

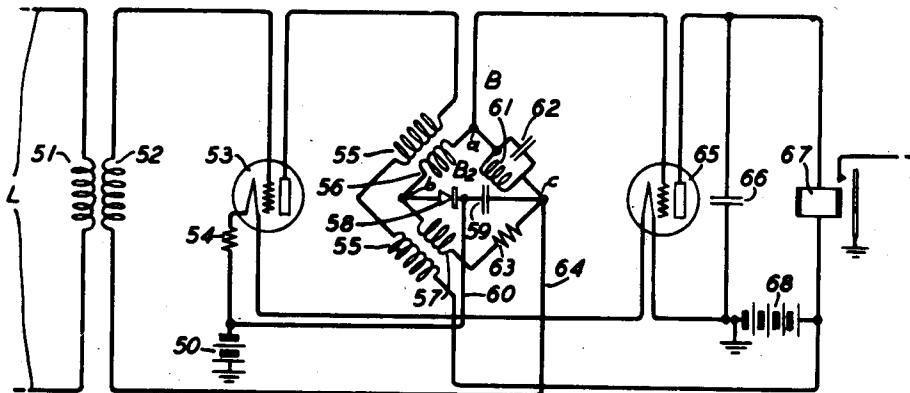
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SIGNALING SYSTEM

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· SIGNALING SYSTEM

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This invention relates to signaling systems and particularly to signal receivers adapted to respond to signaling current of a particular frequency.

It is the object of the invention to provide a more reliable signal receiver adapted to respond to signaling current of a particular frequency without responding to non-signaling current of the same and other frequencies.

It is, of course, known to use alternating current for signaling over telephone lines and, moreover, to signal with current within the voice frequency range. It is, of course, necessary in such signaling arrangements to provide means for preventing false operation of the signal device in response to voice currents which include the particular voice frequency which is used for signaling.

This invention is a signal receiving circuit arrangement comprising a signal device controlled by a thermionic tube, and an impedance bridge connecting the control tube to a signaling circuit, the bridge being balanced to current of a particular frequency and unbalanced to current of other frequencies and directly connected to the grid of the control tube in such a manner that the signal device is operated only when the current in the signaling circuit is of the particular frequency and does not include other frequencies.

A feature of the invention is a signal receiving circuit arrangement comprising a signal device controlled by a thermionic tube, an impedance bridge and an amplifier, the control tube being directly connected to the impedance bridge and through the bridge and amplifier in series to a signaling circuit; the bridge is balanced to current of a particular frequency, unbalanced to current of other frequencies, is connected to the grid of the tube so that the signal device is operated only when the current in the signaling circuit is of the particular frequency and does not include other frequencies, and is effective in response to current of frequencies other than the particular frequency to decrease the amplification of the current incoming over the signaling circuit and thereby further decrease the probability of false operation of the signal device.

Further explanation of the invention will be made by considering a circuit arrangement in which the invention is embodied, such an arrangement being shown schematically in the drawing which forms a part of this specification. The invention is, of course, not limited to the specific arrangement shown in the drawing and is, in general, applicable to all signal devices the operation of which is desired in response to signaling current of a particular frequency but only when there is substantially no current of other frequencies included with the signaling current of the particular frequency.

The drawing which consists of a single figure shows a signal receiver which comprises an amplifier 53, an impedance bridge B, a signal detector tube 65 and a signal relay 67.

In the arrangement shown in the drawing, the incoming signaling circuit includes the line L and the primary winding 51 of a transformer, the secondary winding 52 of which is connected to the grid of the amplifier tube 53 so that all of the current in the signaling circuit is amplified by tube 53. The output circuit of tube 53 includes the primary winding 55 of another transformer, the secondary windings 56 and 57 of which constitute two like elements of the impedance bridge B. The coil 61 and capacitor 62, in parallel, constitute another element of the bridge; and the non-inductive resistor 63 is the fourth element of the bridge. The coil 61 and capacitor 62 constitute a tuned circuit having a very high impedance to current of the particular signaling frequency to which it is desired the signal relay 67 shall respond, and having a comparatively low impedance to current of all other frequencies. The resistor 63 is of very high resistance so that its impedance, the same for all frequencies, is substantially equal to that of the tuned circuit 61—62 at the aforementioned signaling frequency.

The grid of amplifier tube 53 is connected through the transformer winding 52 to point c of the bridge B, thence through resistor 63, transformer winding 57, rectifier 58, and conductor 60 to the negative pole of battery 50; and the grid of control tube 65 is connected to point a of the bridge B, thence through transformer winding 56, in parallel with coil 61 and resistor 62 and transformer winding 57 all in series, through rectifier 58 and conductor 60 to the negative pole of battery 50. The filaments of tubes 53 and 65 are energized in series by current from battery 50, resistor 54 being included in this circuit to provide the desired difference in potential between the filaments and grids of the tubes. The battery 68 supplies the desired difference in potential between the anodes and cathodes of the two tubes, the winding of signal relay 67 being included in the anode circuit of the control tube 65.

If the current incoming over line L is of a frequency or frequencies other than the signaling frequency, there is a difference in potential across points b and c of the bridge B, since the impedance of resistor 63 is very high and the impedance of the tuned circuit 61—62 is comparatively low. This difference in potential across points b and c of the bridge B causes the charging of capacitor 59 on the half of the voltage cycle which is poled in the direction to which rectifier 58 offers a very small impedance, the other half of the cycle being suppressed by rectifier 58. The charge thus built up in capacitor 60

59 increases the negative bias on the grid of tube 65, so that no increase in the current through the winding of relay 67 results and relay 67 is not operated. If the current incoming over line L is of the signaling frequency and includes no other frequencies, there is no difference in potential across points *b* and *c* of the bridge B, since at that frequency, the very high impedance of the tuned circuit 61—62 is substantially equal to that of resistor 63; and the voltage induced in transformer windings 56 and 57 is impressed on the grid of control tube 65 so as to increase the current through the winding of signal relay 67 and cause the operation of this relay. But, if the current incoming over line L includes other frequencies in addition to the signaling frequency, the increase of the negative grid bias due to the charging of the condenser 59 in response to the current of non-signaling frequencies renders ineffective the increase in potential of the grid of tube 65 due to the current of signaling frequency, thereby preventing the operation of signal relay 67. To further reduce the probability of false operation of relay 67, when current of both signaling and other frequencies is being received, the charging of condenser 59 not only increases the negative bias of the grid of tube 65 but also increases the negative bias of the grid of amplifier tube 53 so that less energy reaches the bridge B.

What is claimed is:

1. In combination, a signaling circuit, a signal relay, a thermionic tube controlling the operation of said relay, an impedance bridge, a thermionic amplifier connecting said bridge to said signaling circuit, said bridge being balanced to current of a particular frequency and unbalanced to current of other frequencies, a connection between the grid of the control tube and the bridge for rendering the tube effective to cause operation of the signal relay in response to current in the signaling circuit only when the current therein is of the particular frequency and no other, and a connection between the grid of the amplifier and the bridge effective to decrease the amplification of the current in the signaling circuit when this current includes frequencies other than said particular frequency.

2. In combination, a signaling circuit, a signal relay, a thermionic tube controlling the operation of said relay, a transformer and an impedance bridge for coupling said signaling circuit to the grid of said tube, said bridge being balanced at a particular frequency and unbalanced at other frequencies, and a source of biasing potential connected to and through said bridge to the grid of said tube.

3. In a combination according to claim 2, a thermionic amplifier connected between said signaling circuit and the primary winding of said transformer, the grid of said amplifier being connected to and through said bridge to said source of biasing potential.

4. In combination, a signaling circuit, a signal relay, a thermionic tube controlling the operation of said relay, a transformer, circuit means for coupling the primary winding of said transformer to said signaling circuit, an impedance bridge, two adjacent arms of said bridge consisting of like secondary windings of said transformer, another of the arms of said bridge comprising an inductive winding and a capacitor in parallel, said winding and capacitor being resonant at a particular signaling frequency, and a high

non-inductive resistor constituting the fourth arm of said bridge, the grid of said tube being connected to the junction point between one of the secondary windings of the transformer and said inductive winding and capacitor, control means comprising a rectifier and a condenser connected across the junction between the secondary windings of the transformer and the junction between said inductive winding and said non-inductive resistor, and a source of biasing potential connected to the junction point between said rectifier and said capacitor.

5. In a combination according to claim 4, a thermionic amplifier connected between said signaling circuit and the primary winding of said transformer, the grid of said amplifier being connected to the junction point between said inductive winding and said non-inductive resistor.

6. In combination in a voice frequency signaling system, a signaling circuit, a signal relay for responding only to signaling current of a particular frequency within the voice-frequency range and only when there is substantially no current of other frequencies in said circuit, means comprising a transformer, an impedance bridge and a thermionic tube connecting said relay to said circuit, like secondary windings of said transformer comprising adjacent branches of said bridge, an inductive winding and a capacitor connected in parallel constituting a third branch of said bridge, a non-inductive resistor constituting the fourth branch of said bridge, said inductive winding and capacitor being resonant at the particular frequency to which it is desired that said signal relay be operatively responsive so as to balance the impedance of said non-inductive resistor at said particular frequency and no other, the grid of said tube being connected to the junction between one of the secondary windings of said transformer and said inductive winding and capacitor and the anode of said tube being connected in series with said relay, and means comprising a rectifier and a capacitor connected in series across the junction between the like secondary windings of the transformer and the junction between the inductive winding and capacitor and non-inductive resistor for biasing the grid of said tube.

7. In a combination according to claim 6, a thermionic amplifier connecting said signaling circuit to the primary winding of said transformer, the grid of said amplifier being connected to the junction between said inductive winding, capacitor and non-inductive resistor.

8. The combination of a signaling circuit and a signal receiving device for responding to signaling current of a particular frequency in said circuit, said device comprising a relay, an impedance bridge, means connecting said circuit to said bridge, a single three-element thermionic tube connecting said bridge to said relay, the winding of said relay being connected in series with the anode and cathode of said tube, and a source of negative grid bias connected in series with said bridge between the cathode and grid elements of said tube, said bridge being balanced at said particular frequency and unbalanced at all other frequencies so as to effect operation of said relay only when the current in said signaling circuit is of said particular frequency and has no component of another frequency.

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