July 17, 1951 V. J. COOPER 2,560,685

VARIABLE INDUCTANCE FOR USE ON VERY HIGH FREQUENCIES

Filed Nov. 12, 1947

Fig. 1

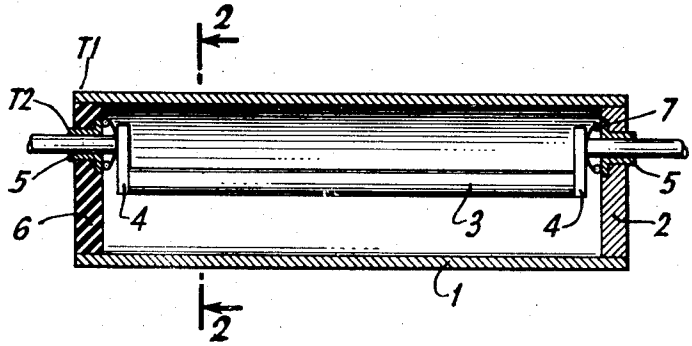


Fig. 2

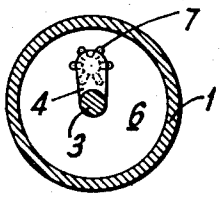


Fig. 4

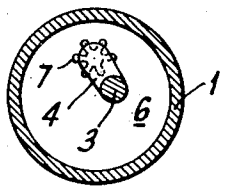
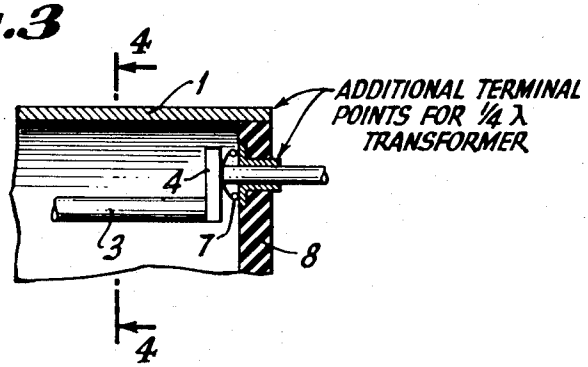


Fig. 3



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Patented July 17, 1951

2,560,685

UNITED STATES PATENT OFFICE

2,560,685

VARIABLE INDUCTANCE FOR USE ON VERY HIGH FREQUENCIES

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Application November 12, 1947, Serial No. 785,247
In Great Britain October 24, 1946

4 Claims. (Cl. 171—242)

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This invention relates to variable inductance, variable impedance transforming and like devices, for use on radio and other very high frequencies, and has for its object to provide improved devices of good adjustment range, high efficiency and great mechanical simplicity. Though not limited thereto the invention is particularly suitable for use in connection with single tube radio and other very high frequency stages.

According to this invention a variable inductance, variable impedance transforming or like device comprises two longitudinal conductors extending parallel to one another and one within the other, said conductors being arranged for relative movement about an axis which is eccentric to the axes of both conductors and is parallel to the direction of conductor extension.

Preferably the distance between the axis of relative rotation and the axis of each conductor is the same, so that in one position of adjustment the inner conductor is concentric with the outer conductor. Preferably both inner and outer conductors are in the form of tubes of circular section.

In a preferred variable inductance device, in accordance with this invention, the two conductors are effectively connected together at one end by low impedance means (e. g., direct, or through a suitable capacity), the terminals of the device being at or near the other ends. In a preferred variable impedance transforming device, in accordance with the invention, the terminals are at each end, and the two conductors are insulated from one another at each end, and the electrical length is made equal to one quarter (or an odd multiple of one quarter) of a wavelength, so that the device acts as a quarter wavelength transmission line of variable characteristic impedance.

The invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a diagrammatic sectional elevation of one embodiment;

Fig. 2 is an end section on the line 2—2 of Fig. 1; and

Figs. 3 and 4 are mutually perpendicular views of part of a modification.

Referring to Figs. 1 and 2 (which show one form of variable inductance device in accordance with the invention), there is provided a straight outer conductor 1 in the form of a tubular conductive member shown here as a tube of circular section closed at one end by a conductive disc or conducting end plate 2 in good electrical contact with said tube. An inner conductor 3, also in the form of a conductive rod or conductive tube

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of circular section but of considerably smaller diameter, is mounted within the outer conductor by means of cranks 4, and equivalent rotatable bearings 5 provided one in the end plate 2 at a predetermined point away from the center thereof and the other in a corresponding position in an insulating disc or end plate 6 at the other end of the device. Spring or other contact means 7 are provided for ensuring good electrical connection between the crank at one end, and the adjacent end plate 2, so that the inner and outer conductors are electrically in good connection with one another, and also between the crank at the other end and the bearing 5 (which is of metal) at that end.

The distances between the axis of rotation of the crank (i e., the center line of the bearing 5) and the axis of the inner conductor is the same as that between said axis of rotation and the outer conductor axis, so that in one position of adjustment the inner conductor is concentrically within the outer conductor. Terminals (not shown) are provided at T_1, T_2, i. e., effectively at the conductor ends remote from the conducting end plate 2.

In practice, by varying the relative position of the conductors as permitted by the rotatable crank, a device as illustrated may easily be constructed to allow for a range of characteristic impedance variation of about 2 to 1, and a corresponding range of inductance variation.

Where a variable impedance transforming device is required, an arrangement as illustrated in Figs. 1 and 2 may be modified as shown in Figs. 3 and 4 by replacing the metal end plate 2 with a second insulating end plate 8, at the same time making the overall length one-quarter of a wavelength or an odd multiple thereof. Such an arrangement will behave as a quarter wave transmission line of variable characteristic impedance, and may be used to effect impedance transformation in accordance with well-known principles.

What is claimed is:

1. A variable inductance device comprising a tubular conductive member, a conductive disc closing one end of said tubular conductive member, an insulating disc closing the other end of said tubular conductive member, said discs having eccentrically located apertures therein and arranged in registry, a conductive crank member in each of said apertures, and a conductive rod positioned within said tubular conductive member and arranged on said crank members for relative movement of said rod with respect to said conductive tubular member, the ends of said tubular conductive member and said conductive rod

adjacent said insulating disc serving as the terminals of said device.

2. A variable inductance device comprising a tubular conductive member, a conductive disc closing one end of said tubular conductive member, an insulating disc closing the other end of said tubular conductive member, said discs having eccentrically located apertures therein and arranged in registry, a conductive crank member in each of said apertures, and a conductive rod positioned within said tubular conductive member and arranged on said crank members for relative movement between said rod and said conductive tubular member, the crank member arranged in said insulating disc serving as one terminal of said device and the end of said tubular conductive member adjacent said insulating disc serving as the other terminal.

3. A variable inductance device comprising a tubular conductive member, a conductive disc closing one end of said tubular conductive member, an insulating disc closing the other end of said tubular conductive member, said discs having eccentrically located apertures therein, and arranged in registry, a bearing member in each of said apertures, a conductive crank member in each of said bearing members and a conductive rod positioned within said tubular conductive member and arranged on said crank members for relative movement of said rod with respect to said conductive tubular member, the bearing member arranged in said insulating disc serving as one terminal of said device and the end of said tubular conductive member adjacent said insulating disc serving as the other terminal.

4. A variable inductance device comprising a tubular conductive member, a conductive disc closing one end of said tubular conductive member, an insulating disc closing the other end of

said tubular conductive member, said discs having eccentrically located apertures therein and arranged in registry, a bearing member in each of said apertures, a conductive crank member in each of said bearing members and a conductive rod positioned within said tubular conductive member and arranged on said crank members for relative movement of said rod with respect to said conductive tubular member, said crank members having dimensions equal to the degree of eccentricity between said apertures and the centers of said discs whereby said conductive rod is concentrically located within said tubular member at one position of said movement, a resilient member arranged on each of said crank members to make contact between said conductive rod and said bearing members, the bearing member arranged in said insulating disc serving as one terminal of said device and the end of said tubular conductive member adjacent said insulating disc serving as the other terminal.

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