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1,449,878.

E. AUSTIN.
MODULATOR.
FILED JAN. 12, 1922.

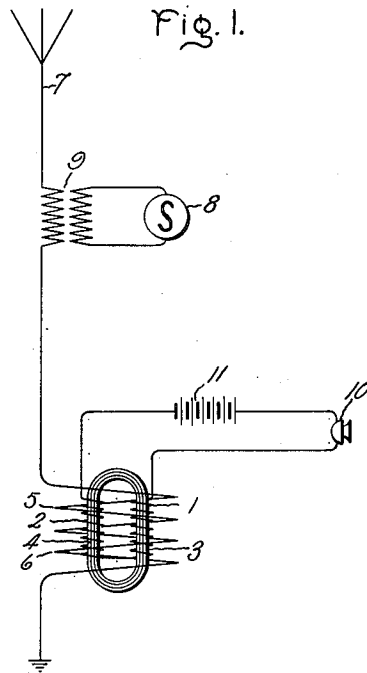
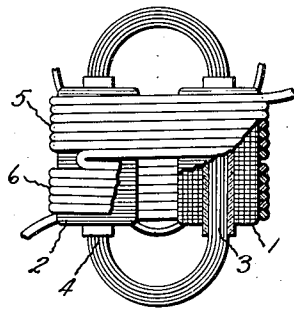


Fig. 2.



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UNITED STATES PATENT OFFICE.

EDWARD AUSTIN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MODULATOR.

Application filed January 12, 1922. Serial No. 528,846.

To all whom it may concern:

Be it known that I, EDWARD AUSTIN, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Modulators, of which the following is a specification.

My present invention relates to modulators of high frequency current, and more particularly to modulators of the type commonly known as magnetic amplifiers.

Devices of this general type as used in the past and as described, for example, in United States patent to Alexanderson, 1,206,643, have depended for their action upon the varying inductance of a winding supplied with high frequency current under variations in the magnetization of a core of magnetic material with which the winding is associated.

When such a device has its high frequency windings connected in series with the antenna of a radio transmitting system the effect, if operated in accordance with past practice is to vary the tuning of the antenna. In case a source of high frequency current such a vacuum tube generator is employed, the frequency of which is largely determined by the antenna tuning, this results in a wide change in the wave length transmitted without any appreciable control of the amplitude of the radiated waves. For radio telephony, however, particularly with short wave lengths, it is regarded as better practice to maintain the wave length constant and effect the transmission by varying the amplitude of or modulating the antenna current in accordance with the telephone current.

The object of my invention is to provide a magnetic modulator which will serve to control the amplitude of the antenna current without appreciably varying the tuning of the antenna.

In carrying my invention into effect I provide a core of magnetic material having two magnetizing coils surrounding two legs of a preferably closed core of magnetic material. I surround these two coils by a winding made up of two portions wound in opposite directions. By arranging the winding for the high frequency current in this way the inductance of the winding is greatly reduced and becomes only a small portion of the total inductance of the oscillating circuit. Hence

small variations in the inductance of the winding with changes in the magnetization of the magnetic core produce such small percentage changes in the total inductance of the circuit that they do not appreciably affect the tuning. The high frequency losses in the core, however, vary greatly with variations in the magnetization and as a result the device acts principally as a variable resistance in the antenna circuit.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation will best be understood by reference to the following description taken in connection with the accompanying drawing in which Fig. 1 shows diagrammatically the application of my invention to a radio telephone transmitting system, and Fig. 2 is a view of the modulator with a portion of the windings broken away.

As indicated in the drawing, my improved modulator comprises a pair of coils 1 and 2 surrounding the two legs 3 and 4 of a continuous magnetic core made of thin laminations. Surrounding the coils 1 and 2 is a winding made up of two portions 5 and 6 wound in opposite directions. The winding 5, 6 is connected in series with a radiating antenna 7 which is supplied with high frequency current from a source 8 through the usual coupling transformer 9. The source 8 may be of any form desired, either a high frequency alternator, an arc generator, or a vacuum tube generator. Modulation of the antenna current is effected by supplying a telephone current by means of the transmitter 10 and local battery 11 to the windings 1 and 2.

While it is possible to vary the antenna current by varying the tuning the control which is obtained in this way over the range necessary for effecting satisfactory voice modulation of the antenna current is non-linear. Such control therefore induces distortion in the current transmitted and this distortion is increased by the non-linear detuning effect of the receiver. In the case of short wave radio transmitters the inductance of the circuit being comparatively low, a small change in the inductance of the modulator will produce considerable distortion if the inductance of the modulator consti-

tutes an appreciable percentage of the total inductance of the oscillating circuit. By the arrangement which I have described it will be apparent that the inductance of the modulator may be made to represent a very small percentage of the total inductance of the circuit. The modulating effect, however, will not be appreciably reduced since the individual fields are established by the two halves of the high frequency winding, thus making it possible to vary the effective resistance of the winding by varying the permeability of the core. The resultant high frequency field, however, which determines the inductance will be very low and the percentage change in this inductance by reason of changes in the magnetization of the core will also be lower by reason of the differential winding. Hence for a large change in the magnetizing current the percentage change in the total oscillating circuit inductance will be very low and the distortion will be reduced to a minimum.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The combination in a modulator of a closed core of magnetic material having two substantially parallel legs, winding on each of said legs and a winding surrounding the

windings on both of said legs, said last-mentioned winding being composed of two portions wound in opposite directions.

2. The combination in a modulating system of a closed core of magnetic material having two substantially parallel legs, windings on each of said legs, means for supplying a modulating current to said windings, a winding surrounding the windings on both of said legs, said last mentioned winding being composed of two portions wound in opposite directions, and means for supplying high frequency currents to said last mentioned winding.

3. The combination in a signaling system of a closed core of magnetic material having two substantially parallel legs, windings on each of said legs, means for supplying audio frequency signaling currents to said windings, a winding surrounding the windings on both of said legs, said last-mentioned winding being composed of two portions wound in opposite directions, a transmitting circuit in which the last-mentioned windings are included and means for supplying high frequency currents to said transmitting circuit.

In witness whereof, I have hereunto set my hand this 11th day of January, 1922.

EDWARD AUSTIN.