May 27, 1952 E. M. OSTLUND 2,597,897

CAPACITIVE COUPLING ASSEMBLY

Filed May 23, 1945

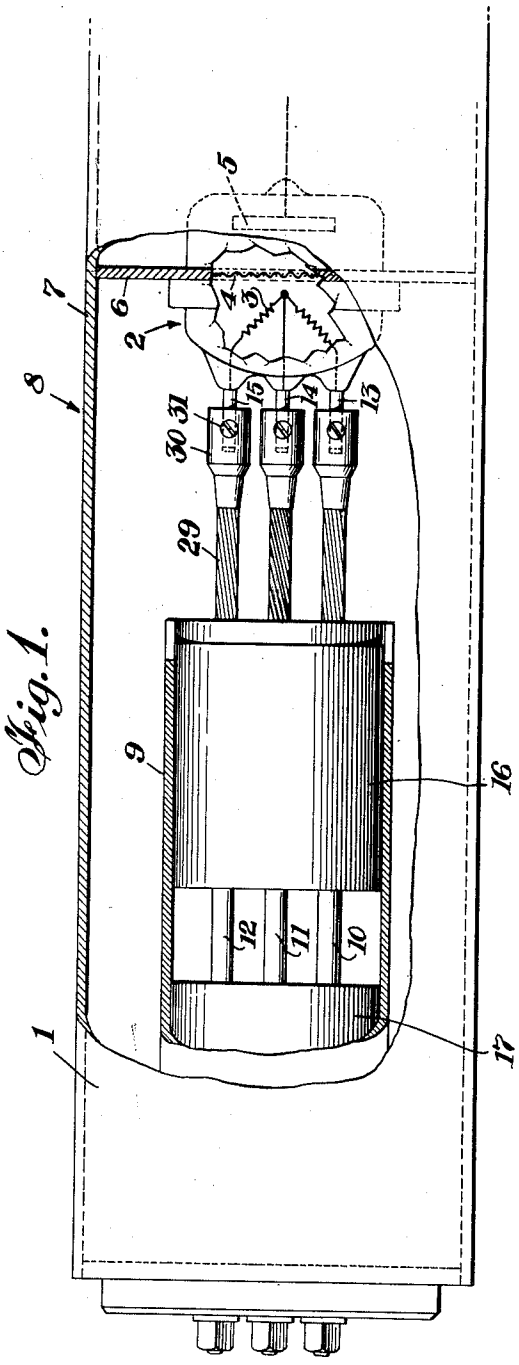


Fig. 1.

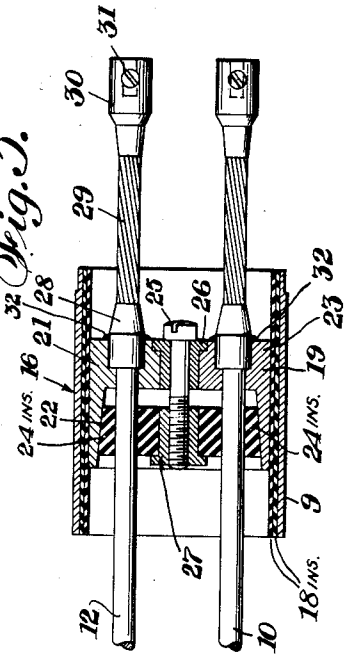


Fig. 3.

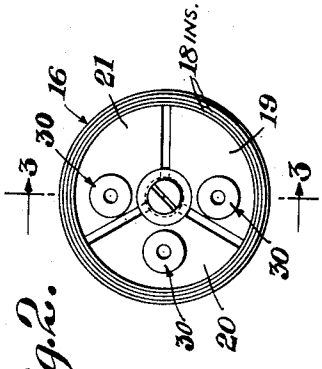


Fig. 2.

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Patented May 27, 1952

2,597,897

UNITED STATES PATENT OFFICE

2,597,897

CAPACITIVE COUPLING ASSEMBLY

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Application May 23, 1945, Serial No. 595,300

9 Claims. (Cl. 315—39)

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The present invention relates to a capacitive coupling assembly, and particularly to one adapted to serve as a by-pass condenser between a hollow conductor and one or more transmission lines extending within said conductor.

In certain applications where one or more conductors extend within a hollow conductor, it is desired to capacitively couple the inner conductors to the hollow conductor. A typical example of such application is found in certain coaxial line oscillators in which transmission lines apply direct current voltages from a power pack to the cathode terminals of the vacuum tube in said oscillators, while a hollow conductor, surrounding said transmission lines and forming the inner conductor of a coaxial line, is required to carry the radio frequency voltages appearing at said cathode terminals. To keep the radio frequency voltages out of the power supply and in the coaxial line, a by-pass condenser arrangement, or capacitive coupling assembly, is provided adjacent the cathode terminal capacitively coupling each of the transmission lines which are connected with the cathode terminal to the hollow conductor. A similar by-pass condenser arrangement is provided towards the opposite end of the hollow conductor so that the hollow conductor is capacitively short-circuited at both ends to the transmission lines to thereby prevent the hollow conductor from forming resonant sections with the transmission lines and thus preventing any externally originated radio frequency current from entering the coaxial line through such means.

An object of the present invention is the provision of an improved capacitive coupling assembly.

One of the features of the assembly embodying my invention is that the dielectric of the by-pass condenser between the transmission lines and the hollow conductor surrounding said lines is continuous and is not perforated for mounting purposes. Another advantage of the assembly embodying my invention is that the leakage paths around the edges are long. A feature of this assembly is that it may be readily mounted within the hollow conductor, and likewise readily removed. Another important feature of the assembly embodying my invention is the shortness of the radio frequency paths between the hollow conductor and the inner conductors to which it is capacitively coupled by said assembly. The short radio frequency paths provided by this assembly have low inductive reactance.

Other and further objects, advantages and features of the present invention will become apparent and the invention will be best understood from the following description of an embodiment thereof, reference being had to the drawing, in which:

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Fig. 1 is an elevational view, partly broken away, of a coaxial line oscillator including an embodiment of the capacitive coupling assembly of my invention;

Fig. 2 is an end view of the assembly illustrated in Fig. 2; and

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2.

Referring now to the drawings and particularly to Fig. 1, the numeral 1 generally designates a coaxial line oscillator including an electron discharge device 2 having a cathode 3, grid 4 and anode 5. The grid 3 is coupled by means of a disc 6 to the outer cylindrical conductor 7 of a coaxial line 8 whose inner cylindrical conductor 9 is hollow. Within the hollow inner conductor 9, a plurality of linear conductors 10, 11 and 12 extend, and they are connected to the terminals 13, 14 and 15 of the cathode 3 of the electron discharge device 2. These linear conductors 10—12 supply the direct current potentials from a suitable source of power supply to said cathode. These direct current leads carry heating current for heating the cathode, and the negative side of the B power supply. In order to keep the radio frequency current at the cathode terminals in the coaxial line 8 and to prevent it from entering the power supply, I provide a capacitive coupling assembly 16 or by-pass condenser arrangement, which serves to by-pass the radio frequency energy to the hollow inner conductor 9. A similar capacitive coupling assembly 17 is also provided, assemblies 16 and 17 being arranged within the hollow inner conductor 9 towards opposite ends thereof, assembly 16 being adjacent the cathode terminals and assembly 17 being adjacent the outer end of the coaxial line 8.

In Figs. 2 and 3 the details of assembly 16 are illustrated. Since assembly 17 is similar in construction the details thereof will be omitted. The assembly 16 includes a sheet 18 of dielectric material which is loosely wound around the inner surface of the hollow inner conductor 9. Abutting the inner surface of the wrapped sheet 18 of dielectric material are three conducting segments 19, 20 and 21 in the form of sectors of a circle, each of said segments being separated or otherwise effectively insulated from the others and the segments are symmetrically disposed around the central longitudinal axis of the hol-

low cylindrical conductor 9. Each of said segments 19—21 has a tapering portion 22 extending longitudinally from the main portion 23 thereof. The segments 19—21 are spread apart and maintained in fixed position within the hollow inner conductor 9 by means of a tapered insulator 24 which slides within the tapered portions 22 of said segments and forces them outwardly. A screw 25, arranged in a central flanged collar 26 of insulating material between said segments and threadably engaging a flanged sleeve 27, extending through insulator 24 moves said insulator axially as said screw 25 is tightened thus bringing thicker portions of said insulator between the tapered portions 22 spreading said portions and the segments of which they are part, and forcing said segments against the dielectric material 18 which in turn is forced against the inner surface of the hollow inner conductor 9, thereby fixing the assembly in place within said hollow conductor.

The linear conductors 10, 11 and 12 pass through openings in the segments 19, 20 and 21 respectively and are electrically connected thereto. While said linear conductors may be simply connected to their respective segments, for example by soldering 32, in assembly 16 other means are provided to enable these linear conductors to be conveniently connected with the terminals 13—15 of the cathode of electron discharge device 2. For this purpose, a connector 28 is slipped over the end of each of the linear conductors 10, 11 and 12 and connected therewith, for example by pinching and soldering. Connectors 28 are soldered to their segments. A flexible cable 29 connects each connector 28 to a connector 30 of the type having an opening therein for the reception of one of the terminals 13—15 and having a screw 31 adapted to be turned to secure said terminal within the connector 30. By this arrangement, the entire assembly 16, including also the hollow inner conductor 9, may be inserted in the coaxial line structure 1 and connected to the cathode terminals by connectors 30.

In assembly 17, the linear conductors 10, 11 and 12 may be connected to the conductive segments thereof in any convenient manner as simply by soldering them within said segments.

It is preferred that the sheet 18 be substantially wider than the length of the segment as measured longitudinally in relation to the hollow inner conductor. Thus long leakage paths around the edges of the dielectric are provided.

While I have described the details of one embodiment of my invention, it will be apparent to those versed in the art that numerous changes may be made in these details without departing from the teachings thereof. For example, the dielectric might be applied in liquid form to the inner surface of the hollow inner conductor. Other changes such as in the means for connecting the linear conductors to the segments will occur to those versed in the art. Furthermore it will be apparent that the number of segments may be changed depending upon the number of conductors which are to be coupled to the hollow inner conductor. Accordingly, while I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of my invention as defined in the accompanying claims.

I claim:

1. A capacitive coupling assembly for coupling one or more linear conductors, extending within a hollow conductor, to said hollow conductor, comprising one or more segmental conductive elements, one connected to each linear conductor, mounted within the hollow conductor about its axis, a dielectric member between said elements and the inner surface of the hollow conductor, and wedging means for radially expanding said segmental elements against the dielectric member to press the latter against the opposed inner surface of the hollow conductor.

2. A capacitive coupling assembly for coupling one or more linear conductors, extending within a hollow conductor, to said hollow conductor, comprising a supporting member within said hollow conductor, conductive segments mounted on the support and each connected to one of said linear conductors, a dielectric member between said segments and the inner surface of said hollow conductor and wedging means between the support and said segments to spread the segments and press the dielectric against said inner surface.

3. A capacitive coupling assembly for coupling one or more linear conductors extending within a hollow elongated conductor to said conductor comprising an insulator within said hollow conductor having a tapered portion extending longitudinally with respect to the hollow conductor, conductive segments mounted around and abutting said tapered portion and extending transversely of the hollow conductor towards the inner surface thereof, each of said segments being connected to one of said linear conductors, a dielectric member between said segments and the inner surface of said hollow conductor, and wedging means for moving the insulator to advance thicker parts of the tapered portion thereof between said segments to spread the segments and press the dielectric against said inner surface.

4. A capacitive coupling assembly for coupling one or more linear conductors extending within a hollow elongated cylindrical conductor to said hollow conductor comprising an insulator arranged centrally within said hollow conductor and having a portion thereof tapering axially, conductive members in the form of sectors arranged around and abutting said tapered portion and extending radially of the central axis of the hollow conductor towards the inner surface thereof, each of said sectors being connected to one of said linear conductors, a dielectric member between said sectors and the inner surface of said hollow conductor, and means for moving the insulator axially to advance thicker parts of the tapered portion thereof between said sectors to spread the sectors and press the dielectric against said inner surface.

5. A capacitive coupling assembly according to claim 3 wherein each of said segments is spaced, and thereby insulated, from each other.

6. A capacitive coupling assembly according to claim 1 wherein said dielectric member consists of a continuous sheet of dielectric material loosely inserted in said hollow conductor contiguous to the inner surface thereof.

7. A capacitive coupling assembly according to claim 1 wherein said conductive segments have openings therein through which said linear conductors extend.

8. In a coaxial line device including an electron discharge device having a plurality of electrodes; the combination comprising a hollow inner conductor of said line connected to one of said electrodes, a linear conductor connected to said electrode and extending within said hollow

inner conductor, a dielectric member covering a portion of the inner surface of said hollow conductor, a segmental conductive element connected to said linear conductor within the hollow conductor and adjacent said dielectric member, and wedging means for expanding said element against said dielectric member.

9. In a coaxial line device including an electron discharge device having an anode, cathode and grid, a coaxial line including an outer conductor coupled to the grid, and a hollow inner conductor the combination comprising, a plurality of linear conductors connected to the cathode terminals and extending within said hollow inner conductor, and means for capacitively coupling said linear conductors to said hollow conductor adjacent the cathode comprising an insulator within said hollow inner conductor having a longitudinally-extending tapered portion, conductive segments mounted around and abutting said tapered portion and extending radially of the central axis of the hollow conductor toward the inner surface thereof, each of said segments being connected to one of said linear conductors and having an opening therein through which said linear conductors extend, a dielectric member between said segments and the inner surface of said hollow conductor, and wedging means for moving the insulator to advance thicker parts of the tapered portion thereof between said segments to spread the segments and press the dielectric against said inner surface, thereby fixing the assembly within said hollow conductor.

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