

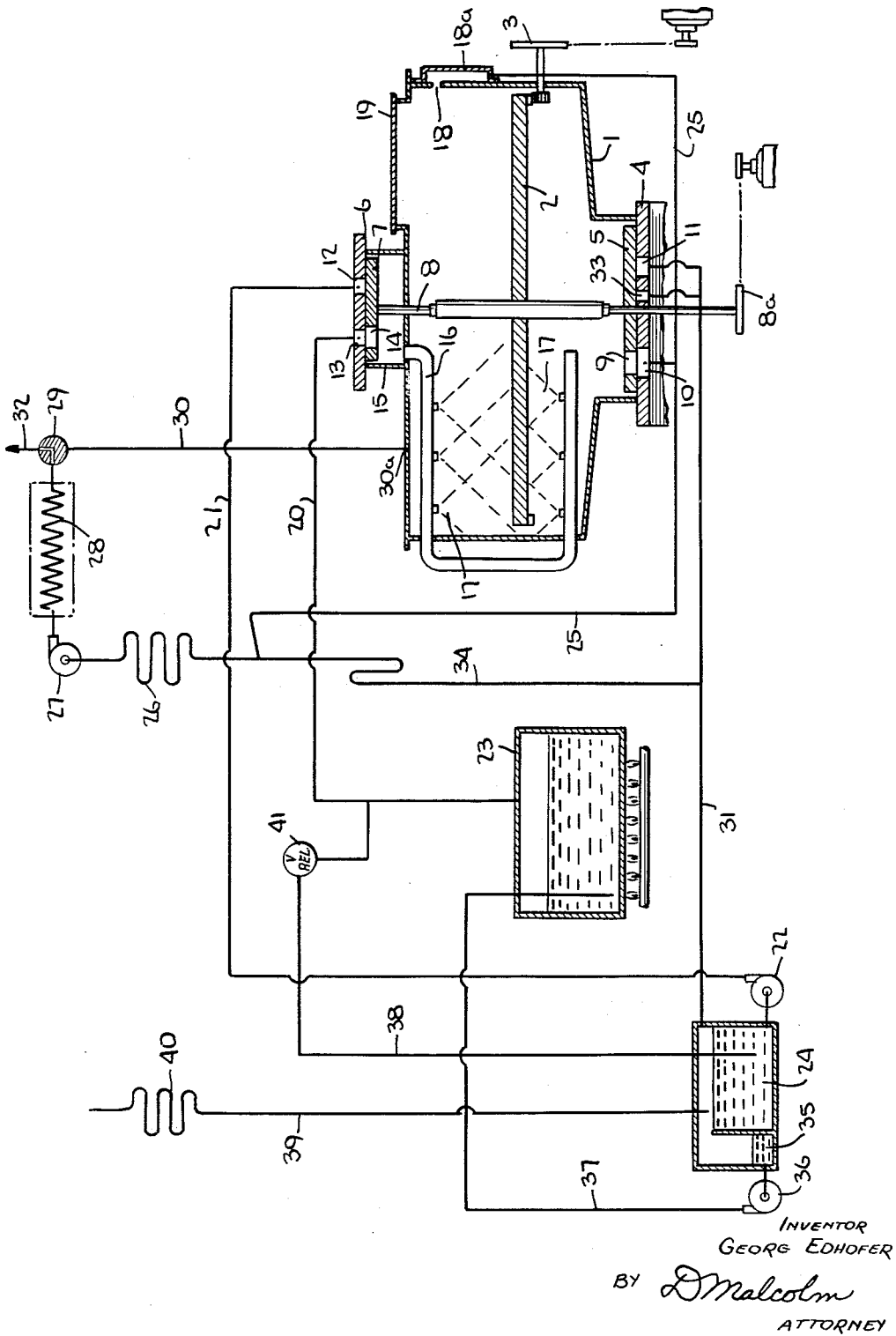
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APPARATUS FOR CLEANING RIGID OBJECTS

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APPARATUS FOR CLEANING RIGID OBJECTS

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This invention relates to apparatus for cleaning rigid objects such as metal plates, castings, etc., which have become contaminated with grease, oil, dirt, metal shavings and the like, and it has for its object to provide a novel and improved apparatus for cleaning such objects.

Another object of the invention is to provide an efficient apparatus of the above type employing volatile solvents, preferably chlorinated hydrocarbons, which expedites the complete removal of soluble and insoluble dirt and other impurities from the objects to be cleaned, and in which the loss of solvent is negligible.

A further object is to increase the efficiency of cleaning apparatus of the above type by spraying the objects under treatment from all sides with liquid solvent, and subsequently spraying said objects with solvent vapor.

Still another object is to provide a cleaning apparatus of the type specified which employs the same jets for spraying the objects under treatment with both liquid and vaporous solvent.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

It is a common practice to clean all kinds of objects with volatile solvents, for example chlorinated aliphatic hydrocarbons such as trichlorethylene, perchlorethylene and the like. To cite just one example, polished brass plates which have been lying around a factory or warehouse, and have become encrusted with grease, dust and dirt, must be thoroughly cleaned before they can be fabricated into bright, shiny radio panels, etc., and the above-mentioned cleaning fluids have frequently been used for such purpose.

In one type of machine for cleaning objects by means of volatile solvents, for example, the objects to be cleaned are placed in several containers or baskets arranged in the form of a star on a disc-like rotatable platform, and are subjected in separate work stages to a number of different cleaning steps. The solvent is usually forced into the cleaning containers either by pressure of the solvent vapor or by air.

The present invention provides an improved apparatus for cleaning objects of the type described, which is characterized by its efficiency of operation which can be largely automatic, its large capacity, and its economy of solvent.

The invention is described in detail in connection with the accompanying drawing which is a diagrammatic illustration of a preferred apparatus embodying the invention.

The cleaning container 1 shown in the drawing has on its bottom and top walls, respectively, the control heads 4 and 6 and the control plates 5 and 7, respectively, which control plates 5 and 7 are rotatable. These rotatable control plates 5 and 7 are connected by means of the shaft 8 and can be moved by means of the driving gear 8a. The cleaning container 1 contains the rotatable platform or support disc 2 on which the objects to be cleaned are placed either in separate locations or in baskets, and which can be moved by the drive 3.

The control head 6 contains the apertures 12 and 13 which, by means of the duct 21, are connected with the pump 22 and the solvent container 24, and by means

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of the duct 20 with the evaporator 23. The control plate 7 has the aperture 14 which is connected by means of the chamber 15 with the duct 16 and the jets 17. The lower control plate 5 has the aperture 9 which gives access to the interior of the container 1. The apertures 10, 11 and 33 are in the lower control head 4. Aperture 10 is connected by means of duct 25 and duct 34 with cooler 26, blower 27, air heater 28, three-way cock 29 and duct 32, while apertures 11 and 33 are connected by means of duct 31 with the solvent container 24.

The wall of the cleaning container 1 is provided with suction apertures 18 which provide access to the suction pocket or bag 18a. The opening for inserting the objects into cleaning container 1 is opened and closed by means of the lid 19. Another opening 30a of container 1 is at the top of the container and serves to help the circulation of the air which has been enriched with the solvent in container 1. It is connected with the three-way cock 29 by means of duct 30.

The container 24 which is open on top stands in the closed container 35 which serves to receive the overflow from container 24. Container 35 is connected by means of pump 36 and duct 37 with evaporator 23 and by means of duct 39 with cooler 40. A duct 38 goes from evaporator 23 to the solvent container 24 by means of pressure relief valve 41.

The device operates as follows: In starting position all apertures of the control heads 4 and 6 and control plates 5 and 7 are set by means of the drive 8a in such a way that none of the apertures coincides with any other aperture. Thus all apertures 9—10, 9—11, 9—33 and 12—14, 13—14 are closed. To prevent the escape of solvent vapor when the lid 19 is open, fresh air is sucked into the container 1 by means of suction apertures 18 and the suction pocket 18a, through duct 25, cooler 26, blower 27, air heater 28, three-way cock 29 and duct 32, and then blown out. The objects to be cleaned are placed on the disc or platform 2 which is rotatable by the drive 3, and, after the objects are in place, the lid 19 is closed.

Thereupon control plates 5 and 7 are rotated by a quarter turn by means of the drive 8a, so that apertures 12 and 14, as well as 9 and 11, coincide. At the same time pump 22 is started, whereby the heated cleaning fluid (but not heated to the boiling point) is taken from solvent container 24 and sprayed on the objects to be cleaned, after passing duct 21, chamber 15, duct 16 and jets 17. The soiled solvent flows back to reservoir 24 through apertures 9—11 through the duct 31. Depending on the degree of soiling, the objects to be cleaned can be sprayed for a few seconds or a few minutes.

After the spraying with the liquid solvent has been completed, the control plates 5 and 7 are moved by another quarter turn by means of the drive 8a. Thereby the apertures 13 and 14 as well as 9 and 33 are brought to coincide. Solvent vapor at a high velocity and at a temperature slightly above the boiling point is blown on the objects to be cleaned from the evaporator 23 by way of duct 20, apertures 13—14, duct 16 and spraying jets 17. A double cleaning effect is thereby achieved, namely a washing action due to the high velocity of the jet of vapor hitting the material to be cleaned, and a rinsing action due to the condensation of the vapor on the objects to be cleaned which continues as long as the latter are heated up to the temperature of the solvent. The condensate which results flows off into solvent container 24 by means of apertures 9—33 and duct 31.

Thereafter the cleaning container 1 is blown out. For this purpose the control plates 5 and 7 are moved another quarter turn by means of the drive 8a. Thereby the apertures 9 and 10 are brought to coincide, while the aper-

tures 12, 13, 11 and 33 are closed. The air which has been heavily enriched with solvent in container 1 is blown into circulation through apertures 9—10 and suction apertures 18, suction pocket 18a, through duct 25, cooler 26, blower 27, air heater 28, three-way cock 29 and duct 30. The condensate collecting in cooler 26 flows into container 24 by means of ducts 34 and 31. The condensate flowing into solvent container 24 renews the soiled solvent there partly all the time, so that it is always at hand ready for use in the cleaning process.

In order to remove the cleaned objects, the control plates 5 and 7 are moved another quarter turn by means of the drive 8a, whereby all apertures are closed. Circulatory connection is created only by means of the suction apertures 18, suction pocket 18a, duct 25, cooler 26, blower 27, air heater 28, three-way cock 29 and duct 30. After opening the lid 19, the three-way cock 29 is set in such a way that the duct 30 is closed and duct 32 opened. Thus fresh air can be taken in through the lid opening 19, the suction apertures 18, suction pocket 18a, duct 25, cooler 26, blower 27, air heater 28 and duct 32 through the upper part of cleaning container 1, and then blown out again. The cleaned objects are taken out and the device can be loaded again.

The collecting condensate from the cleaning container 1 and from cooler 26, as well as the soiled solvent from container 1, flows into container 24 by way of ducts 31 and 34. The surplus solvent flows into container 35, from which it is transported either continuously or intermittently into the evaporator 23 by means of pump 36 through duct 37.

The vapor supply to cleaning container 1 is shut off in the starting position, during spraying, during blowing out of the cleaning container, and during removal of the objects which have been cleaned. The solvent vapor which is continuously developing in evaporator 23 flows at that time into the solvent container 24 by way of valve 41 and duct 38, and heats the solvent. The solvent vapors developing there flow through duct 39 into cooler 40 and are condensed there. The resulting condensate flows back into container 24. The described apparatus has the following distinct advantages:

(1) The loss of solvent is negligible, because only the upper air layers containing the solvent are removed when the cleaning container is filled with objects to be cleaned or when the latter are removed.

(2) Excellent cleaning results are achieved by spraying from all sides with liquid solvent.

(3) The cleaning action is improved by subsequently spraying the material with solvent vapor.

(4). The use of the same jets for the liquid as well as for the vaporous solvent represents another advantage of the apparatus.

While a specific embodiment has been shown and described herein for purposes of illustration, it will be evident to those skilled in the art that the invention is capable of various modifications and adaptations within the scope of the appended claims.

The invention claimed is:

1. Apparatus for cleaning objects with volatile solvents

comprising, in combination, a closed container having means for admitting the objects to be cleaned, a rotatable support in said container for the objects to be cleaned, jets in said container for spraying fluid solvent upon the objects on said support, stationary control heads containing apertures mounted on said container above and below said support, rotatable control plates cooperating with said control heads to close the apertures in the latter and containing apertures adapted in certain positions of said rotatable control plates to coincide with the apertures in said control heads, and sources of liquid and vaporous solvent connected respectively to separate apertures in said control heads.

2. Apparatus according to claim 1, in which said container has a lid which may be opened to admit the objects to be cleaned, and means including a suction aperture adjacent said lid for drawing air into said container to prevent the escape of solvent vapor when said lid is open.

3. Apparatus according to claim 2, characterized by a suction pocket connected to said suction aperture, and ducts connecting said suction pocket to a cooler and blower.

4. Apparatus according to claim 3, having a heater connected to said blower, a three-way cock connected to said heater, and ducts controlled by said cock leading, respectively, to the atmosphere and to said container.

5. Apparatus according to claim 1, having a pump connected to an aperture in one of said control heads, and an open solvent container connected to the inlet of said pump.

6. Apparatus according to claim 5, characterized by the provision of a closed solvent container in which said open solvent container stands.

7. Apparatus according to claim 6, including an evaporator, and a pump connecting the bottom of said closed solvent container to said evaporator.

8. Apparatus according to claim 7, characterized by the provision of a cooler connected directly to said closed solvent container at a point adjacent the top of the latter.

9. Apparatus according to claim 5, characterized by the provision of an evaporator, a duct connecting said evaporator to the control head above said support in said container, and means including a pressure relief valve connecting said evaporator to said open solvent container.

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