Jan. 31, 1939. H. WATERMAN 2,145,842

ELECTRIC CONDENSER

Filed April 7, 1938

FIG. 1.

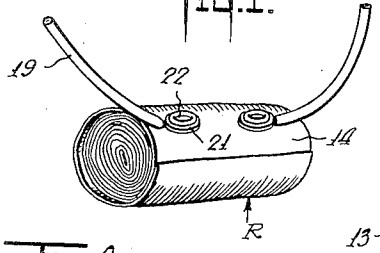


FIG. 2.

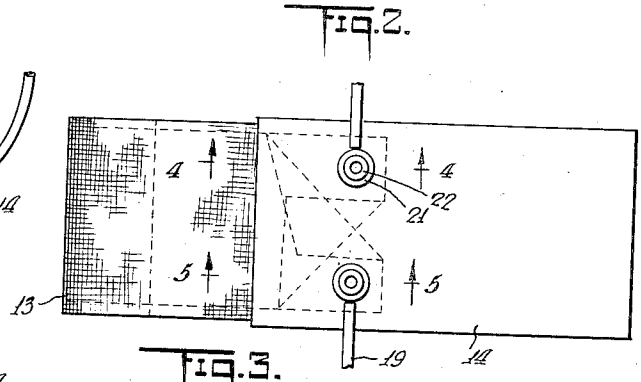


FIG. 4.

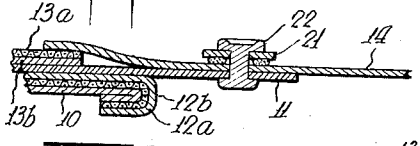


FIG. 3.

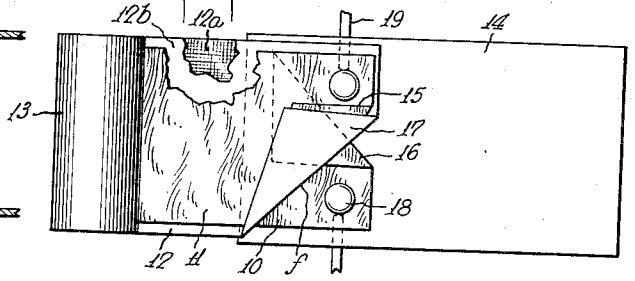


FIG. 5.

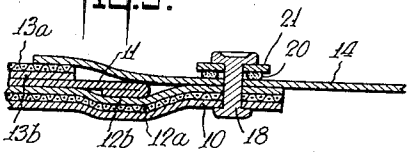


FIG. 8.

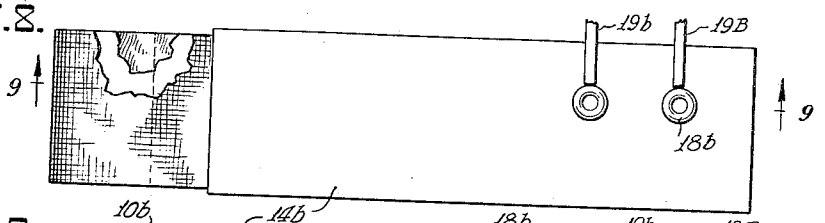


FIG. 9.

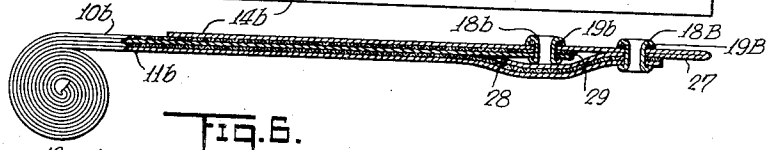


FIG. 6.

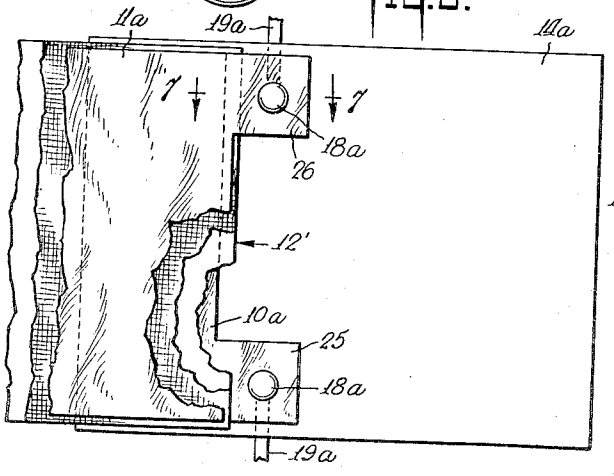
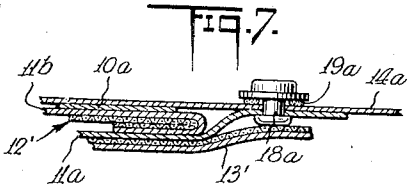


FIG. 7.



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ELECTRIC CONDENSER

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Application April 7, 1938, Serial No. 200,596

9 Claims. (Cl. 175—315)

The present invention is concerned with electric condensers, more especially of the enrolled type and while it is useful in all categories of condensers of this type, it has particular utility in connection with such condensers made of extremely thin foil, and more especially of the variety used as dry electrolytic condensers.

Among the objects of the invention are to provide a condenser of the above type in which the terminals are securely connected mechanically and electrically with respect to the foils and are adequately protected from tearing even delicate foil, though the terminals be subjected to substantial tensile strain.

Another object is to provide a structure of the above type which lends itself to rapid quantity production by the use of automatic winding machines, without the need for special costly manual operations, and more particularly one by which the terminals may be readily applied without slitting or waste of foil and all of the objections that such procedure involves.

In general, the invention involves the use of a protective insulating covering sheet, desirably of varnished paper, about the enrolled condenser, to which the ends of the respective foils are connected by rivets or eyelets, which serve to effect mechanical and electrical connection to wire terminals exposed at the outside of said protective sheet.

Among various specific embodiments, the respective foil ends may be angularly cut away at opposite corners at the outer ends or bent back if desired, or the two foils may be made with integral short tabs from near the opposite edges thereof so that the respective rivets may clear the foils of opposite polarity. As a third embodiment, particularly useful with rolls of short axial length, the outer foil may be somewhat longer than the inner one, and the respective rivets be correspondingly spaced peripherally of the roll, the protective sheet being desirably folded back and interposed between the two foils at the region where the rivet connection is made with the shorter foil.

In the accompanying drawing, in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a perspective view of one embodiment,

Fig. 2 is a plan showing the roll of Fig. 1 partly opened and viewed from the exterior,

Fig. 3 is a view similar to Fig. 2 showing the parts as seen from the interior,

Fig. 4 is a view in longitudinal cross-section taken on line 4—4 of Fig. 2,

Fig. 5 is a similar view taken on line 5—5 of Fig. 2,

Fig. 6 is a view similar to Fig. 2 of an alternative embodiment,

Fig. 7 is a longitudinal cross-section taken on line 7—7 of Fig. 6,

Fig. 8 is a plan view of the roll partly unwound, showing the terminal connection of a still further embodiment, and

Fig. 9 is a sectional view taken on line 9—9 of Fig. 8.

Referring now to Figs. 1 to 5 of the drawing, there is shown a condenser roll R, which illustratively comprises a pair of electrodes 10 and 11, with an interposed interspacer 12 and a second interspacer 13 on the outside of the outer of the foils.

In the embodiment of Figs. 1 to 5, a protective sheet 14 of length preferably somewhat in excess of the peripheral length of the roll and made illustratively of oil paper is superposed over the outer interspacer member 13 to extend beyond the end thereof.

The electrode foils, which in this embodiment may be of equal length, are shown respectively diagonally bent inward at their outer ends. As shown in Fig. 3, the lower edge of foil 11 is bent inward at 15 and the upper edge of foil 10 at 16. If desired and as preferred, the corresponding interspacer corners 17 are bent in with the respective foils. Instead of bending back the foils as described, they may be snipped off at the fold lines *f*.

Rivets 18 penetrating the corresponding unbent ends of the respective foils, thus each clears the foil of opposite polarity in its attachment to the protective sheet 14. The rivets serve to mount wire terminals 19, the ends 20 of which are looped about the shanks of the rivets, metal washers 21 under the heads 22 of the rivets assuring reliability of contact. In this manner, a secure electrical and mechanical connection is effected of each foil with the corresponding wire terminal thereof.

In the completed condenser, the protective sheet 14 of varnished paper or the like is wrapped around the roll as best shown in Fig. 1, so that all of the delicate foil elements are completely encased and enclosed thereby, and only the rugged wire terminals and the corresponding rivet heads are exposed at the outside, with the rivet heads aligned axially of the condenser roll. The condenser is, of course, enclosed in any suitable casing (not shown).

It is understood that in the ordinary electrostatic condenser, the interspacer would be of paper or gauze, impregnated with oil or wax to serve as a di-electric. In the dry electrolytic condenser application, the interspacers would desirably be composite in character including a sheet of dense structure and one of more absorbent character, illustratively a sheet of paper 12a and one of gauze 12b, or a sheet of absorbent paper and one of "Cellophane". The interspacer would be impregnated with electrolyte and at least one of the foils, preferably the inner one, would be formed as the anode, the outer foil serving as the cathode, and the rivets would desirably be of the same metal as the foils, preferably aluminum, thereby to avoid galvanic action.

In the embodiment shown in Figs. 6 and 7, each of the foils is provided with an integral tab extending longitudinally along opposite edges of the condenser roll, foil 10a having its tab 25 near the bottom as shown in Fig. 6 and foil 11a having its tab 26 near the top. Although these tabs are shown projecting beyond the interspacers 12' and 13' it is understood that if desired, the interspacers may extend for the length of the respective tabs. In this embodiment, as in that of Figs. 1 to 5, the protective sheet 14a of oil paper or the like is interposed between the tabs and the associated wire terminal members 19a, the parts being connected together by rivets 18a as shown. The condenser when completed and rolled will correspond to the showing of Fig. 1.

In the embodiment of Figs. 8 and 9, the inner foil 11b with its associated interspacer extends longitudinally somewhat beyond the outer foil 10b. The protective covering 14b of oil paper or the like is preferably reversely bent as at 27 with its infolded end 28 extending inward beyond the free end 29 of the outer foil 10b. The outer foil 10b and its associated interspacer are riveted as at 18b to the protective outer sheet 14b, the rivet mounting the wire terminal as at 19b, which is at the outer face of the said sheet. Similarly the inner foil 11b which protrudes beyond the end of the outer foil is connected to the companion wire terminal 19b by means of rivet 18b which extends through the two layers 14b and 27 of the protective covering, the inner foil 11b and its associated interspacer. In this embodiment, which is preferably used where the condenser is of small axial length, it is seen that the rivets are spaced peripherally rather than longitudinally of the condenser roll.

Illustratively the rivets shown in the last embodiment are hollow or of the eyelet type, which, it is understood, may be used interchangeably with the solid rivets shown in the other embodiments, and the term "rivet" as used in the claims is generic to both embodiments of fasteners.

It will thus be seen that there is herein described apparatus in which the several features of this invention are embodied, and which apparatus in its action attains the various objects of the invention and is well suited to meet the requirements of practical use.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. An electric condenser of the enrolled type, comprising a pair of electrode foils, interspacers therebetween, an outer protective insulating sheet, a pair of terminals at the exterior of said sheet, and rivets through said sheet and through the respective electrodes to bond the latter to said sheet and attach the terminals thereto, each rivet having clearance with respect to the electrode of opposite polarity.

2. An electric condenser of the enrolled type, comprising a pair of electrode foils, interspacers therebetween, an outer protective insulating sheet, a pair of terminals at the exterior of said sheet, and rivets passing through the protective sheet, the corresponding electrode and the associated interspacer and fastening the corresponding terminals in place, each rivet having clearance with respect to the electrode of opposite polarity.

3. An electric condenser of the enrolled type, comprising foil electrodes and insulating interspacers therebetween, one of said electrodes having a part extending beyond the other electrode near one end thereof, a protection external insulating sheet, a wire terminal at the exterior of said sheet and a rivet through the sheet mechanically and electrically bonding said terminal to said extending part of one of the electrodes.

4. An electric condenser of the enrolled type, including electrodes and interspacers therebetween, a portion near the end of one of said electrodes extending beyond the other electrode, an insulating protective sheet at the exterior of said roll, wire terminals at the outside of said sheet, and rivets through said sheet and through the ends of the respective electrodes at the inside, and to the wire terminals at the outside of the protective sheet, and insulating means interposed between the inner electrode and the rivet through the outer electrode.

5. An electric condenser of the enrolled type, comprising electrodes and interspacers therebetween of substantially the same length, each of said electrodes and its corresponding interspacer having a triangular part near the end thereof free from superposed relation with respect to the other, a protective paper covering at the outside of said condenser, wire terminals at the outside of said covering and rivets through the covering and through the respective electrodes at that region of the other electrode which is free from superposed relation therewith, and serving to bond the terminals to the respective electrodes.

6. An electric condenser of the enrolled type, comprising electrodes and interspacers therebetween of substantially the same length, the end of one of said electrodes being triangularly bent at one corner and of the other electrode at the opposed corner to bring the foils out of superposed relation with respect to each other at said corners, an oil paper protective sheet at the exterior of the condenser, rivets spaced across the width of said protective sheet and near one end thereof, and extending through the respective electrodes at the region where the companion electrode is folded back and wire terminals at the exterior of said protective sheet, bonded by the respective rivets both electrically and mechanically with the corresponding electrodes.

7. An electric condenser of the enrolled type, comprising electrode foils and interspacers therebetween, wire terminal for said condenser,

each of said foils having a narrow longitudinal tab, said tabs being near opposite longitudinal edges of the respective foils, a protective outer sheet, and rivets through the sheet and through the respective tabs, each of said rivets serving to fasten one of said wire terminals to the outside of the protective sheet and effecting mechanical and electrical connection thereof to the corresponding electrode.

8. An electric condenser of the enrolled type, comprising a pair of electrode foils and corresponding interspacers, the inner of said foils extending longitudinally beyond the outer one, a protective sheet at the exterior of said foils and interspacers, a rivet through the outer end of the outer of said foils and through the corresponding interspacer, a wire terminal at the outside of said protective sheet affixed by said rivet for electrical connection to the corresponding foil, and a second wire terminal attached by a corresponding rivet to the inner foil and near the outer end thereof, said rivets being spaced from each other peripherally of the condenser roll.

9. An electric condenser of the enrolled type, comprising a pair of electrode foils with corresponding interspacers therebetween, the inner of the foils and its interspacer extending somewhat beyond the outer of said foils, a varnished paper protector extending about the condenser roll, a rivet extending through the end of the outer foil, its corresponding interspacer and the protector and a wire terminal at the exterior of said protector and bonded by said rivet to said foil, said protector being reversely bent with its end interposed between said rivet and the inner foil, a rivet extending through said foil, the interspacer and the superposed plies of the protective cover, and a second wire terminal attached by said rivet to said longer foil, and exposed at the outside of said protector.

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