Feb. 11, 1930. W. C. GRUNOW 1,746,469

CONDENSER AND METHOD OF MAKING SAME

Original Filed Feb. 18, 1927 2 Sheets-Sheet 1

Fig. 1

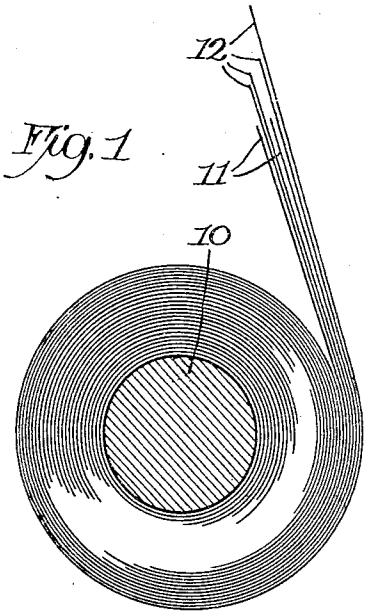


Fig. 2

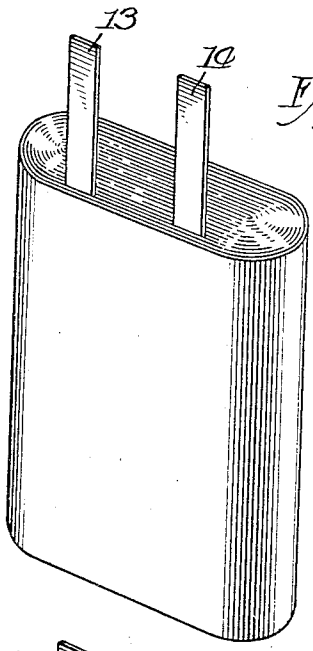


Fig. 3

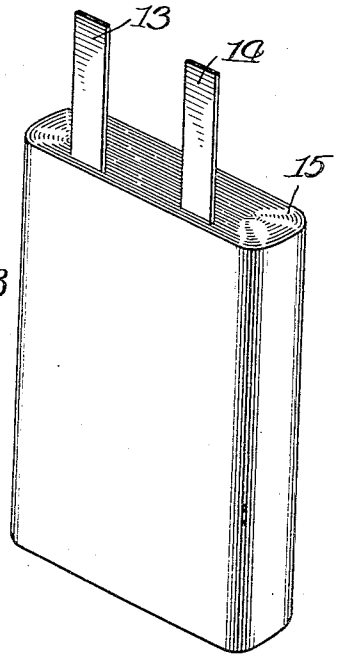
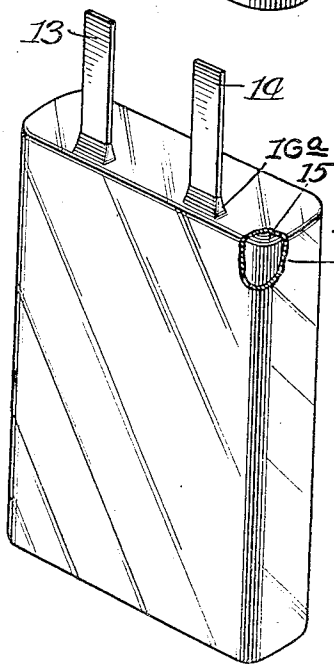


Fig. 4



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CONDENSER AND METHOD OF MAKING SAME

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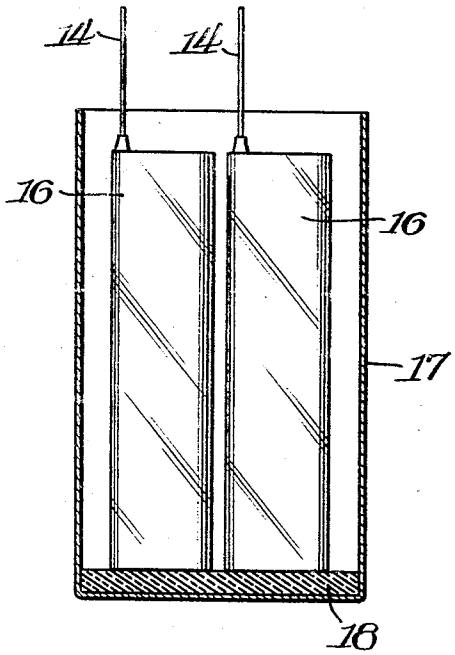


Fig. 5

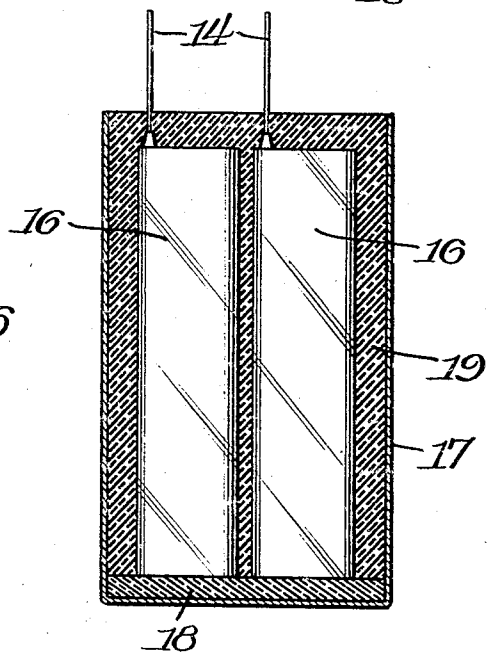


Fig. 6

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1,746,469

UNITED STATES PATENT OFFICE

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CONDENSER AND METHOD OF MAKING SAME

Application filed February 18, 1927, Serial No. 169,417. Renewed December 30, 1929.

My invention relates in general to electrical condensers, and an improved method of making the same.

It relates more in particular to the production of paper-foil condensers adapted to be "potted" singly or in multiple form to produce a finished condenser of requisite capacity.

Among the principal objects of the present invention, is to provide a condenser with improved electrical characteristics.

Another object is to produce a condenser having a longer life.

Another object is to produce a condenser whose electrical characteristics will be constant.

Another object is to provide an improved method of manufacturing condensers.

Another object is to provide a method whereby condensers of a superior type may be constructed more economically than heretofore.

The principal novel steps of the method are indicated in the accompanying drawings, wherein—

Fig. 1 shows the condenser as wound;

Fig. 2 illustrates the manner in which it is flattened;

Fig. 3 shows its appearance after it has been impregnated and before it is coated;

Fig. 4 represents its appearance after the coating step;

Fig. 5 is a vertical sectional view showing the way the condensers may be placed in the pot preparatory to being sealed therein, and

Fig. 6 is a similar view illustrating the manner in which the condensers are sealed in the pots.

In general my condenser comprises a paper-foil condenser body, entirely enclosed in a continuous imperforate shell of thoroughly non-hygroscopic material, preferably a material such as chlorinated naphthalene. The method comprises winding the paper-foil body in a suitable manner, baking it to remove all vestiges of moisture therefrom, thoroughly impregnating the condenser in liquefied chlorinated naphthalene or the like, applying pressure to the flat sides of the condenser until the chlorinated naphthalene has solidified, and finally forming an imperforate shell of chlorinated naphthalene about the condenser body in a suitable manner as by dipping or the like.

Although the invention is directed more in particular to the production of the sealed casing or shell about the condenser body, still I obtain the best results by controlling the preliminary steps of the process in certain respects. The process has been developed of course not only to produce the best condensers of the type which can be made, but also to produce them economically.

In winding the paper and foil to produce the condenser body, I employ a round mandrel 10. The foil 11 and paper 12 are partly wound, the usual terminals 13 and 14 applied in contact with the foil, and the winding resumed until the proper number of turns have been taken. The outer section of paper is then secured in place by the use of any suitable substance such as a gum-mastic or gum arabic adhesive.

The mandrel is then removed from the condenser, and the paper and foil body collapsed to form a body of oval cross-section as shown in Fig. 2. These bodies are then assembled in a suitable tray, and baked under a vacuum to remove all vestiges of moisture therefrom. When they are thoroughly moisture free, they are subjected to the impregnating step of the process.

The impregnating material which I employ is preferably chlorinated naphthalene. In actual practice I have used the chlorinated naphthalene which is sold to the trade under the name of Halowax. I may employ however, other materials which are substantially as non-hygroscopic as chlorinated naphthalene. Indeed by observing certain details of my process, much better results can be obtained with such impregnating materials as paraffin or ozocerite than have been obtained by the use of these materials in the past. The impregnating material is heated to reduce the same to liquid form, and the moisture free condensers are immersed therein. A vacuum of at least twenty-eight inches is maintained above the impregnating liquid until substantially all of the air is removed

from the condensers, and the impregnating liquid has replaced the same. When this condition exists a pressure greater than atmospheric pressure preferably about one hundred pounds per square inch is applied to the surface of the liquid, this pressure being designed to force the impregnating liquid into the smallest interstices in the material of the condenser, and between the foil and paper.

When the condensers are thoroughly impregnated, they are removed and a pressure of about one hundred pounds is applied against their flat sides, and retained until the impregnating liquid has cooled sufficiently to become solid and the condenser is self-sustaining. This time varies, depending on weather condition, but normally is approximately two hours.

When the condensers have cooled they are removed from the trays and will be found to have the appearance indicated by Fig. 3. While they are thoroughly impregnated there are still exposed edges 15 and holes which permit moisture to enter, particularly if the condensers are allowed to stand for any length of time to overcome this difficulty, the condensers are then sealed before they have absorbed enough moisture from the atmosphere to deleteriously affect their insulation resistance. I aim to perform the sealing operation as soon after removal from the trays as possible. During humid seasons I take particular precautions to seal the condensers without delay, and they are accordingly dipped immediately when they are removed from the trays. When the condensers are dipped they acquire a coating 16 on the outside thereof, this coating being entirely imperforate so that it acts as an absolute seal of the openings 15. This coating 16 is found to have filled up around the terminals to form enlargements 16ª which have the effect of thoroughly sealing the condensers at the place terminals emerge from between the paper and foil.

In the dipping operation I use a liquefied sealing material, preferably the same as employed in the impregnating operation. My best results have been obtained with chlorinated naphthalene. After being dipped, the condensers are immediately removed and the liquid which adheres to the surface thereof quickly solidifies, and this results in forming the shell-like casing around the outside of the condenser.

After the dipping the operator examines the condenser, particularly the ends thereof, and if any unevenness or irregularity shows, they are again dipped to avoid the possibility of small openings remaining in the shell-like casing. When this dipping operation has been completed, a shell of chlorinated naphthalene has been formed completely around the condenser body.

Other means can be employed to produce this shell-like casing but I have employed the dipping method as being the most suitable and economical.

The shell-like casing thus produced is absolutely continuous and imperforate except where the condenser terminals project therethrough. Even here however, a perfect seal is obtained because the chlorinated naphthalene grips the base of the terminal firmly enough to prevent all absorption of moisture at this point.

After the unit condensers are produced, they are potted in any proper manner either individually or, as is usually done, in multiples of several condensers therefore resulting in a large condenser of increased capacity.

The method which I have employed in potting the condensers, is to preliminarily make the necessary connections between the terminals of the condensers which are to be included in the pot or casing and then place the condensers into a pot or casing after the bottom thereof has been covered with a sealing compound. After the condensers are in the pot or casing, the sealing compound is poured over the top thereof. The sealing compound may vary and may include asphalt materials with various waxes, or may consist solely of the black wax-like substance which goes under the name of ordinary black sealing wax.

The specific step which is entirely new with me in the production of condensers as far as I am aware, is the sealing of the condensers in a shell-like casing of non-hygroscopic material such as chlorinated naphthalene, immediately after they have been impregnated and the impregnating material has solidified. By the use of this practice, my process is rendered more economical, and the resulting condenser much superior to any condensers of this type heretofore produced.

My process eliminates the second baking step which is usually applied to the condensers immediately before they are sealed in the pots. Other economies result from the fact that in the inspection of condensers produced by my methods, there are practically no rejections, almost perfect electrical results being obtained. The significance of this fact in dollars and cents will appear to those skilled in the art.

I obtain a better condenser by the use of my process because there is no opportunity for the absorption of moisture between the impregnating step and the potting of the condensers. It takes on an average, from one to two days to progress the condensers through this portion of the manufacturing process and it is apparent that a great deal of moisture can be absorbed during this time when the condensers are not preliminarily sealed. This time of from one to two days or more is required in the ordinary process

for the usual testing and grading of the condensers, and for joining them in banks when they are to be potted in multiple.

A condenser produced according to my process, does not depend upon the use of the sealing materials in the pots to exclude air and moisture therefrom. It has become very apparent to me that with the usual sealing compounds employed in this operation, considerably insufficient protection is afforded the condensers; and that condensers produced in the old way will invariably cover a period of years or even months sometimes, absorb sufficient moisture to greatly impair their performance.

I believe that some of the advantages possessed by my condenser are due to the use of chlorinated naphthalene instead of paraffin, which is the material most commonly used in the past for impregnating condensers. Paraffin is slightly hygroscopic, but so little so that the moisture absorbed thereby was not supposed to affect the capacity of the condenser in any way. I believe however, that the better results which I have obtained indicate that this small amount of moisture may have a deleterious effect upon the life and performance of the condenser.

My improved condenser depends for its value, not only upon the provision of a sealing thereof before potting and before they have had time to absorb sufficient moisture in the subsequent steps of the process to deleteriously affect their insulation resistance, but also upon the use of such a material as chlorinated naphthalene. As far as I am aware, I am the first one to employ this material in this way.

In the use of my condenser body as suggested previously I may employ any of the standard methods heretofore used. It is customary to "pot" condensers in proper numbers to secure the capacity desired in a particular instance and in this potting operation I use the same general arrangement and the same general process heretofore used.

Reference may be had to Figs. 5 and 6 showing one specific manner in which the potting may be performed. A container 17 generally of metal is provided and a layer 18 of sealing compound is preliminarily placed in the bottom thereof, and the condensers in proper number set into the pot and on top of the sealing compound 16. The height is arranged so that the terminals 13 and 14 project upwardly beyond the container. Sealing compound 19 of any suitable material, such for example as a mixture of asphalt and rosin oil, etc., is put in around the condensers to entirely envelope the same while leaving the terminals projecting freely at the top. In connection with the potting operation it is sometimes customary to dip the condensers into a suitable sealing compound just before they are placed in the pots for the purpose of insuring the formation of a satisfactory seal without the inclusion of air bubbles or the like immediately in contact with the condenser body. I may employ this step of the process where it is deemed necessary but I find that I am able to obtain a satisfactory seal in most cases without this preliminary dipping step.

For purpose of illustration, I have described certain details of my condenser and the method employed in the manufacture thereof, but it is obvious that I do not limit myself to these specific details, the invention being restricted only by the scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent is:

1. As a new article of manufacture an electrical condenser body adapted to be sealed in a container, said body being impregnated and coated with chlorinated naphthalene.

2. As a new article of manufacture an electrical condenser body adapted to be sealed in a container, said body being impregnated with chlorinated naphthalene, and enclosed in an imperforate shell of chlorinated naphthalene, the terminals only breaking the continuity of said shell, and the shell firmly gripping the base of said terminals to provide an absolute seal at these points.

3. The method of manufacturing an electrical paper-foil condenser body adapted to be sealed in a container, which comprises winding said condenser body upon a round relatively large diameter mandrel, removing the mandrel and collapsing the condenser to oval cross-section form, removing the moisture from said condenser body, impregnating the condenser body with chlorinated naphthalene, and finally forming an imperforate shell of chlorinated naphthalene around the moisture free condenser body.

4. The method of manufacturing an electrical paper-foil condenser body adapted to be sealed in a container, which comprises winding the paper and foil in alternate layers upon a round relatively large diameter mandrel to produce a condenser body, removing the mandrel and collapsing the condenser to oval cross-section form, baking said condenser body to remove the moisture therefrom, impregnating said condenser body with heated liquefied chlorinated naphthalene, applying a predetermined pressure to the impregnated condenser body until the chlorinated naphthalene has solidified and finally forming an imperforate shell of chlorinated naphthalene around the moisture free impregnated condenser body.

5. The method of manufacturing an electrical paper-foil condenser which comprises winding the condenser body, impregnating such body in heated liquefied impregnating material, pressing the condenser until the impregnating material has solidified and then

forming an imperforate shell of insulating material about the condenser body immediately and before the application of further process steps to the condenser such as testing and the like.

6. The method of manufacturing an electrical paper-foil condenser which comprises winding the condenser body, impregnating such body in heated liquefied impregnating material, pressing the condenser until the impregnating material has solidified, forming an imperforate shell of insulating material about the condenser body, joining the condenser bodies in banks, placing a bank in a pot, and pouring sealing material around the condenser bank to complete the potting.

In witness whereof, I hereunto subscribe my name this 15th day of February, 1927.

WILLIAM C. GRUNOW.