

Method of Plating Piston and Apparatus Thereof

THIS INVENTION relates to a method of plating a piston, in particular piston-ring groove portion of a piston, and to an apparatus for performing the plating method.

Hitherto, as is illustrated in Figure 4, a method conventionally employed for plating piston-ring groove portion of a piston comprises the steps of: hanging down a piston (b) into a plating tank (a) with a hanging member (c) attached to the opposite end face of piston head while putting the piston head downward; securing the piston (b) with the piston-ring groove (d) to be kept in horizontal direction or sideways; providing periphery of the piston-ring groove (d) with anode (e) while providing the piston (b) with cathode (f); plating one surface of the piston-ring groove (d); taking the piston (b) out of the plating tank; hanging down the piston (b) into the plating tank after reattaching the piston to the hanging member (C) in such a manner that the piston head is upward; and plating the remaining surface of the piston-ring groove in the plating tank in the like manner as the above.

In the prior method of plating a piston as mentioned above, however, there exists several problems to be

solved. That is, since the piston-ring groove is placed sideways, hydrogen gas, impurities, floating matters or the like produced in the plating tank may stay on the plating surface of the piston-ring groove, then precipitate and stick to the surface, eventually resulting in serious problems such as inhibition of even electrodeposition, generation of pinholes, peeling of plating. Moreover, because of the piston-ring groove placed horizontally, it is impossible to form a plated layer of even thickness at once on both upper and lower surfaces of the groove, and thus it is obliged to perform plating dividing into two processes first on one surface, then on the other surface after taking the piston out of the plating tank and inverting the position as mentioned above, which needs very troublesome work and takes time a lot. Furthermore, it is necessary for any portion left without plating to be masked and, in such masking, there is a further problem of requiring a delicate manual work to be performed in horizontal direction in parallel to the piston-ring groove, which is more difficult than the work to be performed in vertical direction and apt to bring about vertical dislocation.

The present invention was made to solve the above-discussed problems and has an object of providing a method of plating a piston and an apparatus for use therein which

are free from production of defectively plated product due to sticking of hydrogen gas, floating materials, impurities or the like to piston-ring groove of the piston.

Another object of the invention is to provide a
5 method of plating a piston and an apparatus for use therein in which plated layer of even thickness is formed on both upper and lower surfaces of the piston-ring groove at once without replacing the direction of the upper and lower surfaces invertedly, and in which anode and cathode
10 are simply formed.

A further object of the invention is to provide a method of plating a piston and an apparatus for use therein in which manual masking can be performed in vertical direction instead of horizontal direction, thus
15 required works being simplified and efficiently performed as a whole.

In order to accomplish the foregoing object, in the method of plating a piston in accordance with the present invention, a piston is attached to a cathode suspending
20 member in such a manner that piston-ring groove of the piston is located in vertical direction, then the piston is soaked into a plating liquid, and anode is, for example, annularly provided on outer periphery of the piston-ring groove portion to be plated.

25 The apparatus for performing the mentioned plating

method in accordance with the invention comprises supporting posts respectively erected outside the left and right sides of a plating tank; cathode holders of V-shape in section each provided on upper end of each of the supporting posts; an almost T-shaped cathode suspending member
5 whose cross rod is mounted on between the mentioned left and right cathode holders; a piston attaching plate fixed to a vertical rod of each of the mentioned cathode holders, and to which piston-ring groove is attached in
10 such a manner as to face vertically; and an annular anode formed on outside of the piston-ring groove.

In the method of plating a piston and the apparatus of the above arrangement, since the piston-ring groove faces in vertical direction as mentioned above, the mentioned hydrogen gas, floating materials, impurities and
15 the like produced in plating liquid move upward otherwise precipitate without staying in and sticking to the piston-ring groove. Furthermore, when attaching a piston to the cathode suspending member outside the plating tank and
20 mounting the cross rod of the cathode suspending member on between the cathode holders, a cathode system is automatically established from the cathode holder to a piston by way of the cross and vertical rods, whereby metal ion dissolved out of the anode into the plating liquid precipitates on the piston-ring groove surface to perform
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plating.

In the method of plating a piston and the apparatus of the above arrangement, since the piston-ring groove is electro-plated while being suspended vertically, the disadvantage of defective plating pertinent to the prior method and apparatus caused by hydrogen gas, impurities, floating materials staying in the piston-ring groove can be overcome resulting in formation of a plated layer of even thickness without pinhole or peeling. Thus, there is no need of plating the piston-ring groove divided into two processes requiring troublesome reattachment of the piston-ring groove up side down, which means that the time needed for attachment and plating are reduced by half. Further, since the cathode system is formed just by attaching the piston to the vertical rod and placing the cross rod between the cathode holders, it is now possible to attach the piston and the cathode simultaneously at once. Furthermore, since manual masking can be performed in the vertical direction, dislocation in vertical positioning is largely prevented. As a result, productivity in entire plating work can be significantly improved.

Other objects and advantages of the present invention will become apparent in the course of following description together with the accompanying drawings.

According to the invention there is provided a method for plating a piston comprising the steps of: attaching a piston to a vertical rod of a cathode hanging member such that a groove of the piston is located vertically; said cathode hanging member being an almost T-shape which is formed of a bar-like cross rod having a sufficient length to extend horizontally in and along a V-groove of cathode plates and which is provided with a hanging hook, and a vertical rod attached vertically to said cross rod, each of said cathode plates being V-shaped in longitudinal section and arranged opposedly on left and right outside a plating tank; placing said cross rod of said cathode hanging member on the cathode plates thereby forming a cathode system between said cathode plates and the piston; thus performing an electroplating in said plating tank.

According to a further aspect of the invention there is provided an apparatus for plating a piston comprising: cathode holders inside of which cathode plates each being V-shaped in longitudinal section and wired cathodically are arranged, and which are supported from under side of each cathode plate by a V-shaped support plate through an insulating plate; said cathode holders being mounted opposedly on upper part of supporting posts erected respectively on left and right outside the plating tank; and a cathode hanging member which is almost T-shaped being formed of a bar-like cross rod having a sufficient length to extend horizontally in a V-groove of cathode plates in said opposed cathode holders and which is provided with a hanging hook, and a vertical rod attached vertically to said cross rod; wherein a piston attaching plate for attaching an end face of a piston to said vertical bar is longitudinally attached, and said cross rod of said cathode hanging member is placed on the cathode plates, whereby a cathode system is formed between said cathode plates and the piston.

In the drawings forming a part of the present application with same reference numerals designated to like parts throughout the same,

5 Figure 1 is a partially sectional front view of the apparatus of plating a piston and the method in accordance with the invention;

Figure 2 is a sectional view taking along the line A-A of Figure 1;

10 Figure 3 is a partially sectional front view illustrating the apparatus in which two pistons are attached; and

Figure 4 is a front view of a plating apparatus and the method in accordance with the prior art.

15 An embodiment in accordance with the present invention is hereinafter described with reference to the accompanying drawings. In Figures 1 and 2, the cathode holders 1, 1 are illustrated each formed by laminating plates such as substantially V-shaped holding plate, insulating plate, cathode plate and supporting plate.
20 More specifically, each cathode holder 1 comprises a holding plate 4 of V-shape in section fixed directly onto the supporting post 3 right above, an insulating plate 5 of similar V-shape in section fixed onto the upper side of

the mentioned holding plate 4, a cathode plate 6 of similar V-shape in section fixed onto the upper side of the mentioned insulating plate 5, and a supporting plate 7 of similar V-shape in section fixed further onto the mentioned cathode plate 6. The cathode suspending member 8 comprises the cross rod 9 being a bar formed so as to have an enough length to be horizontally bridged over between the cathode holders 1, 1 provided on left and right sides, and the vertical rod 11 formed so as to have an enough length to suspend the lower half of itself into the plating liquid 10 from the cross rod 9 downward. Thus, a T-shape is formed between the cross rod 9 and the vertical rod 10 of the cathode suspending member 8. The piston attaching plate 14, to which an end face 13 in the opposite side of the head side of the piston 12 is attached, is vertically secured to the lower half of the vertical rod 10. A suspending hook 15 is mounted on substantially the center position of the cross rod 9 forming an inverted U-shape. It is preferred that the anode 16 is, for example, provided annularly on the outer periphery of the piston-ring groove 17 of the piston 12.

As is illustrated in the embodiment in Figure 3, two pieces of piston 22, 22 can be attached respectively to the left and right of the lower part of the vertical rod 21 in order to plate these two pistons at once.

As many apparently different embodiments of the present invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments
5 thereof except as defined in the appended claims.



CLAIMS

1. A method for plating a piston comprising the steps of: attaching a piston to a vertical rod of a cathode hanging member such that a groove of the piston is located vertically; said cathode hanging member being an almost T-shape which is formed of a bar-like cross rod having a sufficient length to extend horizontally in and along a V-groove of cathode plates and which is provided with a hanging hook, and a vertical rod attached vertically to said cross rod, each of said cathode plates being V-shaped in longitudinal section and arranged opposedly on left and right outside a plating tank; placing said cross rod of said cathode hanging member on the cathode plates thereby forming a cathode system between said cathode plates and the piston; thus performing an electroplating in said plating tank.

2. An apparatus for plating a piston comprising: cathode holders inside of which cathode plates each being V-shaped in longitudinal section and wired cathodically are arranged, and which are supported from under side of each cathode plate by a V-shaped support plate through an insulating plate; said cathode holders being mounted opposedly on upper part of supporting posts erected respectively on left and right outside the plating tank; and a cathode hanging member which is almost T-shaped being formed of a bar-like cross rod having a sufficient length to extend horizontally in a V-groove of cathode plates in said opposed cathode holders and which is provided with a hanging hook, and a vertical rod attached vertically to said cross rod; wherein a piston attaching plate for attaching an end face of a piston to said vertical bar is longitudinally attached, and said cross rod of



said cathode hanging member is placed on the cathode plates, whereby a cathode system is formed between said cathode plates and the piston.

3. A method of plating a piston substantially as described herein with reference to Figs. 1, 2 and 3 of the accompanying drawings.

4. Apparatus for plating a piston substantially as described herein with reference to Figs. 1, 2 and 3 of the accompanying drawings.
