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F. W. SCHMIDT, JR

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HIGH-FREQUENCY TRANSFORMER AND CIRCUIT

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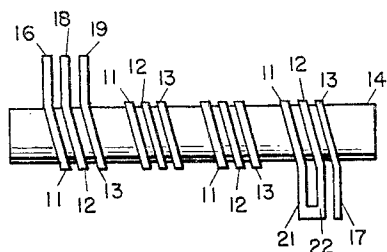


Fig. 1

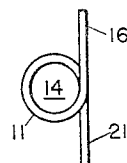


Fig. 2

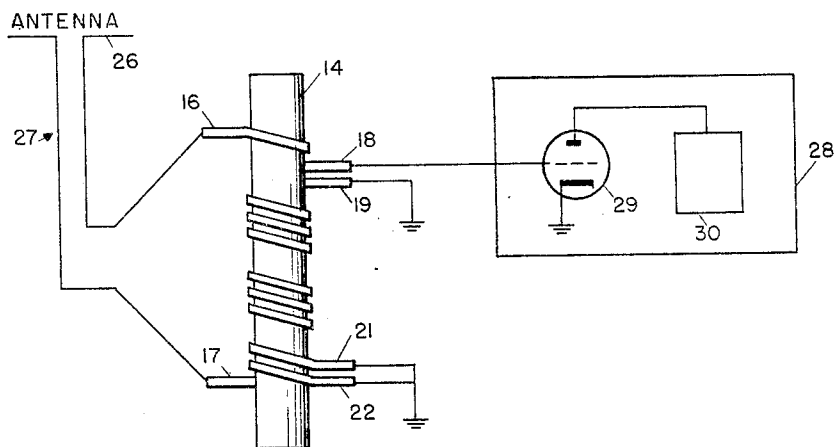


Fig. 3

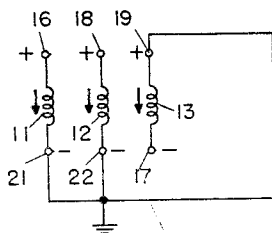


Fig. 4

INVENTOR.
FRED W. SCHMIDT JR.
BY *Daily & Daily*
ATTORNEYS

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HIGH-FREQUENCY TRANSFORMER AND CIRCUIT

Fred W. Schmidt, Jr., Whittier, Calif., assignor to Allen B. Du Mont Laboratories, Inc., Clifton, N. J., a corporation of Delaware

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5 Claims. (Cl. 250—20)

This invention relates to transformers for alternating electrical energy and more particularly to such transformers as are useful for the higher frequencies such as in television. The transformer is particularly applicable for connecting an antenna to the input circuit of a television receiver.

It is among the objects of the invention to provide a high frequency transformer which is efficient and which provides impedance matching over a wide range of frequencies.

Another object is to provide a transformer having a balanced input.

Other objects will be apparent to those skilled in the art.

Figure 1 is a side elevational view of a transformer constructed according to the invention, showing the windings positioned on a core.

Figure 2 is a view of an end of Figure 1.

Figure 3 is a partial schematic diagram, showing the transformer as connected in a television receiver circuit.

Figure 4 is a schematic diagram illustrating electrical operation of the novel transformer.

In Figure 1, three windings 11, 12, 13 are interwound on a magnetic core 14 which is preferably made from powdered ferrous material. The windings 11, 12, 13 are preferably of a good electrically conductive material, such as copper or silver, which may be shaped in a flat strip-like manner having a rectangular cross-section. However, round wire may be used if desired.

One winding 11 is wound in a helical manner on the core 14. A second winding 12 is wound on the core between the turns of the first winding 11. A third winding 13 is wound on the core between the turns of the second winding 12 and first winding 11.

In the preferred circuit shown in Figure 3, the desired impedance ratio of the transformer is 4 to 1. More specifically, the desired input impedance is 300 ohms and the desired output impedance is 75 ohms. The transformer may be wound and connected as shown, with three windings of number 24 wire, each having four turns or laps on a core one inch in length and $\frac{3}{16}$ " in diameter, the core being of powdered iron procurable on the market under the name Stackpole G-5. The windings are closely adjacent in each turn or lap while the spacing between laps is approximately the diameter of one wire. An end 1 of the first winding and a correspondingly opposite end 17 of the third winding will represent 300 ohm impedance thereacross, and the end 18 of the second winding 12 will have an impedance of 75 ohms with respect to the end 19 of the third winding and ends 21 and 22 of the first and second windings.

Figure 3 shows an antenna 26 connected by means of a 300 ohm transmission line 27 to the 300 ohm input terminals 16 and 17 of the transformer. Terminals 19, 21, and 22 are connected to ground or to the equivalent point of television receiver circuits 28. The 75 ohm output terminal 18 of the transformer is connected to an input electrode of an electronic tube 29 in the television

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receiver 28. Although the input electrode is shown as being a control grid of the tube 29 it may in some certain cases be desirable to employ, instead, the cathode of the tube 29 as an input electrode. Also, while the 75 ohm output terminal 18 of the transformer is shown to be directly connected to the input electrode of the tube 29, it is possible to insert various tuned circuits, filters, or traps between the output terminal 18 of the transformer and the input electrode of the tube 29. The input impedance of the tube 29 is partly determined by the characteristics of a load impedance 30 connected to an output electrode thereof.

The transformer functions to couple or electrically connect the balanced output of the transmission line 27 to the unbalanced input of the television receiver 28. The transformer provides impedance matching between the antenna and the receiver, and provides a balanced push-pull input impedance coupling, over the wide range of frequencies used for television.

Referring to the schematic diagram of Figure 4, a push-pull input signal is connected between the terminals 16 and 17. At a particular instant, the polarity is temporarily such that the terminal 16 is positive and the terminal 17 is negative. Because of the arrangement of the windings and connections thereto, the windings 11 and 13 will have signal currents flowing therein in a same direction, as is indicated by the arrows in the drawing. The winding 12, being centrally positioned between the windings 11 and 13, has signals induced therein, by the windings 11 and 13, which are equal and in phase, and which add together to produce single combined output signal at the terminals 18 and 22. The relative polarities of the input and output terminals will reverse during every half-cycle of the alternating input signal.

As pointed out previously, the adjacent turns of the windings 11 and 13 should be spaced relatively farther apart than the spacings between adjacent turns of the windings 11 and 12, and of windings 12 and 13, as is shown in Fig. 1.

While a preferred embodiment of the invention has been shown and described, other embodiments and deviations therefrom will be apparent to those skilled in the art. The true scope of the invention is defined by the following claims.

What is claimed is:

1. In electrical coupling apparatus, a transformer comprising a core, three windings interwound on the surface of said core, a first terminal connected to a first end of a first of said windings, a second terminal connected to a first end of a second of said windings, a third terminal connected to a second end of a third of said windings, and a fourth terminal connected in common to a first end of said third winding and to the second ends of said first and second windings, said first ends of said windings being at the same physical end of said core, and said second ends of said windings being at the remaining physical end of said core.

2. The apparatus of claim 1 in which the spacing between successive laps of said three windings is greater than the spacing between the windings in any one lap around said core.

3. Apparatus for connecting an antenna to input electrodes of an electronic tube, said apparatus comprising a core, three windings interwound on said core, a connection between said antenna and a first end of a first of said windings, a connection between one of said input electrodes and a first end of a second of said windings, a connection between said antenna and a second end of a third of said windings, and a common connection between a second said input electrode and a first end of said third winding and second ends of said first and second

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windings, said first ends of said windings being at the same physical end of said core, and said second ends of said windings being at the other physical end of said core.

4. The apparatus of claim 3, in which said second winding is positioned on the surface of said core between said first and third windings.

5. In electrical coupling apparatus, a transformer comprising a core, two windings interwound on said core, a third winding interwound on said core between turns of said two windings, two signal input terminals each connected respectively one to each physically opposite ends of said two windings, a first signal output terminal connected to an end of said third winding, and a second signal

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output terminal connected in common to the remaining ends of said two windings and said third winding.

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