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AUTOMATIC DRYCLEANING STILL

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FIG. 2

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This invention relates to a distillation process and to an automatic still used in drycleaning.

The drycleaning process ordinarily used in the cleaning of garments removes not only solid soils but also soluble soils, fatty acids, body oils and color dyes from the garments being cleaned and holds them in the cleaning solvent. This is undesirable for several reasons. In the first place, the presence of dyes in the cleaning solvent causes dulling of light colored fabrics by deposition. Secondly, fatty acids and body oils give the solvent an unpleasant odor which is retained by the garments after cleaning. And third, the soluble soils (which are obviously not a desirable ingredient in the cleaning solvent) are not readily removed by the system's distillation/filtration filters.

The introduction of certain types of filter aids, such as activated granular carbon, will remove part of the soluble soils but the use of these aids is greatly restricted by the fact that they rapidly become saturated and form an impervious film over the filter elements, thus reducing the flow through the elements to such an extent that cleaning efficiency is greatly reduced.

Accordingly, a preferred method of removing soluble soils from the cleaning solvent is by distillation.

Drycleaning stills ordinarily used with drycleaning processes which utilize a synthetic solvent such as perchlorethylene, are of the atmospheric type, that is, they are vented to the drycleaning machine, or to the room or atmosphere. The soluble soils encountered ordinarily have a higher boiling point than the cleaning solvent and it is therefore the solvent which is vaporized in the still. The solvent vapors are conducted to a condensing area leaving the edible soils in the boil chamber of the still. These soils are accumulated until they are present in sufficient quantities to raise the boiling point of the mixtures of solvent and residues to such a high value that the distillation rate is greatly reduced. At this point it is customary to drain the residues from the boil chamber to a waste pipe or receptacle.

With the advent of solvent-soluble soaps and the introduction into the solvent of small controlled amounts of moisture to assist in the drycleaning process, the problems of distillation have been increased because the soap and moisture introduced into the boil chamber along with the solvent interact with the residues of the distillation and cause foaming. When foaming occurs, the dirty solvent that is, the solvent containing residues is carried into the condensing area and from there is returned to the solvent storage tank. This, of course, is to be avoided, and it has heretofore been the duty of the operator to watch for foaming and to take the necessary action to stop it when it occurs. When foaming occurs which is not detected by the operator, and if it continues long enough, the entire residue content of the still can be carried over to the condensing area and will then contaminate the cleaning solvent in the storage tank to the point that cleaning operations must be discontinued until the entire contents of the storage tank itself has been distilled.

When foaming occurs which is detected, the operator takes action to greatly reduce the heat input to the boil chamber in order to minimize the foaming. However, when it does this, the distillation rate is also greatly reduced.

Another means of controlling foaming is to introduce a cold solvent spray directed toward the surface of the solvent in the boil chamber. Although this method has been moderately successful, it likewise greatly reduces the distillation rate of the still.

Our present invention provides a distillation process and still in which foaming is automatically controlled without appreciably reducing the distillation rate.

The still of our present invention is especially suited for use with batch rinse processes.

Our invention will become clear from a consideration of the following detailed description of a preferred embodiment illustrated in the drawing in which:

FIG. 1 is a front elevational view, partly in section, of a still embodying our present invention; and

FIG. 2 is a side elevational view, partly in section, of the still of FIG. 1.

In describing the preferred embodiment of the invention illustrated in the drawing, specific terminology has been resorted to for the sake of clarity. However, it is not the intention to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

Referring now to the drawing, solvent is introduced through a conduit connection 1 (FIG. 2) into the boil chamber 2 thru a conduit line from the machine not shown. When the level in the boil chamber 2 is high enough to displace the float of float control 16 (FIG. 1), an electrically operated solenoid valve 3 is energized automatically to allow steam to enter steam coil 4 to boil the solvent contained in the boil chamber. Vapors generated during the boil rise through duct 5 to enter condensing chamber 6. When these vapors contact the cold surfaces of condensing coil 7 they are condensed and run down into the trough 8 formed between duct 7 and the side of condensing chamber 6.

A valve 9 located in a discharge conduit from trough 8 is normally closed but has a small orifice hole in the gate.

The condensate level builds up in the trough 8 until it flows out a pipe conduit 10 into the side of after cooler water separator 11. The condensate retained in trough 8 is cooled below the condensing temperature before leaving the condensing chamber 6. The internal construction of water separator 11 is such that as the condensed solvent rises through channel 12 of separator 11 it passes through an orifice 13 into a rag container chamber 27 and then passes through the rags, which remove minute traces of water, into a pipe conduit 14 and then into the solvent storage tank. A sight glass 15 is provided for a visual check of the condition of the condensate. Water is displaced to the top of the liquid level in water separator 12 and flows to waste through pipe conduit 16. Cooling coil 17 within the water separator further reduces the temperature of the condensate before it is returned to the storage tank.

In accordance with one feature of the automatic still of our present invention, when enough solvent is boiled out of the chamber 2 to drop the solvent to a selected low level, the float level control 18 operates automatically to de-energize the solenoid-operated control valve 3, thus automatically shutting off steam to steam coils 4. In accordance with a second feature of the automatic still of our present invention, a light source 19 and a photoelectric cell 20 are located on opposite sides of the boil chamber 2 near the top thereof. These elements 19, 20 are so located, in line with each other, that light from source 19 is beam directly on the sensing element of photo cell 20. Interposed between light source 19 and...
photo-electric cell 20 on each side of boil chamber 2 is a glass lens 21, 21. These lenses also seal off the vapors from elements 19, 20. The light intensity of source 19 is sufficient to penetrate the vapors formed within the boil chamber and energize sufficiently the cell 20. However, should the solvent within the boil chamber 2 foam up sufficiently to reach the beam of light extending across the top of the boil chamber, the light from source 19 will not penetrate adequately the denser dark foaming liquid. Thus, light from source 19 is effectively removed from the photo cell 20, and when this occurs power to the electrically operated valve 23 is interrupted and steam to steam coils 4 is shut off. With the removal of the heat supply, the foam blanket drops and as soon as the foam drops below the beam of light, the light from source 19 again reaches the photo cell 20 in sufficient amount to close the circuit to electric valve 3 and restore steam to coils 4. The foam thereupon rises, the beam of light is again intercepted, and the heat is again shut off. The action is rapid, and results in heat being applied in a pulsating manner with such rapidity as to provide almost continuous distillation, even when a heavy layer of foam exists which extends from the level of the solvent to the beam of light. It will be seen then that while heat is applied in such volume as to maintain a high rate of distillation the foam blanket is prevented automatically from rising sufficiently to enable foam from reaching duct 5 and contaminating the condensate.

In accordance with still another feature of our invention, steam coil 4 is deliberately sized to supply more heat than the condensing coil 7 can remove so that as residues build up in boil chamber 2, raising the boiling point of the solution in the boil chamber, sufficient heat will still be supplied to cause the solution to boil, thus maintaining the high distillation rate. This third feature of our automatic still, a heat-sensitive thermo-switch 22 is located within the upper portion of the condensing chamber 6 and so set that if hot solvent vapors reach its element instead of relatively cool air it will operate to cut off power supply to the electric valve 3, thereby automatically removing the steam heat supply to coils 4 until such time as the vapors in the condensing chamber 6 drop in level and allow the atmospheric air to cool the area surrounding the element of thermo-switch 22 sufficiently to cause the heat-sensitive element to return to its former position, thus reenergizing valve 3. It will be seen that the thermo-switch 22 acts as a safety device against the boil-up rate of solvent vapors exceeding the condensing capacity of the coil 7 and thereby allowing said vapors to escape into the room, which might otherwise happen when the boil chamber contains a solution of low residue content.

As a further feature of the still of our present invention, a pipe conduit 23 is provided which connects with conduit 14 so that if the valve 24 were to be closed the air would be forced through the entire apparatus. This conduit is connected with the storage tank 15 and so arranged that the storage tank 15 is automatically opened and closed by the water separator 10, thus providing a continuous flow of distillate from the distilling apparatus.

It will be seen that the still according to our invention provides means: (1) for the automatic turning on and off of steam to steam coils 4 in response to the solvent level in boil chamber 2, thus preventing boiling the chamber dry; (2) for the automatic prevention of foam contamination; and although providing for distillation at a high rate (3) for preventing the distillation from exceeding the condensing capacity of the condensing coil. Each of the means (1), (2), (3) just mentioned operates independently to de-energize the electrically operated valve 3, as in response to a relay-operated series switch. Although not shown, it will be understood that means are provided for locking out the automatic circuit to allow the still to be cleaned by stripping of the solvent from the residue.

While the preferred embodiment of this invention has been described in some detail, it will be obvious to one skilled in the art that various modifications may be made without departing from the invention as hereinafter claimed.

Having thus described our invention, we claim:

1. A still for distilling soiled solvent at a high distillation rate without requiring manual attention, said still comprising: a boil chamber for boiling the mixture of solvent and soils; a relatively large supply of heat for said boil chamber sufficient in quantity to continue to boil said mixture at a high rate despite the presence of the inorganic residue; and although providing for distillation at a high rate without permitting foam to reach said condensing chamber, said condensing chamber located above and in communication with said boil chamber for condensing the solvent vapors received from said boil chamber; sensing means providing a beam of light across the upper part of said boil chamber for sensing that foam has risen in said boil chamber to the height of said light beam; means coupled to said sensing means for shutting off the supply of heat to said boil chamber when said foam reaches said beam of light and for restoring the supply of heat when the foam subsides below said beam of light, thereby to provide a pulsating supply of heat to said boil chamber and thereby to permit solvent distillation to take place at a high rate without permitting foam to enter said condensing chamber; and heat sensitive means in the upper part of said condensing chamber coupled to means operative in response to the temperature at said upper level rising above a pre-determined value for shutting off the supply of heat to said boil chamber so long as said temperature at said level is above said pre-determined value and for restoring the supply of heat when the temperature at said upper level falls below said pre-determined value, thereby to permit solvent distillation to take place at a high rate without exceeding the condensing capacity of said condensing chamber.

2. An automatic still for distilling soiled non-aqueous solvent, said still comprising: a boil chamber for receiving the said solvent; means responsive automatically to the level of the said solvent in said boil chamber for turning on a supply of heat to said boil chamber when said level reaches a pre-selected maximum and for automatically shutting off said supply of heat when said level is reduced to a pre-selected minimum, thereby to prevent boiling said chamber dry; a condensing chamber above and in communication with said boil chamber for condensing solvent vapors received from said boil chamber; heat-sensitive control means in the upper part of said condensing chamber for shutting off the supply of heat in said boil chamber when the level of solvent vapors in said condensing chamber rises sufficiently to reach said heat sensitive means and for restoring said heat supply when said level falls below said heat sensitive means, thereby to permit solvent distillation to take place at a high rate without exceeding the capacity of said condensing chamber; and means responsive to the level of foam generated in said boil chamber for automatically shutting off the supply of heat to said boil chamber when said foam rises to a predetermined level, thereby to prevent solvent distillation to take place at a high rate without permitting foam to reach said condensing chamber, said
means responsive to the foam level in said boil chamber including a light source and a light-responsive cell at spaced-apart locations in the upper part of said boil chamber, thereby to transmit a horizontal beam of light from said light source across the upper part of said chamber to said light-responsive cell.

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