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COUPLING TRANSFORMER FOR RADIO FREQUENCY HEATING APPLICATIONS

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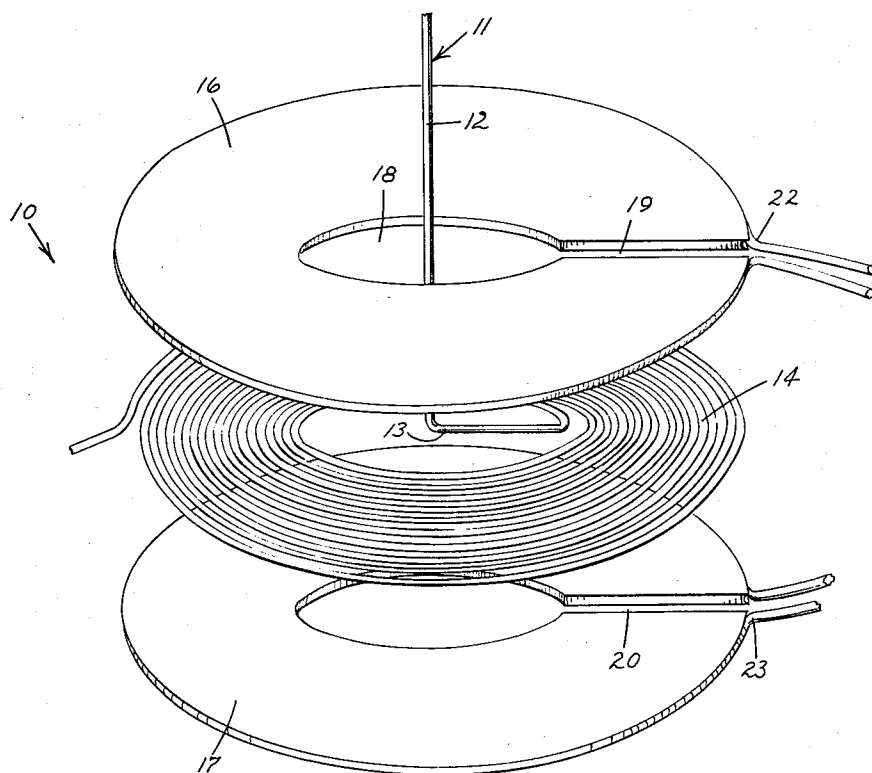


fig. 1

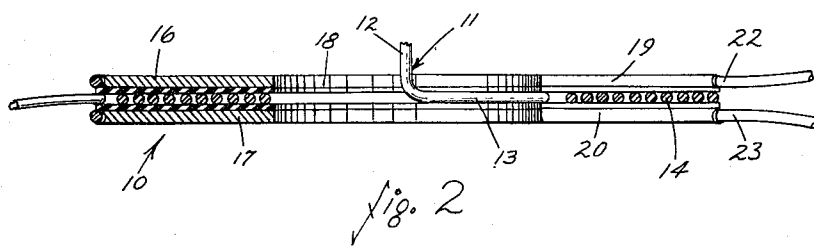


fig. 2

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COUPLING TRANSFORMER FOR RADIO FREQUENCY HEATING APPLICATIONS

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4 Claims. (Cl. 336—200)

This invention relates to an improved transformer construction and, more particularly, relates to an improved transformer construction characterized by its high coupling coefficient.

While a large variety of transformer constructions have been suggested heretofore, such constructions are either too expensive or lack one or more of the desirable features of transformers for use in low cost circuitry applications where a high coupling coefficient is required.

For example, the manufacturing cost of induction heating equipment, including the circuitry thereof, must be held to as low a level as possible. However, it frequently happens that low cost transformer constructions known in the prior art are not satisfactory for this use because of their inability to give a sufficient output under normal conditions of operation. While the problem of devising a low cost transformer having a high coupling coefficient has been recognized in the prior art, insofar as I am aware, the prior constructions have not been suitable for use on induction heating equipment and other allied uses.

Accordingly, it is an object of this invention to provide an improved transformer construction.

It is a further object of this invention to provide an improved transformer construction, as aforesaid, which has a high coupling coefficient.

It is a further object of this invention to provide an improved transformer construction, as aforesaid, which construction is inexpensive to manufacture and which is efficient in operation.

It is a further object of this invention to provide an improved transformer construction, as aforesaid, which is particularly useful for induction heating equipment.

Other objects and advantages of this invention will become apparent to persons acquainted with equipment of this type upon reading the following description and inspecting the accompanying drawings, in which:

Figure 1 is an exploded view of my transformer construction.

Figure 2 is a central sectional view of my transformer construction.

General description

The invention provides a transformer construction which includes a primary winding defined by a wire wound in an involute form. In a preferred embodiment, a pair of magnetically conductive plates are disposed on either side of such primary winding and are electrically insulated therefrom. The secondary windings of the transformer are provided by conductors which are respectively wound around the edge of each of the plates.

Detailed description

The transformer of the present invention, while inherently of broad utility, is particularly useful for coupling a high frequency supply circuit to an induction heater circuit of lower frequency. Particularly, the transformer is useful in the circuit of an induction heating unit in

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which a vacuum tube oscillator unit constitutes the high frequency power supply. Accordingly, the following description will proceed primarily with reference thereto.

The transformer 10 includes a conductor 11 which includes a portion 12 connected to any suitable supply circuitry, such as an anode of an oscillator tube, and a portion 13 extending at right angles to portion 12. Portion 13 includes a portion 14 coiled in involute form with the turns thereof being co-planar. The portion 14 defines the primary winding of the transformer.

A pair of flat plates 16 and 17 are positioned on either side of portion 13 closely adjacent the turns thereof but electrically insulated therefrom. The plates are made of a suitable material capable of conducting magnetic flux, such as soft iron. The plates 16 and 17 are in the form of annular rings and the conductor 11 extends through the central opening 18 in one of said plates, here plate 16. The plates have slots 19 and 20, respectively formed therein, said slots extending radially between the inner and outer edges of said plates. Conductors 22 and 23 are wound around the plates 16 and 17, respectively, from the opposed edges of slots 19 and 20, respectively, preferably on the peripheries thereof.

The conductors 22 and 23 can be connected in parallel or in series and thence to a load, or they can supply independent loads.

Ordinarily the portion 14 of the conductor 11 is wound to provide several turns, for example ten turns, while a lesser number of turns (in this embodiment, only one turn) is provided on each of the plates 16 and 17. Thus the transformer finds its greatest utility as a step-up or a step-down transformer wherein only a relatively small number of turns are desired in each of the primary and secondary windings. In a transformer where the primary winding consists of ten turns and the secondary conductors on plates 16 and 17 consist of a single turn each, a parallel connection of the conductors on the plates 16 and 17 will provide a 10:1 ratio, whereas if the conductors on plates 16 and 17 are connected in series, the transformer has a 5:1 ratio.

As shown in Figure 2, the two plates and the portion 14 define a sandwich-like structure and the magnetic flux generated in the portion 14 of the conductor is conducted through the flux path provided by plates 16 and 17. The plates 16 and 17 provide a path for a magnetic flux from the portion 13 to the conductors 22 and 23. Because of the close positioning of plates 16 and 17 on either side of portion 13, only a very small amount of flux leaks out of the intended path. The slots 19 and 20 provide an air gap between the respective ends of the conductors 22 and 23.

It is apparent that the disclosed transformer construction is capable of inexpensive manufacture since it consists of relatively few parts, which are easily manufactured. Further, because of the relatively small number of turns, the mounting of the primary and secondary windings in proper position is comparatively simple.

It is apparent that a greater number of primary and secondary windings can be provided, if desired. Thus, for example, it is feasible to provide a second conductor similar in all respects to conductor 11, and sandwich same between plate 16 and an additional plate positioned on top thereof to form a three layer structure.

This, and other modifications of the embodiment herein particularly chosen for illustrative purposes, will be apparent to persons acquainted with apparatus of this general type and, accordingly, the claims hereinafter appended are to be interpreted as covering such modifications, excepting as said claims by their own terms expressly recite otherwise.

I claim:

1. A transformer comprising in combination: a con-

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ductor including a portion wound in co-planar, involute form and defining the primary winding; rings on, and in contact with, either side of said portion but electrically insulated therefrom, said rings being of a magnetically conductive material, each ring having a slot therein extending from the inward to the outward edge thereof; a second conductor on each of said rings, and extending therearound from one edge of said slot thereof to the other, said second conductor defining a secondary winding of said transformer.

2. A transformer comprising in combination: a pair of parallel, spaced rings, said rings each having a slot therein extending from the radially inner to the radially outer edge thereof, said rings being made of a magnetically conductive material; a first conductor having a first portion extending through the central opening in one of said rings and having a second portion wound in the form of an involute, the turns in said second portion being coplanar and disposed between, closely adjacent to, but electrically insulated from, said rings, said first conductor defining a first winding of said transformer; a conductor mounted on, but electrically insulated from, each of said rings and each extending respectively, from one edge of

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the slots on each of the rings to the other edge thereof, said last-named conductors each defining a second winding of said transformer.

3. The device of claim 2 wherein each of said rings constitutes flat, annular plates.

4. A transformer comprising in combination: a conductor including a portion wound in involute form and defining the primary winding; rings on, and in contact with, either side of said portion but electrically insulated therefrom, said rings being of a magnetically conductive material, each ring having a slot therein extending from the inward to the outward edge thereof; a second conductor on each of said rings, and extending therearound from one edge of said slot thereof to the other, said second conductor defining a secondary winding of the transformer.

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