E. A. BAYLES AND H. HIGHAM.

ELECTRICAL CONDENSER.

APPLICATION FILED FEB. 23, 1915.

1,346,694. Patented July 13, 1920.

FIG. 1.

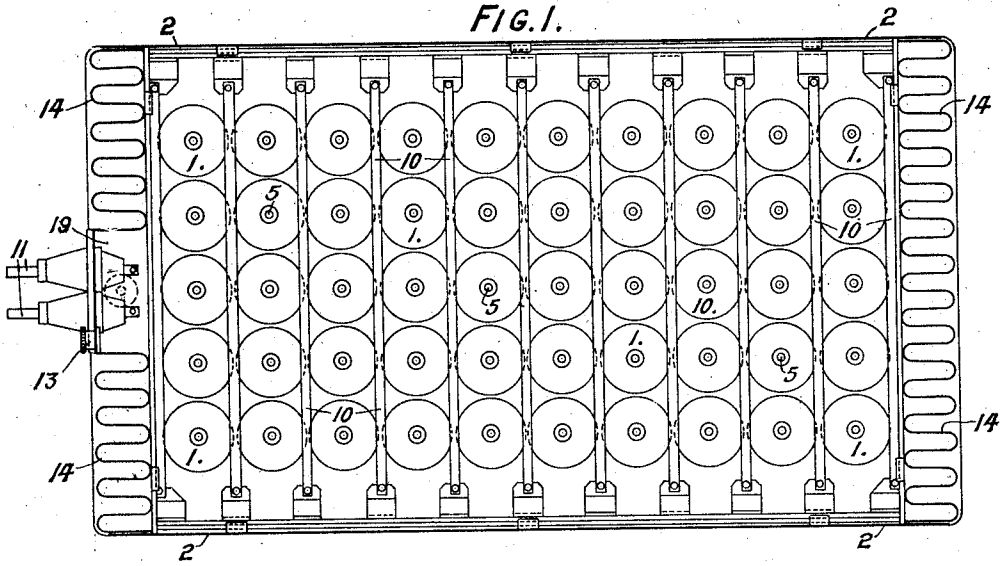


FIG. 2.

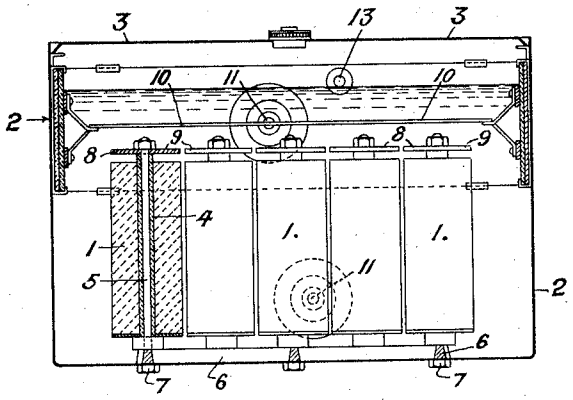
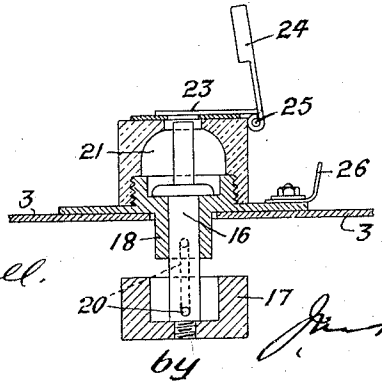


FIG. 3.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL CONDENSER.

1,346,694. Specification of Letters Patent. Patented July 13, 1920.

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To all whom it may concern:

Be it known that we, ERNEST ARTHUR BAYLES and HAROLD HIGHAM, subjects of the King of England, residing at Helsby, in the 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, wherein the di-electric is paper or like material, and they are made of a strip or ribbon, or a plurality of strips or ribbons of such paper or material, and metal, rolled or folded up.

Electrical condensers of this kind have been and are now used successfully in connection with systems of electricity supply, or electricity circuits having low tension but in circuits where higher tensions are used, they have not been wholly successful. That is, they are not reliable, and therefore are not practically available for such circuits, they being liable to break down or become damaged; and the object of the present invention, primarily, has been to provide condensers of this kind, which shall be immune to this liability of breaking down or becoming damaged in such circuits, and under other conditions of such higher tension currents.

A condenser according to this invention consists of a condenser body or bodies, composed of the rolled or folded paper and metal, submerged in and maintained in oil, and disposed in a case or box containing oil.

A condenser thus made or constituted is capable of successfully withstanding the strain or stress to which it is subjected, when used in high tension circuits such as referred to, and will not break down.

The kind of oil which is employed is similar to that used in electrical transformers, and sometimes called "non-sludging" transformer oil.

As regards the coiled or folded laminated paper and metal condenser bodies, in the preferred form, the metal employed is coated or formed on the paper (this being done in any known suitable way of coating paper with metal), so that the paper is a metallic surfaced one; it being found that this gives better results; but in cases where the metal plate or portion is a separate strip or ribbon of metal foil, then this foil should be pervious to liquid, and this perviousness can be furnished by employing finely perforated metal foil.

In the manufacture of the condensers, the rolled or folded bodies are first dried under a high temperature under atmospheric pressure, and then further dried under a vacuum in a suitable vessel or container; and while under this condition, that is, while under vacuum, the oil is admitted to the vessel, and the vacuum is maintained for a considerable time, and the vessel is preferably kept at about 200° to 250° Fahrenheit.

After this, the vacuum may be taken off, and the pressure on the oil will be the normal atmospheric pressure; and then again, after this, the vessel may be again put under vacuum. And these alterations of pressures may be repeated several times, and continued say, each for the space of a quarter to three quarters of an hour.

After this treatment, the condensers may be left for a considerable time, say for several days, submerged in the oil, under atmospheric pressure, which will of course be after they have been removed from the treating vessel or pan; and then they may be again put under vacuum. After cooling the condensers are tested.

The object and effect of this lengthened rest, is to give time for the air to escape from the fibers of the paper.

These operations will be performed on the condenser bodies within a case or box which will be filled with oil, so that they will be submerged; and preferably in the box or case which is to constitute their container.

The strips or ribbons of paper (which is say somewhat analogous to cigarette paper), are wider than the metal and project beyond both edges of same; and in use, the spaces outside the foils are sealed in the oil; and preferably three laminæ of paper are used together, with one of metal, and these are coiled up into the roll or body.

It is preferred that after the condenser bodies have been produced and treated in the manner above described, that air is kept away from them; that is, after they have been impregnated, air should be kept from them, and they should be maintained under oil, during the process of manufacture and afterward in the completed state.

In some cases, the condenser bodies are impregnated, and treated in the manner described, in one box or tray, and tested; and those bodies which have passed the test

are transferred from this tray or box, to the final tray or box; and this transference is effected while submerged in oil. Namely, the tray or box containing the condenser bodies is placed in a tank and submerged, and the case to which they are to be transferred and fixed, is also submerged; and the condenser bodies are taken from the tested tray and placed in position in the other tray; and when this tray is filled, it can be taken out and all the necessary fixings, bus-bars, and the like fitted under the liquid.

In use, the trays or boxes will be closed with a cover, and sealed up, and where a number of them are used, they will be arranged preferably side by side.

The oil in the condensers may be cooled and circulated through them by providing at the ends or other suitable parts, cooling surfaces, say by making in them deep corrugations, so that the oil which may become warm, will cool on the surface, and will circulate at each end, and so the whole body will be kept cool.

A construction and arrangement of parts of a condenser according to this invention is illustrated in the accompanying drawings, in which Figure 1 is a plan showing the interior of the case, and the condenser bodies in position; and Fig. 2 is a cross section. Fig. 3 shows a detail of automatic valve used in connection with the condenser.

Referring to these drawings, 1 represents the condenser bodies, consisting of coiled up or folded convolutions of paper and metal; and 2 is the box or case—preferably of metal—in which these bodies and oil are contained. 3 is the lid or cover of the box.

The condenser bodies are furnished with a core 4 of paper, wood, or the like, in the form of a tube; and they are supported by rods 5 which pass through the cores 4, and screws or are fixed in a metal grid frame or tray 6, resting on the bottom of the box 2, and secured there by screw bolts 7; the bodies being held down in position on the grid or tray by nuts 8 screwing on to the upper end of the rods 5, and having between them and the bodies, the insulator disk 9, through holes in which the leads from the plates are passed.

The whole body of paper is preferably wrapped in a wrapping of textile fabric.

Above the condenser bodies, and across the box, insulated bus bars 10 are fixed, and these in turn are connected up with insulated conductors 11 fixed on one end of the box, through which the current is led to and from the condenser.

As above stated, the bodies 1 are always submerged in oil, and, preferably, for transit, the box—the lid of which is sealed on the body—is completely filled with oil; but when the condensers are put to use, some of this oil is run off by the tube 13, in one end of the box below the level of the lid, which is normally closed by a screw plug, so that while the bodies remain submerged, there is a space between the level of the liquid and the cover of the box.

The box ends 14 consist of deeply corrugated metal (but other parts may be so formed), which provide on the outside a large metal area for contact with the air; and inside, the same area for contact of the oil. By these means, if the condensers are so placed that the air has access to the ends of the box or case, a large and effective cooling surface for cooling the oil is furnished. This cooling at these parts will produce convection currents of the oil within the case; and thereby the temperature of the whole body of oil will be kept cool.

Or, again, the oil may be circulated by positive circulating pumps or means, by withdrawing it from each of the condenser boxes, and simultaneously supplying fresh cooled oil to them, the oil being cooled in any suitable way in the circulating system; and the oil may thus be continuously more or less renewed, and the old oil withdrawn, as it may be found requisite or advisable.

And furthermore, this oil may be put under a vacuum occasionally for the extraction of air, or any other gases which may be contained in it.

An automatic valve or release device is used in connection with the condenser, by which, when an abnormal pressure comes on the case by excessive temperature, the pressure can be relieved. A device of this kind is illustrated in section in Fig. 3; and it consists of a plunger 16, with a weight 17 at its lower end, working in a case or cylinder 18 fixed in the lid or cover 3 (say over the space 19 in one end of the cover where the connections 11 are placed). This plunger has a hole 20 on it, the lower end of which is open to the space above the oil in the case, and the upper end of which is normally covered by the cylinder 18, so that normally the hole is closed. When however, the pressure in the case becomes excessive, the plunger 16 will be raised by it, and the upper end of the hole 20 will communicate with the interior of the hollow cup 21, which is open to the atmosphere by a hole in its top; and so the excessive pressure of air within the condenser is relieved; and after this pressure is so automatically relieved, the weight 17 pulls the plunger 16 back to the position shown in the drawing and so cuts off the connection with the atmosphere.

The relief device has an electric contact device connected with it, consisting of a plate 23, having connected with it a weighted arm 24, and hinged at 25; and this plate and its weight are actuated by the top of the plunger 16, when lifted; and the weight 24 being thus moved over its center of sup-

port, falls on to part 26; and these parts 23 and 24, being in the circuit of an alarm or indicating device of any known suitable kind, an indication will be given of the fact that the pressure on the condenser is, or has been excessive; and the alarm or indicating circuit remains closed until attended to.

This relief valve device will also relieve the condenser, if the pressure in it becomes excessive in transit to the place of use; in which case, the condenser being filled completely with oil, some of it will escape.

The filling of the condenser case with oil for transit, prevents the possibility of air bubbles being formed in the oil by shaking, and so working in between the layers of dielectric.

What is claimed is:—

1. An electrical condenser consisting of a casing containing oil, a plurality of condenser bodies each composed of coiled or folded laminæ of paper and metal impregnated with oil and submerged in the oil in the casing substantially as set forth.

2. An electrical condenser consisting of a casing containing non-sludging transformer oil, and bodies of coiled or folded laminæ of paper and metal, the paper of which is impregnated with oil, said bodies being submerged in the non-sludging transformer oil in the casing.

3. An electric condenser comprising in combination a closed casing containing a body of oil, there being a space between the surface of the oil and the roof of the casing, and a multiplicity of cylindrical coiled condenser bodies each consisting of laminæ of coiled paper and metal, the cylindrical bodies being submerged in the oil in the casing, substantially as set forth.

4. The process of manufacturing electrical condensers consisting of rolling or folding alternate laminæ of metal, and paper strips; then drying such bodies under high temperature; then further drying the bodies under a vacuum in a suitable container; admitting oil to the container and the condenser bodies therein, and maintaining a vacuum in the container for a considerable time; and maintaining the temperature of the container contents, substantially as set forth.

5. The process of manufacturing electrical condensers consisting of rolling or folding alternate laminæ of metal, and paper strips; then drying such bodies under high temperature; then further drying the bodies under a vacuum in a suitable container; admitting oil to the container and the condenser bodies therein, maintaining a vacuum in the container for a considerable time, and maintaining the temperature of the container contents, then removing the vacuum and allowing the atmospheric pressure to act on the submerging liquid of the bodies, then subjecting the liquid and the bodies again to a vacuum, substantially as set forth.

6. The process of manufacturing electrical condensers consisting of rolling or folding alternate laminæ of metal, and paper strips, then drying the bodies under high temperature, then further drying the bodies under a vacuum in a suitable container, admitting oil to the container and the condenser bodies therein, maintaining a vacuum in the container for a considerable time, maintaining the temperature of the container contents, then removing the vacuum and allowing the atmospheric pressure to act on the submerging liquid of the bodies, then subjecting the liquid and the bodies to a vacuum, then removing the vacuum and subjecting the oil and submerged bodies to atmospheric pressure a relatively long time in the container, and then subjecting the oil and bodies in the container again to a vacuum, substantially as set forth.

7. The process of manufacturing electrical condensers consisting of rolling or folding alternate laminæ of metal, and paper strips; then drying such bodies under high temperature, then further drying the bodies under a vacuum in a suitable container, admitting oil to the container and the condenser bodies therein, and maintaining a vacuum in the container for a considerable time, and maintaining the temperature of the container contents, and preventing air contacting with the impregnated bodies during the manufacture of and after the condensers are completed by keeping said condensers constantly under oil, substantially as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ERNEST ARTHUR BAYLES.
HAROLD HIGHAM.

Witnesses:
SOMERVILLE GOODALL,
FRANK E. FLEETWOOD.