May 27, 1941. R. F. FLAHIVE 2,243,093

DEGREASING AND CLEANING APPARATUS

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Fig. 1.

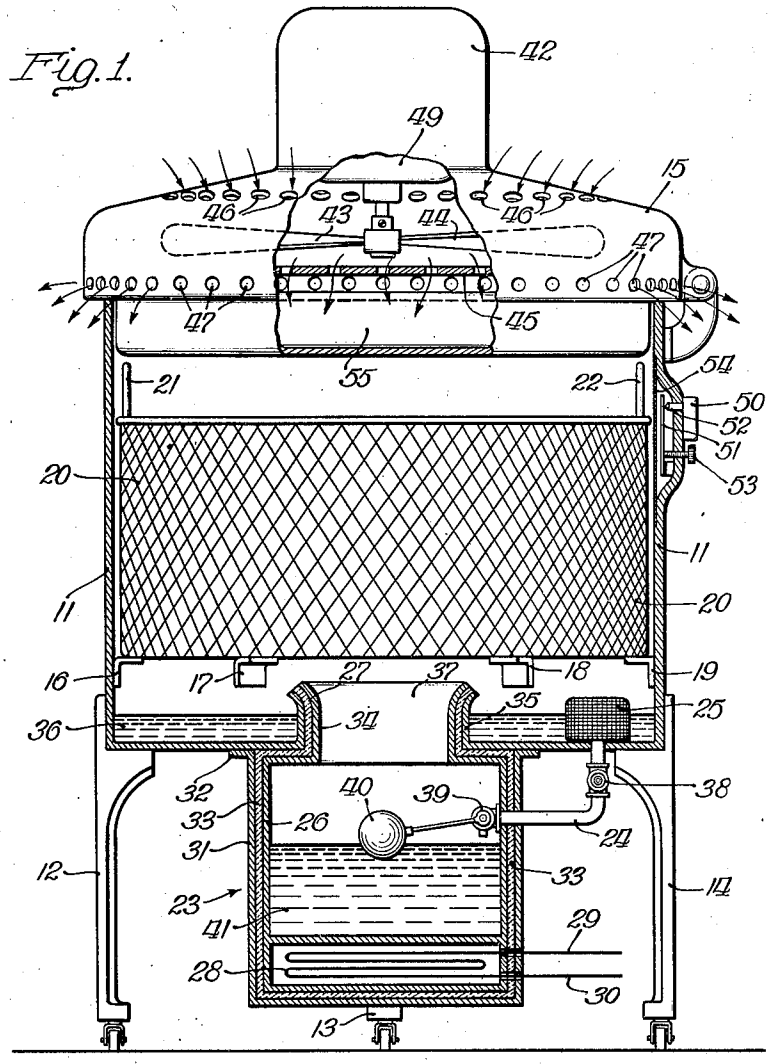
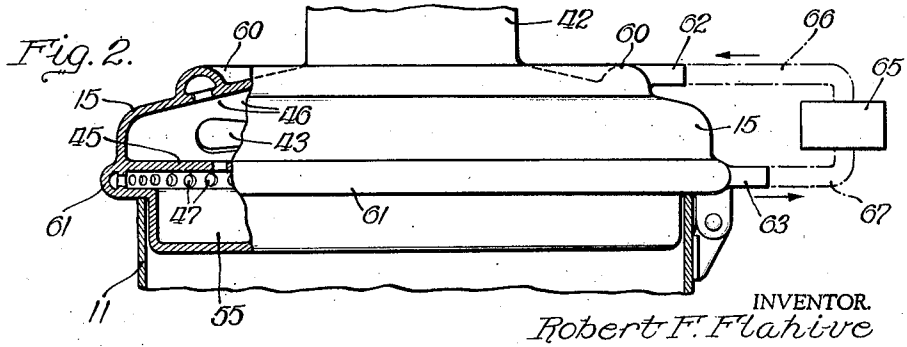


Fig. 2.



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DEGREASING AND CLEANING APPARATUS

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6 Claims. (Cl. 202—170)

This invention relates to the treatment of parts, especially metal parts, with solvents for the purpose of cleaning and degreasing, and is particularly concerned with an improved unitary apparatus permitting the use of volatile solvents and providing for a maximum difference of temperature so as to effect maximum condensation to accomplish the degreasing in an economical and efficient manner.

The salient objects of the invention may be briefly stated as follows:

One object is concerned with the provision of a self-contained degreasing apparatus combining in a unitary structure a solvent vapor generator and a degreasing container.

Another object is realized by the provision of means for facilitating the condensation of the solvent vapors and for recirculating the solvent through the vapor generator.

A further object of the invention has to do with means for filtering and cleaning the condensed solvent before admitting it into the vapor generator for recirculation, and means for determining the optimum solvent level in the generator chamber as well as the effective vapor level in the degreasing chamber of the apparatus.

Still another object is realized by the provision of heat insulating means interposed between the vapor generator and the degreasing tank so as to operate the apparatus with maximum thermal efficiency.

The above noted objects and other objects and features which have not yet been mentioned will appear from the detailed description which is rendered below with reference to the accompanying drawing, wherein:

Fig. 1 shows an embodiment of the invention with several parts in section or broken away to illustrate details; and

Fig. 2 represents part of a modified structure wherein the cooling provisions for facilitating the condensation of the solvent vapor are arranged for unified control.

The drawing is in several respects more or less diagrammatic in order to simplify the explanations. Only parts which are essential for the invention will be described in detail; structures that may safely be assumed to be well known will be referred to only to the extent necessary for supporting the understanding of the invention. Like parts are designated by like reference numerals in both figures of the drawing.

Referring now to Fig. 1, the new apparatus comprises generally a degreasing tank 11 supported on legs such as 12—13—14 and equipped with a lid or cover 15. The legs are provided with suitable coasters for the mobility of the unit, and the lid is hingedly attached to the tank 11 so as to permit ready access to the interior. Brackets such as 16—17—18—19 support a removable receptacle 20 which may be a suitable wire basket or the like equipped with handles such as 21—22. The parts to be degreased are placed in this basket and are thus suspended within the degreasing tank for the solvent vapor treatment. A thermostatic switch 50 is provided on the tank to control the vapor level in a manner to be later on described in detail. This switch is preferably disposed on the general control panel which is suitably arranged, for example, on the front section of the apparatus. The placement of the switch, as shown on the drawing, is diagrammatic and is only intended to support the understanding without regard to its true position in a practical embodiment.

A solvent vapor generator 23 is arranged at the bottom of and forms a unit with the degreasing tank 11. This generator is arranged in heat-insulated relation with the degreasing tank and is connected therewith over a valve-controlled pipe 24 for admitting the liquid solvent into the generator tank over a filter 25.

The structural details of the apparatus are described below.

The solvent vapor generator consists of an inner housing 26 with a restricted neck 34 extending into the degreasing tank and flaring outwardly as shown at 27, thus forming a vapor passage into the degreasing tank and an annular solvent reservoir at the bottom thereof. A suitable heating element 28, provided with conductors 29—30 is disposed in the generator tank. These conductors may be included in a suitable cord wired to the control panel and equipped with a plug for connection with a suitable socket of a commercial current supply. One side of this circuit may be connected over the thermostatic switch 50, that is, over the contact point 52 and the bi-metal spring 51 in a well known manner. Upon operation of this thermostatic switch responsive to a rise of temperature at the corresponding level of the degreasing tank, the connection between the bi-metal spring 51 and the contact 52 is interrupted for the purpose of disconnecting current from the heating element 28. The screw 53 is provided on the thermostatic switch for adjusting the actuation of the bi-metal leaf spring 51 and thus governing the switch operation. The guard 54 prevents injury

to the switch in the course of handling the basket 20.

The shell 31 secured in any suitable manner on the bottom of the degreasing tank 11, for example, by means of its flange 32, supports the vapor generator in place. A heat-insulating layer 33 is interposed between the inner housing 26 and the supporting shell 31 and confines the heat generated by the element 28 to the interior of the generator where it is needed. It should be observed that the insulating layer 33 conforms to the shape of the generator housing 26 and surrounds its lower portion as well as its restricted flaring neck 34/27 entirely, thus also covering part of the bottom of the degreasing tank as well as tubular portion 35 which rises from the bottom line of the degreasing tank to form the annular trough or reservoir for holding the solvent 36. This annular reservoir supplies solvent to the generator 23. The term "annular" is used herein merely in a descriptive sense, and not for the purpose of denoting any undue limitations, because the corresponding structures may obviously receive any desired form, circular or polygonal, without altering the operations for which they are intended.

The solvent generator 23 is thus directly connected with the degreasing tank 11, forming a unitary structure therewith, and communicating with it through the vapor passage 37 for conducting the solvent vapor upwardly toward the parts contained in the basket 20 for degreasing. The thermostatic switch 50 is included in the circuit of the heating element 28 of the vapor generator and operates to interrupt the circuit automatically when the vapor in the degreasing tank has reached a level sufficiently high to effect its actuation. This level is predetermined for any unit and the control afforded by the thermostatic switch prevents waste of current as well as of solvent. The generation of vapor beyond a point where the vapor envelops the parts placed in the tank for degreasing is unnecessary and would be wasteful. The use of this thermostatic device is optional. Attention is called to the fact that the representation of the thermostatic switch device, as shown in the drawing, is somewhat distorted. The switch is in reality considerably smaller in proportion to the size of the tank and other parts and has been shown in the drawing on a somewhat enlarged scale in order to represent details more clearly. The switch may be placed in practice substantially on or slightly below the level of the upper rim of the basket 20. In other words, the switch is placed in practice somewhat below the level at which effective vapor condensation is desired, to compensate for the moment of inertia in the switch operation in relation to the speed of vapor generation, and to provide for sufficient generation of vapor to envelop all the parts in the basket 20 while preventing vapor generation in excess of what is actually needed. It is also possible to mount the thermostatic switch on a suitable gear so that its position within the tank may be selectively adjusted to any desired level within a predetermined range by operating a knob on the control panel. This gear may include a frame for the switch which is movable on a track within a vertically extending groove or recess in the inner wall of the tank by means of a shaft secured thereto and projecting to the outside through a vertical slot in the tank wall. The shaft may be provided with a suitable knob for shifting it and with it the frame and the switch up or down to any desired level. Any desired and known means for locking the device in operating position may be provided. The mechanism is suitably shielded against the escape of vapor to the outside. This modification may be useful in cases where variable quantities of parts are to be treated and where utmost economy is desired at all times. The switch will be adjusted to its lowest level in case the basket contains only a few parts for treatment, or to an intermediate level, or, as the case may be, to its highest level if the basket is filled with parts to its capacity.

The pipe 24 connects the vapor generator with the degreasing tank 11 over a shut-off valve 38 and the filter 25. Its purpose, as appears from the drawing, is to conduct the liquid solvent which accumulates in the annular reservoir 36 into the vapor generator. The inner end of the pipe 24 is provided with a valve 39 which is controlled by the float 40. The float is placed so as to permit the supply of solvent from the annular reservoir space 36 to the vapor generator only up to a level of thermal efficiency of the latter. In other words, the liquid solvent 41 in the vapor generator will never exceed the predetermined amount at which it can be efficiently vaporized.

The lid or cover 15 is equipped with a motor 49 arranged within the cap 42 for driving the blades 43—44. A perforated partition 45 separates the lid into an upper intake section and a lower cooling section, the latter being designated by the numeral 55. The intake section is connected to the outside through the apertures 46 and the cooling section or chamber 55 is connected to the outside through exhaust ports 47 which are arranged circumferentially on the lid just below the plane of the perforated partition 45. The perforations in this partition may extend radially outwardly substantially to a point in line with the tips of the blades 43—44, as is particularly apparent from Fig. 2.

The operation is as follows:

Assuming that the apparatus is empty and is to be prepared for operation, the lid 15 is first lifted and a volatile solvent is poured into the tank. Part of the liquid solvent drops directly downwardly through the vapor passage 37 into the vapor generator 23 and part collects in the annular reservoir space or trough and seeps into the vapor generator through the filter 25 and pipe 24. As the liquid 41 rises in the generator it lifts the float 40 and the float valve 39 finally closes the supply through pipe 24 when the proper solvent level is reached as indicated in Fig. 1. The amount of liquid solvent in the generator is in a certain proportion in excess of the capacity of the annular reservoir space 36 in the degreasing tank and may be appropriately marked on the apparatus so as to indicate how much solvent should be initially poured into the apparatus to prepare its operation. If desired, a suitable indicator gauge may be provided to show the liquid level either in the generator or in the degreasing tank, or in both.

Numerous solvents may be used, especially those whose vapors are heavier than air, for example, benzine, benzol, carbon tetrachloride, trichloromethane, tetrachloromethane, dichlorethane, tetrachlorethane, trichlorethylene, or tetrachlorethylene. These solvents are noted only for the sake of example; others may be substituted or used if desired or required to meet any given problem of degreasing or cleaning.

The parts to be cleaned, for example, metal stampings as they come from the punch presses, are placed in the basket 20 and the basket is then put into the degreasing tank 11, as shown in Fig. 1. The lid 15 is then closed and current is allowed to flow through the windings 28 of the heating element. The liquid solvent 41 is heated and vaporizes, and the vapor escapes upwardly through the vapor passage 37 into the tank 11, spreading over the cold metal parts and condensing upon them. The parts are thus subjected to a vapor bath, and the condensing action absorbs the greasy and oily material on their surface during the liquefaction stage in a slushing or washing manner which is accelerated with the temperature difference between the hot vapors and the metal parts as well as the surrounding atmosphere inside the tank 11. The heating circuit is automatically disconnected by the operation of the thermostatic device 50, as previously described, to interrupt the generation of solvent vapor beyond the vapor level required for the solvent bath of the metal parts in the degreasing tank.

In order to accelerate the liquefaction of the solvent vapor, I have included ventilating and cooling means in the lid or cover 15, comprising the fan blades 43—44 operated by the motor 49. The operation of this ventilating means is started preferably upon putting the apparatus into operation, and the fan draws air through the intake ports 46 and forces the air through the apertures in the partition 45 into the ventilating or cooling space 55 from which the air is expelled through the exhaust ports 47. The circulation is in the direction of the arrows shown in the drawing. Air from a compressor may simply be blown through the ventilating chamber 55 in lieu of the arrangement shown, or a cooling medium may be conducted through coils disposed within the cooling space 55.

The modification shown in Fig. 2 contemplates a somewhat different arrangement for the cooling or ventilating provisions in the cover 15. The intake ports 46 extend into an intake manifold 60 and the exhaust ports 47 likewise extend into an exhaust manifold 61. A flexible hose may be attached to the intake and to the exhaust manifolds at 62 and 63, respectively. Fresh air may thus be taken in from the outside, and the exhaust air may be expelled to the outside in the direction of the arrows shown in Fig. 2. If desired, the intake air may be supplied over a refrigerating device as diagrammatically indicated at 65. The intake manifold will then be connected by suitable hose or pipe 66 with this refrigerating device. It is also possible to provide for a completely closed circulating system over the refrigerating device 65 and in this latter case the exhaust manifold will be connected to the refrigerating device at 63 over the pipe or hose connection 67.

It will also be seen from Fig. 2, taking into consideration the remarks made previously with regard to the structure Fig. 1, that the ventilating and cooling means can be modified by dispensing with the fan structure and the motor and in lieu thereof merely blowing cold air through the ventilating space 55 by means of a compressor which may then be placed as indicated at 65 and connected by hose connection such as 66 to the ventilating space or to suitable coils provided in the ventilating or cooling space of the device.

Changes may be made in details or in the assembly, and it therefore should be understood that the foregoing disclosure is being made merely for the purpose of furnishing examples of how the invention can be carried into practice and not for indicating any inherent limitations. What is believed to be new and desired to have protected by letters patent is defined and pointed out in the appended claims.

What is claimed is:

1. In combination, a relatively large tank for receiving parts for solvent vapor treatment, a tubular member extending upwardly from the bottom of said tank and forming with said bottom an annular solvent reservoir space thereat, the upper open end of said tubular member flaring laterally within said tank and partially restricting said reservoir space therein, a relatively small tank for generating solvent vapor disposed below the bottom of said large tank, coaxial with said tubular member a flaring restricted neck portion on said small tank projecting through said flaring tubular member into said large tank for conducting vapor from said small tank into said large tank, heat insulating means on the outside of said generator tank and on the restricted neck thereof, and a housing directly and substantially permanently connected to the bottom of said large tank for securing said generator tank thereto in heat insulated relation therewith.

2. In an apparatus for degreasing parts, especially metal parts, a degreasing tank, a solvent vapor generator directly connected thereto and communicating therewith through an opening in the bottom thereof for admiting hot solvent vapor into said tank, a cover for said degreasing tank, said cover comprising an upper housing portion resting in closed position circumferentially on the upper open edge of the degreasing tank, a lower cooling portion depending from the upper housing portion and extending into said degreasing tank, a perforated partition between said housing portion and said cooling portion, air inlet perforations in said upper housing portion, air outlet perforations in said cover disposed just below the plane of said partition, and means in said housing portion for drawing in air as a cooling medium from said inlet perforations and driving it through said perforated partition downwardly into said cooling portion and expelling it through said outlet perforations to cool the cooling portion of said cover so as to maintain a relatively cool area mainly in the upper portion of the degreasing tank substantially below the upper edge thereof where the cover rests in closed position during the operation of the apparatus.

3. A unitary substantially self-contained apparatus for degreasing and cleaning parts, especially metal parts, comprising an upper degreasing tank, an opening in the bottom of said tank, a collar projecting centrally into the tank defining said opening and forming a reservoir space at the bottom of the said tank which extends annularly around said opening, a pot-like housing directly and substantially permanently connected to the bottom of said degreasing tank and forming a structural unit therewith, a generator vessel disposed within said housing for receiving a volatile cleaning medium, a restricted neck portion on said vapor generating vessel projecting into said collar forming said opening in said degreasing tank and constituting a vapor passage from said generating tank into said degreasing tank for admitting vapor thereinto which is generated in said generator vessel, and

insulating means disposed on the outside of said generator vessel and the restricted neck portion thereof to heat insulate said entire generator vessel and the vapor passage thereof with respect to said housing and said degreasing tank and the collar thereon forming said annular reservoir space.

4. The apparatus defined in claim 3, together with an additional valve controlled passage connecting said generator vessel and said annular reservoir space in said degreasing tank for draining liquid cleaning medium collected in said space, and means for governing the level of the volatile medium in said generator vessel.

5. The apparatus defined in claim 3, together with heating means in said generator vessel to produce heat for vaporizing the cleaning medium therein, and means for controlling the operation of said heating means to govern and determine the amount of effective vapor generated and admitted into said degreasing tank.

6. A unitary substantially self-contained apparatus for degreasing parts, especially metal parts, by applying thereto the vapors of a volatile cleaning medium and for preventing undue loss of the cleaning medium by subjecting it to a closed controlled cycle involving vapor generation, application of the vapor to parts to be cleaned, condensation of vapors and return of condensed medium for regeneration of vapor, said apparatus comprising, in combination, a main degreasing tank for receiving parts to be degreased, an annular upwardly extending and flaring collar at the bottom of said tank forming an annular liquid collecting reservoir space thereat, a vapor generating vessel depending from said main tank, a restricted upwardly flaring neck on said generator vessel disposed within the flaring collar of said main tank and forming a vapor passage, a housing for said generator vessel directly and substantially permanently secured to the bottom of said main tank, heat insulating means completely surrounding the outside of said generator vessel and the restricted flaring neck thereof so as to heat insulate said vessel against said housing and said main tank, a heating element in said housing for producing heat to vaporize liquid cleaning medium therein, the vapor rising upwardly through said vapor passage and spreading within said main tank to clean the parts disposed therein, a cover for said main tank resting in closed position on the edge of the open end thereon, a cooling portion depending from said cover downwardly into said main tank, air inlet perforations in the upper portion of said cover, means in the upper portion of said cover for drawing in air through said air inlet perforations and driving it downwardly as a cooling medium through said lower cooling portion which is disposed within said main tank and expelling it through outlet perforations in said cover to produce a temperature difference in the upper portion of said tank for condensing the vapors therein, the condensation dropping downwardly mainly into said annular reservoir space at the bottom of said main tank, a filter in said annular reservoir space, means connecting said space with said generator vessel through said filter, and means in said main tank for governing the operation of said heating element to control the generation of vapor depending on the temperature obtaining in said main tank as a consequence of the amount of vapor admitted thereinto.

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