

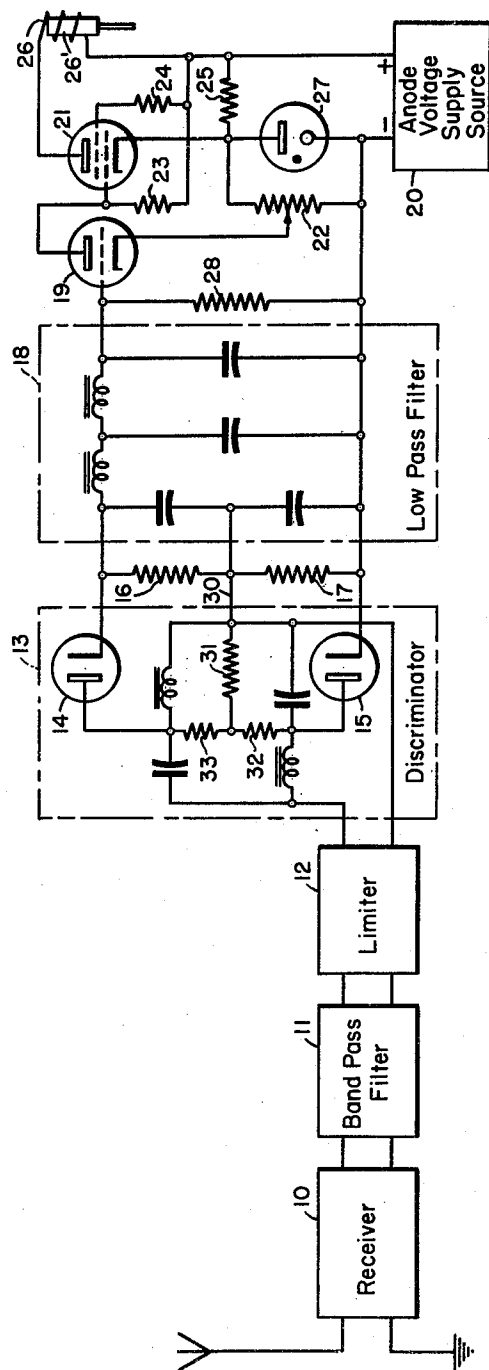
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C. J. MADSEN

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FREQUENCY SHIFT APPARATUS

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WITNESSES:

Robert Baird
Wm. C. Groome

INVENTOR

Carl J. Madsen.

BY

F. E. Browder
ATTORNEY

UNITED STATES PATENT OFFICE

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FREQUENCY SHIFT APPARATUS

Carl J. Madsen, Hingham, Mass., assignor to
Westinghouse Electric Corporation, East Pitts-
burgh, Pa., a corporation of Pennsylvania

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This invention relates to radio teletypewriter systems utilizing frequency-shift keying.

The conventional teletypewriter system utilizing frequency-shift keying requires polarized relays for operating the selector magnets of the teletypewriter printer, and requires involved push-pull amplifier circuits for operating the relays.

This invention provides a radio teletypewriter system utilizing frequency-shift keying in which the selector magnet is operated directly from the anode circuit of an amplifier tube, and in which but two tubes are used between the discriminator and the selector magnet. In one embodiment of the invention, the discriminator acts to apply a negative bias on the grid of a control tube when the signal is on the mark frequency, causing an amplifier tube to become conductive and to energize or close the selector magnet of the printer. When the signal is on the space frequency, the discriminator acts to apply a positive bias to the grid of the control tube, causing the amplifier tube to become non-conductive, so that the selector magnet of the printer is deenergized or released. During the period of no signal, the grid of the amplifier tube is so biased that it draws sufficient anode current to barely maintain the selector magnet in closed position at the threshold of operation.

While in normal operation, a "mark" signal is transmitted during periods of no traffic; however, occasional component casualties may occur in either the transmitter or receiver units which will result in a "no signal" condition.

An object of the invention is to provide for the direct operation of the selector magnet in the printer of a radio teletypewriter system utilizing frequency-shift keying, from the receiver-converter unit without the use of relays.

Another object of the invention is to reduce the number of vacuum tubes and other components in radio teletypewriter systems utilizing frequency-shift keying.

Another object of the invention is to provide a radio teletypewriter system utilizing frequency-shift keying in which the selector magnet current is maintained at a value barely sufficient to hold the armature of the selector magnet in closed position during the periods no signals are being received.

The invention will now be described with reference to the drawing which is a circuit schematic of one embodiment of the invention.

The conventional receiver 10 supplies received signals through the conventional band-pass filter

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11 and limiter 12, into a frequency discriminator 13.

The outputs of the two discriminator rectifier tubes 14 and 15 are connected in polarity opposition across the series-connected resistors 16 and 17, which have such values that at cross-over frequency the potentials across the two resistors are equal and opposite. The junction point of the resistors 16 and 17 is connected to the anodes of the tubes 14 and 15 through lead 30, resistor 31 and resistors 32 and 33. It is seen that the end of resistor 33 opposite the junction point with resistor 32 is connected to the anode of the tube 14, and the end of resistor 32 opposite the junction point with resistor 33 is connected to the anode of tube 15. The resistor 31 functions to maintain a substantially constant load on the limiter 12.

The resistors 16 and 17 are connected across the input of the low-phase filter 18, the output of which is connected to the grid of the control tube 19 and to the negative terminal of the anode voltage supply source 20.

The anode of the tube 19 is direct-connected to the control grid of the amplifier tube 21, and the cathode of the tube 19 is connected to the slider of the potentiometer 22, one end of which is connected to the cathode of the tube 21, and the other end of which is connected to the negative side of the source 20.

The anode of the tube 19 is connected through the resistor 23 to the positive side of the source 20, and its grid is connected through the grid resistor 28 to the negative side of the source 20.

The screen grid of the tube 21 is connected through the resistor 24 to the positive side of the source 20. The cathode of the tube 21 is connected through the resistor 25 to the positive side of the source 20. The anode of the tube 21 is connected through the winding 26 of the selector magnet of the teletypewriter printer to the positive side of the source 20. The cathode of the tube 21 is connected through the voltage regulator tube 27 to the negative side of the source 20.

In operation, the low-pass filter removes the ripple due to the rectification of the signal, so that essentially a direct-current potential is applied to the grid of the control tube 19.

The potentiometer 22 is adjusted for varying the bias on the grid of the tube 21 until the anode current of the tube 21 is approximately 60% to 75% of normal value. Thus, lack of signal will maintain sufficient current through the selector magnet winding 26 to prevent the teletypewriter printer from running open as would ordinarily occur when "no signal" is being received.

When the incoming signal is on the mark frequency, the rectifier tube 15 will conduct, causing the grid of the tube 19 to be biased negatively with respect to its cathode so that it is non-conducting, with no current flow through the resistor 23, thus permitting the control grid of the tube 21 to become positive with respect to its cathode. The tube 21 is then fully conductive and draws normal anode current which passes through the selector magnet winding 26, providing normal current for closing the selector magnet armatures 26'.

When the incoming signal is on the space frequency, the rectifier tube 14 will conduct, causing the grid of the tube 19 to be biased positively with respect to its cathode, causing the tube to be conductive. The anode current drawn by the tube 19 passes through the resistor 23, causing a voltage drop therethrough which causes the control grid of the tube 21 to become negative with respect to its cathode, resulting in the tube being non-conductive, and resulting in a decrease in the anode current of the tube 21 which causes the winding 26 of the selector magnet to be deenergized.

Thus, when no signal is being received, the selector magnet current is maintained at a value barely sufficient to hold the armature of the selector magnet in closed position at the threshold of operation. When the signal is on the mark frequency, the selector magnet armature is closed; and when the signal is on the space frequency, the selector magnet is deenergized so that it is placed in open position.

I claim as my invention:

1. A radio teletypewriter receiver for receiving signals transmitted on space and mark frequencies, comprising a thermionic control tube having a grid, a cathode, and an anode; a thermionic amplifier tube having a control grid, a cathode, and an anode; an anode voltage supply source; a printer selector electromagnet having an energizing winding connected in series with said source and said anode of said amplifier tube; a frequency discriminator; circuit connections connecting the output of said discriminator to said grid and cathode of said control tube, said connections including means for biasing said grid of said control tube to one polarity with respect to its cathode when signals on mark frequency are supplied into said discriminator, and for biasing said grid of said control tube to the opposite polarity with respect to its cathode when signals on space frequency are supplied into said discriminator; circuit connections connecting said grid and cathode of said amplifier tube to said anode and cathode of said control tube, said last-mentioned connections including means for biasing said grid of said amplifier tube positively with respect to its cathode when said grid of said control tube is biased negatively, whereby sufficient anode current drawn by said amplifier tube will flow through said magnet winding for placing said magnet in its closed position, and for biasing said grid of said amplifier tube negatively with respect to its cathode when said grid of said control tube is biased positively, whereby the anode current of said amplifier tube will be reduced so as to deenergize said winding, whereby said selector magnet will be placed in its open position.

2. A radio teletypewriter receiver as claimed in claim 1 in which the last-mentioned circuit connections includes means for normally biasing

said grid of said amplifier tube sufficiently positive with respect to its cathode that sufficient anode current will flow through said winding for maintaining said magnet at the threshold of operation when no signals are applied to said discriminator.

3. A radio teletypewriter receiver as claimed in claim 1 in which a low-pass filter is located between the output of the discriminator and the grid and cathode of the control tube.

4. A radio teletypewriter receiver as claimed in claim 1 in which the last-mentioned circuit connections includes means for normally biasing said grid of said amplifier tube sufficiently positive with respect to its cathode that sufficient anode current will flow through said winding for maintaining said magnet in closed position at the threshold of operation when no signals are applied to said discriminator, and in which a low-pass filter is located between the output of the discriminator and the grid and cathode of the control tube.

5. A radio teletypewriter receiver for receiving signals transmitted on space and mark frequencies, comprising a frequency discriminator including two rectifier tubes having cathodes and anodes; a control tube having a grid, a cathode and an anode; an amplifier tube having a grid, a cathode and an anode; a cathode bias resistor connected to the cathode of said control tube and to the cathode of said amplifier tube; circuit connections connecting said grid of said control tube to the cathode of one of said rectifier tubes, and connecting the cathode of the other of said rectifier tubes to said bias resistor; resistors connected in series between said cathodes of said rectifier tubes, the mid-point connection of said series-connected resistors being connected to said anodes of said rectifier tubes, said series-connected resistors being so connected and having such values that at the cross-over frequency, the potentials thereacross are equal in value and are opposite in polarity, said anode of said control tube being direct connected to said grid of said amplifier tube; an anode voltage supply source; a grid bias resistor connecting said grid of said control tube to the negative terminal of said source, and a printer selector electromagnet having its energizing winding connected in series with said supply source and said anode of said amplifier tube.

6. A radio teletypewriter receiver as claimed in claim 5 in which a low-pass filter is located between the series-connected resistors and the grid and cathode of said control tube.

7. A radio teletypewriter receiver as claimed in claim 5 in which the cathode bias resistor is a potentiometer having one end connected to the negative terminal of said source, having its other end connected to said cathode of said amplifier tube, and having its slider connected to said cathode of said control tube.

CARL J. MADSEN.

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