United States Patent [19]
Laroche

[11] 3,718,147
[45] Feb. 27, 1973

[54] INSTALLATION FOR DEGREASING METAL ARTICLES

[75] Inventor: **Rene V. Laroche**, Fribourg, Switzerland

[73] Assignee: **Aluminium Suisse SA**, Chippis, Switzerland

[22] Filed: **Feb. 16, 1971**

[21] Appl. No.: **115,810**

[30] **Foreign Application Priority Data**

Feb. 17, 1970 Switzerland..........................2221/70
Feb. 2, 1971 Switzerland..........................1476/71

[52] **U.S. Cl.** **134/60**, 134/72, 134/108, 134/109, 202/170

[51] **Int. Cl.** **B08b 3/02**

[58] **Field of Search**............134/60, 72, 73, 108, 109; 202/170, 170 D

[56] **References Cited**

UNITED STATES PATENTS

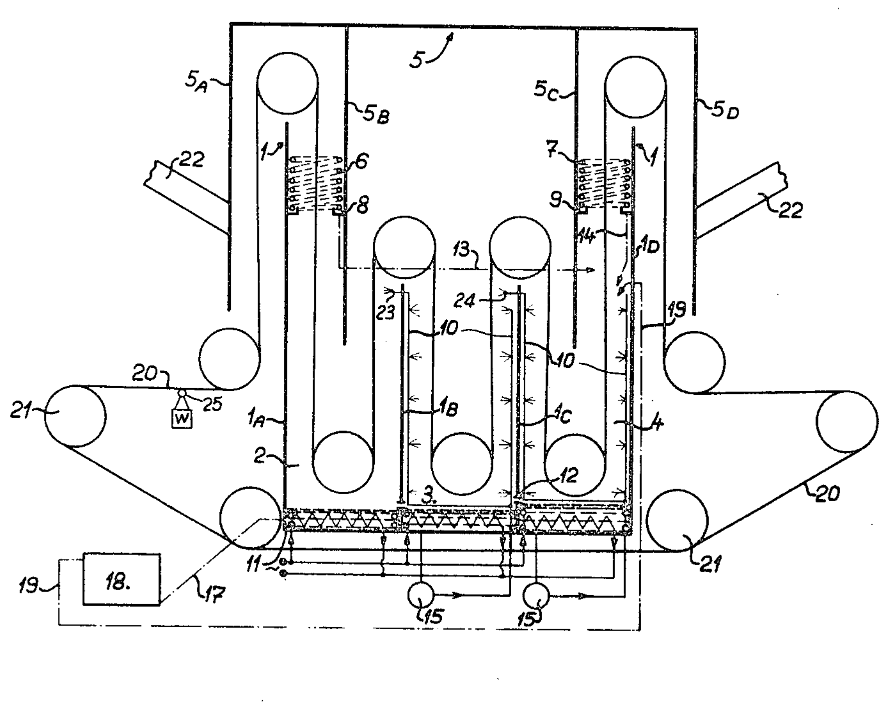
1,907,875	5/1933	Robertson	202/170 X
2,028,759	1/1936	Dinley	134/60
2,270,642	1/1942	Somes	134/60 X
2,369,050	2/1945	Helfenstein	202/170 X
2,541,901	2/1951	Zademach et al.	134/60 UX
3,085,948	4/1963	Kearney	202/170 D
3,120,853	2/1964	Kearney et al.	134/108 X

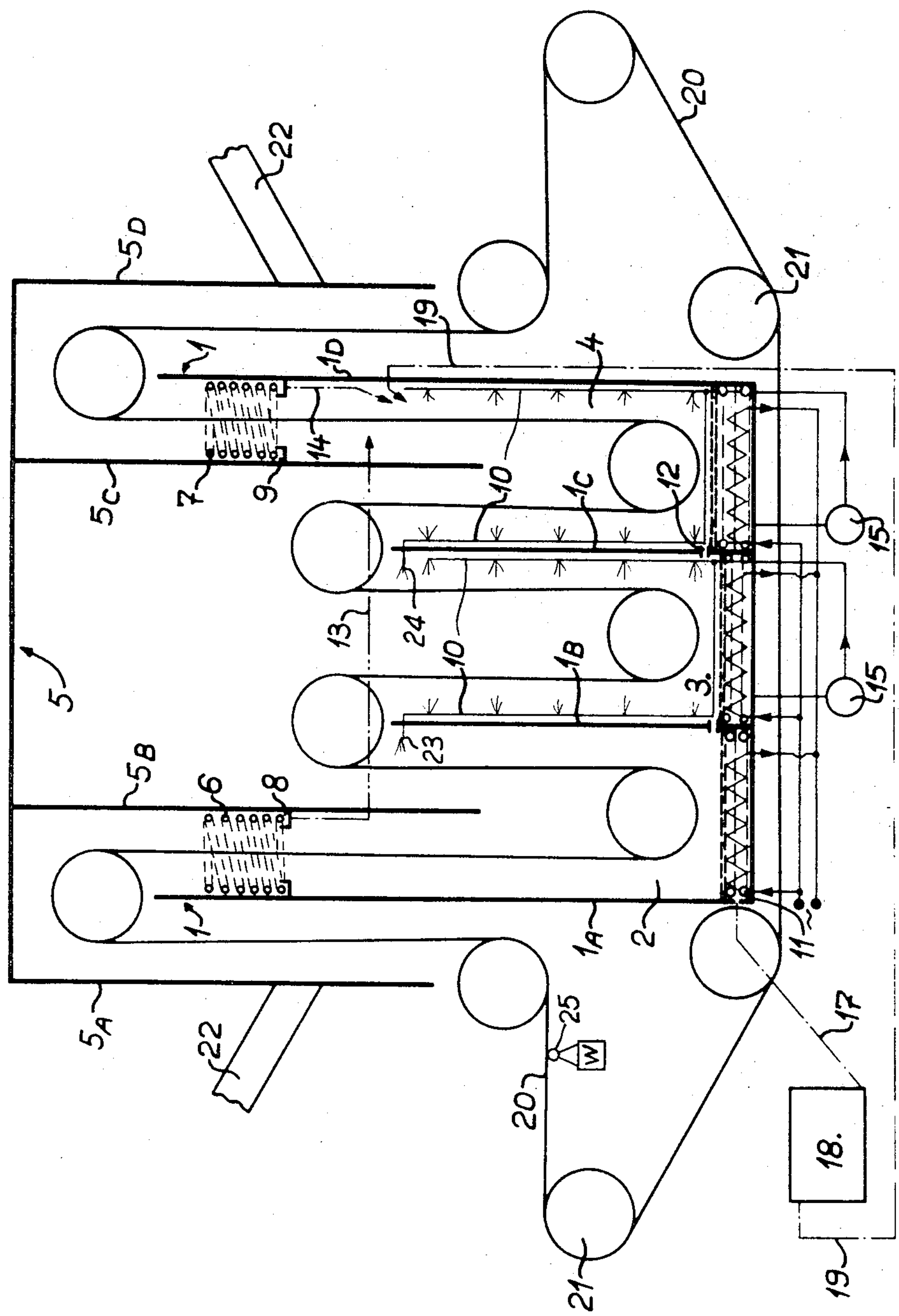
Primary Examiner—Daniel Blum
Attorney—Robert E. Burns and Emmanuel J. Lobato

[57] **ABSTRACT**

An installation for degreasing metal articles comprises means for driving articles to be cleaned successively through at least two chambers comprising heating means in their lower parts, the first chamber being a condensation chamber, and the other chamber(s) each comprising means for spraying a solvent. Condensers are located at the inlet to the first chamber and the outlet to the last chamber. Means for regenerating and recycling solvent comprise three circuits:a first circuit for each spraying chamber comprising means for pumping solvent from the bottom of the chamber to feed the spraying means ; a second circuit formed by overflows between adjacent chambers to enable a flow of solvent from the final chamber to the first chamber, and a first return conduit connecting the first chamber and the final chamber, said first return conduit comprising a distiller comprising level compensating means by the external supply of solvent and being adapted to deliver distilled solvent to the final chamber; and a third circuit comprising means for recuperating condensation from the condensers and second return conduits for the delivery of condensation from the recuperation means to the final chamber ; the second circuit having a by-pass formed by at least one spraying nozzle at the outlet of each chamber except for the final chamber, each last mentioned spraying nozzle being fed by solvent taken from the adjacent following chamber.

1 Claim, 1 Drawing Figure




5D
22
20
21
19
1
1D
4
14
10
12
1C
5C
7
9
13
24
15
3.
1B
23
5
5B
6
8
1A
2
11
17
5A
25
W
22
20
18.
21
19

INSTALLATION FOR DEGREASING METAL ARTICLES

The invention concerns an installation for degreasing metallic articles, for example metal boxes, cans or other containers after manufacture and prior to coating them with a protective layer.

Washing with soda, in addition to the drawback of being relatively inefficient for dissolving fat has the drawback of attacking the metal, especially aluminum ; in this case, there is formation of aluminate, then precipitation of hydroxide during rinsing with water. This hydroxide remains on the walls of the container and is subsequently covered by the protective layer, for example of varnish. In view of the fact that it is necessary to heat varnish to cause polymerization the aluminum hydroxide decomposes into alumina and water, the latter causing bubbles that can rupture the layer of varnish. Moreover, the residue of alumina decreases the adherence of the varnish.

Single or repeated immersion in an organic solvent only gives an incomplete removal of the metallic impurities. Moreover, vapor phase washing is often inefficient, especially with thin walled containers, for example aluminum cans, for which the quantity of solvent condensed on the surface is insufficient.

Installations have already been proposed to overcome these drawbacks. In the installation described in British Pat. specification No. 329,156, articles to be degreased are exposed to solvent vapor in a first chamber, then sprayed with liquid solvent in a second chamber. Condensers located at the inlet and outlet of the installation prevent loss of solvent vapor into the atmosphere. All of the solvent circulates in a distillation circuit for the purposes of purification, but distillation of all of the solvent requires a large capacity distilling plant which consumes large quantities of energy.

In a somewhat improved installation, described in German Pat. specification No. 727,853, articles to be cleaned successively pass through several chambers in which they are sprayed by solvent in the vapor phase, which falls onto inclined planes to be recuperated and pumped to feed the spraying heads. Spraying can be carried out at different temperatures. All or a part of the solvent falling on an inclined plane can be used to feed the preceding spraying heads, and the liquid falling in the first chamber is taken off for purification by distillation.

The present invention aims to further improve these installations.

According to the invention, there is provided an installation for degreasing metal articles, comprising means for driving articles to be cleaned successively through at least two chambers, a first chamber being a condensation chamber and the succeeding or following chamber or chambers being spraying chambers with means for spraying a solvent therein ; an inlet at the upper part of the first chamber having a first condenser therein and an outlet at the upper part of the final chamber having a second condenser ; heating means in the lower part of the chamber ; and means for regenerating and recycling solvent comprising three circuits for the solvent : a first circuit for each spraying chamber comprising means for pumping solvent from the bottom of the chamber to feed the spraying means ; a second circuit formed by overflow passageways between adjacent chambers to enable a flow of solvent from the final chamber to the first chamber, and a first return conduit connecting the first chamber and the final chamber, said first return conduit including a distiller having level compensating means for the external supply of solvent and being adapted to deliver distilled solvent to the final chamber ; and a third circuit comprising means for recuperating condensation from the condensers and second return conduits for the delivery of condensation from the recuperation means to the final chamber ; the second circuit having a bypass formed by at least one spraying nozzle at the outlet of each chamber except for the final chamber, each spraying nozzle being fed by solvent taken from the next succeeding or following chamber.

The use of three solvent circuits enables use of a small capacity distiller, since the second circuit represents only about 20 percent of the total capacity of the two circuits. Moreover, rinsing by means of an additional chamber fed by the following chamber enables an installation of n chambers to be the equivalent of an conventional installation of $2n-1$ chambers.

The use of overflows between the chambers enables the level of solvent at the bottom of the chambers to be maintained constant, and allows adjustment of the flow of solvent in the second circuit.

The single FIGURE of the accompanying drawings diagrammatically shows, by way of example, an embodiment of the invention.

A generally rectangular shaped tank 1 comprises two inner walls 1B and 1C between two outer walls 1A and 1D so as to define three chambers 2, 3 and 4. Inner walls 1B and 1C are of lesser height than outer walls 1A and 1D.

On the tank 1 is mounted a cover 5, also of generally rectangular shape , comprising outer walls 5A, 5D and inner walls 5B and 5C. The inner walls 5B and 5C of cover 5 bear against the frontal and rear walls of the tank 1, not shown.

The wall 1A of the tank 1 is partially located between the walls 5A and 5B of the tank 5, and similarly for wall 1D in relation to walls 5C and 5D.

Rectangular coiled condensers 6 and 7 are located respectively between the walls 1A and 5B at the upper part of the inlet to chamber 2, and 5C and 1D at the upper part of the outlet to chamber 4 so as to surround the inlet and outlet to the chambers 2 and 4 respectively.

Gutter-shaped channels 8 and 9 are located respectively under the condensers 6 and 7 and are adapted to receive condensation from these condensers. Conduits 13 and 14, schematically shown by dotted-dashed lines, connect the channels 8 and 9 respectively to chamber 4; this constitute the said third circuit for the solvent.

Spraying heads 10 are located on the side walls of the chambers 3 and 4. Two pumps 15, each connected to one spraying chamber individually feed the spraying heads of the latter ; this constitues the first solvent circuit for each spraying chamber.

Super-heated oil or water operated heat exchangers 11 are located at the lower parts of each chamber 2, 3 and 4 to ensure evaporation of the solvent. These heat exchangers 11 intercommunicate with one another by orifices 12 acting as overflow means. The orifice 12 between chambers 3 and 4 is at a slightly higher level than the orifice 12 between the chamber 2 and 3 and an outlet conduit **17** in the chamber **2** is slightly lower than the orifice **12** between the chambers **2** and **3**. A counter-flow of solvent from the final chamber **4** to the first chamber **2** can thus occur. The chamber **2** is connected by conduit **17** to a distillation apparatus **18** ; a conduit **19** evacuates the product of distillation collected in distillation apparatus **18** and delivers it into the chamber **4**. Distillation apparatus **18** contains a certain quantity of liquid solvent the level of which is kept constant by an external feed device controlled by a conventional constant head device, well known to those skilled in the art and therefore not shown. This constitutes the said second circuit for the solvent.

An endless chain **20** mounted on guide pulleys **21** is driven around a path through the chambers **2**, **3** and **4** of the installation. In each chamber, each part of this path between two rollers is slightly inclined in relation to the vertical, in such a way as to traverse the zones surrounded by the condensers **6** and **7** and to pass near the spraying heads **10**. Metallic rods **25** are fixed laterally of and perpendicular to the links of the chain and serve as supports for containers W, for example cans, to be cleaned by the removal of grease.

On walls **5A** and **5D** are connected suction conduits **22**. The installation also comprises a spraying nozzle **23** at the outlet of chamber **2**, fed by solvent pumped from the chamber **3** and used as a rinsing nozzle for cans to be cleaned leaving the chamber **2**, and at least one spraying nozzle **24** fed by the solvent taken up from the chamber **4** for rinsing cans leaving the chamber **3**. These spraying nozzles **23**, **24** therefore form a by-pass avoiding the orifices **12** of the second solvent circuit.

The described installation operates as follows :

The condensation chamber **2** and the spraying chambers **3** and **4** are filled with solvent, for example trichlorethylene or perchlorethylene, up to the levels of the overflow orifices **12**.

This solvent is heated up to its boiling point by the heat exchangers **11**. When the boiling temperature is reached, the pumps **15** come to action and solvent discharged by the pumps **15** is atomized by the spraying heads **10** in the chambers **3** and **4**. The first chamber **2** is simply filled with solvent vapor. The atmosphere in the different chambers being saturated with solvent vapor, this spraying is not accompanied by any aerosol formation.

The solvent vapor condenses on the condensers **6** and **7**. At the level of these condensers, a vapor barrier is set up separating the internal part of the installation from the exterior. Nevertheless should any vapor escape, the suction conducts **22** enable removal of solvent-laden air, for recovery of the solvent.

Taking into account the important desaturation in solvent vapor at the level of the condenser **7** and the high temperature of the cans being cleaned passing by that location, the cans cause rapid evaporation of solvent still adhering to them and leave the installation dry.

The flow of the solvent contrary to the movement of the cans to be cleaned means that the cleanest solvent is to be found at the outlet end of the installation ; this, together with the vapor-phase spraying process results in giving the installation a high efficiency of operation.

By the presence of rinsing nozzles **23** and **24** at the outlet of chambers **2** and **3**, the described three chamber installation is equivalent to a five chamber installation (or $2n-1$, where n is the actual member of chambers), since the first chamber is used both as a condensation chamber and a rinsing chamber and in the second chamber spraying is carried out by means of solvent taken up from this chamber and rinsing with solvent taken up from the third chamber.

What is claimed is :

1. An installation for degreasing metal articles, comprising means for driving articles to be cleaned successively through at least two chambers, a first chamber being a condensation chamber and the other or succeeding chambers being spraying chambers and having means for spraying a solvent therein; an inlet at the upper part of the first chamber having a first condenser and an outlet at the upper part of the final chamber having a second condenser; heating means in the lower part of each of said chambers; and means for regenerating and recycling solvent comprising three circuits for said solvent; a first circuit for each spraying chamber comprising means for pumping solvent from the bottom of the spraying chamber to feed the spraying means; a second circuit formed by overflow connections between adjacent chambers to enable a flow of solvent from the final chamber to the first chamber, and a first return conduit connecting the first chamber and the final chamber, said first return conduit including a distiller having a level compensating means for the external supply of solvent and being adapted to deliver distilled solvent to the final chamber; and a third circuit comprising means for recuperating condensation from the condensers and second return conduits for the delivery of condensation from the recuperation means to the final chamber; the second circuit having a by-pass formed by at least one spraying nozzle at the outlet of each chamber except for the final chamber, each of said last mentioned spraying nozzles being fed by solvent directly by said pump means from the next adjacent following chamber.

* * * * *