No. 691,600. Patented Jan. 21, 1902.

J. COATES.

MANUFACTURE OF ELECTRICAL CONDENSERS.

(Application filed Jan. 2, 1901. Renewed Aug. 9, 1901.)

(No Model.)

Fig. 1.

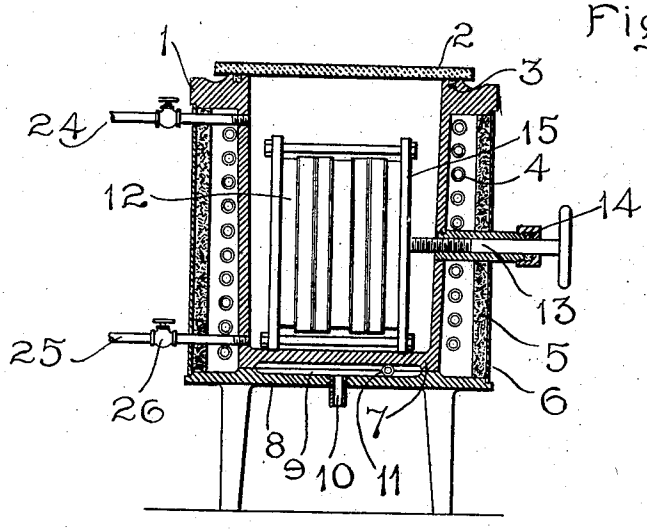


Fig. 2.

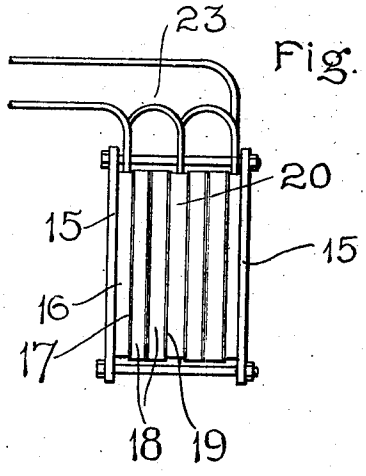
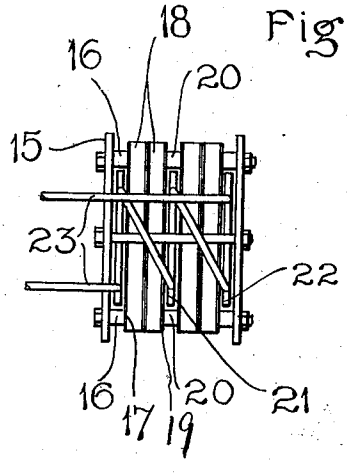


Fig. 3.



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UNITED STATES PATENT OFFICE.

JESSE COATES, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MANUFACTURE OF ELECTRICAL CONDENSERS.

SPECIFICATION forming part of Letters Patent No. 691,600, dated January 21, 1902.

Application filed January 2, 1901. Renewed August 9, 1901. Serial No. 71,533. (No model.)

To all whom it may concern:

Be it known that I, JESSE COATES, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in the Manufacture of Electrical Condensers, (Case No. 1,977,) of which the following is a specification.

My present invention relates to a process of insulation which is particularly valuable in connection with the manufacture of electrical condensers, although not, however, limited to use in this relation only.

The various details of my invention are directed more especially toward the prevention of cracks, fissures, and similar openings which are apt to be found in the insulating material of condensers as heretofore manufactured, these defects being due to the contraction of the insulating material during cooling.

One of the distinguishing features characteristic of my invention is the cooling of a mass of condenser elements from the interior of the mass instead of from the exterior, as heretofore. If under these circumstances cracks or fissures tend to form, the fluid insulating material about the condenser immediately flows in and fills them up, thereby leaving the insulation of the condenser when finally cooled in a perfectly homogeneous condition, free from cracks, air-bubbles, or other similar imperfections. This obviously greatly improves the static capacity of the condenser and at the same time enables it to be subjected to high potentials without disastrous results.

In connection with the cooling of the condensers as thus described I provide means whereby the contraction of the insulating material is followed up by external pressure applied through a compression-screw or other suitable means, this pressure aiding in the removal of any tendency to crack which may exist as the contraction of the insulating material takes place.

A better understanding of my invention may be had by referring to the following description of the operation as carried out by a suitable apparatus—such, for example, as is illustrated in the drawings. The various features of novelty will be more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a sectional view of a treating-tank suitable for carrying out my invention. Fig. 2 is a bunch of condensers assembled ready for treatment, and Fig. 3 is a section of this bunch of condensers.

The treating-tank consists of a vessel 1, open at the top, the opening, however, being closed, when desired, by means of a closely-fitting heavy glass plate 2. The joint between this plate and the top of the treating tank or vessel is made air-tight by means of a rubber packing or gasket 3, inserted in a groove in the top of the tank-wall. The sides of the tank are surrounded by a coil 4, of steam-pipe, to which steam may be admitted through supply-pipes provided with valves in the usual manner, these pipes, however, not being shown. A non-conducting shield 5 surrounds the steam-pipes to prevent undue radiation of heat, this shield being held in place and protected by means of a metal retaining-casing 6, as shown.

The bottom of the treating-tank 1 is provided with an extended edge 7, which rests upon and makes a fluid-tight joint with a supporting base-plate 8, the upper surface of which forms, in conjunction with the hollowed-out lower portion of the treating-tank, a shallow chamber 9, to which cooling-water may be admitted, when desired, the admission being effected through the downwardly-extending tap 10. The outlet is indicated at 11.

At 12 is indicated a bunch of condensers in position ready for treatment. At the right of this bunch of condensers is shown a clamping-screw 13, which may be used to compress the condensers during the operation of cooling. This clamping-screw passes through the fluid-tight stuffing-box 14 into the interior of the treating-chamber 1. In arranging the condensers for treatment each condenser is placed between two thin sheets of metal, and then a number of condensers are arranged side by side, the number of condensers thus placed together being generally not over two. These pairs of condensers are now to be arranged in the retaining-frame 15 in such a

manner that they may be acted upon by certain cooling devices, so located as to abstract heat from the interior of the mass of condensers as assembled. Fig. 3 will perhaps best illustrate the manner of thus assembling the condensers. First comes one of the end plates 15. Upon this is placed two separating-blocks of wood 16, upon this a rather heavy plate of metal 17, and upon this plate a pair of condensers 18, arranged each between two sheets of thin metal, as above described. Upon these two condensers is then placed a second heavy sheet of metal 19, then two more separating-strips of wood 20, and then another heavy sheet of metal, and so on until the desired number of condensers have been assembled. The space afforded by the interposition of the separating-strip 16 is intended to allow the insertion of flat hollow boxes of sheet metal through which a circulation of cooling-water is maintained. Sections of these boxes are indicated at 21 22. Each of these boxes is provided with an outlet and an inlet tube, these tubes being connected, preferably, in series with each other, so that water may flow from one cooling-box through the series and out.

Fig. 2 is a side elevation of the condensers when arranged with these cooling-boxes in position. The cooling-boxes of course do not show in the figure, but their presence is indicated by the water-pipes 23, through which the circulation of cooling-water takes place. These cooling-boxes and the circulating-pipes 23 are not inserted in position, however, until after the condenser has been impregnated with the hot insulating material.

The process of impregnation commences with a thorough baking of the condensers in a suitably-heated oven. This baking thoroughly dries out the condensers and removes any traces of moisture which may exist. The condensers after being baked are inserted on edge in the treating-tank in the position shown in Fig. 1. The cover 2 is then placed in position, and the valve 24 in a pipe leading to a vacuum-pump is then opened. The vacuum-pump is allowed to operate for a considerable period—as, for example, ten hours—during which time the air and vapor, which may be confined in the mass of the condensers, is given an opportunity to expand and to escape into the chamber of the treating-tank, from which it is drawn by the air-pump. The elimination of gaseous bodies is facilitated by occasionally screwing up the compression-screw 13 and then releasing the pressure. This periodic squeezing of the condenser urges gaseous matter from the interior of the condensers toward the edges, from which it more readily escapes.

After the pumping has been continued a sufficient time molten insulating fluid is admitted to the chamber in any suitable manner—as, for example, through the pipe 25, controlled by the valve 26. This pipe extends to any suitable reservoir of the fluid material. As soon as the valve 26 is opened the low pressure in the treating-tank causes the insulating fluid to be drawn through the pipe 25 into the tank. When the fluid in the tank has risen, so as to cover the bottom of the mass of condensers to an extent of not more than one or two inches, for example, the tap 26 is closed. The hot insulating compound thus admitted to the bottom of the treating-chamber is absorbed into the condensers, being drawn up into the fibers and spaces of the condenser by the action of capillary attraction. The slowly-ascending fluid pushes before it any small air-bubbles or collections of vapor that may exist in the fiber of the paper forming the dielectric of the condenser. During this operation the heating-coils about the treating-tank are of course kept hot in order to maintain the insulating material in fluid condition.

The level of the insulating compound is kept just above the bottom of a condenser-section, as shown, until a complete saturation of the condensers by capillary attraction has taken place. More insulating compound is then admitted to the treating-chamber, and the level of the same gradually rises until the condenser-sections are completely submerged, thereby preventing the reëntry of air into the condensers. The next step is the cooling of the condensers. This is done by admitting cooling-water both to the cooling-chamber 9 under the treating-tank and to the cooling-boxes 21 located in the interior of the mass of condensers. Steam is still maintained in the heating-coils about the treating-tank in order to maintain the insulating compound surrounding the mass of condensers in a fluid condition. As the interior of the mass of condensers is cooled the insulating compound contracts, and as it contracts the fluid insulating compound surrounding the mass of condensers immediately flows in and prevents the production of any cracks or fissures in the condenser-sections. As the cooling and consequent contraction of the condensers progresses the clamping-screw 13 is turned from time to time, so as to follow up the contraction by mechanical compression. This squeezes together the sheets of the condenser-sections and prevents the insulating compound from drawing away from the sheets with which it is in contact as it contracts during cooling. The element of mechanical compression is therefore important in securing a perfectly-insulated condenser. After the cooling in the interior and bottom of the condenser has sufficiently progressed the heat in the steam-coils about the treating-tank is discontinued and the whole mass allowed to solidify. Steam is then momentarily supplied to the heating-coils, so as to loosen the mass inside the treating-tank. The condensers are then removed from the tank, superfluous insulating material trimmed off, and the individual sections separated from each other.

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

1. The method of impregnating an absorbent body, which consists in drying the same, removing gaseous bodies confined in the body, filling the body with molten insulating material through the action of capillary attraction, then cooling the body in such a manner that insulating fluid at its edges is the last to solidify.

2. The method of treating an absorbent body which consists in filling it with molten insulating material and then cooling the same so that the insulating fluid at the edges of the body is the last to solidify.

3. The method of treating an absorbent body which consists in filling it with molten insulating material, cooling the same so that the insulating fluid at the edges of the body is the last to solidify, and applying pressure to the body as the cooling progresses.

4. The method of treating an absorbent body which consists in submerging the body in molten insulating material and then cooling the mass by first abstracting heat from its interior.

5. The method of treating an absorbent body which consists in filling the body with molten insulating material through the action of capillary attraction, and then cooling the body so that fluid in contact with its exposed surface is the last to solidify.

6. The method of removing gaseous bodies or vapors from a condenser or other absorbent body which consists in maintaining a more or less perfect vacuum about the same and from time to time compressing the condenser or other body and then discontinuing the compression.

7. The method of treating condensers which consists in assembling them in a bunch, filling them with molten insulating material by the action of capillary attraction, and cooling by abstracting heat chiefly from the interior of the bunch.

8. The method of treating condensers which consists in assembling them in a bunch, submerging them in molten insulating fluid, and then cooling the bunch from its interior so that insulating fluid about the bunch is the last to solidify.

9. The method of treating condensers which consists in assembling them in a bunch, submerging them in molten insulating fluid while in vacuum, and then cooling the bunch from its interior so that insulating fluid about the bunch is the last to solidify.

10. The method of treating condensers which consists in assembling them in a bunch, submerging them in molten insulating fluid and cooling the bunch from its interior and from its bottom.

In witness whereof I have hereunto set my hand this 21st day of December, 1900.

JESSE COATES.

Witnesses:

DUGALD MCK. MCKILLOP,

JOHN A. MCMANUS.