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E. S. DOBSON

1,837,413

INDUCTIVE COUPLING DEVICE

Filed Oct. 6, 1930

FIG. 1

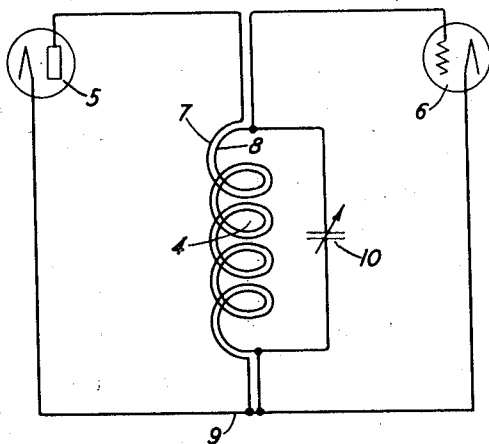


FIG. 2

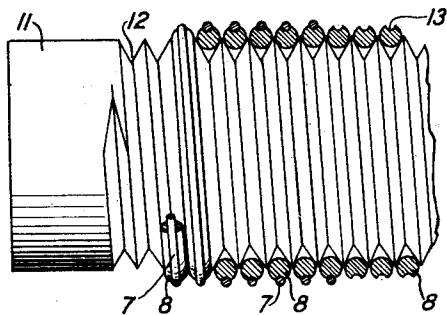
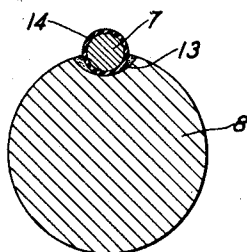


FIG. 3



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INDUCTIVE COUPLING DEVICE

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This invention relates to inductive couplers or transformers and more particularly to apparatus of this type adapted for use at the higher radio frequencies commonly designated as short waves. It has for its principal object to improve the coupling and the efficiency of high frequency transformers.

A radio frequency transformer which is to be used with short waves and is required to have a very high efficiency for the transfer of the electrical power of such waves from one circuit to another must necessarily have very close coupling between its windings. In a radio receiver to be used, for example, in an airplane where every means to reduce the weight of the apparatus to a minimum is important, the most efficient devices are desired throughout the receiver and accordingly it is important to have a highly efficient transformer for coupling the successive stages of the radio frequency amplifier. With a coupling transformer of high efficiency a maximum degree of amplification may be obtained from each amplifying stage and the apparatus will be utilized to the best possible advantage.

The desired characteristics are conveniently provided by a transformer constructed as hereinafter described and consisting of two windings, the inner one of which has a groove in its surface in which groove an outer winding is wound.

In the detailed description of the invention given below, reference is made to the accompanying drawings in which Fig. 1 is a schematic representation of a typical circuit in which the inductive coupling device of the invention may be employed;

Fig. 2 is a detailed view of a portion of a transformer embodying the invention and partially cut away in order to show its construction; and

Fig. 3 is a greatly enlarged cross sectional view of the primary and secondary conductors.

In the illustrative circuit shown in Fig. 1 the transformer 4 is employed as a coupling device for connecting the output circuit of a space discharge tube 5 with the input circuit of a second space discharge tube 6. Primary

winding 7 of transformer 4 is connected to the output circuit of tube 5. Secondary winding 8 is connected to the input circuit of tube 6. The two windings may be connected together at one end, as for example by the common conductor 9. The secondary winding may be tuned if desired, by means of the variable condenser 10 connected between the terminals of the winding. In the preferred form of the invention, the windings 7 and 8 have each the same number of turns. It is desired to secure a close and efficient coupling between the windings in order that the voltage impressed upon the input circuit of tube 6 may be equal to the full voltage developed by the winding 7.

The construction of a preferred form of the invention is shown in Fig. 2. The windings of the transformer 4 are supported by any suitable winding form 11 into which is preferably cut a helical groove or screw thread 12 to aid in maintaining the winding permanently in proper position.

In the circuit of Fig. 1 it is desirable to make the secondary winding 8 of a relatively large conductor in order that its resistance may be as small as possible. In general, the smaller the resistance of the winding 8 the more pronounced will be the resonant effect of the tuned circuit comprising winding 8 and variable condenser 10. The primary winding 7 on the other hand, is connected with the output circuit of the tube 5 which generally has a relatively large resistance so that the actual resistance of the winding 7 is not a matter of any great importance. The winding 7, may therefore, be composed of a wire of much smaller diameter than that used in the winding 8.

The larger secondary winding 8 is applied as the inner winding, directly in the groove 12. A smaller groove 13 is formed in the outer surface of the conductor to receive and support the winding 7. The groove 13 may be formed before winding the wire 8 on the form by passing the wire 8 through a suitable die or in any other convenient manner. Alternatively it may be cut in the wire after winding when a very heavy wire is used. The winding 7, which is insulated in the or-

dinary manner by an insulating covering 14 as shown in Fig. 3, is wound in the groove 13 after the winding 8 is in place. The position of the winding 7 in the groove 13 is shown in greater detail by the enlarged cross sectional view, Fig. 3. If desired, the wire 7 may be held in place by means of cement or varnish.

It is evident from the construction of the coupling device as herein described that the primary and secondary windings are so nearly superimposed that they are both subjected to the same magnetic field. As a result, the coupling between the windings is extremely close. The voltage generated in the primary windings will be practically the full voltage applied to the primary winding. The close coupling together with the very small resistance of the secondary winding promotes a high efficiency in the operation of the transformer or coupler.

In a transformer which was constructed in accordance with the invention, and was found to operate efficiently with radio frequency currents ranging from 3900 to 6400 kilocycles, the winding form was a cylindrical tube having an outside diameter of one inch. The outer surface of the tube was threaded 14 times to the inch. The inner winding was composed of No. 14 B & S gauge bare copper wire. The outer winding was composed of No. 36 black enameled wire wound with silk and covered with cotton. The outer winding was cemented in place with cellulose acetate. The dimensions given herein, however, are illustrative only and are not intended to limit the invention.

What is claimed is:

1. An inductive coupler comprising an inner winding consisting of a conductor having a groove in its surface and an outer winding consisting of an insulated wire wound in the groove in said inner winding.

2. An inductive coupler or transformer comprising a winding form, a spaced winding of bare wire wound on said form and having a groove in its surface and an insulated wire wound in said groove.

3. A transformer comprising a winding form having a groove formed in its surface, a bare wire having a longitudinal groove in its surface extending from one end to the other of said wire and an insulated wire wound in said longitudinal groove and fastened to said bare wire.

4. An inductive coupler comprising a spaced winding of relatively large wire, said winding having a groove in its outer surface and a relatively small insulated wire wound in said groove.

5. An inductive coupler or transformer having an inner winding and an outer winding characterized in this, that the outer winding is wound in a groove in the surface of the inner winding.

6. A transformer comprising a conductor having a longitudinal groove in its surface, a second conductor insulated from said first conductor and fastened in said longitudinal groove, said assembly of conductors being formed into a plurality of turns, means for supporting said conductors in said arrangement and means for insulating adjacent turns.

7. A transformer comprising a grooved winding form, an inner winding of bare wire having a groove in its outer surface, said inner winding being positioned in the groove of said winding form and an outer winding of insulated wire in the groove of the inner winding.

In witness whereof, I hereunto subscribe my name this 4th day of October, 1930.

ELLSWORTH S. DOBSON.