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E. A. CRESWICK

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DISTILLATION METHOD AND APPARATUS FOR DRY CLEANING

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2 Sheets-Sheet 1

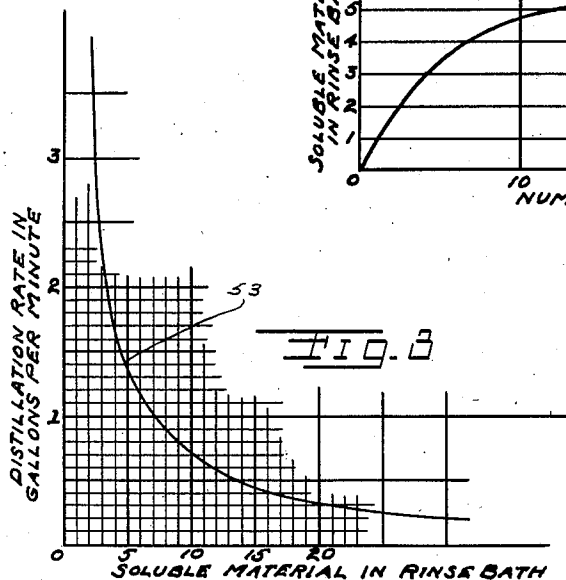
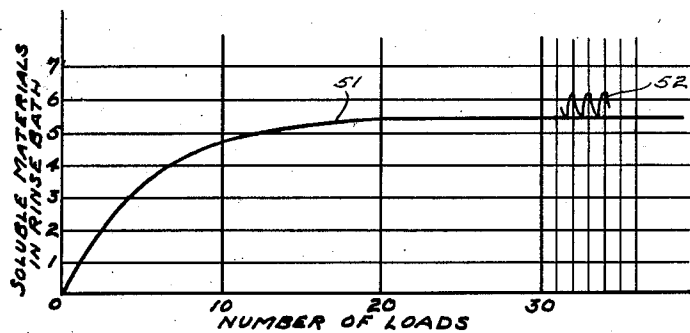
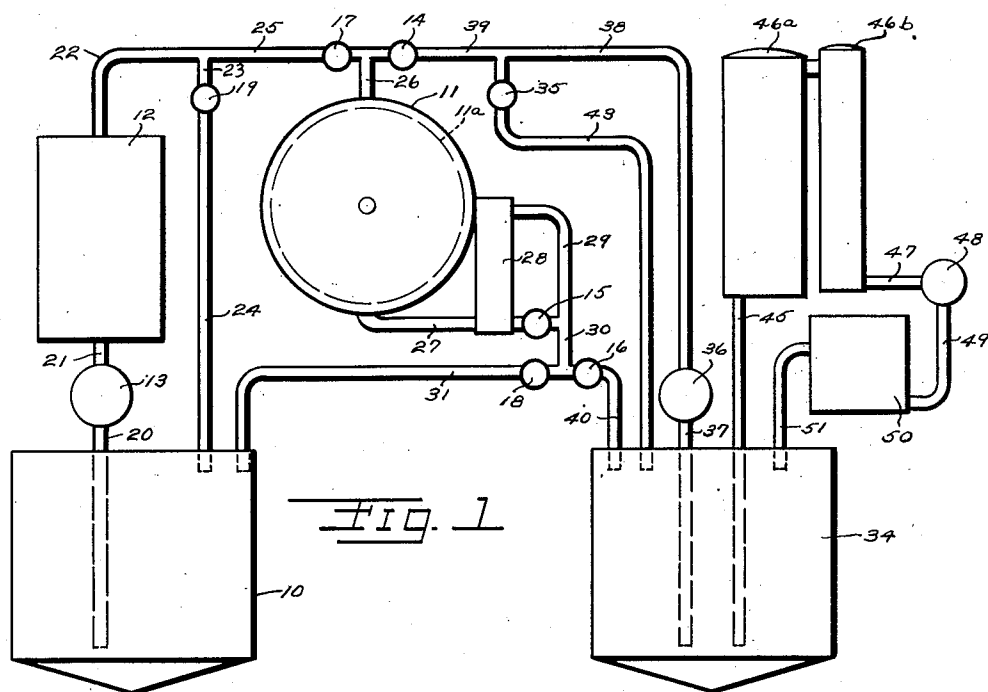


Fig. 2

Fig. 3

INVENTOR.
EDWARD A. CRESWICK
BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

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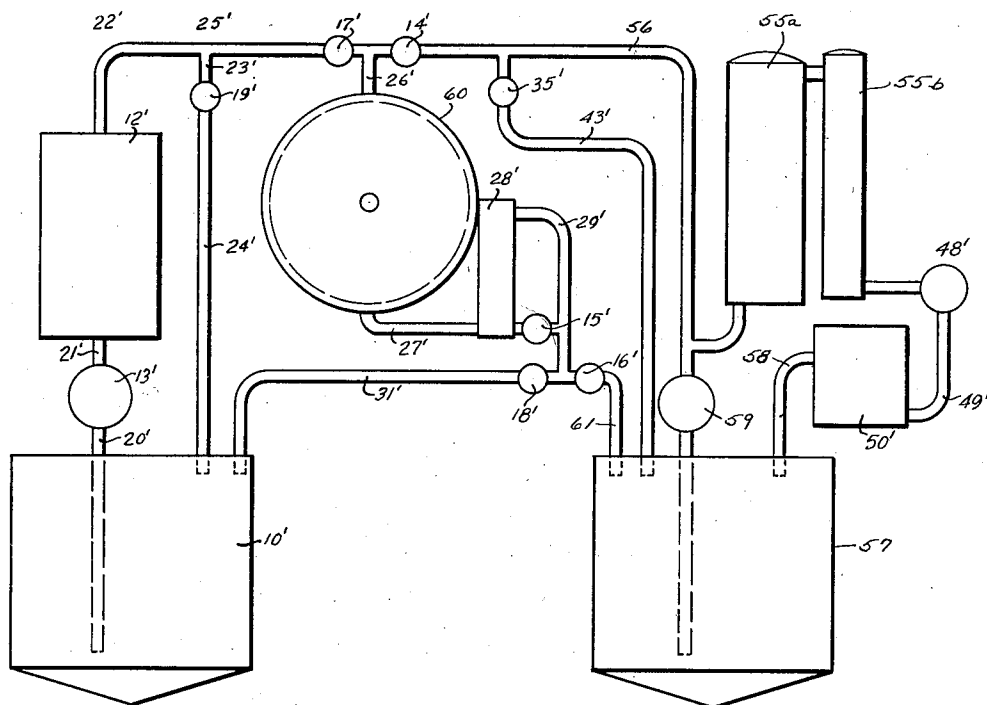


Fig. 4

INVENTOR.

EDWARD A. CRESWICK

BY

Hyde, Meyer, Baldwin & Doran

ATTORNEYS

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DISTILLATION METHOD AND APPARATUS
FOR DRY CLEANING

Edward A. Creswick, Cincinnati, Ohio, assignor to The American Laundry Machinery Company, Cincinnati, Ohio, a corporation of Ohio

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3 Claims. (Cl. 8—158)

This invention relates to a novel and improved dry cleaning system and apparatus usable for dry cleaning outer garments or other articles of wearing apparel or textile fabrics, or the like, and it is an improvement on the system and apparatus disclosed and claimed in my copending application for Dry Cleaning System, Serial No. 76,676, filed February 16, 1949, now Patent Number 2,630,694.

The said copending application discloses what I will term, for convenience, the "two-bath" system, utilizing two baths, one for washing and another for subsequent rinsing, with continuous filtering of each bath for insoluble soil removal and with extraction of removable liquid after both the washing and the rinsing operation.

The main advantage of the two-bath method is that it permits high concentrations of detergent in the first step, the wash bath, with low total detergent consumption, and elimination of the need for excessive quantities of clean solvent. In addition, it avoided the disadvantages of the batch system which required periodic replacement of clean solvent from an undesirably large solvent storage capacity. High detergent concentrations, however, render the use of adsorbent filter aids such as activated clays impractical because adsorption of detergent causes excessive filter pressure and detergent loss. Consequently only inert filter aids such as diatomaceous earths can be used successfully in the wash bath filter, and filtration of the detergent-laden wash bath is purely a mechanical removal of suspended solids. As a result, the soluble soil which is added to the wash bath by each successive load is not removed by filtration of the solvent.

An object of the present invention is to provide, in combination with the two-bath system above characterized, means for continuous distillation and return of a portion of the rinsing bath whereby to maintain the soluble soil content of the rinsing bath below an established minimum and permit uninterrupted operation of the system.

A further object of the invention is to provide a two-bath system wherein such distillation step may be substituted for the filtration step previously used for purification of the rinsing bath, or may be used to supplement each filtration of the rinsing bath.

Other objects and advantages of the invention will be apparent from a study of the following specification, in conjunction with the accompanying drawings, in which Fig. 1 is a diagrammatic representation of a two-bath system employing my distillation step.

Fig. 2 is a graph depicting the soluble material content of the rinsing bath plotted against the number of loads rinsed.

Fig. 3 is a graph showing the effect of distillation rate, in gallons per minute, plotted against quantity of soluble material in the rinse bath.

Fig. 4 is a view similar to Fig. 1, but showing diagrammatically another embodiment of the invention.

The apparatus will first be described, and its novel

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characteristics and advantages will thereafter be discussed.

Referring first to Fig. 1, the reservoir 10 holds the supply of wash solvent for the first bath. This solvent preferably has a high soluble soap concentration to best utilize the advantages of the system. There is also indicated a washer-extractor unit comprising a cylinder 11 containing therein a rotatable work holding drum 11a, a filter 12 and a pump 13. In starting, valves 14, 15, 16, 17 and 18 are closed, and valve 19 is open. Pump 13 is started and the wash liquid is circulated through conduit 20, pumps 13, conduit 21, filter 12, conduits 22 and 23, valve 19, and conduit 24 to the reservoir 10.

When a load of material to be cleaned is placed within drum 11a, valve 19 is closed and valves 17 and 18 are opened. The drum motor (not shown) is started which rotates drum 11a, and wash liquid is now circulated through conduit 20 and 21, filter 12, conduit 22, 25 and 26, cylinder 11, conduit 27, button trap 28, conduits 29, 30 and 31 to the reservoir. It is apparent that there is continuous filtration, both when the wash liquid is passing through the bypass 24 and when it is passing through the cylinder 11. The overflow conduit 29 determines the liquid level in the cylinder 11. The filter removes the insoluble soil. The soluble soil and detergent are not removed from the bath, and this soluble soil builds up slowly for several hundred loads to an equilibrium point at which the soil carried by the load to the rinse bath is equivalent to the soil added by the new load. This is not objectionable since the purpose of the wash bath is to remove the insoluble soil by filtration, and dissolve the soluble soil for substantially complete removal in the rinse bath.

After completion of the washing period the inlet valve 17 is closed and the valves 19 and 15 are opened. Wash liquid from reservoir 10 is circulated through filter 12 and bypass pipe 24 through valve 19, by means of pump 13, and cylinder 11 is drained to reservoir 10 through valves 18 and 15.

An extraction step is now introduced wherein drum 11a is whirled to remove the major portion of wash liquid in the work, the liquid thus removed being drained to reservoir 10.

Valves 15, 17 and 18 are now closed to set the stage for the rinsing step. Reservoir 34 contains rinse liquid, usually a volatile hydrocarbon solvent. Valves 14 and 16 are opened, valve 35 is closed and the rinse liquid is circulated by pump 36 through conduits 37, 38 and 39, valve 14 and conduit 26 to cylinder 11, and then through conduit 27, button trap 28, conduits 29 and 30, valve 16 and conduit 40 to reservoir 34. A filter (not shown) may be supplied in conduit 38 for continuous filtration. If pump 36 operates continuously, or if the same motor drives both pump assemblies, the bypass line 43 and valve 35 permits the rinse liquid flow to be shunted through the bypass when the cylinder is not under rinse.

After the rinse step, valve 14 is closed, and valves 35 and 15 are open. Cylinder 11 drains rinse liquid through conduit 27, valve 15, conduit 30, valve 16 and conduit 40 to reservoir 34. The pump 36 circulates rinse liquid through conduits 38 and 43. After, or during the completion of, drainage the tub 11a is rotated for removal of excess rinse liquid by centrifugal extraction.

Continuously, during operation of the wash and rinse operations, a parallel distillation of rinse liquid is taking place through conduit 45, still elements 46a and 46b, conduit 47, pump 48, conduit 49, water separator 50 and conduit 51.

Fig. 4 shows another embodiment of the invention in which the still unit 55a, 55b is in liquid flow communication with the conduit 56 which conduit corresponds to the conduit 38 of Fig. 1. Any part in Fig. 4 which is indi-

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cated by a reference character identical with that in Fig. 1, but with a prime designation (i. e. part 24') performs identical functions to those performed by the part with a corresponding reference character (i. e. part 24) in Fig. 1, so that the description of the operation of that portion of the Fig. 1 embodiment will now be applicable to the correspondingly numbered part of Fig. 4. As in Fig. 1 the outlet from the still delivers pure cleaning fluid to rinse bath reservoir 57 through conduit 58. Conduit 61 of course is carrying to reservoir 57 the soil containing rinse fluid from cylinder 60.

The principle of operation will first be discussed in general terms, and thereafter more specifically and with mathematical substantiation.

When the washing liquid containing some soluble soil is discharged from the washer-extractor, and when an additional increment of washing liquid containing soluble soil is removed by extraction, there still remains in the washed (but not rinsed) fabric a final increment of liquid containing soluble soil. When this washed and extracted load is put on rinse, the rinse bath would, of course, acquire most of this final increment of soluble soil and with successive wash-rinse cycles on successive batches of fabric the rinse bath would increase in soluble soil concentration except for the continuous distillation of a part of the rinse liquid and return of distilled liquid to the rinse bath. This removal of soil by distillation and return of clean rinse liquid balances the intake of soluble soil from each successive rinse step, and the build-up of soluble soil in the rinse bath levels off after a relatively small number of rinsing cycles.

The continuous removal of solvent from the rinse bath to the still, and the return flow of distilled solvent at the same rate into the bath reduces the content of soluble soil and detergent in the rinse bath by dilution. As it happens the greater the amount of soluble material introduced into the bath, the more there is removed.

The curve 51, Fig. 2, indicates the buildup of soluble soil in the rinse bath to equilibrium level at about twenty loads, as shown on the abscissa, the ordinate figures indicating arbitrary quantitative units of soluble soil. The ultimate level, here shown as about five and one-half units, is quite acceptable in the cleaning art. The smaller fragmentary curve 52, of undulating character, indicates the momentary increase of soluble soil in the rinse bath as each load is introduced, and the decrease to the average minimum level as that load is rinsed while distillation and replenishment proceeds. The curve of 53, Fig. 3, indicates quantitatively the effect of the distillation rate, in gallons per minute, on the amount of soluble material in the rinse bath, because of course the distilled liquid is returned to the rinse bath, as shown by the means in Fig. 4 for taking the distilled liquid from the condenser 55b to reservoir 57. Obviously the higher the replacement upon distillation, the lower the number of soluble soil units in the rinse bath.

The relationship is not a linear one, and the curve of Fig. 3 indicates that at the higher distillation rates the efficiency in removal of soil decreases rapidly. For example an increase of from one and one-half gallons per minute to two gallons per minute effects a change of only about one unit of soluble soil, whereas an increase of from one-half gallon per minute to one gallon per minute effects a change of about seven units of soluble soil so that the process is definitely more economical and efficient at the lower distillation rate.

The retention of a trace of detergent by fabric after cleaning is considered to improve its appearance and feel.

It will be seen that this simplified method of distillation in a two-bath system, permits the use of very high concentrations of detergent in the first bath with the maintenance of a practically constant low content of soluble soil and detergent in the second bath with no appreciable

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change in the volume of the second bath. The volume of the second bath, need only be sufficient to fill the circuit of the bath, which is considerably less than would be the workable requirement if batch distillation were used.

In batch distillation processes there are periodically alternating high and low contents of soluble material in the second bath. This disagreeable situation is eliminated by my continuously operating distillation and replacement system.

In my system, also, the retention of detergent in the finished load is not permitted to exceed an acceptable amount, and the soluble soil is maintained below a tolerable minimum value, which in commercial practice of my invention is lower than that obtainable by the other systems heretofore and at present used in dry cleaning practice. Further, the constant low content of soluble soil and detergent in the rinse bath further permits the very effective use of activated clays, usually termed "sweeteners," in the rinse bath if it be desired to render the rinse bath entirely free of soluble material.

What I claim is:

1. A method of cleaning fabrics for use in a dry cleaning system utilizing a washer-extractor machine, a washing liquid reservoir, a rinsing liquid reservoir, a washing liquid filter, a washing liquid pump, a rinsing liquid pump, and a still, the method comprising a plurality of cycles, each cycle effecting the cleaning of a respective batch of fabrics by means of a washing step followed by a rinsing step, the washing step consisting of circulating the washing liquid from said washing liquid reservoir through the fabric in said washer-extractor and through said filter, the method further comprising circulating the washing liquid through said filter between said washing steps and returning it to the washing liquid reservoir while by-passing said washer-extractor, the rinsing step consisting of circulating rinse liquid containing soluble soil from said rinse liquid reservoir through the washed fabric in said washer-extractor and returning soil-containing rinse liquid to said rinse liquid reservoir, the method further comprising continuously, and simultaneously with the rinsing step, transmitting a soluble soil-containing portion of said rinse liquid from said rinse liquid reservoir directly to said still, and continuously returning distilled rinse liquid from said still to said rinse liquid reservoir whereby to maintain the soil content of said rinse liquid below a predetermined level.

2. In an apparatus for dry cleaning fabrics in which an extractor machine is supplied with fresh dry cleaning fluid from a fluid reservoir and in which the washed fabric in the extractor is subsequently rinsed, the improvement which comprises providing an apparatus for rinsing such previously washed fabrics, said apparatus including a rinse system therefor, said rinse system consisting of a rinsing liquid reservoir, means for circulating a soil-containing supply of rinsing liquid from said rinsing liquid reservoir to said extractor machine, and returning soil-containing liquid to said reservoir, a still, an open conduit having an end immersed in the rinsing liquid reservoir and the other end communicating with said still, and another conduit having an end communicating with said still and the other end opening into said reservoir, and means for simultaneously operating the still while circulating rinse liquid to the washed fabrics.

3. Apparatus as defined in claim 1 wherein pump means is disposed in one said conduit.

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