May 1, 1951 S. WALD 2,550,891

BIFILAR INDUCTOR

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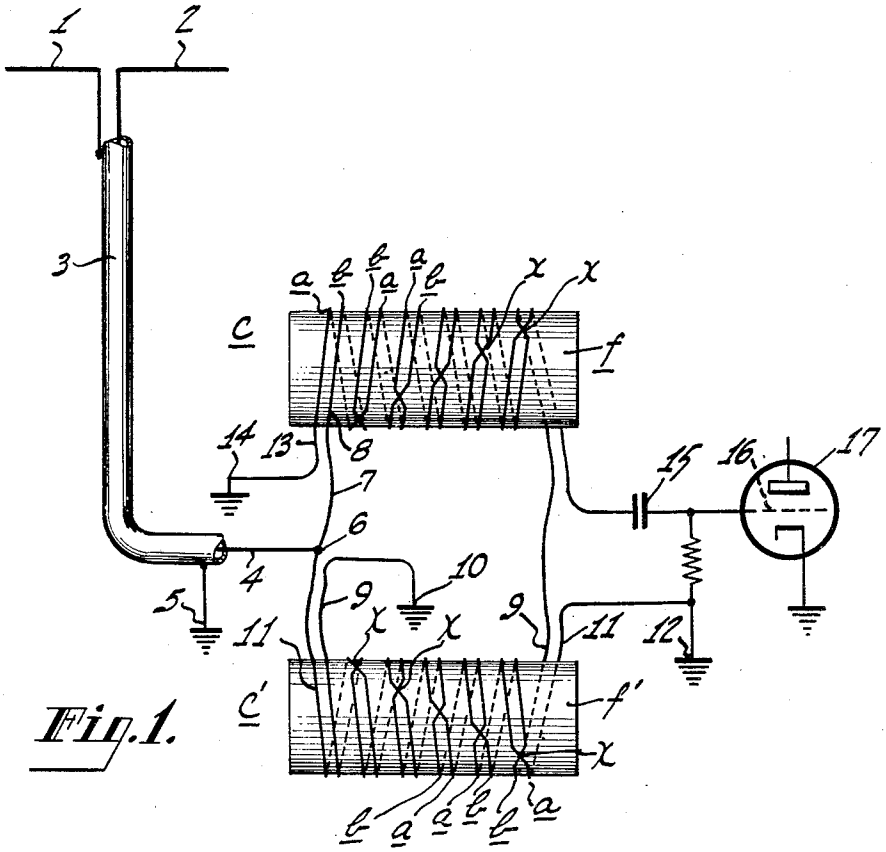


Fig. 1.

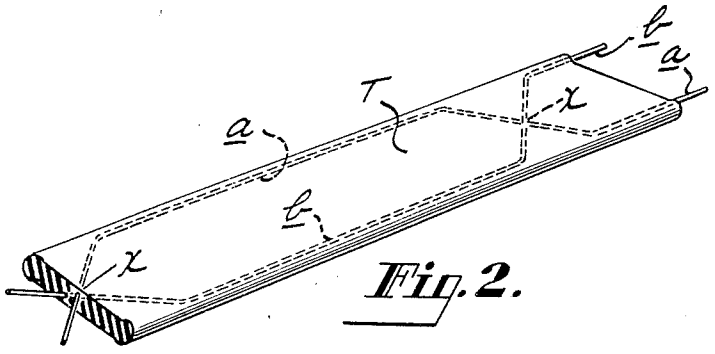


Fig. 2.

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BIFILAR INDUCTOR

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5 Claims. (Cl. 175—359)

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This invention relates to inductance apparatus for connecting electrical circuits, particularly to improvements in bifilar coils for impedance matching in radio-frequency circuits and will be described as embodied in a single-layer, bifilar coil suitable for matching television and other high-frequency circuits of unequal impedances.

In electrical signaling installations wherein the impedances of the individual circuits are unequal, it is usual to employ an impedance-matching transformer, or the like, between the circuits in order to obviate reflection and other losses incident to the mismatch. If the circuits involved are designed to handle low frequencies, the matching device may comprise a transformer having a suitable turns ratio, but in matching high frequency circuits, electrical leakage may dictate the use of auxiliary capacitors which, usually, must be of the expensive variable type, to permit changes in the working frequency. However, it is known (see The Engineers' Digest, vol. 3, No. 2, February 1946, pp. 86–87) that a coupling device comprising a bifilar coil (which heretofore has taken the form of two superposed windings separated by an insulating tube) dispenses with the necessity of re-tuning such high frequency circuits and hence eliminates the necessity for auxiliary tuners. In television installations it is desirable that the particular bifilar coil employed in making the match possess a very low order of distributed capacitance in order to render it capable of handling the very high frequencies and broad frequency spectrums employed in television.

Accordingly, it is an object of the present invention to provide a bifilar coil suitable for use in television and other high frequency systems for the communication of intelligence.

Another and related object of the present invention is to provide an improved bifilar coil and one possessing a very low value of capacitance per unit of length.

Considered from one aspect, the foregoing and related objects are achieved in accordance with the invention by the provision of a bifilar coil wherein the two parallel wires are transposed once per turn, progressively, in such a way that no turn of either wire is in direct capacitive relationship with two turns of the other wire.

The invention is illustrated in the accompanying drawing, wherein:

Fig. 1 is a partly diagrammatic drawing of a television input circuit incorporating a pair C, C' of bifilar coils constructed in accordance with the

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principle of the invention to exhibit a very low value of self-capacitance, and

Fig. 2 is a plan view of a tape-like insulator within which the crossed wires of the bifilar coils of the invention are embedded.

In the drawing, 1 and 2 designate the separate arms of a dipole antenna, and 3 and 4 designate the outer and inner conductors of a concentric transmission line to which the arms of the dipole are respectively connected. The outer conductor 3 of the line 3—4 is grounded, as indicated at 5, and the inner conductor 4 is connected at a junction point 6 to a conductive lead 7 which connects one end of the primary winding 8 of the bifilar coil C to the corresponding winding 9 of the bifilar coil C'. The other end of the primary winding 9 is grounded at 10, and the first mentioned end of the primary winding 8 is connected in series with the secondary winding 11 of the coil C', which is grounded at 12. The secondary 13 of the bifilar coil C is grounded at one end, as shown at 14, and is connected through a blocking capacitor 15 to the signal grid 16 of a radio frequency amplifier 17.

The bifilar coils C, C' are shown wound on separate coil forms *f*, *f'* constituted of a low-loss insulating material, such as polystyrene. The two parallel wires *a* and *b* of each bifilar coil are wound in a single layer helix about and along the axis of the coil form and are transposed, on the surface of the form, at least once per turn with respect to their relative position along said axis. The wires *a* and *b* are of course insulated from each other at the points *x* at which they cross each other. The insulation may comprise an enamel or other suitable coating on the separate wires or, as shown in Fig. 2, it may comprise a flexible tape-like piece of insulating material T within which the wires *a* and *b* are embedded prior to being wrapped on the surface of the coil form.

In order to achieve the lowest practical distributed capacitance (and consequent minimum resistance to high frequency currents) the points *x* at which the wires *a* and *b* are transposed are progressively off-set from each other around the axis of the coil form (instead of falling on a line parallel to said axis).

As previously indicated, the transposed bifilar coils of the present invention are especially useful in impedance matching circuits of the general character above described. This is so because with variations in capacitance eliminated or greatly reduced, and the effects of inductance variations eliminated, by virtue of the inherent

nature of bifilar windings, the impedance presented by the device of the present invention is maintained substantially constant over a broad frequency range.

What is claimed is:

1. A bifilar coil comprising a pair of conductors wound in a single layer helix having a plurality of turns about and along a common axis with said conductors transposed at least once per turn with respect to their relative position along said axis.

2. A bifilar coil in accordance with claim 1 and wherein said transposed conductors are disposed in equally spaced parallel relation substantially throughout the length of said coil.

3. A bifilar coil in accordance with claim 2 and wherein said spaced apart, transposed, parallel conductors are embedded in a tape-like member constituted of insulating material.

4. A bifilar coil comprising a pair of conductors wound in spaced apart substantially parallel relation along and about a common axis in a single layer helix having a plurality of turns,

each turn of one conductor of said pair being disposed adjacent to another turn of said conductor, and each turn of the other conductor of said pair being disposed adjacent to another turn of said other conductor.

5. A bifilar coil in accordance with claim 4 and wherein said pair of conductors are disposed on the outer surface of a coil form constituted of a low loss insulating material.

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