Aug. 7, 1923. 1,463,796

J. R. CARSON

TRANSLATING CIRCUITS

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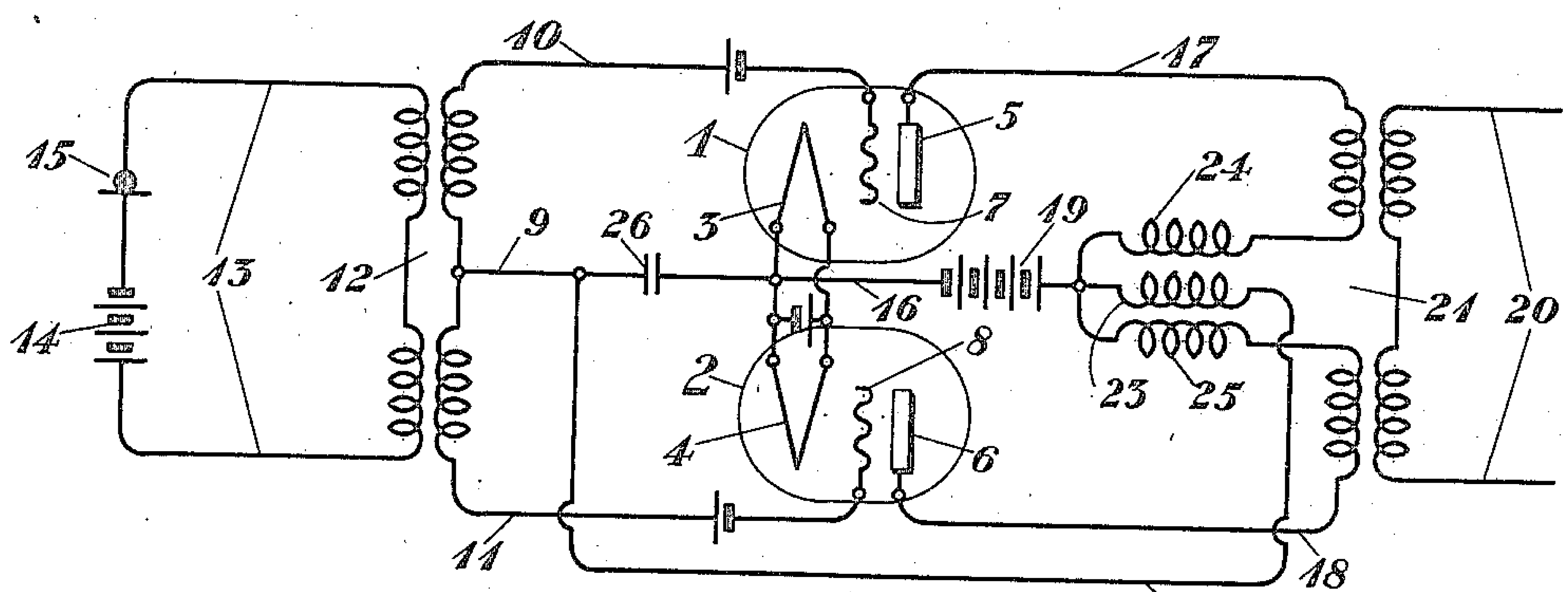

Fig.1

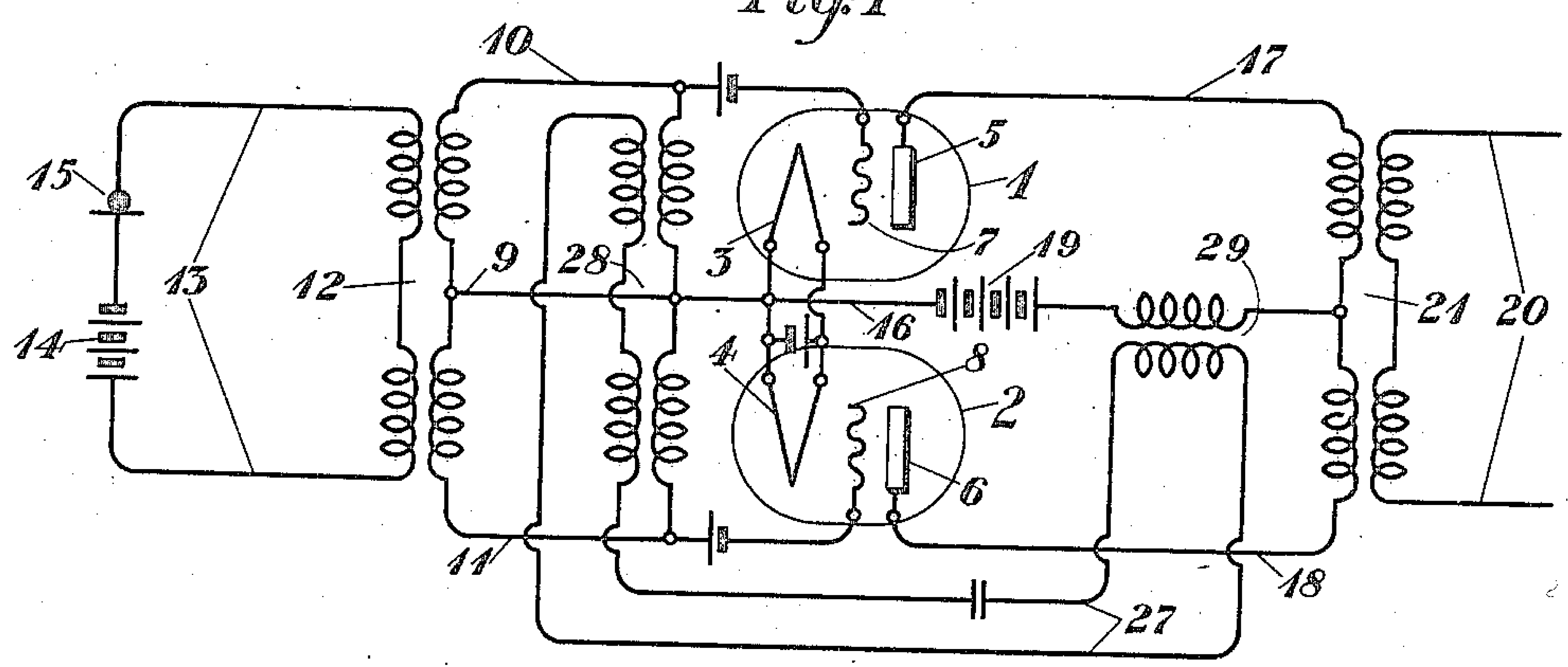

Fig. 2

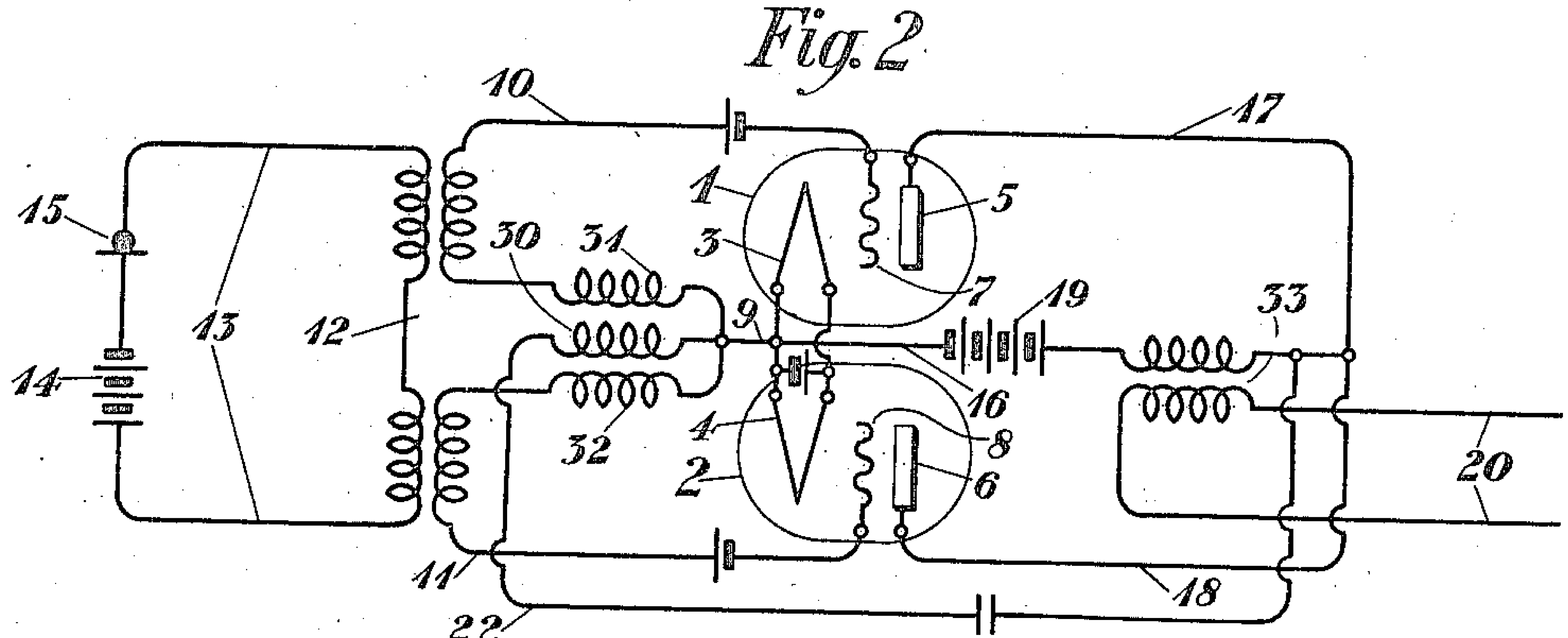

Fig. 3

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TRANSLATING CIRCUITS.

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To all whom it may concern:

Be it known that I, JOHN R. CARSON, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Translating Circuits, of which the following is a specification.

This invention relates to signaling systems, and more particularly to systems in which signals are transmitted by means of carrier currents.

The invention has for one of its objects the provision of a transmitting organization so arranged that high frequency oscillations will be modulated by signalling waves in such a manner that the amplitude of the modulated oscillations will closely correspond to that of the modulating waves. Another object of the invention is to provide a means for the generation of high frequency oscillations the amplitude of which will be determined solely by a controlling modulating wave. A still further object of the invention is to provide an arrangement of oscillating vacuum tubes of such character that the amplitude of the oscillations generated thereby will at all times correspond to and be determined by the modulating signal waves. Other and further objects of the invention will be clear from the description hereinafter given.

The objects of the invention are secured as herein disclosed by providing a duplex vacuum tube arrangement, having similar conductive paths, with a feed back connection so arranged as to normally feed back no energy when the two sides of the arrangement are balanced. When, however, the relative conductivity of the two paths is varied in accordance with the modulating waves, an amount of energy will be fed back depending upon and in proportion to the degree of unbalance, and oscillations will be generated whose amplitude is determined by the modulating wave.

The invention may now be more fully understood from the following description when read in connection with the accompanying drawings, Figures 1, 2 and 3 of which constitute circuit diagrams of three different embodiments of the invention.

Referring to Figure 1, a pair of vacuum tubes 1 and 2 are shown, each including filaments 3 and 4, anodes or plates 5 and 6 and controlling electrodes or grids 7 and 8. Parallel input circuits having a common path 9 and individual paths 10 and 11 are connected between the filaments and grids of the two tubes. A source of signalling variations is associated with said input circuits through a transformer arrangement 12. As illustrated, said source comprises a circuit 13 including battery 14 and a telephone transmitter 15. Parallel output circuits comprising a common path 16 and individual paths 17 and 18 are connected between the filaments and plates of the tubes. A battery 19 to furnish the space current for the tubes may be included in the common path 16. An outgoing circuit 20 is associated with the output circuits through a transformer arrangement 21, the primary windings of which are included in the individual paths 17 and 18 of the output circuits. A feed back connection 22 extends from the common path 9 of the input circuits through a winding 23 of a transformer to the common path 16 of the output circuits. Windings 24 and 25 of the transformer are also included in the individual paths 17 and 18 of the output circuits. The coils 24 and 25 are oppositely wound so that the connection of the feed back conductor 22 to the output circuits is differential, while its connection to the input circuits is such that the input circuits are in parallel with respect thereto. A condenser 26 is included in the coupling circuit 22, the frequency of the generated oscillations being controllable by variation of its capacity.

The connections above described are such that if the tubes 1 and 2 have the same conductivity, the circuit is balanced and normally singing does not take place since an impulse in the feed back circuit 22 produces equal variations in the potentials of the two grids and equal impulses flow over circuits 17 and 18 so that, due to the action of the transformer windings 23, 24 and 25, no effect is repeated to the feed back circuit 22. When, however, signal variations occur in the circuit 13 potential variations of opposite sign are impressed upon the grids 7 and 8, and the conductivity of one of the tubes is increased, and that of the other is decreased simultaneously in proportion to the amplitude of the signaling wave. The circuit is now unbalanced so that oscillations are set up over the feed back circuit 22, the amplitude of which is determined by the amplitude of the signal variations. The oscillations set up in the system are transmitted through the transformer 21 to the outgoing circuit 20, so that the latter circuit receives high frequency oscillations varied in amplitude in substantially direct proportion to the amplitude of the modulating signal waves.

A modified arrangement is illustrated in Figure 2 in which the feed back circuit 27 is inductively related to both the output and input circuits. In this case also, the feed back circuit 27 is differentially associated with the input circuits through a transformer arrangement 28, while the output circuits are arranged in parallel with respect to the feed back circuit with which they are associated through a transformer 29 having a winding included in the common conductor 16 of the output circuits.

In this case also the feed back circuit is balanced with respect to the input and output circuits so that normally oscillations are not set up. An impulse occurring in the circuit 27 acting through the transformer 28 induces potential variations of opposite sign on the grids 7 and 8. As a result, an impulse will flow from the plate 5 through the primaries of transformer 21 to the plate 6, but since the conductivity of the two tubes, is substantially the same, no change in the current flow through the common conductor 16 occurs. The impulse is, therefore, not repeated to the feed back circuit 27. When, however, signal variations occur in the circuit 13 the conductivity of one tube is increased and that of the other tube is decreased, thereby unbalancing the circuit so that an impulse originating in the feed back connection 27 will produce an impulse in the common conductor 16, thereby being again repeated to the circuit 27, so that oscillations are set up in the system whose amplitude depends upon the degree of unbalance produced by the signal variations. The oscillations are then transmitted through the transformer 21 to the outgoing circuit 20.

A still further modification is illustrated in figure 3 which differs from that of Figure 1 in that the connections of the feed back conductor 22 to the input and output circuits respectively are reversed. In Figure 3 the feed back circuit 22 is directly connected to the common path 16 of the output circuits, so that said circuits are in parallel with respect thereto, while said circuit 22 is connected to the common path 9 of the input circuits through a winding 30 of a transformer arrangement having windings 31 and 32 included in the individual paths 10 and 11 of the input circuits. Coils 31 and 32 are oppositely wound so that the input circuits are differentially connected with respect to the feed back circuit. The outgoing circuit 20 may be associated with the output circuits in the same manner as in Figure 2, but as shown is associated therewith by means of a transformer 33, the primary of which is included in the common conductor 16 of the output circuits.

Normally no oscillations are set up in the system, as an impulse originating in the feed back circuit 22 produces an impulse in the output circuits which tends to flow from the plate of one tube to the plate of the other tube without producing any effect in the common conductor 16. When, however, the system is unbalanced by an increase in the conductivity of one tube and a decrease in the other produced by a signal variation in the circuit 13, oscillatory currents flow in the common path 16 in proportion to the degree of unbalance, so that oscillations having an amplitude determined by that of the signal variations are set up in the system and transmitted through the transformer 33 to the outgoing circuit 20.

By means of the circuits above described an oscillatory vacuum tube system may be so controlled by a modulating signal wave as to produce oscillations whose amplitude is substantially directly proportional to the amplitude of the modulating waves.

Furthermore, it will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated, without departing from the spirit of the invention as defined in the following claims:

What is claimed is:

1. In a signaling system an oscillating vacuum tube arrangement, means normally preventing the generation of oscillations by said arrangement, and means responsive to modulating signal waves for setting up oscillations the amplitude of which is at all times substantially proportional to that of the controlling waves.

2. In a signaling system a vacuum tube arrangement having input and output circuits, an oscillatory feed back connection between said input and output circuits which is normally balanced with respect to said circuits so that no oscillations are produced, and means controlled by modulating waves for disturbing the balance of said circuits.

3. In a signaling system, a pair of variable impedance elements, input and output circuits for each impedance element, oscillatory feed back connections between said input and output circuits normally balanced with respect to said circuits, so that no oscillations are produced and means to vary the impedance of said impedance elements in such a manner as to disturb said balance.

4. In a signalling system, a duplex translating arrangement including a pair of conductive evacuated gaps, input circuits for controlling the conductivity of said gaps,

output circuits for said gaps, oscillatory feed back connections between said input and output circuits normally balanced with respect to said circuits, and means to impress modulating variations upon said input circuits to vary the conductivity of said gaps in such a manner as to disturb said balance.

5. In a signalling system, a duplex translating arrangement including a pair of conductive evacuated gaps, output circuits associated with said gaps, controlling electrodes for determining the conductivity of said gaps, input circuits associated with said controlling electrodes, oscillatory feed back connections between said input and output circuits normally balanced with respect to said circuits, and means to impress modulating variations upon said input circuits to vary the conductivity of said gaps in such a manner as to disturb said balance.

6. In a signaling system, a translating arrangement including a pair of vacuum tubes each including a filament, an anode and a controlling electrode, output circuits connecting said filaments and anodes, input circuits connecting said filaments and controlling electrodes, oscillatory feed back connections between said input and output circuits normally balanced with respect thereto, and means to impress modulating variations upon said input circuits in such a manner as to disturb said balance.

7. In a signaling system, a translating arrangement including a duplex vacuum tube structure, a pair of input circuits and a pair of output circuits associated with said structure, an oscillatory feed back connection interlinking said pairs of circuits so that the one pair will be in parallel with respect thereto and the other pair differential with respect thereto and means to impress signal variations upon said input circuit in such a manner as to set up oscillations over said feed back connection.

In testimony whereof, I have signed my name to this specification this 7th day of October 1918.

JOHN R. CARSON.