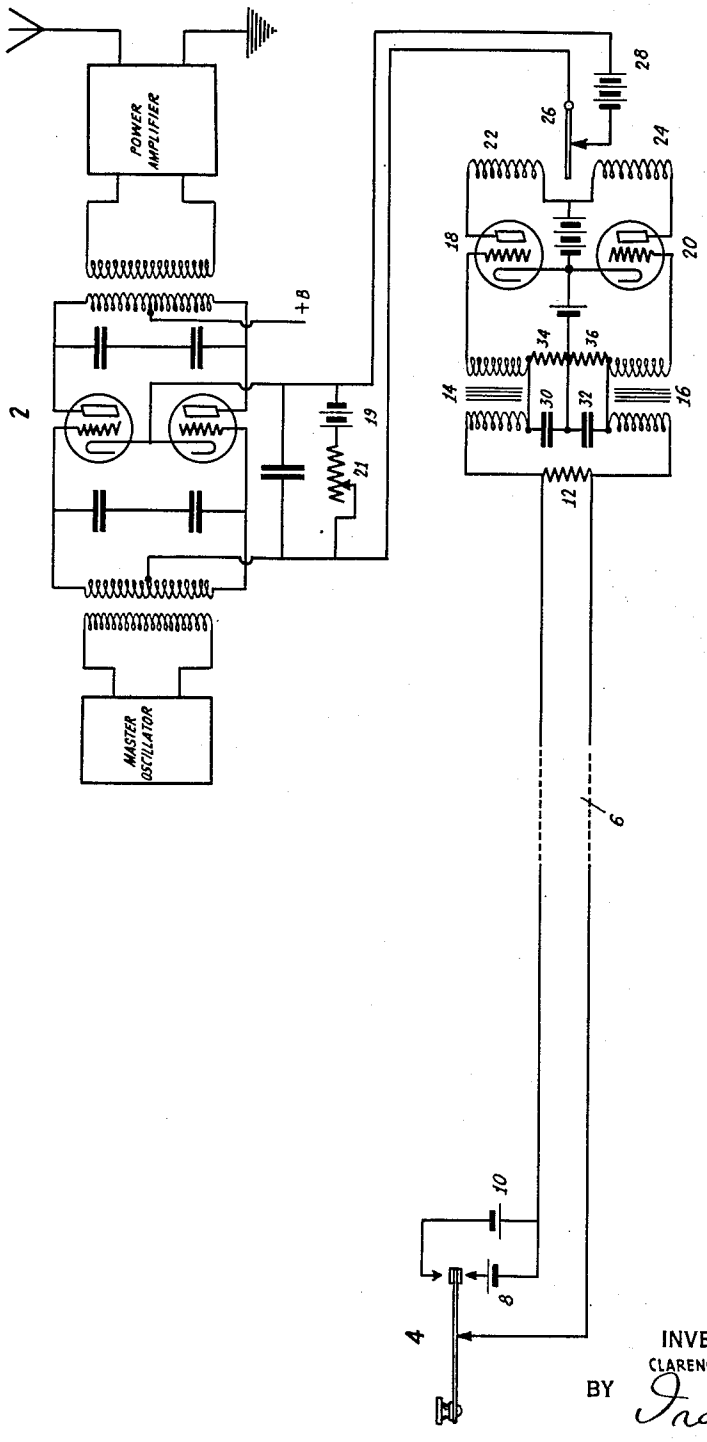
June 2, 1931. C. W. HANSELL 1,808,220

KEYING

Filed Nov. 2, 1927



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Patented June 2, 1931 1,808,220

UNITED STATES PATENT OFFICE

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KEYING

Application filed November 2, 1927, Serial No. 230,439.

This invention relates to keying, and more particularly to a method and means for high and low speed keying of a remote transmitter.

Ordinarily when direct current is used for keying at slower speeds current assumes a steady state on the line for each of the signal pulses, and it is the duration of the current which measures the duration of the signals finally transmitted. At higher keying speeds the electrical characteristics of line begin to be felt, and it is impossible to increase keying speed above a relatively low value because of the time required for the current to assume a steady state. It is a primary object of my invention to greatly increase keying speed, and I find that the desired result may be attained by utilizing the rate of change of current on the line for controlling the transmitter. This may be done by coupling the line to the transmitter control means reactively, as for example, through a transformer.

When utilizing the rate of change of current for signalling at high speeds the resultant line current begins to resemble an audio frequency current, and it then becomes desirable to actually prevent the line from assuming a steady state for signalling impulses. To that end reflection should be prevented, and for this the line may be terminated by a resistance equal to the surge impedance or characteristic impedance of the line.

The alternating current effect is extremely desirable because under the older method a relay is unable to follow the signals at high speed, for a preponderance of either spaces or dashes in the letters will give the line a direct current component, aside from the variations, which will hold the relay to one side or the other, and so spoil the keying. To make the alternating current effect more nearly perfect and to get a maximum ratio between signal and stray interference it is desirable to feed to the line both plus and minus direct currents, and to key these alternately.

The coupling as so far described depends upon the rate of change of signal current, and makes it impossible to key at slow speeds, because at slow speed the current at the end of the line reaches a steady value in a time less than the duration of a dot or dash, and the signal then should follow the steady state current values. Accordingly, it is a further object of my invention to provide for low as well as high speed keying, which I do by coupling the line to the transmitter control means resistively, as well as reactively, and then by-passing the resistances with blocking condensers. During high speed keying the resistances are practically short circuited by the condensers, and the transformers are effective for transferring the signals, but on the other hand, during low speed keying the transformers have negligible reactance, the condensers have a very high reactance, and the resistances become the effective coupling means.

The invention is more fully described in the following specification, accompanied by a drawing the single figure of which is a wiring diagram for one form of my invention.

Referring to that figure there is a transmitter 2, a remote keying means 4, and an interconnecting wire land line 6. The keying means have been shown as a simple key, but in actual practice may be a punched tape or other machine transmitter. There are sources of direct current 8 and 10, of opposite polarity, arranged to be connected to the line 6 under control of the key 4.

The line is terminated by a surge resistance 12, and is then coupled through transformers 14 and 16 to the control electrodes of the tubes 18 and 20 in push-pull. The anode circuits of the tubes include the coils 22 and 24 of a differential relay 26, which is arranged to control a source 28 of grid blocking potential. There is a working bias battery 19 arranged in series with a resistance 21. The transmitter 2 may consist of any suitable number of amplifier or amplifier and multiplier stages, and a suitable one of these has its grid bias varied by the relay 26, thereby controlling the output of the transmitter.

The transformers 14 and 16 are connected in series through blocking condensers 30 and 32, and the resistances 34 and 36 connected in parallel therewith. It will be clear from the

diagram that during high speed keying the resistances are of no effect, inasmuch as the condensers form a low reactance path for the alternating current, but on the other hand, at low keying speeds the transformers have negligible reactance, while the condensers have high reactance, and therefore the line currents flow through the resistances 34 and 36, thereby impressing the low speed signals on the control electrodes of the tubes.

With this arrangement keying speeds have been raised from a former maximum of 75 words per minute for a certain control line system to a regular operating value of 250 words per minute, and in experimental tests a speed of 500 words per minute has been attained, at which time the speed of the electro-mechanical relay proved the limiting factor.

I claim:

1. The method of keying a remote transmitter having amplifier tubes which includes putting plus and minus direct control current on a line, and at the terminal of the line utilizing induced potentials resulting from the rate of change of the control current for applying blocking potential to the grid of an amplifier tube in the transmitter.

2. The method of feeding control current from a line to an amplifying relay circuit for both high and low speed keying which includes reactively coupling the line and amplifier circuit for response to the rate of change of the line current and amplification of the line current for high speed keying, and resistively coupling the line and amplifier circuit for response to the steady line current and amplification of the steady line current for low speed keying.

3. An arrangement for high and low speed keying of a transmitter comprising a key, a line, a source of plus and minus direct current fed to the line under the control of the key, a surge resistance at the end of the line, an electron emission tube, a transformer coupling the line to the tube grid, a resistance also coupling the line to the tube grid, a condenser in parallel with the resistance, and means responsive to the anode current of the tube for controlling the transmitter.

4. An arrangement for high speed keying of a transmitter comprising a key, a line, a source of plus and minus direct current fed to the line under the control of the key, a surge resistance at the end of the line, a pair of vacuum tubes arranged in push-pull, transformer means coupling the line to the tube grids, and means responsive to the anode currents of the tubes for controlling the transmitter.

5. An arrangement for high and low speed keying of a transmitter comprising a key, a line, a source of plus and minus direct current fed to the line under the control of the key, a surge resistance at the end of the line, a pair of vacuum tubes arranged in push-pull, transformer means coupling the line to the tube grids, resistance means also coupling the line to the tube grids, condensers connected in parallel with the resistance means, and means responsive to the anode currents of the tubes for controlling the transmitter.

6. An arrangement for high speed keying of a transmitter having stages comprising a key, a line, a source of plus and minus direct current fed to the line under the control of the key, a surge resistance at the end of the line, a pair of vacuum tubes arranged in push-pull, transformer means coupling the line to the tube grids, a relay in the anode circuits of the tubes, and a source of potential controlled by said relay for blocking the grids of a stage of the transmitter.

7. An arrangement for high and low speed keying of a transmitter having stages comprising a key, a line, a source of plus and minus direct current fed to the line under the control of the key, a surge resistance at the end of the line, a pair of vacuum tubes arranged in push-pull, transformer means coupling the line to the tube grids, resistance means also coupling the line to the tube grids, condensers connected in parallel with the resistance means, a relay in the anode circuits of the tubes, and a source of potential controlled by said relay for blocking the grids of a stage of the transmitter.

8. A slow and high speed code signal repeater comprising a surge resistance connected across the incoming line, a transformer primary, a condenser, and a second transformer primary connected in series with each other and in parallel with the surge resistance, a pair of electron emission tubes, a transformer secondary, a divided resistance, and a second transformer secondary connected in series with each other between the control electrodes of the tubes, means connecting the terminals of the condenser to the terminals of the resistance, and output circuit connected between the anodes of the tubes, and circuits connecting the cathodes of the tubes to the mid points of the divided resistance and the output circuit in order to complete the control electrode to cathode and anode to cathode circuits of the tubes, whereby the incoming line is reactively coupled to the tubes through the transformers for high speed signalling, and resistively coupled to the tubes by the divided resistance for low speed signalling.

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