March 2, 1937. A. E. HATFIELD 2,072,332

METHOD OF DRY CLEANING

Filed Aug. 12, 1935

Fig. 2.

STAGE I

(a) Dehydrate Solvent

STAGE II

(b) Incorporate Water-repelling Material With Solvent

(c) Charge Fabrics To Washer

(d) Remove Greasy Soil From Fabrics

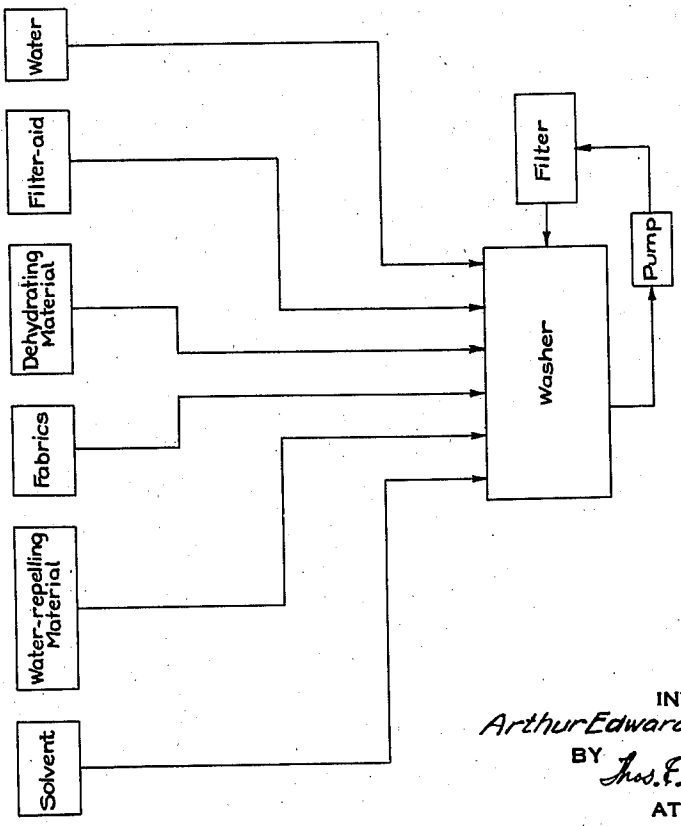
(e) Render Fabrics Water-repellant

STAGE III

(f) Incorporate Water With Solvent

(g) Remove Water-Soluble Soil From Fabrics.

Fig. 1.



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METHOD OF DRY CLEANING

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6 Claims. (Cl. 68—38)

My invention relates to a method of dry cleaning, that is, a process of cleaning garments, fabrics, textiles, and the like, by means of solvents such as light hydrocarbons, including gasoline and naphtha, and chlorinated hydrocarbons such as carbon tetrachloride or trichlorethylene and like organic solvents.

The instant invention is an improvement over my Patent 1,990,691 of February 12, 1935.

In Patent 1,990,691, I disclosed a process of dry cleaning which enabled both greasy soils and water soluble soils to be removed without the dangers and disadvantages attending the humidifying of a dry cleaning solution. In the process of my patent, I am able to accomplish the results by first rendering the fabrics water repellent and then subsequently humidifying the dry cleaning solution.

In practical operation, a dry cleaning bath is used for successive batches of clothes. After the dry cleaning solvent has been once humidified, I have found that colloidal water is dispersed throughout the solution. This water is of such small quantity that it is not objectionable in causing clothes to shrink. I have found, however, that the presence of water has a deleterious effect when greasy soils are removed. If it is attempted to remove greasy soils in the presence of water, upon the clothes being immersed in the cleaning bath, the dirt is first released from the clothes and then is redispersed because of the presence of water and redeposited upon the clothes. This results in making the clothes look hazy and dull. In order to get perfect dry cleaning, therefore, it is essential that the greasy soils be removed from the clothes and the dry cleaning solution clarified or filtered of the greasy dirt by filtration or the like, before it is attempted to remove the water soluble soils by humidifying the dry cleaning solution.

One object of my invention is to provide an improved method of dry cleaning in which the greasy soils and water soluble soils are removed in stages.

Another object of my invention is to provide a process of dry cleaning in which both greasy soils and water soluble soils are removed from the fabrics without the danger of redeposition of soil upon the clothes.

Another object of my invention is to provide a process of dry cleaning in which a dry cleaning bath is alternately humidified and rendered substantially anhydrous, and the same bath continuously used for cleaning successive batches of fabrics.

Other and further objects of my invention will appear from the following description.

In general, my invention contemplates the dehydrating of the dry cleaning bath by means of a dehydrating agent after the water soluble soil has been removed by humidifying the dry cleaning bath in order that the same bath may be used for cleaning a subsequent batch of fabrics of greasy soil in the absence of water or moisture.

More particularly, I employ as a dehydrating agent a natural, hydrous silicate of alumina, known generally as "bentonite" which has the property of absorbing from ten to twenty-five times its weight of water.

Bentonite may be represented by the formula,

$$Al_2O_3 \cdot 4SiO_2 \cdot xH_2O$$

In the above formula, x may represent any number from 1 to 15 depending upon the dryness of the sample. The amount of chemically combined water, however, does not ordinarily exceed $2H_2O$. Bentonite, however, has very little chemical affinity for water. It is no more hygroscopic than any inert, powdered, argillaceous material. Bentonite, however, does have a great physical avidity for water in liquid form. In the formula given above, the alumina may be replaced to a considerable extent by iron, lime or magnesia and, to a very limited extent, by alkali.

In the accompanying drawing, which forms part of the instant specification and is to be read in conjunction therewith;

Figure 1 is a schematic view showing the arrangement of the washer, pump and filter through which cyclic flow of the solvent occurs.

Figure 2 is a chart showing the stages of my process in outline.

More particularly, I may employ as a dry cleaning solvent any of the well known agents such as naphtha, gasoline, carbon tetrachloride, trichlorethylene, and the like. The system is first filled with dry cleaning fluid. The pump is started and dry cleaning fluid is circulated from the washer to the pump, through the filter and back to the washer. Filter aid, which may be fuller's earth, diatomaceous earth, or the like, is introduced into the circulating ring of the fluid. It is understood that the filter aid may be introduced at any suitable point into the ring. A convenient place for its introduction is into the washer. The filter aid is caught upon the leaves of the filter, pre-coats the filter and precludes its becoming clogged readily. The amount of finely divided bentonite is then introduced, together with some additional filter aid. Bentonite may

be used alone, if desired. Instead of bentonite, I may employ other dehydrating agents, such as calcium chloride and the like, either alone or with bentonite. However, if the original dry cleaning fluid is not substantially anhydrous, the bentonite, in absorbing water from the dry cleaning fluid will tend to clog the filter. The addition of bentonite along with a diatomaceous earth which is highly porous will assure that resistance to flow will not build up unduly. The circulation is continued to permit any water which might be present to be taken out of the dry cleaning fluid by the bentonite which is caught upon the leaves of the filter. The dry cleaning fluid is then ready for the incorporation therewith of a material capable of rendering fabrics water repellent. This material may be, as disclosed in my Patent 1,990,691, paraffin wax, glycerides of various fatty acids of high molecular weight, various naturally occuring or synthetic aliphatic esters, or mixtures thereof. It is only necessary that the materials employed are stable and do not have objectionable odor. To assist in the dispersion of the water repelling material, a dispersing or coupling agent such as ethylene glycol, monobutyl ether or the like may be employed. The dry cleaning bath may contain from five percent to fifteen percent by weight of the water repellent material. A solution of about eight percent by weight of dry cleaning solvents has been found to be very efficient in practice.

After the material has been added, the pump is started to thoroughly incorporate the material with the dry cleaning bath. Inasmuch as the water repelling material is soluble in the dry cleaning fluid, it will form a solution which will pass through the filter easily. The bath is then ready for the reception of the clothes to be cleaned. These are introduced into the washer and the pump is started, producing the circulation of the dry cleaning fluid. The dry cleaning will dissolve the greasy material and release dirt and soil from the clothes. As rapidly as the soil is removed, it will be deposited upon the leaves of the filter. If desired, filter aid may be added with the clothes to insure that the matter released by the clothes does not tend to clog the filter and thus build up resistance to the flow. At the time the filter aid is added, the bentonite may be also added. In practice, I have found that a mixture comprising about seventy percent by weight of calcined diatomaceous earth such as that sold under the trade name of "Hyflo Supercel", and about thirty percent by weight of bentonite, makes an efficient agent. The materials are intimately mixed and added in proportion to the weight of the clothes. I have found that the amount of the above mixture to be added should be from one half to one percent of the weight of the fabrics being cleaned. Inasmuch as the solution is anhydrous, the bentonite will merely be caught upon the leaves of the filter, while the filter aid will prevent the dirt released from the clothes clogging the filter and building up pressure.

The circulation is continued until all the solids are removed from the solution and the clean solution is circulated. This can be readily determined by sight glasses which are usually provided in dry cleaning systems of the type described. In practice, a time interval of about ten to fifteen minutes is necessary in order to remove all of the greasy soils from the clothes and maintain a clear circulating solution. The bath is now ready for humidifying. It is understood that dry cleaning fluids will not touch water soluble soils such as stains occasioned by sugars, starches, and the like. In order to remove these soils, water is necessary. Due to the fact that the fabrics have been rendered water repellent, the amount of water added is not critical. It is unnecessary, however, to add an excess of water. In general, the amount of water to be added may be gauged by the condition of the fabrics. If the fabrics are extremely dirty, about thirty cubic centimeters of water could be added for each pound of fabrics. If the fabrics are moderately clean, fourteen cubic centimeters of water per pound of fabrics is adequate to remove water soluble soils. The water may be added in any suitable manner, at any suitable place in the circulating ring. For every three parts of water, it is advisable to add one part of a dispersing or coupling agent to assist in the dissemination of the water through the dry cleaning bath, thus humidifying it. Such materials as alcohols, triethanolamine, and cyclohexanol are adapted to be used as dispersing agents. A convenient place for the introduction of the water is into the washer. The circulation is continued and the action first is to disperse the water through the bath, enabling it to dissolve the water soluble soils.

As the dry cleaning bath passes through the filter, which it will be remembered has been coated with a quantity of bentonite, part of it is absorbed by the bentonite. Each time the bath comes in contact with the bentonite, a portion of the water is absorbed. The circulation is continued a short time after it is optically clear to insure that all of the water is absorbed from the dry cleaning bath so that it will be ready to receive the next batch of clothes. It will be observed, of course, that the dehydrating may be carried on after the clothes are removed and before the next batch is added.

It will be obvious that my improved process has many advantages. In prior practice, the moisture in solution in colloidal suspension was detrimental to the cleaning of the next batch of clothes, due to the effect of redepositing the soil on the clothes in the presence of moisture. Heretofore it was necessary, before a fresh batch of clothes was entered into the system, to determine the quantity of water in order to avoid adding an excess of water during the second stage of the process. This was done by extracting one hundred cubic centimeters of the solution and distilling it in the laboratory and measuring the amount of water in the first ten or twenty cubic centimeters of the condensate which came off. The number of cubic centimeters of water will represent the percentage of water in the bath.

By substantially completely dehydrating the bath before entering a fresh batch of clothes, the danger of redepositing soil upon the clothes due to the presence of water and thus obtaining dull or hazy work is greatly lessened. Perfect control of the amount of water in the solution obtains in my improved process since a fresh batch of clothes is always charged to a substantially anhydrous bath. In the process of my patent, a certain amount of water was absorbed by the filter aid, which has the property of absorbing about its own weight in water. The colloidal water, however, passed through the filter with ease and was always present in the bath. While this did not have a deleterious effect upon the clothes from the standpoint of shrinking them, it did cause

redeposition of the soil and, if a larger quantity of water were present, the clothes would look dull. By the use of bentonite, I am enabled to render a dry cleaning bath, which has been humidified, substantially anhydrous, thus obtaining superior results.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. A process of dry cleaning including the steps of dehydrating an organic solvent, incorporating a material capable of rendering fabric water-repellent with the dehydrated solvent, washing fabrics in the anhydrous solution to remove greasy soil and to render the fabrics water-repellent, incorporating water with the solvent and washing the fabrics in the humidified solvent to remove water-soluble soil from the fabrics.

2. A process of dry cleaning including the steps of dehydrating an organic solvent by contacting the same with bentonite, withdrawing the dehydrated solvent from the bentonite, dissolving a material capable of rendering fabrics water-repellent in the dehydrated solvent, washing fabrics in the solution to remove greasy soil and to render the fabrics water-repellent, dispersing a minor amount of water in the solvent and washing the fabrics in the humidified solvent to remove water-soluble soil.

3. In a process of dry cleaning in which a solvent containing a material capable of rendering fabric water-repellent is circulated through a washing stage and a filtering stage continuously to remove greasy soil, and then water is dispersed through the circulating solvent to remove water-soluble soil, the step of dehydrating the solvent before commencing the process.

4. In a process of dry cleaning in which a solvent containing a material capable of rendering fabric water repellent is circulated through a washing stage and a filtering stage continuously to remove greasy soil, and then water is dispersed through the circulating solvent to remove water-soluble soil; the step of dehydrating the solvent by contacting the same with bentonite before commencing the process.

5. A process of dry cleaning including the steps of washing a fabric in anhydrous solvent containing a material capable of rendering the fabric water-repellent, to remove greasy soil and impart moisture repelling properties to the fabric, then adding bentonite to the dry cleaning solution, then dispersing water through the dry cleaning solution to remove water-soluble soil and allowing a sufficient time interval to permit the bentonite to absorb the added water.

6. A process of dry cleaning including the steps of circulating a solvent containing a material capable of rendering fabrics water-repellent, through fabric, continuously filtering the solvent, adding a filter aid and bentonite to the circulating solvent and allowing the filter aid and bentonite to be caught in the filter, dispersing water through the solvent and continuing circulating the solvent until the same is rendered substantially anhydrous.

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