

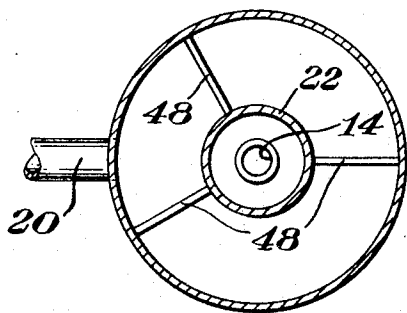
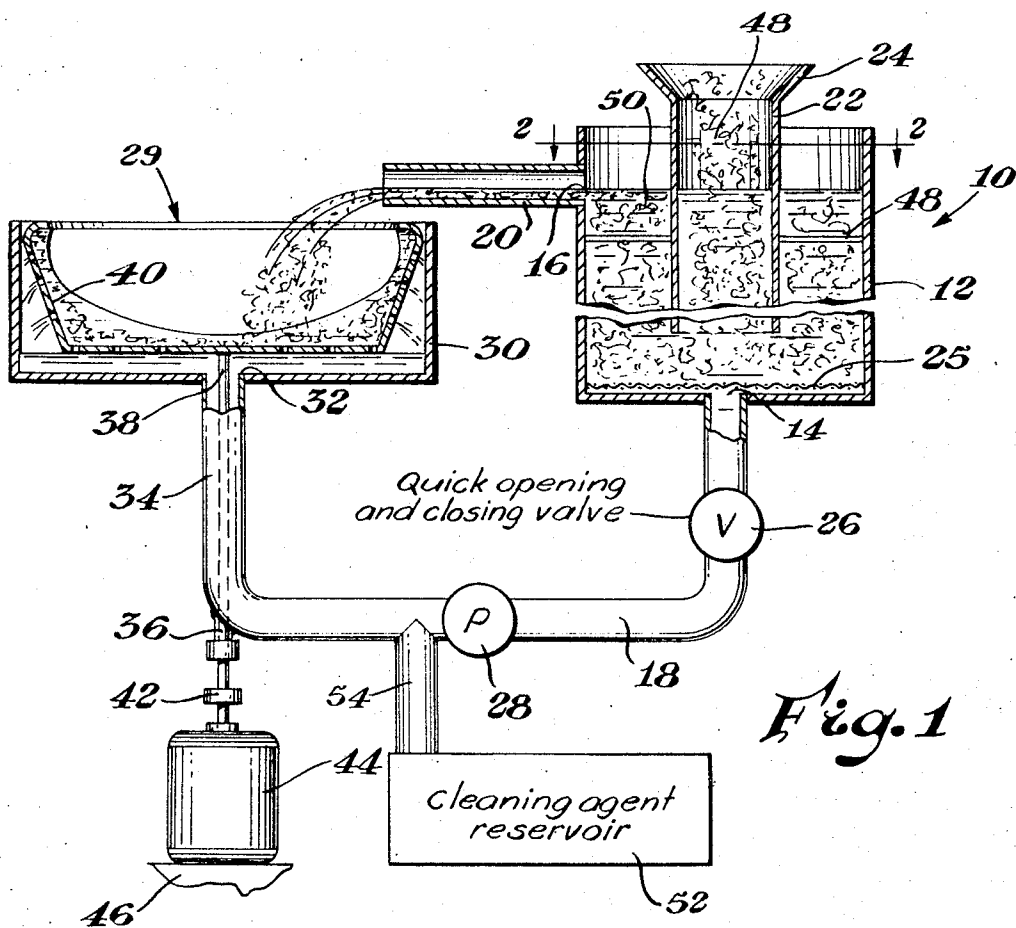
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METHOD AND APPARATUS FOR CLEANING CHIPS AND THE LIKE

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1

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METHOD AND APPARATUS FOR CLEANING CHIPS AND THE LIKE

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13 Claims

ABSTRACT OF THE DISCLOSURE

A feed tube reservoir for receiving chips or small parts, the reservoir being disposed in a washing chamber with the bottom of the tube reservoir disposed near the bottom of the washing chamber. Means are provided for introducing liquid cleaning agent under cyclic stress into the bottom of the washing chamber and for removing solvent and cleaned parts from the upper part of said washing chamber. Means for separating the cleaning agent to the washing chamber are provided. A method of cleaning chips and parts using the above techniques is disclosed.

This invention relates to a method and apparatus for cleaning chips or small parts and particularly to a method and apparatus for cleaning chips or small parts in which the cleaning solvent used is periodically subjected to cyclic stress (tension) to promote parts transfer through the apparatus as the cleaning proceeds.

The cleaning of metal chips, such as brass or aluminum chip, for example, by conventional methods is often too expensive to justify such an operation in order to later reclaim the metal.

Accordingly, a principal object of this invention is to provide an improved method and apparatus for cleaning chips and small parts.

Another object of this invention is to provide an improved, more economical to use method and apparatus for cleaning metal chips and small parts.

In accordance with this invention there is provided a feed tube reservoir for receiving chips or small parts, the reservoir being disposed in a washing chamber with the bottom of the tube reservoir disposed near the bottom of the washing chamber. Means are provided for introducing liquid cleaning agent under cyclic stress into the bottom of said washing chamber and for removing solvent and cleaned parts from the upper part of said washing chamber. Means for circulating the cleaning agent to the washing chamber are provided.

The invention, as well as additional objects and advantages thereof, will best be understood when the following detailed description is read in connection with the accompanying drawing, in which:

FIGURE 1 is a diagrammatical view of apparatus in accordance with this invention, and

FIGURE 2 is a sectional view taken along the line 2—2 of FIGURE 1.

Referring to the drawing, there is shown cleaning apparatus 10 comprising an outer washing chamber 12 which is generally cylindrical in shape with an open top, side walls and closed bottom.

A materials feed tube 22 is disposed at least partially within the chamber 12, with the upper part of the tube 22 having an outwardly flared part 24 at the upper end of the tube. The tube 22 is supported within the chamber 12 and above the bottom of the chamber 12 by a distance which is preferably no greater than one-fourth of the depth of said chamber below said means for discharging cleaned parts by a distance which is by support elements

2

48 which extends between the chamber walls and side wall of the tube 22.

The lower end of the tube 22 is usually disposed above the bottom of the chamber 12 by a distance of about 6 inches (when a 3 inch diameter tube 22 is used with an 8 inch diameter chamber 12). Usually the flared part 24 of the tube 22 is disposed above the top of the chamber 12. An output spout or tube 20 is coupled to a bore 16 in the side wall of the chamber 12. The diameter of the tube 20 is large enough to permit easy flow through it of the chips or parts being cleaned.

The bottom of the chamber 12 has a bore 14 therein, the bore 14 being disposed generally in axial alignment with respect to the tube 22.

A cleaning agent supply tube 18 is coupled to the bore 14 and to a pump 28. The tube 18 has a quick opening and closing valve 26 disposed along its length between the pump and the bore 14.

Cleaned chips or parts receiving means, indicated generally by the numeral 29, are provided. The receiving means 29, as shown, comprises a rotatable basket 40 disposed in a cup-like member 30 which has an axially disposed bore 32 in the bottom thereof. A cleaning agent return tube 34 is coupled between the bore 32 and the pump 38.

A shaft 38 is fixedly coupled to the bottom of the rotatable basket 40 and to the shaft of a motor 44 (secured to a base 46) by means of a coupling. The shaft 38 extends for part of its length inside the pipe 34, passing through a suitable packing gland 36 in the wall of the pipe 34.

The outlet spout or tube 20 extends over the top of the rotatable basket 40. A compliance element (not shown) may be coupled, if needed, to the tube 18 between the pump 28 and the valve 26.

A cleaning agent reservoir 52 is coupled to the input side of the pump 28 through the line 54.

In operation, metal chips 50 (for example) are fed into the feed tube 22 while the pump 28 and the quick opening and closing valve 26 are operating. The valve 26 is rapidly opened and closed by mechanical drive or other means, to place the cleaning agent under tension to produce cavitation at a cyclic rate of between 1/2 and 10 cycles per second. Usually the repetition rate for opening and closing the valve is between 1 and 3 times per second. The pumping rate is adjusted to give sufficient flow through the chamber so that, when the chips or parts are subjected to cavitation following the closing of the valve 26, the chips 50 (or parts) being cleaned are moved slowly down the tube 22, up the washing chamber, and then out the delivery tube 20 and into the rotatable basket 40. As the basket 40 rotates, the cleaning agent, such as a chlorinated solvent, for example, or other suitable cleaning agents, is removed by centrifugal action as the basket rotates, and drains from the cup-like member 30 and into the line 34 where it returns to the reservoir 52 or to the pump 54. It is realized that the return line for cleaning agent may in some situations need to be coupled to the cleaning agent reservoir from the member 30 by a one line and a second line be coupled from the reservoir 52 to the pump, but the arrangement shown is as it is because of its simplicity. Separate lines would especially be needed if excessive air entered the pumping system through the line 34.

In one device made in accordance with this invention, the feed tube 22 is 3 inches in inside diameter, the chamber 12 is 8 inches in inside diameter and is 24 inches long. The bottom of the feed tube 22 is 6 inches from the bottom of the chamber 12. A screen 25 is disposed at least across the bore 14 to prevent loss of chips or parts down the tube 18.

Typical cleaning agents which may be used for sodium

metasilicate solutions or 5 percent sodium hydroxide solution plus wetting agent.

While the valve 26 is actuated cyclically, usually, a non uniform repetition rate may be used which provides reasonable movement and cleaning of the chips or parts through the washing chamber 12.

Thus, while the above described apparatus shows a typical setup for cleaning chips or small parts (metal or non-metal), the apparatus may be considerably changed in form without departing from the scope of this invention. One such improvement anticipated in connection with a high capacity cleaning unit is a centrifuge which would discharge both the cleaning agent and the chips or parts automatically.

It is also practical to construct a cleaning unit in which the washing chamber is concentric with and disposed partially within a centrifuge whereby the means for discharging cleaned chips or parts is the rim of the wall of the washing chamber.

What is claimed is:

1. A method of cleaning chips of material or small parts, comprising:

(a) feeding said chips or parts through a conduit from above into a washing chamber, said washing chamber having a bottom and upstanding sides, and said conduit extending into said washing chamber and having a lower end adjacent to but spaced from said bottom,

(b) simultaneously flowing substantially liquid cleaning agent through said washing chamber from an entry conduit coupled to said bottom and axially aligned with and below the conduit through which said chips or parts are fed, the flowing of said cleaning agent being rapidly repetitively interrupted and resumed to place said cleaning agent under cavitation, the overall flow rate being sufficient to move said chips or parts through said chamber.

(c) discharging said chips or parts through flow means coupled through said washing chamber wall above the lower end of the conduit through which said chips or parts are fed, and

(d) separating adhering cleaning agent from said washed chips or parts which have been discharged from said chamber.

2. A method in accordance with claim 1, wherein said separation is achieved by use of centrifugal force.

3. A method in accordance with claim 1, wherein cavitation is produced in said cleaning agent by placing said cleaning agent under tension at a repetition rate of between one-half and ten times per second.

4. A method in accordance with claim 1, wherein said cleaning agent is a sodium metasilicate solution.

5. A method in accordance with claim 1, wherein said cleaning agent is a sodium hydroxide solution plus a wetting agent.

6. A method in accordance with claim 1, wherein said cleaning agent is a chlorinated solvent.

7. Apparatus for cleaning chips or small parts comprising:

(a) a washing chamber having an open top, closed bottom and side walls;

(b) first conduit means extending into said chamber from the top of said chamber and having a discharge end part disposed adjacent to but spaced from said bottom for introducing said chips or small parts into said washing chamber near the bottom of said chamber;

(c) second conduit means coupled to said bottom and axially aligned with said first conduit means for introducing cleaning agent into said washing chamber at the bottom thereof;

(d) pumping means disposed in said second conduit means and spaced from said bottom;

(e) quick opening and closing means disposed in said second conduit means and positioned between said pumping means and said bottom;

(f) third conduit means coupled to said washing chamber wall and disposed above said discharge and part for discharging cleaned chips or parts from said washing chamber; and

(g) means for removing adhering cleaning agent from said cleaned discharged chips or parts.

8. Apparatus in accordance with claim 7, wherein said quick opening and closing means is a valve.

9. Apparatus in accordance with claim 8, wherein said valve is mechanically driven.

10. Apparatus in accordance with claim 7, wherein said means for removing adhering cleaning agent from said cleaned chips or parts is a centrifuge type device.

11. Apparatus in accordance with claim 7, wherein said third conduit means for discharging cleaned chips or parts is a spout-like member.

12. Apparatus in accordance with claim 7 further comprising a cleaning agent reservoir coupled to said pumping means, and a line connecting said means for removing adhering cleaning agent to said pumping means.

13. Apparatus in accordance with claim 7, wherein the discharge end part of said means for introducing chips or small parts is spaced from the bottom of said chamber by a distance no greater than one fourth of the depth of said chamber below said means for discharging cleaned parts.

References Cited

UNITED STATES PATENTS

1,580,723	4/1926	Hapgood	134—25 XR
1,624,982	4/1927	Rosenberg	134—109 XR
2,578,040	12/1951	Booth et al.	134—109 XR
2,647,846	8/1953	Bagno	134—1
3,024,138	3/1962	Schlott	134—1
3,092,515	6/1963	Pike et al.	134—25
3,119,721	1/1964	Suares	134—25
3,222,221	12/1965	Branson	134—25 XR

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