HANGING DEVICE FOR ANODIZING

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Filed: Oct. 14, 2008

ABSTRACT

An exemplary hanging device for fixing workpieces for anodizing, includes a support frame, a hook module, and a resilient member. The support frame includes an upper frame portion and a lower frame portion formed at opposite ends thereof. The hook module includes a number of connecting hooks. The resilient member is fixed to the lower frame portion. The hook module and the resilient member are made of a conductive material. The hook module is configured for connecting workpieces in series via the connecting hooks. A first end of the hook module is hung on the upper frame portion and a second end of the hook module is connected to the resilient member. The resilient member is capable of creating an elastic force to tighten the workpieces to the hook module.
FIG. 3
(RELATED ART)
HANGING DEVICE FOR ANODIZING

BACKGROUND

[0001] 1. Technical Field
[0002] The present disclosure generally relates to hanging devices and, particularly, to a hanging device for anodizing.

[0003] 2. Description of the Related Art
[0004] Aluminum workpieces are typically anodized to protect the bare aluminum and for appearances. In an aluminum anodizing process, the aluminum workpieces are suspended on a hanging device. The hanging device with the aluminum workpieces are submerged in an electrolyte solution, such as a vitriolic solution. When the hanging device is electrically connected to an anode of an electrical source, the aluminum workpieces are anodized in the electrolyte solution.

[0005] Referring to FIGS. 3 and 4, a typical hanging device 10 for hanging a plurality of aluminum workpieces 20 includes a hanging hook 11, a support pole 12, a plurality of elastic pieces 13 fixed to the support pole 12, and a plurality of fixing hooks 14 attached to the elastic pieces 13. The hanging hook 11, the support pole 12, and the elastic pieces 13 are generally made of titanium because titanium provides electrical conductivity without being anodized. A copper bar electrically connected to an anode hangs from the hanging hook 11. Each aluminum workpiece 20 defines four fixing holes 22 configured to receive the fixing hooks 14. The aluminum workpieces 20 are hung by the fixing hooks 14, and the elastic pieces 13 create an elastic force so that the aluminum workpieces 20 are tightly connected to the fixing hooks 14.

[0006] However, the aluminum workpieces 20 are attached to the hanging device 10 in a parallel connection, so that each aluminum workpiece 20 needs to be fixed by two elastic pieces 13 and four fixing hooks 14. Therefore, a plurality of aluminum workpieces 20 need to be fixed to the hanging device 10, many elastic pieces 13 and fixing hooks 14 are required. Many elastic pieces 13 and fixing hooks 14 result in a high cost of the hanging device 10 because of the cost of titanium. In addition, the hanging device 10 cannot be adapted to fix aluminum workpieces having different sizes because it is difficult to adjust a distance between two hooks 14 fixed on opposite ends of each elastic piece 13. Furthermore, since the electrical conductivity of titanium is relatively poor, an oxidation film formed on the aluminum workpieces 20 by anodizing may not have a sufficient thickness. Moreover, it is inconvenient to fix the workpieces 20 to the hanging device 20 by operating the elastic pieces 13, one by one.

[0007] Therefore, a new hanging device for anodizing is desired to overcome the above-described shortcomings.

SUMMARY

[0008] A hanging device for fixing workpieces for anodizing, includes a support frame, a hook module, and a resilient member. The support frame includes an upper frame portion and a lower frame portion formed at opposite ends thereof. The hook module includes a plurality of connecting hooks. The resilient member is fixed to the lower frame portion. The hook module and the resilient member are made of a conductive material. The hook module is configured for connecting workpieces in series via the connecting hooks. A first end of the hook module is hung on the upper frame portion and a second end of the hook module is connected to the resilient member. The resilient member is capable of creating an elastic force to tighten the workpieces to the hook module.

[0009] Other advantages and novel features will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present hanging device for anodizing. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0011] FIG. 1 is an isometric view of an embodiment of a hanging device for anodizing.

[0012] FIG. 2 is a side view of the hanging device of FIG. 1 assembled with a plurality of workpieces for anodizing.

[0013] FIG. 3 is side view of a typical hanging device for anodizing.

[0014] FIG. 4 is front view of the typical hanging device of FIG. 3 assembled with a plurality of workpieces for anodizing.

DETAILED DESCRIPTION

[0015] Referring to FIG. 1, one embodiment of a hanging device 100 for anodizing, includes a support frame 31, a hanging hook 32, four first connecting hooks 34, a plurality of second connecting hooks 36, four third connecting hooks 38, and four resilient members 39.

[0016] The support frame 31 includes an upper frame portion 312, a lower frame portion 314, and two side frame portions (not labeled) electrically connecting the upper frame portion 312 to the lower frame portion 314. The upper frame portion 312 and the lower frame portion 314 are rectangular-shaped. The upper frame portion 312 is substantially parallel to the lower frame portion 314.

[0017] The hanging hook 32 is made of titanium. The hanging hook 32 is fixed to the upper frame portion 312 and has a hook portion for hanging on a copper bar electrically connected to an anode.

[0018] The first connecting hooks 34, the second connecting hooks 36, and the third connecting hooks 38 cooperatively form a hook module 50. The hook module 50 is made of a conductive material, such as aluminum. Each of the first, second, and third connecting hooks 34, 36, 38 may be formed by bending aluminum wires. Each first connecting hook 34 includes a hanging portion (not labeled) formed at a first end and a hook portion 342 formed at a second end. The hanging portion of each first connecting hook 34 is configured to movably hang on the upper frame portion 312, so that a distance between two adjacent first connecting hooks 34 can be conveniently adjusted. Two hook portions 362 are formed at opposite ends of each second connecting hook 36. A hook portion 382 and a fixing portion 384 are formed at opposite ends of each third connecting hook 38. The fixing portion 384 of each third connecting hook 38 is configured for connecting to each of the resilient members 39. The hook portions 342, 362, 382 are all configured for fixing a plurality of workpieces.

[0019] The resilient members 39 are made of titanium. Each resilient member 39 includes two ends fixed to the lower frame portion 314 and an arched portion (not labeled) connected to the fixing portion 384 of each third connecting hook.
38. The two ends of each resilient member 39 may be fixed to the lower frame portion 314 by hot-pressure welding.

[0020] Referring also to FIG. 2, each workpiece 40 is made of aluminum and defines four fixing holes 42. When using the hanging device 100, the hanging portions of two first connecting hooks 34 are movably hung on a first side of the upper frame portion 312. The hook portions 342 of the two first connecting hooks 34 are latched into two fixing holes of a first workpiece of the workpieces 40, thus the first workpiece is hung by two connecting hooks 34. The hook portions 362 at a first end of a first pair of the second connecting hooks 36 are latched in the other two fixing holes 42 of the first workpiece, and the hook portions 342 at a second end of the first pair of the second connecting hooks 36 are latched into two fixing holes of a second workpiece of the workpieces 40. Thus, the first and the second workpieces are connected by the first pair of the second connecting hooks 36 in series. Similarly, a third workpiece of the workpieces 40 is connected to the second workpiece 40 by a second pair of the second connecting hooks 36 and a fourth workpiece of the workpieces 40 is connected to the third workpiece 40 by a third pair of the second connecting hooks 36. Therefore, the first, second, third, and fourth workpieces 40 are connected in series by the first, second, and third pair of second connecting hooks 36. Finally, the hook portions 362 of a pair of the third connecting hooks 38 are latched in two fixing holes 42 of the fourth workpieces 40, and the fixing portions 384 of the third hooks 38 are connected to the arched portions of the resilient members 39. The resilient members 39 create an elastic force pulling the fixing portions 384 of the third hooks 38, thereby tightening the workpieces 40 to the hook module 50. Similarly, a second side of the upper frame portion 312 may also hang four workpieces by the hook module 50.

[0021] After the workpieces 40 are hung on the hanging device 100, the hanging hook 11 is hung on a copper bar that is electrically connected to an anode. The hanging device 100 and the workpieces 40 are submerged in an electrolyte solution to anodize the workpieces 40 in the electrolyte solution.

[0022] Since the hook module 50 is made of aluminum, and aluminum is cheaper than titanium, the production cost of the hanging device 100 is decreased. The resilient members 39 create an elastic force for stably tightening the workpieces 40 to the hook module 50, so that electrical conductivity between the workpieces 40 and the hook module 50 is considerably enhanced. In addition, because electrical conductivity between the workpieces 40 and the hook module 50 is enhanced, an electrical current passing through the workpieces 40 is stable. As a result, an oxidation film formed on the workpieces 40 by anodizing has a sufficient thickness, and the quality of the anodized aluminum workpieces 20 is improved. Furthermore, the workpieces 40 are conveniently connected to the hook module 50 in series. Moreover, a distance between adjacent first connecting hooks 34 can be conveniently adjusted, thus the hanging device 100 can be adapted to fix workpieces having different sizes.

[0023] It should be pointed out that, the resilient member 39 may be a tension spring. A number of the first connecting hooks 34, the second connecting hooks 36, the third connecting hooks 38 and the resilient members 39 may be adjusted according to a size of each workpiece 40 and a size of the support frame 31.

[0024] It is believed that the present embodiments and their advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the spirit and scope of the disclosure or sacrificing all of its material advantages, the examples hereinbefore described merely being exemplary embodiments of the disclosure.

What is claimed is:

1. A hanging device for fixing a plurality of workpieces for anodizing, comprising:
   - a support frame comprising an upper frame portion and a lower frame portion formed at opposite ends thereof;
   - a hook module comprising a plurality of connecting hooks;
   - and
   - at least one resilient member fixed to the lower frame portion;

   wherein the hook module and the at least one resilient member are made of a conductive material; the hook module is configured for connecting the plurality of workpieces in series via the connecting hooks; a first end of the hook module is hung on the upper frame portion and a second end of the hook module is connected to the at least one resilient member; the at least one resilient member is capable of creating an elastic force to tighten the plurality of workpieces to the hook module.

2. The hanging device of claim 1, wherein the support frame is made of titanium and the hook module is made of aluminum.

3. The hanging device of claim 1, wherein the connecting hooks are made by bending aluminum wires.

4. The hanging device of claim 1, wherein the connecting hooks comprises at least one first connecting hook, a plurality of second connecting hooks, and at least one third connecting hook; the at least one first connecting hook comprises a first end hung on the upper frame portion and a second end connected to a first workpiece of the plurality of workpieces; each second connecting hook comprises a first end fixed to the first workpiece and a second end fixed to a second workpiece of the plurality of workpieces; the at least one third connecting hook comprises a first end fixed to a last workpiece of the plurality of workpieces and a second end fixed to the at least one resilient member.

5. The hanging device of claim 4, wherein the first end of the at least one third connecting hook is a hook portion fixed to the last workpiece and the second end of the third connecting hook is a fixing portion fixed to the at least one resilient member.

6. The hanging device of claim 1, wherein the at least one resilient member is made of titanium.

7. The hanging device of claim 1, further comprising a hanging hook fixed to the upper frame portion, and electrically connected to an anode.

8. The hanging device of claim 1, wherein the hanging hook is made of titanium.

9. A hanging device for fixing a plurality of workpieces for anodizing, comprising:
   - a support frame comprising an upper frame portion and a lower frame portion formed at opposite ends thereof;
   - a hanging hook fixed to the upper frame portion and electrically connected to an anode;
   - at least one resilient member fixed to the lower frame portion;
   - a hook module comprising:
     - at least one first connecting hook comprising a first end hung on the upper frame portion and a second end
connected to a first one of the plurality of workpieces; a plurality of second connecting hooks comprising two ends fixed to two of the plurality of workpieces; and at least one third connecting hook comprising a first end fixed to a last one of the plurality of workpieces and a second end fixed to the at least one resilient member; wherein the hook module and the at least one resilient member are made of a conductive material; the hook module is configured for connecting the plurality of workpieces in series via the at least one first connecting hook, the plurality of second connecting hooks, and the at least one third connecting hook; the at least one resilient member is capable of creating an elastic force to tighten the plurality of workpieces to the hook module.

10. The hanging device of claim 9, wherein the support frame is made of titanium and the hook module is made of aluminum.

11. The hanging device of claim 9, wherein the first end of the at least one third connecting hook is a hook portion fixed to the last one of the plurality of workpieces and a second end of the third connecting hook is a fixing portion fixed to the at least one resilient member.

12. The hanging device of claim 9, wherein the at least one resilient member is made of titanium; the at least one resilient member has an arch-shaped portion.

13. The hanging device of claim 9, wherein the hanging hook is made of titanium.

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