March 27, 1962 R. U. CLARK 3,027,504

VARIABLE CAPACITY TRIMMER CONDENSERS

Filed Jan. 5, 1960

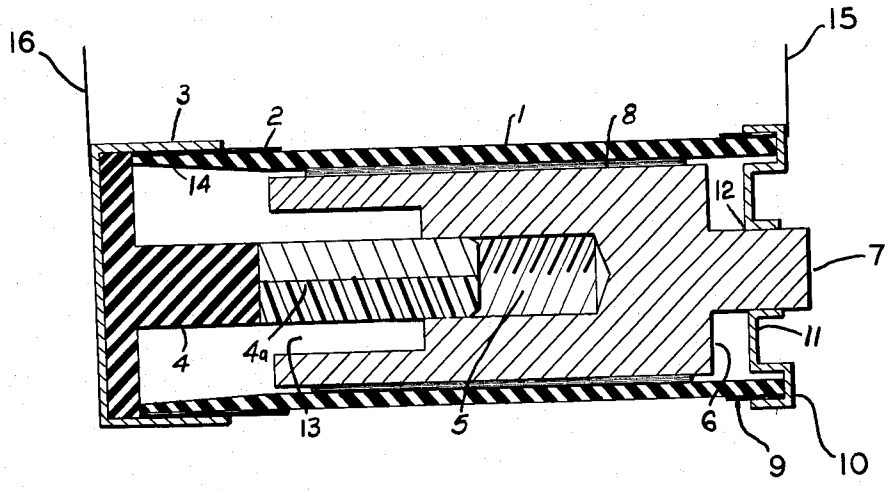


FIG. 1

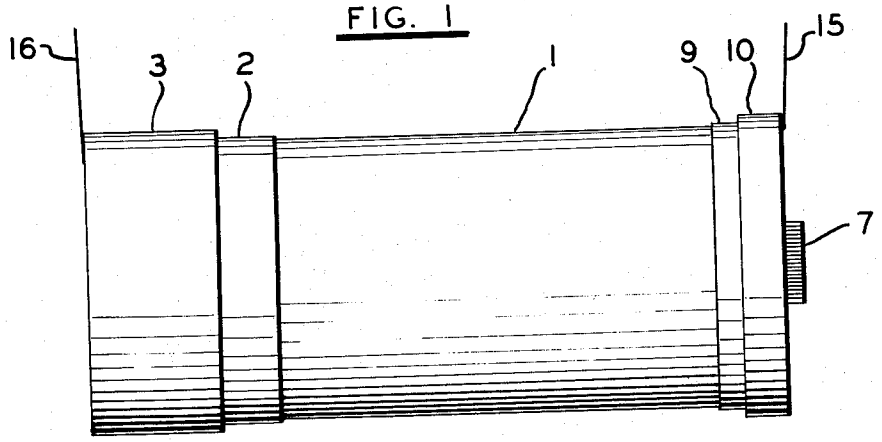


FIG. 2

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United States Patent Office 3,027,504 Patented Mar. 27, 1962

3,027,504

VARIABLE CAPACITY TRIMMER CONDENSERS

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Filed Jan. 5, 1960, Ser. No. 566
1 Claim. (Cl. 317—249)

The present invention has to do with low capacity variable condensers of the type generally referred to as "trimmer" condensers. Such condensers are generally made in the micro-micro-farad range of values of capacity and carry ratings of one to ten micro-micro-farads, one to twenty micro-micro-farads etc.

The various present types of variable condensers may be classed as the interleaving plate type, the variable pressure book type, and the telescoping tube type. The present invention falls within this last mentioned type classification.

Past designs of telescoping tube type condensers, in which the coupling between electrodes is controlled by a simple screw feed used to vary the relative engagement of the two electrode plates, have some inherent defects.

One of the requirements for a satisfactory "trimmer" condenser is that once set to a given relative engagement between plates there should be practically no change in the capacity arrived at by a given screw feed adjustment over a wide range of temperature of operation. This has been partially accomplished in the past by making the feeding screw from a material having a coefficient of thermal expansion close to zero.

The present invention overcomes the need for using a very low coefficient of expansion material for the feed screw. This a very desirable feature since such materials are expensive and are of a somewhat magnetic nature which is not a desirable characteristic.

The method of circumventing the need for low coefficient of expansion materials in the present invention is by arranging the feed screw so as to expand in opposition to the direction of major expansion of the movable electrode, into which it threads and by providing a properly proportioned overhang in the variable electrode which expands or contracts in opposition to the direction of expansion or contraction of the feed screw, thus resulting in practically no change in coupling between the variable electrode and the fixed electrode in the condenser.

It is also common practice in the telescoping type "trimmer" condenser to use a glass tube carrying the fixed plate on the outside wall at one end of the tube and to provide a round sliding slug like plate which is a good sliding fit in the tube as the movable plate. This requires some air space between the tube bore and the sliding electrode. This is not a good condition as air has a dielectric constant of only one which keeps the maximum available capacitance value quite low in small size units.

In order to overcome the above mentioned defect I coat the outside surface of my sliding electrode with "Teflon" which has a dielectric constant several times the constant of air, and also allows a relatively tight fit to be maintained between the tube bore and the slug electrode without increasing the feeding torque, due to the very low coefficient of friction of the "Teflon." This coating also helps to provide an hermetic seal between the tube and the sliding slug electrode.

Other features of my improved condenser will be apparent from the description that follows outlining the function of the parts as shown in the attached drawing.

Referring now to the drawing there is shown in FIGURE 1 a cross-sectional view of the condenser taken in a plane parallel to its longitudinal axis and in FIGURE 2 there is shown a plan view of the condenser.

In FIGURE 1 there is shown at **1** an insulating tube preferably of a low electrical loss glass or ceramic. Covering a portion of the outside surface of this tube at one end there is deposited a metal coating **2** which has soldered to it a metal cup **3**. Between this cup and the abutting end of the glass tube there is also positioned a shouldered longitudinally split feed screw of insulating material at **4**, the split being shown at **4***a*. This screw engages with a tapped hole **5** in one end of a metal slug electrode **6** which has a partially knurled hub on the other end at **7** and a coating of "Teflon" on its external wall area at **8**, shown enlarged for clarity. The partial knurl on the hub is of the same total diameter as the hub and is a single direction knurl to take a hollow tool that will allow the slug to be rotated.

At the end of the glass tube adjacent to the knurled hub on the slug there is deposited a metal coating at **9**, to which is soldered a split metal ferrule **10** which has a central annular section **11** that fits over the unknurled section of the hub at **12** and which makes a good electrical contact with **7**.

With the assembly set up as described it can be seen that by turning the knurled hub end of the slug with a suitable tool the coupling between the slug electrode and the metal end cup and metal coating will change and vary the capacity of the condenser. At **13** in FIGURE 1 is shown a counter-bored section of the tapped hole **5** which does not engage with the feed screw **4** at **13**. The length of this bore is developed mathematically for a given size of condenser so as to provide a nearly complete counter movement to that due to thermal expansion of the feed screw which changes in operating temperature with the condenser. This I have I have discovered can best be calculated at mid-point capacity set and is a function of screw length and counter-bore depth. A further correction for constant capacity with temperature is had by tapering the tube bore to give more clearance at the capped end of the insulating tube. This provides a vernier control of the compensating arrangement of opposed electrode and feed screw expansion. This slight taper is shown at **14** FIGURE 1. Contact to the sliding slug electrode is made through the ferrule **10** at section **11** to hub **12**. Contact lead wires are soldered or attached to the ferrule **10** at **15** and the metal cup **3** at **16**. In plan view FIGURE 2 leads **15** and **16** also show.

Having described my improved condenser, I claim:

In combination in a variable trimmer condenser, a tubular dielectric member having an externally located cylindrical metal coating overlying one end of the peripheral surface of the tubular dielectric member, a second cylindrical metal coating overlying the opposite end of the said tubular dielectric member, a hubbed metal ferrule member having a through-bore, said ferrule member mounted in direct electrical contact with the said last mentioned metal coated area, a cylindrical metal electrode located within said dielectric tube, and of suitable diameter to give a sliding fit therein, said electrode having a reduced diameter portion at one end extending in sliding engagement with the said hubbed ferrule through-bore, and a counter-bore at the other end with a threaded axial bore opening into said counter-bore, a non-conducting feed screw member having a threaded shank and a flanged end, said threaded shank engaging said threaded axial bore, a metal cup like cap engaging the first mentioned metal coated area on said tubular dielectric member, said cup like cap holding said flanged end of said feed screw member against the end of said tubular dielectric member, an outwardly expanding internal taper within the first mentioned coated end of the tubular dielectric member, said taper and said electrode's counter-bore having parameters such that they combine to off-set any capacity

change due to temperature change in said trimmer condenser by means of pre-adjusted double directional axial displacement compensation in the electrode member, in the area between the point of first contact of the feed screw with the first thread in the counter-bored end of the electrode and its counter-bore exit.

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