

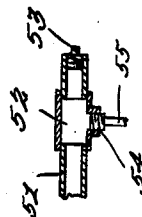
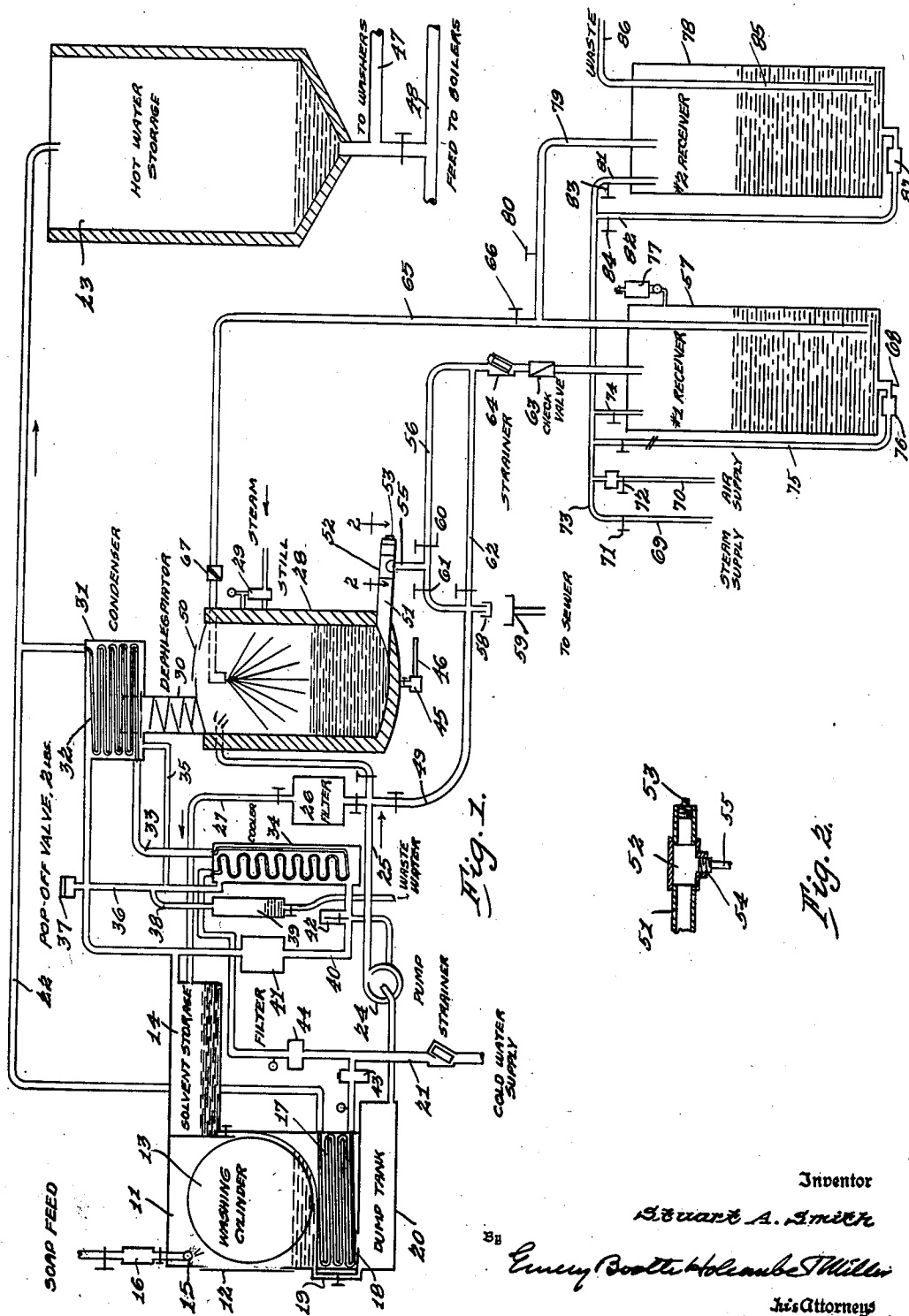
Jan. 20, 1942.

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2,270,609

LIQUID SOLVENT CLEANING SYSTEM

Filed March 27, 1939



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UNITED STATES PATENT OFFICE

2,270,609

LIQUID SOLVENT CLEANING SYSTEM

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Application March 27, 1939, Serial No. 264,426

2 Claims. (Cl. 202-163)

This invention relates to dry cleaning machines and systems such as are used in laundries and establishments for cleaning garments utilizing solvents other than water, and aims to improve the operation of such systems and reduce the cost of maintenance of such machines, to protect the health of the attendants from noxious vapors, to conserve the solvent and to keep it free from acidity, and to eliminate dirt and other conditions likely to produce spots on the garments.

In the operation of a dry cleaning machine utilizing so-called "dry cleaning" fluids, including carbon tetrachloride, trichlor ethylene and perchlor ethylene, naphtha, and other commonly used solvents, not only is the cost of make-up fluid due to leakage and wastage a considerable item of expense, but difficulties in maintaining the solvents clean at all times also interfere with economical operation, causing spotting of the garments and loss of time in shut downs for cleaning the filter and still with which such machines are provided for separating the grease and dirt from the used solvent and soap solution and clarifying the solvent to enable it to be used over.

Heretofore it has been customary to operate the solvent recovery still at not in excess of 20° F. above the boiling point of the solvent used in order to avoid developing acidity in the solvent and forming hard deposits of greasy solid material on its interior and on the heating coils or walls and thereby interfering with the operation of the still; but unless great care is taken to keep the apparatus clean, the unavoidable formation of scale on the heating coils so reduces the evaporating capacity of the still that steam pressure of 45 pounds or greater must be used to operate under normal full load conditions, with correspondingly high temperatures in the still, producing an acid condition in the solvent and increasing the formation of scale, and resulting in shut downs or in recycling a part of the solvent without clarifying it, because the cost of the solvent is too high to permit throwing it away after it has been discharged from the washing vat.

My invention comprises means for periodically drawing off the dirt and heavy materials deposited in the still, and for enabling it to be thoroughly cleaned at suitable intervals. The invention also comprises means for saving and utilizing the heated water which flows through the cooling and condensing coils and still jacket.

One of the objects of the invention is to save

the liquid contents of the still for recovery of the solvent therefrom, and for discarding the solid materials in a form in which they are easily disposed of without getting on the machine and its surroundings or soiling the attendants' hands and clothing which is important in a cleaning establishment. A further object is to provide for operating the machine so as to reduce the amount of cleaning required to the extent that a mere wiping out periodically will suffice to prevent scale from forming in the still.

Other objects and advantages of the invention will appear in connection with the following description of a typical form of apparatus, illustrating the invention as applied to a well known dry cleaning machine, as shown in the accompanying drawing.

Referring to the drawing,

Fig. 1 is a diagrammatic view of the principal operating parts of the machine, showing the pipes and valves connecting the several parts through which the cleaning solution and vaporized solvent are caused to circulate, together with the storage tanks and parts associated therewith for holding the unclarified solvent mixture left at the end of the working period;

Fig. 2 is an axial cross-section on the line 2-2 in Fig. 1, showing the trap in the draw off pipe from the still to the sump and settler.

The dry cleaning apparatus or system illustrated comprises a closed washing chamber 11, adapted to be sealed by a door 12 when in operation, within which is the oscillating drum 13 which receives the clothes. A storage tank 14 is provided for the solvent detergent mixture, usually consisting of a suitable volatile solvent to which there may be added a soluble soap, preferably supplied through a horizontal distributor pipe 15 provided with a plurality of needle spray orifices to insure uniform distribution into the working cylinder. An automatic metering valve 16 is provided in the soap supply line for measuring the supply and for preventing the back flow of the solvent vapor which is produced during each cleaning operation.

Automatic means (not shown) are provided for oscillating the washing cylinders, and for circulating air through the washing chamber for drying the garments at the end of each washing cycle, as is usual in machines of this kind, and a water cooled coil 17 in a chamber 18 in the lower part of the washing chamber through which the vaporized solvent and air are caused to flow serves to condense and re-

cover a large part of the vaporized solvent and reduce the loss into the atmosphere following each washing. A valved pipe 19 leading from the bottom of the washing chamber to a dump tank 20 provides means for emptying the washing cylinder and chamber of dirty solvent and soap solution periodically. The condensed solvent in the chamber 18 also drains into this dump tank. Cooling water is supplied through a pipe 21, provided with suitable reducing valves and gauges for adjusting the flow to suit seasonal needs and variations in the temperature of the natural water supply, and the warm waste water is carried away through a pipe 22 into a hot water storage tank 23.

The contents of the dump tank are forced by pump 24 through a pipe 25, filter 26 and pipe 27 back into the solvent storage tank 14, until the solvent becomes contaminated with dirt, soap and grease, whereupon it may be pumped into the steam jacketed clarifying still 28, heated by steam from a suitable boiler (not shown) to a temperature of about 265° F. in systems employing perchlorethylene as the solvent. An automatic shut off valve 29 in the steam supply closes upon the steam pressure reaching 45 pounds, or whatever pressure corresponds to the maximum temperature desired in the still. The vaporized solvent passes through a dephlegmator 30 into a condenser 31 cooled by a water coil 32 supplied from the water supply 21 by a pipe 33 which passes through a solvent cooler 34 before reaching the condenser. The coil 32 connects with the pipe 22 which discharges into the hot water storage tank 23. The condensed solvent flows out of the bottom of the condenser through a pipe 35 which leads into a vertical gravity separator pipe 36 which empties at its lower end into the cooler 34, and at the upper end of which is a pop off valve 37. From the separator pipe, at a point above the discharge end of the pipe 35 but not higher than the bottom of the condenser 31, there branches off a water discharge pipe 38 which empties into a trap 39 provided with a valved outlet at its lower end from which the trapped water can be withdrawn periodically.

The cooled solvent is conducted from the cooler through a pipe 40 and filter or fine strainer 41 to the solvent storage chamber 14, into the top of which it discharges by gravity, the level of the discharge opening being lower than the bottom of the condenser 31, and also lower than the point of connection of the water discharge pipe 38 to the vertical separator pipe 36. A clean out valve 42 is provided for drawing off the solvent liquid from the filter 41 and cooler 34 and pipe lines between the condenser and solvent storage tank when it is desired to clean the filter. The valve 42 discharges into the pump 24 or pipe leading to the pump to permit the solvent drawn off to be returned to the solvent storage tank or to the still.

Suitable control valves 43, 44 are provided for admitting the proper amounts of water to the coil 17 and cooler 34 to keep these units and the condenser 31 at the desired temperatures while the machine is operating. An automatic drip valve 45 is provided at the bottom of the still heating jacket and a pipe 46 conducts the condensed steam to the boiler feed water return system. From the hot water storage tank suitable pipes 47, 48 lead to the laundry wheels and to the boiler feed water line.

The apparatus as described above is completely automatic with the exception of opening the

chamber 11 to introduce and remove the garments operated upon, the only attention required being to start the machine, to withdraw the solvent and clean the still bottom when dirty, and to draw off condensed water from the separator trap 39 periodically, as in well known dry cleaning machines now in use, for example, that described in Davis Patent No. 2,114,776, granted April 19, 1938, to The Prosperity Company, Inc.

In the operation of the apparatus, deposits of dirt, grease and unvaporized oily substances accumulate in the filter 26 and still 28 in the course of repeated washings, and heretofore the removal of these accumulations periodically has been a difficult problem because of their semi-solid consistency and penetrating oily character, smearing everything with which they come in contact, so that special precautions on the part of the attendants are required to avoid soiling the garments which must be handled by them in such establishments and to avoid endangering their health whenever the still has to be opened.

My invention comprises means for cleaning the filter and still periodically, preferably after the close of the day or working period, and for removing and clarifying the liquid contents thereof before reusing the solvent. The filter may be emptied through a pipe 49, normally closed by a valve. The still has a manhole 50 in its top, and a laterally extending bottom clean out pipe 51 of sufficient size to enable it to be swabbed out from end to end. A 3" pipe is about the right size, and this pipe is provided with a T fitting 52 near its outer end, which is closed by a plug 53 (see Fig. 2), the stem of the T being at right angles to the axis of the pipe and partly closed by a thimble or bushing 54 into which a smaller pipe 55 is tightly screwed. This T is adjusted at such an angle that the branch pipe 55 has a slight slope downwards from the side of the clean out pipe 51, but as the smaller pipe opens from the middle of the side wall of the larger one, not all of the liquid in the latter can escape through the branch pipe 55 when the latter is open to drain the still. The amount of residue left in the clean out pipe may be controlled to a desired degree by adjusting the angular position of the T with a Stillson wrench.

The branch pipe 55 discharges into a distributor pipe 56, one end of which leads to a receiver tank 57 and the other connects with the drain pipe 49 from the filter 26 and is closed by a cap 58 which may be removed to discharge into an open sump 59 having connection to the sewer. Valves 60, 61 are provided to close one or the other of the two lines leading from the branch pipe 55. A drain pipe 62, also normally closed by a valve, is provided to drain the pipe 49 and connecting end of the pipe 56 into the receptacle 57. A check valve 63 and strainer 64 are located in the pipe 56 near the end which discharges into the receiver tank. A return pipe 65, which extends into the receiver tank 57 nearly to its bottom, connects the latter with the still 28, and is provided with a valve 66 and check valve 67 for controlling the flow from the receiver tank back into the still.

The receiver tank 57 is fitted with a bottom connection 68, through which steam or air may be admitted for stirring up its contents from the steam and air supply pipes 69, 70 respectively. Either or both supply pipes may be connected through suitable shut off valves 71, 72 to a mani-

fold pipe 73, having valved branches 74, 75 leading to the top and bottom, respectively, of the receiver tank, the bottom branch connection being fitted with a check valve 76.

An automatic air valve and sight gauge 77 is fitted to the receiver 57 near its top to permit escape of air not under pressure from the receiver and to cut off the escape of air upon a substantial increase in the pressure. This valve has a glass body to serve as a sight gauge or visual indicator when the receiver is full. The air vent in this valve is so small as to restrict the flow from the still through the clean out pipe 51 and connecting pipes leading to the receiver sufficiently to prevent any solid matter from being carried out through the branch pipe 55, causing it to be trapped in the clean out pipe.

A second receiver tank 78, similar in all respects to the first receiver, may be provided to supplement the storage capacity of the latter and to enable accumulations of heavy residues to be kept until they can be redistilled or otherwise disposed of conveniently. This second receiver is provided with a filling pipe 79 emptying into its top, connecting with the pipe 65 and closed by a valve 80, and with air and steam connections 81, 82 leading to its top and bottom from the manifold 73, controlled by valves 83, 84, respectively. A discharge pipe 85 extending down through its top nearly to its bottom and connecting at the other end with a waste pipe 86 is also provided. A check valve 87, similar to the check valve 76, is provided in the pipe 82 near the bottom of the tank 78.

In the operation of the apparatus at the close of a working period, after the pressure in the system falls to atmospheric pressure, the valve 60 is opened to permit the contents of the still to escape into the first receiver, and the air vent in the valve 77 being very small, this will take considerable time, notwithstanding that the still is quite hot, and the solid material will be left trapped in the bottom of the still and in the pipe 51. After the still has cooled, the attendant opens the manhole 50 and swabs the residue which has dried on its bottom into and through the clean out pipe, together with the partly dried contents of the latter, the plug 53 first being removed for this purpose and a suitable receptacle placed at the open end to receive the swabbings. A corrugated cardboard container is entirely satisfactory for this purpose, as the swabbings and cleaning rags, cotton lint, or other textile material used for cleaning the still may be readily discharged through the pipe 51 into such a receptacle by means of a wire hook. The receptacle may be thrown into a waste barrel or burned without danger of getting any dirt on the apparatus or attendants' hands or clothing from the solid partly caked contents.

The receiver 57 has sufficient capacity to hold the drainings from the still for several weeks' operation. When it is full, the solvent mixture in the receiver, which has stood long enough for any fine solid material in suspension therein to settle out, may be forced back into the still through the pipe 65 by admitting air pressure to the top of the tank and redistilled to recover the solvent, and the fluid matter remaining in the bottom of the still is drawn off into the receiver 57. At the end of each six or twelve months or other convenient period, the solid matter in the bottom of the receiver may be stirred

up with live steam and together with a small volume of solvent may be transferred to the second receiver through the pipes 65 and 79 by means of air pressure supplied through the pipe 74. Thereupon the first receiver may be cleaned with live steam, which may be evacuated through the pipe 65, still and drain pipe 51 to the sewer connection 59. After a sufficient volume of waste material has accumulated in the second receiver 78, the liquid portion may be driven off through the waste pipe 85, and the heavy sediment at the bottom may be stirred up by means of live steam introduced through the pipe 82 leading to its bottom and also drawn off and discarded.

The deposit in the bottom of either receiver tank may be readily loosened up by air or live steam, preferably introduced through the bottom outlet, and the mixture of condensed steam and solid matter may be driven off by air or steam pressure admitted to the top, as frequently as may be necessary, but once in six months is sufficient if the tank 78 is of adequate size.

In stills of the so-called closed type, which frequently are fitted with interior heating coils in addition to the water jacket and which cannot be swabbed out effectively, a blow down pipe may be provided for blowing water and steam into the interior of the still and between the heating coils to clean them after the contents have been drawn off as described above. Following the cleaning down operation, the water and dirt in the bottom of the still may be blown out through the bottom of the still and sewer connection outlet 58 with live steam.

In the operation of vacuum stills, the vacuum maintained during the operation of the still is sufficient to draw back the solvent from the storage receptacle, and if not, mechanical pumps may be used in place of air pressure to prevent air from getting into the system.

The advantages of my improved system and apparatus include savings in operating costs by preventing waste of the solvent used and by saving the hot water produced in the operation of the process, and preventing of breakdowns and tie-ups from operating the still at too high a temperature, besides a much greater ease of operation and increased cleanliness of the apparatus and premises and lessened likelihood of spoiling the work in process.

I claim the following as my invention:

1. A clarifying means for closed liquid solvent cleaning systems, said means including a still having a bottom outlet, a closed receptacle for holding used solvent into which said outlet discharges, a trap in said outlet, and an air vent in communication with said receptacle, said air vent controlling the rate of flow into said receptacle to prevent solid material from being carried through said trap.

2. A clarifying means for closed liquid solvent cleaning system, said means including a still having a bottom outlet, a closed receptacle for holding used solvent into which said outlet discharges, a trap in said outlet, and an air vent and pressure valve in communication with said receptacle, said air vent controlling the rate of flow into said receptacle to prevent solid material from being carried through said trap and said pressure valve closing said air vent upon a substantial increase in the pressure within said system.

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