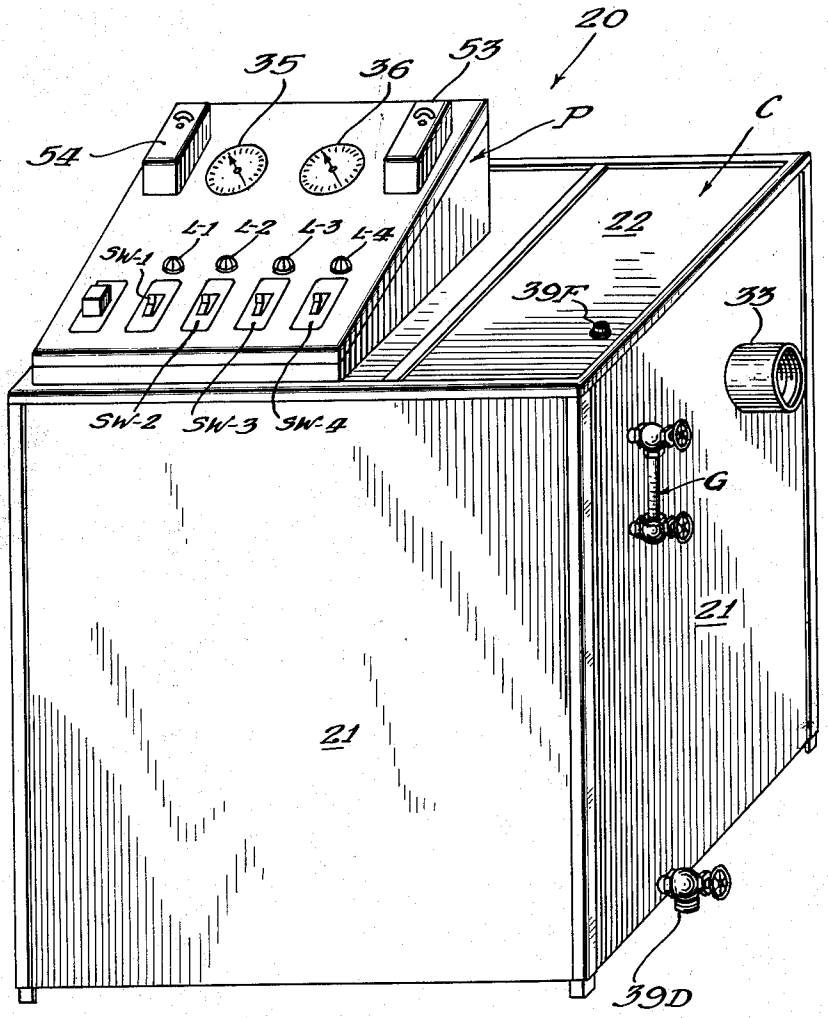
Feb. 7, 1956 S. M. McKENDREE 2,733,587

DRY CLEANING SYSTEMS

Filed Feb. 17, 1953 3 Sheets-Sheet 1

FIG. 1



Inventor:
Samuel M. McKendree
By: Wallace and Cannon
Attorneys

Feb. 7, 1956 S. M. McKENDREE 2,733,587

DRY CLEANING SYSTEMS

Filed Feb. 17, 1953 3 Sheets-Sheet 2

FIG. 2

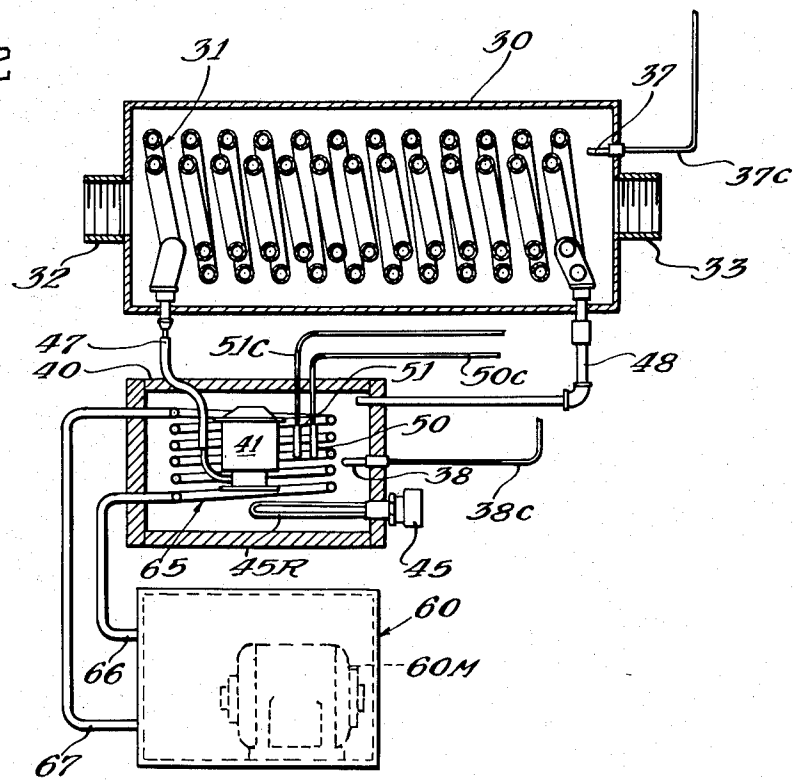
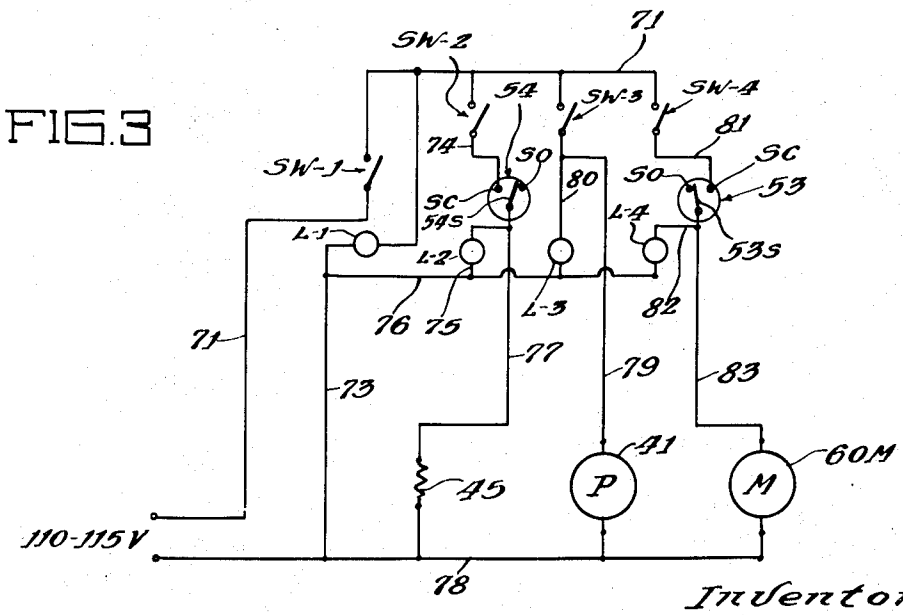


FIG. 3



Inventor:
Samuel M. McKendree
By: Wallace and Cannon
Attorneys

Feb. 7, 1956 S. M. McKENDREE 2,733,587

DRY CLEANING SYSTEMS

Filed Feb. 17, 1953 3 Sheets-Sheet 3

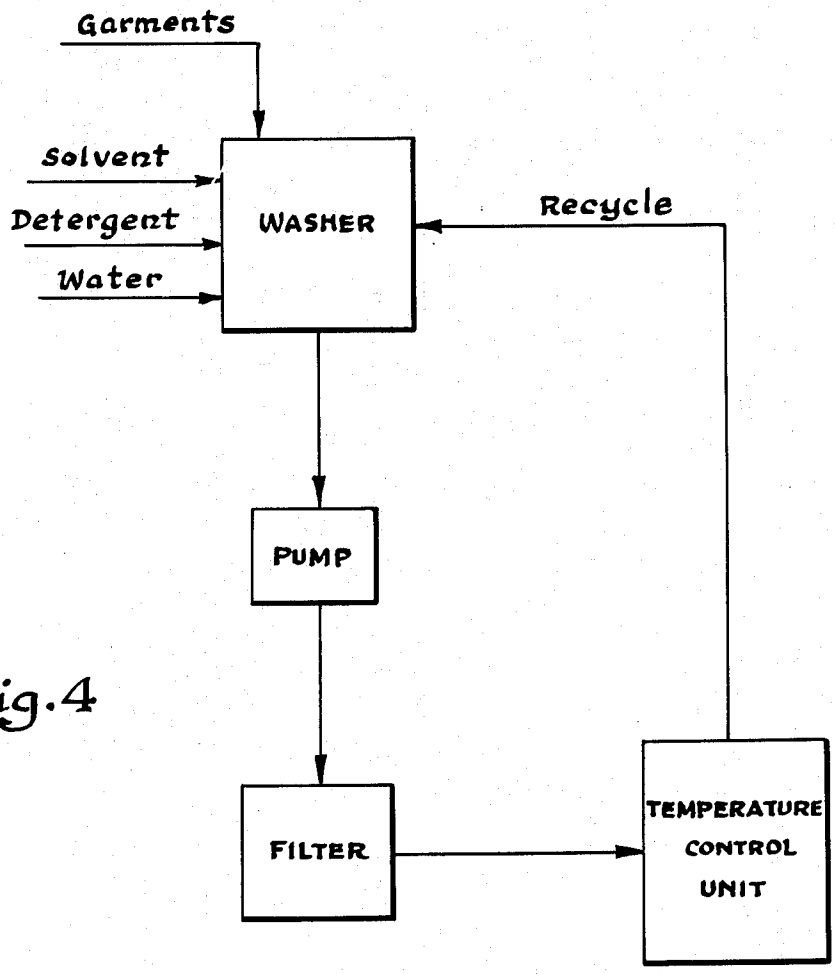


Fig. 4

Inventor
Samuel M. McKendree
By Wallace and Cannon
Attorneys

United States Patent Office 2,733,587 Patented Feb. 7, 1956

2,733,587

DRY CLEANING SYSTEMS

Samuel M. McKendree, Danville, Ill.

Application February 17, 1953, Serial No. 337,267

4 Claims. (Cl. 68—18)

This invention relates to dry cleaning operations and more particularly to an arrangement for a dry cleaning system which permits the temperature of the dry cleaning fluid or solvent in the system to be accurately controlled.

In my application Serial No. 308,555, filed September 9, 1952, there is disclosed a method of dry cleaning in which the temperature of the dry cleaning solution is maintained within a pre-selected range in order that the formation of undesirable viscous emulsions induced by extreme temperature conditions in the dry cleaning solution will be prevented. The present invention is concerned specifically with a mechanical arrangement and automatic control mechanism whereby the method disclosed in the above-identified application may be performed.

Accordingly, it is an object of the present invention to control the temperature of a dry cleaning solution so that the dry cleaning solution is maintained in a condition that does not favor the formation of viscous emulsifications. A related object of the present invention is to afford a control unit and control mechanism for maintaining the temperature of a dry cleaning solution at or near a particular pre-selected temperature.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment of the present invention and the principle thereof and what I now consider to be the best mode in which I have contemplated applying that principle. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a perspective view of a control unit embodying the principles of the present invention;

Fig. 2 is a schematic illustration of a sectional view taken through the lower part of the unit shown in Fig. 1;

Fig. 3 is a wiring diagram illustrating part of the control means embodied in the control unit of the present invention; and

Fig. 4 is a schematic representation of a dry cleaning system utilizing a control unit in accordance with the present invention.

For purposes of disclosure, the present invention is illustrated in Figs. 1 to 4 as embodied in a control unit 20 adapted to be arranged in combination with a conventional dry cleaning system which would ordinarily include a filter and washer Fig. 4, the control unit 20 preferably being arranged between these other two units of the dry cleaning system so that the dry cleaning solution passing into the filter has a controlled temperature. As shown in Fig. 4, the garments to be cleaned are introduced into the washer containing the desired dry cleaning solution. Such solution is pumped from the washer to the filter, then to the control unit 20, and from the control unit 20 is re-cycled back to the washer.

The control unit 20 is contained in a cabinet C which houses and encases the various elements which are necessary for properly controlling the temperature of the dry cleaning solution. The cabinet C is preferably made of ordinary sheet metal panels as 21, and a top panel 22 of like construction serves to support a panel P on which are located certain of the indicating thermometers, pilot lights, control switches, and other measuring and control means to be described below.

As shown in Fig. 2, a relatively large cylindrical tank 30, and constituting a heat exchanger in the present instance as will be apparent from the description to follow, is arranged horizontally inside the housing C toward the back thereof, and this tank is provided with an inlet pipe 32 and an outlet pipe 33 through which the dry cleaning fluid may enter from the washer and pass out to the filter of the dry cleaning system. The washer and filter constitute no part of the present invention and therefore illustration of these units of the conventional dry cleaning system is deemed unnecessary.

The dry cleaning solution represents what may be termed the controlled medium in accordance with conventional terminology, and the temperature of the dry cleaning solution is the variable that is to be controlled under and in accordance with the present invention. To the partial accomplishment of this end, there is arranged below the heat exchanger 30 a rectangular container 40 in which the control agent is adapted to be placed for circulation through the tank 30, and in the present instance the control agent is in the form of a liquid. Thus, by regulating the temperature of the control agent to be above or below that of the cleaning solution, heat can be passed into or taken from the latter in a heat exchange operation to maintain the temperature of the dry cleaning solution at the desired value. The container 40 for the control fluid can be filled through an opening 39F, Fig. 1, at the top of the cabinet C and drained from a tap 39D located on one of the side panels 21. A sight gauge G is also arranged at the side of the cabinet for measuring the liquid level in the container 40.

For regulating the temperature the control agent in one direction, a refrigerating unit 60 of a known type is arranged within the cabinet C, below the container 40 for the control agent, and this refrigerator represents one of the two final control units of the automatic control mechanism. The second final control unit takes the form of an immersion resistance heater 45 of a known type that is arranged in the container 40 in contact with the control fluid therein, and from this it will be recognized that one of the final control units is adapted to cool, and the other to heat, the control agent contained in the container 40. As will be pointed out in more detail below, measuring means are also suspended in the tank 40 in contact with the control agent, and these means are arranged to control actuation of one or the other of the above-identified final control units 45 and 60.

As was noted above, the present invention utilizes a heat exchanger, and as shown in Fig. 2, the heat exchanger 30 embodies a set of heat exchange coils 31 which will normally be immersed in the dry cleaning fluid continually passing into and out of the exchanger 30 through the conduits 32 and 33 during operation of the dry cleaning system. This set of coils 31 is supplied with control fluid from the tank 40 through an inlet pipe 47. The inlet 47 is connected at its other end to an immersion pump 41 of a known type that sets in the tank 40, and this pump is effective, when driven, to force control fluid out through the pipe 47 and along the heat exchanging path defined by the coils 31 in the heat exchanger 30.

An outlet pipe 48 is connected to the coils 31 at the end opposite the inlet pipe 47, and this outlet 48 constitutes a return line for the control fluid back into the tank, as shown in Fig. 2, after the control fluid has performed its heat exchanging work relative to the dry cleaning solution.

The particular fluid that is circulated as a control agent in the coils 31 will be largely a matter of choice. One fluid that I have found to be entirely satisfactory is a mixture of water and one of the well known organic (so-called automotive "anti-freeze") liquids in the proportion of about one gallon of anti-freeze liquid to about four gallons of water. Such organic liquid is non-corrosive and has excellent thermal qualities readily adaptable to the practice of the present invention.

As disclosed in more detail in my aforesaid co-pending application, it is necessary, in order to prevent the formation of emulsions in the dry cleaning solution, to maintain the temperature of the dry cleaning solution within a pre-selected range, around 80° to 90° F. That is, during the hot months of the year, for instance, the dry cleaning solution tends to become over heated, whereas the dry cleaning solution tends toward a colder state in the winter months, and either of these conditions is conducive to the formation of undesirable emulsions in the dry cleaning solution, thereby materially decreasing the efficiency of the dry cleaning operation. To the end that this desired range of temperature can be assured in the dry cleaning liquid, an automatic control mechanism is afforded which, in accordance with the present invention, serves to control the temperature of the fluid control agent and thereby, through the heat exchange coils 31 which transmit the control agent through the heat exchanger 30, that of the cleaning solution. Since it will be readily recognized from the foregoing that it may be necessary either to cool or heat the dry cleaning solution, two separate control loops and necessary measuring means are afforded so that one or the other of the final control units 45 or 60 will be actuated to work on the control agent if a departure from the desired temperature range for the dry cleaning solution is detected.

As shown in Fig. 2, the refrigerating unit 60 which constitutes one of the final control units is arranged below the container 40, and this refrigerating unit comprises a set of refrigerating coils 65 of the usual type arranged inside the tank 40 in contact with the fluid control agent contained therein. The coils 65 are adapted to conduct a refrigerant through the tank 40 in a known manner and thus are connected to entrance and return conduits 66 and 67 which in turn are connected to the storage and compressor elements (not shown) of the refrigerator 60. The particular type of refrigerator which is to be thus arranged with the control unit 20 constitutes no part of the present invention and therefore further description in this regard is believed to be unnecessary.

The refrigerator 60 is mounted in the control unit 20 so that its motor 60M, Fig. 2, can be energized in the event that the temperature of the dry cleaning solution passing through the heat exchange tank 30 is determined as being above the desired value, say above 90° F. Positioned in the tank 40 to be normally immersed in the fluid control agent is the sensing bulb 50, or primary element, of a first control means that includes a thermostat controller 53 mounted on the control panel P as shown in Fig. 1. A capillary tube 50C leads from the bulb 50 into this thermostat controller, and the bulb and tube together are filled with an expandable fluid that is adapted to impinge upon a diaphragm (not shown) of the thermostat 53 to control the opening and closing of a switch 53S. The switch 53S of the thermostat controls the refrigerator motor 60M, being normally located at its open position SO, Fig. 3.

The other final control element, the immersion heater 45, is arranged within control unit 20 so that its resistance elements as 45R are immersed in the tank 40 to heat the fluid control agent when necessary. The heater 45 is also controlled by a thermostat, and to this end another primary element in the form of a bulb 51 is suspended in the tank 40 to also sense the temperature of the control agent. A capillary tube 51C leads from the bulb 51 to another thermostat 54 located on the control panel P, and the temperature responsive fluid in the bulb 51 and its tube 51C impinge on a diaphragm (not shown) of the thermostat 54 to control the opening and closing of its switch 54S. Switch 54S is adapted to control the heater 45 and, as shown in Fig. 3, is also normally open, and when closed completes an electric circuit into the heater 45.

In Fig. 1, there is shown a pair of indicating dial thermometers 35 and 36 located on the panel P between the thermostat controllers 53 and 54, and these thermometers indicate, respectively, the temperature of the dry cleaning solution in the tank 30 and of the fluid control agent in the tank 40. These thermometers are each of the immersion bulb type, and accordingly there is a corresponding bulb 37 and tube 37C, Fig. 2, which connect to the thermometer 35, and a bulb 38 and tube 38C connecting to the thermometer 36. The bulb 37 is immersed in the heat exchanger 30 to measure the temperature of the dry cleaning solution leaving at pipe 33, and bulb 38 is immersed in the container 40 to measure the temperature of the fluid control agent therein.

The present invention utilizes electricity as the power unit for operating each of the control means. Thus, and as shown in Fig. 3, the control unit 20 is to be connected to a 110–115 volt alternating current source through a lead-in conductor wire 71 and a return conductor wire 78. These wires 71 and 78 conduct power either to the immersion heater 45 or to the motor 60M of the refrigerating unit. A manually operated master switch SW–1 is located on the panel P, and this switch must be closed in order to operate any part of the automatic control unit 20. A conductor 73 is connected across the wires 71 and 78, and a pilot lamp L–1 on the panel P is connected in series with the switch SW–1 through the wire 73 so that this lamp is on when switch SW–1 is closed.

The thermostat 53 which is adapted to control the refrigerator motor 60M is also connected across the conductors 71 and 78, and for this purpose a manually controlled switch SW–4 located on panel P is arranged at the end of the lead-in conductor in series with the switch SW–1. The conductor wire 71 terminates at one contact of switch SW–4, and the other contact of this switch is connected to the thermostat 53 through a wire 81 that terminates at the closed contact SC of the thermostat switch 53S. When switches SW–1 and SW–4 are both closed, and when the thermostat switch 53S is at its closed contact SC, it will be seen that motor 60M is energized through a wire 83 that leads from the switch 53S into motor 60M and the return conductor 78 that leads from motor 60M back to the source of power. On the other hand, if any one of these three switches is open, motor 60M cannot be energized and no refrigerant circulates in the coils 65.

A wire 82, connected at one end to wire 83, leads through another pilot lamp L–4 and is connected at its other end to a wire bus 76. The bus 76 connects to the wire 73 for lamp L–1, so that lamp L–4 will indicate when the thermostat 53 is effective to connect the refrigerator motor to the source of power.

Similarly, for the other final control unit, there is located on panel P in association with the thermostat 54 a manual switch SW–2 which, when closed, leads current through a wire 74 to the closed contact SC for the thermostat switch 54S. Switch 54S, like 53S, is normally at its open contact SO. A wire 77 leads from switch 54S through the resistance heater 45 and then to the main return conductor 78. A wire 75, leading through a lamp L–2, is connected at one end to wire 77 and at its other end to the bus 76, and it will be seen from this that lamp L–2 will indicate on panel P when

the thermostat switch 54S is at its closed contact SC to connect the heater 45 to the source of power to heat the control agent.

The pump 41 which is adapted to pump control agent from the container 40 through the coils 31 is controlled by another manual switch SW–3 on the control panel P. Thus, a wire 79 leads from this switch to the pump 41 and then connects on to the main return conductor wire 78, and as shown in Fig. 3, closing of switch SW–3 places the pump 41 in series with the lead-in conductor 71. A wire 80 also leads from switch SW–3, and this wire is connected to a pilot lamp L–3 and then to the wire bus 76. Accordingly, lamp L–3 indicates when pump 41 is effective to pump the fluid control agent from the container 40 through the heat exchange coils 31.

In connection with the wiring diagram of Fig. 3, it will readily be recognized that once the manually controlled switches SW–1, SW–3 and either SW–2 or SW–4 are closed, the automatic control mechanism of the unit 20 is in condition for complete operation. That is, by closing these switches, the pump 41 is operable to pump control fluid through the heat exchanger, and unless the temperature of the cleaning solution is equal to that of the control fluid, the latter will be effective to either pass heat into, or extract heat from, the dry cleaning solution in a heat exchange relation, such of course depending upon which of the switches SW–2 or SW–4 is the one closed.

The thermostat controllers 53 and 54 operate independently of each other in that the controller 53 is adapted for control work during the hot months of the year, when the dry cleaning solution tends to become over-heated, whereas the controller 54 is adapted for control work during the winter months. Therefore, either one or the other of the switches SW–2 or SW–4 will ordinarily be closed during use of the automatic control unit 20 since the final control unit corresponding thereto will not be needed.

Assuming that the unit 20 is in use during the summer months of the year and that the dial thermometer 35 indicates a temperature of the dry cleaning solution in excess of that desired, the thermostat 53 is adjusted manually in a well known manner so that the control switch 53S associated therewith closes and the refrigerator unit 60 thereby energized to circulate refrigerant in a cooling relation through the coils 65. When it is determined that the temperature of the dry cleaning solution has been lowered below a temperature favoring emulsion formation (pump 41 operating of course) the set point of the thermostat is then synchronized by the operator to this temperature and switch 53S will ordinarily open. The pump 41 will continue to circulate control agent through the heat exchange coils 31 to maintain this desired temperature in the dry cleaning solution. However, in the event of a rise in temperature for the cleaning solution, this will be reflected in a rise in temperature of the control agent above the set point of the thermostat 53 and switch 53S will automatically close under the influence of the expandable fluid in the capillary 50 in accordance with known principles. Refrigerant will again flow through the coils 65 until the temperature of the control agent and cleaning solution corresponds to the value of the set point for the thermostat 53 and the switch 53S again opens. In this connection, it should be pointed out that a preferred type of thermostat controller 53 for the refrigerating unit is one in which the set point covers a range of temperature fluctuation. Thus, it will be clear that if the control agent and control medium each have the same initial temperature, any rise in temperature of the latter will also cause the temperature of control agent to rise. Accordingly, the thermostat 53 can be selected so that its switch 53S closes only after the occurrence, say, of a six degree rise in temperature of the control fluid in the tank 40, and this affords a corresponding degree of freedom in the control system.

Control during winter months is similar. In this instance, switch SW–2 for thermostat 54 is closed instead of switch SW–4 so that the heater 45 can be operated when needed. If it is determined that the temperature of the dry cleaning solution is low enough to favor the formation of emulsions in the cleaning solution, the thermostat 54 is manually adjusted so that its switch 54S closes to complete the circuit to the heater 45. When the thermometer 35 indicates that the dry cleaning solution has been heated sufficiently by the circulating control fluid which in turn is being heated by the heater 45, the set point of the thermostat is then synchronized to this temperature by the operator. Again it is preferable that the thermostat 54 be of a type in which the set point is at the end of a range of temperature changes, for instance so that the switch 54S closes only after a three or four degree fall in temperature of the control agent.

Within the foregoing context, it will be appreciated that the terms "synchronized" and "set point" have been used in several senses. For instance, the term "set point" usually indicates a precise value, but since it may be desired to have the switches in the thermostat controllers close only after the temperature rises or falls for more than several degrees in a critical range it will be seen that the term "set point" has also been used to indicate values within such a critical range. Similarly, it may be desirable to anticipate or purposely provide for a lag between the temperature of the control agent and the cleaning solution in which case the set point of the corresponding thermostat will not be precisely the desired temperature value for the cleaning solution but may be above or below the desired value.

The essential consideration under and in accordance with the present invention is that an auotmatic control mechanism be afforded capable of regulating the temperature of the dry cleaning solution, both in summer and winter months, to a value that does not favor emulsification. Thus, final control units may be used other than those which have been specifically described for purposes of disclosure, and of course there are different ways of synchronizing the controllers of these units to the desired temperature for the cleaning solution. The present arrangement, however, constitutes the preferred form, but a somewhat similar arrangement for the desired end would be to locate the measuring means for the final control unit directly in contact with controlled medium.

I claim:

1. In a dry cleaning system utilizing dry cleaning solution and comprising a washer and a filter, an automatic control unit between the washer and the filter for maintaining the dry cleaning solution at a pre-selected temperature comprising, a heat exchanger through which said solution is adapted to pass from the filter to the washer, a container arranged adjacent said heat exchanger for containing a fluid control agent, means to conduct said control agent through said exchanger to thereby control the temperature of said dry cleaning solution, temperature control means including a first final control unit for cooling said control agent, and a second final control unit for heating said control agent in said container therefor, and thermostats each connected to a respective one of said final control units and synchronizable to said preselected temperature value whereby the control agent may be cooled or heated to control the temperature of said dry cleaning solution.

2. In a dry cleaning system utilizing dry cleaning solution and comprising a washer and filter, an automatic control unit between the washer and the filter for maintaining the dry cleaning solution at a pre-selected temperature comprising, a first tank through which said solution is to pass from the filter to the washer, a set of heat exchange coils arranged in said first tank, a second tank adapted to contain a supply of fluid control agent, means to pump said control agent from the second tank through said heat exchange coils and back in to said second tank,

a resistance heater immersed in said second tank and adapted to be connected to a source of electrical power to heat said control agent whereby the latter may heat said dry cleaning solution as it is pumped through said heat exchange coils, a set of refrigerating coils immersed in said second tank, a refrigerator adapted to be energized to pump refrigerant to said refrigerating coils whereby said control agent may be cooled to accordingly cool said dry cleaning solution as the control agent is pumped through said heat exchange coils, and a pair of thermostat controllers each including an element adapted to sense the temperature of the control agent in the container and each being connected, respectively, to said resistance heater and refrigerator, the thermostat controller for the resistance heater having a set point whereat a temperature for the control agent below a pre-selected value is effective to connect said resistance heater to said source of power to heat the control agent, and the controller for the refrigerator having a set point whereat a temperature for the control agent above a pre-selected value is effective to energize said refrigerator to cool the control agent.

3. In a dry cleaning system utilizing dry cleaning solution and comprising a washer and a filter, an automatic control unit between the washer and the filter for maintaining the dry cleaning solution at a pre-selected temperature comprising, a heat exchanger through which said cleaning solution may pass from the filter to the washer, means for conducting a temperature-responsive control agent in the form of a liquid through said heat exchanger to perform heat exchange work in one direction or the other relative to the heat content of said cleaning solution, final control elements including means to heat said control liquid and means to cool said control liquid whereby the temperature of said cleaning solution may be controlled accordingly by the control agent, said final control means acting independently of each other, and a thermostat controller for each of said final control means to actuate one or the other to hold the temperature of said cleaning solution at said pre-selected temperature.

4. In a dry cleaning system utilizing dry cleaning solution and comprising a washer and a filter, an automatic control unit between the washer and the filter for maintaining the dry cleaning solution at a pre-selected temperature comprising, a heat exchanger to hold the temperature of said cleaning solution at the pre-selected value therefor as the solution passes from the filter to the washer, means to conduct a temperature-responsive liquid control agent through the heat exchanger to pass heat in one direction or the other relative to said cleaning solution, and means to control the heat content of the control agent, the last-named means comprising a heating unit to heat the control agent and a cooling unit to cool the control agent to thereby regulate the temperature of the cleaning solution, and thermostat controllers including temperature measuring elements adapted to energize one or the other of said units to hold the temperature of the cleaning solution at said pre-selected value.

References Cited in the file of this patent

UNITED STATES PATENTS

1,896,953	Hassell	Feb. 7, 1933
1,958,791	Kalbfleisch et al.	May 15, 1934
1,985,376	Lindenberger	Dec. 25, 1934
2,114,776	Davis	Apr. 19, 1938
2,142,995	Busi	Jan. 10, 1939
2,316,669	Busi	Apr. 13, 1943
2,343,147	Katsulos	Feb. 29, 1944
2,450,478	Johnson	Oct. 5, 1948
2,519,148	McShea	Aug. 15, 1950
2,555,012	Spofford	May 29, 1951