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F. W. EDWARDS

3,286,139

TRIMMER CONDENSER

Filed Sept. 2, 1965

FIG. 1.

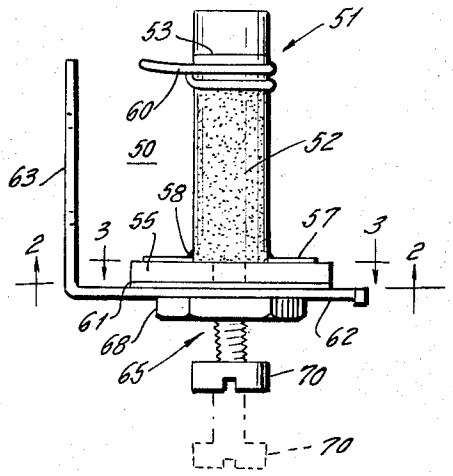



FIG. 2.

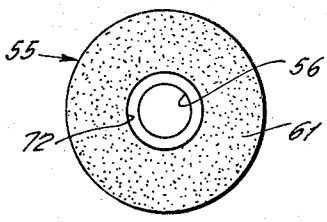



FIG. 3.

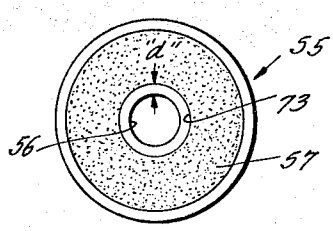
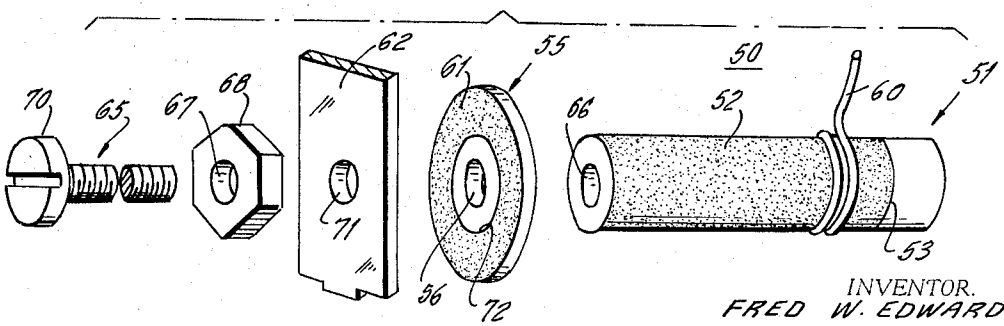



FIG. 4.




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# TRIMMER CONDENSER

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9 Claims. (Cl. 317—248)

This invention relates to trimmer condensers, and more particularly relates to novel trimmer condensers incorporating a relatively high minimum capacity setting.

In many situations requiring the utilization of a variable capacitive circuit element, it is necessary to provide controlled temperature compensation. The mechanical requirement imposed by the variable section have, however, required the utilization of materials which do not have the desired degree of temperature control, with the end result that intricate and expensive auxiliary means must be employed to maintain proper circuit performance over the experienced temperature extremes. Further, for high frequency operation, it is desirable to provide a structure having a minimum of inherent inductance. The instant invention avoids these problems in an extremely simplified manner by the provision of a condenser assembly having a fixed capacitive section to provide a minimum value, and a variable section, additive thereto. The fixed section may be constructed of a wide choice of materials, such that it is either predominant in its temperature characteristic or suitably compensates for the characteristic of the adjustable section.

In accordance with the present invention, I provide a disc of ceramic, or other suitable dielectric material, having a central opening forming a "toroidal" shape. This disc is rendered capacitative by suitable metallic coatings on its opposed faces. Such disc condenser is utilized herein to establish the minimum capacity value for the trimmer condenser. Extending from one face of such disc is a hollowed cylinder or tube of a suitable ceramic or other dielectric material. The outside surface of the cylinder is metallized to constitute a plate of the condenser. A threaded member is arranged to project within the "toroidal" disc and cylinder to afford an adjustable capacitance with the tubular metal layer. The screw, threaded to its minimum or exterior position with respect to the cylinder, leaves the stated minimum capacity due to the disc condenser of the trimmer.

The mechanical characteristics of ceramics are such that the fabrication of a threaded cylinder for use in a trimmer of this type limit the materials available to a narrow range of electric characteristics while the disc can be readily fabricated from a wide variety of materials so that this provides an adjustable condenser availability by designing in such a way that the fixed minimum condenser section is either predominant in its temperature characteristic or compensates for the characteristic of the adjustable section.

The primary object of the present invention is to provide a novel trimmer condenser of minimum inherent inductance having a fixed minimum capacitance section in conjunction with a variable capacitance section.

Another object of the present invention is to provide a novel trimmer condenser having controlled temperature characteristics.



A further object of the present invention is to provide a novel trimmer condenser composed of a disc shaped condenser section which constitutes a minimum capacitance for the trimmer, and a tubular extension condenser which constitues a variably adjustable added capacitance section.

Still another object of the present invention is to provide a trimmer condenser having a high minimum capacitance constructed relatively at low cost and having a minimum inherent inductance.

These and further objects of the present invention will become more apparent in the following description of an exemplary embodiment thereof, taken in connection with the following drawings, in which:

FIGURE 1 is an elevational view of the trimmer condenser of the present invention.

FIGURE 2 is a plan view of the condenser disc, as seen along the line 2—2 in FIGURE 1.

FIGURE 3 is a plan view of the condenser disc, as seen along the line 3—3 in FIGURE 1.

FIGURE 4 is an enlarged exploded illustration of the invention trimmer condenser.

Referring to the figures, trimmer condenser **50** comprises a cylindrical tube **51** of ceramic or other suitable dielectric material. The exterior surface of cylinder **51** is coated with a closely adhering metallic layer **52**, such as silver. The silver coating **52** extends from the bottom edge of cylinder **51** to a location **53** near its upper end. The interior of cylinder **51** is hollow to receive a metallic member which is adjustable axially along the cylinder **51** in a manner to be more fully described.

Secured with cylinder **51**, at its base, is a disc **55** of dielectric material, such as ceramic, and which constitutes the high minimum capacitance for the condenser **50**, as will be set forth. FIGURES 2 and 3 show respective opposite faces of the disc **55**, and the central opening **56** thereof. The upper face, or cylinder-side, of disc **55** contains an annular metallic coating **57** of silver. Annular layer **57** is soldered to layer **52** of cylinder **51** along soldered joint **58**. The combined metallic layers **52**, **57** constitute one plate or section of the trimmer condenser **50**. Lead **60** connects to cylindrical metallic layer **52** for external connection of condenser **50**, circuitally.

The bottom face of disc **55** is coated with annular metallic layer **61**, also preferably of silver. The layer **61** coacts capacitively with the annular layer **57** on the opposite disc face. The layer **61** is secured with bracket leg **62**, mechanically and electrically. Alternatively, layer **61** may be placed directly against the unit chassis (not shown) in which it is utilized, with such mounting being typical where layer **61** is connected to chassis ground. The indicated bracket is L-shaped, and contains extending arm **63** used to mount the condenser assembly. The bracket **62** constitutes the opposite terminal of the condenser **50** to lead **63**. As annular layer **61** is juxtaposed with bracket arm **62**, the capacitive action of the combination, in conjunction with opposite annular metallic layer **57** constitutes the minimum capacitance for the trimmer condenser **50**, as will be now understood by those skilled in the art.

While the effect of the vertically extending cylindrical layer **52** adds some minor capacitive value to the minimum for the trimmer condenser **50**, the basic minimum

capacitance is afforded by the annular layer **57** on doughnut **55** with respect to layer **61**. Such minimum capacitance is thereby provided with a minimum and negligible inherent inductance. The purpose of the cylindrical layer **52** is primarily for affording the net adjustable capacitance to which the condenser may be set, above the said minimum capacitance, as will now be set forth.

Towards this end a threaded metallic member, which is threaded screw **65**, is arranged to axially extend through the interior opening **56** of the disc **55** and into the hollow portion **66** of cylinder **5**, to variably coact capacitatively with cylindrical layer **52**. The threaded screw **65** coacts with interior threads **67** (see FIGURE 4) of the nut **68** which is secured with leg **62** of the bracket. The head **70** of screw **65** is notched for screwdriver adjustment of the trimmer capacitance. The axial position of screw member **65** within cylinder **51**, and with respect to cylindrical coating **52**, determines the additional capacitance for the condenser that is superimposed upon the stated minimum capacitance thereof. The interior position, indicated in solid lines in FIGURE 1, of screw **65** illustrates such intermediate trimmer capacitance value setting for condenser **50**.

The farthest position of adjustment screw **65** into cylinder **51** determines the maximum capacity setting for the trimmer condenser. The minimum capacity setting, which corresponds to the stated minimum capacitance for the trimmer condenser **50**, is indicated at the extended position **70** in dotted lines FIGURE 1. In such position **70**, the threaded portion of screw **65** engages with nut **68**, and is in the preferred embodiment in the minimum coaction position (almost negligible) with cylindrical coating **52**. Such representation of the minimum capacitance is determined by the condenser action basically of the silver coated doughnut disc **55** as stated hereinabove.

FIGURE 4 is an enlarged exploded view of the invention trimmer condenser **50**, affording a clearer understanding of its component sections and assembly thereof. The metallic nut **68** and annular metallic coating **61** are soldered or otherwise mechanically and electrically affixed to the metallic bracket arm **62**. An opening **71** is arranged in bracket arm **62** through which screw **65** passes. The diameter of opening **71** is preferably larger than the internal opening of disc **55** at **56**; the interior circumference **72** of annular conductive layer extends interiorly from the periphery of opening **56**; and the interior circumference **73** of the opposite annular layer **57** (see FIGURE 3) is inwardly spaced from the periphery of opening **56** of disc **55**. This serves as a clearance spacing to isolate equi-potential conductive film **57**, solder fillet **58** and conductive film **52** from voltage breakdown with opposite condenser terminal film **61** (or screw member **70**, nut **68** or bracket **63**, electrically connected thereto).

To maintain the conductive portion of disc **55** spaced safely from screw member **65** which passes therethrough, the distance between the circumference of the disc opening **56** and the inner periphery **73** of annular conductive layer **57** (as shown by "*d*" in FIGURE 3) is preferably of the order of the thickness between the walls of the cylinder **51**. In this manner, the outer cylindrical layer **52** on cylinder **51** still readily is secured electrically and mechanically with the annular layer **57** by a ring of solder **58**.

A simple practical trimmer condenser, with the stated electrical characteristics, is accordingly afforded by the invention condenser **50**. It is relatively inexpensive of component fabrication. In preferred production thereof, the cylinder **51** and disc **55** are suitably silvered with metallic coatings **52**, **57** and **61** already described. The cylinder **51** and disc **55** are assembled in the manner shown in FIGURE 1, together with bracket **62**, **63**, nut **68** and screw **65**. A preformed ring of solder, containing suitable flux, is arranged at the base of cylinder **51**, where it is contiguous with the annular silver layer **57** on disc **55**. Similarly, solder and flux are arranged for surface **61** adjacent bracket leg **62**, and for nut **68**. The thus assembled components are thereupon subjected to heating for the soldering phase of assembly. The terminal **60** may be incorporated with assembly **50**, or thereafter as desired, for the utilization of the condenser.

As stated, condenser **50** has a minimum inherent inductance value for the capacitance range for which a given condenser **50** is constructed. In a particular embodiment, wherein the disc **55** had an inner diameter of 0.130 inch, and an outer diameter of 0.360 inch, and a thickness of 0.070 inch, the nominal minimum capacitance was 10.6 picofarads. The cylinder **51** of this condenser embodiment had a diameter of 0.18 inch, and an axial length of 0.3 inch, with a capacitive range for the trimmer condenser **50** to a maximum of 13.8 picofarads. Disc section **55** may be constructed of titanium dioxide while the mechanical requirements imposed by cylindrical section **51** are more readily met by a material such as Steatite. These materials have been selected so that the temperature characteristics of disc section **55** will be either predominant or compensate for the temperature characteristic of cylindrical section **51**.

It is to be understood that specific dimensions and materials of the invention condenser will provide different minimum and maximum capacitance ranges and the above parameters are given for illustrative purposes only and are not intended as a limitation of my invention.

While the present invention has been described in connection with an exemplary embodiment, and in a particular application, it is to be understood that modifications may be made both as to its construction and application without departing from the broader spirit and scope of the invention, as set forth in the following claims.

I claim:

**1.** A trimmer condenser including a first and second terminal, a fixed capacitive section and a variable capacitive section electrically connected between said terminals, said fixed capacitive section including a disc with first and second metallic layers on opposed faces thereof, said variable section including a tubular member having an external metallic layer electrically connected to said first disc layer, said tubular layer electrically connected to said first terminal, said second disc layer electrically connected to said second terminal, means for adjusting the capacitance of said variable section such that the combined capacitance of said fixed and variable sections, as presented to said first and second terminals, is adjustable.

**2.** A trimmer condenser as set forth in claim **1**, characterized as having relatively low inherent inductance, said disc and first and second metallic layers constituting substantially the minimum capacitance value of said condenser.

**3.** A trimmer condenser as set forth in claim **1**, wherein said disc is formed of a first dielectric material, said tubular member is formed of a second dielectric material, said materials of pre-selected temperature coefficients such that the temperature characteristic of said disc predominates.

**4.** A trimmer condenser as claimed in claim **1** wherein said adjusting means comprises a metallic element adjustably positionable in said tubular member to preset an extended capacitance value for the condenser.

**5.** A trimmer condenser as claimed in claim **4**, further including means for operatively maintaining said element in its preset position.

**6.** A trimmer condenser as claimed in claim **4**, further including a bracket connected with the other of said disc layers, and means secured with said bracket for maintaining said element in its preset position.

**7.** A trimmer condenser as set forth in claim **2**, wherein said adjustment means comprises a metallic screw adjustably positionable in said tubular member and connected to said second disc layer to preset an extended capacitance value for the condenser.

8. A trimmer condenser as claimed in claim 1, in which said first disc layer is annular in shape and extends within a region gap-separated from the inner opening of the disc to minimize voltage breakdown to said second disc layer via said inner opening.

9. A trimmer condenser as claimed in claim 7, in which said one disc layer is annular in shape and extends within a region gap-separated from the inner opening of the disc to minimize voltage breakdown to said other disc layer via said inner opening.



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