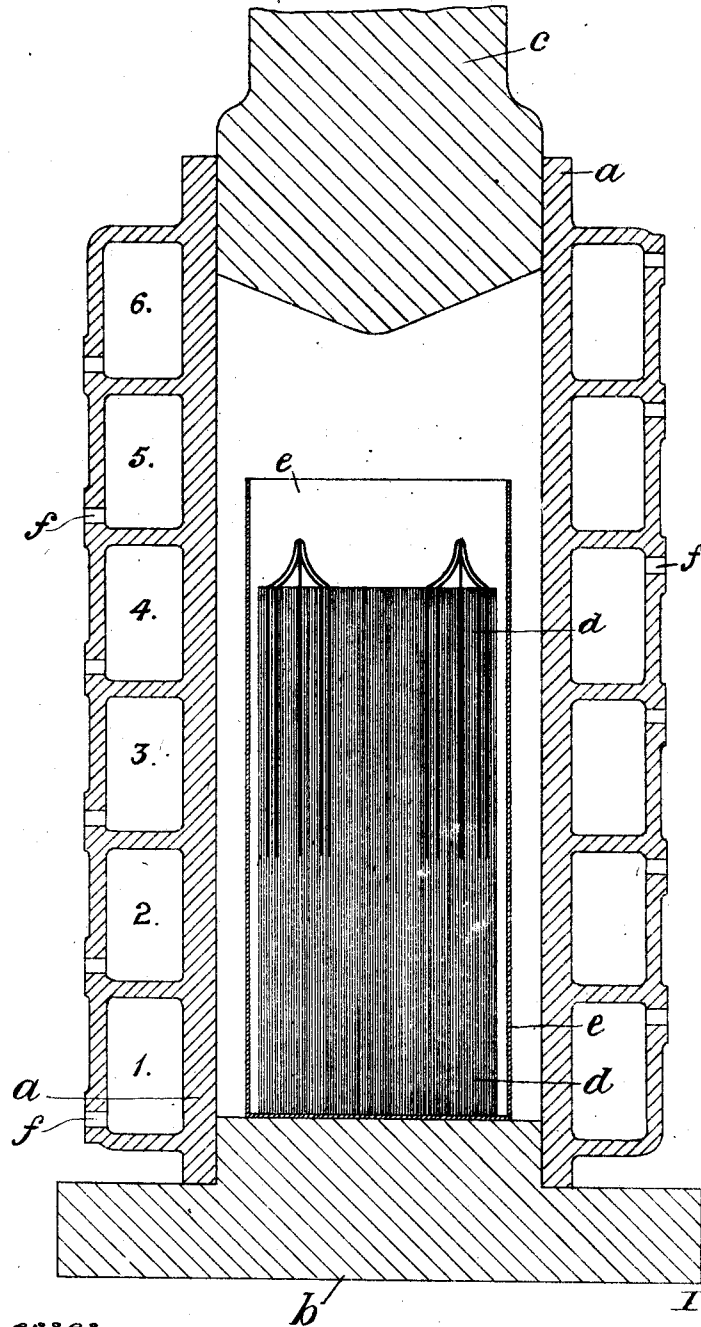


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ELECTRICAL CONDENSER.
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1,063,105.

Patented May 27, 1913.



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ELECTRICAL CONDENSER.

1,063,105.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ERNEST ARTHUR BAYLES, a subject of the King of England, residing at "Hillside," Helsby, in the
5 county of Chester, England, have invented new and useful Improvements in or Connected with Electrical Condensers, of which the following is a specification.

This invention has reference to static electrical condensers of the type wherein the dielectric is paper or like material, and they are made of a plurality of strips or laminae of such paper or material, and metal, rolled or coiled up, the metal between the laminae
10 of paper constituting the two plates of the condenser. The metal in some cases may be coated or formed on or constitute a metallic surface on the paper, or in others it may be separate and rolled up with it; that is, it
15 may be composed of alternate layers of conducting material such as tin foil, copper, and the like, and a di-electric of paper or the like.

Electrical condensers of the above type
25 are well-known and largely used, and for a given space occupied they have a relatively large electrical capacity. Moreover, electrical condensers of this type have been proposed to be made so as to render them suitable for use in connection with high tension
30 "power" circuits, as well as under other conditions; that is they possess the necessary characteristics and qualities to enable them to be used practically and successfully in
35 such circuits or with high voltages, without the liability of breaking down or being damaged; this being partly effected by increasing the di-electric strength of the condenser.

The objects of the present invention have
40 been primarily to provide improvements in processes of, and means for manufacturing condensers of the type referred to, and more particularly those of the latter kind, by which the process of manufacture can be
45 carried out more effectively, simply, and rapidly, and the condenser made or produced in a manner and form well suited to the conditions of use and service it has to undergo, and possessing in a high degree the qualities
50 and characteristics specified.

In the manufacture of condensers of the kind referred to, and more particularly those used in high tension circuits, such as referred to, the paper (or like) di-electric, is, in order

to give it the quality of high capacity, im- 55
pregnated with an insulating substance such as paraffin wax, or like substance, which is solid at ordinary temperatures, as well as filling the interstices between the paper and metal convolutions; as the case may be; and
60 in general practice, the condenser is made up, by rolling the laminae of which it is composed, fairly tightly, and then the roll is immersed in paraffin wax or like substance, in a heated and liquid state, sometimes under artificial pressure, and impregnated by
65 it; and subsequently, the wax or substance, with the condenser structure roll immersed in it, is allowed to cool.

According to this invention, the condensers of the kind referred to, are immersed in the molten paraffin or like substance, in a vessel, and preferably under considerable pressure, so that the di-electric becomes impregnated, if it is not already im- 75
pregnated, and the interstices within it, wherever they may exist, become filled with the melted wax, or substance; and the cooling and solidifying of the liquid is arranged and adapted to take place gradually at a
80 part of the condenser which is away from the direction of application of pressure, and cools and solidifies gradually from this place or point toward the direction of application of such pressure, so that as the wax or substance solidifies, it does not interfere with
85 the full pressure of the liquid being maintained on such parts of the condenser as are not inclosed by solidified wax at any moment, so that up to the last portion of the
90 condenser to become incased or covered with solidified wax or substance, the wax in a liquid state, at full pressure will be in contact with, and acting on the said unincased portion, it being in communication through
95 the liquid medium, with the point or part from which the pressure is applied to the liquid; so that, as the paraffin or like substance solidifies on the condenser, it will at every part, (including of course those parts
100 most requiring it, viz., the ends at which the liquid enters most freely) be subjected hydraulically to pressure through the liquid directly, and not through the solid substance or semi-solid substance. The effect of this
105 is, that as the wax shrinks in solidifying, no spaces are left by shrinkages of the wax between the interstices of the convolutions of

the roll, but these spaces between the laminae are filled completely up, uniformly at both ends, and all over, with the effect above referred to.

5 In carrying out the complete manufacture of the condensers, strips of metal such as referred to and paper or like di-electric, or metal surfaced paper or like material, are rolled up fairly tightly, and bound and
10 dried in any suitable way; and the rolled article is then placed in a metal can or other similar container—preferably one having a closed bottom and open top—and in this container or casing is placed in a vessel and
15 subjected to vacuum; and while under this condition—that is still under a vacuum—the molten paraffin wax or other equivalent impregnating substance is introduced into the vessel. By this treatment, the air will
20 be first drawn off or removed and the melted wax or substance will enter and fill the spaces or interstices to a large extent or degree; including those between the roll and the interior of the case. Each condenser—
25 now comprising the roll and its casing—while the wax is still liquid, is inserted in a “press” which may contain liquid wax or like substance, and pressure is applied to the liquid, say through a ram or other suitable means of applying pressure; and then
30 while the pressure is applied to the liquid, the cooling of the cylinder or the press vessel in which the condenser or condensers is or are placed, is commenced and carried out—preferably artificially by external cooling—
35 for solidifying the wax or substance; the solidifying of it must begin or take place first at a part or point in the condenser which is away from, or opposite the point or direction of application of the pressure. By this method of cooling and solidifying as stated, the direct pressure can be applied through liquid—and not solid paraffin or the like—to the last point of the condenser, where solidification takes place, that
45 is preferably the end which is open. Thus the solidification creeps up gradually around the condenser to this last point where the liquid exists, and which is in communication directly with the direction of application of pressure, until this last part also is inclosed and covered in by solidified wax under pressure.

At present it is preferred that the container of the cylindrical roll, forming the
55 body of the condenser, is cylindrical and has an open upper end, and closed bottom; and that the roll fits loosely in it, and it—the container—stands some distance above the
60 top of the roll, so that when it is filled with wax and treated as described, it will be covered in at this upper end with a considerable depth of wax. When the condensers are so made, the press used will preferably
65 comprise a vertical cylinder, adapted to re-

ceive one condenser (or it may be more), as shown in the accompanying drawing. This cylinder in the drawing is marked *a*, and rests on a bottom plate *b*; and the ram *c*—which is adapted to be removed from the
70 cylinder, or the cylinder from it, by any suitable moving means which can move these parts in relation to each other—fits and works in the opposite end of the cylinder. When the ram is not in the cylinder,
75 the condenser body *d*, within its holder or container can *e* (which will be filled with molten wax so that the condenser is submerged in it) can be introduced into the upper open end of the cylinder. When this
80 is done, the cylinder *a* is filled with molten wax, and the ram is inserted, and the pressure applied to the liquid. In this case, the cylinder *a* is adapted to be cooled from the end farthest from the ram *c* first, that
85 is near its bottom, so that solidification will begin at this part, and proceed in a direction toward the ram *c*, *i. e.*, the direction of application of pressure; and so that the part of the condenser *d*, on which the liquid last
90 solidifies, and which will be last in direct liquid communication with the direction of application of pressure, will be the upper end; and hence the interstices between the laminae of paper or convolutions of the
95 condenser when the operation is complete; must be filled with close wax solidified under pressure, more or less high; and so that no spaces can exist due to the shrinkage of the wax in cooling, after the charging or filling
100 treatment or action; and all are filled with the substance of a uniform density and solidity. The lower end *b* of the cylinder *a* fits over a projection or plug on the removable end *b*, as shown; and this loose end may
105 be adapted to be carried on a movable part of the press, and moved up and down on it, by suitable pressure, and so move the cylinder *a* up and down; while the plunger *c* may be fixed to an upper stationary frame
110 or part of the press. After the solidification of the wax or insulation takes place, the bottom plate of the press *b* is lowered or moved away from the cylinder, and removed from it; and the condenser, enveloped
115 in solidified wax within its container *e* is ejected by moving the cylinder up over the stationary ram *c*; and thus an easy method of ejecting the condenser, and all the solidified wax, as a plug, from the cylinder, is
120 provided.

By the use of an open can or container, deeper than the condenser body, and keeping the latter submerged in molten wax or like substance while removing it from the
125 vacuum apparatus to the pressure apparatus, and by the manner of manufacture herein described, the premature closing of the interstices at the end of the condenser by the solidification of wax at that part,
130

and the distortion of paper, which would take place if the wax cooled at the end, are prevented.

The press cylinder *a* has a plurality of chambers, 1, 2, 3, 4, 5, 6, around it forming jackets, through all of which cooling or heating fluids can be passed, at will; the several chambers or spaces being provided with fluid inlet and outlet aperture *f*. By these means, different parts of the cylinder, and so portions of the wax, can be kept hot, or cooled artificially at will.

During the period the condenser is within the press *a*, and subjected to liquid under pressure, the paraffin wax or like substance within the cylinder is artificially heated at one part, or some parts, and cooled at others; the effect of which is that the process or action above described can be more efficiently and readily carried out. As regards this artificial cooling and heating, after the container, containing the condenser body, submerged in liquid wax or other like insulation substance (as taken from the vacuum treatment above referred to) has been placed in the cylinder *a*, and the cylinder filled with liquid wax, and during the first portion of the operation, the part of the cylinder *a* farthest from the direction or point of pressure applied to the liquid, namely, that part surrounded by the jacket or space 1, will be artificially cooled by passing cold fluid through it; and preferably this part will be permanently kept cold by supplying to the jacket, a cooling fluid; while the part within the jacket 5 may be kept heated by passing hot fluid through it, up to the very last portion of the operation; when if desired, it may be filled with cooling fluid, or allowed to cool by natural cooling. The heating fluid used would be of a temperature that would keep the wax in that part of the cylinder, which it is in contact with, melted. With regard to the intervening portions of the cylinder *a*, namely, those inside the jackets 2, 3 and 4, these may, from the bottom, be filled in sequence with an artificial cooling fluid, but the chamber or jacket next beyond that filled, will be empty, so that a blank or non-filled jacket space, will precede the filling of the jackets from the colder end. Obviously, however, this manner of gradual or sequential cooling may be modified according to the conditions

existing, and to meet the requirements of different or special cases. During the second part of the operation, that is the cooling of the cylinder from the lower end upward (which may take about two hours) as stated, the jacket or space 5, which is around the cylinder about the upper and open end portion of the container *c*, is always kept charged with hot fluid, so as to keep the liquid wax at this part, which is nearest the direction of application of pressure, hot. That is to say the liquid in one part at least of the cylinder through which the pressure had to pass or be applied to it, must be kept hot during the whole process or operation.

In general, the process or method employed is one in which variable artificial heating and cooling of the molten or liquid wax or equivalent substance in different parts or zones of the press takes place in a certain sequence or order, of which that above described gives a specific instance, and illustrates the general method.

With regard to the pressure which the liquid wax is subjected to, this, in some cases may be as much as one ton to the square inch; but it is not necessarily restricted to this degree of pressure, as it may be found that in the manufacture of condensers for some special uses, or under special conditions, it is not necessary to use this high pressure, and that therefore, it can be reduced if desired.

What I claim is:—

In the manufacture of electrical condensers of the kind herein referred to, the method which consists in submerging the condenser in a bath of liquid wax or insulation subjecting such liquid to pressure, thereby impregnating the spaces in the condenser with dielectrics and effecting the cooling and solidification of the wax, while under pressure in a gradual manner, by passing artificial cooling fluid, around the bath in a sequence of stages, in the manner substantially as herein described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNEST A. BAYLES.

Witnesses:

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