July 21, 1959 J. L. MAYBERRY ET AL 2,895,321

COMBINATION WASHER-EXTRACTOR AND SPRAY MEANS

Filed Jan. 15, 1953 2 Sheets-Sheet 1

Fig. 1.

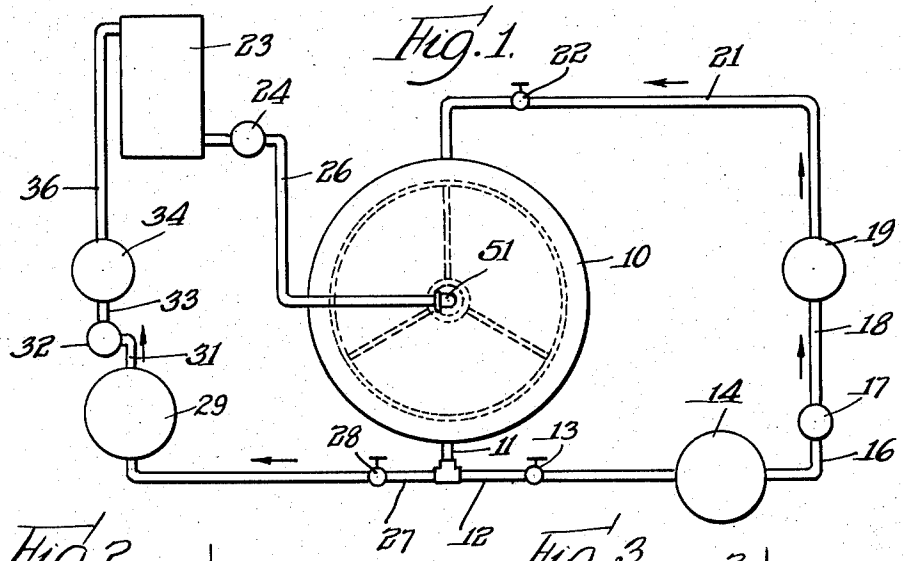


Fig. 2.

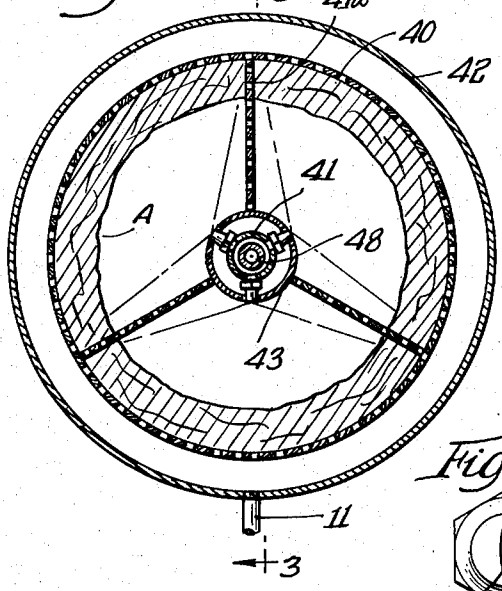


Fig. 3.

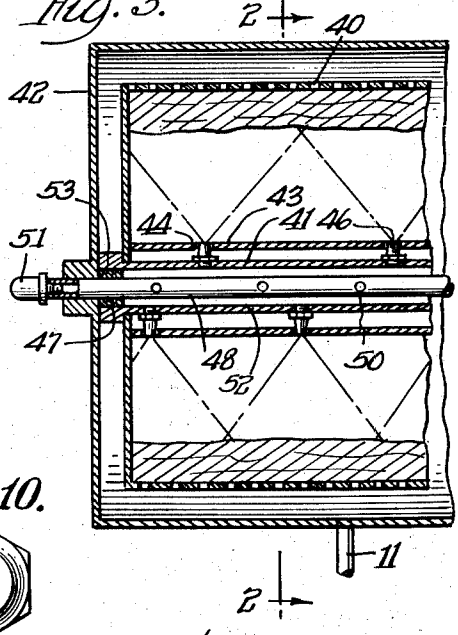


Fig. 10.

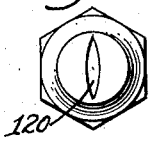


Fig. 4.

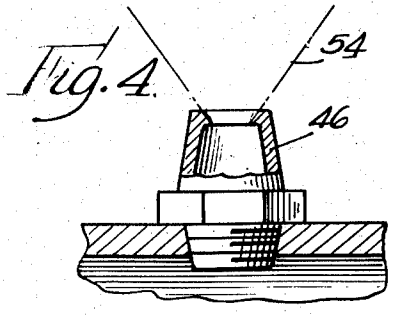
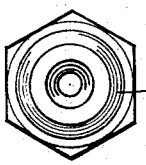


Fig. 5.



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July 21, 1959 J. L. MAYBERRY ET AL 2,895,321

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Filed Jan. 15, 1953 2 Sheets-Sheet 2

Fig. 6.

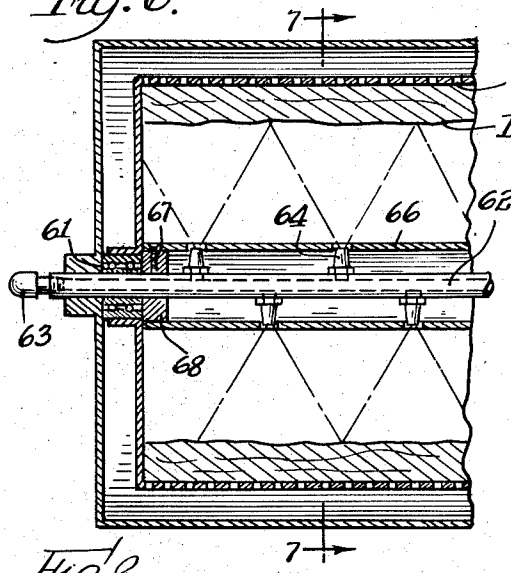


Fig. 7.

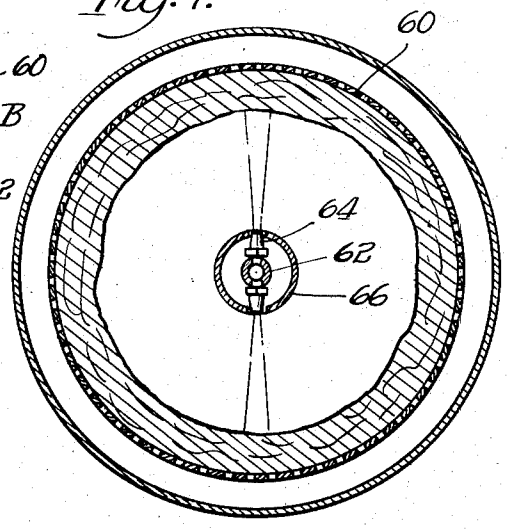


Fig. 8.

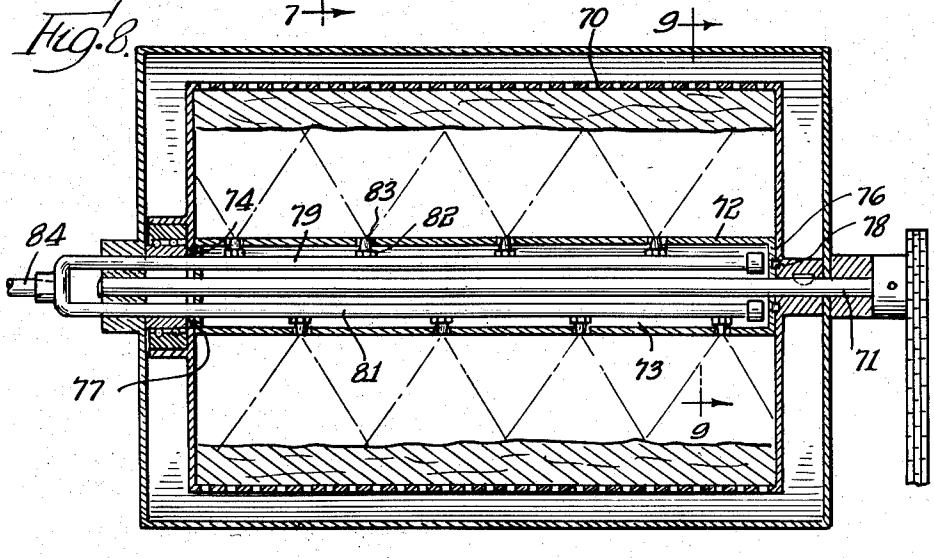
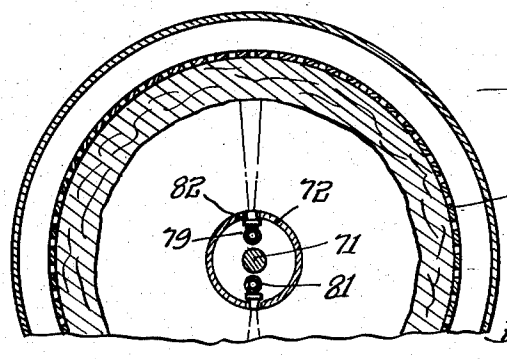


Fig. 9.



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COMBINATION WASHER-EXTRACTOR AND SPRAY MEANS

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Application January 15, 1953, Serial No. 331,400

3 Claims. (Cl. 68—148)

This invention relates to the dry cleaning of fabrics and is particularly concerned with new and useful improvements in apparatus for dry cleaning such fabrics. The term "fabrics," as used herein, will be understood to cover clothing and garments of all types and all other fabric items and fabrics such as are commonly subjected to dry cleaning operations.

While numerous specific processes and types of equipment have heretofore been utilized for the dry cleaning of fabrics, in general, the commercial dry cleaning establishments utilize a system comprising a dry cleaning washer which is piped to a button trap, pump and pressure filter. The process, generally speaking, involves subjecting the soiled fabrics, in the washer, to the action of an organic solvent, which may, for example, be a hydrocarbon such as naphtha or Stoddard solvent, or a chlorinated solvent such as trichlorethylene, the organic solvent usually having dissolved therein a small proportion of a dry cleaning soap or other non-volatile dry cleaning detergent, with or without supplemental ingredients such as wetting agents, small proportions of water, etc. The soap or detergent serves to improve soil or stain removal as well as whiteness retention by (*a*) imparting electrical conductivity to the solvent, (*b*) defluocculating inert soil to prevent redeposition, and (*c*) dispersing limited amounts of water in a finely divided state in the water-immiscible dry cleaning organic solvent for effecting safe removal of water-soluble soil which is not otherwise affected by the dry cleaning solvent proper. The soiled fabric is tumbled about in the washer and the organic solvent is commonly passed, usually continuously, through the washer and through a filter in order to remove accumulations of insoluble or inert soil, lint and the like from the organic solvent which have been released from the fabrics in the washer. The filtered dry cleaning solvent is crystal-clear but is contaminated with such substances as fatty acids, cholesterol, lanolin, mineral oils and other solvent-soluble impurities which have been removed from the soiled fabrics in the washer. Activated powders are commonly used in the filter to adsorb some of the solvent-soluble impurities during the cleaning operation, but such powders are not effective to remove all of the solvent-soluble impurities. Hence, after the organic solvent has been used for cleaning a series of loads of soiled fabrics, the organic solvent is drained for distillation and replaced with new or distilled organic solvent for treatment of the next series of loads of soiled fabrics.

After the cleaning operation in the washer, the clothes or fabrics are removed and placed in a so-called extractor, which is a centrifugal type of apparatus, wherein the fabrics are whirled about so as to remove therefrom the excess organic solvent containing the detergent or the like, said excess solvent being recovered for further use. The resulting dry cleaned fabrics are then placed in tumbling devices so as to aerate them and fluff them while simultaneously evaporating the retained organic solvent.

Such systems are very commonly of the continuous

type wherein, after the solvent has been utilized for a given period of time in relation to the treatment of certain poundages of fabrics, the solvent is by-passed to a suitable distillation unit and distilled after which it is recirculated back to the washer.

One of the specific processes which is currently in considerable favor and widely practiced in the industry is the so-called "charged system" of dry cleaning. This involves the activation or charging of the dry organic solvent in the washer-filter assembly with a synthetic or soapless detergent which is sufficiently solvent-soluble to avoid removal in the filter, and is sufficiently stable to avoid removal as a result of decomposition by the acidity of the soil removed from the fabrics. An attempt is made to maintain a nearly constant charge of detergent for a series of loads of soiled fabrics in order to produce uniform results. When used with a suitable detergent, and when due consideration is given to operating procedures and solvent reclamation, the "charged system" of dry cleaning is generally regarded as being superior to at least most heretofore known methods which are considered practical by commercial operators of dry cleaning plants.

However, the "charged system" possesses two significant drawbacks. First, the amount of detergent used in activating or charging the solvent is restricted to avoid an excess of non-volatile matter remaining in the fabrics after extracting and drying. A content, in the dry cleaning solvent, of 0.37% by volume of non-volatile active detergent ingredient is considered very high by various operators, and many prefer to reduce the concentration to 0.25%. Others who seek improved detergency at the risk of oiliness in finished fabrics resort to as much as 0.50% non-volatile active detergent ingredient. Were it not for the above-mentioned factors, most operators would use as high as 1.5% to 3.0% of non-volatile active detergent ingredient as these higher concentrations produce far superior detergency.

The second significant drawback to the "charged system" is the build-up of soluble impurities in the activated or charged solvent. More frequent distillation of the filtered solvent is required and this results in excessive cost for detergent. Activated filter powders capable of removing, from the solvent, a portion of the soluble impurities removed from the fabrics also remove a portion of the active detergent ingredient and thus reduce the concentration thereof. The result is that, too often, after drying, the fabrics contain not only a film of non-volatile active detergent but also a film of soluble impurities including fatty acids, cholesterol, lanolin and mineral oil.

Both of the aforementioned objections to the "charged system" may be overcome by cleaning the fabrics in one washer-filter assembly reserved for a so-called super-soap solution containing, for instance, about six times as much non-volatile active soap or detergent ingredient as is used in the "charged system," and then transferring the fabrics to a separate washer-filter assembly reserved for organic rinse solvent which has not been activated or charged with non-volatile detergent and which is maintained in a relatively volatile state. This procedure is known in the trade as the "two-bath" method. To avoid excessive cost for detergent, and to avoid excessive contamination of the organic rinse solvent, the fabrics are centrifugally extracted after soaping and before rinsing, and the extracted soap solution is salvaged and returned to the soap system for repeated use. If, instead of centrifugally extracting prior to rinsing, the fabrics are merely permitted to drain on the drainboard in the soap washer, at least about six times as much soap solution is transferred to the rinse solvent. It follows, therefore, that, by centrifugally extracting after soaping or washing and prior to rinsing, and by salvaging the thus extracted soap solution, it is possible to use about six times as much

active soap ingredient with no addition in soap cost, and the rinse solvent may be used for about six times as many loads before building up with an excessive amount of detergent.

This "two-bath" method is highly advantageous from the standpoint of dry cleaning efficiency. The separate so-called volatile rinses contribute greatly by eliminating unpleasant odors from soluble impurities, and by providing for brighter colors and whiter whites with no oily film. The use of the order of six times as much active non-volatile detergent ingredient as used in the "charged system" contributes to greatly improved detergency. This may be evidenced, for instance, by a test comparing a soap solution adaptable to the "charged system" and a soap solution adaptable to the "two-bath" method. The former solution comprised 0.25% non-volatile active detergent and 0.20% water in a petroleum solvent of Stoddard specification. The latter solution comprised the same type of solvent and with the same percent water, but with the non-volatile detergent increased sixfold, namely, to 1.5%. The electrical conductivity of the unactivated solvent was too small for measurement. When activated with 0.25% non-volatile detergent and 0.20% water, the electrical conductivity was increased to 2500 units. When activated with 1.5% non-volatile active detergent, the conductivity was increased to 10,500 units. In this higher state of conductivity, the soap solution produces higher inert soil removal, higher water-soluble soil removal and, by preventing redeposition, higher whiteness retention. Tremendous savings are effected throughout several departments in the plant by the near elimination of the costly wet cleaning process which is customarily resorted to for the handling of fabrics containing more than the usual amount of water-soluble soil.

In spite of this increased efficiency in cleaning and rinsing, few plants can employ the "two-bath" method because few are equipped with an extra washer for rinsing, and few have the manpower required for the three transfers of fabrics, namely, from soap washer to extractor, to rinse washer and back to extractor. This compares with only one transfer of fabrics when using the "charged system" from washer to extractor. The high costs of equipment and labor, required in the "two-bath" method, have militated against its commercial adoption on any significant scale.

In more recent years, it has been proposed to utilize so-called combination washer-extractor units for carrying out the dry cleaning operation. In its more conventional form, the washer-extractor equipment setup involves a so-called combination washer-extractor together with two filters. One of the filters is designed to handle the filtration of the organic solvent which is utilized in the initial washing of the clothes in the washer-extractor, and the other filter is cut into the system subsequently for handling the rinse wherein a volatile solvent is continuously circulated through the washer-extractor and said second filter. In operation, in this system, the fabrics are cleaned in the washer-extractor, the organic solvent utilized being a conventional organic solvent containing a high percentage of a detergent or soap, usually of the order of about 2% to 4%, more commonly, about 3%, the organic solvent solution containing said detergent or soap being continuously circulated through the washer. After the completion of the washing operation, the fabrics, while still remaining in the washer-extractor, are subjected to centrifugal action to extract therefrom the organic solvent solution of the detergent or soap. Thereafter, the first filter is cut out of the system and fresh organic solvent, to which no detergent or soap has been added, is continuously passed through the washer-extractor and through the second filter until the fabrics are adequately rinsed. Upon completion of the rinse treatment, the rinse solvent is drained out of the washer-extractor and then the extractor is operated to throw out from the fabrics by centrifugal force any remaining organic solvent which may be contained therein. The clothes are then removed from the washer-extractor and placed in conventional equipment for fluffing and evaporating any contained organic solvent. Suitable means are provided for recovering detergent or soap and rinse solvent for subsequent treatment and reuse in the process, automatic equipment usually being employed. An alternative form of this type of equipment, wherein the washer-extractor combination is utilized, involves the employment of only a single filter together with the combination washer-extractor, such filter being utilized for handling the organic solvent solution of the detergent or soap which is used in the washing step proper.

While the operation of a washer-extractor unit possesses advantages from a number of standpoints, the cleaning cycle, in the usual case, is of about 40 minutes duration. It has been discovered, in accordance with our present invention, that this cleaning cycle time can be very substantially reduced while obtaining all of the other as well as additional advantages of the use of the combination washer-extractor.

In accordance with the present invention, extremely satisfactory results are obtained so far as the dry cleaning operation proper is concerned and, at the same time, the operations are exceedingly economical. This invention enables the utilization of strong soap or detergent solutions, such as those in the "charged system" or even higher concentrations, and is particularly advantageously practiced with the use of dry cleaning organic solvent solutions containing from about 1.5% to about 3.0% of non-volatile active detergent in the washer-filter assembly. Concentrations of detergent as high as 7% are occasionally utilized but, usually, the upper amount is of the order of 3%.

In general, in accordance with the present invention, the initial step in the process is the same as is conventionally carried out in the use of the washer-extractor, namely, the removal of the soil from the fabrics by subjecting them to the action of a dry cleaning organic solvent solution containing a small proportion of a dry cleaning detergent, with or without the addition of water to said solution depending upon the nature or classification of the soiled fabrics being cleaned. After the cleaning operation proper is completed, the fabrics are then subjected, as usual, to rapid centrifugal extraction to remove at least most of the organic solvent detergent solution therefrom, said extracted detergent solution being continuously filtered or being diverted to a tank reserved therefor so that it may be used repeatedly in the washing step. Then, while subjecting said fabrics to rapid centrifugal action in said washer-extractor, said fabrics are contacted with an essentially soap-free organic solvent, particularly in the form of a stream or spray as described in detail hereafter, to dilute the activated solvent remaining in the fabrics after the immediately preceding centrifugal extracting step whereby, in effect, to rinse from the fabrics substantially all of the organic solvent detergent or activated solution therefrom which remains in the fabrics after the initial centrifugal extracting operation. Where strong soap or detergent solutions are used in the washer, the fabrics, after the centrifugal extracting operation, may retain, for instance, of the order of 2 gallons of solvent per 100 pounds of fabrics, said solvent containing say 3% of soap or detergent. The spray rinse treatment serves to dilute the concentration of soap or detergent in the solvent retained by the fabrics to a materially lesser amount, most advantageously not to exceed 0.5% and, better still, to 0.25% or less. Finally, said organic solvent rinse is extracted from the fabrics by centrifugal action while still remaining in said washer-extractor. The solvent rinse is diverted to a separate tank reserved only for rinse solvent and from which it can be repumped, with or without filtering, into

the washer-extractor for the treatment of subsequent batches of cleaned fabrics.

In the particularly preferred embodiments of the present invention, the equipment utilized comprises combination washer-extractor and filter assemblies, the construction of the washer-extractor being modified to incorporate means therein for projecting a spray or stream of clean, pure organic solvent, free or substantially free of detergent, which may be characterized as the rinse solvent, upon the fabrics for a very short period of time after the initial washing and extracting steps.

The invention may be illustrated in connection with the accompanying drawings wherein there is shown, in part in schematic form, a layout of equipment suitable for the practice of the present invention.

Fig. 1 shows a schematic arrangement wherein a combination washer-extractor and filter assembly are utilized in the practice of the invention;

Fig. 2 shows a vertical section taken along the line 2—2 of Fig. 3 of one embodiment of a conventional type of combination washer-extractor modified so as to be useful in the practice of the present invention;

Fig. 3 is a vertical section taken along the line 3—3 of Fig. 2;

Fig. 4 is an enlarged view, partly in section, showing the shape of the spray aperture in the spray nozzles and the general configuration of the spray;

Fig. 5 is a top plan view of the spray nozzle of Fig. 4;

Fig. 6 is a longitudinal vertical partial section of another embodiment of a modified washer-extractor in which the arrangement of the spray construction is different from that of Fig. 2;

Fig. 7 is a vertical section taken along the line 7—7 of Fig. 6;

Fig. 8 is a longitudinal vertical section of still another embodiment of a modified washer-extractor;

Fig. 9 is a vertical section taken along the line 9—9 of Fig. 8;

Fig. 10 is a view showing a fan type spray nozzle which is used to advantage in various of the embodiments of Figs. 6–9, inclusive.

Referring, now, to Fig. 1, which shows a schematic arrangement of equipment for the carrying out of the present invention, numeral **10** represents the combination washer-extractor. The drain pipe **11** from the washer extractor is connected by means of conduit **12**, having valve **13** therein, to the wash bath circulating tank **14**. Leading from said tank **14** is a pipe **16** which connects into filter pump **17** which, in turn, connects through pipe **18** into the wash filter **19**. A conduit **21** provided with valve **22** leads from the filter into the washer extractor. After the washing operation has been completed, the fabrics, while still remaining in the combination washer-extractor, are subjected to centrifugal action to extract therefrom the organic solvent solution of the detergent or soap. Thereafter, the valves **13** and **22** are closed, preferably automatically, and the rinse solvent part of the system is cut in, also preferably through the use of automatic controls, the rotation of the extractor basket, however, being continued.

The organic rinse solvent is pumped into the extractor through spray nozzles, hereafter described in detail, from a rinse storage tank **23** by a pump **24** through conduit **26**. The rinse solvent which drains through drain pipe **11** then passes through conduit **27**, provided with valve **28**, into the rinse bath circulating tank **29** and thence through pipe **31** from which it is pumped by pump **32** through pipe **33** into rinse filter **34** from which it passes through conduit **36** back into rinse storage **23**.

No novelty is claimed for any of the equipment or the layout thereof shown in Fig. 1 except in relation to construction of the combination washer-extractor provided, as described below, with spray devices.

In Figs. 2 and 3, which show one form of a conventional type of combination washer-extractor of the divided basket type, modified so as to be useful in the practice of the present invention, the perforated divided basket **40**, having dividing partitions **41***a*, is mounted for rotation, on a horizontal axis, on hollow shaft **41**, within the stationary housing **42**. A sleeve **43**, concentric with shaft **41**, is fixedly attached at its ends to the basket **40** and is provided with spaced apertures **44** in which the ends of spray nozzles **46** are disposed, said spray nozzles being mounted between the shaft **41** and sleeve **43**. It will be seen that the ends of the spray nozzles are flush with the outer surface of the sleeve **43**. Furthermore, the spray nozzles **46** fit snugly into the apertures **44** so as to leave no open space in the wall of the sleeve **43** surrounding the ends of the nozzles. The ends of the shaft **41** terminate in bearings **47**. The assembly comprising the basket **40**, shaft **41**, sleeve **43** and nozzles **46** rotate as a unit, being driven through a motor or the like, not shown. Disposed within the hollow shaft **41** is a hollow, stationary pipe **48** having spaced perforations **50** therein, a supply pipe **51** being connected at an end of the pipe **48**. Rinse solvent is supplied from conduit **26** into pipe **48** from which it passes through the apertures **50** into chamber **52** and thence through the nozzles **46** from which it issues and is projected against the previously washed clothes lining the wall of the basket **40**. Packing or sealing means **53** is provided around the ends of the pipe **48** to prevent leakage of solvent from the chamber **52**.

Figs. 4 and 5 show nozzles of the type which are useful in the embodiment of Figs. 2 and 3. This nozzle produces a full conical spray as shown at **54**. Since nozzles of this character are per se well known, no detailed description thereof is necessary. The nozzles **46** are so arranged in number and position that the spray issuing therefrom encompasses the entire surface of the exposed wall of fabrics A in the basket **40**.

In the embodiment of Figs. 6 and 7, the construction is such that the spray nozzles are stationary and do not rotate with the perforated basket **60** and said basket is not of the divided type. The basket **60** is supported at its ends on sealed bearing rings **61** and is adapted to be rotated by motor means or the like (not shown). A stationary pipe **62** is disposed longitudinally of the basket **60** and is supported adjacent its ends and connected thereinto at an end is a supply pipe **63** through which rinse solvent is supplied to the pipe **62**. The pipe **62** carries a plurality of spray nozzles **64** which are spaced apart and arranged to project their respective sprays in such a manner as to encompass the entire area of the exposed wall of fabrics B in the basket **60**. Concentrically arranged with respect to the pipe **62** is a stationary longitudinal sleeve member **66** having apertures therein which are alined with the various nozzles and into which said nozzles project but which do not protrude therethrough. The member **66** has a collar **67** which is fixed thereto and preferably also to the pipe **62**. Sealing means **68** are positioned on each side of the collar **67**. The nozzle **64**, the general type of which is shown in Fig. 10, has a nozzle aperture of generally oval configuration and serves to deliver a thin generally flat spray of liquid organic rinse solvent therethrough with a spread of about 45 degrees, as shown in Figs. 6 and 7. The spray nozzles are arranged longitudinally of the pipe **62** so that there is a slight overlap of adjacent sprays near the areas whereby they strike the exposed wall of fabrics.

Figs. 8 and 9 show a construction in which the perforated basket **70** is rotatably mounted on a shaft **71**. A concentric longitudinal sleeve member **72** encompasses the shaft **71** forming a chamber or housing **73**. The end members **74** and **76** bear against the inner end walls of the basket **70** and seals **77**, **78** are provided to prevent leakage from said chamber **73**. It will be understood that the sleeve member **72** remains stationary during rotation of the basket **70**. Passing into the chamber **73** are two longitudinally extending pipes **79** and **81**, into which the

spray nozzles **82** are threaded or otherwise fixed, the ends of the spray nozzles extending into apertures **83** in the sleeve **72**. The pipes **79** and **81** are connected to a supply pipe **84** for the organic rinse solvent. The type of spray nozzle used in this embodiment of the invention is the same as that employed in the embodiment of Figs. 6 and 7.

Fig. 10 shows the fan type of nozzle utilized in various of the embodiments, said nozzle having a generally oval aperture **120** which furnishes a relatively thin, generally flat spray having a spread of about 45 degrees. This spread may, of course, be varied, depending upon the exact configuration of the spray opening.

The washer-extractor is operated at high speeds during the extraction step, the next step of contacting of the cleaned fabrics therein with the organic rinse solvent, and the final step of extracting the rinse solvent. The usual speeds range from about 500 to about 2100 r.p.m., depending in part upon the size of the basket, with a preferable range of about 700 to about 1500 r.p.m.

The washer-extractor is operated, in the usual case, for the extracting operation, for from about 1 to about a few minutes, for instance, 6 minutes, in order to remove at least most of the organic solvent detergent solution from the cleaned fabrics after the washing operation. The exact length of time varies with the speed and size of the basket and upon the nature of the fabrics. In general, after the initial extraction operation, the fabrics will still contain of the order of 12% to 14% of the detergent solution in the case of woolens, of the order of 14% to 16% in the case of silks, and of the order of 20% to 22% in the case of cottons. It will be understood that these percentages may vary quite widely but they are illustrative of certain typical situations.

After the initial centrifugal extraction step has been completed, the volatile rinse spray of organic solvent is gravity fed or, more advantageously, pumped under pressure so as to be projected onto the cleaned fabrics in the washer-extractor, without stopping the operation of the washer-extractor and while continuing to rotate the same at a high rate of speed as heretofore described. The rinse solvent is advantageously forced through the spray nozzles at a pressure of about 5 to about 30 pounds per square inch and, more particularly, at a pressure of about 10 to about 15 pounds per square inch. The pressure should not be so high as to cause damage to the cleaned fabrics, it being necessary in this regard to exercise particular care in the case of fine or delicate fabrics. In the usual case, it is unnecessary to extend the treatment with the spray beyond about 3 minutes and, in most cases, a period in the range of about ½ to about 2½ minutes is ample. The amount of rinse solvent utilized, while somewhat variable, will usually fall within the range of about ⅛ and, better still, about ¼ to about ½ gallon per pound of cleaned fabrics in the washer-extractor. Greater amounts require extra time and involve extra consumption of power and are not ordinarily required. A 0.5 inch spray nozzle of the type described above delivers from about 12.2 gallons of organic rinse solvent per minute at a pressure of 15 pounds per square inch to about 17.3 gallons per minute at a pressure of 30 pounds per square inch; a 0.75 inch spray nozzle, which would normally be used in the larger type of washer-extractor, for example, a 40 inch diameter extractor basket, delivers about 24.5 gallons per minute at 15 pounds per square inch and about 34.6 gallons per minute at 30 pounds per square inch. Nozzles of other sizes may be utilized or designed to meet capacities and particular conditions which may be encountered in any specific installation in the light of the guiding principles and teachings disclosed herein.

It is important, for best results, that the organic rinse solvent be not allowed to accumulate in the washer-extractor. Hence, the organic rinse solvent should be withdrawn from the washer-extractor, while said solvent is being projected against the cleaned fabrics therein, at a rate sufficient to prevent any accumulation of said solvent in the washer-extractor. To this end, the drain line or pipe from the washer-extractor should be of sufficiently large diameter to insure against the possibility of such accumulation or a pump should be inserted in the drain line or in operative connection with the drain line to draw out the rinse solvent to prevent undue accumulation in the washer-extractor during the step of projecting the rinse solvent against the cleaned fabrics in the washer-extractor and while the latter is being rapidly rotated.

After the spray or organic rinse solvent is discontinued, the rotation of the washer-extractor is continued for a short period of time, usually of the order of 1 to a few minutes, for instance, about 5 minutes, to effect removal of the extracted organic rinse solvent from the cleaned and rinsed fabrics. The centrifugal force pulls the organic rinse solvent through the cleaned fabrics and rapidly and effectively serves to bring about the desired reduction of detergent and other undesired materials from the cleaned fabrics.

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A combination washer-extractor for use in connection with the dry cleaning of fabrics, comprising a basket having a perforated circumferential wall and end walls, means for rotating said basket about a horizontal axis at a high rate of speed, spray rinse means for directing diverging rinse sprays within said basket including a plurality of spray nozzles spaced from each other longitudinally of said axis between said end walls and within the interior area of the confines of said basket and terminating substantially closer to the basket axis than to said perforated circumferential wall, a housing substantially concentric with and spaced from said horizontal axis, said housing having apertures in the circumferential wall of said housing and in alinement with the spray openings of the respective spray nozzles through which housing apertures liquid projected through said spray nozzles is directed toward said perforated circumferential wall, the outer tips of said spray nozzles extending at least immediately adjacent to their said correspondingly alined housing apertures but not beyond the outer circumferential surface of said housing, the axis of each of said spray nozzles being directed toward a point on the circumferential wall so that the sprays issuing from said nozzles together encompass essentially the entire length of the basket and directly impinge upon the face of the exposed wall of fabrics forced by centrifugal forces against said circumferential basket wall upon rapid rotation of said basket, and means for admitting liquid organic solvent under pressure to said spray nozzles.

2. A combination washer-extractor in accordance with claim 1, wherein the axis of each of the spray nozzles is directed toward a point on the circumferential basket wall spaced less than one-half the axial length of the basket away from the nozzle involved so that the line bisecting the axial profile angle of each diverging nozzle spray intersects said circumferential basket wall at said associated point thereon.

3. A combination washer-extractor in accordance with claim 1, the spray nozzles have nozzle apertures of generally oval configuration to deliver individual relatively thin generally flat diverging sprays of said liquid organic solvent.

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10

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