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(54) **Stainless steel surface finishing process and stainless steel panels obtained by said process**

(57) Stainless steel surface finishing process, comprising electrochemical coloration of the steel sheet or plate carried out by wet buffing the surface using an electrolytic solution and subsequent passage of electric current through the same solution, forming spots, engravings and marks reproducing the surface unevenness characteristic of metal laminates previously used in the applications replaced by stainless steel nowadays, abra-

sion of the surface for further reproducing the opaque-lead aspect of such disused metal laminates; stainless steel surfaces obtained through such process, comprising an antique effect surface reproducing the surface aspect of the metal laminates previously used in the applications replaced by stainless steel nowadays.

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Description

DETAILED DESCRIPTION

Field of the art

[0001] Stainless steel has the characteristic of being protected by a surface layer of chromium oxide, generated from the chromium contained in steel and from the oxygen of the atmosphere, hence not requiring any further surface protection against corrosion. Should the surface be damaged, the layer is immediately self generated, in the presence of oxygen.

[0002] The standard steel finishing and the mechanical surface finishing of flat stainless steel, hot and cold laminated, may vary in terms of roughness, reflectivity, colour, brightness, slipperiness and they constitute the base for subsequent surface finishing operations, which modify the surfaces so as to meet specific requirements.

[0003] The surface finishing operations should obviously be carried out by selecting - right from the start - the steel finishing closest to the final desired end result.

[0004] Fundamental stainless steel surface finishing operations include a first type of finishing constituted by the mechanical polishing and brushed finishing, which imply the use of abrasive instruments and/or materials, which engrave the steel surface up to a given depth.

[0005] Then there are decorated finishing operations, obtained by pressing or laminating through rollers using surface patterns, which can also efficiently stiffen the plate allowing thinner coatings hence reducing costs and weight.

[0006] Peening produces uniform, non-directional, surfaces with low reflectivity, which offer a contrast with the extremely shiny surfaces. The materials used for performing peening comprise stainless steel shots, ceramic grains, aluminium oxides, each of which contribute to widening the array of surface finishing solutions available.

[0007] Electropolishing is an electrochemical process used to improve the surface of the material by removing "the peaks and depressions" of the unevenness of the profile thereof, making it smoother and increasing reflectivity thereof. The degree of smoothness and reflectivity deriving from this process depend on the roughness of the initial material.

[0008] In electrolytic coloration, the inert chromium oxide layer on the stainless steel surface, which provides the characteristic of resistance against corrosion of the material, through a chemical process assumes a coloration which is then fixed through an electrolytic process in a vat; depending on the time of submersion in the acid solution, there forms a surface layer and, through the physical phenomenon produced by the interference with the light, i.e. the superimposition of the light in arrival and the reflected one, there occurs the generation of intense colour effects.

[0009] In such known field of the art a process for sub-

jecting the stainless steel surfaces to antique effect, with the aim of making them similar to the surface aspect of the metal laminates previously used in the applications replaced by stainless steel nowadays, especially in the furnishing industry, such pewter and zinc, is yet to be provided.

Objects of the invention

[0010] The main object of the present invention, within the framework outlined above, is to provide an innovative and functional process for attaining stainless steel surfaces, especially in furnishing applications, reproducing the surface aspect of disused metals previously used in the industry.

[0011] Another object of the present invention is to attain the previous object through a process that can be implemented using few and small industrial equipment, sufficient to attain the result with reference to the relatively small amounts sufficient for the furnishing industry, without requiring the large equipment used for the surface finishing of steel in the large amounts required for applications in the building industry and the like.

[0012] Another object of the invention is to attain the previous objects through a method suitable to attain any type of antique effect or other finishing solutions not available in the current array of "industrial products".

[0013] A further object of the present invention is to attain the previous objects through a simple and efficient process, safe in operation and relatively inexpensive considering the results practically obtained therewith.

Summary of the concept solution

[0014] These and other objects are attained through the stainless steel surface finishing process according to the present invention, comprising electrochemical coloration of the steel plate sheet carried out by wet buffing the surface using an electrolytic solution and subsequent passage of electric current through the same solution, forming spots, engravings and marks reproducing the surface unevenness characteristic of metal laminates previously used in the applications replaced by stainless steel nowadays, abrasion of the surface for further reproducing the opaque-lead aspect of such disused metal laminates; stainless steel surfaces obtained through such process, comprising an antique-effect surface reproducing the surface aspect of the metal laminates previously used in the applications replaced by stainless steel nowadays.

Description of the embodiment

[0015] Further characteristics and advantages of the process and the products implementing the process according to the present invention will be more apparent from the following detailed description of a preferred but not exclusive embodiment thereof, solely provided by

way of non-limiting example.

[0016] The steel plate used for making the sheets, panels or variously-shaped structures to be subjected to the surface treatment process according to the present invention is preferably of the Aisi 304, Aisi 316, Aisi 430, Aisi 470L type.

[0017] As an implementation of the process according to the present invention sheets or structures thus made variously shaped in a stainless steel plate are subjected to electrochemical coloration, by wet buffing the surface using an electrolytic solution and subsequent passage of electric current through the same solution; such procedure is carried out through passing the sheet or plate lying on a conveyor, preferably a roller conveyor, over an electrically polarised electrode, and beneath a reverse polarity buffer roller, between which the electric current which activates the coloration process is passed and fixes the obtained aesthetic effect thereof; transversely with respect to the direction of advancement of the sheet, along the entire extension of the aforementioned buffer roller, the electrolytic solution is poured through special nozzles distributed along a feeder; the buffer roller is constituted by a press, adapted to press on a face of the sheet a thickness of any spongy absorbent material suitable for the purpose, or suitable to be soaked with the electrolytic solution and leave it under compression, spreading it on the sheet when pressed thereon; such roller, or relative mechanical equivalent, may be conceived in any manner; preferably the thickness of absorbent material is not wound around the roller, or relative equivalent, forming a cylindrical shape or however closed on itself, so as to repeatedly surround the sheet with the same surface, on the contrary the absorbent material is preferably constituted by a belt unwound upstream of the pinch roller and wound downstream, or vice versa, through reel means, or relative equivalent means, in any conceived manner suitable for the purpose; hence the belt thus made of spongy absorbent material contacts the surface to be treated only once.

[0018] Lastly, the plate sheet is mechanically cleaned of the excess electrolytic solution by using a blade, washed with water and dried of the remaining washing water using a further blade unit or the like, thus making it ready for the subsequent operations.

[0019] Thus, without requiring an electrolytic bath and expensive, or at least complex and cumbersome relative equipment, the inert chromium oxide layer on the stainless steel surface is made to assume a colour functional to the aspect of the metal intended to be attained, wherein the chromatic variations to be conferred to the panel are marginal, given the intention of attaining various metal shades of grey quite close to the colour of stainless steel.

[0020] Given that the colouring process does not imply the presence of pigments, the subsequent operations can be completed after the treatment without risking to damage the chromium oxide surface layer.

[0021] Given that the inert layer is transparent, it is the substrate that influences the end aspect of the product, the opaque colour however attained - as regards the aspect of the metal intended to be attained - thus requires an opaque finishing.

[0022] The stainless steel plate sheets thus subjected to electrochemical colouring depending on the colour of the metal intended to be imitated, are then subjected to pressing, under a press or roller, spots, engravings and marks reproducing the surface unevenness characteristic of metal laminates previously used in the applications replaced by stainless steel nowadays, in particular such as pewter and zinc.

[0023] The surface roughness of such disused materials is thus reproduced by abrasion through abrasive cloths or papers or brushes.

[0024] This allows obtaining stainless steel panels of any dimensions, having all the aesthetic characteristics of the zinc or pewter panels, suitable to be shaped for any application and in particular for coating the surfaces of furnishing furniture and the like.

Alternative embodiment

[0025] It is obvious that in further alternative embodiments still falling within the concept solution under the embodiment illustrated above and claimed hereinafter, the stainless steel surface finishing process according to the present invention may be obtained using equivalent technical materials and process, i.e. provided with further supplementary solutions, same case applying to all configurations of the respective components which may vary to suit the purpose; in particular, as already indicated in some steps, the stainless steel elements that can be subjected to the process according to the present invention are not necessarily panels or sheets, but the surfaces subjected to the treatment may belong to variously shaped structures.

Advantages of the invention

[0026] As clear from the detailed description of a preferred embodiment above, the stainless steel surface finishing process according to the present invention offers the advantages corresponding to the attainment of the preset objects as well as other objects:

actually, it integrates a functional, modular, polyvalent and economic automatic solution adapted to obtain stainless steel panels and shaped structures, with all the known advantages related to hygiene, robustness and resistance to corrosion of such material, with the surface aspect of disused metal materials with which work surfaces in particular furnishing furniture for example in kitchens and public business counters used to be covered with, so as to be able to reproduce furnishing furniture similar to those of the past whose metal laminated surfaces do not

reveal the relative modern design or however match the aesthetic quality of the model they are used to supplement

Claims

1. Stainless steel surface finishing process, **characterised in that** it comprises electrochemical coloration of the face of the steel structure carried out by wet buffing the surface using an electrolytic solution and subsequent passage of electric current through the same solution, forming spots, engravings and marks for reproducing the surface unevenness, abrasion of the surface to confer it opaque-lead aspect for subjecting the surface aspect thereof to an antique effect. 5
2. Process according to claim one, **characterised in that** said wet buffing of the surface using an electrolytic solution is carried out through passing the sheet or plate or shaped structure lying on conveyor means over an electrically polarised electrode and beneath pressure means covered with reverse polarity absorbent material with respect to that of said electrode along whose extension pressure means is made to pour through a plurality of nozzles the electrolytic solution through which the electric current which activates the coloration process is made to pass and fixes the obtained antique effect thereof. 10 25 30
3. Process come according to claim two, **characterised in that** said wet buffing the surface using an electrolytic solution is carried out through passing the sheet or plate or shaped structure lying on a roller conveyor, over an electrically polarised electrode, and beneath a pressure buffer roller covered with reverse polarity absorbent material with respect to that of said electrode along whose extension there is made to pour, through nozzles distributed on a feeder, the electrolytic solution through which the electric current which activates the coloration process is made to pass and fixes the obtained aesthetic effect thereof. 35 40 45
4. Process according to the preceding claim, **characterised in that** said absorbent material is constituted configured as a belt unwound upstream of the pinch roller and wound downstream, or vice versa, through reel means hence the belt thus made of spongy absorbent material contacts the surface to be treated only once. 50
5. Process according to claim one, **characterised in that** said pressing of the surface is performed through a press or roller reproducing the spots, engravings and marks reproducing the surface unevenness characteristic of metal laminates of pewter or zinc. 55
6. Process according to any one of the preceding claims, **characterised in that** said abrasion of the surface is carried out through abrasive cloths or papers or brushes.
7. Stainless steel panels and shaped structures obtained through the process according to any one of claims 1 to 6, **characterised in that** the antique steel surface effects reproduce the surface effects of the antique zinc products.
8. Stainless steel panels and shaped structures obtained through the process according to any one of claims 1 to 6, **characterised in that** the antique steel surface effects reproduce the surface effects of antique pewter products.
9. Stainless steel surface finishing process and stainless steel surfaces with such process obtained according to any one of the preceding claims and substantially as described and illustrated in the attached drawings as well as for the specified purposes.



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 5379

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1 The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 December 2011	Examiner Suárez Ramón, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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09-12-2011

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