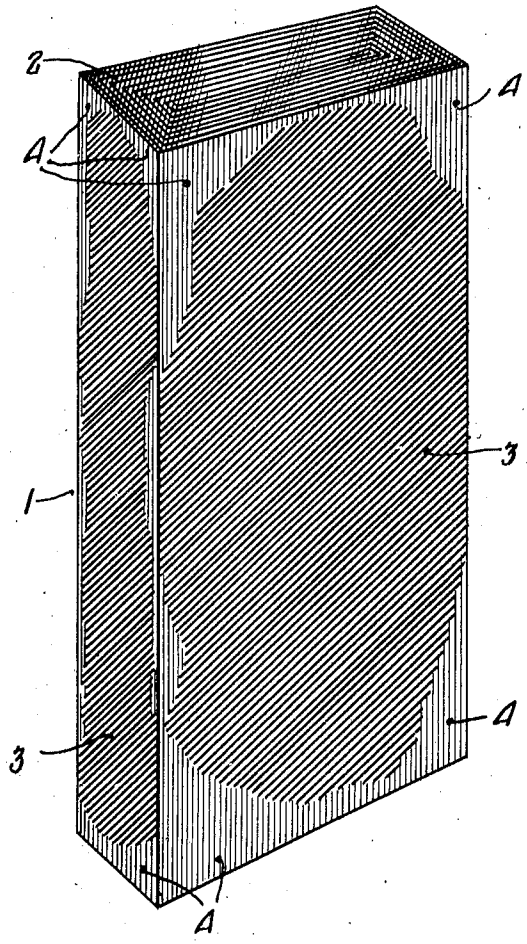
Oct. 23, 1928. 1,688,478

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ELECTRICAL CONDENSER

Filed Jan. 13, 1927



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Patented Oct. 23, 1928. 1,688,478

UNITED STATES PATENT OFFICE.

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ELECTRICAL CONDENSER.

Application filed January 13, 1927. Serial No. 160,887.

This invention relates to improvements in electrical condensers; especially electrical condensers of unchangeable capacity and including paper or other fibrous or porous insulation which is to be impregnated with wax or some other suitable liquid dielectric which solidifies after the impregnation becomes complete.

An object of this invention is to provide a novel condenser and method of impregnating same, of such a character that the insulation will be very effectual and the condenser much more durable than prior condensers of the class designated; and therefore capable of longer and more satisfactory operation.

Further objects and advantages of this invention are set forth hereinafter; and I reserve the right to make alterations in structure and the manner of proceeding, without departing from the principle of the invention or exceeding the scope of the appended claims.

On the drawings:

The figure shows in outline a condenser according to my invention and illustrates the method of producing same.

In the particular description of the drawing, the numeral 1 indicates the body of the condenser made by winding up two or more sheets or strips of conductive material, such as metal foil, separated by strips or sheets of paper or other insulation. The roll thus made is compressed into a form of a prism, as shown in the drawing, and is provided with terminals, so that the sheets of metal foil of opposite polarity in the condenser can be connected to an outside circuit. This type of condenser is well-known, and the sheets of metal foil are well incorporated in the body of the condenser 1, and well covered by the sheets of insulation, and for that reason the sheets of metal foil do not appear on the figure above-mentioned, and only concentric layers of the wound up sheets of insulation are illustrated, and are indicated by the numeral 2. When such condensers are compressed into final form, they are usually impregnated by immersing in melted paraffin, or other liquid insulation, to fill the spaces between the layers of insulation and the pores thereof, and prevent the occurrence of small cracks or voids which will give admission to air and moisture. Such voids enable the condenser to become imperfect, and greatly reduce its efficiency. The body 1 may be subjected to pressure while the process of impregnation is taking place, and after cooling, the wax or other liquid insulation solidifies and tends to close any minute spaces in the insulation or between adjacent layers of insulation or metal foil, and sealing the interior of the body of the condenser 1 entirely.

However, during cooling, the liquid insulation with which impregnation is effected, especially if wax is employed, undergoes shrinkage and contraction. As a result, while the body of the condenser may be completely impregnated, there will be spaces near the ends shown at the top and bottom of the figure, where voids will occur, particularly near the ends between the edges of adjacent layers, and at the corners. If the diagonal shade lines indicated by the numeral 3 represent the distribution of the wax throughout the body of the condenser, the portions at the corners and edges adjacent the ends, where no wax or relatively little wax will remain after impregnation and when cooling has taken place, is clearly indicated in the figure, because these diagonal shade lines do not extend all the way to the ends and corners. Therefore, such a condenser may after a while admit air and moisture to the interior through voids occurring at the ends, where the paraffin or other liquid insulation, upon solidifying, has not been retained. The temperature at which the body of the condenser 1 is impregnated with the liquid insulation may be taken, for example at 285° F.

To insure full impregnation throughout the body of the condenser all through the places from which the wax might shrink and eventually permit voids to occur, I prefer to put the condenser 1 through a second process of impregnation after the impregnation with wax has been completed. To this end, the condenser after being removed from the tank containing the melted wax, is placed, while still hot, in a tank containing cold petrolatum, or the like, the tank being pumped for about half an hour to remove air. The body 1 is completely covered by the petrolatum and later air under atmospheric pressure is admitted to the tank. The heat in the body 1 melts the petrolatum with which it comes into contact, and the petrolatum will soak into the body 1 at the ends and corners, as indicated at the vertical shade lines 4, and

any voids at the ends and corners will thus be filled by the liquid petrolatum. The condensers remain in the petrolatum until they become cool, and as the paraffin shrinks and contracts up to the point where it solidifies, for example at 130° F., or thereabout, it is followed up by the still liquid petrolatum which penetrates in through the ends as far as the wax 3 shrinks. Thus, all voids are filled up, and as the cooling continues until it approaches room temperature, the petrolatum also becomes thicker and more nearly solid, and will not run out of the body of the condenser, but stick inside of the ends and corners thereof, and thus complete the effect which the impregnation with paraffin does not fully insure.

It is to be understood that by "impregnation" of a condenser I refer to the displacement of all air and moisture, or the complete filling of voids and interstices, for all practical purposes, within the condenser body as distinguished from any process in which the condenser is merely dipped or coated. Altho the dipping or coating compound may penetrate into the condenser body, the latter process does not insure the displacement of all air and moisture, or prevent the formation of voids therein.

Condensers worked as above will safely withstand far higher voltages than condensers impregnated in the usual way, with paraffin, wax, or some other liquid compound of that nature.

When paper condensers are treated to impregnate them with wax they must always be heated to eliminate moisture and air and make the wax fluid enough to penetrate the condensers. All waxes have a large coefficient of expansion; and whenever a condenser impregnated with wax cools, the wax contracts to a large extent; and the contraction is what causes spaces and voids in the condenser. As described above the voids and spaces are apt to occur particularly at the ends. Also, the wax in hardening and contracting exerts mechanical forces and stresses on the paper which may do injury, besides giving rise to voids and cracks, and the condenser will break down in time. But if the condenser, while still warm, after being impregnated with wax is placed into petrolatum, or similar insulating substance, the petrolatum will prevent the condenser from becoming as hard as when wax is used alone and will fill in voids and prevent such spaces and voids from forming. No mechanical strains will then occur and the condenser will be much more durable and withstand higher voltages in service.

As stated above, the effect of plunging the body of a condenser while still hot into petrolatum is to melt the petrolatum and render it more fluid so that it penetrates further and more quickly into body 1 at the ends and corners and all other parts which are left empty by the wax. I have stated that petrolatum or the like may be employed and I have found that heavy oil answers very well, particularly an oil of such a nature which will have characteristics similar to those of petrolatum when petrolatum is melted.

It has long been known in the art that a condenser which will satisfactorily withstand a potential several times greater than its rating on test will often break down in service at considerably lower potentials. This has been a source of considerable trouble and annoyance and no satisfactory explanation has heretofore been advanced. I believe, however, that the presence of voids within the condenser body permits of ionization which may be very small at first, but gradually increases in service and eventually causes a break-down of the dielectric, but in the process disclosed ionization is prevented by the fact that no voids are formed by the shrinkage of the impregnating compound, due to the use of a second compound which follows up and fills all of the interstices as the first impregnating compound cools.

Having described my invention, what I believe to be new and desire to secure and protect by Letters Patent of the United States is:—

1. The method of treating a condenser body which comprises impregnating the same in a heated insulating compound, immersing the body while heated in another compound having a lower melting point, and cooling the body while so immersed.

2. The method of treating a condenser body which comprises impregnating the same in heated wax, immersing the body while heated in cooling oil, and permitting the body to cool while so immersed.

3. The process of treating a condenser body which consists in impregnating the same in a heated insulating compound which contracts upon cooling, removing the body from the compound and immersing the same while hot in a cooling compound having a lower melting point, and permitting the body to cool while so immersed whereby the last-named compound will follow up the first-named compound as it contracts and thereby prevent the formation of voids within the body.

4. The process of impregnating a condenser containing insulation which consists in first immersing it in a heated insulating material which becomes solid at ordinary temperatures and shrinks upon cooling to pervade the greater part of the body of the condenser, treating the body before said insulating material has cooled with another compound, and cooling the body while so treated to impregnate the remaining portions thereof.

5. The process of treating a condenser

body which consists in impregnating the same in heated paraffin wax, removing the body and immersing the same, before the wax has cooled, in petrolatum, and cooling the body while so immersed whereby the petrolatum will follow up the wax as it cools and prevent the formation of voids within the body.

6. The process of impregnating a condenser body containing insulation, which consists in immersing the body in melted wax, immersing the same while hot in petrolatum, exhausting air and subsequently admitting air and cooling the body while so immersed so that as the wax which impregnates the greater portion of the body shrinks and contracts upon cooling, the remaining outer portions of the body will be filled with petrolatum and the body thus fully impregnated throughout.

7. A condenser body impregnated with an insulating compound throughout the greater portion thereof, and impregnated further with another compound throughout its remaining portions, said body being free from voids and having all interstices filled with compound.

8. A condenser including a body containing porous insulation and impregnated with wax throughout the greater portion of the body thereof, and impregnated further with petrolatum throughout the remaining portions of the body, said body being free from voids and having all interstices filled with impregnating compound.

9. A condenser body including armatures separated by fibrous dielectric material, the body being impregnated throughout its central portion with a compound having a given melting point and which contracts upon cooling, said body being impregnated throughout its remaining outer portions with a compound having a lower melting point.

10. A condenser having a body containing porous insulation impregnated with a plurality of insulating compounds having different melting points, each of the compounds occupying different portions of the body, the body being free from voids and having all interstices filled with compound.

11. A condenser having a body containing porous insulation impregnated in certain portions thereof with an insulating compound which is hard at ordinary temperatures and impregnated in other portions thereof with an insulating compound which is viscous at ordinary temperatures.

12. A condenser body impregnated throughout the greater portion thereof with an insulating compound which is hard at ordinary temperatures, the edges of the condenser body being impregnated with an insulating compound which is soft at ordinary temperatures.

In testimony whereof I affix my signature.

ARTHUR J. WEISS.