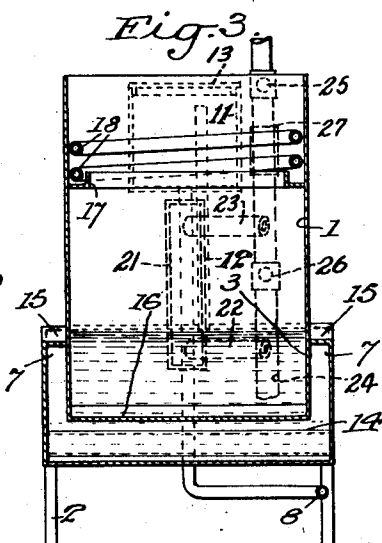
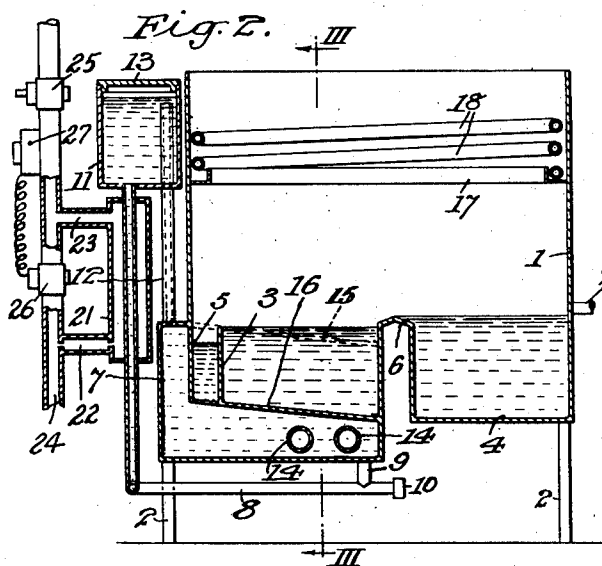
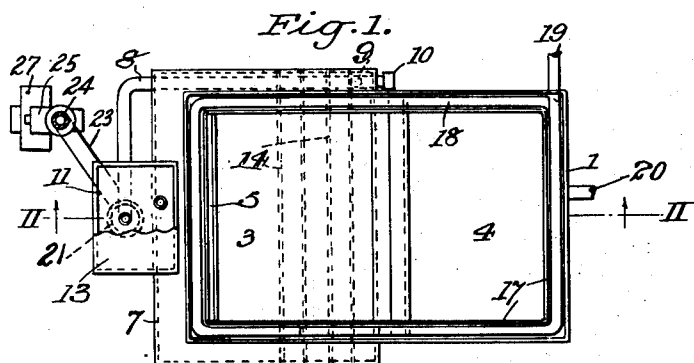


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VAPOR PHASE DEGREASING APPARATUS INCLUDING
TEMPERATURE CONTROL OF VAPOR CONDENSERS
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VAPOR PHASE DEGREASING APPARATUS,
INCLUDING TEMPERATURE CONTROL OF
VAPOR CONDENSERSMarcel C. Boss, Westfield, N. J., assignor to Mabor
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This invention relates to a degreasing apparatus of the type which uses chlorinated solvents such as trichloroethylene, in liquid and/or vapor phase, for the purpose of removing grease and the like from articles such, for instance, as metal castings or parts, prior to their inspection or assembly or in preparation for subsequent processing or finishing operations.

This invention has for an object to provide an apparatus of this character in which the solvent is heated and/or vaporized by the indirect application of heat from a heating jacket to the exterior of the solvent containing tank or vessel.

Another object is to provide such an apparatus in which heating fluid is circulated through the jacket by a thermosyphon arrangement.

Another object is to provide such an apparatus which includes means for elevating the temperature of the cool circulating water in the usual condensing coil by bringing the same in contact with a portion of the circulating system of the heating jacket.

A further object is to provide certain improvements in the form, construction and arrangements of the several parts of the apparatus, whereby the above named and other objects may be effectively attained.

In the production of degreasing apparatus of the class to which this invention is directed, it has been customary to heat the solvent by the use of heating elements, such as steam coils or electric devices located within the vessel or tank, or by gas burners or other heating units brought into contact with the outside of the bottom of the vessel. Experience has developed notable drawbacks in the case of all these procedures.

The contact of the flame of gas burners or the like with the bottom of the vessel, which is generally composed of sheet steel, causes corrosion of the metal, and the vapor of the solvent, which is always present to a certain degree, is liable to be decomposed by the flame with the development of harmful products and disagreeable and dangerous odors. The use of steam coils within the solvent vessel occupies considerable space, and the pipe tends to become caked with oily dirt which is affected by the heat with the production of hydrochloric acid, while the heat transfer capacity of the coils is substantially reduced. When electric heating units are arranged in the

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vessel, they rapidly become coated with dirt and the like, as a consequence of which overheating of the unit occurs. This class of heating elements also tends to decompose the solvent as a result of high temperature with the development of hydrochloric acid fumes and the like. Electric heating units located on the outside of the bottom of the vessel also tend to overheat, to carbonize dirt deposits, and to decompose the solvent especially when the vessel is substantially empty. If the solvent is distilled in the apparatus itself, the liquid level recedes and may expose the upper part of the heating device. An electric unit thus exposed promptly overheats and has the effect of decomposing the heavy solvent vapor even though the liquid solvent has been nearly completely evaporated by boiling.

These prior forms of heating arrangement, and particularly those in which the heating units are located within the solvent containing vessel, render the cleaning of the vessel difficult because of their obstruction, and the replacement, repair or cleaning of the heating units themselves requires the complete emptying of the vessel. Furthermore, active boiling of the solvent generally takes place only at points immediately adjacent the heating units which seriously tends to reduce efficiency of the apparatus, especially when a vessel or tank of considerable length is being used. Finally, corrosion and overheating resulting from the use of prior heating arrangements has led to leakage with unfortunate results in respect to the health of operatives.

My present invention overcomes the above named disadvantages and inconveniences, as well as others attendant upon the use of prior structures, with particular relation to provisions for heating, and offers a structure and arrangement excellently adapted to apparatus of this character which functions through the effects of solvent liquid and/or vapor while, at the same time, avoiding increase in cost of manufacture, installation or operation, and making available a wide range of utility without requiring more expert attention than is ordinarily at hand in plants making use of degreasing apparatus.

Practical embodiments of the invention are represented in the accompanying drawing, in which:

Fig. 1 represents a top plan view, partly broken away;

Fig. 2 represents a vertical section taken in the plane of the line II—II of Fig. 1, looking in the direction of the arrows; and

Fig. 3 represents a section taken in the plane of the line III—III of Fig. 2, looking in the direction of the arrows.

The vessel or tank for containing the solvent is denoted generally by 1 and may be composed of any suitable material such, for instance, as sheet steel. It is supported by suitable legs, of which two are shown and marked 2 and 2. The vessel 1 is shaped in its lower part so as to form two compartments, 3, 4, and a small subdivision 5. The compartments 3 and 4 are designed for holding the solvent in which the articles to be degreased are dipped, and they are separated by an air space 6 chiefly because, as will hereinafter be pointed out, the compartment 3 is heated and the compartment 4 is not heated.

The small subdivision 5 is intended to serve as a distillation chamber, and it will be observed that the said chamber and the compartments 3, 4 are so arranged that surface grease, and the like, can flow from the compartment 4 into the compartment 3, and from the latter into the distillation chamber 5.

For the purpose of heating the solvent, I provide a jacket 7 which embraces the bottom and the lower part of one end and about half of both sides of the vessel 1, thereby serving to transfer heat by conduction to the compartment 3 and the chamber 5 when the jacket 7 is supplied with a heating medium. It will be observed that the jacket is in contact with the bottom and three sides of the chamber 5 and with the bottom and two sides of compartment 3, whereby the chamber 5 will be heated to a higher degree than the compartment 3, as is desirable in order that the chamber 5 may be employed for distillation of the solvent. As the compartment 4 is not contacted at any part by the jacket 7, the solvent in the said compartment will not be heated and will be at substantially the temperature of the ambient air.

A pipe 8 is connected by a branch pipe 9 to the bottom of the jacket 7, and is provided with a screw cap 10 for draining. The said pipe 8 extends along beneath jacket 7 and then upwardly where it connects with the bottom of an expansion tank 11 which is secured in any suitable way (not shown) to the upper part of the vessel 1. A second pipe 12 leads from the upper part of jacket 7 through a fluid-tight aperture in the bottom of tank 11 and extends upwardly within the said tank to a point near the top of tank 11.

The jacket 7, pipes 8, 9 and 12, and the tank 11 are filled with a suitable heating medium such, for instance, as mineral oil or a salt solution like that known and sold commercially under the name Dowtherm, the filling operation being performed by removing the cover 13 and pouring the liquid into the tank 11 until the jacket and pipes are completely filled and the tank 11 is filled to a point near the top thereof and above the upper end of pipe 12.

In order to heat the liquid, a pipe coil is located in the lower part of the jacket 7, two portions of the pipe being shown and marked 14, 14. An end of the pipe coil is connected in any appropriate manner (not shown) with a source of heat such, for instance, as combustion gas or steam which latter may, if desired, be under high pressure. The injection of the gas, steam, or the like into the pipe coil 14, 14 will serve to heat the oil or other liquid medium, and will set up a thermosiphon action which will cause circulation of the

liquid from the jacket 7 upwardly through pipe 12, into expansion tank 11 downwardly through pipe 8, and back into the jacket 7 through branch pipe 9. The space above the liquid in tank 11 allows for expansion of the liquid when heated. As indicated at 15, 16 in Fig. 2, the top of the portions of jacket 7 which contact the sides of the vessel 1 and the bottoms of compartment 3 and chamber 5 slant upwardly from the portion of the jacket with which the branch pipe 9 is connected toward pipe 12, which formation assists the thermosiphon action. This type of immersed combustion gas or steam coil is known to be of very high efficiency.

Within the upper part of the vessel 1 is fixed an angle iron gutter 17 which extends along all four walls of the vessel and serves to receive solvent vapor condensate which drips from the usual low temperature pipe coil 18 which is mounted by any suitable means in the vessel above the gutter and, as is well understood by those familiar with this industry, promotes condensation of the solvent vapor and establishes a substantially definite line of separation between the upper air and the bank of solvent vapor that lies above the compartments 3, 4 and chamber 5. The said low temperature coil 18 has its ends connected to a source of temperature affecting fluid such as water, which is maintained at a temperature slightly above the atmospheric dew point, i. e., from 100° F. to 120° F., in order to prevent condensation of air moisture upon the coil 18 which, if present, might drip downwardly into the solvent and undesirably intermix therewith. The gutter 17 is provided with a drain pipe 19 for leading the condensed solvent vapor to a feed pipe 20 which enters compartment 4; the connection between the gutter and said compartment being preferably through a suitable vessel where any water present in the condensate is separated, as is common practice in this art.

There is no showing in the drawing of the means for carrying the articles to be degreased and moving them into and out of the vessel 1, because various forms of such means, e. g., metallic mesh basket and electric hoist or continuous conveyor, are well known to and thoroughly understood by those versed in this industry.

Briefly describing the operation of or manner of using the invention, solvent liquid, such as trichlorethylene, is fed in through the top of the vessel 1 until the compartments 3 and 4 are substantially filled and the chamber 5 is largely filled. Oil, or other suitable liquid, is poured into the tank 11 until the jacket 7 and pipes 8, 9 and 12 are filled, and the tank 11 is nearly filled. Heating medium is supplied to the pipe coil 14, 14 until the fluid in the jacket 7 comes to such a degree as to cause boiling of the vapor within compartment 3, and more active boiling within chamber 5 which latter, as already indicated, has more complete contact with the jacket 7 than has compartment 3. Temperature controlling fluid, such as water, is fed into the coil 18 to establish a temperature slightly above atmospheric dew point, as previously mentioned. The articles to be degreased are carried in their basket or the like and dipped first into the hot solvent in compartment 3; then into the cool solvent in compartment 4; then carried upward slowly through the bank of solvent vapor lying above the said compartments, and finally upward slowly through the bank of air adjacent the level of the coil 18, and out of the vessel 1. Liquid solvent in the compartments 3, 4, remove grease and other foreign matter from the

articles being dipped by direct liquid contact with the articles; and additional removal takes place by the solvent vapor which condenses on the surface of the articles. As this treatment elevates the temperature of the articles, they are rapidly dried while passing slowly through the layer of air above the bank of solvent vapor. In this connection it may be remarked that the solvent vapor is several times the density of air so that there is little difficulty in maintaining distinct banks or layers of vapor and air within the vessel 1.

As the operation continues it will be evident that the liquid solvent within the compartments 3 and 4 becomes contaminated with the foreign matter removed from the articles and, as the said matter is largely of an oily or greasy nature, it will rise to the surface of the liquid solvent and spill over from compartment 4 into compartment 3, and from the latter into chamber 5. From the foregoing, it will be seen that chamber 5 normally contains solvent which is hottest and least pure due chiefly to the presence of a substantial amount of oil or grease; that compartment 3 contains solvent which is not so hot but more pure; and that compartment 4 contains solvent which is cool and fed with pure solvent. The high temperature imparted to chamber 5 serves to assure distillation of the solvent and the formation of vapor regardless of the extent to which the solvent therein is contaminated by oily matter removed from the articles being degreased which raises the boiling point of the solvent.

It will be clear that, if desired, this apparatus may be used for degreasing by vapor treatment alone, in which case the basket containing the articles will not be dipped into either of the compartments 3 or 4, but will merely be lowered into the vessel 1 and suspended for a suitable period of time within the bank of solvent vapor which condenses thereon and removes the grease, and the like; after which the basket is slowly moved upwardly through the air above the vapor for the purpose of drying the articles that have been cleaned. It will be observed that the apparatus hereinabove described eliminates entirely the presence of heating units or devices within the vessel 1 and its subdivisions 3, 4, and 5; and further that the application of heat is not only exterior to the vessel 1, but is also indirect through the oil or the like from the heating coil 14, 14. Hence, it is practical to use powerful heating mediums, such, for instance, as combustion gases or high pressure steam within the coil 14, 14 without the possibility of injurious effects such as those mentioned at the outset of this specification. The thermosyphon action within the heated jacket and associated parts promotes the efficiency of the heating, and the whole arrangement enables rapid heating of the solvent to and above its boiling point and maintenance of the same at suitable operating temperature while avoiding all likelihood of injurious effects that have been characteristic of previous degreasing apparatus of this class.

The apparatus also includes means for warming the water or the like which circulates in the coil 18. The said means includes a cylindrical jacket 21 which surrounds and is fixed to the up-rising portion of pipe 8, and is connected by short pipes 22, 23 with a main water supply pipe 24. A pressure reducing valve 25 is fitted to pipe 22, as are also a thermostatically controlled valve 26 and its thermostat 27.

In the operation of this heating means, cold water is supplied from a suitable source (not

shown) into the lower part of pipe 24 and through the said pipe to the coil 18. A portion of the said water is by-passed through pipe 22, jacket 21, and pipe 23. The portion of water thus by-passed will be heated in the jacket 21 because of the elevated temperature of the part of pipe 8 that lies within the said jacket, and the return of this heated water to pipe 24 will elevate the temperature of the water flowing through said pipe 24 to coil 18. The thermostat 27 will be affected by the temperature of the water coming from the jacket 21 and will automatically regulate the amount of water supplied to the pipe 24 which is allowed to be by-passed through jacket 21; it being understood that the operator has set the thermostat to the desired degree of temperature control.

Preferably, the openings from pipe 24 into pipe 22, and from the latter into jacket 21, are somewhat constricted, as illustrated in Fig. 2, so that only a comparatively small portion of the water supplied to pipe 24 passes through jacket 21 when the valve 26 is wide open. However, when valve 26 is closed, all the cold water supplied to pipe 24 must pass through jacket 21. Valve 25 serves to control the pressure at which the water is fed from the pipe 24 to the coil 18. If it is desired to increase the heat transfer from pipe 8 to the water in jacket 21, the said pipe, or at least the part thereof that lies within jacket 21, may be composed of some material having high heat conductivity such, for instance, as copper.

With reference to all the forms of the invention, I desire it to be understood that various changes may be resorted to in the shape, construction, arrangement and material of the parts, as well as in the number of solvent containing compartments and types of fluids and heating elements or units employed, without departing from the spirit or scope of the invention; and hence I do not intend to be limited to details herein shown or described, except as the same may be included in the claims or be required by disclosures of the prior art.

What I claim is:

1. Apparatus of the character described comprising, a vessel for containing solvent, a jacket for containing heating fluid on the exterior of said vessel, means in said jacket for heating the fluid, means for circulating the heated fluid, means for circulating a temperature affecting fluid at a portion of the vessel above the solvent, and means for transferring heat from the jacket fluid to said temperature affecting fluid, said last named means including conduits for circulating said temperature affecting fluid in contact with a portion of the means for circulating the heated jacket fluid, and thermostatic means for regulating the amount of said temperature affecting fluid that is brought into contact with said portion of the means for circulating the heated jacket fluid.

2. Apparatus of the character described comprising, a vessel for containing solvent, a jacket for containing heating fluid on the exterior of said vessel, means in said jacket for heating the fluid, an expansion tank located in an elevated position with respect to the jacket, conduits connecting the said tank with the said jacket for circulating the heated fluid, means for circulating a temperature affecting fluid at a portion of the vessel above the solvent, a supply conduit for said temperature affecting fluid, and means for causing the temperature affecting fluid to flow from said supply conduit into contact with a con-

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dult which connects the said tank and jacket before entering the said circulating means above the solvent in said vessel.

MARCEL C. BOSS.

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