United States Patent

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[33] **France**
[31] **105,072 and 129,419**

[54] **CLEANING APPARATUS PARTICULARLY FOR TEXTILE ARTICLES**
12 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **68/18**
[51] **Int. Cl.** **D06f 43/02, D06f 43/08**
[50] **Field of Search** 68/18

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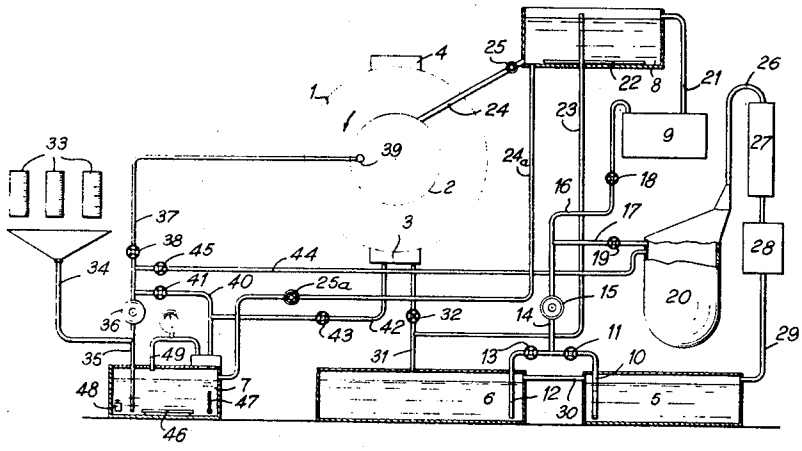
Primary Examiner—William I. Price
Attorney—Waters, Roditi, Schwartz & Nissen

ABSTRACT: A cleaning apparatus particularly for textile articles, the operation of which comprises the steps of subjecting the mechanically agitated articles in an initial phase to the action of a solvent in conjunction with mechanical action in an enclosed cleaning space, following in a second phase to the action of a pulverized aqueous solution prepared beforehand in a vessel external to said enclosed cleaning space and in which said solution has its water content proportioned and its temperature governed, said second phase being effected in conjunction with preferably reduced mechanical action.



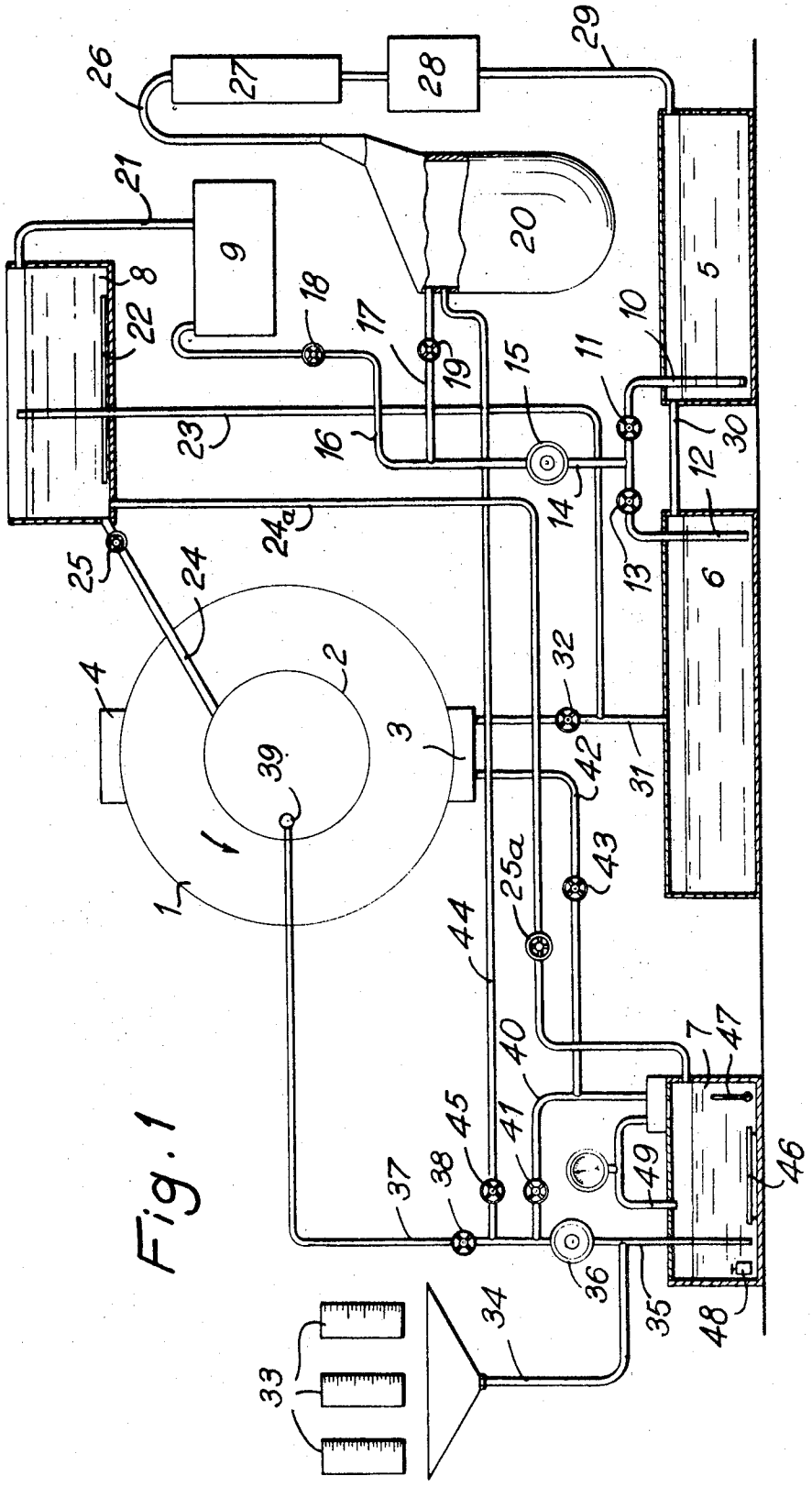

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Fig. 1

Fig. 2

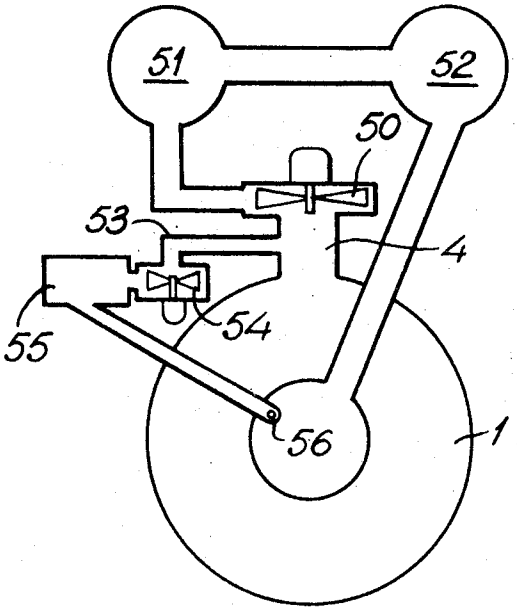
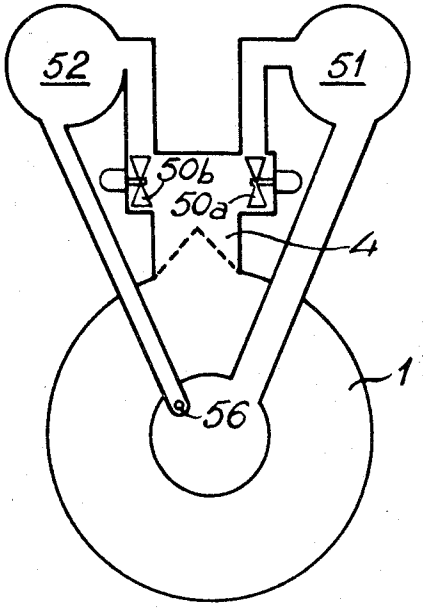


Fig. 3



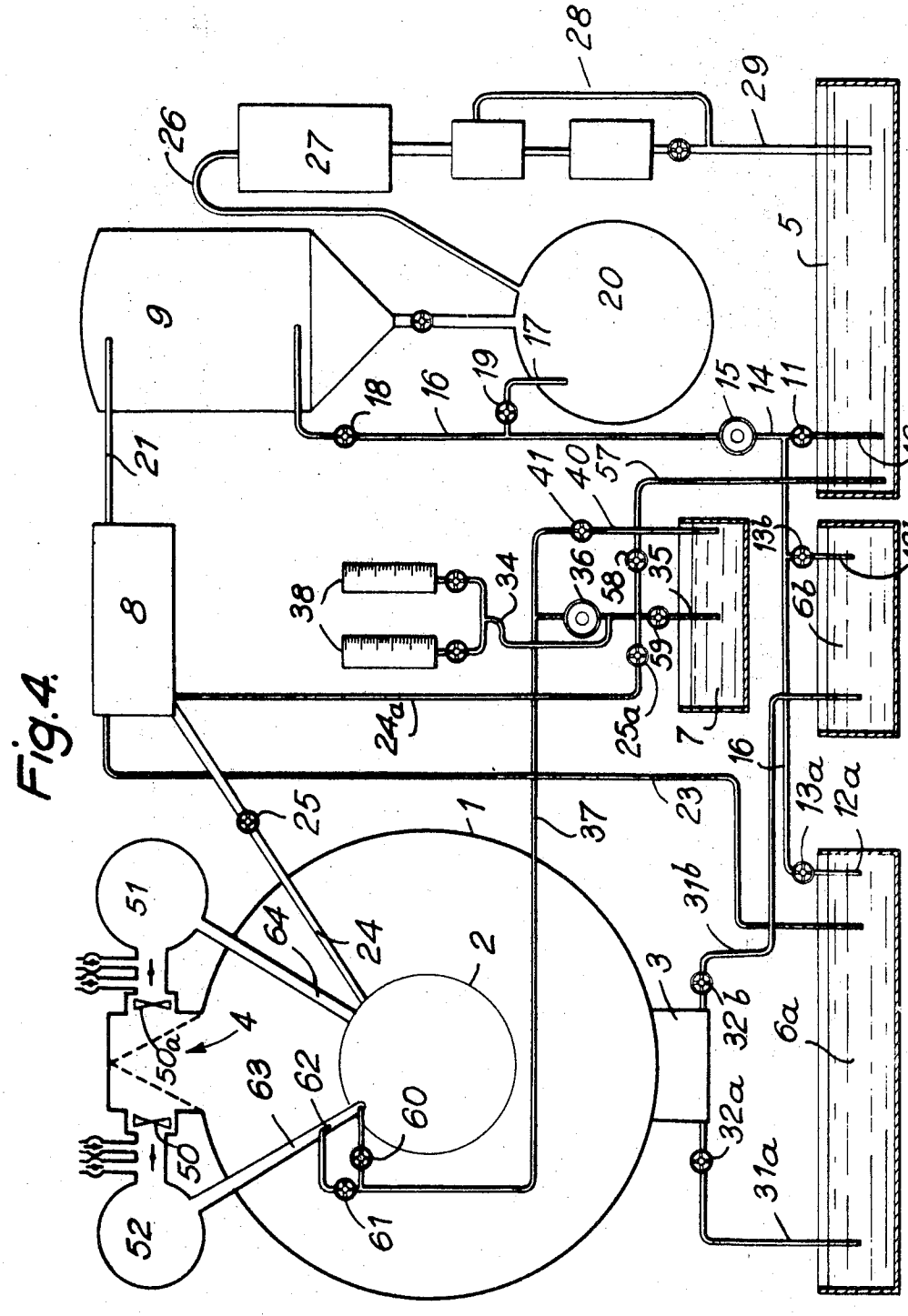

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Fig. 4.

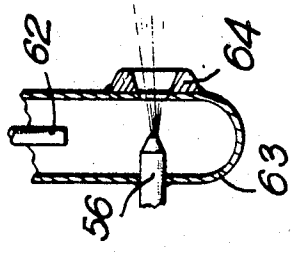
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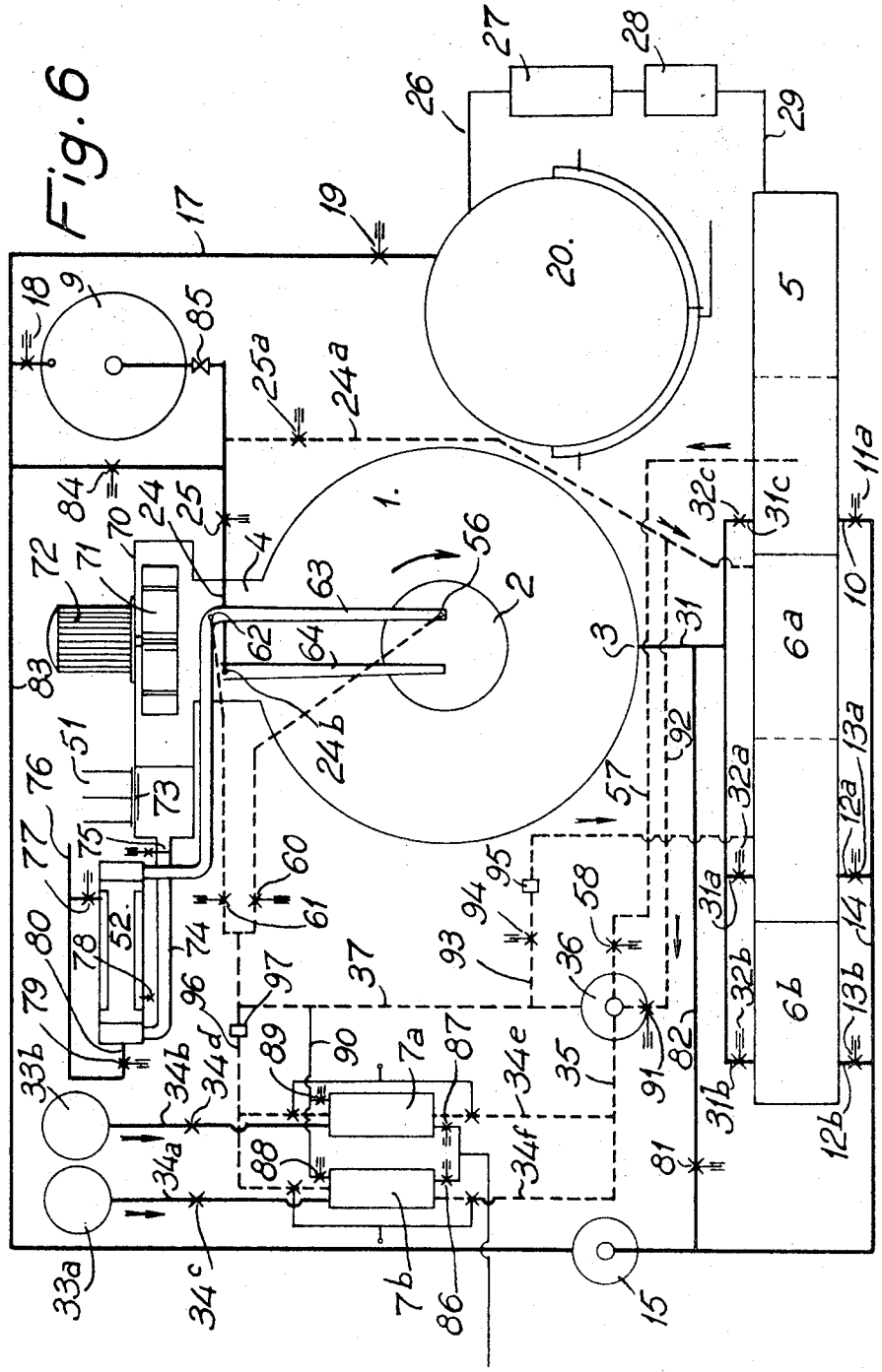
Fig. 5

Fig. 6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CLEANING APPARATUS PARTICULARLY FOR TEXTILE ARTICLES

SUMMARY OF THE INVENTION

It is already known to clean clothes by subjecting them at once to mechanical action in a perforated cleaning machine drum rotating about a horizontal axis, and to chemical action by employing a solvent in the drum, followed by a cleaning solution consisting of soaps, water and solvents. The clothes undergo the final stage of the cleaning process with a white solvent and are then spin dried by rotating the drum at high speed.

The cleaning solvent and aqueous solution allow stains of different kinds to be eliminated.

It is preferable to have the largest possible quantity of soap and water in the solution in order to ensure optimum cleaning. On the other hand, the resulting great dampness of the clothes has many undesirable effects, notably a marking and a consequent shrinking effect, especially if the clothes are heavily charged with solvent or if there is a mechanical agitating effect with dropping of the clothes.

Further, it is somewhat inconvenient to prepare the aqueous solution in the cleaning space, as proportioning and temperature control thereof can be carried out only with difficulty.

It is the object of the present invention to provide a method of mitigating these drawbacks by causing the aqueous cleaning solution to be prepared and checked in a device external to the cleaning space or chamber and by satisfactorily apportioning the solvents and the solution.

The apparatus of this invention allows for subjecting the articles to be cleaned to the action of a solvent coupled with a mechanical action and possibly followed by hydroextraction, then to the action of an aqueous solution prepared and checked beforehand in a vessel external to the cleaning chamber by injection of the solution into this chamber in the liquid state but as a spray preferably mixed with air, whereby to so obtain a humid atmosphere instead of a liquid solution.

If the solution is injected in the liquid state, it will be advantageous to simultaneously limit, i.e. reduce or even cancel, the mechanical action sustained by the article. It will then be useful to limit such action by causing its intensity to be varied by a solution humidity sensor.

Where the cleaning space is a perforated drum, the mechanical action is varied by modifying the speed of rotation of the drum.

In cases where the solution is atomized, a small quantity thereof is discharged with advantage into a powerful stream of air at variable temperature. The pressure effect of this airstream may therefore combine with a calorific effect resulting from its temperature.

It is a teaching of this invention that this high-pressure airstream is drawn from the cleaning space and recycled through an independent pressurizing and heating circuit.

The above-disclosed phases of the process may be followed by heavy rinsing with solvent, and the cleaning may be completed with the aid of a white or nonwhite solvent introduced at a moderate rate, i.e. at a rate intermediate the initial high inflow rate of solvent and the low inflow rate of aqueous solution, and to this end use may be made with advantage of the airstream referred to above.

The present invention further relates to such an apparatus that includes a machine comprising a chamber in which the mechanical action is performed, solvent tanks and a solution vessel external to the chamber.

It is a further teaching of this invention that the solution vessel includes control means for controlling the humidity and temperature of the solution. A humidity sensor may be provided to vary the mechanical action and most notably the rotation speed of a drum constituting the mechanical treatment device inside said chamber or treatment space.

The apparatus may include solution atomizing means positioned in a conduit for leading in air at high pressure and variable temperature, and means for providing a moderate inflow of solvent, likewise positioned in said conduit. In that event the air is preferably recycled through a circuit distinct from the customary condensation and heating circuit. This distinct circuit comprises a heater and a fan or blower and is either entirely separate from the condensation circuit or connected as a branch circuit thereof.

When the solution is atomized the humidity is no longer in suspension in a liquid but is absorbed into the textile fibers. When the article is subsequently rinsed with a solvent, the moisture is retained in the fibers, thus preventing a sheet of water from appearing in the tanks.

The cleaning is also improved by this atomization since there is no danger of impurities being redeposited on the articles after being entrained by the liquid solution, for such impurities are quickly carried away by the ample quantity of solvent which is then streamed through rapidly.

Machines of the kind referred to can be simplified and made more readily adaptable to different applications and more easily automated within a cleaning cycle, which can itself be varied to suit such factors as the nature of the component parts of the load to be cleaned and the degree to which they are sullied.

To this end the machine is equipped with a single fan which not only performs the known operations of recovering the solvent vapors and ultimately ventilating the loads, but also provides an internal air circulation which is effective during the cleaning operations in introducing pure or activated steam, pure solvent, solvent charged with finish-imparting substances, solution charged with water and soaps, or several of these at once, all of which are atomized into contact with the load to be treated, in different doses and concentrations, as they are discharged into this internally circulating air.

It will also be of advantage to atomize the different substances with a plurality of separate means, at separate locations, by feeding them at different pressures adapted to the required modes of supply.

The invention likewise relates to apparatus for performing the method modified as hereinbefore disclosed, with interconnections equipped with power-operated valves, at least at those locations where actuations are frequent in the completion of a cycle.

The description which follows with reference to the accompanying nonlimitative exemplary drawings will give a clear understanding of how the invention can be carried into practice.

In the drawings:

FIG. 1 is a diagrammatic view showing a first embodiment of apparatus for performing the subject method of this invention.

FIGS. 2 and 3 are diagrams of two embodiments of the air recycling circuits of a machine according to the invention.

FIG. 4 is a highly diagrammatic showing of a second embodiment of apparatus according to the invention.

FIG. 5 is a schematic detail view of the spraying zone of the apparatus of FIG. 4, and

FIG. 6 is a highly diagrammatic showing of an alternative cleaning installation, with its auxiliaries and associated circuits for conveying the cleaning, finishing or other substances.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to FIG. 1, there is shown thereon a cleaning chamber consisting of a perforated drum 1 rotating about a horizontal axis and a door 2 through which the clothes to be cleaned are inserted.

At the bottom of the drum is a waste liquid drain orifice 3 and at its top is a surplus humidity or solvent vapor collecting manifold capable of being connected to recovery and deodorization means (not shown).

The illustrated apparatus includes a white solvent tank 5, a working solvent tank 6 and a graduated vessel 7 for the cleaning solution, located outside the drum, and a solvent tank 8 connected through filtering means 9 to tanks 5 and 6.

A suction dip pipe **10** controlled by a valve **11** is placed in the white solvent tank **5**, and a suction pipe **12** equipped with a valve **13** likewise dips into working solvent tank **6**. These two dip pipes **10** and **12** unite into a single conduit **14** beyond the valves **11** and **13**. Connected into conduit **14** is a solvent suction pump **15**. Conduit **14** divides beyond pump **15** into two pipes **16** and **17**, respectively comprising valves **18** and **19**, and extending respectively to filtering means **9** and to a distiller **20**.

A filtered solvent conduit **21** issues from filter **9** and extends into tank **8** which is equipped with a cooler **22** and an overflow pipe **23** for returning surplus solvent to tank **6**.

Storage and cooling tank **8** has two outlets, to one of which is connected the conduit **24** for delivering solvent under the control of a valve **25** and to the other the conduit **24***a* which is equipped with a valve **25***a* and is connected to the top of tank **7**.

The distiller **20**, down the wall of which the working solvent driven by pump **15** through conduits **12**, **14** and **17** streams, is provided with a vapor exhaust **26** connected to a cooler **27** and thence to a separator **28** which is connected in turn through a return pipe **29** to white solvent tank **5**.

Lastly, a conduit **30** interconnects the tops of tanks **5** and **6**. A recycling pipe **31** embodying a valve **32** connects with overflow **23** in order to return the used solvents to tank **6**.

On the left-hand side of FIG. **1** may be seen the vessel containing the cleaning solution **7** which is prepared by combining suitable proportions of ingredients such as solvents, soaps and water stored in containers **33**. These ingredients are conveyed into vessel **7** through a feed pipe **34**. A suction pipe **35** dipping into vessel **7** connects with pipe **34** and with a pump **36**. The delivery end of pump **36** is connected to a pipe **37** embodying a valve **38** and extending up to a sprayer **39** positioned within drum **1** for delivering the solution thereinto.

Sprayer **39** is preferably disposed roughly at midheight in drum **1**, and to the left thereof, in order that the clothes impregnated with solution should be located below rather than above. This ensures that the clothes are charged with less solution at the top of the drum, where a drying airstream (not shown) is provided to carry away the surplus moisture in the clothes; in addition, the solution drains away easily into exhaust **3** for subsequent recycling. The clothes can thus be impregnated and traversed by a small quantity of solution, enabling highly active concentrations of solution to be used with advantage.

Between pump **36** and valve **38** the conduit **37** branches off into a conduit **40** embodying a valve **41** and returning to the top of tank **70**, whereby to agitate the solution in simple fashion, and subsequently into a conduit **44** embodying a valve **45** and connected to distiller **20** to enable the solvent of the cleaning solution to be recovered thereat and conveyed to tank **5**. Before returning to vessel **7**, conduit **40** receives a recycling pipe **42** embodying a valve **43**, which pipe issues from exhaust **3** and circulates the solution.

Preferably, the vessel **7** includes heating means **46**, a thermometer **47**, a thermostat **48** and an agitator device consisting in this instance of the circuit **35**, **36**, **41**, **40**, all of which components are intended to provide and maintain set temperature conditions in the solution.

A test circuit **49** permits small offtakes to be made of the gaseous atmosphere prevailing in vessel **7** in order to ascertain its relative humidity. In the apparatus described herein for exemplary purposes, this circuit includes an accelerator, a hygrometer or like device equipped with contact switches for operating as well known on the drive coupling means of a motor for rotating the drum **1**, in order to vary the drum rotation speed. Thus, when the relative humidity exceeds a threshold determined by the nature of the article to be cleaned, the mechanical action thereon is diminished or even virtually arrested.

The apparatus shown in FIG. **1** functions in the following manner: the valves **13** and **18** are opened and the pump **15** started in order to accumulate working solvent in the tank **8**, where it is cooled. Valve **25** is then opened, causing the solvent to be poured over the clothes falling and agitating within drum **1**. The solvent is recovered by opening valve **32**.

The cleaning solution is prepared with solvents introduced by opening valve **25***a* and with soap and water admitted through conduit **34**, while at the same time checking the temperature and humidity of the solution.

Upon opening valve **38** and starting pump **36**, the solution is ultimately delivered into drum **1** by sprayer **39**, which sprayer is in the exemplary embodiment described herein located at midheight, on that side of the drum where the velocity vectors are directed downwardly. The solution can be circulated by opening valve **43**, and its temperature and relative humidity are in all cases rigorously preset.

Finally, the valves **11** and **18** are opened, pump **15** is restarted and valve **25** opened, thereby causing the cleaning to be completed by streaming through the white solvent. The last step is to rinse the clothes cleaned in the drum and to remove them therefrom.

Reference is now had to FIG. **2** for a showing of a rotating drum **1** and its means **4** for discharging vapor-charged air. The discharge means **4** are connected in customary way to a circuit into which are connected successively a fan **50**, a condenser **51** and a heater **52** for recycling heated air into the drum. In accordance with the present invention, a discharged gas recycling bypass circuit **53** is provided which includes a blower **54** for setting the air under high pressure, a heater **55** and a solution sprayer **56**. Circuit **53** embodies easy dismantling features.

Reference is next had to FIG. **3**, which shows a duplication of the recycling circuits, obtained by positioning at the discharge means **4** two fans **50***a*, **50***b* connected respectively to a circuit incorporating a condenser **51** and to a circuit incorporating the heater **52**, which is itself subsequently connected to sprayer **56**. This feature of the present invention avoids excessive pressure losses, which restrict the circulation of air and reduce the efficacy of the evaporation it produces on the clothes. The drum can be heated very rapidly at the outset since the air no longer passes over the condenser, thereby increasing also the airflow over the clothes. In addition, the heating of the drum can be arrested more rapidly by completely shutting off the hot air distribution system, while the recycling circuits hereinbefore described further allow the cleaning machine to be transformed into a rotating dryer by using only the heating circuit.

The independent recycling and heating circuit obtained thus makes it possible to provide a delivery of gas at high pressure and variable temperature, resulting in satisfactory atomization of the solution and even in a gasification as a result of the heat and pressure.

The embodiment of apparatus shown in FIG. **4** includes numerous parts identical to those in FIG. **1**, so that only those differing therefrom will be described hereinbelow. The working solvent tank **6** is replaced by two tanks, of which one **6***a* contains the working solvent and the other **6***b* the dirty rinsing solvent. Recycling pipe **31** and its control valve **32** are in this case duplicated in the form of pipes **31***a*, **31***b* and valves **32***a*, **32***b*. Similarly, dip pipe **12** and its control valve **13** are replaced by two dip pipes **12***a*, **12***b* and their associated valves **13***a*, **13***b*.

The drum **1** is equipped with the condensation circuit **50***a*, **51** and the heating circuit **50***b*, **52** shown in FIG. **3**. The inlet to injection pump **36** is connected to dip pipe **35**, to which pipe are connected in succession, starting from the pump side, a proportioned liquid feed pipe **34**, and, at the same point, a pipe **57** embodying a valve **58** and dipping into white solvent tank **5** and a pipe **24***a* embodying valves **25***a* and extending from storage and heating tank **8**, and lastly a valve **59**. The temperature governing means are not shown in FIG. **4**.

Injection pipe **37** branches off firstly towards sprayer **56** (see FIG. **5**) via a valve **60**, and secondly via a valve **61** towards means **62** for delivering solvent at a moderate rate, the function of which will be explained in greater detail

hereinafter. Sprayer 56 and means 62 communicate into a common highapressure air delivery conduit 63. Condenser 51 is connected to the drum through a return conduit 64. The filter 9 and distiller 20 are interconnected by a valve-embodying conduit.

Reference to FIG. 5 provides a schematic detailed showing of the sprayer 56 communicating with the means 62 in conduit 63. It will be appreciated that the airflow will entrain in mist form the jet of solution delivered through sprayer 56 and also atomize the jet of liquid issuing from the means 62. The edges 65 of the outlet of conduit 63 are rounded to avoid damaging the clothes.

The apparatus shown in FIG. 4 functions in the following manner: the clothes inserted into drum 1 are washed rapidly by streaming thereon a large quantity of filtered solvent conveyed through conduits 24 at a rapid rate from tank 8. The solvent dissolves the stains and is then recovered by opening valve 32*a* and allowing it to flow through pipe 31*a* back into tank 6*a*. The clothes are then rinsed by rotating the drum at high speed and opening valve 32*b* to allow the solvent expelled by the rinsing process to flow into dirty solvent tank 6*b*. The drum rotation speed is then reduced to obtain the desired mechanical action, and fan 50*a* is started so as to convey air through conduit 63 at a variable temperature depending on the setting of the heating system 52. The cleaning solution prepared and checked as hereinbefore explained is then atomized in this airstream and is conveyed to sprayer 56 by opening valve 59 and starting pump 36. The amount of solution introduced will vary with the quality of the clothes and the degree of cleaning to be carried out. This quantity remains small since the spraying results in desirable distribution and satisfactory absorption by the textile fibers. The solution provides very effective cleaning since the clothes are not weighted down with solvent.

High-speed rinsing is effected with an abundant quantity of filtered solvent by reopening valves 25 and 32*a*. A special feature of this apparatus enables ultimate rinsing to be effected with a white solvent delivered at moderate rate by starting pump 36 and opening valves 58 and 61. Preferably, the quantity of white solvent delivered compensates for the quantity of solvent channelled to the distiller in order to maintain a balance in the tanks.

The dirty solvent can be dispatched to distiller 20 at any convenient time chosen by the operator.

Referring lastly to FIG. 6, there is shown thereon a machine comprising a chamber 1 having a sealable closable access door 2 to an opening in an agitating and rinsing drum which can be rotated either continuously or oscillated to and fro at different speeds, as well known per se, which speeds may be more or less high in order to permit rinsing of the load contained in the drum and undergoing the cleaning operation. The lower part of chamber 1 comprises a drain orifice 3 and the upper part a barrel plate 4 through which the air and solvent vapors flow. Barrel plate 4 is connected to the suction orifice of a case 70 surrounding the wheel 71 of a single fan driven by a motor 72. Case 70 is formed with a closable outlet 73 communicating with a conduit 51 extending up to an assembly which includes a condenser, a solvent vapors recuperator and a ventilating chimney, followed possibly by an air heater adapted to convey the air at the required temperature to a conduit 64 within chamber 1 that opens out opposite the inlet into the rotating drum, for instance into the opening closed by the door 2.

The case 70 further communicates with the inlet pipe 74 into a heater 52 the outlet of which is connected to the inlet of a conduit 63 arranged similarly to the conduit 64 referred to precedingly. A pneumatically operated valve 75 is connected to inlet 74. The heating jacket of heater 52 is fed through a conduit 76 off a steam generator (not shown) with an interposed pneumatically operated valve 77, said jacket being fitted with a drain 78. Conduit 76 likewise feeds, via a pneumatically operated valve 79, a steam injector 80 debouching into the heater.

Considering next the solvent-circulating system, more particularly in respect of the return means to the tank from orifice 3, a pipe 31 extends up to a distribution manifold via pneumatically operated valves 32*a* and 32*b* and feeds, through corresponding pipes 31*a* and 31*b* respectively, a working solvent tank 6*a* and a dirty solvent tank 6*b*, and thence via a manually operated valve 32*c* and a corresponding pipe 31*c*, a white solvent tank 5.

The suction side of solvent circulating pump 15 is connected to a manifold 14 through which white solvent is drawn through a pipe 10 and a pneumatically operated valve 11*a*, working solvent through a pipe 12*a* and a pneumatically operated valve 13*a*, and dirty solvent through a pipe 12*b* and a valve 13*b*.

The suction end of pump 15 is further connected through a pneumatically operated valve 81 and a conduit 82 directly to conduit 31 to allow recirculation without transit through the tanks.

The delivery end of pump 15 is connected through a pipe 83 to a pneumatically operated valve 84 and, beyond the latter, to a conduit 24. Paralleled with valve 84 is a filter 9 having at its inlet a pneumatically operated valve 18 and at its outlet a manually operated valve 85. Connected into pipe 24, downstream of valve 85 and of the branch containing the valve 84, is a pneumatically operated valve 25. The pipe 24 extends up to a discharge nozzle 24*b* positioned within the conduit 64, whereby the streaming solvent is able to accompany the circulating air and take advantage of its motion and temperature.

The extension 17 of conduit 83 connects with a pneumatically operated valve 19 positioned at the inlet to a distiller 20 equipped with a suitably supplied and drained steam jacket, and the solvent vapor outlet 26 from distiller 20 connects through a condenser 27, a subsequent separator 28 and a return pipe 29, with the white solvent tank 5.

It will easily be understood that with the means hereinbefore described it is possible, in the manner well known, to perform cleaning operations by agitation and solvent spraying (in a bath or not) within the chamber 1, in conjunction with rinsing, drying and recuperation under the action of fan 71 and the conventional recovery and ventilation circuit. Alternatively, the heater 52 may be used at any time for the air alone with recycling with the same fan, or for the air and the solvent in liquid or more or less vaporized form, by opening valve 75 and closing valve 73.

Alternatively, also, steam may be injected in any proportion and at any selected moment by opening the valve 79, with or without a reduction of the mechanical action on the load in the machine undergoing the processing cycle.

It will be appreciated that the solvent delivered can be caused to pass through the filter 9, or else to avoid the same, by closing valve 18 and opening valve 84, thereby preventing the filter from being unduly clogged by dirty solvent which has been used, for instance, for a preliminary wetting of working overalls, the dirty solvent being returned to tank 6*d* in conjunction with thorough hydroextraction and a small quantity of less charged solvent for preliminary rinsing before the working solvent is used.

Alternatively, the cleaning operations can be performed on less sullied articles with working solvent from tank 6*a*, in conjunction with filtering, while clean and fragile articles can be processed with white solvent drawn from tank 5.

All the cycles using different quantities of solvent can be performed under cold or hot conditions, or else with powerful ventilation while the solvent is working, for any desired period of activity.

Regardless of the articles being treated, it is preferable to end the processing with a rinsing dose of white solvent, and the quantities of dirty solvent channelled periodically for distillation are systematically offset by corresponding intakes of working solvent into the dirty solvent tank and equal quantities of white solvent into the working or dirty solvent tanks, with the distiller 20 ultimately returning into tank 5 the equivalent of such transfers.

The above-described method is suitable for removing grease stains and like heavy soilings.

For dealing with lighter stains or applying waterproof and like finishes, it may be necessary to use a certain amount of soap and water in the solvent.

There is provided to this end a soap tank 33*b* connected, through a pipe 34*b* incorporating a stop cock 34*d*, to a vessel 7*a* for storing a suitably proportioned aqueous cleaning solution. Vessel 7*a* is connected through a pipe 34*e* and a manifold 35 to the suction end of a pump 36. Similarly, for applying special finishes, provision is made for a tank 33*a* containing a finish and most notably a waterproof finish liquid, and this tank is connected through a pipe 34*a* incorporating a stop cock 34*c* to a tank 7*b* for storing a suitably dosed solution, which tank 7*b* is connected through a pipe 34*f* to said manifold 35. The two tanks 7*a* and 7*b* can be interconnected, by pneumatically operated valves 86 and 87, with a compressed air feed manifold, and through valves 88 and 89 with a venting manifold 90, and this circulation of compressed air provides appropriate agitation. The suction end of pump 36 is further connected through a pneumatically operated valve 58 to a pipe 57 which dips into the white solvent tank 5, which is used systematically for all operations involving a cleaning solution, without offtakes from the working solvent and dirty solvent tanks, said solution being moreover recycled if need be, by means which will be referred to hereinafter. Accordingly, the suction end of pump 36 is connected through a valve 91 to a pipe 92 which is connected to a return conduit 24*a* having a valve 25*a* connected thereinto and extending from the outlet of filter 9, beyond manual valve 85, to tank 6*a*.

Pump 36 delivers its output through a pipe 37 which, after separating into two branches, feeds through one of them, via a pneumatically operated valve 60, a sprayer 56 positioned at the end of conduit 63, and through the other, beyond a valve 61, an injector 62 positioned upstream in said conduit 63. The pipe 37 receives the vent 90 and includes a bypass 93 incorporating a pneumatically operated valve 94, a first relatively low-pass pressure limiter 95 and return means to tank 10*a*. Furthermore, prior to separating into two branches, pipe 37 has a takeoff pipe 96 connecting therewith, into which is connected a second relatively high pass pressure limiter 97 located upflow of a point where pipe 96 divides into two return branches to vessels 7*a* and 7*b*. Each of these vessels is equipped with a bypass connecting through the necessary valves.

Obviously, vessel 7*a* at least can be equipped with a thermometer, a thermostat, heating means and a hygrometer for performing the method which was hereinbefore described in the first instance, most notably for slowing down or arresting the mechanical action on the clothes undergoing treatment to suit the water content in the prepared solution.

It is manifestly possible with the apparatus described hereinabove to provide in chamber 1 a powerful and hot stream of recycling air into which it is easily possible to place in suspension, or cause to be entrained, cleaning or finish solutions atomized to a degree dependent upon the choice of injectors 56 or 62 and the choice of pressure settings in limiters 95 or 97. The single fan 7 may perform the recirculation and heat input functions in conjunction with heater 52, if required.

It is possible to recycle the cleaning or finish solutions, or to cause the solutions utilized to return either into working solvent tank or solely into the dirty solvent tank for subsequent distillation, thus making reutilization of the solutions impossible otherwise than deliberately and thereby avoiding accidental pollution or undesirable felting effects on subsequent loads.

The subject apparatus of the present invention thus enables a wide range of cleaning techniques to be applied, such as those involving baths, wetting operations, light or heavy sprayings of filtered solvent or white solvent, which is a useful advantage especially since it prevents articles like mechanics' overalls from bleaching, irrespective of the form of embodiment of the apparatus hereinbefore described.

It goes without saying that many changes and substitutions of parts may be made in the specific constructional forms described hereinabove without departing from the scope of the invention.

I claim:

1. In cleaning apparatus for cleaning articles and comprising a drycleaning machine having a cleaning chamber, a mechanically movable receptacle within said cleaning chamber, solvent tanks in channeled communication with said cleaning chamber, and aqueous solution vessel external of said chamber, channel means including a sprayer for delivering said solution into said chamber, means for atomizing said solution before passing into said chamber, and a solution pump having a delivery end communicating with said chamber through said channel means and a suction end communicating with said aqueous solution vessel.

2. Apparatus as claimed in claim 1, wherein said aqueous solution vessel includes means for governing its temperature- and humidity-sensing means for controlling mechanical action of said receptacle.

3. Apparatus as claimed in claim 1, wherein said receptacle is a rotary cleaning drum, said sprayer being positioned substantially at midheight in said chamber, on that side thereof where the drum rotation velocity vectors are directed downwardly.

4. Apparatus as claimed in claim 1 wherein said sprayer is disposed within a conduit conveying air at high pressure and adjustable temperature to said chamber.

5. Apparatus as claimed in claim 4, wherein said conduit comprises means for discharging solvent at a moderate rate into said chamber.

6. Apparatus as claimed in claim 5, wherein said conduit is part of an air-recycling circuit comprising a fan and a heater.

7. Apparatus as claimed in claim 6, wherein a single fan for recycling air through said treatment chamber has a delivery side connected alternately to a conventional ultimate article ventilation and recovery circuit with prior cooling and subsequent heating and with return air conduit means connected to said chamber and having debouching thereinto a nozzle delivering the solvent used for cleaning, and to a circuit comprising a steam injector-type heater for varying the relative humidity of air delivered into second return means having at least two nozzles debouching thereinto, of which one forms a high-pressure sprayer positioned adjacent the outlet of the conduit and the other a low-pressure injector positioned well upflow of said sprayer.

8. Apparatus as claimed in claim 1, including two pressure limiters of different ratings associated with the delivery end of said pump and connected respectively to said sprayer and to a low-pressure injector positioned upstream thereof.

9. Apparatus as claimed in claim 8, wherein the suction end of said solution pump is connected to a recycling manifold connected to an outlet from a solvent filter, to pipe means dipping into a white solvent tank and to a manifold connected in turn to different pipe means permitting offtakes of cleaning and finish solutions proportioned and stored in independent vessels external to said cleaning chamber, said independent vessels being equipped with individual bypasses.

10. Apparatus as claimed in claim 8, wherein conduit means for surplus solutions at the outlet of the lower rated pressure limiter are connected to said working solvent tank and conduit means for surplus solvents at the outlet of the higher rated pressure limiter are connected to vessels for preparing and storing said solutions, associated bypasses being provided to prevent mixing.

11. Apparatus as claimed in claim 1, comprising a plurality of valves associated with said solvent and solution channels and which are manually operated, and other valves which are power operated.

12. Apparatus as claimed in claim 1, wherein said chamber is supplied with solvent from a point downstream of a filter equipped with a bypass, directly off the delivery end of an associated pump, a return path for said solvent comprising

power-operated valves positioned upstream of working solvent and dirty solvent tanks and a manually operated valve positioned upflow of a white solvent tank, a bypass incorporating a power-operated valve interconnecting said return path with the suction end of said solvent pump.