INNOVATIVE METHODS FOR THE SURFACE TREATMENT INDUSTRY

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Innovative Methods For The Surface Treatment Industry

1. THE SCOPE OF THE PROJECT

This document is aimed to describe a new method of construction for galvanic plant to treat parts within barrels.

The scope of the project is to eliminate the drawbacks tied up to the traditional processes.

In detail:

- To eliminate one of the most unwanted causes of deterioration in the galvanic lines, which is to say the dripping of the barrels that, passing one above the others, drag corrosive substances and produce a devastating effect on the underlying barrels, on the suction hoods and on the anode bars.
- To increase to very high levels the hourly production of treated material, with no need to add further hoist trolleys and then with no risk of jamming the plating line.
- To minimise the distance between anode and cathode, and therefore to optimise the energy consumption, with no risk of collision during the insertion of the barrel and no need of sophisticated positioning systems.
- To improve the uniform distribution of metal deposit on all the parts inside the barrel
- To minimise the emission of fumes and vapours caused by the barrels when they travel outside of the tank, since they are impregnated of the solutions used in the different chemical processes.
- To minimise the space required for the plant installation.

THE TASKS OF THE PROJECT:

- Higher production compared with traditional plant at the same operational conditions
- Lower energy and water consumption
- Reduction of maintenance costs
- Lower ambient emissions
- To minimise the space required for the plant installation.

2. THE FABRICATION DETAILS

These results have been achieved by employing a new method for the design and construction of plating lines.

The main characteristics of this new plant consists in the fact that the barrels are inserted and are advanced inside the tanks having their longitudinal axis parallel to the travelling direction.

In practice in each section of the line it is created a sort of train of barrels, one next to the other, and all of them are simultaneously moved forward, by a dedicated mechanism, of a step equal to the length of a barrel. Therefore the hoist trolleys are used only to move the barrels from one section of the plating line to the next one.

Another relevant contribute is got from increasing the speed of the flow in the electrolytic solutions by reducing the volume of the tanks, that are built with a cylindrical bottom. Moreover the distance between anode and cathode surface is reduced to the very minimum thanks to the elimination of the clearance commonly required for the introduction of the barrels in the traditional plants, and from the absence of suction hoods between barrel and barrel.

Computer simulations and tests performed in a pilot installation ^(*) have proven the feasibility of significantly reducing the voltage still keeping the same current density of a traditional plant, using standard barrels, key 360 mm, length 1000 mm.

The new plant also takes advantage from using multiple rinsing stations that, in a single position and with a reduced consumption of water per barrel, actually perform till three countercurrent rinsing in a very limited amount of time.

The multiple rinse is eased by the shape of the tank, with a cylindrical bottom, and by its dimensions, just larger than the barrel dimensions.

A system of pumps and valves allows the rinsing with a really reduced quantity of water.

It is also to be noticed that although the tank for treatment is a single one, it is feasible to realise a dedicated electrical current feed barrel per barrel.

Plants using the technologies here described are covered by a patent named after "PLATEXPRESS" and are currently produced by ASMEGA – Padova – Italy.

This is made possible by the current bus bar, which is divided into different sections. As a barrel is moved further, it can bring with itself a typical feeding current.

From the maintenance point of view it is to be underlined the easiness to have access and to extract the anode baskets, which are not obstructed by other elements onboard the tanks.

Further advantages come from the fact that the hoist trolleys perform a travelling speed really reduced if compared to that of a traditional plant. Moreover the structure of the hoist trolley is very simplified, as there is no need, in instance, of dripping tanks or precise positioning systems.

Figure 1 – THE INITIAL TEST





Figure 2 – GENERAL VIEW



•	Barrels run on rails	→ distance between anode		
		and cathode can be minimised		
•	Never barrels pass one	→ cleaner plant		
	above the others			
•	Trolley travelling distance	→ reduction of maintenance		
	are reduced:			
	- lower speed			
	- lower accel/decel.			
•	All barrels run through the	→ constant quality		
	same path			

Figure 3 – PLANT CROSS SECTION



Figure 4 – MULTIPLE RINSE – Cross section



3. THE QUALITY OF THE PRODUCTION

One of the basic requests in a galvanic plant to treat small items in barrels, is to get a predetermined thickness of electrolytic deposit on treated materials.

Usually, this result is achieved by changing the current and the deposit time. In a more rational way, this result may be achieved by changing the total treated surface, and therefore the quantity of the material to be loaded in each barrel.

The laws of electrolytic plating and laboratory tests, highlight the fact that there are adequate voltages for each kind of electrolytic solution.

The results of tests performed on some electrolytic baths (e.g. alkaline baths without cyanide, acid zinc baths), are providing important information to fix their optimal use under the economical point of view, but also under the quality and quantity point of view.

Experimental tests have revealed that a bath of alkaline zinc without cyanide, with the same current (600 A) and with the same surface of treated material (nuts MA 6), considering a single barrel and changing the anode – cathode distance, passes from an efficiency of 54% at 11 Volts to an efficiency of 76% at 7 Volts.

Under these conditions, a plant is able to operate at the maximum current and the optimal voltage in accordance to any size of material, getting the best possible result.

At the present time, the methods employed to constantly get a certain deposit are the following:

- a) variation of the current according to the type of material (size and quantity of the material loaded in the barrel);
- b) variation of the process times.

Unfortunately this procedure is in contrast with the rules of a correct application of the metal deposition process, since it does not allow to use the most adequate voltage for that specific electrolyte. In fact, since the current is depending from the voltage, from the resistance of the electrolytic solution and from the temperature, to obtain an increase of the current we are forced to change the voltage.

Table 1 – PRODUCTION ANALYSIS

Alkaline zinc bath with no cyanide

- Material: Nuts MA10
- Bath efficiency calculated at 7 V with 800 A per barrel = 74 %
- Bath efficiency calculated at 11 V with 800 A per barrel = 59 %
- Working conditions : 7 V / 800 A barrel key 360 mm, length 1000 mm

Working	Load	Deposit time	Unload	Thickness	Hourly
positions			nequency		production
16	84	48'	20/h	12 μ	1680 kg
24	84	48'	30/h	12 μ	2520 kg
24	105	60'	24/h	12 μ	2520 kg
30	105	60'	30/h	12 μ	3150 kg

Acid zinc bath

- Acid zinc bath efficiency = 95 %
- Working conditions : 6 V / 800 A barrel key 360 mm, length 1000 mm

Working	Load	Deposit time	Unload	Thickness	Hourly
positions			frequency		production
16	100	48'	20/h	12 μ	2000 kg
24	100	48'	30/h	12 μ	3000 kg
24	125	60'	24/h	12 μ	3000 kg
30	100	60'	30/h	12 µ	3150 kg

This new approach is able to resolve this problem strictly complying with the electrochemical laws, and not encountering the above mentioned drawbacks. In fact:

- The peculiar position of the barrel inside the tank allows to get closer the anode to the treated material; since the resistance of the electrolyte placed in between is decreasing according to the Ohm's low, we are enabled to make use of the minimum adequate voltage and therefore of the optimal current to obtain deposits free from any defects.
- 2) Whenever on specific items it is required an exceptional thickness, not achievable within the normal cycle time; the plant can be provided of an additional line where this kind of material can be treated, changing the deposit time, with no obstacle to the continuity and regularity of the unloading frequency.
- 3) The regularity of the deposit is assured by the fact that all the barrels are following the same path and it is absolutely not depending from the singularity of its tank position, as it happens in the traditional plants (where per any single position there is a different conductivity, a different anode surface, a different solution flow).

Even though the tests we carried out to get deposit of high quality with different thickness have proven that it is useless using different currents and different times for different kind of materials, the plant is anyhow able to satisfy this request in a more rational way than in the traditional plants; this is to say that it is able to perform "in line" exclusions of the current and that it is possible to use different currents per each barrel.

barrels key 360 I 1000 cycle time 2 min 30 sec production 2 ton / h



Figure 6 – ACTUAL PLANT CONFIGURATION

barrels key 5200 I 800 cycle time 3 min 0 sec production 3 ton / h

