Aug. 7, 1923. 1,463,795

J. R. CARSON

TRANSLATING CIRCUITS

Filed Oct. 10, 1918

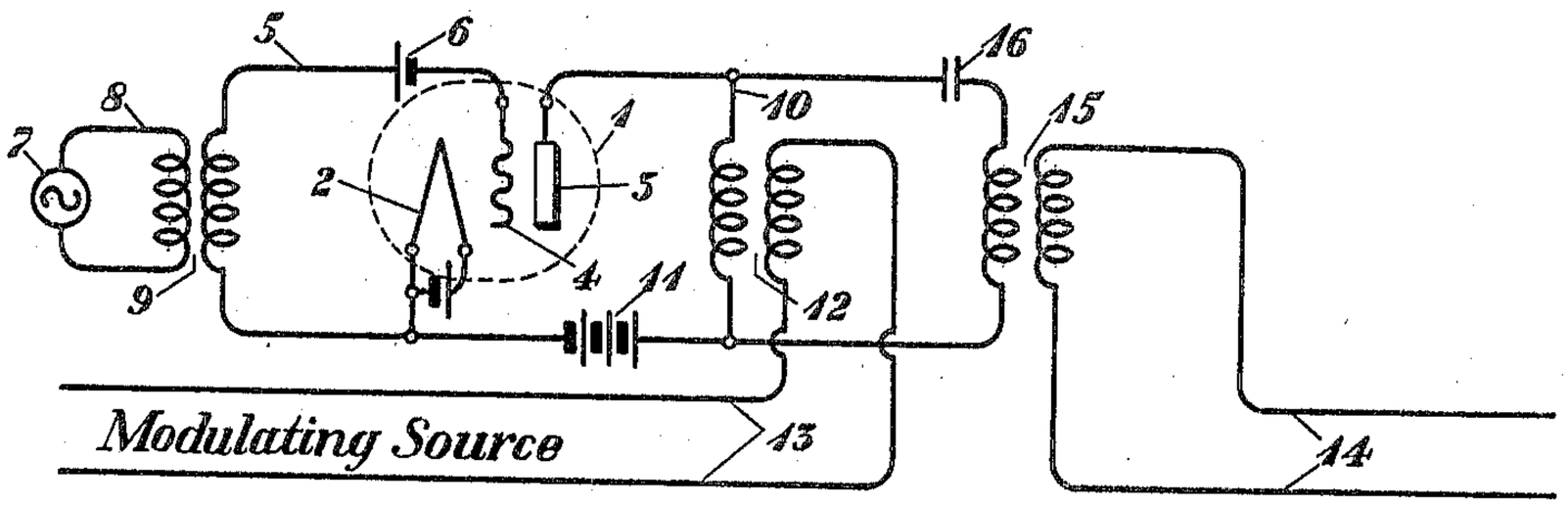

Fig. 1

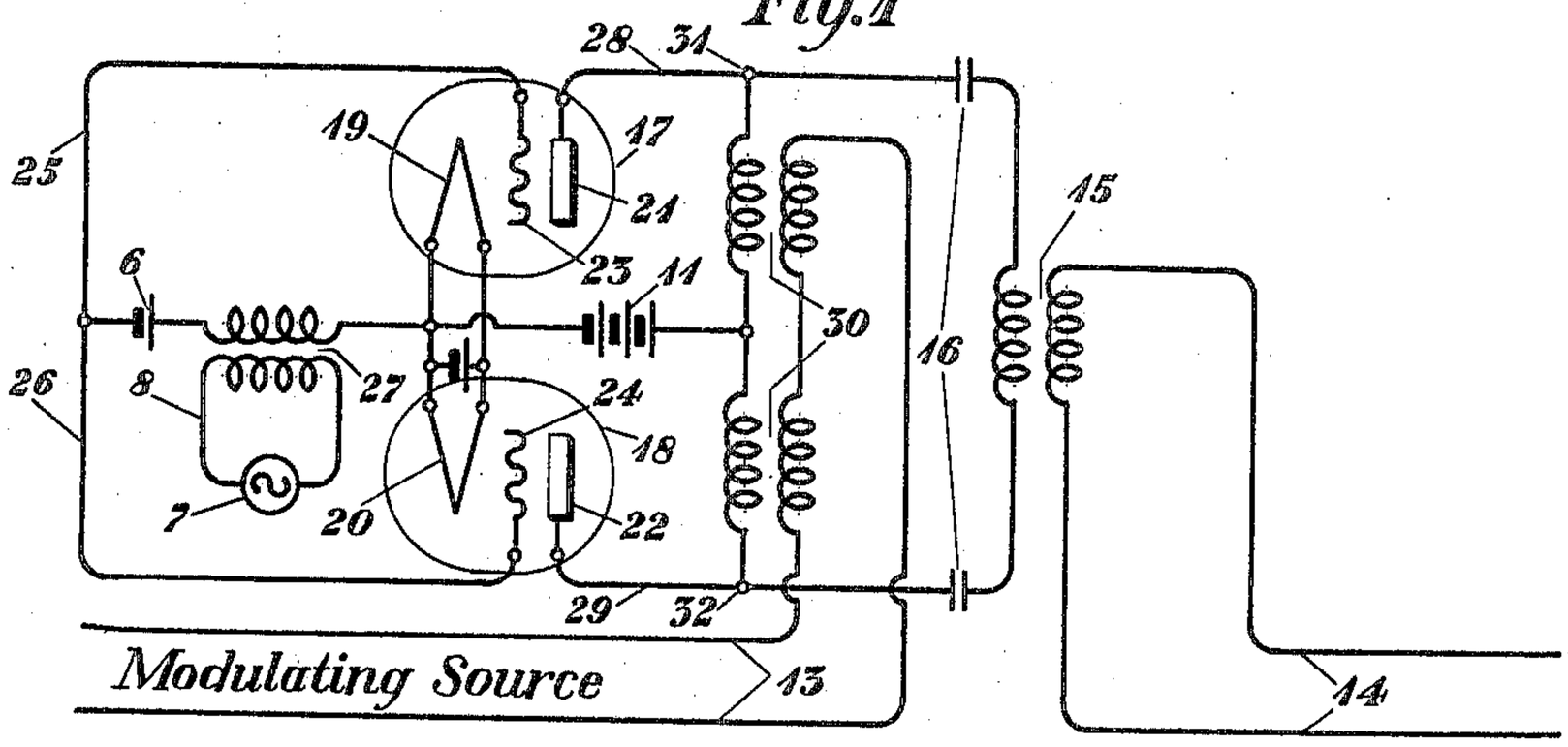

Fig. 2

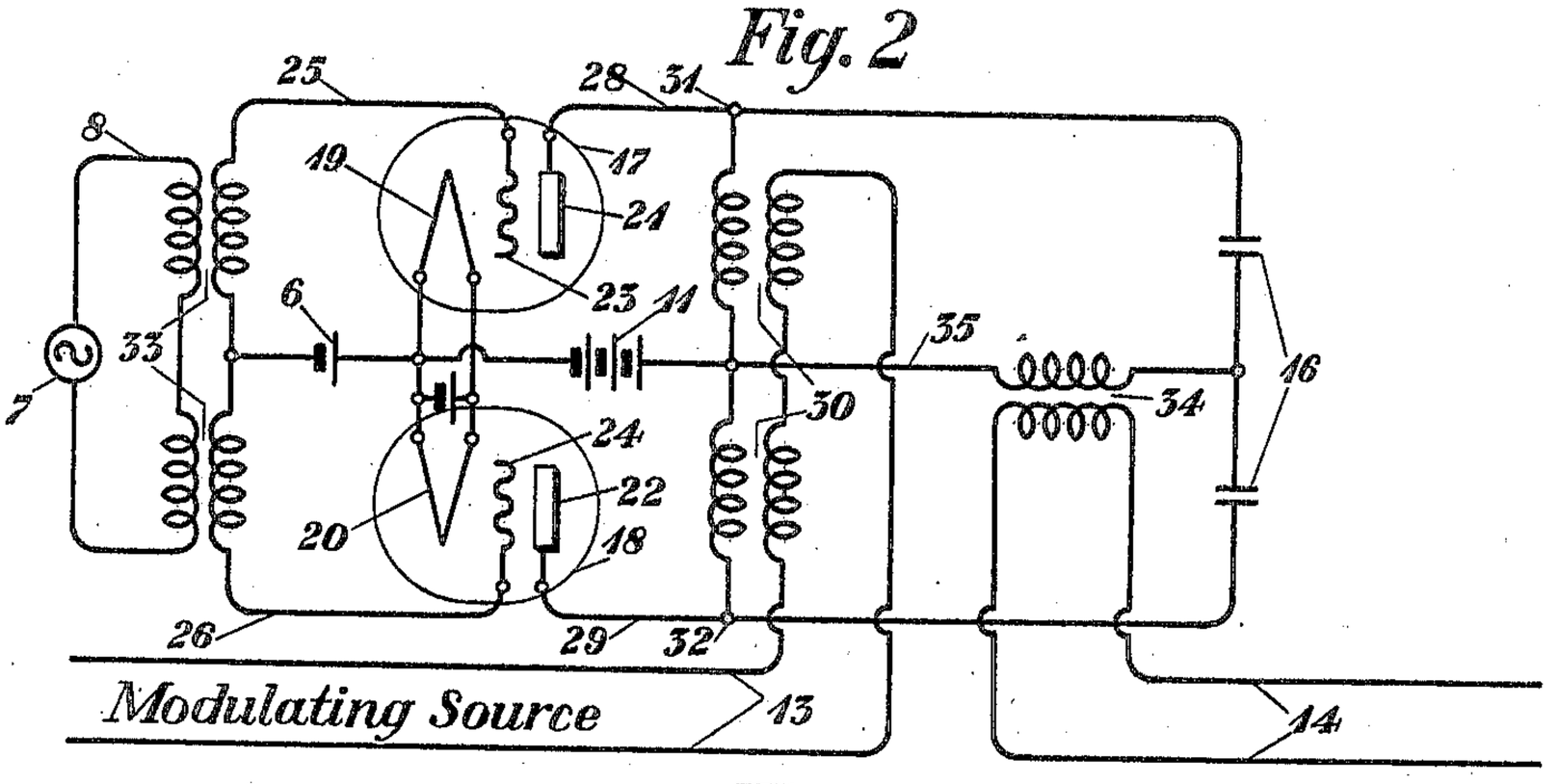

Fig. 3

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UNITED STATES PATENT OFFICE.

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TRANSLATING CIRCUIT.

Application filed October 10, 1918. Serial No. 257,653.

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 circuits, and more particularly to signaling circuits of the type in which carrier currents are employed for the transmission of signals.

One of the objects of the invention is to provide a translating arrangement in which unmodulated high frequency oscillations are applied to the input circuit of the arrangement and variable oscillations are applied to the output circuit. Another object of the invention has reference to the provision of a translating arrangement such as just described, which is capable of use either for modulating high frequency oscillations in accordance with signal variations, or for detecting the signals transmitted by high frequency carrier oscillations, by the interaction of the modulated oscillations with a local source of oscillations in accordance with the heterodyne or homodyne principle of receiving. A further object of the invention is to provide a translating system of this character in which the high frequency oscillations are ineffective upon the outgoing circuit when the variable source of oscillations is inactive, so that, when the translating arrangement is used for modulation, the amplitude of the modulated high frequency oscillations will be directly proportional to the amplitude of the modulating wave. Other and further objects of the invention will be clear from the detailed description hereinafter given.

The objects of the invention are secured as herein disclosed by providing a duplex translating arrangement consisting of two vacuum tubes, each having a filament, an anode and a controlling electrode or grid, although a single duplex tube in which the function of the two filaments is performed by a single filament may be used, if desired. Parallel input circuits are provided for the controlling electrodes, and parallel output circuits are provided for the anodes. The source of high frequency oscillations is applied to the input circuits and the modulating source, which may be either a source of low frequency signals or a source of high frequency modulated in accordance with signals, is connected to the output circuit. An outgoing circuit is also associated with the output circuits. These connections are made in such a manner that the unmodulated high frequency source produces no effect upon the outgoing circuit when the modulating source is inactive.

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

Referring to Figure 1, in which a simplified form of the invention is shown, 1 is a vacuum tube comprising a filament 2, anode 3 and grid or controlling electrode 4. The filament and grid are interconnected through a circuit 5 including a direct current source 6, for impressing a potential upon the grid of such character as to insure the most efficient operation of the tube. A source of high frequency oscillations 7 included in a local circuit 8 is coupled by means of a transformer 9 to the input circuit 5. An output circuit 10 connects the filament 2 and the plate 3, said circuit including a direct current source 11. Coupled to the output circuit 10 by means of a transformer 12 is a circuit 13 leading to a modulating source. An outgoing circuit 14 is also coupled to the output circuit by means of a transformer 15 connected in parallel with the transformer 12, the primary circuit of the transformer 15 having a condenser 16 in series therewith.

If the arrangement is to be used for modulating high frequency oscillations supplied by the source 7 in accordance with signal variations, the modulating source associated with the circuit 13 will be a source of signal waves and modulated high frequency oscillations will be impressed upon the outgoing circuit 14 due to the modulating action of the tube 1. If, however, the arrangement is to be used for detecting received oscillations which have been modulated in accordance with signals at a distant transmitting station, the received modulated oscillations will be impressed upon the circuit 13 and the local source of high frequency oscillations 7 will interact therewith in the tube 1 to impress upon the outgoing circuit detected signal waves corresponding to the signal waves

originating at the distant station. If the arrangement is to function as a detector in accordance with the homodyne principle of operation, the local source 7 will be of the same frequency as the carrier oscillations. If, on the other hand, the arrangement is to operate upon the heterodyne principle, the frequency of the source 7 will differ from that from the oscillations received from circuit 13 sufficiently to produce an audible beat frequency in the outgoing circuit 14.

Where it is desired to render the source of unmodulated high frequency oscillations ineffective with respect to the outgoing circuit when the modulating source is inactive, a duplex arrangement employing two tubes may be used as shown in Figure 2. In this figure, 17 and 18 represent two vacuum tubes provided with filaments 19, 20, anodes 21, 22, and grids 23 and 24 respectively. The input circuits 25 and 26 of the two tubes are connected in parallel, and if desired, a direct current source 6 may be included in a common branch of the input circuits to impress the desired normal potential upon the grids 23 and 24. The source of unmodulated high frequency oscillations 7 included in the local circuit 8 is coupled to the common branch of the input circuits through a transformer 27. The output circuits 28 and 29 are connected in parallel between the filaments and plates, a direct current source 11 being included in the common branch of said circuits. The circuit 13 leading to a modulating source is coupled to the output circuits through a transformer arrangement 30. The outgoing circuit 14 is also coupled to the output circuits through a transformer 15, the primary of which is connected in series with the anodes 21 and 22. Condensers 16 may also be included in series with the primary of the transformer 15.

Where the arrangement above described is to function as an arrangement for modulating high frequency oscillations, in accordance with low frequency signals, since the source 7 is connected in parallel to the grids 23 and 24, the conductivity of both tubes 17 and 18 will be affected alike, and normally points 31 and 32 will be at the same potential so that no effect is produced in the circuit 14. When, however, signal variations are received from circuit 13 the balance existing at points 31 and 32 is disturbed by said signal variations being transmitted through the transformer 30 and high frequency oscillations will be transmitted through the transformer 15 to the circuit 14, the amplitude of said oscillations depending upon and being substantially in direct proportion to the degree of unbalance existing between the points 31 and 32 due to the action of the transformer 30. Modulated high frequency oscillations whose amplitude is directly proportional to that of the wave received from the circuit 13 are therefore transmitted over the circuit 14.

Where the arrangement is to function as a detector, modulated high frequency oscillations received from a distant station are impressed upon the circuit 13. Normally the source 7 will be ineffective to produce any result on the circuit 14 for the same reasons as described in connection with the operation when the arrangement is used for modulating. When the modulated high frequency oscillations are transmitted through the transformer 30, however, the oscillations from the source 7 will interact therewith to produce in the circuit 14 low frequency signal waves corresponding to the signals produced at the distant transmitting station. Where the arrangement is used as a detector in accordance with the homodyne principle of operation, the source 7 should be of the same frequency as the received modulated high frequency oscillations. Where the heterodyne method of receiving is employed the frequency of the source 7 will differ from that of the received oscillations by an amount sufficient to cause an audible beat frequency to be impressed upon circuit 14.

A still further modification is shown in Figure 3 in which the connection of the high frequency source 7 and the outgoing circuit 14 with regard to the input and output circuits respectively is varied to the extent that the source 7 is connected in series with the grids and the circuit 14 in parallel with the plates of the vacuum tubes 17 and 18. As in Figure 2, the input circuits 25 and 26 are connected in parallel from the filaments to the grids. In order to couple the source 7 in series with the two grids, however, a transformer arrangement 33 is provided, the secondary winding of which is divided, one-half being included in circuit with each grid. The outgoing circuit 14 is coupled by means of a transformer 34 to a common conductor 35 of the output circuits 28 and 29, so that the output circuits are in parallel with respect to circuit 14.

When the arrangement just described is to function as a modulator of high frequency oscillations in accordance with low frequency signal waves, the high frequency source 7 impresses opposite charges upon the grids 23 and 24 so that the conductivity of one of the tubes increases while the other decreases. Normally high frequency oscillations, therefore, flow between plates 21 and 22 in series through the condensers 16 without producing any effect in the common branch 35. Consequently the high frequency oscillations are not transmitted through the transformer 34 to the circuit 14. When, however, low frequency impulses in the circuit 13 are impressed upon the output circuits through the trans-

former 30, the balanced condition of the circuit 35 is disturbed and high frequency oscillations flow in said circuit, the amplitude of said oscillations depending upon the amplitude of the waves in the circuit 13. These modulated high frequency oscillations are impressed through the transformer 34 upon the outgoing circuit 14, so that the latter circuit receives modulated high frequency oscillations whose amplitude is directly proportionate to the low frequency waves received from the circuit 13.

The operation of the apparatus as a modulating detector is quite similar, the modulated high frequency oscillations received from a distant station being impressed upon the circuit 13 so that through the interaction therewith of high frequency oscillations from the source 7 low frequency signal waves are impressed upon the circuit 14. Normally, however, the circuit 35 is balanced with respect to the source 7 so that no effect is produced upon the outgoing circuit 14.

By means of the arrangement above described, a simple and efficient translating arrangement is provided, capable of use either as a modulator for transmission purposes, or as a detector for receiving purposes. 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, a translating device, input and output circuits therefor, a source of unmodulated oscillations associated with the said input circuit, a transformer in said output circuit, a source of variable oscillations inductively associated with said output circuit through said transformer, and an outgoing circuit associated with said translating device.

2. In a signaling system, a translating device comprising a vacuum tube including a filament, anode, and controlling electrode, an input circuit connected to said controlling electrode, an output circuit connected to said anode, a source of unmodulated oscillations associated with said input circuit, a transformer in said output circuit, a source of variable oscillations inductively associated with said output circuit through said transformer, and an outgoing circuit associated with said tube.

3. In a signaling system, a modulating device, input and output circuits therefor, a source of unmodulated oscillations associated with said input circuit, a transformer in said output circuit, a source of modulating signal waves inductively associated with said output circuit through said transformer, and an outgoing circuit associated with said output circuit.

4. In a signaling system, a modulating device comprising a vacuum tube, including a filament, anode, and controlling electrode, an input circuit connected with said controlling electrode, an output circuit connected with said anode, a source of unmodulated oscillations associated with said input circuit, a transformer in said output circuit, a source of modulating signal waves inductively associated with said output circuit through said transformer, and an outgoing circuit associated with said output circuit.

5. In a signaling system, a duplex translating device, a pair of controlling input and a pair of controlled output circuits therefor, a source of unmodulated oscillations associated with said input circuits, a source of variable oscillations associated with said output circuits, and an outgoing circuit associated with said translating device.

6. In a signaling system, a duplex translating device comprising a pair of vacuum tubes, each including a filament, anode and controlling electrode, an input circuit connected with each of said controlling electrodes, an output circuit connected with each of said anodes, a source of unmodulated oscillations associated with said input circuits, a source of variable oscillations associated with said output circuits, and an outgoing circuit associated with said tubes.

7. In a signaling system, a duplex modulating device, a pair of controlling input and a pair of controlled output circuits therefor, a source of unmodulated oscillations associated with said input circuits, a source of modulating signal waves associated with said output circuits, and an outgoing circuit associated with said output circuits.

8. In a signaling system, a duplex modulating device comprising a pair of vacuum tubes each including a filament, an anode and a controlling electrode, input circuits connected with each of said controlling electrodes, output circuits connected with each of said anodes, a source of unmodulated oscillations associated with said input circuits, a source of modulating signal waves associated with said output circuits, and an outgoing circuit associated with said output circuits.

9. In a signaling system a duplex translating device, a pair of input and a pair of output circuits therefor, a source of unmodulated oscillations assoeiated with said input circuits, a source of variable oscillations associated with said output circuits, and an outgoing circuit associated with said translating device, 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.

10. In a signaling system, a duplex translating device comprising a pair of vacuum tubes, each including a filament, anode and controlling electrode, an input circuit connected with each of said controlling electrodes, an output circuit connected with each of said anodes, a source of unmodulated oscillations associated with said input circuits, a source of variable oscillations associated with said output circuits, and an outgoing circuit associated with said tubes, 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.

11. In a signaling system, a duplex modulating device, a pair of input and a pair of output circuits therefor, a source of unmodulated oscillations associated with said input circuit, a source of modulating signal waves associated with said output circuits, and an outgoing circuit associated with said output 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.

12. In a signaling system, a duplex modulating device comprising a pair of vacuum tubes each including a filament, an anode and a controlling electrode, input circuits connected with each of said controlling electrodes, output circuits connected with each of said anodes, a source of unmodulated oscillations associated with said input circuits, a source of modulating signal waves associated with said output circuits, and an outgoing circuit associated with said output 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.

13. In a signaling system, a translating device, input and output circuits therefor, a source of unmodulated oscillations associated with said input circuit, a transformer bridge across said output circuit, a source of variable oscillations bridged across said output circuit through said transformer and an outgoing circuit associated with said translating device.

14. In a signaling system, a translating device comprising a vacuum tube including a filament, anode and controlling electrode, an input circuit connected with said controlling electrode, an output circuit connected with said anode, a source of unmodulated oscillations associated with said input circuit, a transformer bridged across said output circuit, a source of variable oscillations bridged across said output circuit through said transformer and an outgoing circuit associated with said tube.

15. In a signaling system, a modulating device, input and output circuits therefor, a source of unmodulated oscillations associated with said input circuit, a transformer bridged across said output circuit, a source of modulating signal waves bridged across said output circuit through said transformer and an outgoing circuit associated with said output circuit.

16. In a signaling system, a modulating device comprising a vacuum tube including a filament, anode and controlling electrode, an input circuit connected with said controlling electrode, an output circuit connected with said anode, a source of unmodulated oscillations associated with said input circuit, a transformer bridged across said output circuit, a source of modulating signal waves bridged across said output circuit through said transformer and an outgoing circuit associated with said output circuit.

17. In a signaling system, a translating device, input and output circuits therefor, said output circuit comprising a conductive path internal to said translating device and a conductive path external thereto, the entire conductive path external to the translating device being non-evacuated, a source of unmodulated oscillations associated with said input circuit, a source of variable oscillations associated with said output circuit, and an outgoing circuit associated with said translating device.

18. In a signaling system, a translating device comprising a vacuum tube including a filament anode and controlling electrode, an input circuit connected to said controlling electrode, an output circuit connected to said anode, said output circuit comprising a conductive path internal to said tube and a conductive path external to said tube, the entire conductive path external to the tube being non-evacuated, a source of unmodulated oscillations associated with said input circuit, a source of variable oscillations associated with said output circuit, and an outgoing circuit associated with said tube.

19. In a signaling system, a modulating device, input and output circuits therefor, said output circuit comprising a conductive path internal to said modulating device and a conductive path external to said device, the entire conductive path external to said modulating device being non-evacuated, a source of unmodulated oscillations associated with said input circuit, a source of modulating signal waves associated with

said output circuit, and an outgoing circuit associated with said output circuit.

20. In a signaling system, a modulating device comprising a vacuum tube including a filament anode and controlling electrode, an input circuit connected with said controlling electrode, an output circuit connected with said anode, said output circuit comprising a conductive path internal to said tube, and a conductive path external thereto, the entire conductive path external to said tube being non-evacuated, a source of unmodulated oscillations associated with said input circuit, a source of modulating signal waves associated with said output circuit, and an outgoing circuit associated with said output circuit.

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

JOHN R. CARSON.