J. R. CARSON.

TRANSLATING CIRCUITS.

APPLICATION FILED OCT. 10, 1918.

1,418,285. Patented June 6, 1922.

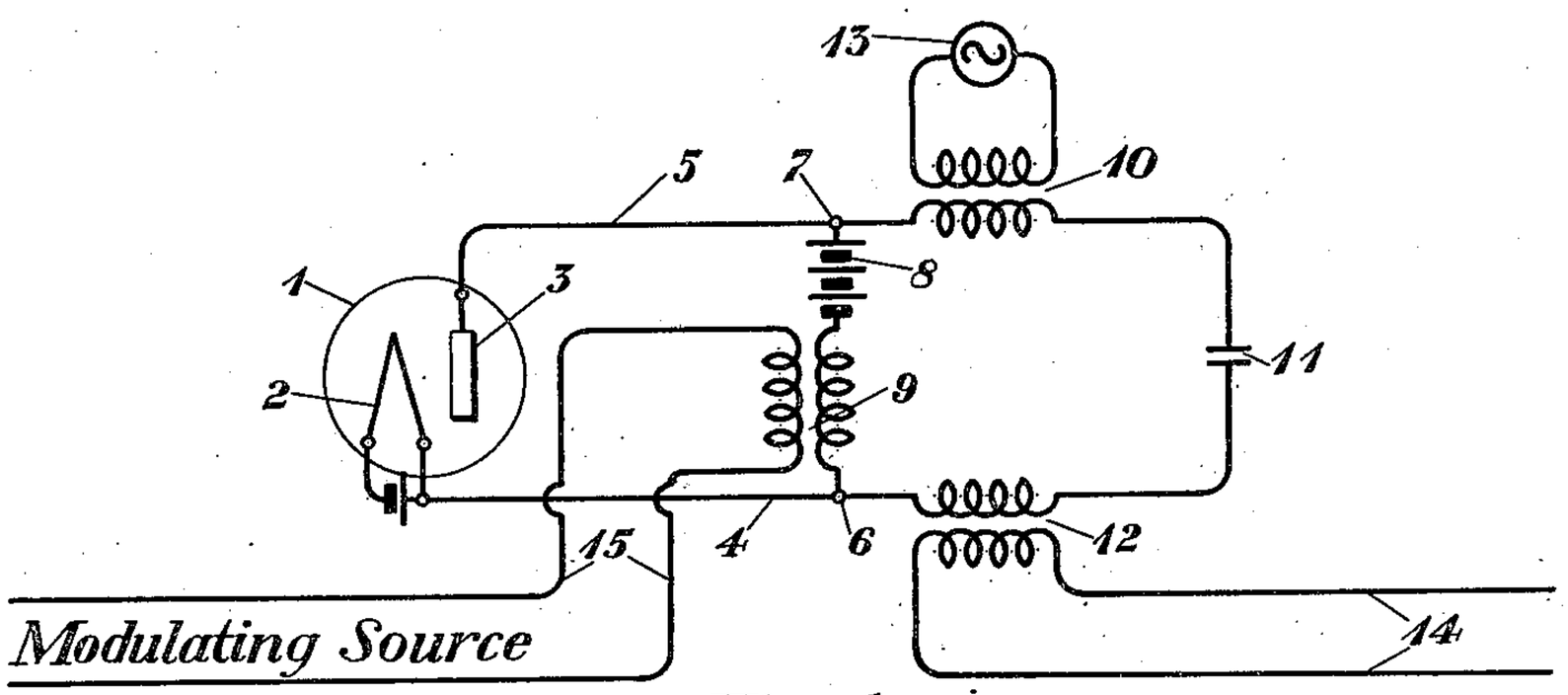

Fig. 1

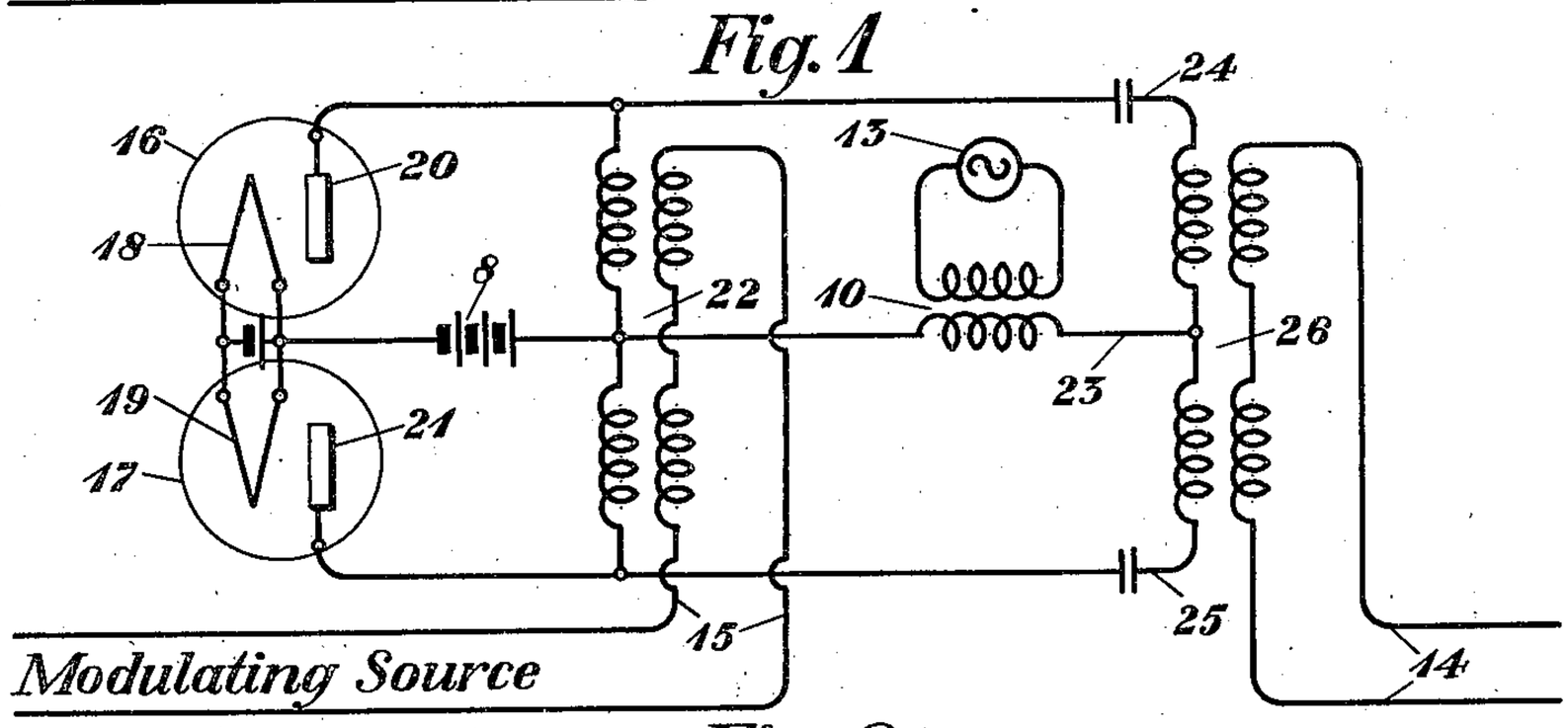

Fig. 2

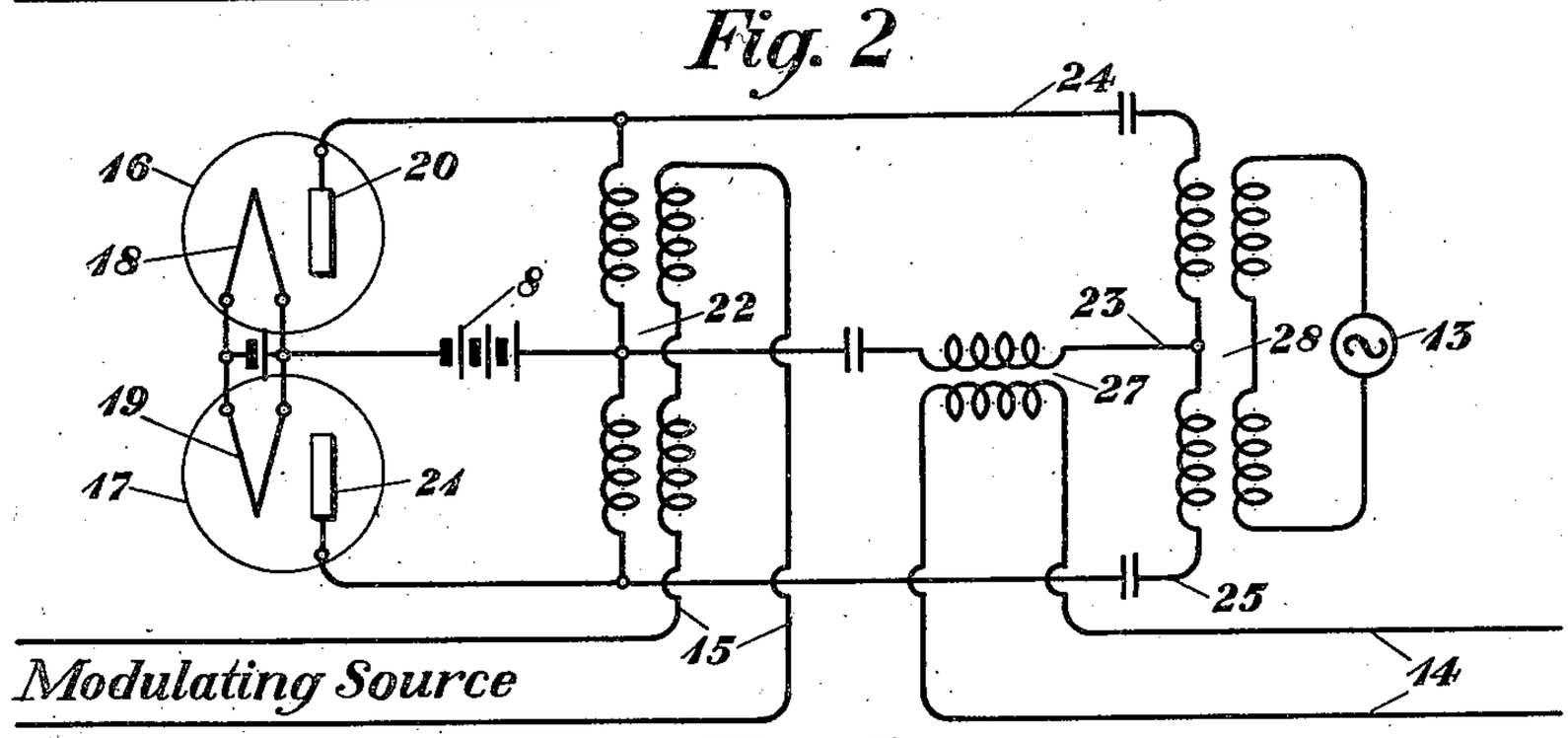

Fig. 3

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TRANSLATING CIRCUIT.

1,418,285. Specification of Letters Patent. Patented June 6, 1922.

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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 carrier currents are employed for the transmission of signals.

The invention has for one of its objects the provision of a translating arrangement for modulating high frequency oscillations, the modulating means comprising a two element vacuum tube or other equivalent device having unilateral conductivity. Another object of the invention is to provide an arrangement of this character capable of use either as a modulator of high frequency oscillations in accordance with signal waves, or as a modulating detector for detecting, in accordance with the homodyne or heterodyne system of receiving, modulated high frequency oscillations transmitted from a distant station. Still another object of the invention has reference to the provision of a translating arrangement of the character just described in which the unmodulated oscillations are ineffective upon the outgoing transmission circuit when the variable modulating source is inactive, so that when the arrangement is used as a modulator, the amplitude of the transmitted oscillations will be directly proportional to the amplitude of the modulating waves.

Other and further objects of the invention will be apparent from the detailed description of the invention hereinafter given.

The invention may now be more fully understood from the following description thereof when read in connection with the accompanying drawing, Figures 1, 2 and 3 of which represent three different diagrammatic embodiments of the invention.

Referring to Figure 1, a translating device is shown consisting of a two element vacuum tube 1, having a heated filament 2, and an anode or plate 3. A circuit comprising conductors 4 and 5 is associated with the filament and plate of said tube, and at points 6 and 7 said circuit divides, one path continuing through a source of direct current 8 and the secondary of a transformer 9, and the other path including the secondary of a transformer 10, a condenser 11 and the primary of a transformer 12. A source of unmodulated high frequency oscillations 13 is associated with the latter path by means of the transformer 10, while an outgoing transmission circuit 14 is associated with said path by means of the transformer 12. A source of modulating waves 15 is associated with said first mentioned path by means of the transformer 9.

The modulating waves supplied over the circuit 15 may be either low frequency signaling waves or high frequency oscillations modulated by means of a signal and transmitted from a distant station, depending upon whether the arrangement is to be used for modulating high frequency oscillations in accordance with the signal, or for detecting modulated high frequency oscillations transmitted from a distant station. If the arrangement is to be used for the former purpose, the operation is as follows:

Oscillations from the source 13 and low frequency signaling waves from the circuit 15 are impressed upon the circuit of the tube 1 through the transformers 10 and 9 respectively. Owing to the fact that the tube has a nonlinear characteristic, with a predominant first curvature, the high frequency oscillations from the source 13 are modulated by the tube in accordance with the signal waves from the circuit 15, and modulated high frequency oscillations are, therefore, transmitted through the transformer 12 to the outgoing circuit 14.

When the arrangement is to be used as a modulating detector in accordance with the homodyne or heterodyne principle of receiving, the high frequency oscillations modulated by means of signal waves at a distant station are received over the circuit 15, and are impressed upon the tube 1 through the transformer 9. High frequency oscillations from the source 13 are also impressed upon the tube through the transformer 10. If the heterodyne system of receiving is employed, the frequency of the source 13 will be slightly different from that received over the circuit 15, so that waves of beat frequency will be transmitted through the transformer 12 to the outgoing circuit 14. Where the homodyne system of receiving is employed, the frequency of the source 13 will be equal to that of the high frequency modulated oscillations received in the cir-

cuit 15, in which case variable low frequency waves corresponding to the signal by which the high frequency oscillations were modulated at the distant station, will be transmitted through the transformer 12 to the outgoing circuit 14.

Where it is desired to prevent the source of unmodulated high frequency oscillations from affecting the outgoing circuit, except when the modulating source is active, an arrangement such as illustrated in Figure 2 may be employed. In this arrangement two vacuum tubes 16 and 17 are shown, having filaments 18 and 19, and anodes or plates 20 and 21 respectively. A source of direct current 8 has one terminal connected to the filaments 18 and 19, and the other terminal is connected in parallel to the plates 20 and 21 through the secondary windings of a transformer arrangement 22 through which the circuit 15 is associated with the tubes 16 and 17. A source of high frequency oscillations 13 is associated by means of a transformer 10 with the common path 23 of two parallel circuits 24 and 25, said parallel circuits being connected to the plates 20 and 21, and including the primary windings of a transformer arrangement 26, whereby an outgoing circuit 14 is associated with the tubes 16 and 17.

This arrangement is such that when the modulating source associated with circuit 15 is inactive, oscillations from the source 13 are ineffective upon the outgoing circuit 14, since the source of oscillations is applied to a bridge circuit which is balanced with respect to the outgoing circuit. When however, waves from the circuit 15 are applied to the tubes 16 and 17, the balance is disturbed, and oscillations will be transmitted through the transformer 26 to the circuit 14, having an amplitude proportional to the degree of the disturbance produced by the waves from the circuit 15. If, therefore, the circuit 15 be associated with a source of low frequency signaling waves, the high frequency oscillations from the source 13 will be modulated in accordance with said waves by means of the tubes 16 and 17, and modulated high frequency oscillations will be transmitted through the transformer 26 to the circuit 14, the amplitude of said oscillations being directly proportional to the amplitude of the modulating signaling waves.

Where the arrangement is to be used as a modulating detector, modulated high frequency oscillations will be received from the circuit 15, and transmitted through the transformer 22 to the tubes 16 and 17. Oscillations from the source 13 will interact with the received oscillations in the tubes 16 and 17 and low frequency signals will be transmitted through the transformer 26 to the circuit 14. These low frequency signal waves will be of beat frequency where the apparatus functions in accordance with the heterodyne principle, and where the homodyne principle is employed the waves will vary in amplitude and frequency in accordance with the original signaling wave by which the high frequency oscillations were modulated at the distant station.

An alternative arrangement is illustrated in Figure 3 which differs from that of Figure 2 in that the relative positions of the outgoing circuit 14 and the source of high frequency oscillations 13 have been interchanged with respect to the tubes 16 and 17. The outgoing circuit 14 is associated by means of a transformer 27 with the common branch 23 of the two parallel circuits 24 and 25, while the source of oscillations 13 is associated by means of a transformer arrangement 28 with the individual paths of said parallel circuits.

In accordance with this arrangement, the circuits are normally balanced so that oscillations from the source 13 are ineffective upon grid circuit 23, and consequently do not react upon the outgoing circuit 14. When the balance is disturbed by waves from the circuit 15, energy is transmitted to the circuit 14 in direct proportion to the amplitude of the disturbing waves. As in the case of the circuit arrangement of Figure 2, the circuit of Figure 3 may be employed either for modulating high frequency oscillations from the source 13 in accordance with low frequency signals impressed upon the circuit 15, or for the purpose of detecting high frequency modulated oscillations impressed upon the circuit 15 in accordance with either the homodyne or heterodyne principle of receiving.

By means of the circuit arrangement above described, a simple and yet efficient modulating arrangement is provided, which is quite flexible in its operation and is readily adapted to a considerable number of uses. It will also 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, a duplex translating device comprising two elements having unilateral conductivity, parallel circuits for each of said elements having common branches connected to said elements, a source of unmodulated oscillations and an outgoing circuit associated with one pair of said parallel circuits, and a source of variable oscillations associated with the other pair of parallel circuits.

2. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, and each including a heated filament and an anode,

parallel circuits for each of said elements having common branches connected to the filaments and anodes of said elements, a source of unmodulated oscillations and an outgoing circuit associated with one pair of parallel circuits, and a source of variable oscillations associated with the other pair of parallel circuits.

3. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, parallel circuits for each of said elements having common branches connected to said elements, a source of unmodulated oscillations and an outgoing circuit associated with one pair of said parallel circuits, and a source of modulating signal waves associated with the other pair of parallel circuits.

4. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, and each including a heated filament and an anode, parallel circuits for each of said elements having common branches connected to the filaments and anodes of said elements, a source of unmodulated oscillations and an outgoing circuit associated with one pair of parallel circuits, and a source of modulating signal waves associated with the other pair of parallel circuits.

5. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, parallel circuits for each of said elements having common branches connected to said elements, a source of unmodulated oscillations and an outgoing circuit associated with one pair of said parallel circuits, and a source of variable oscillations associated with the other pair of parallel circuits, and connections between said sources, said outgoing circuit and said input and output circuits whereby said first mentioned source produces no effect upon said outgoing circuit when said second mentioned source is inactive.

6. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, and each including a heated filament and an anode, parallel circuits for each of said elements having common branches connected to the filaments and anodes of said elements, a source of unmodulated oscillations and an outgoing circuit associated with one pair of parallel circuits, and a source of variable oscillations associated with the other pair of parallel circuits, and connections between said sources, said outgoing circuit and said input and output circuits whereby said first mentioned source produces no effect upon said outgoing circuit when said second mentioned source is inactive.

7. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, parallel circuits for each of said elements having common branches connected to said elements, a source of unmodulated oscillations and an outgoing circuit associated with one pair of said parallel circuits, and a source of modulating signal waves associated with the other pair of parallel circuits, and connections between said sources, said outgoing circuit and said input and output circuits whereby said first mentioned source produces no effect upon said outgoing circuit when said second mentioned source is inactive.

8. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, and each including a heated filament and an anode, parallel circuits for each of said elements having common branches connected to the filaments and anodes of said elements, a source of unmodulated oscillations and an outgoing circuit associated with one pair of said parallel circuits and a source of modulating signal waves associated with the other pair of parallel circuits, and connections between said sources, said outgoing circuit and said input and output circuits whereby said first mentioned source produces no effect upon said outgoing circuit when said second mentioned source is inactive.

9. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, circuits for said unilateral elements, said circuits including individual branches and a common branch, a source of unmodulated oscillations and a source of variable oscillations, one of said sources being associated with the common branch of said circuits and the other circuit being associated with the individual branches thereof, and an outgoing circuit associated with said translating device.

10. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, each element including a heated filament and an anode, circuits for said elements having a common branch and individual branches, the common branch being connected to said filaments and the individual branches being connected to said anodes, a source of unmodulated oscillations and a source of variable oscillations, one of said sources being associated with the common branch and the other source being associated with said individual branches, and an outgoing circuit associated with said translating device.

11. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity, circuits for said elements, said circuits having a common branch and individual branches, a source of modulated oscillations and a source of modulating signal waves, one of said sources being associated with said common branch and the other source being associated with

said individual branches, and an outgoing circuit associated with said device.

12. In a signaling system, a duplex translating device comprising two elements having unilateral conductivity and each including a heated filament and an anode, circuits for each of said elements, said circuits having a common branch and individual branches, a source of unmodulated oscillations and a source of modulating signal waves, one of said sources being associated with said common branch and the other source being associated with said individual branches, and an outgoing circuit associated with the said device.

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

JOHN R. CARSON.