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MODULATION SYSTEM

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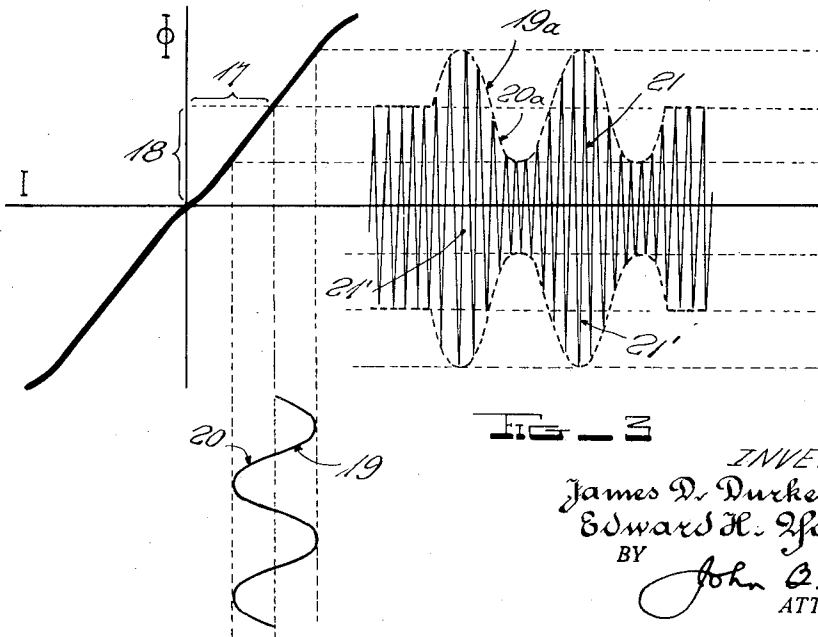
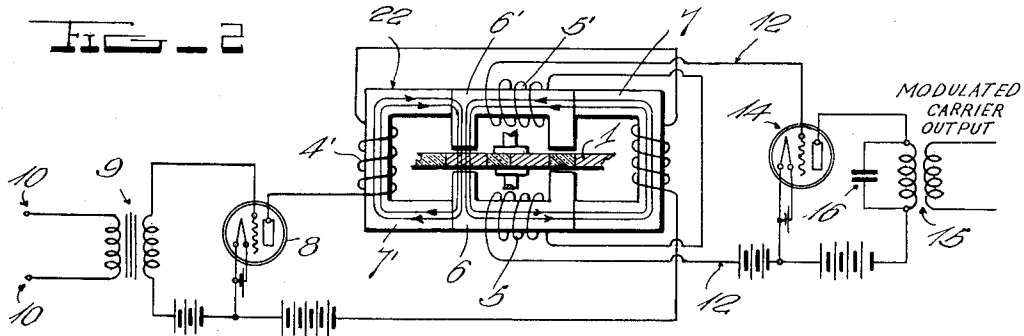
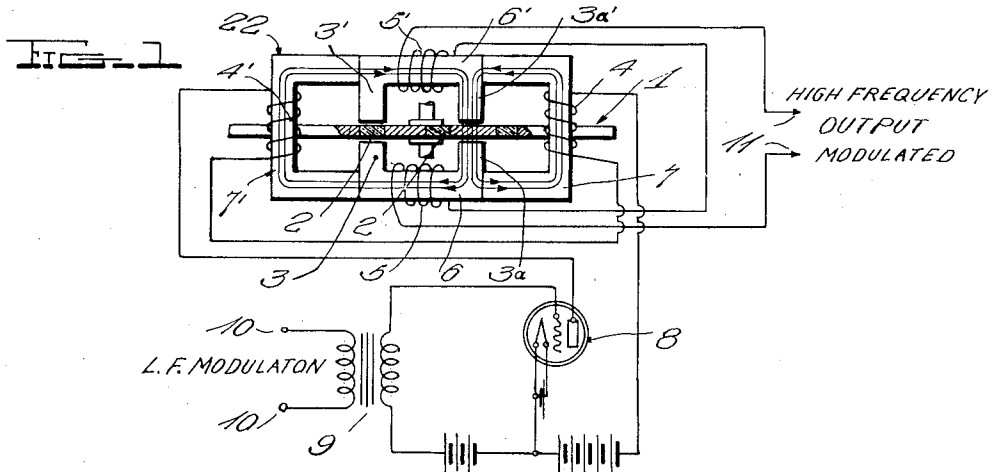


FIG. 3

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MODULATION SYSTEM

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Application July 24, 1935, Serial No. 32,951

10 Claims. (Cl. 179—171)

Our invention relates broadly to carrier modulating systems and more particularly to a system employing a mechanical oscillator for generating the carrier.

5 One of the objects of our invention is to provide means for generating a high frequency alternating voltage at intensities proportional at any instant to the amount of flux in a field of varying intensity.

10 Another object of our invention is to provide means for generating a high frequency carrier modulated in accordance with signal energy.

Still another object of our invention is to provide means for modulating the magnetic field of an induction generator without distortion, whereby a modulated high frequency voltage is produced in the induction generator.

15 A further object of our invention is to provide an arrangement of field structure in an induction generator, which produces a magnetic field of varying intensity unaffected by the flux valving means of the induction generator, whereby an undistorted modulated wave is generated.

20 A still further object of our invention is to provide an arrangement of core structure in an induction generator employed in a modulating system, which involves only shifting of the flux in position in a magnetic circuit of constant reluctance thereby preventing distortion of the modulated output of the system.

Still another object of our invention is to provide means for generating a modulated carrier voltage by modulating the magnetic field of a high frequency mechanical oscillator.

25 Other and further objects of our invention reside in the circuits and arrangements hereinafter more fully described with reference to the accompanying drawing, in which:

30 Figure 1 is a schematic diagram of the connections in the modulating system of our invention feeding directly to a line wire circuit; Fig. 2 is a schematic diagram of the modulating system of our invention having its output circuit connected directly in the grid input circuit of an electron tube amplifier; and Fig. 3 is a graph of a magnetization curve showing the method of modulating the magnetic field.

35 In the system of our invention we employ an induction type mechanical oscillator such as is shown in our copending application for Mechanical oscillator, Serial No. 32,952, filed July 24, 1935, for generating the carrier voltage. In the case of telephonic transmission a carrier of relatively high frequency is desirable and this is obtained in the mechanical oscillator described in our ap-

plication Serial No. 32,952 by increasing the number of perforations in the revolving disc and/or increasing the speed of rotation of the disc.

The modulating system of our invention comprises a mechanical oscillator adapted for generating directly a modulated wave by the employment of a modulated magnetic field, the high frequency voltage being generated in proportion to the amount of flux in the field at any instant. In order to accomplish this effect, a magnetic circuit of special arrangement and operating under prescribed conditions is provided, as will be hereinafter more fully disclosed.

Referring to the drawing in more detail, Fig. 1 shows diagrammatically the elements and the connections in one form of the system of our invention. The mechanical oscillator comprises a core structure 22 and a rotatably driven disc 1 which is composed of magnetic material and has perforations 2 therein adapted to pass between pairs of pole pieces 3 and 3a, 3' and 3a', blocking the passage of the flux through one of the sets of pole pieces, for example, 3 and 3', while a portion of the disc lies between the pole pieces of the other set 3a, 3a', permitting the passage of the flux therethrough. As the disc rotates the flux passes alternately through the sets of pole pieces. Inductor coils 5 and 5' are mounted on the portions 6 and 6' of the core 22 disposed on opposite sides of the disc 1, between pole pieces of different sets. In this position, the coils 5 and 5' are linked by the flux in each shift thereof from the one set of pole pieces to the other.

35 The flux is produced by the coils 4 and 4' which are mounted on the portions 7 and 7' at opposite ends of the core structure. Coils 4 and 4' are shown connected in series with the output of the audio frequency amplifier 8. The coils 4 and 4' are wound and connected in such a manner that the poles adjacent the portion 6 of the core vary always in the same polarity, as also do the poles adjacent portion 6'. The combined flux of both coils 4 and 4' is, therefore, passed through one or the other set of pole pieces; and since in shifting from one set of pole pieces to the other, the flux from one of the coils 4, 4', moves out of the inductor coils 5, 5', and the flux from the other coil moves in from the opposite direction substantially all of the flux threads through the inductor coils 5, 5', to generate voltage therein.

40 It is seen also that due to the complementary arrangement of perforations 2 and solid portions of the disc 1 with respect to the sets of pole pieces, the effective reluctance of the whole magnetic path is substantially constant and there are no

flux variations in the portions 7, 7', of the core due to the valving of the flux by the disc 1. Hysteresis loss in the core is, therefore, maintained at a minimum and distortion of the modulated output due to saturation of the core is prevented.

The input of audio amplifier 8 is connected through audio transformer 9 and terminals 10 to the source of signal energy which may be a microphone pick-up circuit, or any continuous or interrupted audio wave system. Inductor coils 5 and 5' in which the modulated high frequency voltage is generated are connected in series and to the utilization circuits through the output terminals 11. The coils 5, 5' in Fig. 1 are of low impedance and devised to connect directly to a transmission line.

As shown in Fig. 2, the coils 5, 5', may be made of high impedance and connected to the input circuit 12 of an amplifier 14. In this form of our invention, the mechanical oscillator may be smaller in physical size and electrical capacity since it is required to generate only energy sufficient to energize the grid of the amplifier 14. The output circuit of the amplifier 14 includes transformer 15, the primary of which is tuned by means of condenser 16 connected in parallel therewith in order to reduce harmonics and eliminate further distortion.

Fig. 3 is a diagrammatic representation by graph of the relation between magnetizing current I and resulting magnetic flux, Φ , and shows the operation of the system of our invention with respect to that relation. In operation, as indicated in Fig. 3, the normal current output 17 of the amplifier 8 is such as to provide approximately one-half the flux, as denoted at 18, which may be produced in the core 22 by coils 4, 4' before the core is saturated. Under this condition, an oscillation of approximately one-half maximum amplitude will be generated. Now, if the plate current of amplifier 8 is increased, as at 19, by reason of a positive charge on the grid of the amplifier 8 due to a signal in the input circuit, the magnetization in the core will be increased as indicated at 19a and a proportionately increased voltage generated in the coils 5, 5'. And conversely, a proportionately smaller flux 20a is produced and a corresponding voltage generated in the coils 5, 5' when the grid of amplifier 8 is made negative and the plate current less, as at 20, by a signal in the input circuit. Thus, signal energy of audio or voice frequencies applied to the grid of the amplifier 8 will produce corresponding variations in the amplitude of the magnetic field of the mechanical oscillator.

The effect of the rotating disc 1 on the pulsating magnetic field is such as to interrupt and reverse it in direction at high frequency, as shown in Fig. 3 at 21 and 21'. The result is a modulated high frequency wave, modulated in accordance with the signal energy supplied through terminals 10, and having a frequency determined by the operation of the disc 1.

While we have described our invention in certain preferred embodiments, we desire it understood that modifications may be made and that no limitations upon our invention are intended other than may be imposed by the appended claims.

What we claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a modulating system, a mechanical modulator-oscillator device comprising means for producing a magnetic field varying in intensity

in accordance with the modulating signal energy, inductor coils disposed in said magnetic field, and means for reversing said magnetic field with respect to said inductor coils at high frequency whereby voltage is generated in said inductor coils in accordance both with the intensity of the magnetic field as varied by the modulating signal energy and with the frequency of the reversal of the magnetic field with respect to said coils.

2. A modulating system comprising a source of modulating energy, means for amplifying modulating energy from said source, means for producing a magnetic field varying in intensity in accordance with said modulating energy, inductor coils disposed in said magnetic fields and electro-mechanical means for reversing the direction of said varying magnetic field in said coils at high frequency for generating a voltage in said coils in accordance with the frequency of reversal and the intensity of said magnetic field.

3. A modulating system comprising a source of modulating energy, a core of magnetic material, means for normally producing in said core magnetic flux sufficient to half saturate said core, means for varying said flux substantially between its maximum density at saturation and zero in accordance with modulating energy from said source, inductor coils mounted on said core and linked by said magnetic flux, and electro-mechanical means for reversing the direction of said varying magnetic flux in said coils at high frequency for generating a voltage in said coils in accordance with the frequency of the reversal and the density of said magnetic flux.

4. In a modulating system, a mechanical modulator device comprising a substantially rectangular core structure, field windings mounted on the short arms at either end of said rectangular core structure, inductor coils mounted centrally on the long arms at either side of said rectangular core structure, pole pieces on said core structure disposed at either side of each of said inductor coils and projecting inwardly of said rectangular core structure in directly opposite positions, and a rotatable disc member of magnetic material and having perforations disposed adjacent the periphery thereof mounted between said pole pieces whereby the magnetic path through one set of said pole pieces is blocked by one of the perforations in said disc at the same instant the magnetic path between the other set of said pole pieces is made low in reluctance by virtue of a portion of said disc of magnetic material, said disc in rotating effecting the shifting of the magnetic path alternately between the sets of oppositely positioned pole pieces, and means for energizing said field windings from a source of modulating energy whereby a voltage is induced in said inductor coils proportional to the intensity of the magnetic field produced by said modulating energy at the frequency of the shifting of said magnetic field.

5. The method of generating a modulated carrier wave which comprises producing a magnetic field varying in intensity with the modulating energy, reversing the direction of said magnetic field at the carrier frequency rate, and inducing by virtue of said varying and reversing field a voltage proportional to the intensity of the varying field at the frequency of the reversing of the field.

6. The method of generating a modulated carrier wave which comprises providing a magnetic field, reversing the direction of the magnetic field at the carrier frequency rate, inducing

by virtue of said reversing magnetic field a voltage at the frequency of the reversing of the magnetic field, and modulating the intensity of said magnetic field whereby said voltage is correspondingly modulated.

5 7. A modulating system comprising a source of modulating energy, means for amplifying modulating energy from said source, a modulator-oscillator device including means for producing a
10 magnetic field varying in intensity in accordance with said modulating energy, inductor coils disposed in said magnetic field, and means for reversing the direction of said magnetic field with
15 whereby a modulated high frequency voltage is induced in said inductor coils; and an output circuit connected with said inductor coils.

20 8. A modulating system comprising a source of modulating energy, means for amplifying modulating energy from said source, a modulator-oscillator device including means for producing a magnetic field varying in intensity in accordance with said modulating energy, inductor coils disposed in said magnetic field, and means for re-

versing the direction of said magnetic field with respect to said inductor coils at high frequency whereby a modulated high frequency voltage is induced in said inductor coils; and an electron tube amplifier having input and output circuits, said inductor coils being of high impedance and connected in said input circuit. 5

9. A modulating system as set forth in claim 8 and having filter means in the output circuit of said electron tube amplifier for reducing the harmonic content of the modulated output. 10

10. In a modulating system, a mechanical modulator-oscillator device comprising a core structure, field windings mounted on said core structure, inductor windings mounted on said core structure, means for energizing said field windings by modulating signal energy for producing a magnetic field adapted to link said inductor windings, and means for reversing said magnetic field with respect to said inductor windings at the carrier frequency, whereby a modulated carrier wave is generated in said modulator-oscillator. 15 20

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