

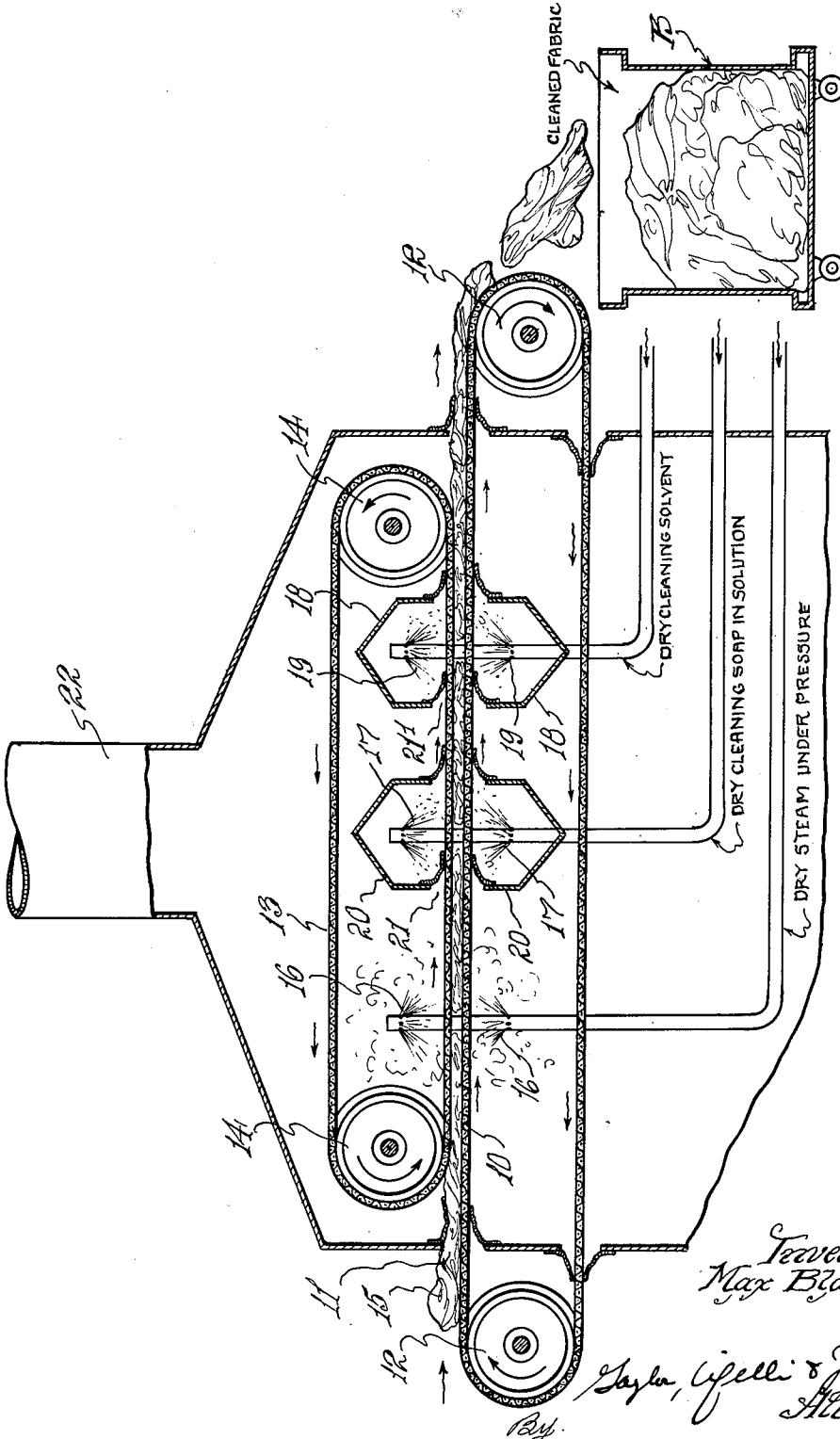
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DRY CLEANING PROCESS

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DRY CLEANING PROCESS

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This invention relates to an improved method for cleaning fabrics, and more especially to a process comprising treating fabrics with steam under pressure, then spraying, also under pressure, the treated fabric with a solution of a dry cleaning soap in a dry cleaning solvent, and then rinsing the fabric.

The dry cleaning of fabrics has acquired an important status in the present-day economy. This method of cleaning, involving the use of dry cleaning solvents such as naphtha, carbon tetrachloride and trichloroethylene, is effective in quickly and efficiently removing foreign matter such as oils and greases.

However, dry cleaning is inherently ineffective to cleanse fabrics which contain foreign matter of the type of water-soluble materials, as distinguished from organic solvent-soluble materials. Examples of such water-soluble materials are water itself, coffee, sugar, salt, etc. and dirt which adheres to the fabrics by reason of water-soluble material contained therewith.

In order to overcome the generally-recognized deficiency of the dry cleaning method, many suggestions have been made. Thus, it has been proposed to "hand spot" the locality having the water-soluble foreign material, water or soap being used for this purpose. This technique suffers from certain disadvantages. It is expensive; it often causes damage to the fabric; and in many cases it only makes the soiled spot larger.

Submitting the entire fabric to the action of water or detergents in water solution or suspension, the so-called "wet cleaning" method, is not the answer as many fabrics are adversely affected: shrinkage, color bleeding, loss of shape and drape, inter alia, often resulting. Indeed, in the case of wool fabrics, "wet cleaning" is out of the question because of the well-recognized resulting shrinkage of wool.

By my present invention I have succeeded in so improving the dry cleaning of fabrics that the advantages of both the dry and wet cleaning methods, without their limitations, are obtained in a quick, efficient and economical manner.

In accordance with this invention, the entire fabric to be cleaned is first exposed to steam under pressure for a brief period, e. g., for a fraction of a second, while moving the fabric along a horizontal screen conveyor. The thus treated fabric is then subjected to a spray of a dry cleaning soap in a dry cleaning solvent, the time of exposure also being quite brief. The fabric is then rinsed and then dried in the usual manner.

It will be seen from the foregoing that my process comprises a complete cleaning operation and is not merely a process which permits the removal of water-insoluble matter. Also, my process, even in commercial operation, is so quick that, for example, 100 pairs of pants can be completely cleaned in six minutes thereby, as contrasted with other present commercial methods which require 135 minutes and which involve pre-spotting by hand followed by conventional dry cleaning.

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There are other important advantages of my process. For example, the individual treatment of each fabric cleaned according to my process permits of greater latitude in the choice and strength of detergents, thereby resulting in a cleaning operation of maximum effectiveness without damage to the fabric. Also, should a dye in a fabric "run" in the course of cleaning by my method the entire batch does not become contaminated, as is the case with conventional batch cleaning methods. My individualized treatment also does not have the disadvantage of batch cleaning methods in which those fabrics having the lowest water absorption are not cleaned properly while at the same time those fabrics having the highest absorption rate tend to shrink. Further, unlike the situation obtaining with batch methods, the dirt and other foreign matter removed by my method cannot be re-inserted into the fabric because of contaminated solvent. The steam and detergent liquids are applied to the fabric by my process in distinction to conventional processes wherein the fabric is tumbled or agitated in the solvent.

In practicing my process, I employ apparatus as shown diagrammatically by the embodiment on the accompanying drawing, in which like characters represent like parts throughout and which forms a part hereof.

In the drawing, the soiled fabric, e. g., a cotton garment, is placed on endless wire screen conveyor 10 near or at point 11. Conveyor 10, when actuated, moves in a clockwise direction around rollers 12, being powered by conventional motor and reduction means, not shown. Similarly, endless wire screen conveyor 13, when actuated, moves in a counter-clockwise direction around rollers 14. The fabric 15 passes between conveyors 10 and 13. The conveyors 10 and 13 are mounted loosely in such manner that they can accommodate fabrics of the usual thicknesses when the fabric passes between them. The steam spray nozzles 16 are directed downward so as to impinge against the top of fabric 15 when the latter passes through the steam chamber and also upwards so as to impinge against the bottom of fabric 15. Thus, when the fabric 15 passes through the steam section of the apparatus it receives simultaneously, from top and bottom, fine sprays of steam for a fraction of a second.

While I have found that various types of nozzles can be employed with satisfactory results so long as a spray giving substantially complete coverage is obtained, best results have been obtained with nozzles which deliver, (a) about 75 to 100 pounds of steam per hour without a fan to remove the expended steam; or (b) higher amounts of steam, up to 200 pounds per hour, if a fan such as fan 22 is employed. In practice, a steam pressure of from 50 to 125 pounds per square inch has been found satisfactory. Pressures lower than 40 pounds per square inch do not give sufficient penetrating effect, while pressures above 125 p. s. i. are not indicated because of the amount of heat engendered.

The steam at the jets should be dry, i. e., free from condensed water. This dry steam may be obtained in known manner. It is also important that the steam should not be permitted to form water on the fabric.

The dry cleaning soap solution nozzles 17 are placed with relation to the fabric 15 in a manner similar to the placement of steam nozzles 16. Enough soap solution is emitted onto the fabric 15 so as to saturate it as it passes through the detergent section. While varying pressures can be employed I have found pressures of the order of 75–200 p. s. i. to be satisfactory, a pressure of 150 p. s. i. giving excellent results.

The detergent nozzles 17 are advantageously located in a compartment 20 with flaps 21 of neoprene or of other suitable material. After the fabric 15 has been subjected to a spray from the detergent nozzles 17 it passes

into the rinsing chamber 18 provided with nozzles 19 for dry cleaning solvent under pressure and flaps 21'. These nozzles 19 are directed against the fabric 15 in a manner similar to nozzles 16 and 17. The cleaned fabric then passes out of chamber 18 into the basket B and is dried in any desired manner.

I have found that my process can be employed with all so-called dry cleaning soaps tested. Examples of some detergents which have proved successful in my process include alkyl phenoxypolyoxyethylene ethanol (Igepal CO-430, sold by Antara Chemicals Division of General Dyestuff Corp.), mixture of sorbitan ester and polyoxyethylene ester derivatives (G-2684, sold by Atlas Powder Co., Wilmington, Delaware), alkylaryl polyether alcohol (Triton X-45, sold by Rohm & Haas Co., Philadelphia, Pa.), complex polyhydroxy polyoxyethylene fatty acid esters (Kessco E 119, sold by Kessler Chem. Co., Inc., Philadelphia, Pa.), modified alkyl aryl sulfonate (Naccolene F, sold by National Aniline Div. of Allied Chemical & Dye Corp.), sorbitan monooleate (Span 80, sold by Atlas Powder Co.), heterocyclic tertiary amine (Alroylene 70, sold by Alroese Chem. Co., Providence, R. I.) and sulfonated mineral oil.

Paste-type soaps, such as potassium oleate having an excess of free fatty acid, such as oleic or stearic acid have also been found to give desirable results, as have also gel-type soaps such as potassium oleate containing also sulfonated oil and ammonium soap. Gel-type soaps usually contain a solvent such as Stoddard solvent or cyclohexanol. Liquid true soaps, such as potassium oleate containing free fatty acids, a solvent like cyclohexanol and ammonium soap, have also been used successfully with my process.

If desired, the aforementioned detergents may be employed per se or in admixture.

While I do not wish to be restricted to any particular theory of operation it is my present belief that the dry cleaning soaps or detergents operate in a novel manner in my process. They either solubilize the moisture in the fabric or float it out, depending on the Hydrophile-Lipophile Balance (HLB). A hydrophilic detergent solubilizes the vapor while a detergent of the lipophilic type tends to float the vapor away from the fabric. In either case the moisture from the steam spray is not absorbed to any substantial extent by the fabric as free water but is removed therefrom after it has accomplished its purpose.

The solvents which can be employed with the dry cleaning soaps in accordance with my novel process are the conventional dry cleaning solvents, examples of which are Stoddard solvent, trichloroethylene, perchloroethylene, and so-called petroleum safety solvents, i. e., those having a flash point of 140° F. or higher.

Nor is the concentration of the soap in solvent critical. Indeed, the conventional practice of the dry cleaning art in this regard is followed here. For illustrative purposes, however, I can state that concentrations of from ½ % to 6%, depending on the particular soap employed, have given satisfactory results. In general, I have found concentrations of from 1 to 2%, by volume, of soap to give excellent results.

In order more fully to clarify this invention, the following examples are given by way of illustration and not by way of limitation.

Example 1

The apparatus shown in the accompanying drawing and described in the foregoing is put into operation by turning on the steam, soap solution and rinse jets, 16, 17 and 19, respectively, by actuating the conveyors 10 and 13 and by turning on the fan 22. The size of a commercial machine presently in operation is such that it is 42" wide by 120" long. The soiled fabrics 15 are placed on the conveyor 10 one right after the other at the rate of 10

to 12 pieces per minute, and move along the conveyor at the rate of about 35 feet per minute.

The steam employed is obtained from a boiler at a pressure of 70 pounds per square inch. It is reduced by a suitable steam reducer to 40 p. s. i. and then passed through a water separator in order to remove any water. Bleeder valves are provided to drain off any water which may form in the line between the water separator and the steam jets.

When the fabrics pass between jets 16, from which dry steam at 40 pounds per square inch is issuing, the fabrics are softened and opened up. In actual operation, the apparatus presently in use has 20 steam jets with a capacity of 160 pounds of steam per hour. The jets in use are so-called drying and blow-off tips (T. T. L. S. S., Spraying Systems Co., Chicago). The steam which hits the fabrics remains in vapor form and should not condense in the form of liquid while on the fabric.

The fabric then passes between the detergent nozzles 17, from which the detergent solution of 1½ % of Igepal CO-430 by volume in Stoddard solvent, under a pressure of 200 pounds per square inch and delivering about 20 gallons per minute through 48 jets (6502-SS), flat atomizing tips, is issuing. This causes a flushing out of the fibers and a suspension of the foreign matter in the detergent liquid.

The cleaned fabric then passes through chamber 18 where it is subjected to a spray of dry cleaning solvent from nozzles 19. It is then dried in any desired manner.

The resulting fabric is sufficiently clean for commercial purposes substantially all of the time. Should a touch-up be deemed advisable, it is a simple matter to do so with a few flicks of the steam gun or as a "rerun."

Example 2

The process of Example 1 was repeated using G-2684 in place of Igepal CO-430, with similar results being obtained.

Example 3

The process of Example 1 was repeated using Triton X-45 in place of Igepal CO-430, with similar results being obtained.

Example 4

The process of Example 1 was repeated using Kessco E 119 in place of Igepal CO-430, with similar results being obtained.

Example 5

The process of Example 1 was repeated using Naccolene F in place of Igepal CO-430, with similar results being obtained.

Example 6

The process of Example 1 was repeated using Span 80 in place of Igepal CO-430, with similar results being obtained.

Example 7

The process of Example 1 was repeated using Alroylene 70 in place of Igepal CO-430, with similar results being obtained.

Example 8

The process of Example 1 was repeated using a mixture comprising 28 cc. of G-2684, 12 cc. of Socony Vacuum Oil 908, and 20 cc. of Span 80, plus a co-solvent for 5 cc. of cyclohexanol in place of the Igepal CO-430, with very excellent results being obtained.

A convenient practical test to employ in order to prevent the addition of too much moisture to the fabrics is to note whether there are any hard wrinkles in the cleaned cloth. If there are, this is an indication that too much steam has been applied and that shrinkage is likely to follow. Accordingly, if hard wrinkles are found, the amount of steam which is permitted to impinge on the

fabric is reduced, either by reducing the capacity of the steam jets 16 or by increasing the linear speed of the conveyors 10 and 13.

My process has been conducted with fabrics of different kinds, for example, wool, rayon, and cellulose acetate. In order to determine the soil removal characteristics of my process I have employed known test, e. g., the so-called "alrose" test and have devised the following convenient test:

Samples of suitable textiles are passed through a composition containing dirty crank case oil (50 cc.) and 100 cc. Stoddard solvent to which composition 1 tablespoon of carbon black has been added. The mixture is stirred to a creamy consistency before the cloth is passed through it. The excess is squeezed off the cloth and the cloth is then dried and subjected to the process of my invention.

This is a continuation-in-part of my co-pending application, Serial No. 248,162, filed September 25, 1951, which latter case is a continuation-in-part of its co-pending application, Serial No. 183,405, filed September 6, 1950, both parent applications having been abandoned.

It will be understood that throughout the specification and claims herein the term "fabric" is used to designate textiles in all the forms in which they are sent to cleaners. Thus, for example, garments, rugs and drapes, are illustrative of the types of articles envisaged by the term "fabrics."

It will also be understood that various modifications in my process may be made without departing from the spirit of my invention. Accordingly, it will be understood that the foregoing is given to illustrate my invention which is to be construed as broadly as permissible in view of the prior art and limited solely by the appended claims.

I claim:

1. A process for dry cleaning fabrics, which comprises spraying dry steam under a pressure of the order of 40 to 200 pounds per square inch onto a soiled fabric for a brief period whereby the fabric is softened and opened up and substantially no liquid is deposited thereon, then substantially immediately spraying under pressure of the order of 75 to 200 pounds per square inch onto the thus-treated fabric a solution of a dry cleaning soap in a dry cleaning solvent, the amount of said solution being sufficient to cause a flushing out of the fibres and to effect the suspension of foreign matter therein, and then rinsing the fabric with a dry cleaning solvent.

2. The process of claim 1, wherein the steam pressure is between 50 and 125 pounds per square inch.

3. The process of claim 1, wherein the pressure of the soap solution is 150 pounds per square inch.

4. The process of claim 1, wherein the steam pressure is between 50 and 125 pounds per square inch and the pressure of the soap solution is 150 pounds per square inch.

5. A rapid, continuous process for dry cleaning fabrics on a perforated moving conveyor, which comprises spraying dry steam under a pressure of the order of 40 to 200 pounds per square inch onto a soiled fabric for a brief period, whereby the fabric is softened and opened up and substantially no liquid is deposited thereon, then substantially immediately spraying under pressure of the order of 75 to 200 pounds per square inch onto the thus-treated

fabric a solution of a dry cleaning soap in a dry cleaning solvent, the amount of said solution being sufficient to cause a flushing out of the fibres and to effect the suspension of foreign matter therein, and then rinsing the fabric by spraying onto the fabric a dry cleaning solvent.

6. The process of claim 5, wherein the steam pressure is between 50 and 125 pounds per square inch.

7. The process of claim 5, wherein the pressure of the soap solution is 150 pounds per square inch.

8. The process of claim 5, wherein the steam pressure is between 50 and 125 pounds per square inch and the pressure of the soap solution is 150 pounds per square inch.

9. A rapid, continuous process for dry cleaning fabrics, which comprises passing them on a moving perforated conveyor through a steam chamber, a soap solution chamber and a rinsing chamber, said chambers being in juxtaposition, so that the fabric while in the steam chamber is sprayed for a brief period with dry steam under a pressure of the order of 40 to 200 pounds per square inch whereby the fabric is softened and opened up and substantially no liquid is deposited thereon, the thus-treated fabric while in the soap solution chamber is substantially immediately sprayed under a pressure of the order of 75 to 200 pounds per square inch with a solution of a dry cleaning soap in a dry cleaning solvent, the amount of said solution being sufficient to cause a flushing out of the fibres and to effect the suspension of foreign matter therein, and rinsing the fabric by spraying onto the the fabric a dry cleaning solvent.

10. The process of claim 9, wherein the steam pressure is between 50 and 125 pounds per square inch.

11. The process of claim 9, wherein the pressure of the soap solution is 150 pounds per square inch.

12. The process of claim 9, wherein the steam pressure is between 50 and 125 pounds per square inch and the pressure of the soap solution is 150 pounds per square inch.

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