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DRY CLEANING APPARATUS

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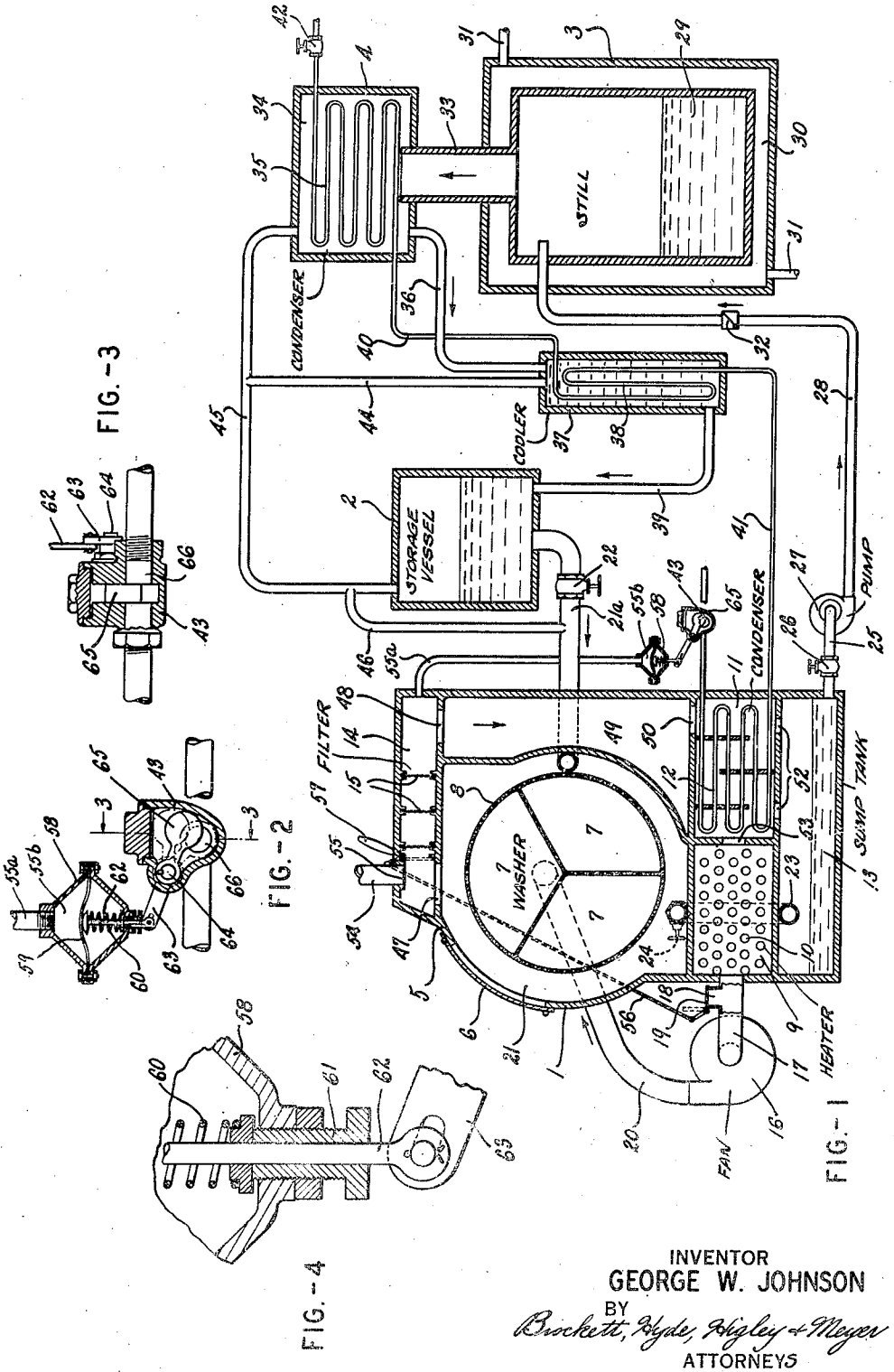

FIG. - 1

FIG. - 2

FIG. - 3

FIG. - 4

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DRY CLEANING APPARATUS

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7 Claims. (Cl. 68—38)

This invention relates to the dry cleaning of fabrics and garments and the like with a volatile detergent, and has more particular relation to closed systems or apparatus for this purpose. The object of the invention is to provide improved apparatus and a method for automatically compensating for otherwise wide fluctuations of pressure within the dry cleaning system or, in other words, for maintaining a fairly uniform pressure, so that the parts of the apparatus can be designed and made of material of the proper strength but with minimum weight and cost, as well as for further advantages which will more fully appear hereinafter.

In the drawing, which represents one suitable embodiment of apparatus suitable for performance of the method, Fig. 1 is a diagrammatic view with some parts in sectional elevation; Fig. 2 is a detail sectional elevation on a larger scale, illustrating an automatic controlling valve; Fig. 3 is a sectional elevation on the line 3—3, Fig. 2; and Fig. 4 is a detail sectional view, corresponding to Fig. 2, but on a larger scale, and illustrating an adjusting device.

One common form of dry cleaning apparatus utilizing volatile detergents comprises a chamber or casing within which the garments or fabrics to be treated are subjected to the effect of a quantity of the liquid detergent, following which the liquid detergent is drained off so far as possible and any remaining detergent is removed by the use of an air current, is condensed and returned to the liquid, and the used liquid detergent is cleansed or clarified by distillation and condensation. While any volatile detergent may be employed, one common detergent suitable for the purpose is carbon tetrachloride.

Systems of this kind, if entirely closed or sealed against escape of liquid or gas to the atmosphere, necessarily must be made of heavy material. That is true not only of the casing or walls of the treating compartment, but also of the walls of containers for liquid, stills, condensers and the like. The reason is that the chambers within the several vessels necessarily are subjected to widely varying fluctuations of pressure if the entire system is sealed or closed at any time, due to the application of heat for distillation, the variations in temperature of the outside air, and also variations in temperature of the cooling medium such as water and the like. As a result, some systems are provided with an open vent to the atmosphere, to maintain atmospheric pressure, or nearly so, with the disadvantage of possible loss of valuable detergent by free escape to the atmosphere.

The present invention is designed to prevent loss of valuable detergent by escape to the atmosphere, incident to the use of a vent, by closing or sealing the system against vent or escape to the atmosphere except during loading or unloading and at the same time providing the system with means and operating it by a method which automatically compensates for the wide fluctuations in pressure which otherwise would be produced in such a system, and particularly by compensating for such wide fluctuations by apparatus sensitive or subject to the conditions within the system and utilizing for the compensation an effect produced upon one or more of the condensers forming a part of the system itself.

As a result, any tendency of the pressure to rise is met by an increase in the condensing effect, with correcting or compensating influence tending to prevent rise of pressure, while any tendency for the pressure to reduce, say to a point below atmospheric pressure, is met by correcting or compensating decrease in the condensing effect and a corresponding tendency to increase pressure.

The system shown in the drawing for purposes of illustration comprises a treating unit 1, a detergent storage vessel 2, a still 3, and a condenser 4 suitably connected and associated with each other.

The treating unit 1 is something like an ordinary washing machine or drying tumbler, comprising an outer casing 5 provided with a door 6 through which the material to be treated, such as garments, fabrics or the like, can be introduced into and removed from the compartment or compartments 7 of a rotatable foraminous drum 8 mounted within the chamber of the casing. Door 6, when closed entirely, seals the unit against inflow or escape of air or gas, except as will appear hereinafter. In the casing are also located a heater including a chamber 9 in which are located heating steam coils 10 or the like, a condenser 11 including a chamber containing condensing coils 12, a sump or receiver 13, and a delinting or filtering chamber 14 in which are removable screens 15. The treating unit is provided with a suitable air flow producing device, such as the fan or blower 16 whose inlet side communicates by a conduit 17 with the chamber of heater 9 and which is also provided with an opening or connection 18 to atmosphere adapted to be opened or closed by a door 19. The de-

livery side of the fan 16 communicates by a pipe 20 with the treating chamber 21 in which is located the drum 8. Liquid detergent is supplied to said treating chamber by way of a supply pipe 21a having a valve 22 and communicating with the storage reservoir 2. Liquid remaining in the treating chamber 21 may be drained therefrom to the sump chamber 13 by way of a pipe 23 provided with a valve 24. Sump chamber 13 communicates by a pipe 25 having a valve 26 with a pump 27, the outlet side of which communicates by a pipe 28 with the evaporating or distilling chamber 29 of the still, which may be heated by steam circulated through the surrounding chamber 30 by pipes 31. A check valve 32 permits flow through conduit 28 only in the direction of the arrow thereon. The vapors or gases produced by the distilling operation in chamber 29 rise through the conduit 33 to the chamber 34 within the condenser 4, being there condensed to liquid form by the effect of the cooling coils 35. The liquid thus condensed flows by pipe 36 to the chamber of a cooler 37, in which are also located cooling coils 38, and on the far side of the cooler flows by way of pipe 39 to the storage reservoir 2.

The several cooling coils 35, 38 and 12 may be separate, in which case any one or all of them may be provided with automatically controlled valves of the character hereafter described, but preferably, and as shown, the several coils are in series with each other, said coils being connected by conduits or pipes 40, 41 and being in communication at one end by way of a valve 42 with a suitable supply of cooling liquid, such as cold water, and discharging at the other end to any suitable point, say to the sewer, by way of a valve generally marked 43.

The several chambers of the condenser 34, cooler 37 and storage reservoir 2 communicate with each other by way of pipes 44, 45, the latter pipe communicating by a branch 46 with the pipe 21a leading to the treating compartment 21.

With this arrangement the material to be treated is first loaded into the compartments of the rotating drum 8, door 6 is sealed and a quantity of liquid detergent is run into the treating compartment by opening the valve 22. Said valve is then closed. The drum 8 is rotated for the proper period of time to produce a thorough agitation of the material in the detergent with a consequent washing or cleansing thereof. Finally, the drum 8 is stopped and the liquid in chamber 21 is drained to the sump 13 by opening valve 24. When as much liquid has drained from the work as is reasonably possible, the fan 16 is started. Heated air from heater 9 is drawn into the fan and is discharged into the treating chamber 21, flowing therefrom through the opening 47 to and through the screens 15 in the delinting chamber 14, thence through opening 48 and passage 49 and opening 50 to and through the chamber of condenser 11, where the volatile detergent in the form of gas is condensed to liquor and drains through the openings 52 to the sump, the air flowing through opening 53 to the heating chamber to be reheated and returned through the same circuit. This drying operation is continued until substantially all of the detergent has been recovered.

The delinting chamber 14 is provided with a connection 54 to atmosphere adapted to be opened and closed by a valve or damper 55, and the two valves 19 and 55 are operatively connected by the link 56 and may be jointly operated by the handle 57. During the washing and drying operations before referred to said valves lie in the full line position, Fig. 1. When the drying operation is finished the valves are turned to the dotted line position, shutting off communication between chambers 21 and 14. Therefore, when the drying operation is concluded the fan continues to operate for deodorizing, drawing fresh air in through the connection 18 and delivering it to the chamber 21 from which it flows to atmosphere through the pipe 54.

The liquid collected in the sump 13 is now pumped to the still 3, is there distilled and is conveyed as a gas to condenser 4 from which, as a liquid, it drains to the cooler 37 and is returned to the storage vessel 2.

In the present system I use one or both of the condensers 35 and 12 or the cooling coil 38 as a means for compensating for wide fluctuations in pressure within the system at times when it is sealed against the atmosphere by the closing of door 6 and dampers 55 and 19, and particularly to correct any tendency of the pressure to vary by an automatic change in the condensing effect or efficiency, subject or sensitive to the pressure within the system. In the arrangement shown, one of the chambers within the apparatus, such as the delinting chamber 14, communicates by way of a pipe 55a with the chamber 55b within a hollow casing 58 containing a movable abutment, such as a diaphragm 59, whose opposite face is subject to the pressure of a loading spring 60, whose pressure is preferably capable of variation, such as by the adjusting screw 61. Said diaphragm moves back and forth under the influence of variations in pressure in chamber 55b and its motion is utilized to actuate a valve for controlling the condensing effect. In the arrangement shown the diaphragm presses against a head on a rod 62 connected to an arm or lever 63 on a valve shaft 64 extending into the casing of the valve 43 and provided within said casing with a swinging gate valve 65 adapted to more or less open or close the passage 66 through the valve which controls the rate of water flow.

In operation of the system valve 42 is opened wide and remains open throughout all operations. The system is designed to operate on approximately atmospheric pressure with variations therefrom not exceeding a positive pressure above atmospheric or a negative pressure below atmospheric of not more than a few pounds, say one or two pounds. Therefore, all parts of the apparatus, including all tanks or vessels and the walls of the treating unit 6, are made of metal or other material of ordinary gauge without excessive weight to withstand heavy pressures. If at any time during the washing or drying operations when both the door 6 and the valves 55 and 19 are closed, the pressure within any part of the system tends to rise or fall more than the limit of one or two pounds, such variation in pressure immediately becomes effective by way of pipes 44, 45, 46 and the like with the chambers in the unit 6 and therefore in pipe 55a and the chamber 57b communicating therewith. The parts are so arranged that as the pressure tends to rise it moves over the diaphragm 59 and opens wider the port or passage 66, thereby increasing the rate of water flow through the several condensing coils, producing an increasing condensing effect with a consequent tendency to reduce pressure in the system. Likewise, as the pressure in the system tends to fall at any point, the diaphragm 59 moves over in the opposite direction and the port or passage 66 is somewhat closed,

thereby decreasing the condensing effect and producing a tendency to increase pressure. The net effect is to tend to stabilize or maintain uniform at approximately atmospheric pressure, the pressure throughout the entire system, and enable all parts of the apparatus to be made of minimum weight but yet with necessary mechanical strength for their intended duties.

Any suitable means, of course, may be provided for adjusting or regulating the sensitivity of the apparatus, or, in other words, the amount of variation in pressure necessary to produce a given amount of correcting adjustment of valve **43**, the arrangement shown in Fig. 2 and including the adjusting screw **61** being but one of the suitable forms for the purpose. Screw **61** will be adjusted to a position depending upon the particular conditions under which the system is operating, and the variables to be encountered, such as the air temperature outside of and surrounding the apparatus, the temperature of the available cooling water, the efficiency of the heating devices, such as the coils in the still, and so forth. In normal operation the screw **61** is adjusted to such a position that the valve **43** is partly open and permits the flow of sufficient cooling water to produce a condensing effect which will substantially balance any tendency to increase pressure, with the net result of producing and maintaining substantially atmospheric pressure, and the inherent strength of the spring **60** will be such as to permit said spring to be compressed upon rise in pressure or permitted to expand upon drop in pressure within the reasonable variation permissible, such as one or two pounds, as before stated, and by its motion produce sufficient valve operation to produce a sufficient correcting influence upon the condensing effect, all as will be readily understood by those skilled in the art.

What I claim is:

1. Dry cleaning apparatus, comprising a casing provided with a fabric treating chamber, a condenser having a cooling chamber, said chambers being adapted to be sealed from the atmosphere, means for circulating solvent vapors between said chambers, means for supplying cooling medium to said condenser, regulating valve means for said supply means, and means sensitive to the pressure within said apparatus for controlling said valve means and arranged to gradually increase the supply as the pressure increases and to decrease it as the pressure decreases.

2. Dry cleaning apparatus of that type in which all parts of the apparatus during the drying operation are sealed from atmosphere, comprising fabric treating, storage, condensing, and distilling vessels interconnected for the flow of volatile detergent between them, and means sensitive to the pressure within the apparatus for controlling the operation of said condenser so as to increase the supply of cooling medium when the pressure within the apparatus is above a predetermined amount and to decrease the supply of cooling medium when the pressure within said apparatus is below a predetermined amount.

3. Dry cleaning apparatus of that type in which all parts of the apparatus during the drying operation are sealed from atmosphere, comprising fabric treating, storage, condensing, and distilling vessels interconnected for the flow of volatile detergent between them, means for producing repeated circulation of solvent vapors between the fabric treating vessel and one of the condensing vessels, heating means for such gaseous medium, and means sensitive to pressure within the apparatus for controlling the operation of said condenser so as to increase the supply of cooling medium when the pressure within the apparatus is above a predetermined amount and to decrease the supply of cooling medium when the pressure within the apparatus is below a predetermined amount.

4. An apparatus in which a volatile solvent is utilized for treating fabric or in which the volatile solvent is being reclaimed comprising a closed system including a solvent-containing chamber, a condenser, means for supplying a cooling medium to said condenser, and means sensitive to pressure conditions existing in said apparatus for increasing the amount of a cooling medium supplied to said condenser when pressure conditions in the system exceed a predetermined amount and decreasing the amount of cooling medium supplied to said condenser when the pressure conditions within the apparatus fall below a predetermined amount.

5. Dry cleaning apparatus which is adapted to be sealed from the atmosphere including a fabric treating chamber, a condenser, means for circulating solvent vapors between the fabric treating chamber and the condenser, means for supplying a cooling medium to said condenser, and means sensitive to pressure conditions within said apparatus for regulating the supply of cooling medium to said condenser so as to increase the supply of cooling medium when the pressure within the apparatus is above a predetermined amount and to decrease the supply of cooling medium within said apparatus when the pressure is below a predetermined amount.

6. An apparatus or system in which a volatile liquid is being utilized or stored comprising a vessel or system which is adapted to be sealed from the atmosphere, a cooling device located in heat exchange relationship with the fluid in said vessel or system, means for supplying cooling medium to said device, and means sensitive to pressure conditions in said vessel or system for regulating the supply of cooling medium to said device so as to increase the supply of cooling medium when the pressure within the system is above a predetermined amount and to decrease the supply of cooling medium in said vessel or system when the pressure is below a predetermined amount.

7. Dry cleaning apparatus including a fabric treating chamber, a condenser and a heater interconnected to form a circuit, said apparatus being adapted to be sealed from the atmosphere, means for circulating solvent vapors through said circuit, means for supplying a cooling medium to said condenser, and means sensitive to pressure within said apparatus for controlling the supply of cooling medium so as to increase the supply of cooling medium when the pressure within the apparatus is above a predetermined amount and to decrease the supply of cooling medium when the pressure is below a predetermined amount.

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