

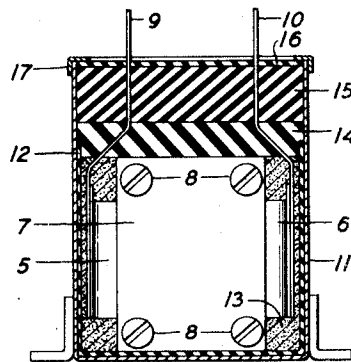
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SEALING OF CONDENSERS AND SIMILAR APPARATUS

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## SEALING OF CONDENSERS AND SIMILAR APPARATUS

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This invention relates in general to the sealing of electrical devices and more particularly to the sealing of condensers or similar apparatus in a container to prevent the entrance of moisture and to bring about such sealing without causing a change in the electrical characteristics of the device.

In the manufacture of precision type mica condensers it has been a preferred practice to dip the assembled units in an asphaltic compound and then pot them in the same compound in a suitable container. However, when the units are dipped in such a compound changes in capacity occur which are not accurately predictable and it therefore is necessary in many cases to unpot the condenser units and adjust their capacity to the desired value by varying the pressure on the clamping plates and then repot them. Since these operations take place after the final drying of the unit an opportunity is afforded for moisture to get into the unit and be sealed in, resulting in detrimental effects on temperature coefficient, conductance, and aging of the completed condenser.

It is an object of the present invention to produce an electrical condenser which will have improved electrical characteristics such as a low conductance and a low temperature coefficient and one in which these characteristics will be maintained for a long life even when subjected to extreme temperature changes.

It is also an object of the present invention to make possible the sealing of electrical apparatus with compounds which have desirable characteristics as sealing material but which are detrimental to electrical units if used as potting compounds in the usual sense.

To accomplish this and other objects and in accordance with the features of this invention there is provided a construction in which the electrical unit is so mounted and sealed that its elements are free to expand and contract when subjected to extreme changes in temperature without permitting the entrance of any moisture into the unit.

The invention may be more clearly understood by referring to the attached drawing in which the single figure is a cross-sectional view showing in elevation one embodiment of the invention. In this drawing there is disclosed a standard type dry stack condenser unit consisting of alternate sets of conducting plates 5 and 6 separated and insulated from each other by means of mica sheets and clamped between clamping plate 7 and a similar clamping plate which is provided

with threaded openings to receive the clamping screws 8. The plates 5 are extended at one side of the clamping plates and are connected to a terminal member 9 and the plates 6 are extended at the opposite side of the clamping plate and are connected to a terminal member 10. This condenser unit is positioned in a cup-shaped metallic container 11 which is open at one end and is preferably seamless formed by an extruding operation so that when the open end is perfectly sealed there is no possibility of the entrance of moisture within the container. Before positioning the unit within the container the latter is provided with an insulating lining 12 of paper or similar material.

After the unit is in position the container is filled to the top of the clamping plate 7 with a layer of granulated insulating material 13 which is packed by tapping the container during the filling process. For this purpose dry sand No. 40 mesh and free from water soluble material has been found satisfactory. The sand-filled condensers are preferably heated under atmospheric pressure for a period of approximately sixteen hours at a temperature of 250° to 300° F. and for approximately five hours under an absolute pressure not exceeding one-half inch of mercury, the temperature being maintained at 250° to 350° F.

Immediately after removing the condensers from the drying tank a layer 14 of a high viscosity asphaltic compound is poured into the container at a temperature of 350° to 400° F. and care is taken to insure that it covers the insulation and wets the terminals and containers in order not to leave any paths through which moisture or liquid may penetrate to the sand. A composition which has been found satisfactory for this purpose comprises about 75 per cent asphalt and 25 per cent rosin and rosin oil. This compound has a high viscosity at the pouring temperature and does not penetrate into the body of sand.

After the condensers have cooled to room temperature a layer 15 of mineral wax which has a melting point between 152° F. and 162° F. and is sufficiently fluid to pour freely at a temperature 180° F. to 220° F. is poured over the layer 14 of asphaltic compound, the latter preventing the mineral wax from penetrating into the underlying body of sand and unit. At the temperatures stated this mineral wax is of low viscosity and bonds with the terminals, walls of the container and the underlying layer of asphaltic compound to form an efficient seal which remains effective

at the lowest temperatures to which the apparatus may be subjected in service. A strip of insulating material 16 dimensioned to closely fit the container is placed over the wax layer 15, the terminal members 9 and 10 passing through close-fitting openings in the insulating strip which is preferably of "Bakelite" or similar material. A close-fitting cover 17 is then forced in place over the container 11, this cover being provided with comparatively large perforations to permit the passage of terminals 9 and 10 therethrough. The cover 17 serves both to protect the device from injury and to retain the wax 15 in position at operating temperatures at which there is a tendency for cold flow.

The body of sand or similar material surrounds the condenser unit on all sides but the bottom side and allows the unit to expand and contract in accordance with temperature changes without otherwise materially affecting the characteristics of the unit. Furthermore this body of sand, because of the large surface area of its individual grains, is believed, to a certain extent, to function as a dessicant for any moisture included within the unit or container while the method of sealing prevents the entrance of moisture under the most severe service conditions. In certain types of apparatus it is required that condensers be mounted on poles where they may be subjected to an extreme temperature range which may vary from as low as  $-40^{\circ}$  F. in the winter time to as high as  $140^{\circ}$  F. in the summer time with the sun shining directly on the apparatus case. Condensers in accordance with this invention have been found to satisfactorily withstand such a range in temperature. Furthermore, accelerated life tests show that such condensers age only about one-tenth as much as condensers potted in standard manners and their temperature coefficient is on an average only about one-tenth as great.

While this method of sealing is particularly adaptable for sealing condensers, it is obvious that it may be used to advantage in hermetically sealing other types of electrical apparatus such, for example, as transformers, induction coils, etc.

What is claimed is:

1. An electrical device comprising a container open at one end, an electrical unit positioned therein with terminals extending through the open end of said container, a body of dry granular insulating material surrounding and covering said unit, and a dual compound seal, filling the open end of said container and consisting of an outer soft compound and inner hard compound for preventing the entrance of moisture to said unit.

2. An electrical device comprising a container open at one end, an electrical unit positioned therein with terminals extending through the open end of said container, means for sealing the open end of said container comprising a soft sealing compound for preventing the entrance of moisture to said unit, a hard compound for preventing the entrance of said soft compound to said unit, and a body of a granular insulating material surrounding said unit for preventing the entrance of said hard compound to said unit.

3. An electrical device comprising a container open at one end, an electrical unit positioned therein with terminals extending through the open end, a body of granular insulating material surrounding said unit and a plurality of layers of viscous insulating materials for preventing

the entrance of moisture to said unit and mixing of said materials, said layers of materials having progressively higher softening temperatures from the open end of said container inward.

4. An electrical device comprising a container open at one end, an electrical unit positioned therein, a body of granular insulating material surrounding and covering said unit, a layer of asphaltic compound covering said granular material, a layer of mineral wax covering said compound, and means for retaining said wax within said container.

5. An electrical device comprising a container open at one end, an electrical unit positioned therein, a body of sand surrounding and covering said unit, a layer of asphaltic compound covering said body of sand, a layer of mineral wax covering said compound, and means for retaining said wax in said container.

6. An electrical device comprising an extruded metallic container open at one end, an electrical unit positioned therein, a body of sand surrounding and covering said unit, a layer of an asphaltic compound having high viscosity at pouring temperatures covering said sand, a layer of mineral wax having low viscosity at pouring temperatures covering said compound, and means for retaining said wax within said container.

7. An electrical condenser comprising an extruded metallic container open at one end, a condenser unit positioned therein, a body of sand surrounding and covering said unit, a layer of asphaltic compound having high viscosity at a pouring temperature of  $350^{\circ}$  to  $400^{\circ}$  F., a layer of mineral wax having low viscosity at a pouring temperature of  $180^{\circ}$  to  $220^{\circ}$  F., and means for retaining said wax within said container.

8. An electrical condenser comprising a condenser unit, a container therefor having an opening at one end, granulated material which does not adhere to said unit or said container and which is infusible below  $400^{\circ}$  F. for embodying said unit in said container, an insulating substance which does not crack at low service temperatures for sealing the open end of said unit and a compound having a relatively high melting point between said substance and said material.

9. An electrical condenser comprising a container having an opening at one end, a condenser unit embedded in sand in said container, a terminal lead electrically connected to said unit and passing through said opening, a mineral wax having a melting point between  $152^{\circ}$  and  $162^{\circ}$  F. for sealing the open end of said container and a layer of compound comprising asphalt and rosin between said sand and said mineral wax.

10. The method of hermetically sealing an electrical device within a container open only at one end which consists in positioning said device within the container, pouring sufficient sand in said container to substantially cover said unit, covering said body of sand with a layer of asphaltic compound which is highly viscous at pouring temperatures, allowing said compound to cool and then pouring thereon a layer of mineral wax which is of low viscosity at pouring temperatures.

11. A method of sealing an electrical condenser unit within a container open at only one end which consists in positioning said unit within the container, substantially surrounding said unit with sand, heating at a temperature of  $250^{\circ}$  to  $300^{\circ}$  F. under atmospheric temperature, further heating at said temperature range under an

absolute pressure not exceeding one-half inch of mercury, covering said body of sand with a layer of an asphaltic compound which is a highly viscous fluid at a temperature of 250° to 350° F.,  
5 allowing said compound to cool and then pouring thereon a layer of mineral wax which is a fluid of low viscosity at a temperature of 180° to 220° F.

12. A method of sealing an electrical device,  
10 comprising a unit within a container open at only one end and terminals extending therefrom, which consists in positioning said unit in said

container, pouring sufficient granular insulating material in said container to substantially cover said unit, covering said granular material with a layer of viscous fluid compound which does not penetrate said granular material and which when  
5 solidified prevents less viscous fluids from reaching said granular material, and then pouring thereon a layer of low viscosity fluid compound which when solidified effectively prevents the  
10 entrance of moisture.

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