June 14, 1932. F. J. GIVEN 1,862,570

ELECTRICAL CONDENSER

Filed March 8, 1928

FIG. 1.

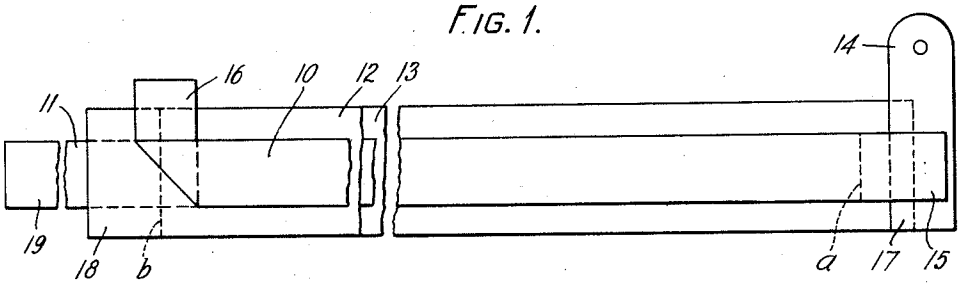


FIG. 2.

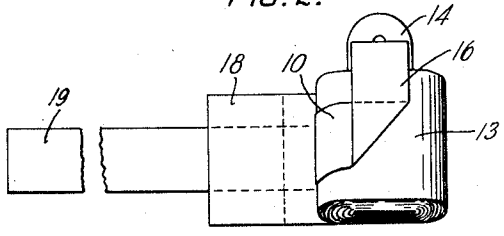


FIG. 3.

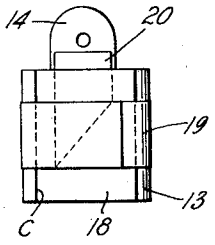


FIG. 4.

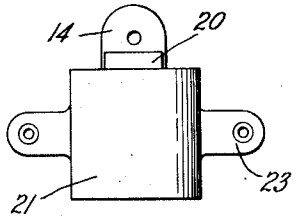


FIG. 5.

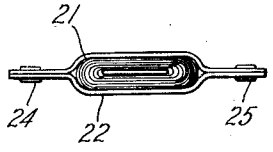


FIG. 6.

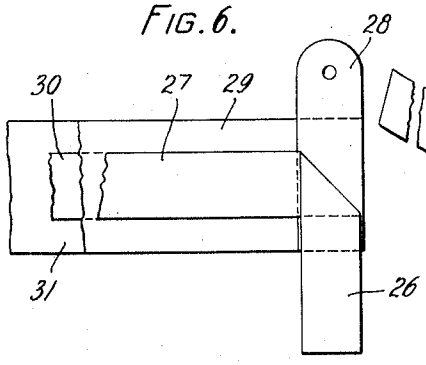
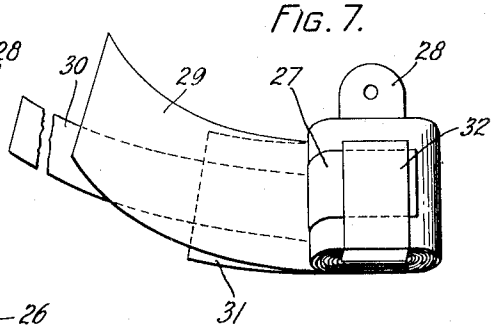


FIG. 7.



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UNITED STATES PATENT OFFICE

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ELECTRICAL CONDENSER

Application filed March 8, 1928. Serial No. 259,938.

This invention relates to electrical condensers and more particularly to such condensers of the fixed capacity type.

An object of the invention is to materially reduce conductance and inductance at high frequency in fixed capacity condensers.

In accordance with this invention the condenser comprises a paper wound unit in which two copper foil conducting strips constitute the conducting elements of the condenser. The conducting strips are wound on a central terminal with insulating paper between the adjacent turns of the conducting strips. The end of the inner strip is folded over the end of the winding of the inner strip and connected to the outer end of the strip to form a closed coil conducting element. The insulating paper is continued around the inner element and the outer conducting strip is wound around the paper and the end thereof is soldered to the adjacent turn to form the outer conducting element. A metallic casing comprising two similar portions having tabs on the edges thereof is placed in contact with the outer conducting element and the pairs of tabs on both sides of the casing are fastened together by eyelets to provide a terminal for the outer conducting element. This construction forms a relatively small inexpensive unit in which the closed coil element materially reduces the conductance and inductance of the unit when associated in a protective circuit.

A more detailed description of the invention follows and is illustrated in the accompanying drawing:

Fig. 1 shows the relative positions of the alternate layers of conducting and insulating strips with respect to the terminal core on which the strips are wound.

Fig. 2 is a perspective view of the partially wound condenser unit showing the method of connecting the outer end of the inner conducting strip to the terminal core to form a closed conducting coil.

Fig. 3 shows the completely wound condenser unit according to one embodiment of the invention.

Fig. 4 is a plan view of the protective casing surrounding the condenser unit and is provided with terminals to facilitate the mounting and connecting of the unit in an electrical circuit.

Fig. 5 is an end view of Fig. 4 showing the two-part casing which securely holds the unit by the eyelets clamping the two halves of the casing.

Fig. 6 shows a modified arrangement of the elements prior to winding them on the terminal core; and

Fig. 7 illustrates in perspective the condenser unit partially wound in accordance with the arrangement of Fig. 6 and shows the method of connecting the ends of the inner conducting strip together to form a closed coil element.

Referring to Fig. 1 of the drawing the condenser unit of this invention comprises a compact paper wound assembly in which the conducting elements are formed of copper foil strips 10 and 11 which are arranged to lie in superposed parallel planes but insulated from each other by a slightly wider strip of dielectric material 12 such as paper. A shorter strip of insulating paper 13 lies to the rear of the conducting strip 11 and is the same width as the insulating strip 12. The conducting strips 10 and 11 and the insulating strips 12 and 13 may be of any suitable length to provide the required capacity value for the assembled condenser unit. The relative positions of the conducting and insulating strips is shown in Fig. 1 in which the strips are arranged to be wound on the central core 14 which is preferably formed of sheet metal. The inner end 15 of the conducting foil strip 10 is attached to one surface of the core 14, preferably by soldering, while the outer end 16 is folded over so that the folded portion extends at right angles to the extension of the strip 10 and parallel with the metallic core 14. The free end of the metallic core is rounded and pierced to act as a terminal connection for the condenser foil element 10. The insulating strip 12 of paper is arranged below the conducting strip 10 with its inner end 17 slightly in the rear of the core 14 and its outer end 18 extending a short distance beyond the folded portion 16 of the conducting strip 10. The outer conducting

foil strip 11 lies under the insulating strip 12 with its inner end positioned at the dotted line *a* and its outer end 19 extending a considerable distance beyond the outer end 18 of the insulating strip 12. The outer insulating strip 13 lies under the conducting strip 11 with its inner end in line with the inner end 17 of insulating strip 12 and its outer end extending to the point indicated by the dotted line *b*. The built-up conducting and insulating strips arranged as above described are then rolled or folded around the core 14 simultaneously. The rolling of the condenser may be accomplished by arranging the elements as shown in Fig. 1 and winding the strips on the core by turning the core in a left-hand direction until the conducting foil strip 10 is completely wound on the core 14. The partially assembled condenser will then appear like the assembly in Fig. 2 with the folded portion 16 extending beyond the longitudinal edge of the paper roll and in alignment with the free end of the core 14. The end 18 of the insulating strip 12 is wound over the folded end 16 of the inner conducting strip and is of sufficient length to cover and insulate the folded end of conducting strip 10. The outer conducting foil 11 is then wound over the layer of insulating paper for one complete turn together with the outer insulating strip 13 which ends at the point *c* as shown in Fig. 3. The winding of the end 19 of the outer conducting strip 11 is continued around the assembly for one complete turn and soldered to the last adjacent turn of the conducting strip. The end 16 of the inner conducting foil 10 projecting beyond the edge of the paper roll is then bent at right angles along the edges of the paper strips until it engages the surface of the terminal core 14 where the free end is soldered to the core 14 as shown at 20 in Fig. 3. This termination of the outer end of the inner conducting element forms a closed coil through the metallic circuit established between the inner and outer ends of the inner conducting strip 10 by the metallic core 14 so that, in effect, the conducting strip 10 forms a short-circuited inductance having low specific resistance. The conductance and inductance between the inner and outer conducting elements is substantially reduced due to the closed coil arrangement of the inner element. This is of particular advantage when the condenser unit is employed in a protective circuit including a telephone transmitter or telephone handset in which high frequency currents are apt to produce packing in the carbon button of the transmitter. When the condenser is completely wound and the conducting elements suitably connected as above described the unit may be dipped in a sealing compound to prevent the entrance of moisture between the layers of the condenser unit. The unit may then be pressed to secure the desired value of capacity.

While the moisture-proofing compound protects the condenser unit from variations in the capacity value of the condenser this coating does not provide sufficient mechanical protection against puncture or other injury to the surface of the condenser. In accordance with this invention the paper wound unit is protected from mechanical injury by forming a light compact metallic casing around the unit as shown in Figs. 4 and 5. The casing comprises two sheet metal members 21 and 22 having their upper and lower edges in alignment with the upper and lower edges of the condenser unit and their side edges curved inwardly to engage the sides of the condenser unit. Projecting from each side edge of each half of the casing is an outwardly extending ear 23 which forms a terminal for the outer conducting element 11 of the condenser unit and a mounting means for the assembled condenser. Referring to Fig. 5 the ears 23 projecting from opposed edges of the metallic members 21 and 22 of the casing cooperate to form a supporting connection and are fastened together by the eyelet 24. The ears 23 extending from the opposite edges of both halves of the casing are similarly connected together by an eyelet 25. This arrangement forms an inexpensive compact unit which completely protects the condenser and provides a terminal connection for the outer conducting element 11 through the contact of the body of the casing with the last turn of the conducting element 11. The symmetrical arrangement of the ears on either side of the casing forms a balanced supporting means for the condenser unit in which either of the pair of ears may be employed as a terminal.

In Fig. 6 the assembly of the condenser is modified by connecting the folded end 26 of the inner conducting element 27 to the terminal core 28 so that the free end of the folded portion extends from the end of the core opposite the pierced end thereof. The layer of insulating paper 29 is arranged behind the conducting strip 27 and below this insulating layer is the outer conducting element 30 after which the insulating paper strip 31 completes the condenser pile-up. This arrangement is rolled in the same manner as described in connection with the condenser unit of Fig. 1 until the outer end of the inner conducting strip 27 is completely wound around the core 28. Then the folded end of the inner conducting strip which projects from the center of the rolled unit is bent over the edge of the paper roll and soldered to the outer end of the inner conducting strip 27 as shown at 32 in Fig. 7. The paper strip 29 and the conducting strip 30 are then wound in the same manner as described in connection with Fig.

1 and the end of the outer conducting strip 30 is attached to the last turn of the conducting strip after passing the end of the outer insulating strip 31. This construction will accomplish the same results as the condenser unit described in connection with Figs. 1, 2 and 3 in that the inner conducting element forms a closed coil and the inductance and conductance between the inner and outer elements will be considerably reduced.

Various other embodiments may be employed to accomplish the same result and it is to be understood that the invention is only to be limited within the scope of the appended claims.

What is claimed is:

1. A rolled paper condenser comprising conductive elements, and insulation therebetween, the longitudinal ends only of one of said elements being connected together.

2. A rolled paper condenser comprising conducting elements, one of said elements having its ends only in electrical contact with each other, the portions intermediate the ends being separated by insulating material, a casing surrounding said elements comprising two metallic members having tabs thereon, and eyelets in said tabs for securing said casing around said condenser elements.

3. A condenser unit comprising a central metallic core, and conductive and insulating elements applied alternately in layers on said central core, one of said conductive elements having its longitudinal ends only in contact with said core, said metallic core acting as a terminal for said conducting element attached thereto.

4. A condenser unit comprising a central core, conductive and insulating elements applied alternately in layers on said central core, one of said conductive elements having its longitudinal ends only in contact with said core, a casing comprising two symmetrical sections enclosing said unit and having oppositely disposed tabs extending laterally from each section, and eyelets securely fastening adjacent tabs together.

5. A condenser unit comprising a central terminal, an inner conducting element, an outer conducting element, adjacent layers of said elements being insulated by dielectric material, the inner and outer ends of said inner element being connected to said central terminal, and the last layer only of said outer element forming a closed coil termination.

6. An electrical condenser comprising a flat core, and a pair of metallic strips and a pair of insulating strips alternately arranged wound around said core, said insulating strips being wider than said metallic strips, one of said metallic strips being electrically connected to said core so as to form a closed electrical circuit.

7. An electrical condenser comprising a flat core, metallic and insulating strips alternately wound around said core, said insulating strips being wider than said metallic strips, the longitudinal ends of one of said metallic strips being electrically connected to said core to form a closed electrical circuit, said core serving as a circuit terminal, a casing comprising two similar punched dish-shaped members having tabs serving as means for securing the condenser in position as well as a circuit terminal, and means securing said tabs together.

8. A rolled paper condenser comprising at least two layers of metallic foil and two layers of paper alternately disposed, the widths of the paper being greater than the widths of the foil, the ends of one of the foils being connected together so as to form a closed circuit.

9. A condenser unit comprising a central core, and a plurality of continuous conducting strips wound thereon to form a plurality of superposed convolutions, adjacent convolutions of said strips being insulated by continuous dielectric material, and the ends only of one of said conductive strips being electrically connected together to form a closed coil, the ends of the remainder of the strips being separated from all portions of said one strip by said dielectric material.

10. A condenser unit comprising a central terminal, a pair of conducting elements wound thereon, said elements being insulated by a continuous paper strip, the inner and outer ends of one of said elements being electrically connected to said central terminal, the portions intermediate the ends being separated by said continuous paper strip, said other element being insulated from said first element and having a closed coil termination of one turn, and a protective casing having a terminal extension engaging said closed coil termination of said other conducting element.

In witness whereof, I hereunto subscribe my name this 7th day of March, 1928.

FREDERICK J. GIVEN.