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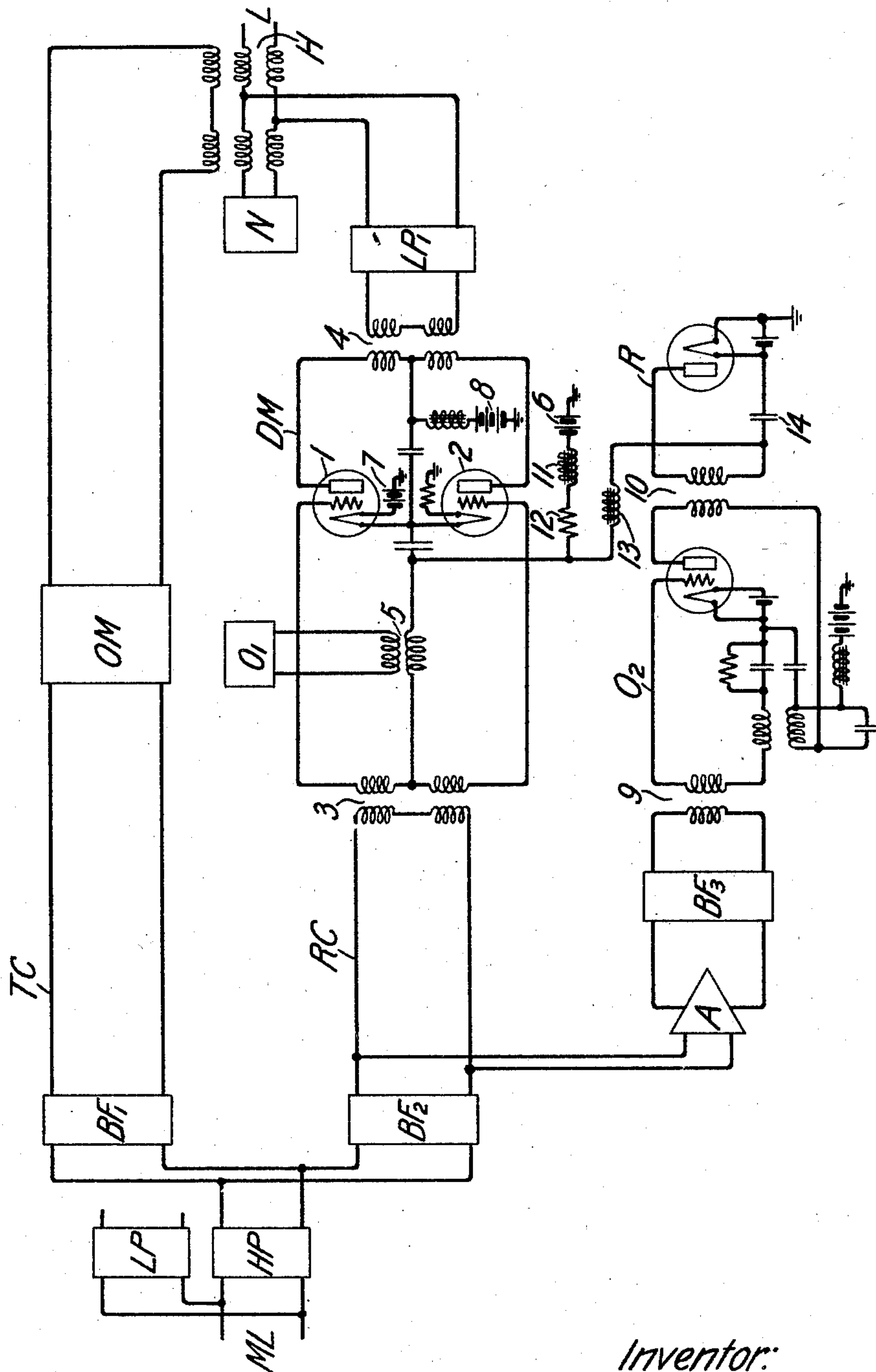
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A. C. DICKIESON

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ELECTRICAL SIGNALING

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Inventor:
Alton C. Dickieson.
by E. W. Griggs Attorney

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ALTON C. DICKIESON, OF BROOKLYN, NEW YORK, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

ELECTRICAL SIGNALING

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This invention relates to electrical signaling and particularly to carrier current telephony.

An object of the invention is to reduce distortion in carrier current telephone systems.

A specific object of the invention is to prevent crosstalk and other extraneous noise from entering the receiver of such a system when no signals are being received, thus producing the effect of a quiet line.

Another object of the invention is to control the operation of a thermionic oscillation generator from a distant point.

The invention is generally applicable to electrical signaling, but will be described in connection with its specific application to carrier telephone suppression systems. In certain types of carrier systems the unmodulated carrier component is suppressed at the transmitting terminal and only the side band is impressed upon the outgoing line. At the receiving terminal the incoming side band is combined in a demodulator with carrier current supplied by a local source, of the same frequency as that suppressed at the transmitting terminal, to reproduce the speech. Ordinarily, during a signaling interval the incoming speech is strong enough to overpower the noise in the subscriber's receiver, but during a pause in the incoming speech the crosstalk and other noise components continue to be detected and produce an unpleasant effect upon the subscriber's ear.

The present invention overcomes this difficulty by disabling the thermionic demodulator in the receiving circuit during intervals when no signals are being received so that no noise can enter the receiver at such time, and rendering the demodulator operative when a side band is received to permit the speech components to pass into the receiver. This is accomplished by blocking the demodulator by a large negative grid potential when no side band is being received. According to a feature of the invention this large negative grid potential is supplied to the demodulator by a control circuit including a space discharge tube oscillator which is adjusted to produce oscillations when no external current is impressed upon its input circuit.

When a side band is received from the distant terminal, however, a portion of the received current is impressed on the input circuit of the control oscillator, causing the oscillations to cease, thus unblocking the demodulator and permitting the speech to be detected.

A particular advantage of the invention is that it may be applied as a unit to existing carrier current signaling systems without otherwise changing the system, and requires no special supervision or maintenance.

The invention will be described in connection with its application to a single channel carrier current telephone system, but it will be understood that it may also be used for various other purposes in the electrical arts.

The drawing is a diagrammatic illustration of a single channel carrier current telephone system embodying the invention.

The drawing shows the east terminal of a single channel carrier current telephone system connected to the main transmission line ML. The usual west terminal, which is identical to the east terminal shown in the drawing, is omitted for the sake of simplifying the showing. The single channel system per se forms no part of the present invention, but may be similar to the system disclosed in the United States patent to Weis 1,602,019, October 5, 1926 or that disclosed in United States patent to Black 1,653,837, December 27, 1927.

The system, as illustrated, is composited for simultaneous low frequency and carrier current communication. This is accomplished by means of a carrier composite set comprising the low pass filter LP and the high pass filter HP. The filter LP is positioned in the voice frequency telephone branch, and the filter HP in the carrier current branch, of the transmission line. These filters serve to separate the currents corresponding to the frequencies used in their respective types of transmission. Obviously, the system could be used for carrier transmission only, in which case these filters could be eliminated.

The filters of the carrier composite set, described above, and each of the other filters

shown throughout the system, may be designed in accordance with the principles set forth in U. S. Patent No. 1,227,113 to G. A. Campbell, issued May 22, 1917.

5 The terminal circuits include a transmitting channel TC and a receiving channel RC. Carrier currents of different frequencies are utilized for transmission in opposite directions over the line ML, the currents transmitted from east to west being chosen of higher
10 frequency than the currents transmitted from west to east.

The transmitting channel TC includes a high frequency band filter BF_1 and an oscillator-modulator OM, while the receiving
15 channel RC includes a low frequency band filter BF_2 , a demodulator DM, an oscillator O_1 and a low pass filter LP_1 . The filters BF_1 and BF_2 serve to separate the directional
20 bands of frequencies to the respective terminal transmitting and receiving channels, the upper band of carrier frequencies being assigned to channel TC and the lower band of frequencies being assigned to channel RC.

25 The demodulator DM comprises a pair of space discharge tubes 1 and 2 connected in push-pull relation, having input circuits connected to the terminals of filter BF_2 by means of a transformer 3 and output circuits connected to the terminals of filter LP_1 by means
30 of transformer 4. The oscillator O_1 is coupled to the common branch of the balanced input circuits by means of a transformer 5. The usual sources of current 6, 7 and 8 are
35 provided to properly polarize the grid electrodes, to heat the filaments, and furnish anode-cathode current, respectively.

The low frequency line L, which may be an ordinary subscriber's telephone line, is associated with channel TC—RC for communication over the line ML with a similar low
40 frequency line at the distant terminal. The low frequency line L is provided with a balancing artificial line or network N and a differential repeating coil H, commonly
45 known as a hybrid coil, for enabling independent transmission in two directions between the line and the terminal circuits.

Voice frequency currents originating in the low frequency line L pass through the associated hybrid coil H into the oscillator-modulator OM where they are combined with carrier currents of the frequency assigned to channel TC. Of the components of modulation appearing in the output circuit of the oscillator-modulator OM, the high frequency band filter BF_1 suppresses all but one side band, for example the upper side band, which it transmits or passes to the transmission
50 line ML.
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The side band currents incoming from the distant terminal pass through the low frequency band filter BF_2 in the receiving channel RC, and are combined in the demodulator DM with carrier currents from the source
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O_1 . Voice frequency components of demodulation appearing in the output circuit of the demodulator DM are selectively transmitted by the low pass filter LP_1 and pass through hybrid coil H to the low frequency
70 line L.

The invention provides a control circuit for preventing crosstalk and other extraneous noise from passing through the demodulator DM into the low frequency line L during so-called quiescent intervals when no side band components are received from the line ML. The control circuit includes an amplifier A having its input circuit connected across the terminals of band filter BF_2 , an oscillator O_2
75 and a rectifier R. The output circuit of the amplifier A is coupled to the input circuit of the oscillator O_2 by means of a transformer 9, and may contain a band filter BF_3 . This filter is designed to transmit currents lying
80 within the frequencies of the incoming side band and is preferably more highly selective than the band filter BF_2 need be in order to prevent noise components from being impressed upon the oscillator. The output circuit of the oscillator O_2 is coupled to the rectifier R by means of transformer 10.
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The oscillator O_2 , as illustrated, is of the three-electrode space discharge type disclosed in the patent to Black, mentioned above, utilizing voltage variations fed back to the input circuit to impress on the control electrode a normal negative bias. The oscillator circuit is so adjusted and its constants so chosen that the energy fed back to the input circuit will produce oscillations when no current is impressed on the input circuit through the transformer 9. When a portion of the incoming side band is impressed upon the input circuit of the oscillator, however, the adjustment is disturbed and the oscillations cease. Any other suitable type of oscillator, properly adjusted, may be employed in place of that illustrated.
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When no side band is incoming from the distant terminal the oscillator O_2 is generating oscillations and impressing current through transformer 10 upon the input circuit of the rectifier R. The battery 6 supplies a negative biasing potential to the plate of the rectifier R as well as to the tubes of the demodulator DM. The alternating voltage impressed upon the input circuit of the rectifier R causes the plate to become positive during a portion of each positive half cycle. When the plate of the rectifier becomes positive with respect to the filament, the space between these electrodes becomes conducting and a unidirectional current flows between the filament and the plate. The direct current component of this current flows from grounded battery 6, through choke coil 11, high resistance 12, choke coil 13, secondary winding of transformer 10, plate and discharge path within the rectifier tube to the
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grounded filament. The condenser 14 provides a low impedance path for the alternating current in the rectifier circuit. This condenser is charged during the portion of the positive half cycles when the plate of the rectifier is positive, and is discharged through the path including choke coil 13, high resistance 12, choke coil 11, grounded battery 6 and the grounded filament of the rectifier tube when the plate is negative. As a result of this action a substantially steady direct current is maintained through the high resistance 12 when the oscillator O_2 is generating oscillations, that is, when no side band is incoming over the line. The current flowing through the high resistance 12, which is connected to the common branch of the input circuits of the demodulator DM, produces a voltage across this resistance which is high compared to the voltage of the battery 6 and is of the same polarity as the voltage of this battery. This has the effect of greatly increasing the negative biasing potential on the grids of the demodulator tubes 1 and 2, causing the grids to be so negative that no space current flows in the output circuits of these tubes. The demodulator is therefore blocked during the periods when no side band is incoming over the line ML. During such periods no noise can be transmitted through the demodulator to the low frequency line L, thus producing the advantageous effect of a quiet line.

When a side band, representing the carrier current modulated in accordance with speech, is received from the distant terminal, a portion of the incoming current is passed into the amplifier A and the amplified current is selectively transmitted by the band filter BF_3 and impressed upon the input circuit of the oscillator O_2 through the transformer 9. The current which is thus impressed upon the input circuit of the oscillator disturbs the adjustment of the oscillator and it therefore ceases to generate oscillations. Current thereupon ceases to flow in the circuit of rectifier R, and the biasing potential supplied to the grids of the demodulator tubes 1 and 2 through the high resistance 12 is returned to normal, thus unblocking the demodulator and permitting the signal to pass into the low frequency line L.

The invention is also susceptible of other modifications and adaptations not specifically referred to but included within the scope of the appended claims.

What is claimed is:

1. A signaling system comprising a current combining device, an incoming circuit connected to said device for impressing signals thereon, means for disabling said device when no signals are being received, and means responsive to signal variations in said incoming circuit to render said device operative.

2. A signaling system comprising a detector, and means including a space discharge tube responsive to incoming signals to block said detector when no signals are being received and to unblock said detector when signals are being received.

3. A signaling system comprising a space discharge device, a rectifier for blocking said device when no signals are being received, and means responsive to incoming signals to render said rectifier inoperative and thereby unblock said device.

4. A signaling system comprising a space discharge device, a rectifier for blocking said device when no signals are being received, an oscillator for supplying current to said rectifier, and means for impressing incoming signals upon said oscillator to render it inoperative and thereby unblock said device.

5. A signaling system comprising a space discharge device having a grid, means for impressing a biasing potential upon the grid of said device, means for increasing said grid biasing potential to block said device when no signals are being received, and means responsive to incoming signals to reduce said grid biasing potential to unblock said device.

6. A signaling system comprising a space discharge device having a grid, means for impressing a biasing potential upon said grid, an oscillator operative when no signals are received to increase said grid biasing potential, and means responsive to incoming signals to render said oscillator inoperative.

7. A signaling system comprising a space discharge device having a grid, a source of biasing potential for said grid, an oscillator operative to produce oscillations when no signals are received, means controlled by said oscillator for impressing upon said grid an increased biasing potential of the same polarity as that of said source, and means responsive to incoming signals to render said oscillator inoperative.

8. A signaling system comprising a space discharge device having a grid, a source of biasing potential for said grid, an oscillator operative to produce oscillations when no signals are received, a rectifier responsive to said oscillations for impressing upon said grid an increased biasing potential of the same polarity as that of said source, and means responsive to incoming signals to render said oscillator inoperative.

9. A carrier current signaling system comprising a circuit for receiving signal modulated carrier currents, a current combining device, a source of sustained carrier current adapted to be combined with the signal modulated currents in said device to reproduce the signal, means for disabling said device when no signal modulated currents are being received, and means responsive to incoming signal modulated currents to render said device operative.

10. A carrier current signaling system comprising a circuit for receiving signal modulated carrier currents, a current combining device having input and output circuits, a source of sustained carrier current adapted to be combined with the signal modulated currents in said device to reproduce the signal, means for impressing a potential upon said input circuit to disable said device when no signal modulated currents are being received, and means responsive to incoming signal modulated currents for reducing said potential to render said device operative.

11. A carrier current signaling system comprising a circuit for receiving signal modulated carrier currents, a space discharge tube demodulator having a control electrode, a source of sustained carrier current adapted to be combined with the signal modulated currents in said demodulator to reproduce the signal, means for impressing a large biasing potential upon said control electrode to block said demodulator when no signal modulated currents are being received, and means responsive to incoming signal modulated currents to reduce said grid potential to unblock said demodulator.

12. A carrier current signaling system comprising a circuit for receiving signal modulated carrier currents, a three-electrode space discharge tube demodulator in said circuit, a source of sustained carrier current adapted to be combined with the signal modulated currents in said demodulator to reproduce the signal, an oscillator operative when no signal modulated currents are received for impressing a large biasing potential on an electrode of said demodulator to block said demodulator, and means for impressing a portion of the received signal modulated currents upon said oscillator to arrest the oscillations to unblock said demodulator.

13. An electrical circuit including a device to produce oscillations including electrical elements adjusted to normally maintain the oscillations, and means controlled at a distant point to arrest said oscillations, comprising means to impress on said device a wave of a frequency different from that of the oscillations produced by said device to disturb the oscillation maintaining adjustment of said device.

14. An electrical circuit including a space discharge device arranged to produce oscillations, and means to arrest said oscillations comprising means for impressing a signal wave directly upon said circuit.

15. An oscillator comprising a space discharge tube having input and output circuits, means associated with said output circuit for impressing voltage variations upon said input circuit to produce oscillations, and means for arresting said oscillations comprising means for impressing a voltage wave upon said input circuit.

16. An oscillator comprising a space discharge tube having an input circuit including a cathode and control electrode and an output circuit including an anode and said cathode, means associated with said output circuit for impressing a negative biasing potential and a wave upon said control electrode to produce oscillations, and means to arrest said oscillations comprising means for impressing another wave upon said control electrode.

17. A repeating device having an input-output characteristic which is curved in part and substantially straight in part, a source of current in the output circuit of said repeater, a source of potential associated with the input circuit of said repeater for normally blocking it to prevent flow of current through said repeater from said output source, a source of waves to be repeated, and means responsive to said waves for unblocking said repeater and for causing it to repeat said waves with distortion by causing it to operate upon a curved part of the input-output characteristic.

18. An electrical circuit including a space discharge device arranged to produce oscillations, and means to arrest said oscillations comprising means for impressing a signal modulated carrier wave directly upon said device.

19. An oscillator comprising a space discharge device having input and output circuits, means for impressing upon the input circuit a sustained wave for normally controlling said device to produce oscillations, and means to arrest the production of said oscillations at will comprising means for impressing another wave upon the input circuit of said device.

In witness whereof, I hereunto subscribe my name this 21st day of October A. D., 1926.

ALTON C. DICKIESON.

Quoted?