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(54) **Method for degreasing articles in a vapour.**

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EP 0 276 876 B1

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Description

The invention relates to method as defined in the first part of claim 1.

Such a method is disclosed in DE-A-742414, in which tetrachloro-ethylene (perchloro-ethylene) is mentioned amongst other degreasing solvents such as trichloro-ethylene, carbontetrachloride etc. In the absence of any information with respect to the ultimate temperature at which the degreasing process is taking, it is assumed that this temperature is intended to correspond to the boiling temperature of the respective solvent. Furthermore no attention is paid - in said DE-A-742414 - to the differences in boiling temperature between the various solvents mentioned. The boiling temperature of tetrachloro-ethylene, however, is by far the highest (121 °C) and should be compared e.g. with the highest boiling temperature of 87 °C of trichloro-ethylene.

In connection with its relatively high boiling point, the use of tetrachloro-ethylene has been limited - in practice so far - to articles having a relative low surface/mass ratio, i.e. to articles which require a relatively long time.

On the other hand tetrachloro-ethylene has appeared to be less harmful to the environment than the other solvents above referred to.

It is for the latter reason that the invention aims at using tetrachloro-ethylene as degreasing solvent to improve the well-known method so as to render such economical independent of the surface/mass ratio of the article to be treated.

In accordance with the present invention this is achieved in that the supply of the tetrachloro-ethylene in the saturated vaporized form is controlled to form a mixture of air and vaporized tetrachloro-ethylene having a temperature between 40 and 90 °C, whereby the cooling step is carried out to separate the exhausted air-tetrachloro-ethylene mixture and whereby the liquid tetrachloro-ethylene component is returned to the liquid tetrachloro-ethylene source and the air is recirculated to the container and the ambient atmosphere respectively.

Consequently, in accordance with the method of the present invention, the articles are cleaned in a (saturated) mixture of air and a vaporized, environment-friendly solvent at a temperature which is considerably lower than the boiling temperature of the solvent.

As an example, a mixture of air and vaporized tetrachloro-ethylene-air mixture is prepared within the treatment container, having a temperature of about 80 °C. At this temperature the vapour pressure of the tetrachloro-ethylene is as low as 0,25 bar, so that the air in the mixture has a pressure of 0,75 bar.

The control of the supply of (boiling) tetrachloro-ethylene into the treatment container can be simply effected by temperature sensing means within said container which are adapted to shut off the tetrachloro-ethylene supply as soon as a predetermined temperature is obtained. By presetting the temperature within the treatment container the quantity of condensate can be controlled in dependency of the degree of pollution of the articles to be cleaned. Moreover it should be noted that the relatively high boiling point of tetrachloro-ethylene simplifies the separation of the ultimate air-tetrachloro-ethylene vapour mixture.

It is to be remarked that in US-A-4.101.340 a method for cleaning articles is disclosed in which the articles are placed in a closable container, wherein the articles are sprayed with a solvent and wherein the ultimate mixture of air and solvent is exhausted prior to opening the container, and whereby a separation of the air-solvent mixture is effected by a cooling step and whereby the liquid solvent component is returned to the liquid solvent source, whereas the air is recirculated to the container. With this well-known method, however, the solvent is not used in a saturated vaporized form, while no mention is made of the specific use of tetrachloro-ethylene as solvent.

The invention also relates to a device as defined in the first part of claim 3.

The device according to the invention distinguishes from the well-known device shown in DE-A-742414 in that temperature sensitive means are provided within said container to control said solvent vaporizing means and thereby shut off the supply of saturated vaporized solvent as soon as a preset temperature within the container is reached.

The invention will be hereinafter explained with reference to the accompanying drawing in which an embodiment is shown of an apparatus in which the method of the invention may be carried out.

The vapour degreaser according to the invention consists of a container 2 in which the articles or components or parts 1 to be degreased are placed on a supporting grid 21. The container 2 may be closed by doors 3 so that the degreasing process may take place within a closed space. Below the grid 21 there is provided a collecting and buffer tank 5, into which the condensate formed during the degreasing process may drain off through a valve 4. From the PER (tetrachloro-ethylene) buffertank 5, cooled PER-liquid flow through a valve 22 into the evaporation room 6, where the PER is brought to vaporisation. The pure PER-vapour (boiling normally at a temperature of 121 °C) is then supplied through a wide riser pipe 7 into the space of the container 2, in which space an air/PER vapour mixture will develop. The desired vapour point is set by means of a tempera-

ture setting means 28 within the container space 2, in the range from 40° to 90° C. The PER-vapour condensates onto the parts to be degreased, and causes these parts to be gradually warmed up. If the temperature of the parts has raised to e.g. 80° C, the air/PER vapour mixture has reached a concentration of circa 2 kg PER/m³ and the degreasing is completed. The heating is then stopped, but the doors 3 are kept closed.

Through an exhaust-fan 8 and a valve 23 the air/vapour mixture from the container 2 is conveyed to a deep-cooling installation 9, in which the mixture from container is cooled until a certain economical balance is reached between cooling and the effective use of an activated carbon filter 12. Herewith PER-vapour is condensated, which condensate flows back through duct 14 into the buffer-room 5.

In order to avoid a too great condensation of water vapour, which is always present in the air/vapour mixture, the gas flows after deep cooling in cooler 9 through a duct 24 into a two-parts condensor 10, in the first part 10a of which the mixture is warmed slightly again. The slightly warmed air leaves the condensor space 10a through duct 16 and flows out into the container space 2. The combination of condensor 10, evaporator 9 and compressor 11 constitutes a "heating pump". The second part 10b of the condensor 10 serves to bring in equilibrium the heat balance between the vapour/air flow and the energy supplied from the "heating pump". The excess in energy supplied is discharged by means of a cooling fan 26.

After the concentration of PER in the air/vapour mixture is reduced in this manner to circa 12 g/m³, the degreasing space is subjected to a slight under-pressure by exhausting the air from the space 2 through a duct 17 and an activated carbon filter 12. This carbon filter 12 may be kept relatively small.

The doors 3 may now be opened to remove the degreased parts 1 from the container. Thanks the very low concentration of PER-vapour in the container and the light under-pressure present therein, no PER-vapours will enter into the surrounding atmosphere.

Claims

1. A method of degreasing articles in a vaporized solvent, comprising the steps of:
 - placing the articles in a closable container;
 - closing the container,
 - supplying tetrachloro-ethylene in a saturated vaporized form into the upper part of the closed container;
 - allowing the tetrachloro-ethylene vapour to

condensate in contact with the articles and allowing the condensate to collect in and drain off from the lower part of the container into a liquid tetrachloro-ethylene source;

cooling and exhausting the vapour from the container at the end of the degreasing process and

opening the container to remove the degreased articles therefrom,

characterized in that the supply of the tetrachloro-ethylene in the saturated vaporized form is controled to form a mixture of air and vaporized tetrachloro-ethylene having a temperature between 40 and 90° C, whereby the cooling step is carried out to separate the exhausted air-tetrachloro-ethylene mixture and whereby the liquid tetrachloro-ethylene component is returned to the liquid tetrachloro-ethylene source and the air is recirculated to the container and the ambient atmosphere respectively.

2. A method according to claim 1, characterized in that just before opening the container to remove the treated articles, a slight under-pressure is created within the container by exhausting a small proportion of the (separated) air from the container via an activated carbon filter into the surrounding atmosphere.

Patentansprüche

1. Verfahren zum Entfetten von Gegenständen in einem verdunsteten Lösemittel, mit den Schritten:
 - Einbringen der Gegenstände in ein verschliessbares Gefäss;
 - Verschliessen des Gefässes;
 - Einleiten von Tetrachloräthylen in verdunsteter Form in den oberen Teil des verschlossenen Gefässes;
 - Kondensieren des Tetrachloräthylens durch Kontakt mit den Gegenständen und Sammeln des Kondensats in und Abfuhr desselben aus dem unteren Teil des Gefässes in eine flüssige Tetrachloräthylenquelle;
 - Kühlung und Abfuhr des Dampfes aus dem Gefäss am Ende des Entfettungsverfahrens und
 - Öffnen des Gefässes um die entfetteten Gegenstände herauszunehmen, dadurch gekennzeichnet, dass die Einleitung von Tetrachloräthylen in verdunsteter Form in der Weise gesteuert wird, dass ein Gemisch von Luft und verdunstetem Tetrachloräthylen bei einer Temperatur zwi-

schen 40 und 90° gebildet wird, wobei der Kühschritt durchgeführt wird um das abgelassene Luft-Tetrachloräthylenmisch zu scheiden und wobei die flüssige Tetrachloräthylenkomponente in die flüssige Tetrachloräthylenquelle zurückgeführt wird und die Luft in das Gefäß bzw. in die Umwelt zurückgeleitet wird.

charbon activé, dans l'atmosphère environnante.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass gerade vor dem Öffnen des Gefäßes - um die behandelten Gegenstände herauszunehmen - ein leichter Unterdruck im Gefäß hervorgerufen wird indem ein kleiner Anteil der (ausgeschiedenen) Luft aus dem Gefäß über einen Aktivkohlenfilter in die Umwelt geleitet wird.

Revendications

1. Procédé de dégraissage d'objets dans un solvant vaporisé, comprenant les phases suivantes:
- on dispose les objets dans un conteneur pouvant être fermé;
 - on ferme le conteneur;
 - on amène du tétrachloroéthylène sous forme de vapeur saturée dans la partie supérieure du conteneur fermé;
 - on laisse la vapeur de tétrachloroéthylène se condenser en contact avec les objets et on laisse le condensat se rassembler et s'écouler de la partie inférieure du conteneur dans une source de tétrachloroéthylène liquide;
 - on refroidit et on chasse la vapeur du conteneur à la fin du processus de dégraissage; et
 - on ouvre le conteneur pour retirer les objets dégraissés de celui-ci,
- caractérisé en ce que l'alimentation en tétrachloroéthylène sous forme de vapeur saturée est commandée pour former un mélange d'air et de vapeur de tétrachloroéthylène ayant une température comprise en 40° C et 90° C, la phase de refroidissement étant effectuée afin de séparer le mélange rejeté d'air et de tétrachloroéthylène, et le composant liquide de tétrachloroéthylène est ainsi renvoyé à la source de tétrachloroéthylène liquide, et l'air est recyclé dans le conteneur et dans l'atmosphère ambiante, respectivement.
2. Procédé suivant la revendication 1, caractérisé en ce que juste avant l'ouverture du conteneur pour retirer les objets traités, on crée une légère dépression à l'intérieur du conteneur en en chassant une petite partie de l'air (séparé) provenant du conteneur à travers un filtre à

