

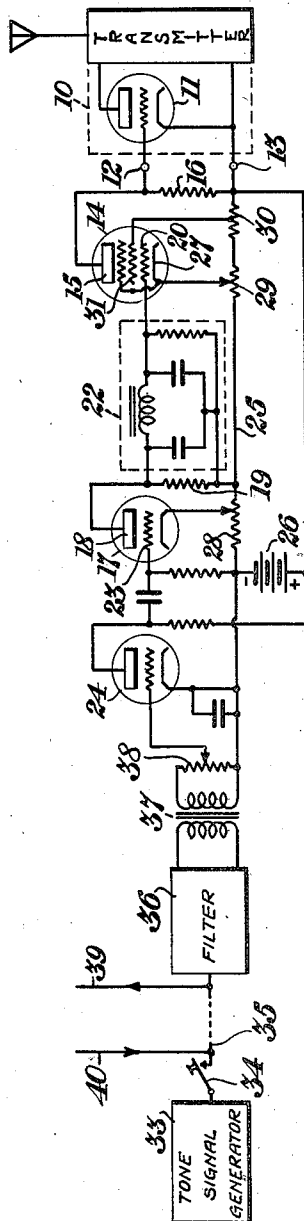
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TRIGGER OPERATED CARRIER TELEGRAPH TRANSMITTER

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TRIGGER OPERATED CARRIER TELE-
GRAPH TRANSMITTER

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1

This invention relates to telegraph keying systems suitable for radio transmission of continuous wave signals, and to circuit features applicable to such system.

A general object of the invention is the provision of a relatively simple, compact, light and inexpensive system that is adapted for the efficient transmission of telegraph signals at substantial speed.

A further purpose is to provide a system adapted for connection to standard types of transmitters employing blocked grid keying to permit their operation from a remote point over ordinary types of telephone lines. When transmitters of this type are operated from a remote point over an ordinary control line extending to the keying arrangement, the line must be of the type adapted to carry a substantial direct current potential. By using an audio frequency tone as a carrier for the keying pulses, no direct current is transmitted over the control line and special types of line are not required. The invention includes an improved arrangement at the transmitter for utilizing the keyed tone waves to operate the transmitter. Specifically, an arrangement is provided that responds with great rapidity to slight changes in the potential of the keyed supply, facilitating high speed transmission. The system is also adapted for multi-channel use in which several transmitters can be separately keyed over a single control circuit.

The invention includes an improved trigger circuit arrangement which, when used in a telegraph system of the indicated type, increases the speed of the system and permits it to follow accurately the rapid voltage and current changes produced by high speed keying.

Other objects and advantages will appear from the following description considered in connection with the accompanying drawing which is a diagram of a system embodying the invention connected between a tone signal generator and a transmitter.

In the illustrated embodiment a transmitter 10 is of the blocked grid keying type and includes keying tube 11 shown as a triode. The usual key and source of blocking grid bias potential at the input of the transmitter are not necessary with the present invention, and are not illustrated.

The system includes a suitable arrangement for maintaining a blocking bias on the grid of tube 11 in the absence of a signal, and removing such bias when a signal impulse is received, thereby placing tube 11 in operation and permitting the transmitter 10 to send out a signal wave.

2

This is in general accomplished by connecting the output tube 14 of the keying system with its output circuit from anode 15 passing through a suitable impedance such as resistor 16 connected across the terminals 12 and 13 of the transmitter 10. With this arrangement the anode current flowing through tube 14 controls the blocking and unblocking of tube 11 in the transmitter by varying the potential drop across resistor 16, which is connected between the grid and cathode of tube 11. If a battery or the like is used to provide blocking bias for the latter tube, resistor 16 should be of sufficiently low value to provide a substantial short circuit across the battery when no anode current is flowing through tube 14. During periods when no signal impulse is received, tube 14 draws anode current through resistor 16, and the value of this current is adjusted to produce a potential drop across said resistor appropriate for applying blocking bias to tube 11.

The system includes a suitable arrangement for reducing the anode current of tube 14 substantially to zero, removing the voltage which this current sets up across resistor 16 and thus unblocking tube 11. This is in general accomplished by means of an actuating tube 17 which is normally biased to cut off. The output circuit from anode 18 passes through resistor 19 and the resulting voltage drop in the latter resistor is applied to the control grid 20 of tube 14. The arrangement is such that when current flows in the output circuit of tube 17 in response to a signal impulse the negative voltage impressed on grid 20 is sufficiently high to bring it to cut off, thereby blocking tube 14 and reducing the anode current through resistor 16 to zero.

Under certain circumstances it is desirable to insert a filter 22 between the anode circuit of tube 17 and the control grid circuit of tube 14. The general purpose of this filter is to prevent any carrier frequency voltage from reaching said grid circuit of tube 14, since such voltage if allowed to pass through the keyer system may produce an undesirable modulation on the transmitter output carrier. When this system is used for remote control in conjunction with ordinary telephone lines, the filter will be of the low pass type with a frequency cut off sufficiently high to pass the maximum frequencies due to high speed keying and sufficiently low to eliminate the carrier wave of the lowest tone frequency that is used. In practice a low pass filter having a frequency cut-off of about 500 cycles has been found to be satisfactory. The blocking grid 23 of tube 17, illustrated as the control grid of a tri-

3

ode, is normally maintained at blocking bias potential, and is connected to a source of tone signals, an arrangement being provided for unblocking tube 17 when a signal impulse is received from said source. In the illustrated arrangement a pre amplifier stage is employed, including tube 24, which is resistance coupled to grid 23. While separate tubes 17 and 24 are illustrated, the arrangement is particularly adapted for the use of a twin triode tube, so that the illustrated arrangement can be provided by using only two tubes.

Tubes 14 and 17 are advantageously coupled by a trigger circuit to accelerate the blocking and unblocking of tube 14. In the illustrated arrangement the novel type of trigger circuit is employed. It includes the provision of a high resistance feedback connection 25 between the anode circuit of tube 14 and the cathode-grid circuit of tube 17, extending across a source of anode supply voltage such as battery 26. The circuit is arranged so that the anode current of tube 14 flows from the positive terminal of the supply voltage through resistor 16 to anode 15, through the tube to cathode 27 and thence through resistor 28 to the negative terminal of the supply voltage. The connection 25 advantageously includes a resistor 29 having an adjustable connection with the cathode 27 to adjust the voltage drop across resistor 16, and a resistor 30 connected to the screen grid 31 of tube 14 which advantageously is of the pentode type. While resistors 28, 29 and 30 are arranged as bleeders across battery 26, they have comparatively high values and therefore there is very little bleeder current from the battery. Consequently the current through resistor 28 is made up almost entirely of the anode current from tube 14.

The bias potential applied to grid 23 of tube 17 is determined by the voltage drop across resistor 28 and consequently is directly dependent upon the anode current of tube 14.

With no signal applied to the system tube 14 will draw sufficient anode current passing through resistor 28 to bias tube 17 for cut off. When a signal is applied to a grid 23 of tube 17 the latter tube starts to draw anode current, which increases the negative bias voltage on grid 20 of tube 14 and reduces the anode current of the latter tube. A slight decrease in the anode current of tube 14 causes a material reduction in voltage across resistor 28 and a consequent decrease in the negative bias on grid 23 of tube 17. The latter decrease causes an increase in the anode current of tube 17, with a resultant reduction in anode current in tube 14.

This operation produces a triggering action whereby a very slight initial anode current in tube 17 will cause immediate and substantially instantaneous anode current cut off in tube 14, thereby placing tube 14 and the remainder of the transmitter 10 in transmitting condition. The sensitivity of the system can be varied by shifting the adjustable contact on resistor 28 which controls the bias on tube 17, so that the system can be made to trigger at any predetermined input voltage.

When the signal impulse applied to the system is terminated the same trigger action occurs in reverse. As the input signal potential is reduced the anode current of tube 17 decreases but tube 14 is not affected until the point is reached where the latter tube starts to draw anode current. At this point the trigger action is initiated and the anode current of tube 14 rises immedi-

4

ately to its original value under conditions when no signal impulse is received, thereby immediately blocking tube 14 and terminating transmission by the transmitter 10.

The trigger circuit arrangement that has been described has other advantages in addition to its speed of operation. It is desirable to apply to the transmitter 10 a wave of the square type in which the beginning and end of the wave are as nearly vertical as possible. However, although a suitable wave may be produced at the keying point, to its passage through intermediate circuit elements, such as filters and transformers, inevitably results in development of substantially sloping ends to the wave envelope, representing substantially longer periods during which the potential rises to the maximum value and falls from that value to zero. However, the trigger system can be arranged to operate at a point close to the beginning of each of said periods, and its operation is so fast that the resulting voltage wave applied to the transmitter 10 is substantially square even though the signal wave applied to the trigger system may have been substantially distorted from the desired type.

This system is also adapted for highly sensitive operation without danger of being triggered by noise or other undesired components which may enter the signal circuit and reach the trigger system. By adjusting the triggering bias on tube 17 the system can readily be arranged so that the potentials developed by such parasitic elements will be insufficient to start the unblocking of tube 17, while slightly higher potentials, which are present only at the beginning of a received signal impulse, will actuate the trigger system in the manner described. It has been found that the tripping potential of the system may be set at a point which is above that which might result from undesired components but nevertheless is located relatively close to the beginning of the potential rise due to an incoming signal. Consequently the desired square wave may be produced without danger of tripping the trigger circuit through parasitic impulse.

As already indicated, the system is suitable for use with a plurality of keyed tone signal generators located at a remote point, the signals from all of the generators being transmitted over a common line and then separated by suitable filters from which each tone signal passes through a trigger circuit system to a separate transmitter. Such an arrangement is indicated, only a single tone signal generator 33 and its associated key 34 connected to transmission line 35 being shown, though other keyed generators may be connected in parallel through line 40. The wave from generator 33 is separated at the transmitting station by filter 36 and applied through impedance-matching transformer 37 to the grid circuit of tube 24. A volume control 38 may be provided to permit adjustment of the signal level applied to the system. Other trigger systems and transmission units similar to that illustrated may be operated from the line 35 through lead 39 and suitable filters connected thereto. With this arrangement a plurality of keyed tone signals may be simultaneously sent from a remote control station over a single ordinary telephone line, and separately transmitted without interference at the transmitting station.

While a preferred form of the invention has been illustrated it should be understood that this

5

form may be varied within the scope of the invention as set forth in the claims.

What is claimed is:

1. A telegraph keying system for operating a continuous wave telegraph transmitter provided with an input tube having a grid maintained at blocking bias potential in the absence of a signal, said keying system including a keyer output tube comprising at least a grid, cathode and anode, an output circuit for said output tube, coupled to grid of said input tube and including means for normally maintaining said blocking bias potential on said input tube grid, means for reducing said potential and unblocking said transmitter tube, said potential reducing means being responsive to a keyed signal for decreasing the output current of said keyer output tube and including a key controlled actuating tube comprising at least a grid, cathode and anode, said tube normally biased to cut off, means coupling said actuating tube to said output tube and a trigger circuit connecting said actuating tube and said output tube, whereby changes from blocked to unblocked condition and from unblocked to blocked condition occur sharply, at a predetermined value of output current from said actuating tube, said connection between the output tube and the actuating tube comprising an impedance in the anode circuit of the output tube across a part of which is connected the grid-cathode circuit of the actuating tube.

2. A telegraph keying system for operating a blocked grid telegraph transmitter, including an output tube, an output circuit therefor, including means controlled by the current in said circuit for normally maintaining blocking bias potential on said grid, and means for reducing said current and thereby unblocking the grid, said reducing means including an actuating tube, an output circuit for said actuating tube including means coupled to said output tube for varying the output current of the latter tube in inverse relation to the output current of said actuating tube, means for normally maintaining a blocking bias potential on said actuating tube, means for unblocking said actuating tube, said unblocking means being responsive to a received signal, key controlled means for applying to the blocking grid of said actuating tube a keyed signal wave adapted to unblock said tube, and a trigger circuit connecting said actuating tube and said output tube, whereby changes from blocked to unblocked condition and from unblocked to blocked condition occur sharply at a predetermined value of output current from said actuating tube, said trigger circuit including means for applying unblocking potential to the blocking grid of said actuating tube, said last means being responsive to changes in the output current of the output tube, whereby retrograde action causes a sharply defined operating point.

3. A system according to claim 2 in which the said means for applying unblocking potential to the blocking grid of the actuating tube comprises an impedance common to the output circuit of the output tube and the grid cathode circuit of the actuating tube.

6

4. A system according to claim 1 in which the said means for coupling the actuating tube to the output tube includes a filter.

5. A system according to claim 1 further comprising tone signal means for overcoming the said normal cut-off bias on said actuating tube.

6. A telegraph keying system, including: a blocked grid telegraph transmitter having an input tube whose control grid may be biased to control the operation of said transmitter; a source of continuous waves of a certain frequency modulated by keying signals; and a trigger circuit arrangement coupled to said source and said transmitter to deliver to said grid substantially rectangular biasing pulses responsive to keying signals from said source, said arrangement comprising an actuating tube and an output tube each with an anode, cathode and grid elements respectively, a source of potential for supplying voltage to the elements of said tubes, a connection including a load resistance between the anode of said output tube and the positive pole of said source of potential, a bleeder resistance connected across said source of potential, a connection between the cathode of said output tube and a first point on said bleeder resistance, connections from the anode and cathode of said actuating tube to second and third points on said resistance each successively lower in potential than said first point, a connection from the control grid of said actuating tube to a fourth point on said resistance which is sufficiently below the potential of said third point to apply cut-off bias to said actuating tube when no keying signals are delivered thereto, filter means for rejecting said certain frequency and coupling the anode of said actuating tube with the control grid of said output tube, and connections from the anode of said output tube to the control grid of said transmitter input tube and from said positive pole to the cathode of said transmitter input tube.

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