



Development of heat treatment device for aluminum electrolytic capacitor

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Abstract: A new type of heat treatment device was developed to solve the carbonization problem of electrolytic paper fiber in pre-treatment of solid electrolyte aluminum electrolytic capacitor. The technical scheme, solution and implementation scheme of the device are put forward. The structure and working mode of the whole heat treatment device are analyzed. The effective and feasible solutions are provided and put into practical application.

Keywords: Aluminum electrolytic capacitor; heat treatment; device; development.

1. Introduction

The development of aluminum electrolytic capacitor has a long time. The traditional process of aluminum electrolytic capacitor with liquid electrolyte generally includes aluminum foil cutting, core winding, electrolyte immersion, assembly, aging and so on. In general, the aluminum electrolytic capacitor with this kind of liquid electrolyte has poor electrical performance, short service life and high ESR value. In recent years, with the continuous development of new technologies, solid electrolyte aluminum electrolytic capacitors have emerged, which have long service life and low ESR. Compared with the traditional aluminum electrolytic capacitor with liquid electrolyte, the process of solid electrolyte aluminum electrolytic capacitor has more pretreatment before impregnation. In order to improve the electrical performance of the electrolytic paper fiber, the damage of the formed aluminum foil was repaired and the electrolytic paper fiber was carbonized. At present, this technology belongs to high and new technology. There are few relevant technological data published in the literature, and there is no record of the development of processing equipment. In order to solve the carbonization problem of electrolytic paper fiber in pre-treatment of solid electrolyte aluminum electrolytic capacitor, we research and provide a kind of heat treatment device, which has been applied and approved the national utility model patent.

2. Technical problems

The technical problem to be solved in the research is to provide a new type of heat treatment device for aluminum electrolytic capacitor. The heat treatment device should be simple in structure, convenient in manufacture, low in cost, complete in carbonization of electrolytic paper fiber, and will not lead to tin accumulation and blackening due to high temperature oxidation. Through this device, the pretreatment of aluminum electrolytic capacitor can be well completed, and its electrical performance can be improved.

3. Solutions

In order to solve the above technical problems, specific solutions are proposed.

The heat treatment device adopts aluminum alloy profile frame body, on which a placement slot is arranged, and a layer of heat insulation layer is laid around the placing groove body. According to the requirements, at least one heating block is placed on the upper part of the heat insulation layer in the placing groove body, on which a heat conducting plate can be detachably arranged, and at least one temperature detector is installed on the heat conducting plate. The heating temperature is controlled by a temperature controller connected with the temperature detector. Therefore, the actual heating temperature can be controlled within the specified range by the temperature detector to control the heating temperature.

A heat insulation board can be horizontally and detachably installed on the heat conducting plate, and a through groove or a through hole which can make the capacitor core package pass through and make the bottom of the core package contact the heat conduction plate. In this way, the heat conduction plate is not easy to dissipate heat, and the cored wire is not oxidized at high temperature, thus avoiding the phenomenon of tin accumulation and blackening of the conductor. Of course, the heat conducting plate can also be provided with a groove or a non through hole to accommodate the core package at the through groove or through hole position of the corresponding heat insulation board.

At least two lifting rods can be installed on the two outer sides of the tank body of the heat treatment device, which can be connected with the cylinder to realize the up and down movement through the action of the cylinder.

According to this scheme, the technical advantages are as follows: the overall structure of the heat treatment device is simple, the operation is convenient, the heating is relatively uniform and easy to realize the temperature control, and the heating effect is good, and the phenomenon of oxidation and tin accumulation of core-clad wire will not occur.

4. Implementation mode

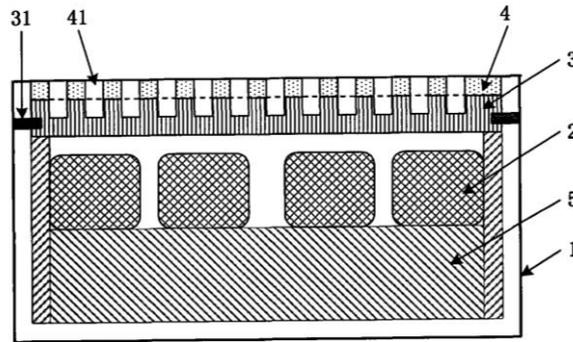


Fig.1 Section diagram of heat treatment device

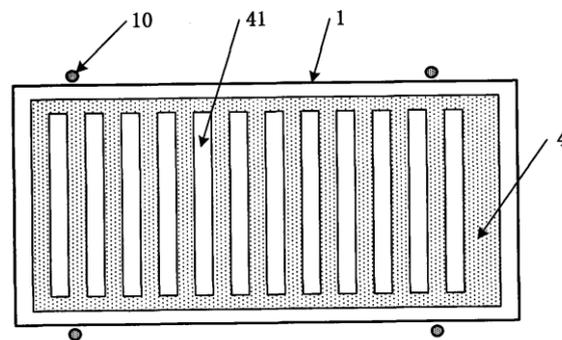


Fig.2 Top view of heat treatment device

As shown in Fig. 1 and Fig. 2, the main structure of the whole device includes a placing groove 1, a heating block 2, a heat conducting plate 3, a heat insulation board 4 and a heat insulating layer 5.

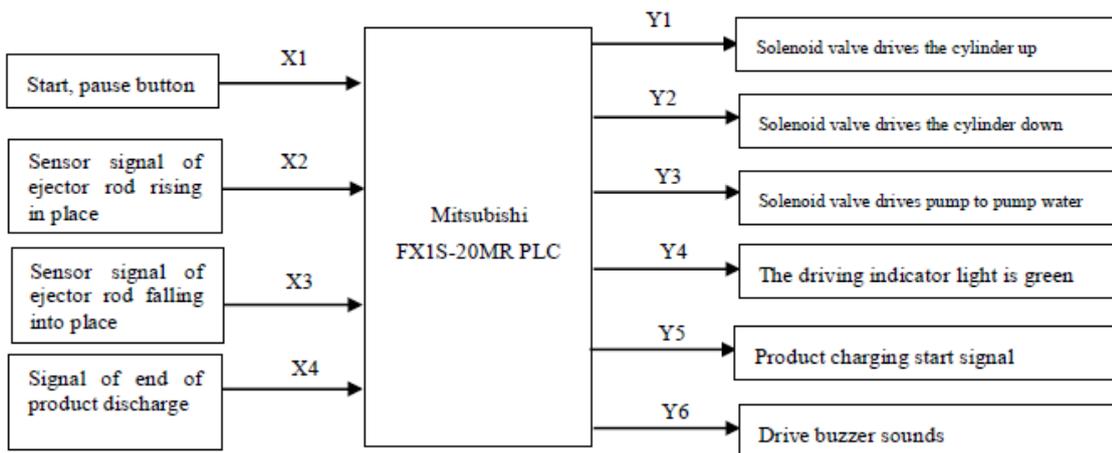


Fig.3 PLC control block diagram of aluminum electrolytic capacitor heat treatment device

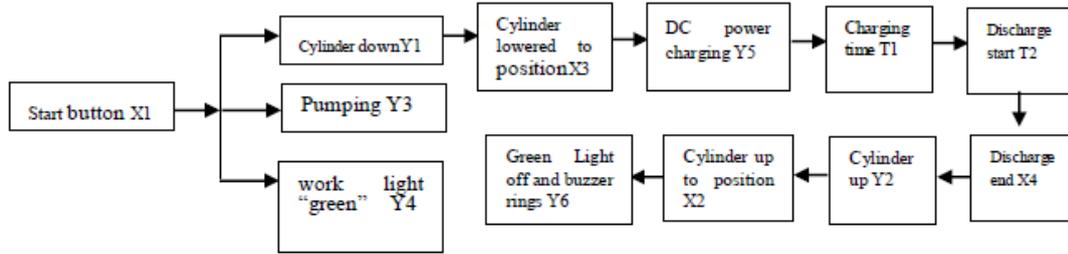


Fig.4 Program control flow chart of aluminum electrolytic capacitor heat treatment device

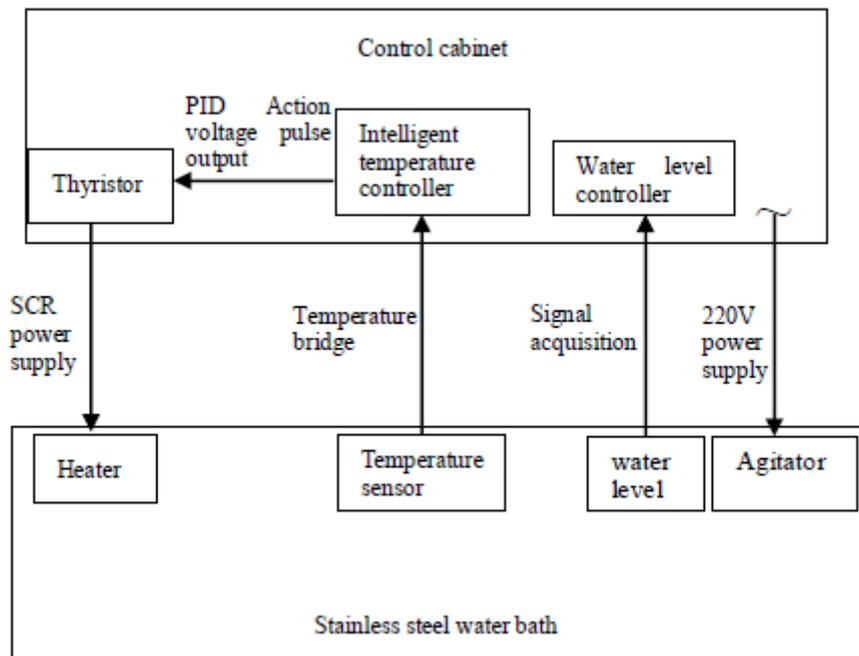


Fig.5 control block diagram of constant temperature water bath

The placing groove 1 placed on the frame body is a groove body with arbitrary shape. It can be square, round or other shapes, generally can be selected according to production requirements, we choose square tank. An insulating layer 5 is arranged around the inner part of the placing groove 1 to isolate the heat loss of the heating block 2 to the surrounding area, so as to realize the maximum heat accumulation.

The heating block 2 is placed on the heat insulation layer 5 inside the placing groove 1. According to the area size of the heating block 2, one or more heating blocks 2 can be selected and placed in order. The heating block 2 is connected with the power supply (not shown in the figure).

The heat conducting plate 3 is horizontally covered on the heating block 2 and is fixed on the placing groove 1 and can be disassembled. Heat conducting plate 3 is usually made of materials with good thermal conductivity, such as copper, aluminum and other metal materials. The surface of the heat conducting plate 3 in contact with the

core package of the capacitor can be a plane, or as shown in Fig. 1, a groove or a non permeable hole which can accommodate the core package is arranged on the surface contacting the core package. At least one temperature detector 31 is installed on the heat conducting plate 3 shown in Fig. 1, which is connected with the temperature controller (not shown in the figure). The best choice is to set temperature detector in several different areas. Based on this, the temperature of several different areas on the heat conduction plate 3 is detected, and then the temperature control is realized by the temperature controller, so as to improve the temperature control accuracy of the whole heat treatment device.

The heat insulation plate 4 is made of thermal insulation material, which is fixed on the heat conduction plate 3, and is horizontally detachable. A through groove 41 (or through hole 41) is arranged on the heat insulation plate 4, which can make the core package of the aluminum electrolytic capacitor pass through and ensure that the bottom of the core package contacts the heat conducting plate 3. For the heat conducting plate 3, the groove or non through hole which can hold the core package can be arranged at the corresponding through groove or through hole position on the surface contacting the heat insulation plate 4. When the capacitor core package is heat treated, the core package passes through the trough or through hole of the heat insulation plate 4 and directly contacts with the heat conduction plate 3. This can effectively prevent the high temperature oxidation of the core package wire or lead to the tin accumulation phenomenon, at the same time, it can also prevent the heat diffusion loss absorbed by the capacitor core package, and improve the heat treatment effect of aluminum electrolytic capacitor.

Corresponding to the technical solution of the device, as shown in Fig. 2, at least two (generally four) push rods 10 can be vertically installed on the two outer sides of the placement groove 1 to realize the up-down lifting. The ejector rod 10 can be lifted up and down through the cylinder, camshaft and other transmission devices. When the capacitor core package is heat treated, the shelf (not shown in the figure) carrying the capacitor core package is placed on the placement slot 1 and supported by the ejector pin 10. At this time, the ejector rod 10 moves downward, and the capacitor core package contacts the heat conducting plate 3 downward. After the heat treatment operation is finished, the ejector rod 10 moves upward to lift the capacitor core package away from the heat conduction plate 3 to complete the whole heat treatment operation. Based on this, the device can realize automatic operation process, convenient operation time control, save manpower, and reduce the cost of heat treatment operation.

In order to further improve the operation control accuracy and heat treatment effect, an electrical control box can be set, which is equipped with Mitsubishi PLC, start stop

button, solenoid valve and digital time relay to realize automatic control of heat treatment operation time, top bar movement, product counting, etc. the specific PLC control diagram is shown in Fig. 3, X is the input signal, y is the output signal, and the PLC control flow chart is shown in Fig. 4, The control block diagram of constant temperature water bath is shown in Fig. 5.

5. Conclusion

The device has the advantages of simple structure, convenient manufacture and low cost. It can solve the carbonization problem of electrolytic paper fiber for the pretreatment of solid electrolyte aluminum electrolytic capacitor. After practical use, it is proved that this device can solve the carbonization problem of electrolytic paper fiber thoroughly, and will not lead to tin accumulation and blackening due to high temperature oxidation. It can better complete the pretreatment of aluminum electrolytic capacitor and effectively improve its electrical performance.

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