United States Patent

Yagishita

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[54] HEATING AND CONCENTRATING TOWER FOR PLATING WASTE RECOVERY UNIT

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[51] **Int. Cl.**.....**B01d 1/00**, E03b , F16k 49/00, F17d , F16l 53/00, B01k 3/00

[58] **Field of Search**.....159/22, 23, 1, 43, 44, 20, 159/20 CS; 137/340, 599.1; 204/232, 237; 117/102

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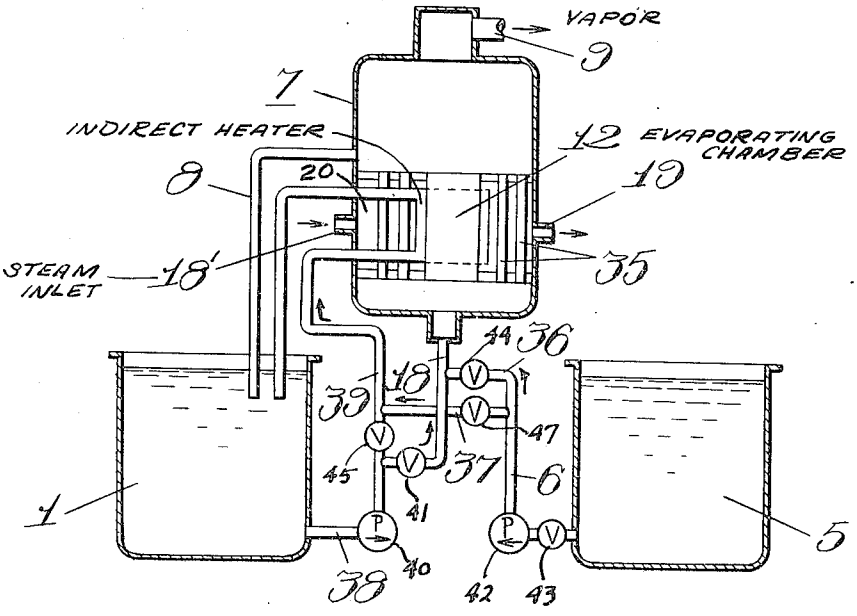
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[57] **ABSTRACT**

In the reclaiming of plating wastes containing chromic acid and the like, the rinse liquid from the first of a plurality of washtubs into which plated articles are dipped successively to rinse off the plating solution, is sucked into a tower, heated by steam to concentrate it to plating strength, and then is returned to the plating tank. The plating solution is also pumped from the plating tank into the tower where it is heated and recirculated back to the plating tank to maintain the solution in the tank at an elevated temperature. Means is also provided to pump the rinse liquid directly from the first washtub to the plating tank, if the rinse liquid in said first tub does not require concentration to raise it to plating strength.

5 Claims, 2 Drawing Figures



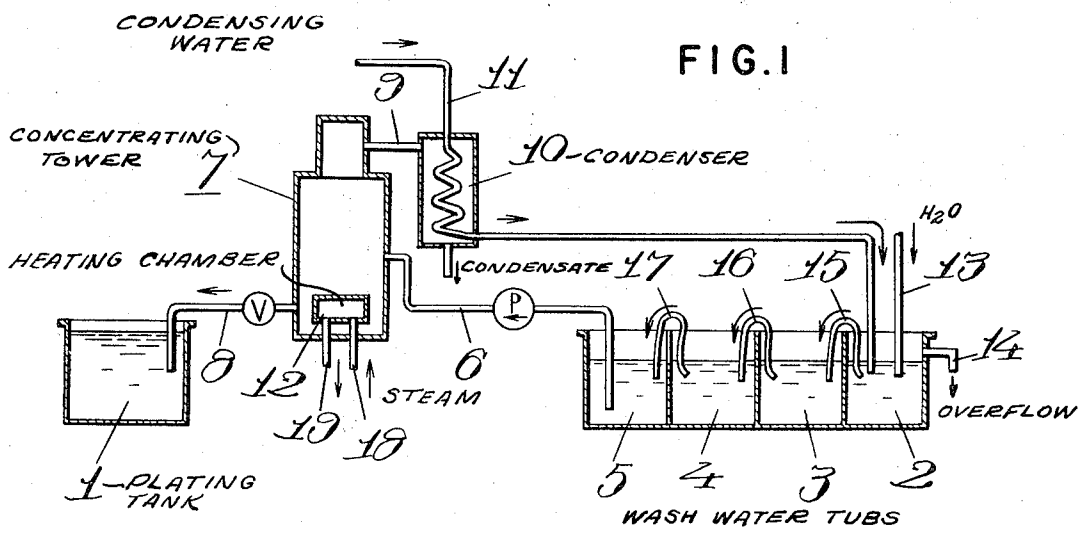


FIG. 1

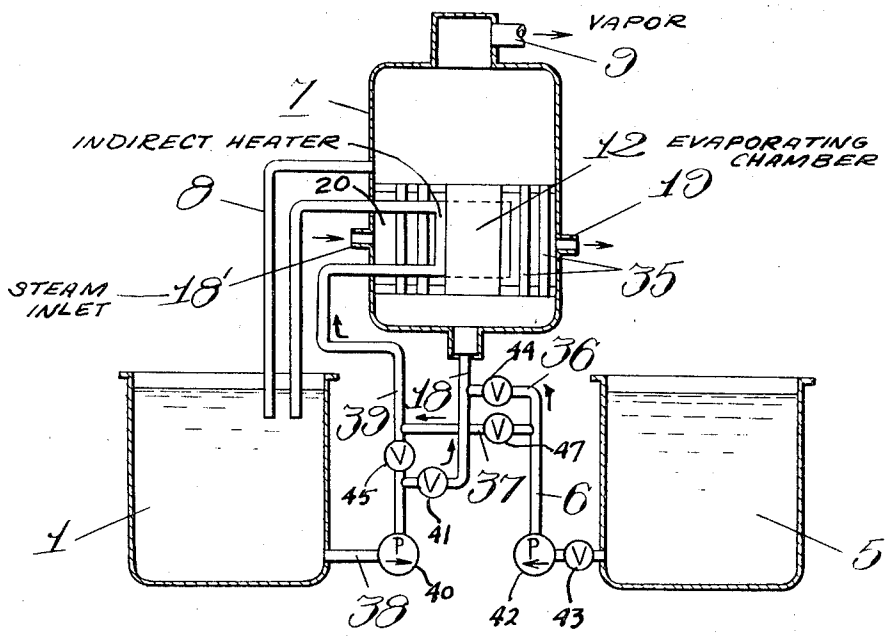


FIG. 2

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HEATING AND CONCENTRATING TOWER FOR PLATING WASTE RECOVERY UNIT

This application is a division of my copending U.S. Pat. application Ser. No. 587,607, filed Oct. 18, 1966, now U.S. Pat. No. 3,542,651.

This invention relates to a unit for disposal of plant wastes. More particularly, this invention relates to a unit for recovery of wastes from metal-finishing plants, such as plating wastes containing chromic acid and the like.

In a number of industries involving the operation of rinsing the products from chemical treatment processes, the amount of effective chemicals in the rinse liquid is considerable, and recovery of such chemicals has had a great economical significance. Moreover, such rinse liquid as a caustic soda solution from a mercerizing process in the fiber industry or a plating solution in the plating industry would result in considerable pollution of streams if they were discharged from rinsing operations following mercerizing or plating operations. Thus, the recovery of such chemicals has been regarded as a necessity from the standpoint of conservation of stream water quality.

In general, the kind of chemicals in the rinse liquids varies from one rinsing operation to another. Most of these liquids are appreciably diluted solutions as compared with the original plating solution, and recovery of chemicals in the rinse liquid is a matter of difficulty because of the expense involved. In a minority of cases, recovery of the expensive chemicals is planned. However, the bulk of such chemicals are discharged from rinsing operations following chemical treatment processes; and a recovery unit that might work out in a most economical and simplified manner has been in demand.

Hence, an object of the present invention is to provide a unit which attains recovery of chemicals contained in a rinse liquid in an economical and simplified manner by rationalizing the usage of rinse liquid either through collecting highly contaminated liquid and returning the same to the operating tank, such as a plating tank, or transferring the liquid to the heating and concentrating tower for concentration, depending on the concentration or level of the liquid contained in the operating tank.

Another object of the present invention is to provide a recovery unit wherein waste water containing toxic chemicals is not discharged from the plant and savings of effluent water may be attained.

A further object of the present invention is to provide a plant waste recovery unit equipped with a heating and concentrating tower which performs the dual function of disposal of waste and recovery of effective chemicals mixed in the rinse liquid through raising the temperature of the operating tank containing the plating solution and the like and concentrating the dilute solutions contained in the rinse liquid by simply adjusting a plurality of valves and thereby making or breaking the circuits.

Now, the present invention will be described hereinbelow with reference to certain embodiments thereof as illustrated in the accompanying drawing, in which:

FIG. 1 is an explanatory view illustrating a recovery unit made in accordance with the present invention; and

FIG. 2 is an enlarged, fragmentary side elevational view showing in detail, and partly in section a preferred embodiment of the heating and concentrating tower employed with this recovery unit.

Referring to FIG. 1, by way of giving a detailed explanation of the unit according to the present invention, a plurality of wash water tubs 2, 3, 4, 5 are connected in series with the plating tank 1, the fourth tub 2 among the wash water tubs serving as the hot wash water tub.

The wash water tubs 2, 3, 4, 5 are connected one with the other by means of siphons 15, 16 and 17, and the fourth tub 2 is fitted with an overflow pipe 14. To the first wash water tub 5 is connected a heating and concentrating tower 7 via a feedpipe 6. Heating of the liquid to be concentrated is effected by means of the steam sent into the heating unit 20 inside said tower and the liquid to be evaporated is sent in via pipe 18 while waste steam is exhausted via pipe 19. Furthermore, a condenser unit 10 is annexed to the heating and concentrating tower 7 to condense the vapor evaporated from the tub water supplied into said tower and heated by the heating steam. Cooling water is passed through a helically wound cooling pipe 11 inserted into said unit 10, and the water heated exchanged in the condenser unit 10 is passed through said pipe 11 supplied to the fourth wash water tub or hot wash water tub 2. Tub water in the first wash water tub 5 pumped into the heating and concentrating tower 7 via feedpipe 6 is heated and concentrated to the level equivalent to that of the plating solution contained in the plating tank 1 before it is restored to the plating tank via pipe 8. Water is supplied at times to the warm wash water tub 2 via pipe 13.

Supposing that the plating operation, comprising moving the plated ware from the plating tank and immersing the same consecutively in a series of wash water tubs, is conducted in a chromium plating plant employing 10 kg. of chromic acid per 8-hour day, and that the capacity of the first wash water tub 5 is 200 liters, the metallic articles plated in the plating tank 1 are washed consecutively in the wash water tubs 5, 4 and 3 and finally in the hot water tub 2. If the recovery unit according to the present invention is not utilized, approximately 85 percent of chromic acid contained in the plating tank 1 goes onto the plated ware and is carried off from the plating tank 1, and the chromic acid concentration levels of the wash water tubs 5, 4, 3 when the operation is finished are approximately 45 g./l., 6.5 g./l. and 0.6 g./1. respectively.

On the other hand, if the recovery unit according to the present invention is utilized, supposing that the evaporative capacity of the heating and concentrating tower 7 is 100 kg./hr. and that the capacity of the first wash water tub 5 is 200 liters and other conditions are also the same as above, the tub water contained in the tub 5 is diminished by one-half per hour, and the tub 5 is supplied with wash water from the second, third and fourth wash water tubs by means of siphons 15, 16, 17. The wash water contained in the wash water tubs 5, 4, 3 is diluted and chromic acid concentration levels of the tubs 5, 4, 3 are maintained respectively at 15 g./l., 1 g./l. and 0.08 g./l., or thereabout.

As will be seen from the above, the concentration levels of the second and third wash water tubs 4, 3 are so low that, needless to say, concentration of wash water contained in these tubs cannot be attained on an economical basis.

FIG. 2 shows one embodiment of the heating and concentrating tower of the present recovery unit wherein elevation and maintenance of temperature of the plating solution and concentration of the rinse water of the wash water tub containing plating solution may be effected at the same time.

In the first instance, in starting a plating operation, such as a copper plating operation, the plating solution must be elevated in temperature. So, the plating solution in the plating tank 1 is pumped into the evaporating chamber 12 FIG. 2 via a suction pipe 38, pump 40, valve 41, and evaporation feed pipe 18, and, after being heated in the heating and concentrating pipes 35 installed in the tower, is returned to the plating tank 1 via a pipe 8 when a predetermined temperature is attained. The heating pipes 35 installed in the tower 7 are in this instance utilized merely to raise the temperature of the plating solution, so the elevation of temperature may be attained in a short period of time. Admission and exhaust of heating steam is by way of the inlet and outlet ports 18' and 19 respectively.

With elevation of temperature of the plating solution, or when the latter has attained a predetermined temperature, valve 41 is closed, and the plating operation is started. As the articles plated in the tub 1 are transferred to the wash water tub 5, dragout of a large quantity of plating solution containing effective chemicals takes place. So, the tub water in the washtub 5 is gradually contaminated, resulting in an increased concentration. When the tub water has reached or exceeded a certain level of concentration, a pump 42, which is installed in a suction pipe 6 to open at one end in the wash water tub, is set into operation; and tub water is admitted into the heating and

concentrating tower 7 via said suction pipe 6, valves 43 and 44 and evaporation feed pipe 18. Tub water heated by the heating pipes 35 is boiled and sent upwardly and then downwardly by way of the downtake 12 for reheating. This process is repeated in the manner described and the rinse water concentrated to the level of concentration of the plating solution 1 is returned to the plating tub 1 via the outlet pipe 8. As the plating operation proceeds, relatively cool articles are dipped in the plating tub 1 successively, and the plating solution is cooled down gradually in addition to the fact that the cooling of the plating solution is promoted by the dissipation of heat from tub wall and liquid surface. In order to keep the plating solution at a constant temperature during the plating operation, plating solution is pumped at all times through valve 45 into the heating pipe 39 enclosing downtake 12 via suction pipe 38 by means of pump 40 and after being heated there, is returned to the plating tub 1.

In case the rinse liquid is concentrated and does not require further concentration, part or all of the rinse liquid may be fed the indirect heater 21 via pipe 39 and valves 43 and 47, suction pipe 6 and pipe 37 and returned direct to the plating tub 1, thus bypassing heating pipes 35.

Having thus described my invention, what I claim is:

1. In a unit for recovery of wastes from metal-finishing plants, and having a plating tank and a plurality of washtubs into which plated articles are dipped successively to rinse off the plating solution, a solution heating and concentrating tower having both a heating chamber and an evaporating chamber therein

means including a first valved pipe connecting said evaporating chamber to the last of said tubs with respect to the flow of increasing concentration wash liquid, and operative to draw dilute plating liquid from said last tub and force it into said evaporating chamber for heating and concentration to plating strength,

a valved second pipe opening at its intake end in said evaporating chamber and at its opposite end in said plating tank to return the concentrated liquid from said evaporating chamber to said tank,

means including a valved third pipe for recirculating plating solution from said tank thru said heating chamber in indirect heat exchange therewith and back to said tank to heat the circulating solution in said heating chamber without further concentration thereof, and

bypass means including a fourth valved pipe connected to said first and third pipes and operable selectively to convey liquid from said last tub through said third pipe and said heating chamber and back to said plating tank, when the last-named liquid is at plating strength.

2. A recovery unit as defined in claim 1, including means connecting said tank to said first pipe to pump plating solution from said tank through said evaporating chamber for rapid heating thereby before return by said second pipe to said tank.

3. A recovery unit as defined in claim 1, wherein

the first-named means comprises a first pump connected at its inlet end to said last tub and at its discharge end to said first pipe, and a first valve disposed in said first pipe between said first pump and said evaporating chamber,

said fourth pipe is connected to said first pipe between said first pump and said first valve, and

said bypass means comprises a second valve disposed in said fourth pipe and operable selectively to connect said first pipe to said third pipe.

4. A unit as defined in claim 3, wherein said recirculating means comprises

a second pump connected at its intake end to said plating tank and at its discharge end to said evaporator third pipe, and

said valve in said third pipe being disposed between said second pump and the point where said fourth pipe is connected to said third pipe.

5. A unit as defined in claim 4, including

a further pipe connected at its intake end to said third pipe between said second pump and said third valve and at its chamber, end to said chamber and

a fourth valve disposed in said further pipe and operable selectively to connect the output of said second pump to said evaporator chamber.

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