PLATE CONDENSER HAVING DISCHARGE ELEMENTS

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ABSTRACT OF THE DISCLOSURE

A plate condenser having discharge elements comprises a plate dielectric having a thickness selected to determine the discharge gap, a pair of electrodes in a band form respectively arranged above and below the dielectric in a close and flat contact with respective surfaces of the dielectric, and an insulating layer of a thermosetting material surrounding the dielectric and electrodes over the contacting areas. Each of the band electrodes is aligned at one end of said contacting area with an end surface plan of the dielectric so as to constitute a discharge element in a parallel relation with each other with its end surface exposed out of the insulating material across the end surface of the dielectric.

This invention relates to plate condensers having discharging elements.

In a conventional condenser having a discharging gap, a part of each condenser electrode itself formed thinly on the dielectric of the condenser has been used as discharging element. For example, silver electrodes have been formed in the end part of element of a cylindrical condenser so that, when an abnormal voltage is impressed there, a discharge may be made and thereby a characteristic of recovery may be soon obtained after the discharge. However, in such condenser, if a discharge is repeated, the thin silver electrodes near the discharging parts will be destroyed by the discharge and will be apt to be deformed and the flashover voltage will fluctuate, so much as to be higher than 20% after 800 discharges. Thus it is difficult to obtain a uniform quality of discharge element and the life of the condenser is short. It has been desired to solve these defects as early as possible.

The present invention is an improvement of a conventional condenser.

An object of the present invention is to form a stable discharging part in a plate condenser having a discharging gap.

The present invention relates to the structure comprising a dielectric of a plate shape, a pair of conductors of a band shape arranged above and below said dielectric in a close and flat contact with respective surfaces of the latter so as to be a pair of electrodes, and an insulating material layer surrounding the dielectric and electrode portions of the conductors so as to hold them integrally.

FIG. 1A is an elevation of a plate condenser having discharging elements according to the present invention.

FIG. 1B is a side view of the same.

FIGS. 2A and 2B are views for explaining a method of manufacturing a plate condenser of the present invention.

FIG. 3 is a view showing the present invention as used.

A plate condenser having discharging elements embodying the present invention shall be explained in the following. In FIGS. 1A and 1B showing a plate condenser having discharging elements according to the present invention, 1 is a dielectric element made preferably of a porcelain. Such porcelain had better be strongly sintered at a high temperature and preferably of titanium or rutile, barium titanate or any alkaline-earth titanate, alumina, forsterite or steatite. Further, the porcelain element 1 should preferably be smooth on the surface and may be painted on the surface with an ordinary glaze. A band conductor 3 is formed in the form of U on said element 1 as shown in FIG. 2 so as to hold the dielectric 1. After the conductor 3 having extensions 3e and 3f at its ends is inserted into cut grooves 16 in a jig 12 so as to be fitted to the jig, the element 1 held with the conductor 3 is dipped into a bath of insulating paint 2 contained in a vessel 13. Here 7 is a limiter for regulating the length to be painted in the longitudinal direction of the element 1. Bolts 8 are screwed into said limiter so as to adjust the position of the limiter.

When heated, the paint 2 deposited on the element 1 of the condenser will strongly hold the conductor 3. Thus conductor 3 will be brought into close and flat contact with the element 1. To this end, the paint 2 is preferably of a material to be solidified by heat as a vehicle. For example, if a mixed thermosetting epoxide-phenol resin containing a hardener is used, the conductor 3 will be able to be closed against the element 1 at a low heating temperature. The conductor 3 is made preferably of silver-plated copper but may be made of a brass, aluminum or iron sheet. The enlarged surface parts 3 of the band conductors 3 holding the dielectric element 1 between them serve as the electrode parts of a condenser. The width and shape of the conductor parts 3 are selected in response to the required electrostatic capacitance. When the paint 2 is set, a part 10 of the paint and bent part 11 of the conductor 3 are cut off with a diamond cutter 9 or the like along the line a-b which corresponds to a side face plane of the element 1, so that the side face of the element 1 will be disposed between cut end edge surfaces of the conductor 3 which is now divided into two electrodes. Thus, sectional face 4 where the side face of the element 1 and conductor edges are exposed will act as a discharge element with the conductor edges serving as a pair of discharge electrodes having a stable discharging function.

Further, part 15 not painted will be made on said element 1 by the limiter 7. The reason for its necessity is shown in the following. A plate condenser having discharging elements according to the present invention as used is shown in FIG. 3. The leading parts 13 and 14 of the conductor 3 are used as bent in a direction substantially at right angles to the dielectric element. In such case, the unpainted part 15 will have an advantage of increasing the insulating effect between the leading parts 13 and 14. The generation of coronas will be little.

As the discharging gap is determined by the thickness of the element 1, the discharging elements of the present invention can be formed to be high in the precision. Therefore, the flashover voltage is very uniform and can be varied by varying the thickness of the element 1.

Though one element is fitted to the jig in the embodiment of this manufacturing method, it is easy to work many at the same time. It is also easy to make a complex circuit part. Thus two or more discharging elements can be formed in the same element 1. In the present invention, it is not necessary to specifically silverplate the element 1.

The conductor 3 should be so smooth as to be easy to bring into close contact with the element 1. The shape of the conductor part 11 in the end part of the U-shaped conductor 3 should conform to the thickness of the element 1.

Further, in the present invention, when the electrostatic capacitance of the condenser of a large value, it will not be necessary to make the width of the conductor 3 large. The same silver electrode as in the conventional
condenser technique may be formed in the element 1 and may be electrically connected with the conductor 3. As the conductor 3 is in the form of a flat plate, the radiation of heat is easy.

In such construction as in the above, when a forsterite porcelain plate of longitudinal length of 10 mm., a lateral length of 7 mm. and a thickness of 0.5 mm. was used for the element 1 and a copper plate of a width of 2.5 mm. and a thickness of 0.2 mm. was used for the conductor, a flashover voltage of 1500 v. DC was obtained.

Further, even when 5000 discharges were made, the rise of the flashover voltage was less than 10%. Substantially no variation of the electrostatic capacitance of the condenser was seen.

Though the discharge generated a corona once, it was soon converted to a spark discharge. The generation of coronas was very little. Even if heat was generated by a corona loss, the heat was seen to be dissipated into the atmosphere through the conductor 3.

Further, at not only impulse produced by a fault within the circuit but also a high voltage close to a direct current, an alternating current and a high frequency, a spark discharge will be easily generated and the delay of the spark will be so little as to be presumed to be less than 10⁻⁴ second. The voltage-time curve V-t is substantially horizontal. Thus the electronic devices can be well protected.

The effects obtained by the plate condenser having the discharging elements of the present invention as described above can endure many discharges and give stable electronic circuits. Said condenser is very easy to make and can protect electronic devices while keeping the action of a condenser. Further, in the present invention, the flashover voltage is stable, complex parts can be easily made, the condenser can be made small and, as the conductor 3 can be made parallel in packing and transportation, it is easy to handle. Thus, the condenser of the present invention has a technical substance far more advanced than of any conventional condenser and its industrial value is large.

While there has been described in connection with the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is aimed, therefore, to cover in the appended claims all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a condenser structure of the plate type, the combination comprising a flat plate made from a dielectric material, a pair of band electrodes applied to and in contact with opposite side faces of said dielectric plate, one end of each of said electrodes terminating at an end face of said dielectric plate to establish a discharge gap between said electrode ends across the said end face, the other ends of said electrodes extending beyond the opposite end face of said dielectric plate, and an insulating layer applied to the opposite side faces of said dielectric plate and over the appertaining portions of said band electrodes in contact therewith to rigidly secure said band electrodes in place on said dielectric plate.

2. A condenser structure as defined in claim 1 wherein the opposite side faces of said dielectric plate at the regions adjacent the extended portions of said band electrodes do not include said insulating layer.

3. A condenser structure as defined in claim 1 wherein the width of said band electrodes is less than the width of said dielectric plate.

4. A condenser structure as defined in claim 1 wherein those portions of said band electrodes which are covered by said insulating layer are wider than the portions which extend beyond the dielectric plate.

5. A condenser structure as defined in claim 1 wherein said insulating layer is a hardened thermosetting resin material.

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