Dec. 14, 1948. J. J. SKELLY ET AL 2,456,335

DEGREASING

Filed Aug. 20, 1946 3 Sheets-Sheet 1

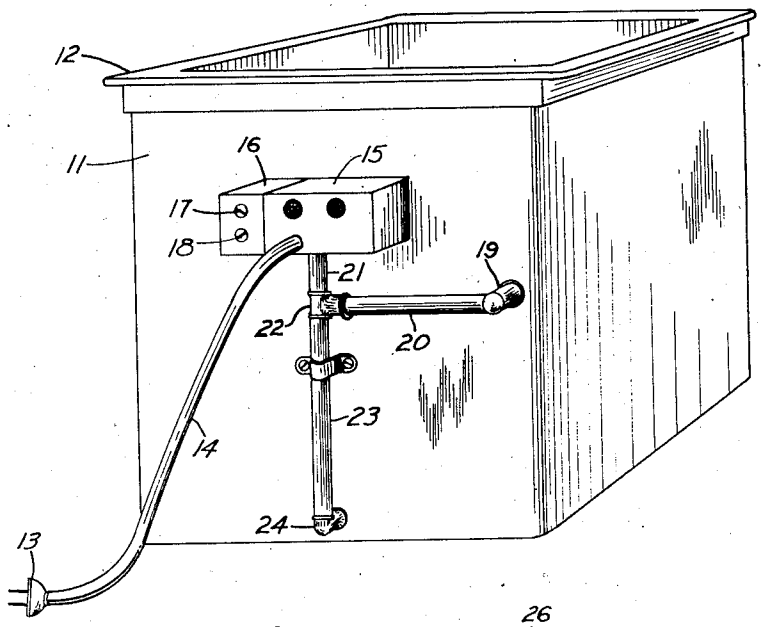


Fig. 1

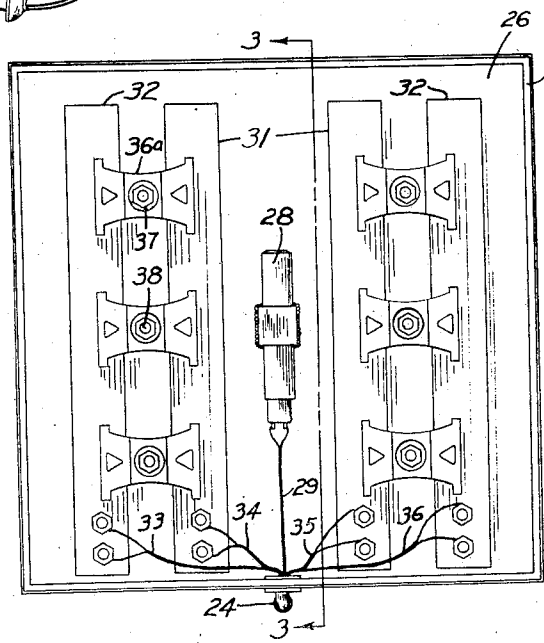


Fig. 2

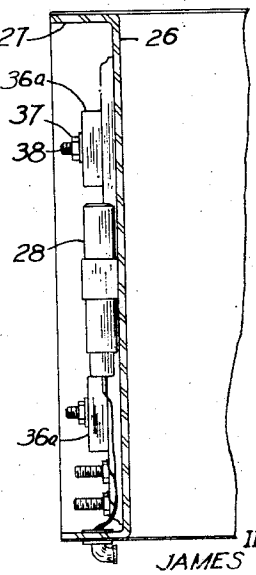


Fig. 3

INVENTORS
JAMES J. SKELLY
& ELDON K. BALSTON
BY
Ridley & Watts
ATTORNEYS

Dec. 14, 1948. J. J. SKELLY ET AL 2,456,335

DEGREASING

Filed Aug. 20, 1946 3 Sheets-Sheet 2

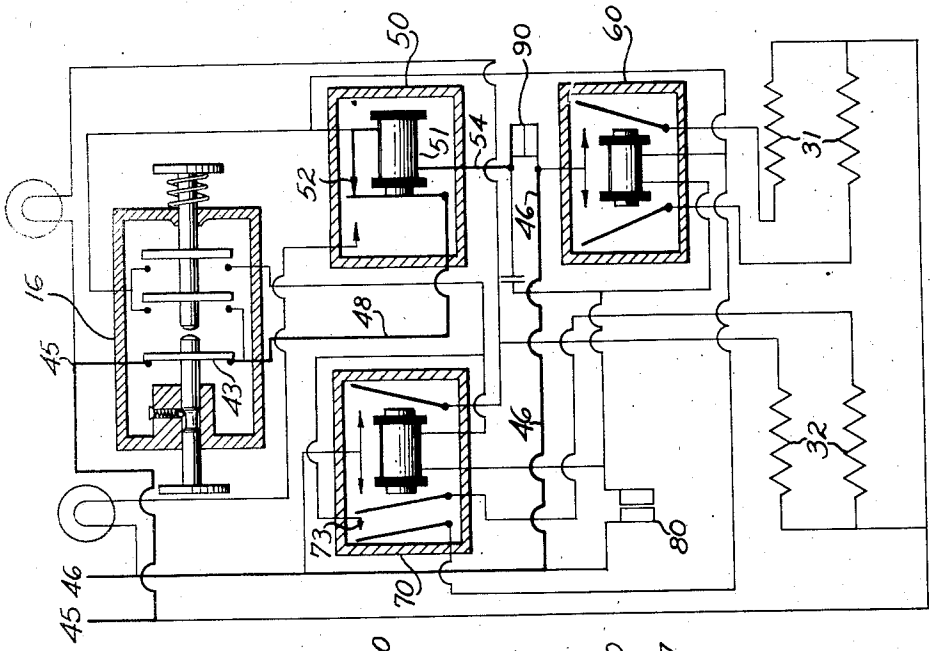


Fig. 5

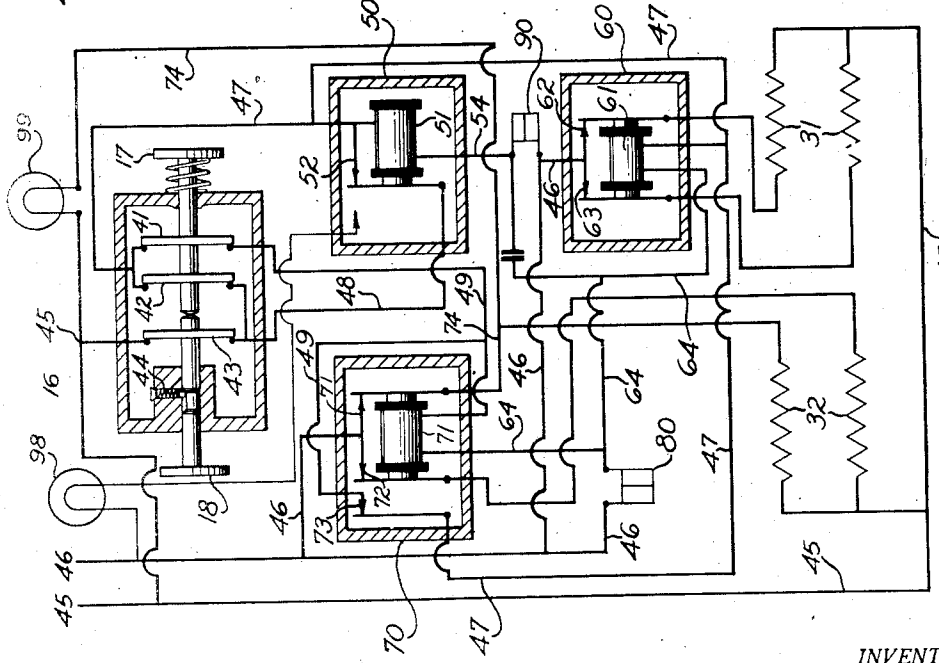


Fig. 4

INVENTORS
JAMES J. SKELLY &
ELDON K. RALSTON

BY Ridley & Watts

ATTORNEYS

Dec. 14, 1948. J. J. SKELLY ET AL 2,456,335

DEGREASING

Filed Aug. 20, 1946 3 Sheets-Sheet 3

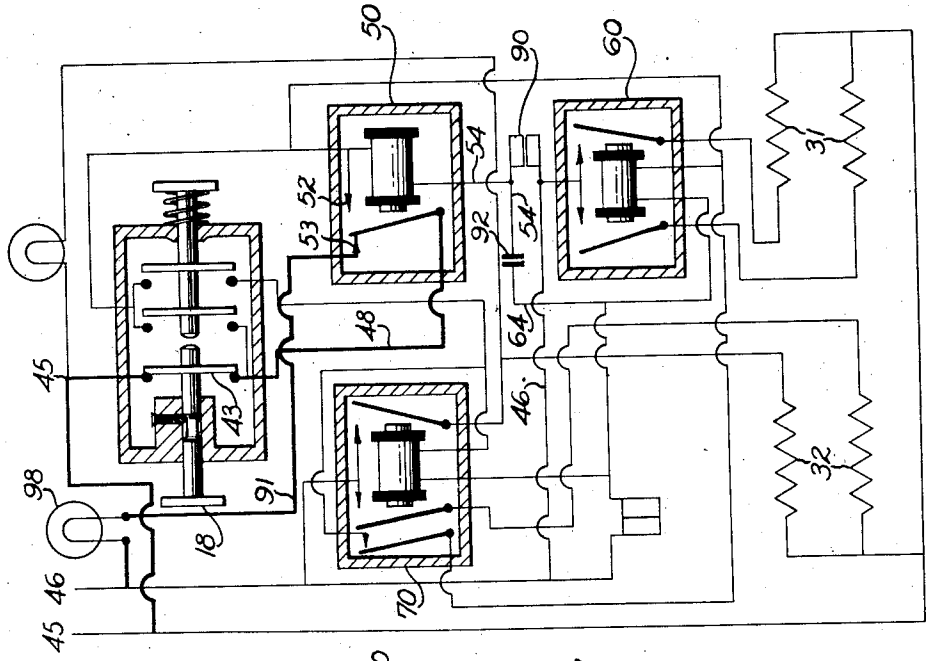


Fig. 7

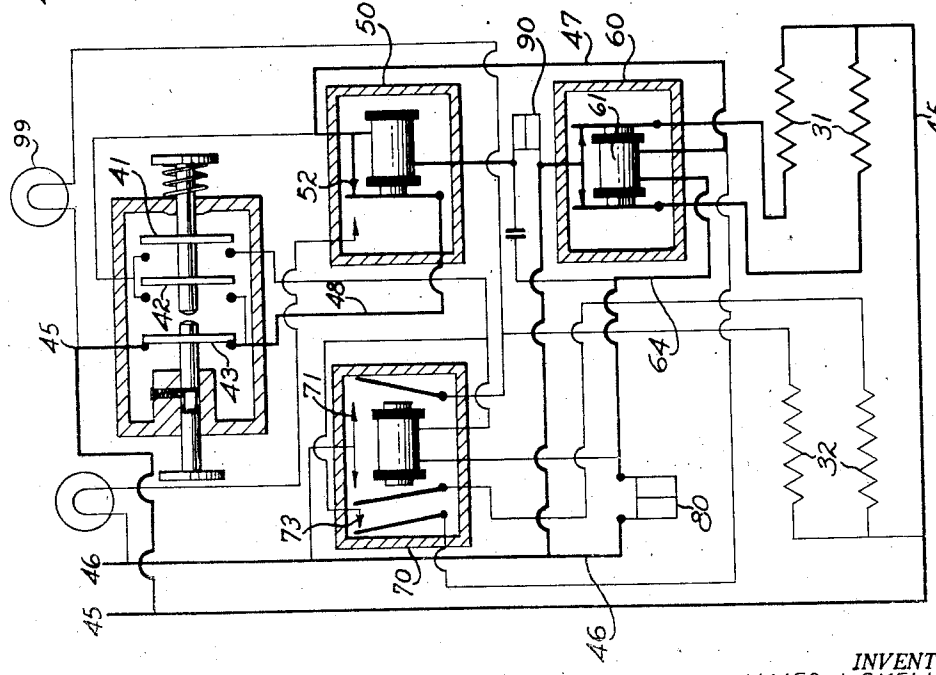


Fig. 6

INVENTOR.
JAMES J. SKELLY &
ELDON K. RALSTON

BY Richey & Watts.

ATTORNEYS

Patented Dec. 14, 1948

2,456,335

UNITED STATES PATENT OFFICE

2,456,335

DEGREASING

James J. Skelly, Cleveland Heights, and Eldon K. Ralston, University Heights, Ohio, assignors to Circo Products Company, Cleveland, Ohio, a corporation of Ohio

Application August 20, 1946, Serial No. 691,686

24 Claims. (Cl. 219—38)

1

This invention relates to degreasing, and more particularly to an improved method of controlling the heat employed in degreasing, and to a novel heat controlling system therefor.

In the customary manner of degreasing, articles to be cleaned are immersed in a body of vaporized solvent, which condenses on the articles and runs off, taking oil, grease, and the like with it. The body of vapor is developed by heating and vaporizing a liquid solvent.

Heat must be supplied at a relatively high rate to develop the body of vapor. To maintain the body of vapor, a relatively small amount of heat is required; and if excessive heat is supplied solvent will be lost. When a work piece is introduced into the vapor, a high rate of heat supply is necessary to prevent undue reduction of the body of vapor by condensation.

The conventional approach to this problem has been to employ a high-capacity heater, which is energized and deenergized in accordance with fluctuations in the volume of the body of vapor to maintain the same approximately constant, insofar as possible.

This prior art method has been carried out by employing degreasing machines comprising a tank having a heater or heaters in the bottom thereof, a vapor chamber in the upper portion of the tank, and a carrier for the support of the work within such chamber.

In degreasers of this character, some types use a thermostat located within the tank to regulate the maximum height to which the solvent vapor can rise. When a degreaser of this type is operating at full capacity of the heaters, the functioning of the thermostat causes the vapor level to fluctuate frequently. Such rapid and frequent changes of vapor height greatly increase the solvent losses from the open top of the tank.

The present invention contemplates, first supplying heat to the solvent continuously at a high rate to develop the body of vapor; second, supplying heat continuously, or substantially so, at a low rate to maintain the vapor body, thus avoiding fluctuations of vapor condition; third, supplying heat continuously at a high rate when an article to be cleaned is introduced into the solvent vapor; and fourth, reducing the rate of heat supply to the low level again when the condensation effect of the article has been overcome.

In order to facilitate the degreasing operation in accordance with the method outlined, this invention also contemplates a novel system of heat control for a degreasing machine which will automatically reduce the heat input after the initial

2

heating-up period, and also after each unit of work has been cleaned.

This invention thus includes an improved organization of heating elements in a degreasing machine and mechanism associated therewith for the automatic control thereof in response to thermal changes in the solvent vapor, the work therein, the liquid solvent mixture, or the environs of the degreasing machine. In detail, the control system performs the following functions: When the machine is idle and all parts thereof cold, the initial operation of the electric system will cause the solvent to be heated at the maximum rate until the correct vapor level is attained, thus conditioning the machine for operation in the shortest practicable time. Thereafter, the electric circuit is automatically readjusted to maintain the machine in a stand-by condition with the vapor level at the requisite point until the work or articles to be cleaned are immersed into the vapor bath.

In the standby condition, certain of the heaters are turned off. The thermal output of the heaters remaining in operation is calculated to offset the heat losses when the vapor reaches a level immediately below the position of the thermostat disposed within the tank. This results in a balanced vapor level having little tendency to fluctuate in height, yet subject to control by the thermostat if conditions such as high room temperature or temporary high voltage should tend to raise the vapor above the desired level.

When articles are suspended in the tank for degreasing, it is only necessary for the operator to press a button to effect capacity operation of the heaters and thus rapidly restore the lowered vapor level resulting from the heat transfer to the relatively cold articles introduced into the degreasing chamber. Upon restoration of the vapor level, the machine reverts to its stand-by condition. A signal light controlled by the system indicates the period during which the heaters are in full operation, thus apprizing the operator when the warming up period of the solvent has been completed and also indicating the completion of the degreasing operation on work in process.

As a safety feature, the control system also incorporates thermostatic means to cut out the heaters when the temperature of the fluid in the tank becomes excessive, which may result from contamination or exhaustion of the solvent. When the heaters are cut out by the safety control, a warning light is turned on.

It will be seen, therefore, that the system re-

sults in substantially automatic operation of the machine. It maintains the vapor at the proper level, safeguards the apparatus against overheating, signals the condition of the machine and indicates the progress of the degreasing operation. By virtue of the control, little attention and expenditure of time on the part of the operator is required, the degreasing is expedited, and the consumption of solvent and electric current is minimized.

An object of the invention is to provide an improved method of degreasing which will minimize loss of solvent and economize on heating energy.

Another object of the invention is to provide a method of degreasing involving improved adaptation of the solvent heating to the requirements of the process.

Another object of the invention is to provide a degreaser which is semi-automatic.

Another object of the invention is to provide a degreaser which incorporates safeguards against overheating.

Another object of the invention is to provide a degreaser which is economical to operate.

A further object of the invention is to provide a degreaser with signalling devices to inform the operator of the condition of the machine.

Other objects and advantages more or less ancillary to the foregoing and the manner in which all the various objects are realized will appear in the following description, which, considered in connection with the accompanying drawings, sets forth the preferred embodiment of the invention, as to method and as to apparatus therefor.

Referring to the drawings:

Fig. 1 is a perspective view of a degreasing machine embodying the invention;

Fig. 2 is a plan view of the lower face of the base of the machine;

Fig. 3 is a transverse section therethrough, the section being taken on a plane indicated by the line 3—3 in Fig. 2; and

Figs. 4, 5, 6, and 7 are wiring diagrams illustrating various stages in the operation of the control system.

The degreasing machine illustrated in Fig. 1 comprises a rectangular tank 11, having the top thereof reinforced by an angle iron 12 and the base inset relative to the bottom edges of the side walls of the tank. Current to the heaters and for the control of the machine is fed from a plug 13 through the conduit 14 to a control box 15 in which are housed the relays and pilot lights. A switch housing 16, mounted adjacent the control box, contains the starting and operating switches for the machine controlled by a "Degrease" button 17 which initiates the operation of the machine and an "Off" button 18 which terminates the operation. A tube 19 mounted in sealed relation with an end wall of the tank intermediate the top and bottom thereof contains a vapor responsive thermostatic switch. The wiring from the switch to the control box is carried by conduits 20 and 21 which are united by a T 22. A conduit 23 coupled with the lower branch of the T and terminating in an elbow 24 passing through the end wall of the tank adjacent the bottom thereof, contains the conduits to the heating elements and the safety thermostat.

The bottom of the tank consists of a plate 26 (Figs. 2 and 3) having down-turned flanges 27 welded to the side walls of the tank. The safety thermostat is mounted in a tube 28 welded to the

bottom plate 26 and is connected by wires 29 to the control box. The heater units comprise two stand-by heaters 31 and two degreasing heaters 32 which incorporate electrical resistance elements and are connected to the control box and power supply by leads 33, 34, 35, and 36. The heaters are mounted upon the bottom of the tank by clamps 36a retained by nuts 37 on studs 38 depending from the plate 26.

The structural details of the push button switch, the thermostats, their encasements, and the heaters form no part of the present invention, and since devices suitable for the contemplated functions may be obtained commercially, they will not be described in detail herein.

The principal elements of the control system of the present invention, as illustrated in Figs. 4 to 7, are the push button station 16, a cutout relay 50, a stand-by relay 60, a degreasing relay 70, a vapor-responsive thermostat switch 80, and the safety thermostat switch 90 mounted in the bottom of the tank. The stand-by heaters 31 are controlled by the relay 60 and the degreasing heaters 32 by the relay 70. The cutout relay 50 interrupts the operation of the heaters when the liquid solvent becomes too hot. A red indicator light 98 signals the operation of the cutout relay, and a green indicator light 99 signals the operation of the degreasing relay and heaters.

The operation of the system will now be described in greater detail with refrence to Fig. 4 which illustrates the condition of the system as its operation is initiated by depression of the "Degrease" button 17. The "Degrease" button closes the contacts 41 and 42, which are normally held open by a spring, and in addition closes the contact 43 associated with the "Off" button 18. The contacts 41 and 42 remain closed only while the button 17 is held depressed, but the contact 43 is retained in its closed position by a ball detent mechanism 44 until opened by depression of the "Off" button 18. On closure of the switch 16, all of the relays are energized and both sets of heaters are turned on. The cutout relay 50 is energized through a circuit from the supply conductor 45 through contacts 43 and 42 in series, the conductor 47, the relay coil 51, conductor 54, and the safety thermostat 90 to the return conductor 46. Relay 50 completes a holding circuit from the supply 45 through contact 43, conductor 48, its forward contact 52, the relay coil 51, conductor 54, and the safety thermostat. The relay 50 will remain energized through this circuit until the "Off" button is pressed or the safety thermostat contacts 90 open.

The stand-by relay 60 is energized by a circuit from the conductor 45 through contacts 43 and 42 in series, the conductor 47, relay coil 61, conductor 64, and vapor thermostat 80 to the return conductor 46. The relay 60 closes its forward contacts 62 and 63, thereby completing parallel circuits from the supply conductor 45 through the stand-by heaters 31 to the return conductor 46. Upon release of the push button 17, the relay 60 is held by a circuit from the supply 45 through contact 43, conductor 48, front contact 52 of the cutout relay and conductor 47.

The degreasing relay 70 is energized by a circuit from supply conductor 45 through contacts 43, 42, and 41 in series, the conductor 49, coil 71 of the relay, conductor 64, and the vapor thermostat 80 to the return conductor 46. When energized, the relay 70 closes its forward contacts 71 and 72 to energize the degreasing heaters 32 through parallel circuits from the supply 45

through a contact 71 or 72 to the return 46. The relay 70 also closes its forward contact 73, completing a holding circuit from the supply 45 through contact 43, conductor 48, contact 52 of the cutout relay, conductor 47, contact 73, conductor 49, relay coil 71, conductor 64, and the vapor thermostat 80. The green pilot light 99 is also energized by the degreasing relay through a circuit comprising conductor 45, conductor 74, and forward contact 71. The pilot light 99 is thus incandescent wherever the degreasing heaters are in operation.

Upon release of the push button 17, contacts 41 and 42 are opened, but do not affect the operation of the apparatus, since the contact 42 is shunted by the forward contact of the cutout relay and the contact 41 is shunted by the forward contact 73 of the degreasing relay. The heating of the solvent continues with all the relays energized, all the heaters in operation, and the green pilot light energized. The operation of the machine may of course be stopped whenever desired by opening contacts 43 by means of the "Off" button 18 deenergizing the entire apparatus.

Normally, however, the condition of the apparatus remains as illustrated in Fig. 4 until the solvent is heated sufficiently for the rising vapor to heat the vapor thermostat 80 and cause it to open its contacts. When this occurs, as illustrated in Fig. 5, the holding circuits of the stand-by re'ay 60 and the degreasing relay 70 are opened at the thermostat contacts 89 and the relay contacts open. The cutout relay 50 remains energized, since its circuit is completed through the safety thermostat 90 rather than the vapor thermostat 80. Deenergization of the relays 60 and 70 interrupts the supply of current to the stand-by heaters 31, the degreasing heaters 32, and the green pilot light 99. Extinction of the light indicates that the machine is ready to receive the work. The holding circuit for the degreasing relay is also opened at its contact 73.

With the heaters off, the solvent will cool, the vapor will begin to condense, the level thereof will be lowered, and the vapor thermostat 80 will close its contacts. When this happens, as illustrated in Fig. 6, the energizing circuit of the stand-by relay is completed from conductor 45 through contact 43, conductor 48, contact 52, conductor 47, relay coil 61, conductor 64, and the thermostat 80 to the return conductor 46, and the stand-by heaters 31 are energized as before. The degreasing relay 70 will not operate since its energizing circuit is open at contacts 42 and 41 and its ho'ding circuit is open at contact 73; therefore, the degreasing heaters 32 remain out of operation. The stand-by heaters are sufficient to maintain the vapor level in the absence of condensation from objects being degreased and serve to maintain the machine in its stand-by condition; that is, with the vapor at the requisite temperature to receive the work. If, because of high atmospheric temperatures or high line voltage, the vapor rises too high in the tank, the thermostat 80 deenergizes the relay 60 and the stand-by heaters are cutout until the vapor level falls. This stand-by condition is maintained until it is desired to perform a degreasing operation.

Whenever the operator desires to degrease an article, he suspends the work in the tank below the vapor level in the usual manner and again presses the "Degrease" button 17, energizing the degreasing re'ay 70. The degreasing relay maintains its holding circuit closed through the forward contact 73 and energizes the degreasing heater 32 to supply additional heat to overcome condensation of the vapor caused by the absorption of heat in the work piece. The relay 70 also energizes the green pilot light 99. When the initial condensation caused by the presence of the objects being degreased has been overcome by the combined effect of both sets of heaters, the vapor thermostat 80 opens its contacts and the machine reverts to the condition illustrated in Fig. 5. Both sets of heaters are deenergized and the green pilot light is extinguished, indicating the completion of the degreasing operation. It will be seen that the only operation the operator is required to perform other than inserting and removing the articles from the tank is to press the "Degrease" button when the machine is first put into operation and when the articles are placed in the tank.

If for any reason the solvent in the tank should become overheated, the safety features of the control system are brought into operation, as illustrated in Fig. 7. Overheating of the fluid causes the safety thermostat contacts 90 to open. The cutout relay 50, which has been held by a circuit from conductor 45 through contact 43, conductor 48, front contact 52, conductor 54, and safety thermostat 90 to conductor 46, is thus deenergized. The holding circuits of the stand-by relay 60 and degreasing relay 70 are opened at contact 52 and therefore the heaters are cut out. Upon deenergization of the cutout relay, its contact 53 c'oses, completing a circuit from conductor 45 through contact 43, conductor 48, contact 53, conductor 91, and the red pilot light 98 to conductor 46. The red pilot light remains energized, indicating to the operator that the circuit has been cut out and requires attention, until the "Off" button 18 is pressed to open contact 43.

A condenser 92 (Fig. 7) is bridged across conductors 54 and 64 to minimize arcing of the contacts of the thermostats when the contacts open.

Although the foregoing description is necessarily of a detailed character, in order that the invention may be completely set forth, it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of parts and modifications of detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

For example, instead of two separate heaters, a single heater operable at two different energy levels may be employed. Electric heaters connectable in either series or parallel relation may be used. Also, other heating mediums than electric heaters, such as gas flames and steam coils may be employed by installation of valves therefor controlled by relays as shown herein, or equivalent control devices, as will be obvious to those skilled in the art.

We claim:

1. A degreaser comprising a tank for containing a solvent, a stand-by heater, a degreasing heater, a thermostat affected by solvent vapor, means for initiating operation of both heaters, lockout means controlled by the thermostat for terminating operation of the degreasing heater, means for deenergizing the heaters, and means controlled by the thermostat for regulating the operation of the stand-by heater until the deenergizing means is operated.

2. A degreaser comprising a tank for containing a solvent, a stand-by heater, a degreasing heater, a thermostat affected by solvent vapor,

means for initiating operation of both heaters, lockout means controlled by the thermostat for terminating operation of the degreasing heater upon generation of a predetermined quantity of vapor, means for deenergizing the heaters, and means controlled by the thermostat for regulating the operation of the stand-by heater to maintain the quantity of vapor at the predetermined value, until the deenergizing means is operated.

3. A degreaser comprising a tank for containing a solvent, a stand-by heater, a degreasing heater, a thermostat affected by solvent vapor, means for initiating operation of both heaters, lockout means controlled by the thermostat for terminating operation of the degreasing heater, means for indicating operation of the degreasing heater, means for deenergizing the heaters, and means controlled by the thermostat for regulating the operation of the stand-by heater, until the deenergizing means is operated.

4. A degreaser comprising a tank for containing a solvent, a first heater, a second heater, a thermostat responsive to the solvent vapor, a first relay for energizing the first heater, a second relay for energizing the second heater, a switch having a holding contact and a normally open contact, an energizing circuit for the first relay including the holding contact and the thermostat, a first energizing circuit for the second relay including the normally open contact and the thermostat, and a second energizing circuit for the second relay including the holding contact, a front contact of the second relay, and the thermostat, whereby both heaters are energized when the switch is operated, the second heater is cut out when the thermostat operates and remains cut out, and the first heater is operated intermittently under control of the thermostat.

5. A degreaser comprising a tank for containing a solvent, a first heater, a second heater, a thermostat responsive to the solvent vapor, a first relay for energizing the first heater, a second relay for energizing the second heater, switch means including a first contact retained in either open or closed position and a second contact retained only in open position, an energizing circuit for the first relay including the first contact and the thermostat, a first energizing circuit for the second relay including the second contact and the thermostat, and a second energizing circuit for the second relay including the first contact, a front contact of the second relay, and the thermostat, whereby both heaters are energized when the switch is closed, the second heater is cut out when the thermostat operates and remains cut out, and the first heater is operated intermittently under control of the thermostat until the switch is opened.

6. A degreaser comprising a tank adapted to contain a solvent, a first heater, a second heater, manually actuatable means for initiating operation of both heaters, a thermal control device exposed to vapor rising from the solvent, lockout means responsive to the thermal control device for terminating operation of the second heater, and means responsive to the thermal control device to regulate the operation of the first heater.

7. A degreaser comprising a tank adapted to contain a solvent, a first heater, a second heater, manually actuatable means for initiating operation of both heaters, a thermal control device exposed to vapor rising from the solvent, lockout means responsive to the thermal control device for terminating operation of the second heater, means responsive to the thermal control device to regulate the operation of the first heater, a temperature-responsive means exposed to the liquid solvent, and lockout means controlled by the temperature-responsive means for terminating operation of both heaters.

8. A degreaser comprising a tank adapted to contain a solvent, a first heater, a second heater, manually actuatable means for initiating operation of both heaters, a thermal control device exposed to vapor rising from the solvent, lockout means responsive to the thermal control device for terminating operation of the second heater upon generation of a predetermined quantity of vapor, means responsive to the thermal control device to regulate the operation of the first heater to maintain the quantity of vapor, a temperature-responsive means exposed to the liquid solvent, and lockout means controlled by the temperature-responsive means for terminating operation of both heaters when the solvent temperature rises above a predetermined point.

9. A degreaser comprising a tank adapted to contain a solvent, a first heater, a second heater, manually actuatable means for initiating operation of both heaters, a thermal control device exposed to vapor rising from the solvent, lockout means responsive to the thermal control device for terminating operation of the second heater, means for indicating operation of the second heater, means responsive to the thermal control device to regulate the operation of the first heater, a temperature-responsive means exposed to the liquid solvent, lockout means controlled by the temperature-responsive means for ending operation of both heaters, and means for indicating the operation of the ending means.

10. A degreaser comprising a tank for containing a solvent, a first heater, a second heater, temperature-responsive means exposed to the solvent, temperature-responsive means exposed to the vapor rising from the solvent, a manual power control, a first control device for the first heater, a second control device for the second heater, means responsive to operation of the manual control for initiating operation of the control devices, means responsive to operation of the control devices for maintaining operation of the heaters, lockout means controlled by the vapor-responsive means for terminating operation of the second control device and heater, means controlled by the vapor-responsive means for regulating operation of the first control device and heater, and means controlled by the solvent-responsive means for terminating operation of both control devices and both heaters.

11. A degreaser comprising a tank for containing a solvent, a first heater, a second heater, temperature-responsive means exposed to the solvent, temperature-responsive means exposed to the vapor rising from the solvent, a manual power control, a maintaining device, a first control device for the first heater, and a second control device for the second heater, means responsive to operation of the manual control for initiating operation of the maintaining device, means responsive to operation of the maintaining device for maintaining operation of the control devices for causing operation of the heaters, means controlled by the vapor-responsive means for terminating operation of the second control device and second heater, means controlled by the vapor-responsive means for regulating operation of the first control device and first heater, and means controlled by the solvent-responsive means for terminating operation of the maintaining de-

vice and thereby both control devices and both heaters.

12. A degreaser comprising a tank adapted to contain a solvent, a first heater, a second heater, a control device responsive to the level of vapor rising from the solvent, lockout means actuated by the control device for terminating the operation of the second heater when the vapor rises to the desired level, means actuated by the control device for interrupting the operation of the first heater when the vapor rises to the desired level, the last-named means being adapted to reinstate the operation of the first heater whenever the vapor falls below the desired level, lockout means responsive to the temperature of the liquid solvent for terminating operation of both heaters when the solvent temperature rises above a predetermined value, means for indicating operation of the second heater, and means for indicating operation of the solvent-temperature-responsive means.

13. A degreaser comprising a tank adapted to contain a solvent, a first heater, a second heater, a manual control switch, a first relay for energizing the first heater, a second relay for energizing the second heater, means responsive to operation of the switch for making and breaking an energizing circuit for the relays, means responsive to operation of the switch for maintaining a holding potential for the relays, a holding circuit for the first relay, a holding circuit for the second relay maintained through a front contact of the second relay, and means responsive to rise of solvent vapor to the desired level for breaking the holding circuits of the first and second relays.

14. A degreaser comprising a tank adapted to contain a solvent, a first heater, a second heater, a manual control switch, a first relay for energizing the first heater, a second relay for energizing the second heater, a cutout relay, means responsive to operation of the switch for making and breaking an energizing circuit for the relays, means responsive to operation of the switch for maintaining a holding potential for the relays, a holding circuit for the cutout relay maintained through a front contact thereof, a holding circuit for the first relay maintained through a front contact of the cutout relay, a holding circuit for the second relay maintained through a front contact of the cutout relay and a front contact of the second relay, means responsive to rise of solvent vapor to the desired level for breaking the holding circuits of the first and second relays, and means responsive to rise of the solvent temperature to a predetermined level for breaking the holding circuit of the cutout relay.

15. A degreaser comprising a tank adapted to contain a solvent, a first heater, a second heater, a manual control switch, a first thermostat responsive to rise of vapor, a second thermostat responsive to solvent temperature, a first relay for energizing the first heater, a second relay for energizing the second heater, a cutout relay, means responsive to operation of the switch for making and breaking an energizing circuit for the relays, means responsive to operation of the switch for maintaining a holding potential for the relays, a holding circuit for the cutout relay maintained through a front contact thereof and the second thermostat, a holding circuit for the first relay maintained through a front contact of the cutout relay and the first thermostat, and a holding circuit for the second relay maintained through a front contact of the cutout relay, a front contact of the second relay, and the first thermostat, whereby rise of vapor to the desired level interrupts operation of the first heater and terminates operation of the second heater, and rise of solvent temperature to a predetermined level terminates operation of both heaters.

16. A degreaser comprising a tank adapted to contain a solvent, a heater operable at a stand-by energy level adapted to maintain vapor at a normal level in the tank, and operable at a higher energy level for rapid evolution of vapor, manual means for energizing the heater at the higher energy level, and means responsive to vapor rising in the tank to terminate operation of the heater at the higher energy level until further operation of the manual means and initiate operation at the stand-by energy level.

17. A degreaser comprising a tank adapted to contain a solvent, a heater operable at a stand-by energy level adapted to maintain vapor at a normal level in the tank, and operable at a higher energy level for rapid evolution of vapor, manual means for energizing the heater at the higher energy level, and means responsive to vapor rising in the tank to initiate operation of the heater at the stand-by energy level and maintain operation at this level until further operation of the manual means.

18. A degreaser comprising a tank adapted to contain a solvent, a heater operable at a stand-by energy level adapted to maintain vapor at a normal level in the tank, and operable at a higher energy level for rapid evolution of vapor, manual means for energizing the heater at the higher energy level, and means responsive to vapor rising in the tank to terminate operation of the heater at the higher energy level, the last-named means comprising a relay initially energized by the manual means and thereafter maintained energized by a circuit through a front contact of the relay and a thermostatic switch opened by rising vapor.

19. A degreaser comprising a tank adapted to contain a solvent, a heater operable at a stand-by energy level adapted to maintain vapor at a normal level in the tank, and operable at a higher energy level for rapid evolution of vapor, manual means for energizing and deenergizing the heater, the initial energization being at the higher energy level, means responsive to vapor rising in the tank to terminate operation of the heater at the higher energy level until further actuation of the manual means, and means responsive to vapor rising in the tank to interrupt temporarily operation of the heater at the stand-by level when an excess of generated vapor is present.

20. A degreaser comprising a tank adapted to contain a solvent, a heater operable at a stand-by energy level adapted to maintain vapor at a normal level in the tank, and operable at a higher energy level for rapid evolution of vapor, manual means for energizing and deenergizing the heater, the initial energization being at the higher energy level, means responsive to vapor rising in the tank to terminate operation of the heater at the higher energy level until further actuation of the manual means, and means responsive to excessive temperature of the liquid solvent to terminate all operation of the heater.

21. A degreaser comprising a tank adapted to contain a solvent, a heating element therein having a variable heat output, a manually operated device for initiating high thermal output of said heating element, a thermal control device exposed to the vapor rising from the solvent, lockout means responsive to the thermal control device for

terminating operation at the high thermal output of the heating element, and means responsive to the thermal control device for regulating the operation of the heating element at a low thermal output.

22. In combination, a tank for containing a vaporizable fluid, a first heater, a second heater, a thermostat affected by the vapor of the fluid, means for initiating operation of both heaters, lockout means controlled by the thermostat for terminating operation of the second heater, means for deenergizing the heaters, and means controlled by the thermostat for regulating the operation of the first heater until the deenergizing means is operated.

23. A degreaser comprising a tank adapted to contain a solvent, a first heater sufficient to maintain the desired solvent vapor level when the degreaser is idle, a second heater to increase the heating rate to counteract condensation upon a workpiece suspended in the vapor, a control device responsive to the level of vapor rising from the solvent, means actuated by the control device for terminating the operation of the second heater when the vapor rises to the desired level, and means actuated by the control device for temporarily interrupting the operation of the first heater when the vapor rises to the desired level, the last-named means being adapted to reinstate the operation of the first heater whenever the vapor falls below the desired level.

24. A degreaser comprising a tank adapted to contain a solvent, a first heater sufficient to maintain the desired solvent vapor level when the degreaser is idle, a second heater, manually actuatable means for initiating the operation of both heaters, a control device responsive to the level of vapor rising from the solvent, means actuated by the control device for terminating the operation of the second heater when the vapor rises to the desired level, means actuated by the control device for interrupting the operation of the first heater when the vapor rises to the desired level, the last-named means being adapted to reinstate the operation of the first heater whenever the vapor falls below the desired level, means responsive to the temperature of the liquid solvent for terminating the operation of both heaters when the solvent temperature rises above a predetermined value, and a manually actuatable means for terminating operation of the heaters.

JAMES J. SKELLY.
ELDON K. RALSTON.

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