Oct. 12, 1948. L. NORDE 2,451,444

ADJUSTABLE WAVE COUPLING SYSTEM

Filed April 5, 1946

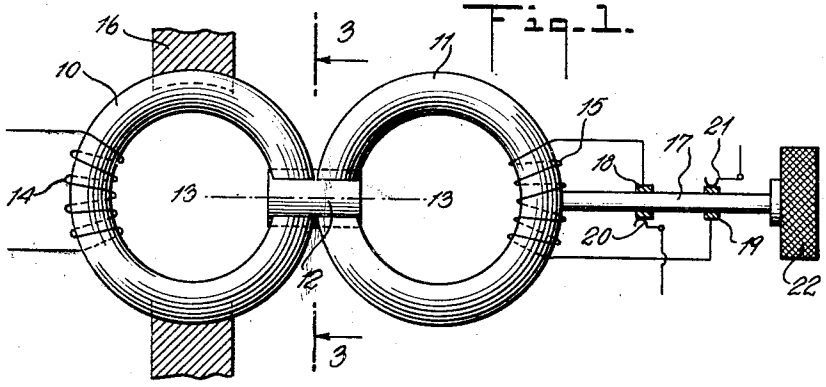


Fig. 1.

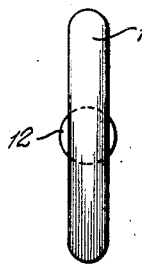


Fig. 2.

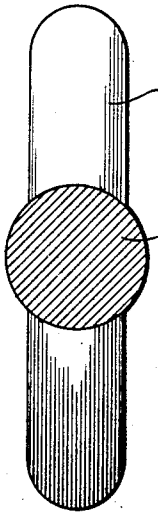


Fig. 3.

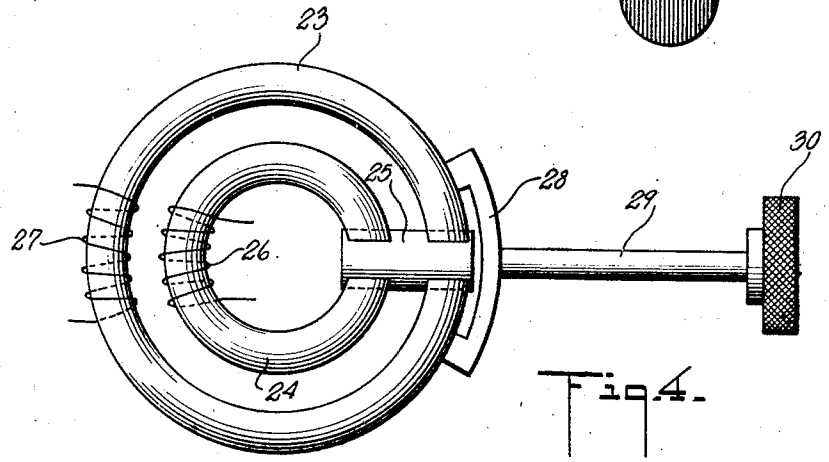


Fig. 4.

INVENTOR.
LESLIE NORDE
BY John J. Logan
ATTORNEY

Patented Oct. 12, 1948

2,451,444

UNITED STATES PATENT OFFICE

2,451,444

ADJUSTABLE WAVE COUPLING SYSTEM

Leslie Norde, Hempstead, N. Y., assignor, by mesne assignments, to Jefferson Standard Broadcasting Company, a corporation of North Carolina

Application April 5, 1946, Serial No. 659,995

1 Claim. (Cl. 171—119)

1

This invention relates to wave coupling systems and more especially to adjustable inductances for use in such systems.

A principal object of the invention relates to a novel form of transformer in which both the primary and secondary windings are provided with toroidal cores.

Another principal object is to provide an adjustable toroidal core coupling transformer for wave signalling systems and the like, in which the primary and secondary windings can be readily adjusted from maximum to zero coupling coefficients while at the same time preserving substantially zero magnetic leakage in all adjusted positions.

A feature of the invention relates to a coupling transformer having toroidal primary and secondary cores, with a common junction core around which both the toroidal cores are rotatable to adjust the coupling coefficient between the windings on said cores.

Another feature relates to an inductance unit comprising a pair of nested toroidal cores with a common junction core and adjustable means for rotating the plane of one core with respect to that of the other core.

A still further feature relates to the novel organization, arrangement and relative location of parts which cooperate to provide an improved adjustable inductance unit.

Other features and advantages not particularly enumerated will be apparent after a consideration of the following detailed descriptions and the appended claim.

In the drawing,

Fig. 1 is a plan view of one embodiment of the invention.

Fig. 2 is an end view of Fig. 1.

Fig. 3 is an enlarged sectional view of Fig. 1, taken along the line 3—3 thereof.

Fig. 4 shows another embodiment of the invention.

Referring to Figs. 1 to 3, there is shown a wave coupling transformer comprising a pair of ring-shaped or toroidal magnetic cores 10, 11. These cores may be of circular cross-section and may be constituted of any magnetic material conventionally used in the manufacture of transformer cores. Preferably however, and particularly where the transformer is to be used in high frequency coupling systems, the cores 10 and 11 are made of compressed comminuted magnetic material such as is conventionally used in so-called permeability tuners. While the drawing shows cores 10 and 11 of the same dimensions, it will be

2

understood that this is done merely for explanatory purposes.

Each of the cores is provided with a circumferential gap with the walls of the gap formed to the arc of a circle. Positioned between each of the cores and passing through the respective gaps therein is a cylindrical auxiliary core 12 also of powdered iron or other magnetic material. The auxiliary core 12 is approximately of the same diameter as the gaps in the respective toroidal cores 10 and 11, so that a relatively close fit exists between the core 12 and the said toroidal cores. However, this fit should be such as to enable either one or both of the cores 10 and 11 to be rotated around the central axis 13—13 of the core 12.

A suitable winding 14 is provided on core 10, and another winding 15 is provided on core 11. The terminals of winding 14 may be connected to any suitable source of electric waves and constitute the primary of the coupling system. Likewise, the terminals of winding 15 are connected to a suitable load circuit and constitute the secondary of the coupling system. The core 10 may be fixedly mounted in a suitable bracket 16 preferably of non-magnetic material so as to maintain the core 10 in a fixed plane. In order to change the coupling coefficient between the primary and secondary, the core 11 has fastened thereto a shaft 17 which may be of insulating material and may carry two contact slip rings 18, 19, to which the terminals of winding 15 are respectively connected. Suitable brushes 20, 21, make contact respectively with rings 18 and 19 and these brushes are connected to the desired load circuit.

An adjusting knob or handle 22 is fastened to shaft 17, so that by turning handle 22 the planar orientation of core 11 with respect to core 10, can be varied. During this turning of the core 11, no disturbance is effected in the magnetic circuit between the two cores because core 11 closely fits around the auxiliary core 12. As a result, the coefficient of coupling between the windings 14 and 15 can be given any value between zero and maximum, and negligible magnetic leakage occurs during any of the adjusted positions of the core 11. With this arrangement, the coefficient of coupling may be continuously adjusted from a given positive value, through zero, to a given negative value. It will be understood of course, that instead of connecting terminals of coil 14 to one circuit, and the terminals of coil 15 to another circuit, the windings 14 and 15 may be connected electrically in series or electrically in

parallel, thus providing a two-terminal variable toroidal inductance.

Fig. 4 shows the invention embodied in a different form, wherein the toroidal core 23 is of larger diameter than the toroidal core 24, the cores being mounted in nested relation. The magnetic circuit between the cores 23 and 24 is completed by an auxiliary cylindrical core 25. The core 24 with its winding 26 may be attached to any suitable fixed support or bracket which however is arranged so as not to interfere with the rotation of the core 23 with its winding 27. The core 23 is provided with a suitable bracket 28 of non-magnetic material to which the adjusting shaft 29 is fastened. By means of the knob 30, the core 23 with its winding 27 can be rotated to assume any planar orientation with respect to the core 24. It will be understood of course that the terminals of winding 27 are provided with suitable slip rings and contact brushes similar to those shown in Fig. 1. If the core 23 is to be stationary, then the core 24 may be permanently attached to the auxiliary core 25, and this latter core 25 can be directly fastened to the shaft 29 so that by turning knob 30 the planar position of core 24 may be varied with respect to core 23.

While certain specific embodiments have been illustrated, various changes and modifications may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

A variable magnetic core transformer, comprising a first toroidal magnetic core, a second toroidal magnetic core, the second core being of smaller diameter than the first core and located within the inner periphery of the first core, a magnetic member coupling the two cores to complete a magnetic circuit therebetween said member being fastened to one core and passing through the other core to provide a rotational bearing for said other core as it is rotated, said member being mounted in alignment with the common diameter of both cores to maintain them concentric, each of said cores having a separate magnetizing winding and means to rotate said cores relatively to each other to vary the effective coupling coefficient between said windings.

LESLIE NORDE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,501,649	Cummings	July 15, 1924
1,603,822	Wilkinson	Oct. 19, 1926
1,853,548	Casper	Apr. 12, 1932
2,162,273	Schulze	June 13, 1939

FOREIGN PATENTS

Number	Country	Date
7,783	Norway	Oct. 22, 1898