J. T. H. DEMPSTER.

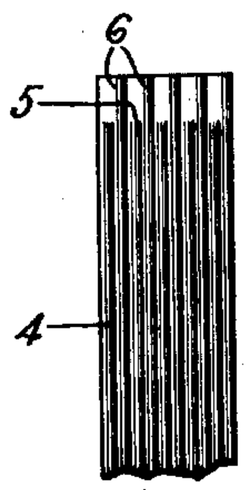
ELECTRICAL APPARATUS AND METHOD OF MANUFACTURING AND OPERATING THE SAME.

APPLICATION FILED AUG. 23, 1904.

917,018. Patented Apr. 6, 1909.

Fig. 1.

Fig. 2.



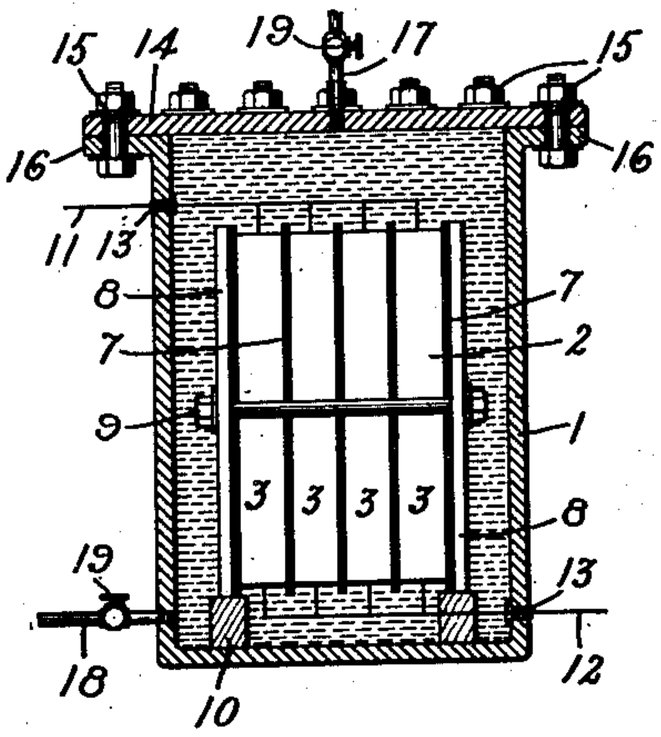
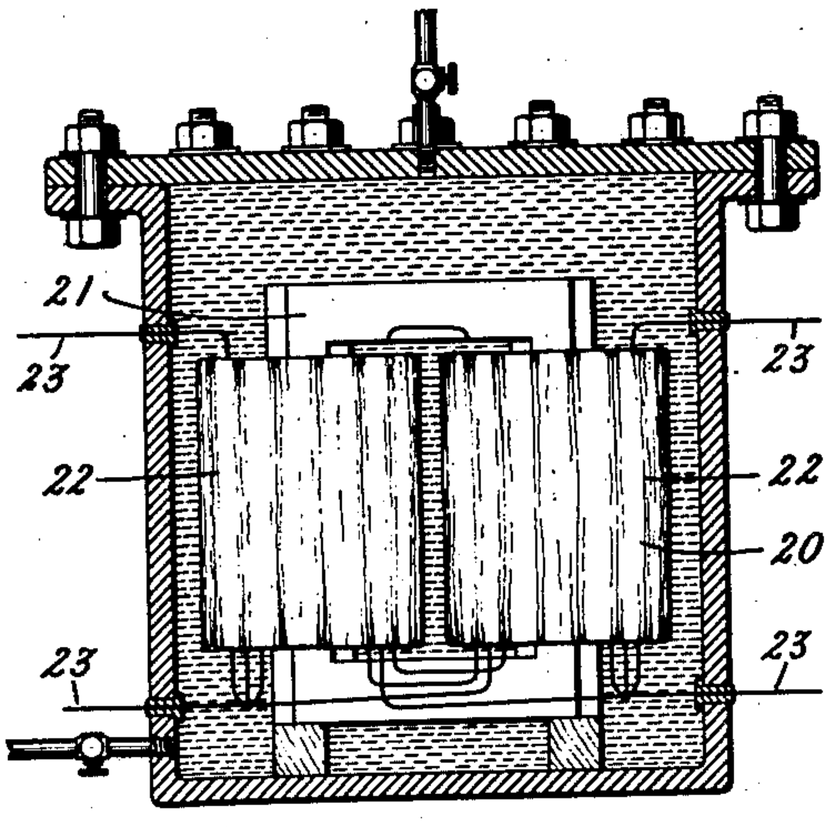


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN T. H. DEMPSTER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRICAL APPARATUS AND METHOD OF MANUFACTURING AND OPERATING THE SAME.

No. 917,018. Specification of Letters Patent. Patented April 6, 1909.

Application filed August 23, 1904. Serial No. 221,834.

To all whom it may concern:

Be it known that I, JOHN T. H. DEMPSTER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Electrical Apparatus and Methods of Manufacturing and Operating the Same, of which the following is a specification.

In the manufacture and operation of static electric condensers of the ordinary form composed of alternate layers of conducting material such as copper, tin-foil and the like, and dielectric such as paraffin paper or the like, difficulty is frequently experienced from air in the form of bubbles located in the layers of dielectric or between the layers of conducting material and the layers of dielectric. If such a condenser is immersed in a bath of a fluid dielectric material such as oil, melted paraffin or the like, and the bath is subjected to a suitable pressure, I have found that not only are the air bubbles reduced in size by the pressure to which they are exposed, but that the fluid dielectric appears to dissolve or take up the air under these circumstances. If the pressure on the fluid dielectric be reduced the air does not thereafter collect in comparatively large bubbles such as were originally present. This is particularly true where the bath consists of paraffin or the like which is allowed to solidify before the pressure is reduced. This result of itself materially improves the condenser. I have found, however, if the pressure to which the bath is subjected is not reduced but on the contrary is maintained during the operation of the condenser, that excellent results are obtained thereby. The advantages obtained appear to be due more or less to the fact that the specific inductive capacity of the dielectric is increased and its resistance to puncture under the stresses produced by the difference of potential between the conducting plates, layers, or members of the condenser, is also increased. In any event, the effect of maintaining the bath under pressure during normal operation is to increase the capacity of the condenser and to decrease its liability to break down under operating conditions.

It will be obvious to all those skilled in the art, that the advantages to be obtained by maintaining material such as oil or paraffin under pressure, are not limited to the case of condensers but are useful in other relations, as for instance in connection with transformers of the ordinary type.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of my invention, however, reference may be had to the accompanying drawings and description.

Of the drawings, Figure 1 is a sectional elevation of a static electric condenser and casing; Fig. 2 is an elevation of a portion of a condenser section which may be employed in Fig. 1; and Fig. 3 is a sectional elevation showing a transformer and casing.

Referring particularly to Figs. 1 and 2, 1 represents the body of the inclosing metal casing. 2 represents the condenser proper located in the casing. The condenser 2 is shown as made up of a number of sections 3, each of which is formed of a number of conducting plates 4 of one polarity alternating with a number of conducting plates 5 of a different polarity. The conducting plates 4 and 5 may be formed of any suitable material such as tin-foil, sheet copper, or the like, and adjacent plates 4 and 5 are separated by layers 6 of insulating material. The insulating material 6 may be in the form of a number of sheets of paper or the like which may be impregnated with oil or paraffin. Heavy layers or sheets 7 of insulating material are employed to separate the condenser sections 3 from each other and from end members 8. The end members 8 and connecting bolts 9 form a frame in which the condenser sections are clamped. The end members 8 rest on blocks or posts of wood 10, which in turn rest upon the bottom of the casing 1.

The terminals 11 and 12 of the condenser pass through apertures formed for the purpose in the side wall of the casing 1, and are suitably insulated therefrom by bushings 13. Preferably the bushings 13 are formed of some material such as a glass having substantially the same coefficient of expansion as the casing, which can practically be welded or cast into the openings in the casing, to form air- and oil-tight joints of great mechanical strength. The upper end of the casing is closed by a plate or head 14 which

is secured to the body of the casing by bolts 15 passing through a flange 16 formed at the upper end of the casing body 1. Any suitable means may be employed for making a strong oil-tight joint between the head 14 and the body of the casing. A pipe 17 is tapped into end plate 14. A similar pipe 18 is tapped into the lower end of the casing. Valves 19 located adjacent to the casing are employed to open and close the pipes 17 and 18 as may be desired.

After the condenser 2 is placed in the casing and the connections are made to the terminals 11 and 12, the end member 14 is clamped tightly in place. The pipe 17 is then connected to an air-pump and air is exhausted from the interior of the casing. After this, fluid insulating material is introduced into the casing through the pipe 18. The insulating material introduced at this time is not sufficient in amount to entirely fill the casing, but is sufficient to more than cover the condenser. The insulating material which is introduced may be in the form of a permanent oil or may be paraffin or the like heated to render it fluid. After the fluid insulating material is admitted in the manner described, the operation of the air-pump and pipe 17 is continued for some time, and the insulating material if such that it solidifies when cold, is maintained fluid by heating the casing. The result of this operation is to cause the condenser to be thoroughly permeated by the fluid insulating material.

As the fluid dielectric creeps into the condenser by what is substantially a capillary action, most of the air in the condenser is displaced. The air displaced is of course removed through the pipe 17. When this operation has been continued for the proper time (usually for several hours) the casing is entirely filled with insulating material through the pipe 18. After this occurs, the valve 19 in the pipe 17 is closed. Means are then employed to force the fluid dielectric material into the casing until a fluid pressure in the casing is obtained amounting to several hundred pounds per square inch. After this pressure is attained, the valve 19 may either be closed, or the pipe 18 may be left in communication with some pressure-producing means. In any event, the valve 19 should not be closed when the insulating material introduced in it solidifies at ordinary temperature, until after the solidification has taken place. The resiliency of the end member 14 and the casing member 1 may be relied upon to account for the slight difference in volume of the insulating material produced by ordinary temperature change.

Putting insulating material such as oil or paraffin under a pressure of several hundred pounds not only mechanically compresses any small bubbles of air which may have remained in the condenser after the original operation, but as I have discovered causes the fluid dielectric to dissolve or take up more or less air somewhat as water takes up carbonic acid gas under pressure.

Some of the advantages of my invention are attained therefore if the fluid pressure of the dielectric is maintained only for a short time, as maintaining the fluid pressure even for a short time practically destroys all large air bubbles which may have remained in the condenser. If a high pressure is not to be permanently maintained, I find it advantageous to slightly reduce the amount of insulating material in the condenser casing and to again start the air pump, exhausting from the upper end of the casing after the amount of the insulating material in the casing has been reduced. After the air pump has been operated for a short time, I again entirely fill the casing with insulating material and then close both valves 19. Preferably, however, I maintain the insulating material within the casing under a pressure which may be in the neighborhood of several hundred pounds per square inch. Apparently it is advantageous to carry the pressure as high as mechanical considerations will allow. The effect of maintaining the dielectric material under high pressure is to increase its specific inductive capacity and to increase its ability to resist breakdown or puncturing stresses.

In Fig. 3 I have shown a casing substantially similar to that shown in Fig. 1, in which a transformer 20 comprising a core 21 and coils 22, is located. The terminals 23 of the transformer are let through the walls of the casing as are the terminals of the condenser shown in Fig. 1. I find it advantageous to fill the casing which surrounds the transformer with insulating material such as oil, and to maintain this insulating material under a pressure of several hundred pounds while the transformer is operated. The principal apparent advantage in this case for maintaining the high pressure of the insulating material appears to be due to the increased strength of the insulating material obtained thereby. This is of course particularly important in connection with transformers in which comparatively high potentials are employed.

It will be readily understood by all those skilled in the art that many variations may be made in the forms in which my invention may be embodied and the uses to which it may be put, and I do not wish the claims hereinafter made to be limited to the specific embodiment of my invention disclosed more than is made necessary by the state of the art.

What I claim as new and desire to secure by Letters Patent of the United States, is;

1. The method of removing air from a con-

denser which consists in immersing a condenser in a bath of liquid insulating material, and maintaining the insulating material under such pressure during the normal operation of the condenser that air contained in said condenser is dissolved or taken up by the insulating material.

2. The method of removing air from electric apparatus which consists in immersing an electric apparatus in a bath of liquid insulating material, and maintaining said bath under a pressure sufficient to cause air contained in said apparatus to be dissolved or taken up by the bath during the normal operation of the apparatus.

3. The method of removing air from electric apparatus, which consists in immersing the apparatus in a bath of fluid insulating material, putting the insulating material under pressure sufficient to cause air in said apparatus to be dissolved or taken up by the insulating material, and then reducing the pressure on said insulating material to a point below atmospheric pressure.

4. The method of removing air from electric apparatus which consists in immersing the apparatus in a bath of liquid material, putting the insulating material under a pressure sufficient to cause air in said apparatus to be dissolved in or taken up by the insulating material, reducing the pressure of the insulating material to a point below atmospheric pressure, thereafter raising the pressure of the insulating material above atmospheric pressure, and maintaining it at that point during the normal operation of the apparatus.

5. The method of removing air from electric apparatus which consists in immersing electric apparatus in a bath of fluid insulating material, putting the insulating material under a pressure sufficient to cause the air in said apparatus to dissolve in or be taken up by the insulating material, thereafter reducing the pressure on said insulating material, and thereafter putting the insulating material again under pressure and maintaining it under said pressure during the normal operation of the apparatus.

6. In a condenser, the combination with the conducting plates of a liquid dielectric material, under such high pressure as to render air soluble therein.

In witness whereof, I have hereunto set my hand this 22nd day of August, 1904.

JOHN T. H. DEMPSTER.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.