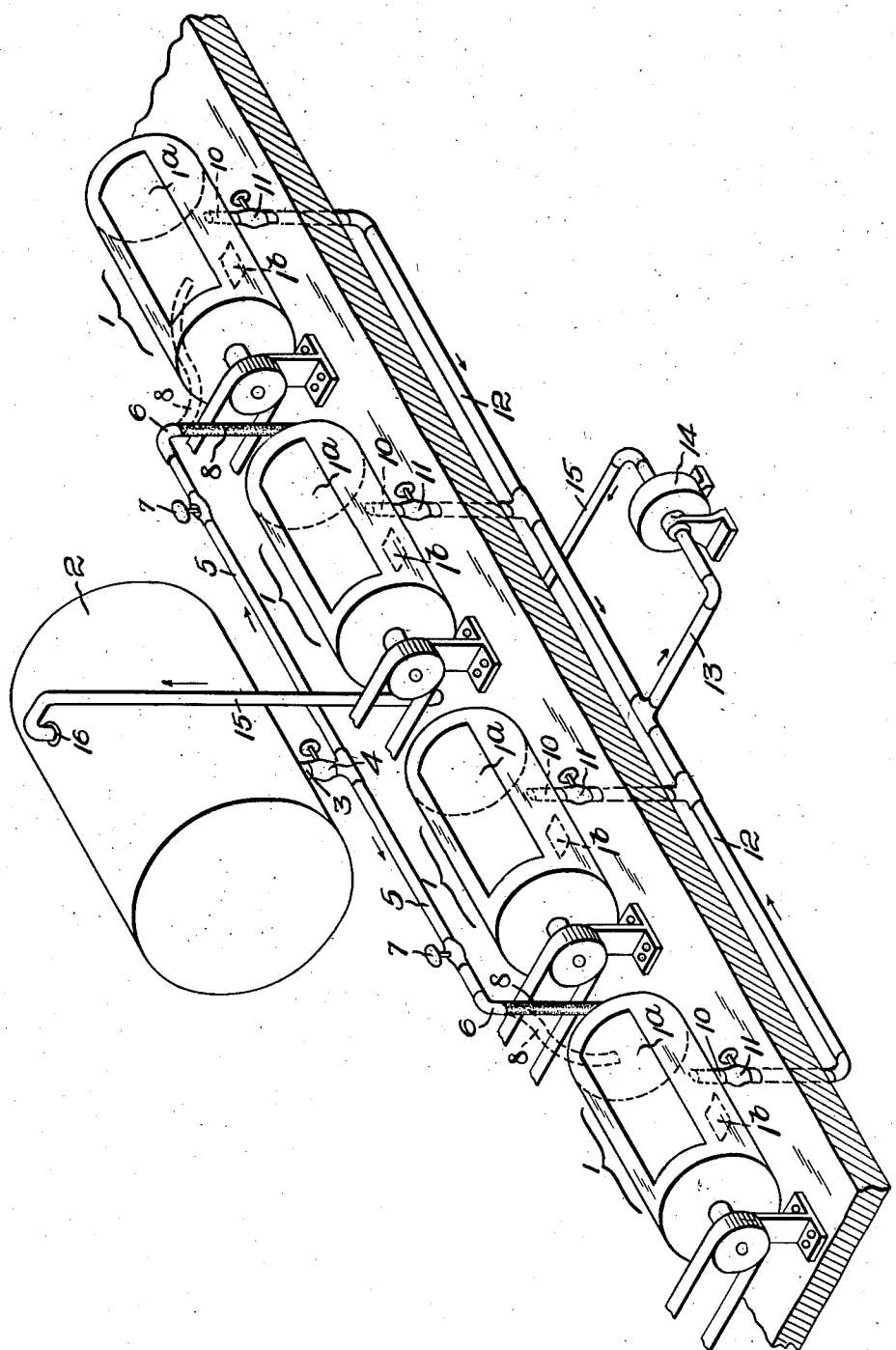

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IMPARTING STIFFENING, BODY, OR FINISH TO TEXTILES AND THE LIKE IN LAUNDERING AND OTHER OPERATIONS

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1 Claim. (Cl. 91—68)

My present invention relates to the art of imparting stiffness, body or finish to textiles and fabrics and is particularly but not exclusively adapted for use in connection with laundering, having special reference to commercial laundry practice as contrasted with household laundry work. It has among its objects to provide a simple, efficient and otherwise improved system and process which are resultant in marked operating economies.

In the single figure of the drawing I have represented, by way of example and largely diagrammatically, one system or apparatus embodying the invention and adapted for the practice of the method thereof.

Under the existing practice in most commercial laundries, the main operations of washing, bleaching, rinsing, souring and bluing, and starching of the clothes, linen and other textile and like articles, all hereinafter referred to as "the load" or "the wash load," are carried out in so-called wash wheels. These comprise in general a rotatable drum or basket in which the load is placed and tumbled about. This drum is perforate, allowing access of the water and other liquids or solutions to the contained load, and is rotatably mounted within a liquid-tight outer receptacle adapted to contain the washing water and solutions used in the course of the laundering operations. Typical instances of such wash wheels may be seen for example in Henrici Patent No. 1,188,073 and in various others of its class. In the herein accompanying drawing a plurality of such wash wheels is illustrated, in this instance four, each designated as a whole by the numeral 1.

The wash wheels such as 1 and their inner rotary elements have suitable charging doors 1a for the admission and removal of the loads and for supplying to the wheels the water, liquids and solutions for the various operations. The clothing or other articles of a load sometimes are massed together for convenient handling in a number of so-called nets, in the nature of porous bags, these nets generally being formed of a cotton textile material having approximately quarter-inch or larger meshes. In such cases the "load" is considered as comprising the articles to be laundered and their containing nets. In other cases nets are not employed.

Under the general practice the various successive washing and rinsing operations in connection with any given load are carried out in the same wash wheel. These operations usually include, for example, an initial washing or so-called breaking. The water supplied to the wheel for this operation is then dumped through the usual discharge opening or dump valve 1b at the bottom of the wash wheel and is run off to the sewer or drain. This is followed by one or more soaping operations, after each of which the dirty water is similarly dumped. Then may follow a bleaching operation and thereafter a series of rinsings after each of which the solution or water employed is dumped and run off. Then generally follows the so-called souring and bluing operation and dumping of the used liquid, and finally the operation of starching or starching and finishing, with which operation my invention is more particularly concerned, and in connection with which the uniform practice heretofore has been to dump and run off to waste any remaining solution, similarly as after the preceding operations referred to.

In more particular, under the prior practice, for each starching operation at each wash wheel, water is supplied to the wheel to the proper level, for example 3 inches, or about 25 gallons in a 40 x 70 inch wheel taken as an illustration. Now assume in the wheel a load of material to be washed weighing 100 lbs. when dry, but now wet to saturation as left from the preceding operation, such as that of bluing. Such wet load has a water content of approximately 25 gallons, making with the added water just mentioned 50 gallons of water in the wheel. Starch solution in a relatively heavy or concentrated form is then added. This concentrated solution is prepared by boiling and maintaining substantially at the boiling point for about one-half hour. A usual solution for this purpose comprises about 15 pounds of starch to 50 gallons of water, or roughly 5 ounces of starch per gallon of water. It will be understood that the volume of said concentrated starch solution to be used, as well as that of the water supplied to the wheel may vary according to the type of wheel, the degree of stiffness desired, the character of the load and other factors. Under the assumed example a normal quantity of the concentrated starch solution to be added to the 50 gallons of water in the wheel may be 10.5 gallons (at the 5 ounce per gallon strength). Thus when the wheel is closed and the starching operation started there is a total liquid content in the wheel of 60.5 gallons, which when mixed forms in the wheel a starch solution, relatively dilute as compared with the initial concentrated or 5 ounce per gallon solution, but having the desired operating strength or body. Such latter solution will hereinafter be referred to as the operating starch solution, or starch at operating strength, as distinguished from the more concentrated or heavier initial form, referred to herein as the concentrated starch or starch concentrate. Since starch is a colloid, it is absorbed into the fabrics as a uniform solution and, when the fabrics are dried and ironed, gives the desired stiffening to the load.

Upon completion of a starching operation,

which usually requires about 7 to 10 minutes, the wheel charging door 1a is opened for removal of the load. An approximately equal volume of the operating starch solution has by then taken the place of the 25 gallons of water previously held in the load. When the load is removed it accordingly carries off with it substantially 25 gallons of the operating starch solution, leaving in the wheel, from the 60.5 gallons total of said operating solution, a residue of about 35.5 gallons of starch solution at operating strength, the same strength as absorbed by the load, and which in accordance with my invention, is available for salvaging for further starching purposes.

Nevertheless it has been the invariable practice heretofore so far as I am aware to dump and waste this remaining solution, containing, in the assumed example, some 58 per cent of the total starch supplied to the wheel for that particular starching operation. My recorded measurements and tests have demonstrated that under present laundry practice there is thus wasted, in substantially every instance, from 40 per cent as the exceptional minimum up to as high as 65 or 70 per cent of the starch ingredient, and approximately the same percentages of the operating starch solution by volume. The variation in waste is due mainly, in connection with any given wheel, other factors remaining the same, to the size of the particular load. In wheels of the 40 x 70 inch capacity above referred to the ordinary run of loads may vary from about 90 up to about 225 pounds (dry weight). Hence both the amount of starch ingredient and the volume of the operating starch solution which is absorbed and carried off with the load varies, substantially in proportion to the load weight.

As previously stated, it is a main object of my invention to provide a process, system and apparatus whereby a substantial saving may be effected, not only in the actual quantity of starch employed but also of any other ingredients, such as water-repelling or finishing compounds, (as for one example the product commercially known under the trade-mark "Aquasec") which may be used in the starch solution; and also to accomplish savings in fuel for heating the solution and maintaining the temperature of the solution, in the quantity of water used, together with other operating economies and improved work as will be apparent from the following description.

In accordance with one system or apparatus for practising my invention, as illustrated in the drawing by way of example, a storage tank 2 is provided at some convenient location desirably but not necessarily adjacent the wash wheel or wheels which it is to supply. The tank 2, on the one hand, and the wheel or wheels 1, on the other hand, are preferably placed at different levels, to provide for gravity flow in one direction between them. As represented, the tank is positioned at a level above the wheels. It has at its lower portion an outlet in communication with a conduit or piping 3 equipped with a control valve 4. The conduit 3 communicates with a distributing conduit or pipe 5 extending to the several wheels 1 of the wash room which it is intended to serve. The conduit 5 in turn is connected to outlet pipes 6, 6, two of which are here shown, respectively disposed between the adjacent ends of adjoining wash wheels 1.

Each outlet 6 is equipped with a control valve 7 and a flexible hose connection 8 adapted to be swung into communication with the intake aperture or door 1a of either of the adjacent wash wheels, selectively. Thus by opening the main valve 4 at the tank and the valve 7 adjacent the particular wash wheel, and directing the flexible hose connection 8 through the door of the selected wheel, the solution content of the tank 2 may be supplied to any of the wheels, to the desired volume, under the valve control.

Return conduit means is provided for connecting to each wash wheel 1 and the storage tank 2. In the illustrated example each wheel, in addition to its usual dump door 1b has a bottom outlet 10 equipped with a control valve as represented at 11, 11. The several outlets 10 of the plurality of wheels 1 are in communication with a collecting conduit 12 leading through a connecting conduit or pipe 13 to the intake side of a suitable pump 14. The other or discharge side of the pump is connected as by the return conduit 15 with an intake aperture 16 at the upper portion of the tank 2.

In starting my new and improved process, as at the beginning of an operating period, such as the first of a week, the operator may follow different steps for obtaining an initial supply of operating starch solution in the tank, for example, as above described. Assuming that a requisite volume of concentrated starch solution has been prepared, he may carry out an initial operation in any one or more of the wash wheels, through the starching operation, adding to the wet load the quantity of water at the desired temperature and supplying the starch concentrate, as usually done under the prior practice as already described. But on completion of the starching operation for any of the wheels, instead of dumping the remaining operating starch solution he opens the appropriate starch outlet valve 11 and starts the pump, which causes this operating solution to flow into the storage tank 2. Said solutions from any desired plurality of the wheels may then be collected and placed in the tank, depending on the capacity of the latter and the order of operations in the several wheels. Thus there is then on hand in the tank a volume of the starch solution at operating strength and temperature.

Or as one alternative the operator may initially prepare starch solution at operating strength in any one or more of the unloaded wheels available. This may be done by flowing into the wheel a predetermined volume of water at the proper warm temperature, say for example 50 gallons and adding the usual quantity of starch concentrate, such as 10.5 gallons, which will provide 60.5 gallons of the relatively dilute or operating starch solution as previously explained. This entire prepared operating solution may then be pumped to the tank to form the start-off supply. Or the desired portion of it may be left in the wheel for starching a load elsewhere prepared for the starching operation.

Having now on hand an available supply of the operating starch solution, for example resulting from salvage as described above, the process may then be carried out as follows. Assume now a wet (with water only) load in any of the wash wheels. Instead of putting any additional water into the wheel the operator merely inserts the appropriate hose connection 8, opens the associated valve 7 and allows the operating starch solution to flow in from the tank 2, up to substantially the usual liquid level for starching. This is generally such relatively low level as to reach to or be somewhat above the lower part of the inner rotary element or drum of the wheel,

perhaps 3 inches in a wheel of the 40 x 70 inch capacity. The supply of the operating starch solution is then shut off. If then left without further procedure, said solution will mingle with and be further diluted by whatever water content is held in the load. Accordingly, under my process, the operator now adds concentrated starch solution, at the customary 5 ounces per gallon strength, in sufficient amount and strength to make the total content of the wheel, with the salvaged starch solution from the storage tank, and the water content of the load, up to the usual concentration for starching purposes.

But he adds new concentrated starch only to the extent of about one-half the volume or quantity which would be necessary if he were making an original solution for the wheel in question. In other words, since all starching operations subsequent to the first one of the series are employing starch solution at operating strength from the storage tank, instead of merely water, there need be added only starch enough to convert the water in the load into a starch solution of operating strength; this is one-half more or less the quantity of concentrated starch solution which is necessary in the first starching process of the series, and for every starching process under the prior practice.

Following the second and each succeeding starching operation at any particular wheel, the total remaining starch solution, at operating strength, namely, the same strength as that of the solution absorbed and taken off with the load, is pumped back or otherwise returned to the storage tank in readiness for use in a succeeding starching operation at the same or any other wheel of the system, in the same way as described in the preceding paragraph.

That the operating starch solutions maintain substantially constant concentration in this process, will be understood from a particular example, for which I will use the same assumed wheel volume and load weight as in the previous presentation. I there obtained a total operating starch solution, before removal of the load, of 60.5 gallons, in which the actual starch ingredient was 52.5 ounces (10.5 gallons of the concentrated solution at 5 ounces per gallon). Since the starch content of the solution absorbed by the load and that of the solution left on removal of the load is the same, due to the colloidal nature of starch, it follows that, 25 gallons of the operating solution being withdrawn with the load, the remaining 35.5 gallons contain approximately seven-twelfths or 58 plus per cent of the starch, 30.5 ounces, or just under one ounce per gallon. Assume now the next load, having the same water content of 25 gallons, to which I then supply 35 gallons of the operating starch solution from the tank, up to the normal standing level, making a volume of 60 gallons containing in all approximately 35 ounces of starch or roughly one-half ounce per gallon. To this I now add but about half the volume usual in present laundry practice, say 5 gallons of the starch concentrate, at the 5 ounce per gallon strength, and accordingly thus bring in an additional 25 ounces (approximately) of starch ingredient, to compensate for the water content of the wet load, giving a total starch content of some 60 ounces for the resulting 65 gallons of the operating starch solution, an actual slight increase in concentration, less than one-half of one per cent, over the previous 52.5 ounces of starch in 60.5 gallons. A ten per cent variation in the concentration, in either direction, is entirely satisfactory for laundering operations and, in fact, is less than ordinarily obtains under previous practice.

It will be noted in connection with the last-described starching operation that the total volume of the operating starch solution in the wheel, before removal of the load, was 65 gallons. With the assumed load, 25 gallons of this solution is subsequently withdrawn with the load leaving 40 gallons of the operating solution to be pumped or otherwise restored to the tank, whereas but 35 gallons was taken from the tank for the described operation. It will also be noted that in said example 5 gallons of the starch concentrate was added. In other words, the remaining operating solution was increased in volume by the volume of the concentrated starch solution added. Hence, with the procedure as above outlined, there would be with each operation a build-up or overrun in the volume restored to the tank. In actual practice this increase is somewhat lessened by reason of mechanical losses and compensating variations in the loads. Eventually, however, the capacity of a given tank might be reached. To correct this difficulty, and to effect still further savings, my invention contemplates the further step, whenever desired, of avoiding such gradually increasing volume of remaining operating solution by initially reducing the water or liquid content of the load. Accordingly, upon completion of the preceding laundering operation, such as bluing, I open the usual dump valve 1^b of the particular wheel and run the wheel for a brief period generally from 1 to 2 minutes, depending somewhat on the size of the load, thus forcing off part of the water content of the load. This operation can be controlled by use of any one of a number of automatic timing devices which can be set for a predetermined time and provide a suitable signal to warn the operator that the extraction operation has been completed. To take the example previously used, namely a 100-pound load having a normal water content of 25 gallons, in a 40 by 70 inch wheel, I find that operation of the wheel for about 1 and ½ minutes serves to remove, by drainage, tumbling and centrifugal action, the proper quantity of the water, namely about ⅕ of the total content of 25 gallons, or 5 gallons. If then the same quantity of operating starch solution is admitted from the tank as previously assumed to bring the liquid level to that usual for the starching operation, namely 25 gallons then, upon the addition of the five gallons of the concentrated starch solution, the total volume will remain at 50 gallons or approximately that figure. Also since in this manner the water content of the partially dehydrated load is reduced, there is left that much less water, for which additional starch need be supplied, thus effecting a further saving.

In the ordinary starching operations as heretofore employed but little attention is paid to load variation, as a matter of present actual practice. If the load is obviously a large one, the experienced washman generally employs a greater quantity of the starch concentrate. Other factors being equal, the starch concentration thus ordinarily used is within the necessary practical limits. To illustrate:—using a 42–84 Henrici machine loaded with 150 pounds in one instance and 200 pounds in a second instance and using the same normal amount of starch concentrate in both cases the concentration would in the first case be .51 per cent and in the second case .46

per cent. Hence with a load ⅓ heavier there is only a 10 per cent decrease in concentration which still gives satisfactory results in the finished work. In my process no special attention to compensation for load variation is necessary, and the present usual laundry practice, including the addition of more starch concentrate in connection with a heavy load, may be followed. On a commercial plant scale of operation I find that the variable introduced by the variant loads, although cumulative in connection with the reclaiming and repeated use of the operating starch solution in accordance with my method, is largely compensated for automatically by the law of averages, since over any extended period of operation the loads average to vary as much on the light side as on the heavy.

From the foregoing, the saving in operating cost, under the practice of the method of my invention, will be readily apparent. I find that the saving in the amount of starch and other finishing ingredients used will rarely be less than 40 per cent, is more often as much as 60 to 65 per cent, and in a series of 110 test runs in a commercial laundry under usual plant conditions the total resultant saving in starch was 48.8 per cent. While this saving in starch and other finishing ingredients is an important item to a laundry operator, the other economies attendant on the practice of my method are frequently of equal or greater importance. For example, in the series of runs just above referred to there was an attendant saving of 3300 gallons of water, by reason of the reclaiming of the remaining operating starch solution to storage. In a laundry operating six starching wheels, this would amount to a saving of nearly a million gallons of water a year. This is an extremely important consideration in numerous municipalities and other locations. Particularly in connection with the larger installations the fuel saving is also an important item. When only one-half of the concentrated starch solution is prepared obviously the fuel cost of preparation, by cooking for one-half hour, is cut in half. I also find that under my process the time of the subsequent extracting or drying operation may be shortened by about ⅓ up to ½, due presumably to the fact that starch used repeatedly according to my process develops a finer solution, or more even grained suspension, and hence the surplus more readily expelled from the fabric by the centrifugal operation of the dryer, and less adheres to the surface of the fabric. This also results in increased facility in ironing, and in a surface and finish which are smoother and more flexible.

So far as I can discover my process may be repeated indefinitely with no deterioration of the starch solution, and as far as I have been able to discover there never comes a time when the starch solution which has been maintained according to my process, becomes unsatisfactory or needs to be discarded in favor of a completely new solution.

It will also be understood, as previously referred to, that in accordance with my method I reclaim and reutilize the entire remaining solution in a wash wheel on removal of the load following that, usually last, wet operation, herein referred to as "starching". Other materials than starch are sometimes used for this operation, sometimes to the entire absence of starch, as by the use of substitutes therefor. In this operation, in addition to the application of starch to the load, there sometimes heretofore has been employed certain water-repellant compounds designed to give an improved finish to the goods, rendering them less susceptible to spotting and soiling or damage from rain, water or other liquids accidentally or otherwise received. Such compounds may include certain stearates and other materials and are relatively expensive. One such compound is that commercially known under the registered trade-mark "Aquasec". Under my method any remaining quantity of such compounds left with the solution in the wheels is likewise salvaged, conveyed to the tank and reutilized, with suitable additions where necessary, with resultant additional saving in the cost of such compounds. It will accordingly be understood that the term "starching" as herein employed is intended to include that finishing operation, generally the last wet operation, as commonly understood in the laundering art, that is, the operation of which starch proper or any other material or materials, whether or not including starch proper or whether or not used in combination with starch proper, is or are applied by absorptive reception to fabrics in laundering them, for the purposes of giving them body, stiffness, polish, lustre, sheen, resistance or imperviousness to water, moisture, dirt or stain, or other finished characteristic.

My invention is not limited to the particular apparatus or steps herein illustrated or described by way of example, its scope being pointed out in my following claim.

I claim:

In the commercial laundry art, that method of starching wash loads prepared therefor in a wash wheel which comprises establishing and rendering available to the wash wheel a supply of starch solution at a predetermined operating strength, presenting in the wash wheel a washed, wet load having a water content as normally residual therein following the last wash wheel operation on the load prior to starching, actuating the wash wheel for a brief period and in draining condition thereby to reduce said normal water content of the given load only by a relatively small volume such that the remaining water content plus a quantity of starch concentrate sufficient to convert it to a starch solution at said predetermined operating strength will not materially exceed in volume that of said initial normal water content of the wet load prior to said draining operation, presenting in the wash wheel from the established supply of starch solution at operating strength a volume thereof adequate for action upon the load by actuation of the wash wheel, adding the above-mentioned quantity of starch concentrate to said presented supply of starch solution at operating strength, starching in the resulting solution the wet load having said slightly reduced water content, withdrawing the starched load and thereby leaving in the wash wheel an unaugmented volume of starch solution at said operating strength, and rendering the latter again available for further similar starching operations.

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