



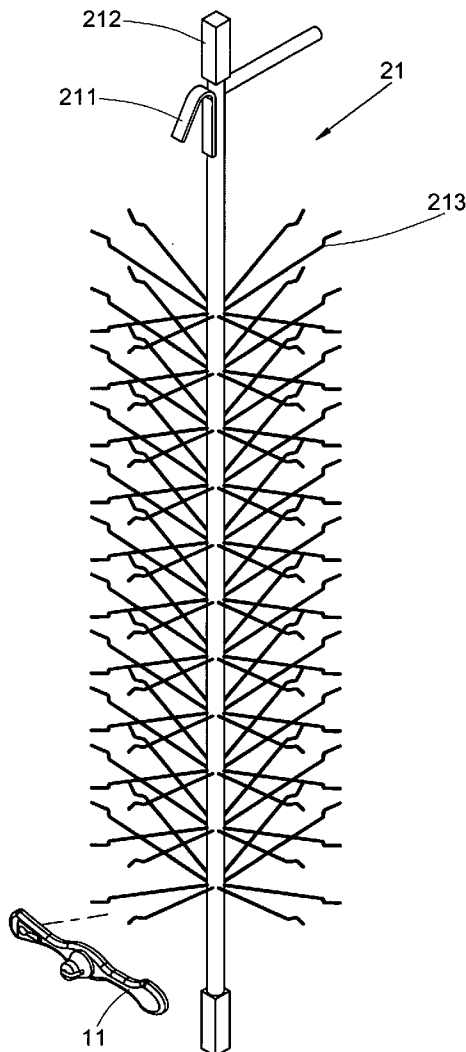
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(19) **United States**(12) **Patent Application Publication**
Chen(10) **Pub. No.: US 2008/0210565 A1**(43) **Pub. Date: Sep. 4, 2008**(54) **METHOD OF SURFACE TREATMENT FOR
METAL AND NONMETAL SURFACES****Publication Classification**(51) **Int. Cl.**
C23C 28/00 (2006.01)(52) **U.S. Cl.** **205/183**(57) **ABSTRACT**

A method of treating the surface of each of a plurality of objects comprising washing the objects; positioning the objects on each of a plurality of structural members; depositing a thin coating on each object; drying the thin coatings; placing the objects and the structural members on a tray in a heating chamber wherein an electric heating unit is disposed in the heating chamber for forming a first metal coat on the thin coating of each object and a second metal coat on each structural member by evaporation; placing the objects and the structural members in a tank filled with electro-coating solution such that after conducting the electro-coating solution positive or negative ions of the electro-coating solution are dissociated and move to the surfaces of the objects for depositing an outer layer thereon; and removing the objects from each structural member.

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(21) Appl. No.: **12/119,217**(22) Filed: **May 12, 2008****Related U.S. Application Data**(63) Continuation-in-part of application No. 11/199,027,
filed on Aug. 8, 2005, now abandoned.

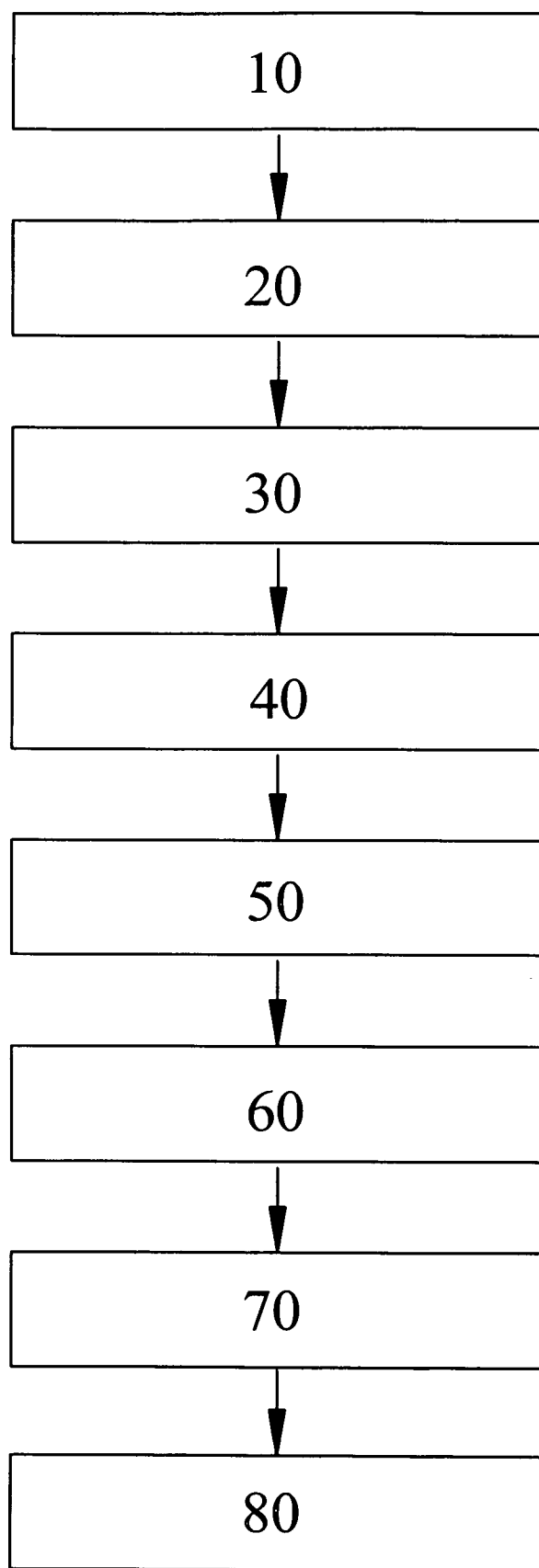


FIG. 1

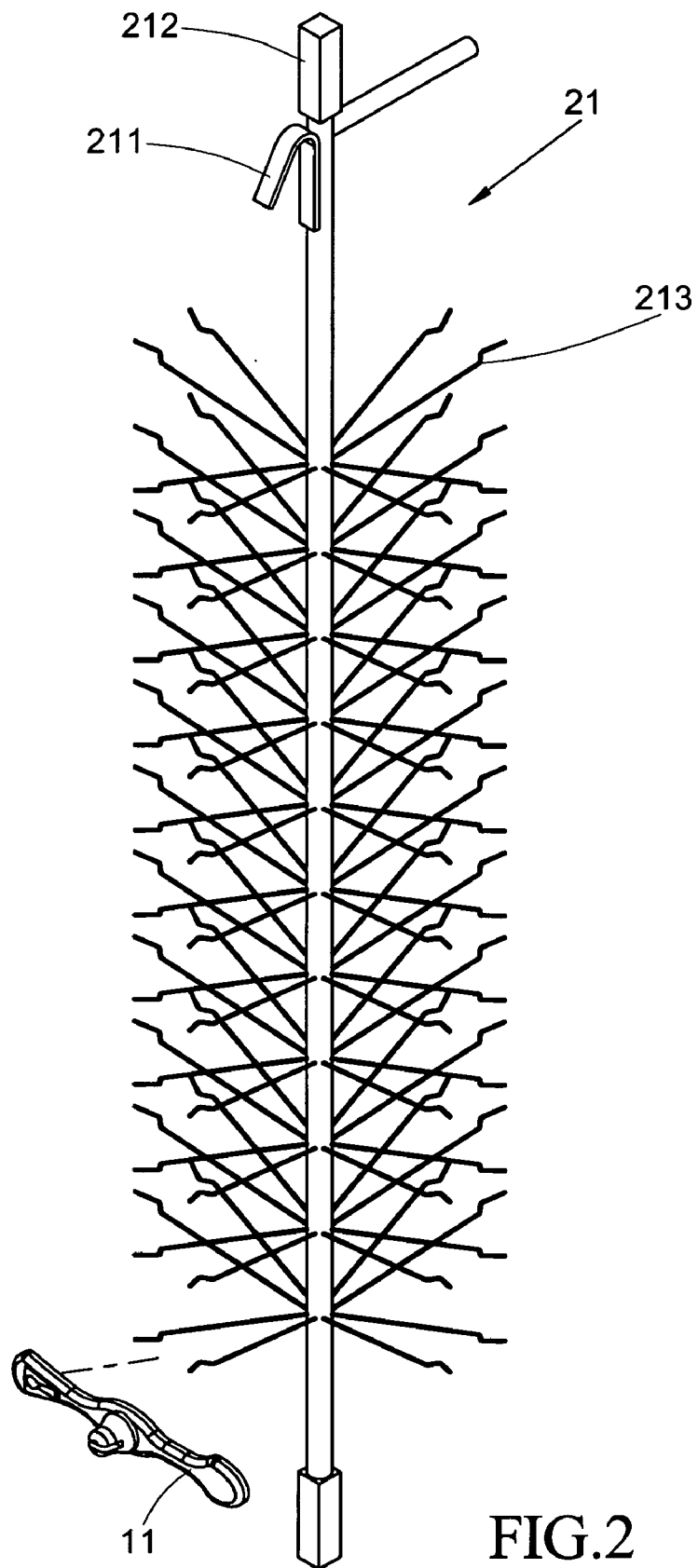


FIG.2

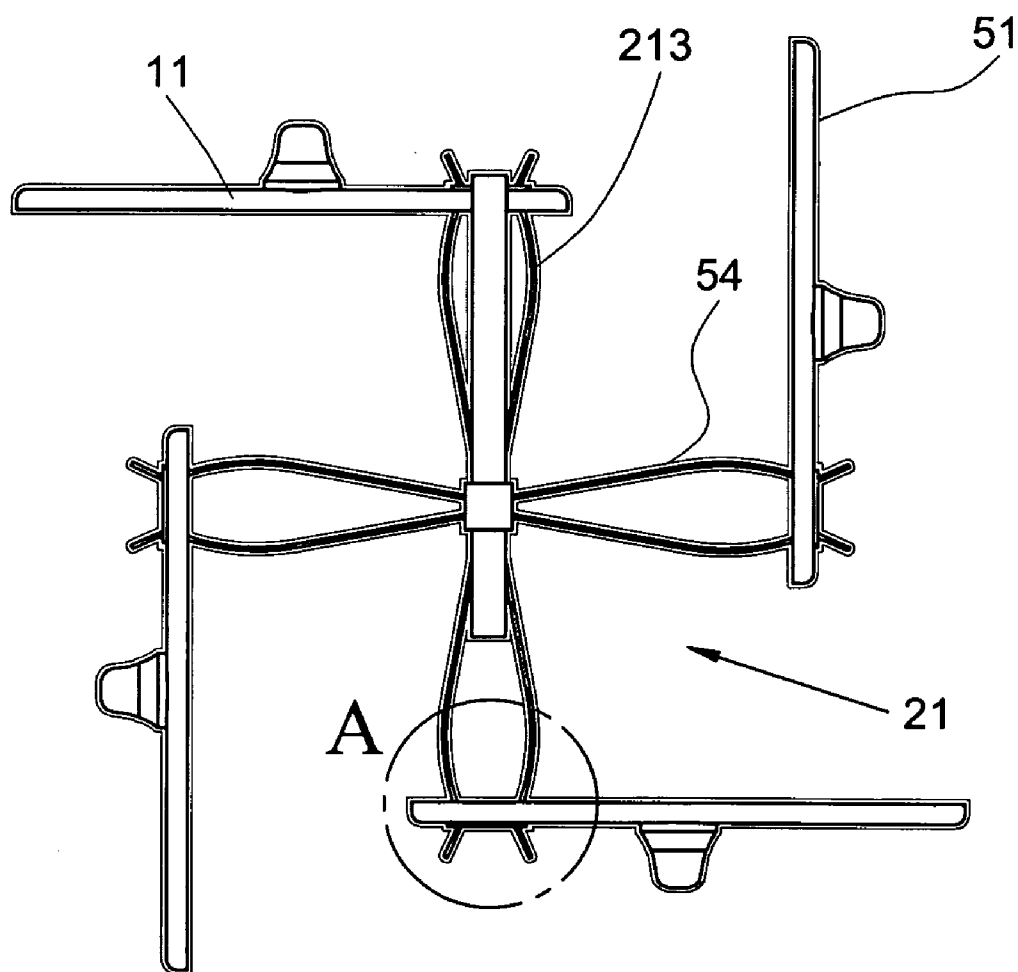


FIG.3

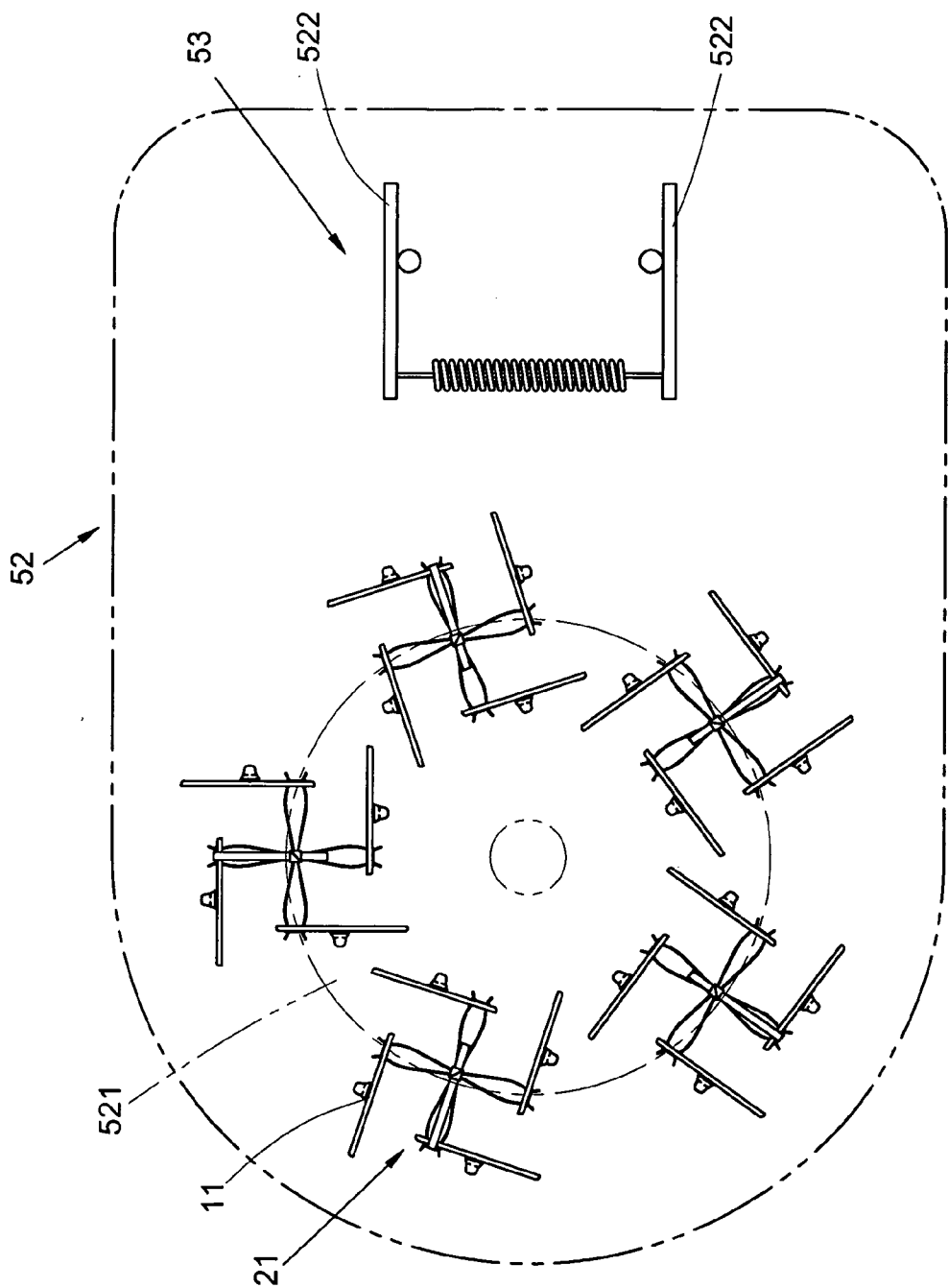


FIG.4

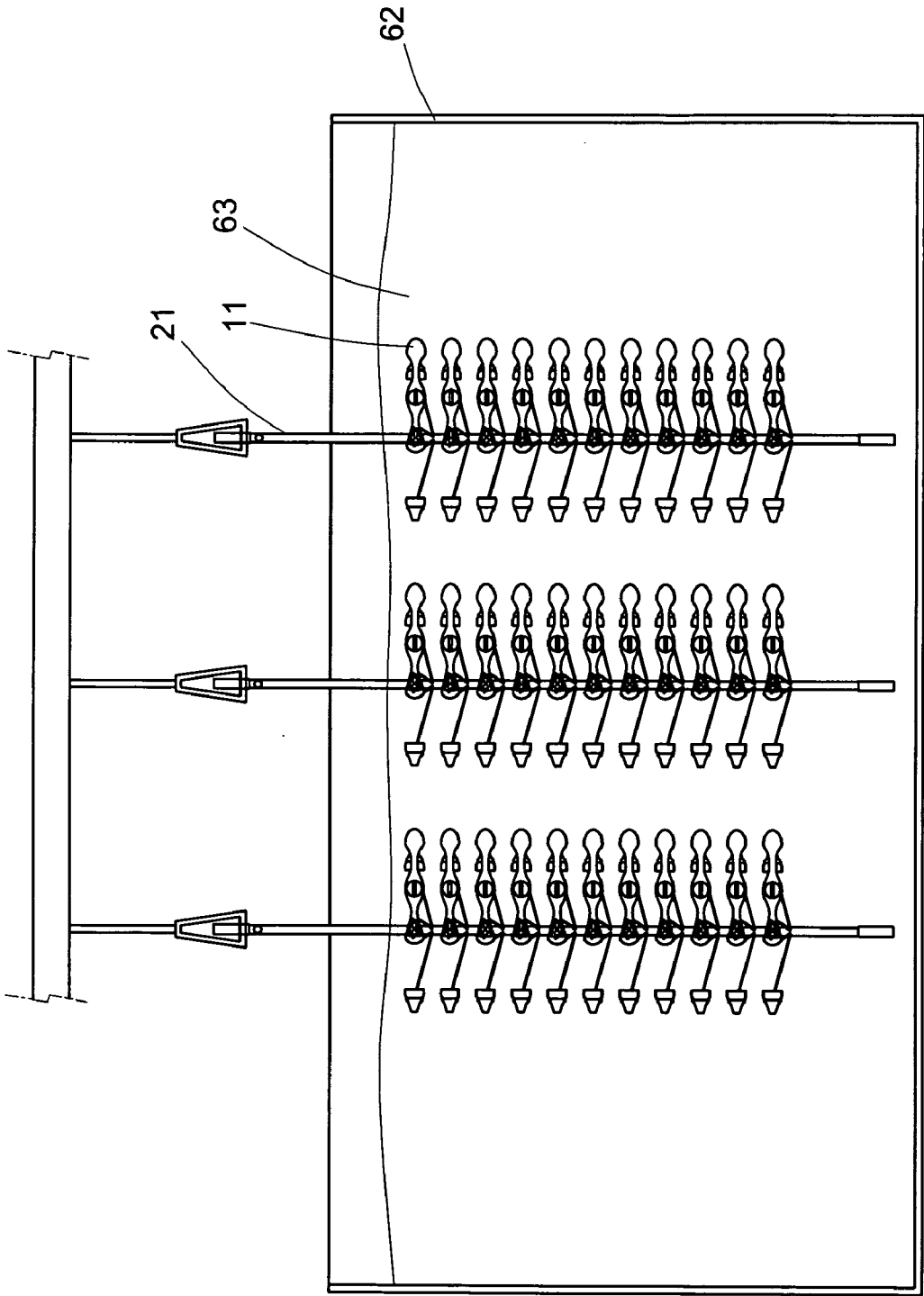


FIG. 5

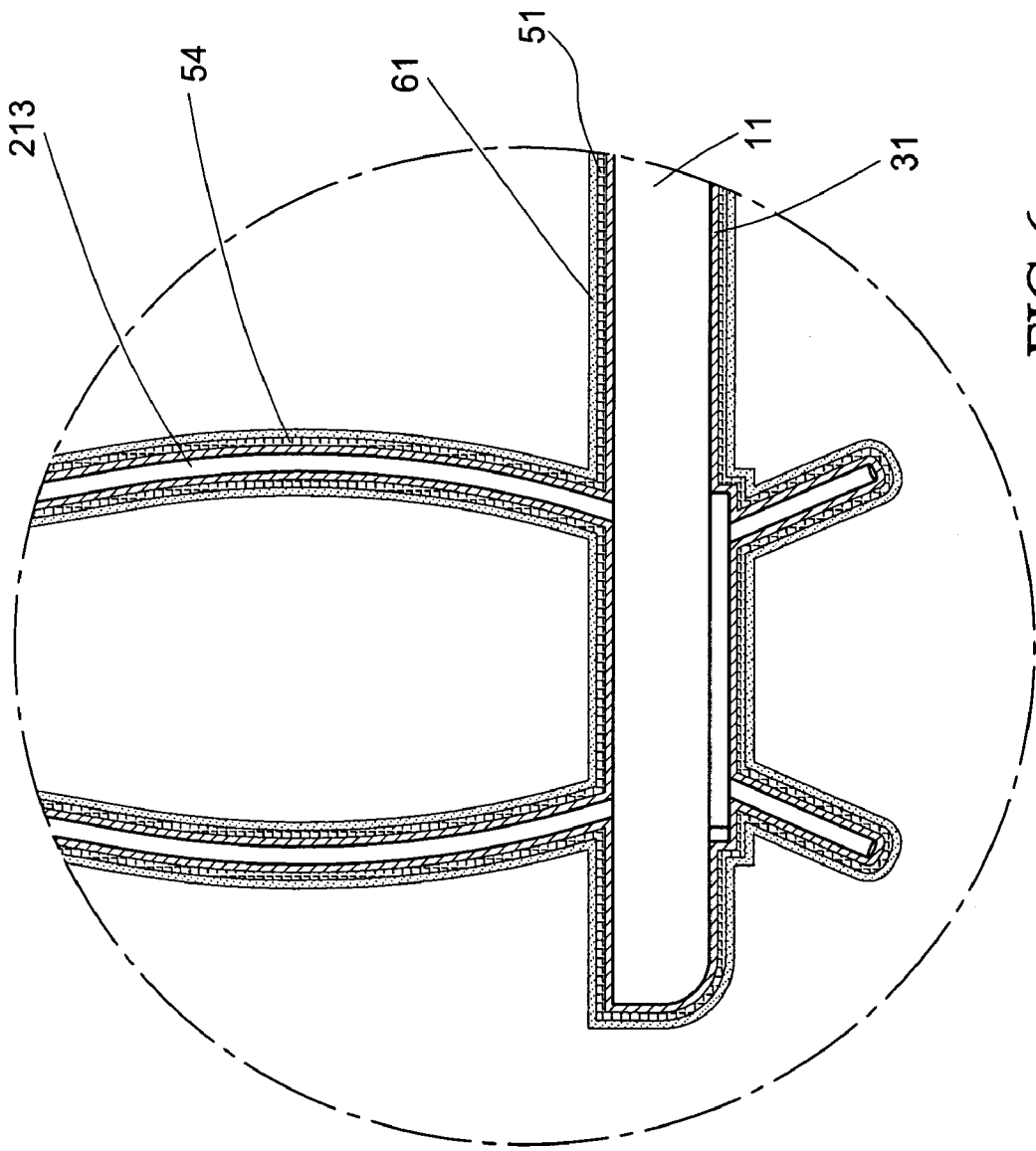


FIG. 6

METHOD OF SURFACE TREATMENT FOR METAL AND NONMETAL SURFACES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of my application Ser. No. 11/199,027 filed Aug. 8, 2005 for "Method of Surface Treatment for Metal and Nonmetal Surfaces", now abandoned.

BACKGROUND OF THE INVENTION

[0002] 1. Field of Invention

[0003] The invention relates to surface treatment for metal or nonmetal materials and more particularly to a method of surface treatment involving steps of depositing a metal coat on a surface of metal or nonmetal object by evaporation and depositing an outer layer on the metal coat by electro-coating.

[0004] 2. Description of Related Art

[0005] A conventional method for electroplating a metal layer on an object such as a drawer handle, a door handle, or a lock generally involves immersing an object to be treated in an electrolytic tank, employing a strong acid solution to remove foreign particles and dust from the surface of the object, electroplating a desired metal layer on the surface of the object, and coating a lacquer on the metal layer as protection.

[0006] However, the chemical solution such as the strong acid solution may pollute the environment and equipment for processing the waste solution is very expensive. As a result, the manufacturing cost is increased greatly. Moreover, only the objects having a metal surface can be electroplated and this inevitably limits the applications. In addition, the lacquer does not have good corrosion resistant property which is important in some circumstances. The lacquer also lacks durability and luster thereof is difficult to maintain as time passes. Usually, the object is coated with copper, nickel and silver sequentially so as to be rustproof. However, many processes are required, resulting in a further increase of the manufacturing cost. Thus, the need for improvement still exists.

SUMMARY OF THE INVENTION

[0007] It is therefore one object of the invention to provide a method of treating a metal or nonmetal object comprising the steps of depositing a metal coat on a surface of the metal or nonmetal object by evaporation and coating an outer layer on the metal coat by electro-coating so that the surface of the produced metal or nonmetal object can be resistant to rust and smooth.

[0008] Another object of the invention is to provide a cost effective method of surface treatment capable of reducing pollution to the environment.

[0009] The above and other objects, features and advantages of the invention will become apparent from the following detailed description taken with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a flowchart depicting a process of surface treatment for metal or nonmetal object according to the invention;

[0011] FIG. 2 is an exploded perspective view showing an object to be positioned on a structural member for surface treatment according to the invention;

[0012] FIG. 3 is a top plan view of the objects positioned on the structural member;

[0013] FIG. 4 is a top plan view schematically depicting the objects on the structural members put in a tank for evaporation;

[0014] FIG. 5 is a longitudinal sectional view of FIG. 4 showing the objects on the structural members being immersed in the electro-coating solution; and

[0015] FIG. 6 is a detailed view of the area in circle A in FIG. 3 showing the object after the surface treatment.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Referring to FIGS. 1 to 6, a process of surface treatment for metal or nonmetal object in accordance with the invention is illustrated.

[0017] The process comprises the following steps:

[0018] In step 10, a plurality of objects (e.g., ones made of metal material) 11 are prepared after being washed. Note that the objects 11 may be made of nonmetal material in other embodiments.

[0019] In step 20, the objects 11 are positioned on a pole shaped structural member (e.g., metal or insulative one) 21.

[0020] In step 30, a thin coating (e.g., acrylic resin, epoxy resin, or nylon resin) 31 is coated on each object 11. The thin coating 31 is adapted to fill any small cavities on the surface of the object 11 so as to make the surface of the object 11 flat.

[0021] In step 40, the thin coating 31 is hardened by drying in room temperature or by heating in a temperature between about 70° C. and 180° C. for a time period between about 20 minutes and about 70 minutes.

[0022] In step 50, the objects 11 together with the structural members 21 are put on a tray 521 in a heating chamber 52 in place. An electric heating unit 53 is provided in the heating chamber 52 and comprises two electrodes 522 of opposite polarities and a tungsten filament (not numbered) interconnecting the electrodes 522. The tungsten filament is wrapped by metal for evaporation. In operation, air in the heating chamber 52 is evacuated to vacuum. Next, the heating unit 53 is energized by flowing electric current thereto. Hence, the tungsten filament is heated by current flowing from one electrode 522 to the other electrode 522 and the metal on the tungsten filament thus is evaporated to become very fine particles which are adapted to adhere to the thin coating 31 on each object 11 and the structural members 21. As a result, a first metal coat 51 is formed on the thin coating 31 of the object 11 by coating and a second metal coat 54 is formed on each of a plurality of branches 213 of the structural member 21 by coating. Thus, the structural members 21 and the objects 11 become conductive. Each of the first metal coat 51 and the second metal coat 54 has a thickness in a range of about 0.1 μm to about 1.0 μm .

[0023] In step 60, place the objects 11 together with the structural members 21 in a tank 62 filled with electro-coating solution 63. Hence, the electro-coating solution 63 conducts by the conductive structural members 21 and dissociated positive or negative ions of the electro-coating solution 63 move to the surfaces of the objects 11 for adhesion (i.e., electro-coating). As a result, an outer layer 61 is coated on each object 11. The electro-coating solution 63 may decompose into positive ions if it is formed of positive acrylic resin, positive epoxy resin, or positive polyurethane resin. The elec-

tro-coating solution **63** may decompose into negative ions if it is formed of negative acrylic resin or negative polyurethane resin.

[0024] In step **70** drying is done.

[0025] In step **80** the objects **11** are removed from each structural member **21**.

[0026] For conveying the structural members **21** (i.e., objects **11**) between different manufacturing steps each structural member **21** is provided with a top mating member **212** adapted to secure to a corresponding mating member (not shown) of the heating chamber **52** for securing the structural member **21** to the heating chamber **52**, an upper hook **211** adapted to hang on a conveyor (not shown), and a plurality of branches **213** adapted to position the objects **11** thereon. Note that the structural members **21** are removed from the conveyor only in the evaporation step (i.e., step **50**).

[0027] The process (i.e., electro-coating) of the invention can be applied to coating the metal objects **11** with a color outer layer in which one such process comprises the following steps:

[0028] a1) Mix a coloring agent with electro-coating solution prior to pouring same in a tank.

[0029] b1) Place objects processed by evaporation in the tank.

[0030] c1) Remove the objects, wash it, and dry it. As a result, a dyed outer layer is coated on each object.

[0031] The weight of the coloring agent in the electro-coating solution is about 6% to 14% of the weight of the electro-coating solution. An anode and a cathode are provided in the tank. In electro-coating, a direct current is applied to the electro-coating solution in the tank for a period of time between about 10 seconds to about 50 seconds. Further, the operating voltage is in a range of about 40V to 190V.

[0032] The other electro-coating process comprises the following steps:

[0033] a2) Pour electro-coating solution mixed with water into a tank.

[0034] b2) Place objects processed by electro-coating in the tank.

[0035] c2) Remove the objects, wash it, and dry it.

[0036] d2) Pour dyeing agent into a second tank.

[0037] e2) Place the objects in the second tank for dyeing.

[0038] f2) Remove the objects, wash it, and dry it. As a result, a dyed outer layer is coated on each object.

[0039] The invention has the following advantages. No strong chemical solution is involved in the evaporation step (i.e., step **50**). Further, the electro-coating solution involved in step **60** causes no pollution to the environment. The invention applies to both metal and nonmetal materials. To the contrary, conventional electroplating is applicable to metal objects only. For electro-coating objects formed of a nonmetal material, the surface of each object is deposited with a first metal coat and that of each structural member is deposited with a second metal coat respectively (i.e., both being conductive). The objects and the structural members are placed in a tank for electro-coating after the evaporation step. Next, for example, acrylic ions in the tank filled with electro-coating solution move to the metal coats. As a result, an outer layer is coated on the object. The outer layer has the properties of corrosion resistance, being aesthetic, wear resistance, etc. The plating of the invention is far much better than the typical lacquer.

[0040] While the invention herein disclosed has been described by means of specific embodiments, numerous

modifications and variations could be made thereto by those skilled in the art without departing from the scope and spirit of the invention set forth in the claims.

What is claimed is:

1. A method of treating the surface of each of a plurality of objects comprising the steps of:

- (a) washing the objects;
- (b) positioning the objects on each of a plurality of structural members;
- (c) depositing a thin coating on each object wherein the thin coating is made of acrylic resin, epoxy resin, or nylon resin, and the thin coating is adapted to fill cavities on the surface of each object;
- (d) drying the thin coatings;
- (e) placing the objects together with the structural members on a tray in a heating chamber wherein an electric heating unit is disposed in the heating chamber and comprises two electrodes of opposite polarities and a tungsten filament interconnecting the electrodes, the tungsten filament being wrapped by metal for evaporation such that evacuating the air in the heating chamber to be vacuum and energizing the heating unit by flowing electric current thereto will evaporate the metal on the tungsten filament into fine particles which are adapted to adhere to the thin coating on each object and each structural member, thereby forming a first metal coat on the thin coating of each object and a second metal coat on each structural member so as to be conductive;
- (f) placing the objects and the structural members in a tank filled with electro-coating solution such that after conducting the electro-coating solution positive or negative ions of the electro-coating solution are dissociated and move to the surfaces of the objects for depositing an outer layer thereon wherein the electro-coating solution is either positive electro-coating solution or negative electro-coating solution; and
- (g) removing the objects from each structural member;

the method further comprising a conveying device, and wherein the structural member comprises a mating member adapted to secure to a corresponding mating member of the heating chamber for securing the structural member to the heating chamber, a hook adapted to hang on the conveying device, and a plurality of branches adapted to position the objects.

2. The method of claim 1, wherein the objects are metal.

3. The method of claim 1, wherein the objects are non-metal.

4. The method of claim 1, further comprising a step of drying between steps (f) and (g).

5. The method of claim 1, wherein the thin coatings are dried by heating in a temperature between about 70° C. and 180° C. for a time period between about 20 minutes and about 70 minutes.

6. The method of claim 1, wherein the positive electro-coating solution is formed of positive acrylic resin, positive epoxy resin, or positive polyurethane resin.

7. The method of claim 1, wherein the negative electro-coating solution is formed of negative acrylic resin or negative polyurethane resin.

8. The method of claim 1, wherein each of the first metal coat and the second metal coat has a thickness in a range of about 0.1 μm to about 1.0 μm .

9. The method of claim 1, wherein step (f) is adapted to be replaced by the substeps of:

- (f-1) mixing a coloring agent with the electro-coating solution prior to pouring same into a vessel;
- (f-2) placing the objects processed in step (e) in the vessel for dying; and
- (f-3) removing the objects to wash and dry so as to form a dyed outer layer on each object.

10. The method of claim **9**, wherein the weight of the coloring agent in the electro-coating solution is about 6% to 14% of the weight of the electro-coating solution.

11. The method of claim **9**, wherein the vessel is provided with an anode and a cathode, and wherein in electro-coating a direct current is applied to the electro-coating solution for a predetermined period of time and an operating voltage of the electro-coating is in a range of about 40 volts to 190 volts.

12. The method of claim **11**, wherein the predetermined period of time is between about 10 seconds to about 50 seconds.

13. The method of claim **1**, wherein step (f) is adapted to be replaced by the substeps of:

- (f-4) mixing the electro-coating solution with water and pouring same into a first vessel;
- (f-5) placing the objects processed in step (e) in the first vessel;
- (f-6) removing the objects to wash and dry;
- (f-7) pouring dying agent into a second vessel;
- (f-8) placing the objects in the second vessel for dying; and
- (f-9) removing the objects to wash and dry so as to form a dyed outer layer on each object.

14. The method of claim **1**, wherein the structural members are metal.

15. The method of claim **1**, wherein the structural members are nonmetal.

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