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FILTER FOR A DRY CLEANING APPARATUS

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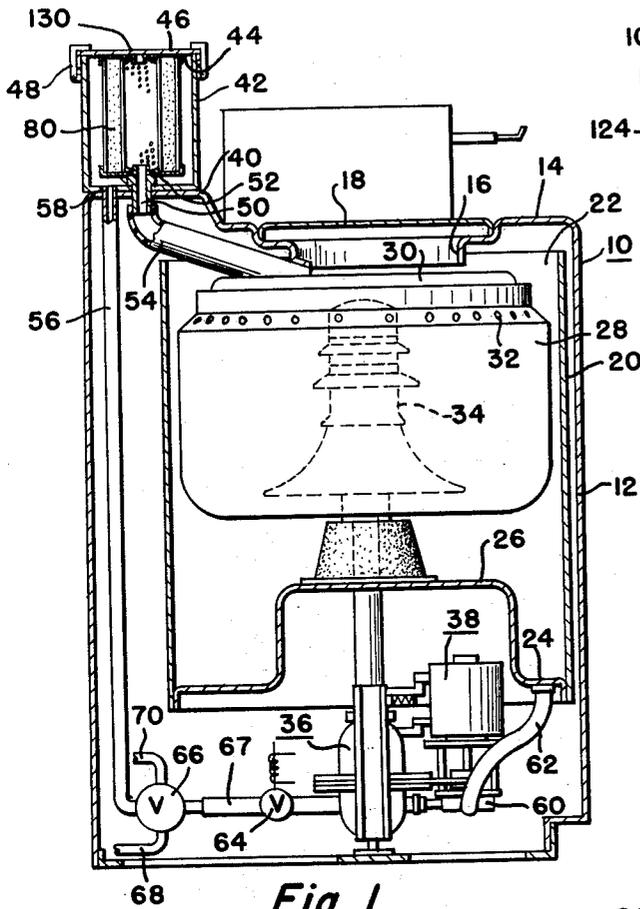


Fig. 1

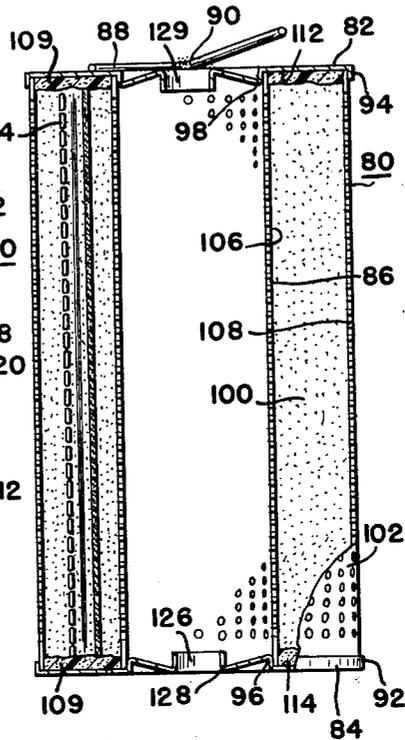


Fig. 2

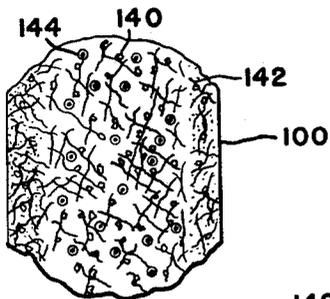


Fig. 4



Fig. 5

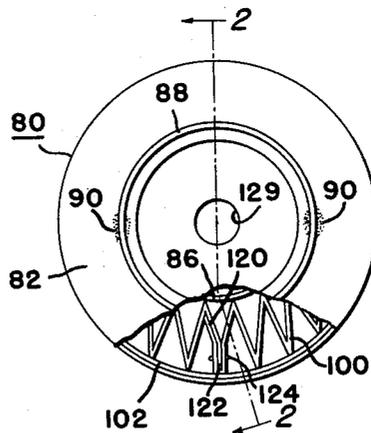


Fig. 3

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FILTER FOR A DRY CLEANING APPARATUS

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This invention relates to a cleaning appliance and more particularly to an improved replaceable paper filter cartridge for a coin-operated or self-service type dry cleaning machine.

In dry cleaning apparatus it is desirable to maintain certain amounts of dry cleaning ingredients or additives in the solvent throughout the consecutive dry cleaning cycles. In the prior art this has been done by frequently testing the condition of the solvent and manually adding the required dry cleaning materials necessary to bring the solvent back to the desired condition. This prior art arrangement requires skilled help to evaluate the condition of the solvent and presents operating problems which are difficult to overcome economically.

Accordingly, it is a general object of this invention to provide a replaceable filter cartridge which includes the ingredients necessary to decontaminate the solvent and to condition the solvent for the dry cleaning process.

Another general object of this invention is the provision of a paper filter cartridge for use in a circulating solvent system, said paper being impregnated with encapsulated dry cleaning additives.

A further object of this invention is the provision of dry cleaning additives in a replaceable solvent filter cartridge, said additives being variably encapsulated in a manner to provide gradual release from the filter cartridge into the solvent.

A more particular object of this invention is the provision of a disposable filter cartridge for removing particulate matter from a circulating dry cleaning solvent, said cartridge having intimately and integrally retained therein additional solvent treating agents for conditioning the solvent for the dry cleaning process, said conditioning agents comprising a detergent dispensable gradually into said solvent throughout the useful life of said cartridge.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a side sectional view, partly in elevation, of a dry cleaner suitable for use with the filter cartridge of this invention;

FIGURE 2 is a side sectional view of the filter cartridge, taken along line 2-2 in FIGURE 3 and partly in elevation;

FIGURE 3 is a top elevational view with parts broken away to show the folded filter paper sheet;

FIGURE 4 is an enlarged cross-sectional view of the filter paper sheet; and

FIGURE 5 is an enlarged detail of an encapsulated dry cleaning additive, such as detergent, for use in the filter paper sheet of this invention.

In accordance with this invention and with reference to FIGURE 1 a cleaning apparatus 10 is illustrated as adapted for use as a solvent dry cleaner. The washer 10 is comprised of an outer casing 12 having a top wall 14 and an access opening 16 which is closed by a hinged access lid or door 18. Within the outer casing 12 is disposed a generally cylindrical solvent container 20 which is imperforate except for a top opening 22 and a bottom outlet 24 at the lowest point thereof. A central bulkhead

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26 serves to support a spin tub 28 for rotation within the solvent container. The spin tub 28 has a top access opening 30 in axial alignment with the cabinet opening 16 and a plurality of circumferentially arranged outflow ports 32. Within the spin tub 28 an agitator 34 is located. Beneath the bulkhead 26 and suspended thereby is an agitating and spinning mechanism shown generally at 36 which is adapted to rotate the spin tub 28 when the mechanism motor 38 is rotating in one direction and to reciprocate vertically the agitator 34 when the motor 38 is reversed. For further details pertaining to the agitating and spinning mechanism 36, reference may be had to the Sisson Patent 2,758,685, issued August 14, 1956.

The top wall 14 of the casing 12 is shown with a raised rear console portion 40 on which is supported a filter container shown generally at 42. The cylindrical filter container or housing 42 has a top opening 44 closed by a cover 46. The cover 46 is generally imperforate and is retained securely on the filter container 42 by clamps 48 or other suitable latch means. The filter container 42 includes an outlet port 50 defined by a raised rib 52 which connects with the supply chute 54 for supplying filtered, decontaminated, and supplemented solvent, such as perchloroethylene, to the spin tub or cleaner basket 28. Contaminated solvent is returned through the supply conduit 56 to an inlet opening 58 in the bottom of the filter container 42.

The return of the solvent from the solvent container 20 to the filter container 42 is as follows. When the motor 38 is energized to spin the tub 28, the solvent contained therein is centrifuged through the outflow ports 32 to the solvent container 20. A pump 60 operated by the motor 38 withdraws solvent from the solvent container by way of a conduit 62 and pumps the solvent to the filter container supply conduit 56 through a solenoid operated valve 64 (for retaining the solvent in the solvent storage container 20 when the equipment is not in operation) and a three-way valve 66 (for selectively connecting the solvent line 67 to a drain line or storage tank line 68, the filter container conduit 56 or a solvent make-up line 70).

A removable and disposable filter element or cartridge 80 is insertable through the opening 44 in the filter container. The filter cartridge 80 is comprised of a generally circular top plate or support 82 of metal or other suitable material and a generally circular bottom plate or support 84 spaced from the upper plate by a perforated cylinder 86 of 3/32-inch cardboard or other suitable material. A ring-like bale or handle 88 is welded as at 90 to the top plate 82 and half thereof may be bent away from the surface of the plate in order to provide a handle for removing the filter cartridge 80. Each plate 84 and 82 is formed with an upturned annular flange 92 and 94, respectively, and a radially inner rib 96 and 98 for nesting therebetween an annulus of folded or accordion-pleated filter paper 100. A perforated outer wrapper 102 of paper is placed about the outer folds of the filter paper 100 and nests within the flanges 92 and 94 of the end plates. This outer wrapper helps to prevent any damage occurring to the pleats of the filter paper during handling of the cartridge.

The accordion-pleated filter paper 100 is formed with radially inner folds 106 touching the outside of the perforated inner cylinder 86, while the outer edges 108 of the folds are circumscribed and retained within the upstanding edge of the end plate flanges 92 and 94 as well as the perforated outer wrapper 102. In joining the end plates to the ends of the folded filter paper annulus, a bed of polyurethane 109 is allowed to foam in place on each of the end plates, first in the annular channel 112 and then in the channel 114, to retain the ends of the filter pleats in sealed engagement with the end plates.

To form the accordion pleats, a strip of filter paper as wide as the filter cartridge is tall is formed into a series of consecutive pleats or folds having a depth equal to approximately one-fourth the diameter of the filter cartridge. The folded sheet of filter paper is then formed into an annulus or cylinder in a manner to place the terminal portions or sheet ends 120 and 122 in juxtaposition. These terminal portions are interlocked and sewn as at 124 to hold the filter paper in proper relationship to the end plates and to provide a seal along the joined edges. The proportions of the fold to the overall diameter of the filter cartridge are determined at one-fourth of the diameter in order to realize a maximum paper surface area available for effective filtering. A filter paper surface area of between 35 and 50 square feet has been determined as sufficient to process adequately a six-gallon per minute solvent flow through the filter cartridge 30.

The bottom plate 84 in the filter cartridge has an inverted collar 126 to form a filter outlet and a contiguous rib 128 which mates with the filter container rib 50 to form a metal-to-metal seal between the filter container and the filter cartridge. For simplicity in manufacture, the opposite end plate 82 is also formed with a collar so that only one end plate die is necessary. The cover 46 includes a central portion 130 which nests in sealing engagement with the collar 129 so that the solvent flow is from the radially outer side of the filter cartridge through the perforated outer wrapper 102 and the folds of the filter paper to the perforated inner cylinder 86. From this point the filtered, decontaminated and supplemented or conditioned solvent flows by way of the outlet port 126 in the bottom end plate to the supply chute 54 leading to the spin tub.

There are three solvent requirements for an efficient dry cleaning process. First, it is necessary to remove the particulate matter from the solvent being circulated to the cleaning tub. Next, it is necessary to remove the dyes and fatty acids from the solvent and, lastly, it is necessary to place certain additives such as detergent and antistats into the solvent to perform certain additional functions during the cleaning in the tub. For instance, the detergent will react on certain spots which the solvent cannot touch. The detergent is also helpful in maintaining a certain water content in the solvent. On the other hand, the antistats are desirable to prevent the accumulation of a static charge on the fabric from the rubbing and flexing action of the fabric being dry cleaned—this charge acting to hold the lint to the fabric and otherwise impairing an optimum cleaning result.

The requirements of removing particulate matter and absorbing dye and fatty acids from the solvent comprises a treatment which is applied to the solvent as it passes through the filter cartridge. On the other hand, those additives which are required in the spin tub to perform the cleaning process must be dispensed or released from the filter cartridge to the solvent as it circulates there-through. It is therefore an object of this invention to provide a means whereby the dry cleaning additives can be dispensed gradually to the solvent passing through the filter cartridge throughout the life of the cartridge. In this way the desired levels of additive retention in the solvent supplied to the spin tub may be maintained.

Turning now to FIGURE 4 wherein an enlarged cross-sectional view of the filter paper sheet of this invention is shown, it can be seen that some of the filter ingredients or particles, such as activated carbon and cellulose fibers 140 and 142, respectively, remain with the filter cartridge throughout its life. The activated carbon, for instance, is actually held mechanically by being interspersed between the multitude of fibers in the paper. In addition to these solvent treating agents which remain with the filter cartridge, there is, in accordance with this invention, an encapsulated dry cleaning additive 144, such as a detergent, which is releasably retained by the intertwining cellulose fibers of the filter paper. Note (FIGURE 5) that the

capsule 144 includes an inner center 146 of detergent or the like and an outer shell 148 of any suitable encapsulating material. The capsules might be of the "timed" variety so that by either controlling the wall thickness of the encapsulating material or by suitable selection of different types of encapsulating material, one can secure in a filter cartridge a gradual leaching out of the detergent into the solvent over the life of the filter cartridge. In this way the tub 28 would contain solvent of uniform quality in each cycle of the dry cleaning process. In other words, the percent by volume of additive in the solvent could be maintained—the detergent, for instance, being dispensed gradually from the cartridge to make up for the detergent removed from the solvent by the "drag-out" of the clothes being cleaned.

The encapsulated detergent could be added to the paper as it is being made or it could be attached to a porous material such as a Saran net which could then be interposed between the carbon impregnated paper and the inner perforated core of the filter cartridge. One suitable encapsulating material could be polystyrene and it should be understood that dry cleaning additives other than detergent could also be encapsulated where it is desired to dispense the additives gradually to the solvent throughout the life of the filter cartridge.

It should now be seen that an improved filter cartridge has been provided for dry cleaning wherein an encapsulated dry cleaning additive effects a gradual dispensing of the additive to the solvent throughout the life of the filter cartridge.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A filter for removing particulate matter and treating a liquid dry cleaning solvent and comprising a filter container having a container inlet adapted to receive solvent returning from a dry cleaning apparatus and a container outlet adapted to supply said dry cleaning apparatus with filtered and treated solvent, said container having an opening and a cover for closing said opening, and a filter cartridge insertible through said opening, said cartridge including a bottom plate having a filter outlet port, a top plate effectively imperforate and in spaced parallel relationship to said bottom plate, a first perforated cylinder perpendicular to said plates and extending therebetween with one end thereof in communication with said filter outlet port, a second perforated cylinder perpendicular to said plates and extending therebetween and a longitudinally extending accordion-pleated annulus of filter paper sheeting interposed in sandwiched relationship between said plates and said first and second cylinders, said accordion-pleated annulus having a radially inner fold engaging said first perforated cylinder and a radially outer fold extending substantially to the periphery of said plates and engaging said second perforated cylinder, said folds forming a partition having an inside wall in communication with said filter outlet port through the perforations of said first cylinder and an outside wall in communication with said container inlet through the perforations of said second cylinder, said filter paper sheeting comprising an integral filtering mat of paper fibers for removing particulate matter from said solvent and solvent conditioning means including a surface active agent variably dispersed throughout said mat for removing contaminate from said solvent, and a plurality of detergent filled capsules held by said mat for dispensing detergent gradually into said solvent, one of said capsules having an encapsulating material soluble in said solvent in a time interval different from that of the encapsulating material of the other of said capsules, thereby to cause the detergent in said one of said capsules to be dispensed into said solvent after the detergent in the other of said capsules.

2. A filter for removing particulate matter and treating a liquid solvent and comprising a filter container hav-

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ing a container inlet adapted to receive contaminated solvent and a container outlet adapted to supply filtered and treated solvent, said container having an opening and a cover for closing said opening, and a filter cartridge insertible through said opening, said cartridge including a first plate having a filter outlet port, a second plate effectively imperforate and in spaced substantially parallel relationship to said first plate, a perforated tubular member substantially perpendicular to said plates and extending therebetween with one end thereof in communication with said filter outlet port and an accordion-pleated annulus of filter paper sheeting interposed in sandwiched relationship between said plates, said accordion-pleated annulus having a radially inner fold extending toward said perforated tubular member and a radially outer fold extending toward the outer edges of said plates, said folds forming a partition having an inside wall in communication with said filter outlet port through the perforations of said tubular member and an outside wall in communication with said container inlet, said filter paper sheeting comprising a single filtering mat of interwoven fibers for removing particulate matter from said solvent and solvent conditioning means including a surface active agent interposed between said fibers for treating said solvent and a plurality of detergent filled capsules held by said mat for dispensing detergent gradually into said solvent, one of said capsules having an encapsulating material soluble in said solvent in a time interval different from that of the encapsulating material of the other of said capsules, thereby to cause the detergent in said one of said capsules to be dispensed into said solvent after the detergent in the other of said capsules.

3. A filter for removing particulate matter and supplementing a liquid solvent and comprising a filter container having a container inlet adapted to receive contaminated solvent and a container outlet adapted to supply filtered and supplemented solvent, said container having an opening and a cover for closing said opening, and a filter member insertible and removable through said opening, said filter member including a support and a longitudinally extending accordion-pleated filter paper portion carried by said support, said filter paper portion forming a partition having one side in communication with said container outlet and another side in communication with said container inlet, said filter paper portion comprising a unitary filtering sheet of interwoven fibers for removing particulate matter from said solvent and solvent conditioning means including a plurality of additive filled capsules held by said fibers for releasing additive gradually into said solvent, one of said capsules having an encapsulating material soluble in said solvent in a time interval different from that of the encapsulating material of the other of said capsules, thereby to cause the additive in said one of said capsules to be released into the solvent after the additive in the other of said capsules to maintain the concentration level of said additive in said solvent.

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4. A filter for liquids comprising a unitary sheet including depth filter means for removing particulate matter from said liquids, and liquid conditioning means for treating said liquids, said liquid conditioning means comprising a plurality of detergent capsules held by said depth filter means for dispensing detergent gradually into said liquids, one of said capsules having an encapsulating material soluble in said liquid in a time interval different from that of the encapsulating material of the other of said capsules, thereby to cause the detergent in said one of said capsules to be dispensed into said liquids after the detergent in the other of said capsules to maintain the concentration level of said detergent in said liquids throughout the life of said filter.

5. A filter for liquids comprising a support means adapted to intercept the flow of said liquids, first means carried by said support means and retainable therewith for decontaminating said liquids, and second means carried by said support means and variably dispensable therefrom as an additive to said liquids, said second means comprising a plurality of additive filled capsules for dispensing additive gradually into said liquids, one of said capsules having an encapsulating material soluble in said liquids in a time interval different from that of the encapsulating material of the other of said capsules, thereby to cause the additive in said one of said capsules to be dispensed into said liquids after the additive in the other of said capsules to maintain the concentration level of said additive in said liquids throughout the life of said filter.

6. The filter of claim 5 wherein said first means includes means for adsorbing contaminants from said liquids.

7. The filter of claim 5 wherein said first means includes means for removing particulate matter from said liquids.

8. The filter of claim 5 wherein said first means includes activated carbon and said second means includes encapsulated detergent.

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