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PROCESS FOR THE CLEANING OF METAL PARTS

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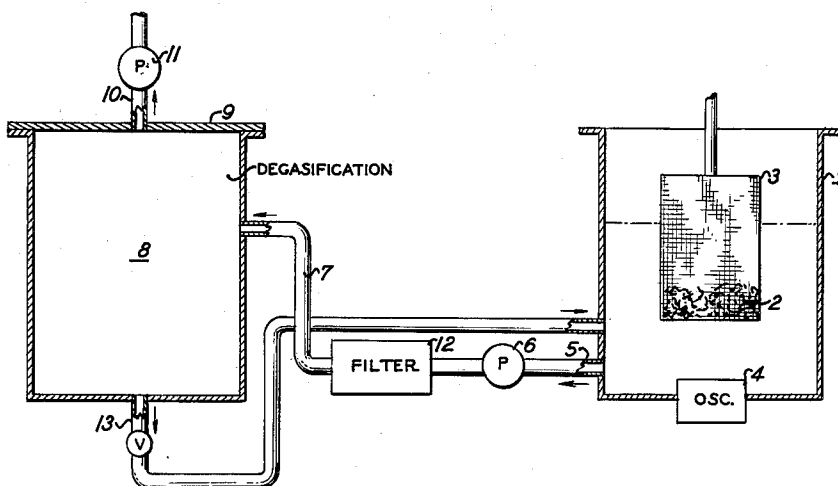


Fig. 1

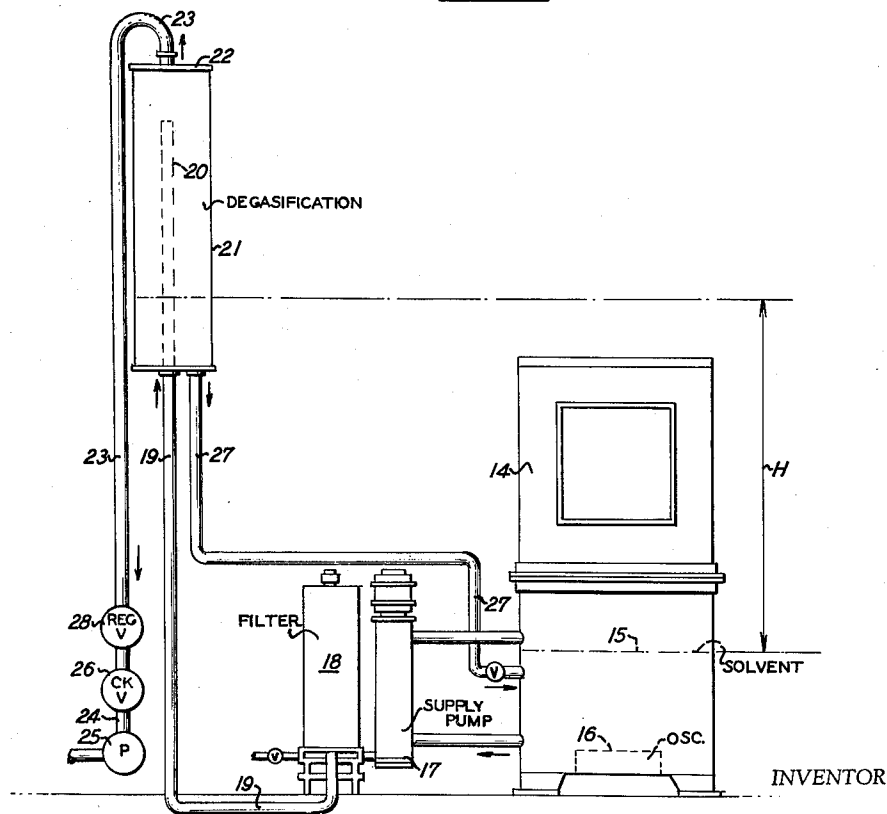


Fig. 2

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PROCESS FOR THE CLEANING OF METAL PARTS 5

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3 Claims. (Cl. 134—111)

The present invention concerns a process for the cleaning 15 of metal parts, in particular such parts in bulk, using ultrasonic radiation in a cleaning liquid, as well as an apparatus for carrying out such a process.

In the cleaning of metal parts, in particular such parts in bulk, by means of ultrasonic radiation in a cleaning 20 liquid, the air released in the liquid by the ultrasonic effect becomes combined into large air bubbles, and these air bubbles move to the source of ultrasonic energy and are held there to form a layer. This layer causes reflection of the wave emitted by the source and reduces or prevents their movement through the liquid.

To obviate this drawback it has already been proposed, during the radiation of the parts to be cleaned with ultrasonic energy, to produce a partial vacuum in the treatment chamber. To allow of this the container for receiving the parts to be cleaned and the energy source must be air-tight. For this reason such a process can conveniently be carried out only in a manually operated apparatus in which introduction of the metal articles to be cleaned is effected by means of a basket. With larger 30 installations, that is, with so-called automatic cleaning machines which have several cleaning baths and a means for the transport of perforate baskets, this process is not applicable.

The object of the invention is to provide an improved 40 cleaning process and apparatus.

It has now been found that the ultrasonic cleaning can also be carried out with good results if, instead of the established use of partial vacuum during the treating process, the treating liquid is de-gasified before the ultrasonic treatment. According to the present invention, therefore, the method of cleaning of metal parts, comprises the following steps:

- (1) Immersing the metal parts in a cleaning liquid;
- (2) Subjecting the liquid to ultrasonic vibrations; and
- (3) Removing the air dissolved in said cleaning liquid 50 in order to cause degasification of the liquid.

Preferably the de-gasification is carried out by removing the cleaning liquid from its container and subjecting it to a partial vacuum, whereupon the de-gasified liquid is then led again into the treatment container whereupon the cleaning process can be carried out by the application of ultrasonic energy in the normal manner and at atmospheric pressure. The absorption of gas by the cleaning liquid proceeds again only very slowly, and on reaching a certain saturation point it is advisable to carry out again the de-gasification procedure.

Furthermore, it is expedient if filtering of the cleaning liquid is effected before the de-gasification, since during filtration the liquid takes up, of course, rather a large amount of air which is then removed from the liquid by the subsequent de-gasification.

An apparatus for carrying out the process has at least one cleaning container and a de-gasification vessel connected thereto. The vessel will conveniently be connected to an installation for producing a partial vacuum therein.

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Embodiments of an apparatus for carrying out the process are schematically illustrated, by way of example, in the accompanying drawing, in which:

Fig. 1 shows a simple installation; and

Fig. 2 shows a continuously operating installation.

In the installation shown in Fig. 1 a cleaning container 1 is filled with a cleaning liquid, for example, with trichlorethylene or water and serves for receiving a mass of small metal parts 2 to be cleaned. The parts 2 are located in a filter basket 3, which is immersed in the cleaning liquid and on the floor of the container 1 is located an oscillator 4 for producing ultrasonic waves.

In addition the container 1 has a pipe 5 which is connected to the suction side of a pump 6, which pipe at the other end is connected via a pipe 7 to a de-gasification vessel 8. The de-gasification vessel 8 is capable of being closed so as to be air-tight, for example by means of a lid 9, which has a pipe 10 leading to a vacuum pump 11. A filtering device 12 is conveniently built in the pipe 7. A closable discharge pipe 13 connects the de-gasification vessel 8 to the treatment container 1.

Before commencing the cleaning treatment, the cleaning liquid is pumped through the pump 6 via the filtering device 12 into the de-gasification vessel 8. This is hermetically sealed and a partial vacuum is produced above the liquid level by means of pump 11. Ascending bubbles in the liquid indicate the progressive de-gasification thereof. When the de-gasification is completed the cleaning liquid passes through the pipe 13 into the treatment container and the normal cleaning process begins. The filter basket 3 is immersed in the de-gasified liquid and the oscillator is set in operation. Intense bubbling on the upper surface of the cleaning liquid shows the unhindered penetration of the cleaning liquid by the ultrasonic waves. The cleaning liquid retains its de-gasified state for a comparatively long period, so that several loads can be cleaned one after the other. When the liquid shows considerable soiling or the formation of bubbles abates, the liquid is again filtered and de-gasified.

A continuously operating installation is illustrated in Fig. 2. A cleaning container is indicated at 14, which, for example, may serve for receiving an automatic cleaning machine. The container 14 is filled with a solvent 15, for example trichlorethylene or perchlorethylene and has fitted to the base thereof an oscillator 16 for producing ultrasonic waves. The container 14 is connected to a supply pump 17 which causes the solvent 15 to pass continuously from the cleaning container 14 through a filter arrangement 18 connected to the pressure side of the pump 17. The filter arrangement 18 is connected via an ascending pipe 19 to an overflow 20 of a de-gasification vessel 21, which vessel is arranged well above the liquid level of the solvent 15 in the cleaning container. The vessel 21 is closed by means of a lid 22 which has a connection for a pipe 23 which is connected to the suction side 24 of a vacuum pump 25, a check valve 26 being provided in the pipe 23.

A return pipe 27 connects the vessel 21 to the cleaning container 14.

The solvent 15 is continuously drawn from the cleaning container 14, cleaned in the filter arrangement 18 and supplied to the de-gasification vessel 21 where the removal of air takes place. For this purpose the vacuum pump 25 is operative, in order to produce a vacuum in the vessel 21. There is thus a level difference H and this is arranged to correspond to the vapor pressure of the solvent, which for trichlorethylene amounts to about 4700 millimetres and for perchlorethylene about 4200 millimetres. The check valve 26 of the vacuum pump prevents solvent from being drawn into the vessel 21 when the pump 17 stops. The desired degree of de-gasi-

fication may be adjusted by means of a regulating valve 28 in the pipe 23.

The installation described works continuously in that the soiled and air-saturated solvent is drawn off through the pipe 19 from the cleaning container 14, is cleaned in the filter arrangement 18 and is de-aerated in the vessel 21, whereupon the cleaned and de-aerated solvent flows back through the pipe 27 into the cleaning container 14.

I claim:

1. Apparatus for the cleaning of metal particles comprising a container adapted to receive a cleaning liquid, means in the base of said container for producing supersonic waves in said liquid, said container having a circulating conduit connected thereto, said conduit including a circulating pump, a filter and a hermetically sealed degasification vessel, said vessel being disposed at an elevated position compared with said cleaning container, the difference in level corresponding to the vapor pressure of said cleaning liquid.

2. Apparatus for the cleaning of metal particles comprising a container adapted to receive a cleaning liquid, means in the base of said container for producing supersonic waves in said liquid, said container being connected to a supply pump by means of a first pipe connection between the base part of said container and the suction side of said pump, and a filter arrangement communicating with the pressure side of said pump, a de-

gasification vessel being disposed at an elevated position compared with said cleaning container, said vessel having an overflow extension which is in connection with said filter arrangement by means of a second pipe connection, the upper part of said vessel being closed by means of a lid, said lid being connected to the suction side of a vacuum pump by means of a third pipe connection, a fourth pipe connection being arranged between the base part of said vessel and the upper part of said container, in order to continuously draw said cleaning liquid from the cleaning container through the filter arrangement the de-aerating vessel, and back to said cleaning container.

3. Apparatus for the cleaning of metal particles as claimed in claim 2, in which in said third pipe connection a check valve is provided.

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