

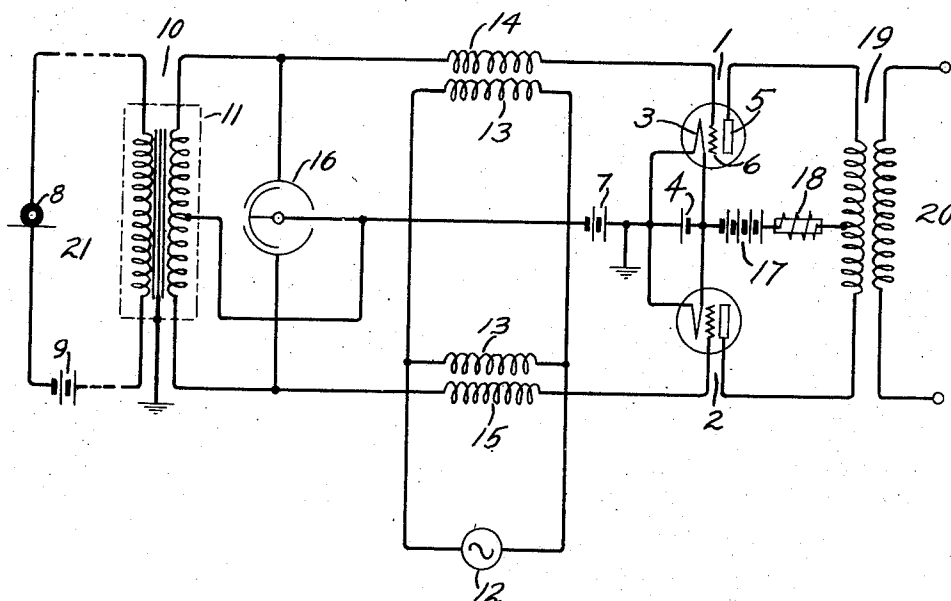
Jan. 12 , 1926.

1,568,963

R. E. CORAM

TRANSLATING APPARATUS

Filed May 17, 1923



Inventor:
Roy E. Coram
by E. W. Griggs Att'y.

UNITED STATES PATENT OFFICE.

ROY E. CORAM, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

TRANSLATING APPARATUS.

Application filed May 17, 1923. Serial No. 639,680.

To all whom it may concern:

Be it known that I, ROY E. CORAM, a citizen of the United States of America, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Translating Apparatus, of which the following is a full, clear, concise, and exact description.

This invention relates to translating apparatus such as modulators employed in high frequency carrier current and radio signaling systems.

The invention has among its objects:

To provide a highly efficient modulator.

To provide a modulator wherein the full force of the high frequency carrier or radio oscillations is applied to the control electrode thereof.

To provide a balanced modulator of the electronic valve type wherein the control electrodes thereof are maintained at the optimum potential for modulation with less high frequency input energy.

Modulators of the electronic valve type with only a single valve or two valves in balanced relation are employed in carrier current or radio telephone and telegraph systems. Speech frequency currents, telegraph currents or other signaling currents impressed upon the modulator interact therein with high frequency oscillations supplied thereto and cause the modulator to deliver modulated high frequency oscillations.

The modulating current variations usually of low frequency, ordinarily originate on a line coupled to the modulator input through a transformer.

In order to prevent fluctuations of the capacity from the windings of such a transformer to ground, the core and containing case of the transformer are grounded. Thus this capacity to ground is stabilized.

In practice one terminal of the heated cathode or cathodes of such an electronic modulator is also grounded to prevent fluctuations in the capacity from the parts thereof to ground.

As heretofore employed, the source of high frequency oscillations has been coupled to the modulator input between the heated cathode or cathodes and the modulating current input transformer or other coupling.

It has been found that the capacity from the modulating current input coupling to ground and the capacity from the incoming line and the apparatus therein to ground forms an effective shunt to the control electrode circuit of the modulator, thus necessitating a greater amount of input energy to maintain the control electrode or electrodes at the optimum potential for modulating purposes.

This shunting effect increases with the frequency of the carrier or radio oscillations so that in high frequency carrier and radio systems an abnormal amount of input energy is required.

In accordance with the present invention the coupling for the source of high frequency oscillations to the modulator is located between the control electrode or electrodes thereof and the modulating current input coupling. Thus the full force of the source of high frequency oscillations is impressed upon the control electrode or electrodes of the modulator and the capacity to ground from the modulating current input coupling has no effect.

The invention is being illustrated as applied to a modulator having two electronic valves connected in balanced relation, but it is to be understood that it may be applied to other types of modulators and employed in other relations.

Referring to the drawing, a pair of three-electrode electronic valves 1 and 2 are provided. Each valve has a grounded cathode or filament 3, heated by current from a battery 4 or other source, an anode or plate 5 and a control electrode or grid 6. The valves are preferably similar and equal in structure and characteristics.

The input circuits of the two valves are arranged in parallel with respect to a battery 7 or other source which supplies negative polarizing potential to the control electrodes.

A source of modulating signal current variations, such as, for example, a transmitter 8 and a battery 9, is coupled to the input circuits by means of a transformer 10.

The transformer 10 is provided with a grounded case 11 to which the transformer core is connected. This construction stabilizes the capacity which exists between the transformer windings and ground.

A source of high frequency oscillations 12

is coupled to the individual paths of the input circuits by means of a four-winding transformer 13 whose primary windings in parallel are connected to the source 12.

5 One secondary winding 14 is located in the path individual to the input circuit of valve 1 between the control electrode thereof and the modulating current input transformer 10. The other secondary winding 15 is similarly connected in the individual path of the other valve input circuit. The primary windings of transformer 13 may, of course, be connected in series instead of parallel.

A variable condenser 16 whose rotor is connected to the conductor common to the two input circuits and whose stators are connected respectively to the conductors individual to the two input circuits provides a path of low impedance to the high frequency oscillations.

20 Condenser 16 is made variable so that the impedance of the individual paths of the input circuits may be varied to compensate for any difference in the characteristics of the two electronic valves whereby the output circuits may be maintained in balanced relation with respect to the carrier frequency oscillations.

Since the couplings, through which high frequency oscillations are supplied to the modulator, are connected in the conductors individual to the input circuits of the tubes and are located between their control electrodes and the modulating current input coil, the total electromotive force of the high frequency oscillations is impressed upon the control electrodes of the tubes. In this manner the effect of the capacity to ground of the windings of the transformer 10, in shunting the high frequency oscillations from the tubes, is eliminated.

The output circuits of the valves 1 and 2 are connected in parallel with respect to the battery 17 and an inductance coil 18 arranged in the common conductor of said output circuits. Each output circuit contains one-half of the primary winding of an output transformer 19 whose secondary is connected to an outgoing circuit 20.

50 Normally when no signal current variations are impressed upon circuit 21 the high frequency oscillations from source 12 acting through transformer 13 impress equal voltage variations of the same phase upon the control electrodes of the valves, thereby producing equal fluctuations of the same phase in the output circuits. Since the two halves of the primary winding of the output transformer 19 are wound in the same direction, the outgoing circuit 20 is differentially coupled to the two output circuits. The fluctuations, therefore, neutralize each other and produce no effect in the outgoing circuit. When, however, low frequency signal current variations from circuit 21 are im-

pressed upon the input circuits through transformer 10 the high frequency potential variations are augmented upon one control electrode and decreased upon the other, producing correspondingly augmented fluctuations in one output circuit and correspondingly reduced fluctuations in the other. The fluctuations in the output circuits are, therefore, no longer balanced and consequently oscillations are produced in the outgoing circuit 20 which have an amplitude proportionate to the instantaneous values of the low frequency modulating current variations incoming from circuit 21.

The balanced modulator illustrated constitutes a duplex translating apparatus wherein the carrier frequency currents are suppressed and currents of frequencies within the side bands are delivered to the outgoing circuit.

A modulator embodying this invention is highly efficient because the optimum control electrode potential can be maintained with only approximately ten per cent of the input energy required in modulators wherein the source of high frequency oscillations is coupled to the common branch of the input circuits.

The invention set forth herein is, of course, susceptible to various other embodiments and adaptations.

The invention claimed is:

1. The combination of an electronic valve modulator having a grounded heated cathode, an anode and a control electrode, an input circuit connected to the cathode and control electrode, means to couple the source of low frequency modulating currents to the input circuit, said coupling means having a capacity to ground in parallel with the path between the control electrode and cathode, a source of high frequency oscillations coupled to the input circuit, said last mentioned coupling means being located between the control electrode and the first mentioned coupling means.

2. A translating apparatus comprising a duplex translating arrangement, parallel circuits for said translating arrangement including a common path and individual paths, conductive evacuated gaps in said individual paths, means to couple a source of low frequency modulating signal current variations to the individual paths, said means having capacity to ground, and means to couple a source of high frequency oscillations to the individual paths, said last mentioned coupling means being so located as to be independent of the shunting effect of said capacity.

3. The combination of a modulator having two electronic valves, each having a grounded heated filament, an anode and a control electrode, parallel input circuits for the valves including a common path con-

5 nected to the grounded cathodes and individual paths connected to the respective control electrodes, a source of low frequency modulating signal current variations coupled to the individual paths, and means to couple a source of high frequency oscillations to the individual paths, said coupling means being located between the control electrodes and the modulating current coupling means.

10 4. The combination of a modulator having two electronic valves, each having a grounded heated filament, an anode and a control electrode, parallel input circuits for the valves including a common path connected to the grounded cathodes and individual paths connected to the respective control electrodes, a source of low frequency modulating signal current variations coupled to the individual paths, a source of high frequency oscillations, and a transformer whose primary is connected in circuit with the source of high frequency oscillations, said transformer having two secondary windings located respectively in the individual paths between the control electrode and the low frequency coupling means.

25

5. A modulator having a grounded element, an input circuit for said modulator including a low frequency transformer for impressing modulating currents thereon, and means for impressing a high frequency E. M. F. between points in said input circuit which lie between said transformer and that input terminal of said modulator electrically most remote from said grounded element whereby shunting from said modulator of high frequency current in consequence of the capacity to ground of said transformer is avoided.

30
35
40
In witness whereof, I hereunto subscribe my name this 27 day of March, A. D. 1923.

ROY E. CORAM.