

July 24, 1956

D. M. RUGGLES

2,756,168

CLEANING OF SMALL ARTICLES

Original Filed Feb. 14, 1948

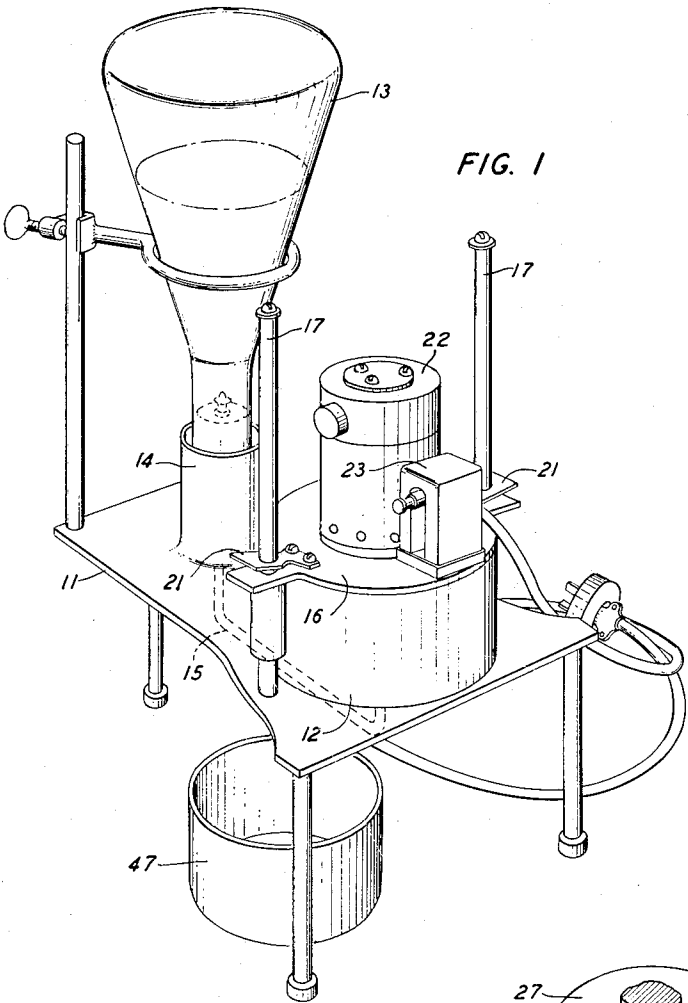


FIG. 1

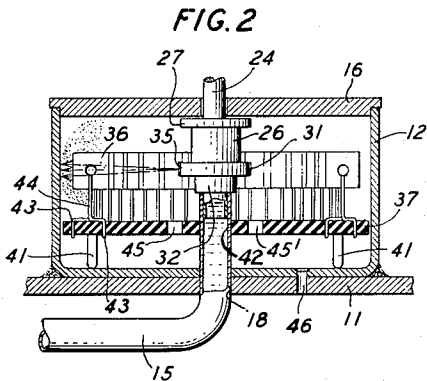


FIG. 2

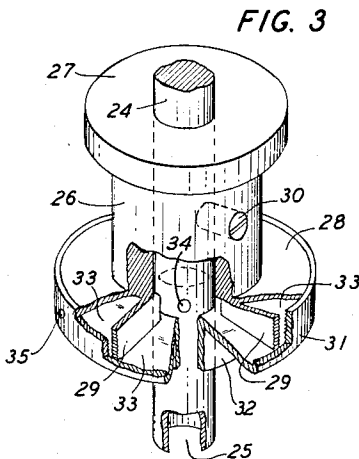


FIG. 3

INVENTOR
D. M. RUGGLES
BY *[Signature]*
ATTORNEY

1

2,756,168

CLEANING OF SMALL ARTICLES

David M. Ruggles, Mount Tabor, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Original application February 14, 1948, Serial No. 8,462. Divided and this application March 14, 1952, Serial No. 276,629

10 Claims. (Cl. 134—34)

This invention relates to the cleaning of small fragile parts and more particularly, to a method for effecting such cleaning.

This application is a division of application Serial No. 8,462, filed February 14, 1948, now abandoned.

An object of this invention is to provide thorough and efficient cleaning of small, fragile articles.

It has previously been proposed to degrease or clean relatively large objects, such as the tubes of a steam condenser, by causing the vapor of a volatile liquid to condense upon the surfaces to be cleaned in such a manner that the resulting liquid drains off and washes away the greasy material. In such cases the vapor, which may be formed by boiling the liquid, is caused to condense on the objects because they are maintained at a temperature below the condensation point of the hot vapor. The surfaces of the objects are relatively extensive and tend to remain at or near their normal temperature despite contact with the hot vapor. If the temperature of the objects approaches that of the hot vapor, continued condensation of the vapor ceases. In some instances cooling mediums may be applied to the objects to further the condensation; for example, water may be circulated around the tubes, through the water space of the steam condenser.

In the instance of certain small fragile parts such as, for example, piezoelectric crystal plates, timepiece works, and the like, the above-discussed method of degreasing has been found generally unsatisfactory. This is due largely to the fact that the small surface objects do not remain at their normally low temperatures but rapidly assume the temperature of the hot vapor. Then sufficient condensation does not result for proper cleansing. Further, it is usually difficult to apply a separate cooling medium to such objects.

Other previously proposed methods of cleaning such parts are a high pressure spray, which entails use of apparatus that is bulky and expensive; and dipping in liquid followed by successive rinses. The dipping method presents the problem that continued use will contaminate each successive rinse.

In accordance with a feature of the present invention, the cleaning fluid is developed into a mist of vapor by forcible ejection of the liquid in a novel manner and without appreciably raising the temperature of the liquid. Complete condensation of the mist then results upon contact with the objects to be cleaned.

In accordance with a further feature of the invention, complete cleansing of objects is attained by the combination of a directly sprayed liquid and a heavy mist formed therefrom.

In accordance with a still further feature of the invention the necessity of the provision of high pressure tanks is eliminated.

In one specific embodiment of the invention, a degreaser is provided which comprises a closed bowl-like container within which are positioned the objects to be

2

cleaned. A volatile cleaning liquid, such as trichloroethylene, is fed from an envelope or flask into the lower portion of the bowl and is drawn up by vacuum into a cylindrical member, rotatably positioned near the top of the bowl. The liquid is then ejected through apertures provided in the peripheral wall of a cylindrical member with sufficient force to cause the liquid to strike the wall of the bowl and to be broken up into a fine mist. The mist settles on the objects being cleaned, condenses into a liquid, and drains off with resultant cleaning action. Because the liquid need not be heated nor pressure tanks employed, the device required is both small in size and inexpensive.

A complete understanding of the arrangement contemplated by the invention and of the operation thereof and appreciation of the various desirable features thereof may be gained from consideration of the following detailed description and the accompanying drawings, in which:

Fig. 1 is an external perspective view of the cleaning apparatus with the cover closed;

Fig. 2 is a vertical sectional view of the cleansing compartment when in operation, a portion of a support for the compartment and a pipe leading to the compartment being also shown; and

Fig. 3 is an enlarged view of the rotatable member according to this invention.

Referring to the drawings, a table 11 supports a container or bowl 12 and a flask 13 filled with a suitable volatile cleaning liquid, such as trichloroethylene. Flask 13 is provided with a suitable neck and stopper and is placed in a hopper type feed compartment 14 which connects to the bowl 12 by means of a pipe 15. The pipe 15 extends into the bowl 12 through an orifice 18 in table 11 and bowl 12 and is open-ended.

A close-fitting cover 16 is provided for the container 12. Cover 16 rides on guide posts 17 and can be held in an open position on the posts 17 by means of spring clamps 21, which may be of the type disclosed in Louvelink Patent 2,382,428. An electric motor 22 is mounted on cover 16, together with an associated switch 23. The shaft 24 of the motor 22 extends through the cover 16 into the bowl 12 and has a hollowed out portion 25 which extends into the open end of pipe 15, when the cover 16 is closed.

Fitted on shaft 24 and connected to it by the set screw 30 is a spindle comprising the body 26 of the spindle, a shoulder 27, and a fin plate 28. Shoulder 27 fits close to the underside of cover 16, and integral with the fin plate 28 are a plurality of fins 29. Fin plate 28 and fins 29 are provided with threads to which screws the threaded upright wall 31 of flange 32. The fin plate 28 of the spindle and the flange 32 then form together a cylindrical hollow rotatable member. Within this hollow member thus formed, the fins 29 define a plurality of independent sections or compartments 33. Connecting the hollowed out portion 25 of shaft 24 and the compartments 33 are a plurality of apertures 34. The threaded upright wall 31 of flange 32 has a plurality of small orifices 35 therein, one for each compartment.

One use of the invention is for the cleaning of piezoelectric crystals 36. However, it will be understood that suitable holding means may be provided for the cleaning of other small objects. As shown in Fig. 2, a tray or rack 37, provided with suitable supports 41, is placed in container 12. The tray 37 has an orifice 42 through which pipe 15 extends. Small apertures 43 are provided into which the crystal leads 44 are placed. A bend in the leads 44 provides support for the crystal 36. A plurality of apertures 45 in tray 37 allow the liquid to drain off and collect in the bottom bowl 12. An outlet 46 is provided through the container 12 and the table 11. A re-

ceptacle, such as jar 47, is placed under outlet 46 to collect the liquid.

In operation a quantity of cleaning liquid is stored in the inverted flask 13. The liquid enters the bowl 12 by means of the open-ended pipe 15. The height of the flask governs the liquid level in this pipe and in one specific embodiment of the invention is so arranged as to maintain a height approximately a quarter inch higher than the bottom end of the motor shaft 24, when the cover 16 is closed for operation. The hollow rotating member or chamber formed by the flange 32 and the fin plate 28 of the spindle is supplied with liquid by means of the hollowed out portion in the core of motor shaft 24. The force necessary to lift the liquid to the hollow rotating member is achieved by means of a vacuum created by the fins 29 within the rotating member rotating at high speed. The vacuum draws the liquid through apertures 34 into the compartments or sections 33. Due to centrifugal force, the liquid is forced out the small orifices 35 drilled in the upright wall 31 of flange 32. The speed of the motor is sufficient to produce a force of the order of 100 pounds per square inch in the liquid. The high pressure and small orifices 35 break up the liquid into a fine spray. The objects to be cleaned, such as piezoelectric crystals, watch parts, or other small objects, are supported by a circular rack 37 which is so positioned that the objects are in a direct line with the spray of the liquid. As shown in Fig. 2, the crystals 36 are positioned radially with respect to the axis of the container 12. Due to the placement and spacing of the objects most of the liquid passes between the crystals and comes in contact with the inner wall of the bowl 12. It strikes the wall with such force as to break up the liquid into a fine mist that floats around within the bowl 12, wetting all the objects therein. As the tiny droplets continue to collect on the objects to be cleaned, the drops become larger and larger until they are heavy enough to run down over the surface, with the resultant complete cleaning action. The liquid is free to run out a drain hole 46 in the bottom of the bowl 12 into a suitable container 47. It is then distilled in a small still and may be used over again.

Although a specific embodiment of the invention has been shown and described, it will be understood that it is but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention.

What is claimed is:

1. The method of cleaning small fragile articles comprising placing the articles in a container, spraying a cleaning fluid against a surface within said container distant from the articles with sufficient force to break up the spray into a fine mist, and allowing said mist to condense on the articles.

2. The method of cleaning small fragile objects comprising ejecting a spray of cleaning fluid from a rotating member against a surface other than the objects with sufficient force to break said spray up into a fine mist, condensing said mist on the objects, and allowing the condensed mist to drain off the objects.

3. The method of cleaning small objects comprising positioning the objects within a container, ejecting a spray of cleaning fluid from a rotating member against a wall of said container with sufficient force to break said spray up into a fine mist, and allowing said mist to condense on the objects.

4. The method of cleaning small articles comprising positioning the articles in a container having a rotatable

apertured member therein, drawing a volatile cleaning fluid into said rotatable apertured member, rotating said apertured member to eject a spray of said volatile cleaning fluid against a surface within said container distant from the articles with sufficient force to break said spray up into a fine mist, condensing said mist on the articles, and allowing the condensed mist to drain off the articles.

5. The method of degreasing small fragile crystal elements comprising positioning the elements in a container having a rotatable apertured member therein, drawing a cleaning fluid into said rotatable apertured member, rotating said apertured member to eject a plurality of sprays of cleaning fluid against a wall of said container to break said sprays up into a fine mist, and condensing said mist on the elements.

6. The method of degreasing small fragile crystal elements in accordance with claim 5 wherein the step of positioning said elements in said container includes aligning said elements with said rotatable apertured member so that a minimum of said sprays impinges directly thereon.

7. The method of cleaning small articles comprising placing the articles within a container, drawing a cleaning fluid into a rotatable member within said container by vacuum, ejecting said cleaning fluid from said rotatable member against a surface within said container other than said articles with sufficient force to break up said fluid into a fine mist, and condensing said mist onto the articles.

8. The method of degreasing small fragile articles comprising placing the articles within a container having a rotatable apertured member therein, said member having a hollow shaft extending into a volatile cleaning liquid, rotating said apertured member to draw said liquid into said apertured member and to eject a spray of said volatile cleaning liquid against the wall of said container with sufficient force to break said spray up into a fine mist, and condensing said mist on the articles.

9. The method of degreasing small fragile crystal elements comprising positioning said elements in a container having a rotatable apertured member therein, drawing a volatile cleaning fluid into said member by vacuum through a hollow shaft, ejecting said volatile cleaning fluid from said rotatable apertured member in a plurality of sprays having sufficient force to impinge on a wall within said container and break up into a fine mist, condensing said mist on said elements, and allowing the condensed mist to drain off said elements.

10. The method of degreasing small fragile crystal elements in accordance with claim 9 wherein the step of positioning said elements in said container includes aligning said elements with said rotatable apertured member so that a minimum of said sprays impinges directly thereon.

References Cited in the file of this patent

UNITED STATES PATENTS

1,090,420	Steed	Mar. 17, 1914
1,345,412	Smith	July 6, 1920
1,651,083	Brotz	Nov. 29, 1927
1,817,328	Weimers	Aug. 4, 1931
1,948,568	Faber	Feb. 27, 1934
1,953,409	Hovda	Apr. 3, 1934
1,986,292	Seavey	Jan. 1, 1935
2,023,013	Faber	Dec. 3, 1935
2,092,321	McFadden	Sept. 7, 1937
2,391,616	Causar	Dec. 25, 1945
2,448,490	Karlstrom	Aug. 31, 1948
2,628,204	Gray	Feb. 10, 1953