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K. P. W. NITSCHÉ
APPARATUS FOR CLEANING OR SIMILAR
TREATMENT OF METALLIC ARTICLES

2,888,939

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3 Sheets-Sheet 1

Fig. 1.

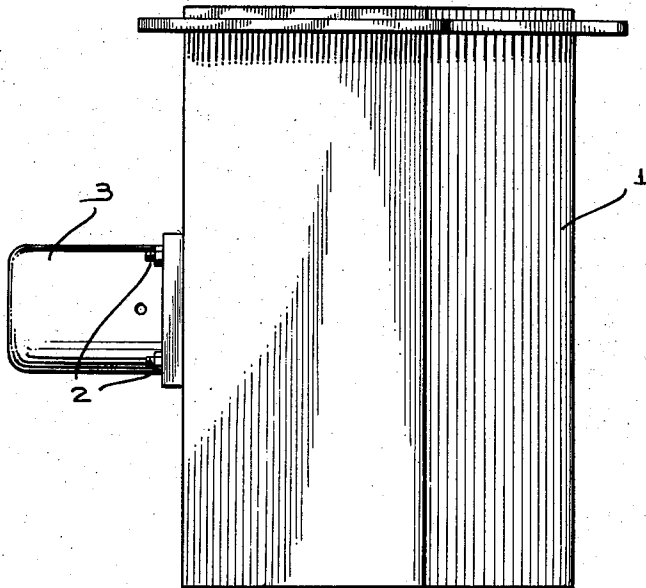
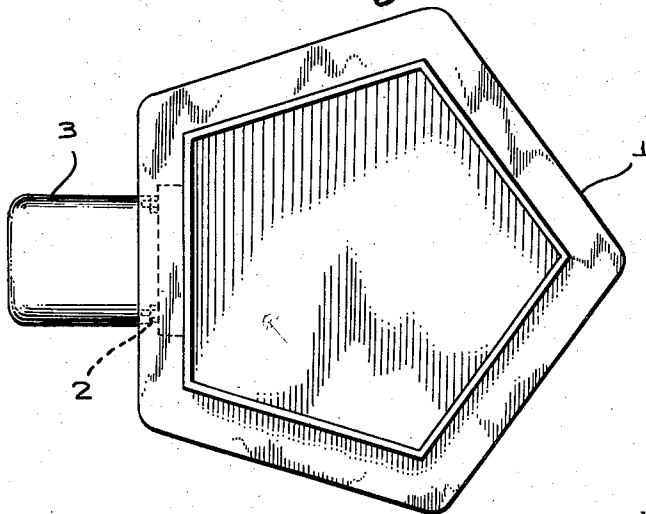


Fig. 2.



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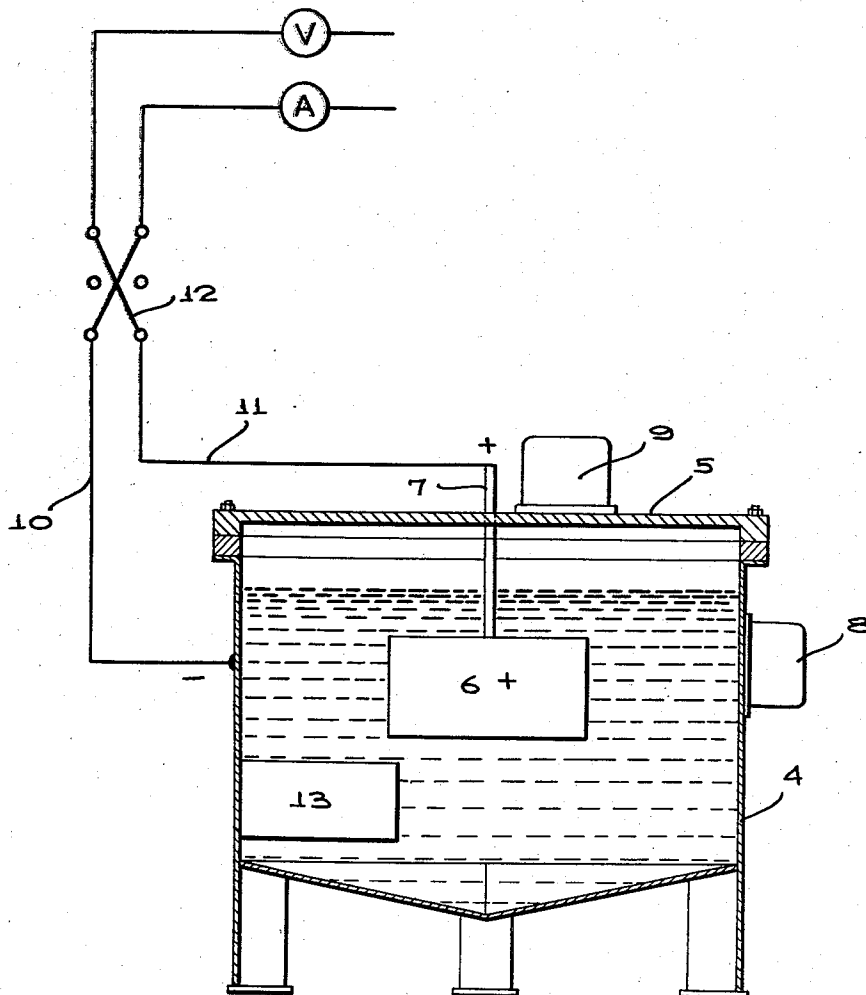
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Fig. 3.



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Fig. 4.

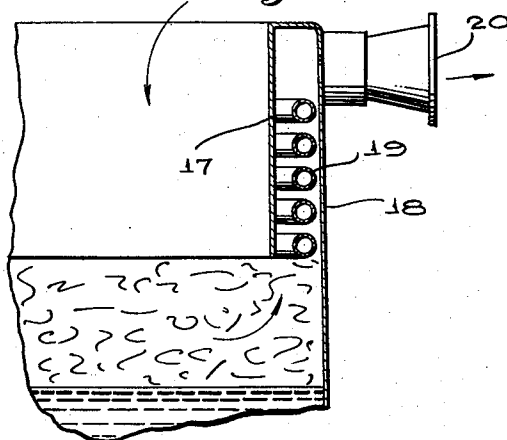
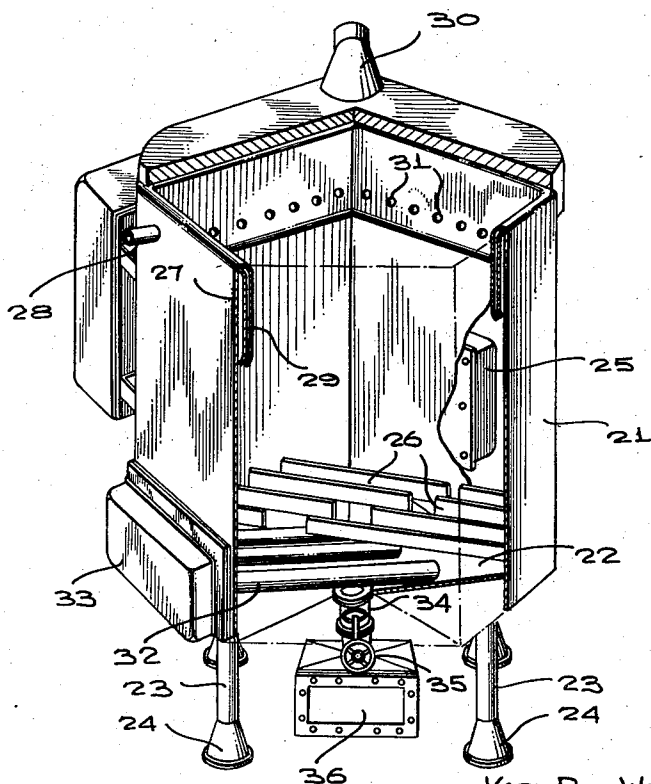


Fig. 5.



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APPARATUS FOR CLEANING OR SIMILAR TREATMENT OF METALLIC ARTICLES

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6 Claims. (Cl. 134—143)

The present invention relates to cleaning or similar treatment, such as degreasing, pickling or rinsing of metallic objects with the aid of liquids. The invention aims at facilitating the removal of the impurities from the surfaces of the objects, which in accordance with this invention is achieved by subjecting the liquid to the action of shocks or impacts at a high frequency by means of at least one vibrating device which operates with a frequency of about 2000 to 20,000 cycles per minute.

This invention is applicable to all liquid treatment of metallic objects to remove impurities adhering to the surfaces of the objects, such as grease, slag, scales, foundry sand, oxide layers etc. The liquid employed depends on the nature of the impurities to be removed and can consist of any liquid conventionally employed for the purpose involved. For degreasing purposes there are used organic solvents, e.g. trichloroethylene, carbon tetrachloride, benzene or benzol, or alkaline saponifying or emulsifying solutions containing e.g. sodium silicate, trisodium phosphate or borax. For pickling or similar treatment acids are used e.g. dilute hydrochloric or sulfuric acid or aqueous iron chloride acidified with hydrochloric acids (for aluminum). The invention may also be used for washing after cleaning or the like to remove the liquid film remaining after the previous treatment.

The invention may also be applied in combination with electrolytic cleaning of the articles.

The apparatus of this invention comprises a container adapted to receive the treatment liquid in combination with a vibrating device acting on the tank wall or against supporting members for the articles being treated.

The invention will be described in detail below with reference to the accompanying drawings.

Figs. 1 and 2 show an embodiment of the apparatus in side elevation and top plan view respectively.

Fig. 3 illustrates diagrammatically a suitable apparatus for electrolytic cleaning.

Fig. 4 is a detail view showing means for withdrawing vapors.

Fig. 5 shows another embodiment of the invention in perspective view with parts broken away.

The vessel 1 according to Figs. 1 and 2 which is suited for cleaning small objects is pentagonal, whereby it has no parallel side-walls. The vessel is filled with the bath to be used, e.g. an acidic solution, which is heated to a suitable temperature. The article is suspended in the bath in a suitable manner. At one wall of the vessel there is by means of screws 2 attached a vibrator 3 operating with a frequency of 2,000–20,000 cycles per minute, e.g. about 6,000 cycles per minute. The vibrator is started whereby the bath is subjected to shocks with a high frequency and is agitated vigorously. Thereby the liquid penetrates into pores in the material and the impurities are released and loosened. The treated goods is then washed in water to remove the acid. Thereupon the article can be immersed in another acid solution in which the liquid will again be subjected to high-frequency shocks so that the article receives a fur-

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ther cleaning treatment. Thereupon the article is washed in hot water, which like the previous washing bath is subjected to vibrations so that any remaining corrosive substances are removed from the material and no oxidation of the material can occur in the continued treatment thereof.

The apparatus according to Fig. 3 consists of a vessel 4, which like the vessel 1 according to Figs. 1 and 2 has suitably the shape of a polygon with an odd number of sides and has a lid 5. The vessel is filled with the desired liquid and the article to be treated, indicated generally at 6, is suspended in the bath by means of suitable support 7. Two vibrators 8 and 9 are attached to the vessel wall and the lid respectively so that the liquid as well as the treated article is subjected to shocks. Suitably, the vibrator 9 operates at a lower frequency than that of the vibrator 8. The vessel 4 and the support 7 which is electrically insulated from the lid 5 are connected through conductors 10 and 11 to a source of direct current. A switch 12 is provided so that the current is reversed at suitable intervals. In the vessel, there is also provided a heating device 13 so that the bath can be maintained at a suitable temperature.

When volatile liquids, such as trichloroethylene, are used as cleaning agents, it is suitable to provide the container with a device whereby vapors of the agent are prevented from flowing out into the ambient atmosphere. A suitable arrangement for this purpose is shown in Fig. 4. The vessel has at its top an inner partition 17, between which and the outer wall 18 there is formed an annular space wherein is disposed a helical pipe 19 through which a coolant can be circulated. On the outer wall 18 there is attached a connection pipe 20 which may be connected to a fan through a suitable conduit. Thus, air will be sucked down into the container through the opening within the inner partition 17 and carrying with it vapors of the solvent, up through the space between the walls 17 and 18 whereby the solvent will condense on the cooling pipe 19 and run back into the tank.

The apparatus of Fig. 5 comprises a tank 21 shaped in cross-section as a regular pentagon and having a bottom wall 22 sloping against its center. The tank is supported on legs 23 with rubber pads 24. At the container wall there is attached one or more vibrators 25 whereby the liquid in the container may be subjected to shocks of a high frequency. In the lower part of the container there are arranged a plurality of parallel lamellar rods 26 which extend from the side-wall for a distance into the container. It has been found that by this arrangement the effect of the vibrations is materially enhanced so that the cleaning action is made more efficient. The dimensions of the rods should be thus selected in consideration of the material and the normal liquid level in the tank and the frequency of the vibrations that resonance occurs in which case the rods will still more drastically enhance the effect of the vibrators.

In the upper portion of the tank there is arranged an inner partition 27 which defines an annular conduit into which a coolant, e.g. water, may be introduced through an inlet 28 and from which it is withdrawn through an outlet (not shown). Inside the cooling conduit there is a partition 29 and the space between this partition and the cooling conduit communicates through a conduit 30 with a suction fan. Air will be drawn into said space below the lower edge of the wall 29 and also through a row of perforations 31 disposed in the lower portion thereof. If volatile substances are utilized in the container, loss of such substances will be avoided thereby, in that they are carried by the air flow into the space between the partitions 27 and 29 and will condense on the cooling conduit and run back into the container.

The apparatus has electric heating means 32 arranged

in the lower portion thereof. The associated electric couplings are arranged within the casing 33.

The tank has in its bottom wall an outlet 34 with a valve 35 through which the contents may be emptied into a suitable receptacle 36.

As an example it may be mentioned that in an apparatus of the type shown in Fig. 5, 50 kgs. of material may be degreased at 50° C. within a period of only about 20 seconds.

The invention is not limited to the embodiments shown and described but these may be varied in many ways without departing from the spirit and scope of the invention.

Having now particularly described the nature of my invention and the manner of the operation what I claim is:

1. An apparatus for liquid cleaning or similar treatment of metallic articles with liquids comprising a polygonal shaped container having side walls, none of which is parallel to any other, and adapted to house the liquid and receive the articles to be cleaned, means for supporting the articles within the container, at least one vibrator and means operatively connecting the vibrator to one side wall of the container to act on said wall.

2. An apparatus as claimed in claim 1, wherein said vibrator operates with a frequency of 2,000 to 20,000 cycles per minute.

3. An apparatus as claimed in claim 1, wherein said container is adapted to contain a volatile solvent and includes a polygonal shaped partition arranged within the upper part of the container and spaced inwardly from

the side walls, a cooling element disposed within the space between the partition and the side walls, suction means in communication with the space between the partition and the side walls at a point above the cooling element to create a suction for drawing vapors from the container over the cooling element on which the vapors condense and the condensate flows back into the container so that vapors of the volatile solvent cannot escape into the ambient atmosphere.

4. An apparatus as claimed in claim 1, wherein rods extend transversely from the side walls for a distance toward the center of the container and are dimensioned so that resonance occurs to enhance the effect of the vibrator.

5. An apparatus as claimed in claim 4, wherein said rods are in parallelism.

6. An apparatus as claimed in claim 1, wherein additional vibrator means is operatively connected to the supporting means for the articles to act on the supporting means.

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