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TRANSIENTLESS MODULATOR SYSTEM FOR KEYING

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Fig. 1.

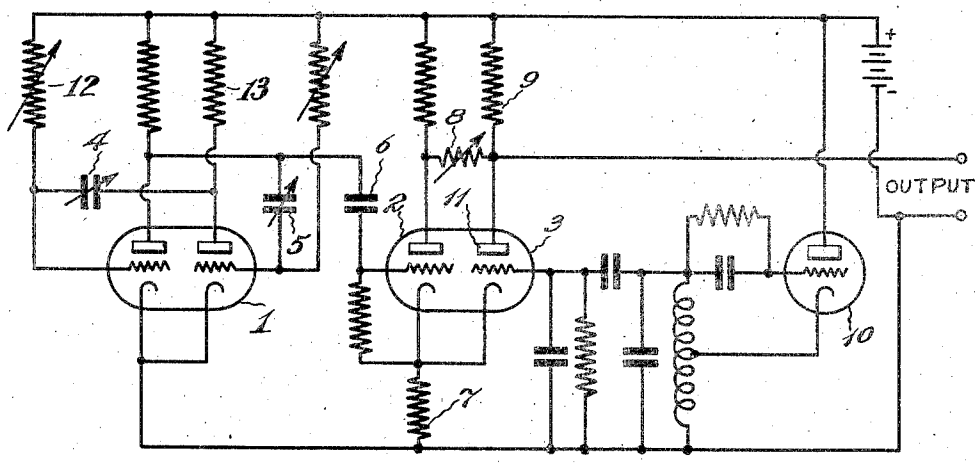
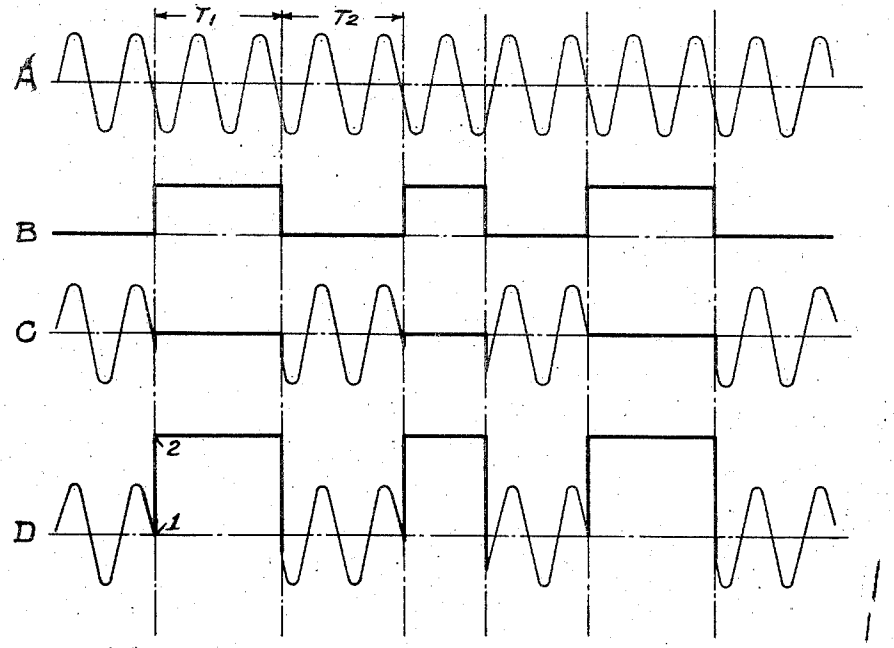


Fig. 2.



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TRANSIENTLESS MODULATOR SYSTEM FOR KEYING

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10 Claims. (Cl. 179—171.5)

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In my Patent No. 2,419,292 issued April 22, 1947, entitled "System for transmitting two simultaneous intelligences," I have disclosed a system whereby two functions may be simultaneously verged into a single signal wave by keying on and off at controlled intervals, the "time on" representing one function, and "time off" representing another function. I have further shown in that system means for transmitting the signal so produced in which it modulates a carrier wave before transmission.

When the carrier frequency is high with respect to the modulation frequency, filter circuits or tuned circuits may be used to separate the modulation voltage from the carrier voltage. However, when the carrier frequency is only slightly higher than the modulation frequency, so that it is necessary to start and stop the carrier within fractional parts of the carrier cycle, filter circuits are not suitable for eliminating transients of modulation frequency from the carrier. It is therefore necessary in such cases to report to other means to eliminate such transients. The object of this invention is to provide such means.

A feature of this invention is a modulator circuit comprising a tube through which anode current may be cut off periodically, but in the intervals when it flows will be directly proportional to an oscillation voltage, without transient effects. Between the intervals when it flows the voltage output will be equal to the average value of the oscillation voltage without transient effects.

In the drawings,

Figure 1 is a circuit diagram illustrating a circuit with which my invention may be practiced; and

Figure 2 is a series of curves illustrating the invention.

In Figure 1, tube 1 and its associated circuits constitute the signal generator in which a signal like that shown in curve B of Figure 2 is produced. The signal generator consists of two tubes in a single envelope 1 and their associated circuits. This circuit is essentially a multivibrator in which the voltage on the anode of each tube is impressed upon the grid of the other tube. When current is flowing through one tube the anode of that tube will become more negative and this negative voltage applied to the grid of the other tube will cut off current through the other tube. The grid of that tube will then become more positive than the cut off voltage through the grid resistance 12 or 13, as the case may be, and current will again flow. The time T_1 (Figure 2) may be controlled by the size of

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resistance 12 or condenser 4 or both or by the size of resistance 13 or condenser 5 or both and the Time T_2 (Figure 2) may be controlled by the other pair of these elements. Thus, the condensers 4 and 5 or resistances 12 and 13, for example, may be made responsive to the two intelligences and, consequently, to produce a signal representing the two functions. This signal, it may be observed, is similar to the output of a conventional multivibrator circuit except for the fact that the frequency or duration of the pulses or square waves is variable and the duration of the intervals between the pulses is also variable. These continuously variable relationships convey the two intelligences. Such intelligences may be any it is desired to transmit. For example, they may be used to transmit continuously from an airborne radiosonde or remote transmitter, information regarding any two independent variables such as temperature and humidity. The circuit might also be used for the transmission by wire or by radio of continuous information pertaining to the location of two coordinates of the pen or stylus of a remote writing equipment which information could be demodulated and utilized to position a reproducing pen or stylus for reproduction of the horizontal and vertical components of transmitted handwriting. This signal is supplied to the grid of triode 2 through a condenser 6. During the positive pulse of voltage this grid is driven positive to draw grid current and the condenser 6 is charged by this grid current so that on the negative swing the grid of triode 2 is dropped in a negative direction only to the point at which plate current through this triode is cut off.

During the time that triode 2 is conducting full plate current, that is while its grid is driven positive by the signal, its cathode is drawn positive. Since the cathode of triode 2 is connected to the cathode of triode 3, the cathode of triode 3 is also drawn positive. It is drawn sufficiently positive to cut off the flow of plate current through triode 3 during this interval.

A carrier frequency generator 10 produces oscillations as illustrated by curve A, Figure 3, which are fed to the grid of triode 3. While triode 3 is conducting it will act as an amplifier, causing voltage of the carrier frequency to appear on the anode 11 of triode 3. When the grid of triode 2 is driven positive to the point where it cuts off the flow of plate current through triode 3, the drop in the resistor 9 in the plate circuit of triode 3 will be zero. The plate 11 of triode 3 would accordingly swing positive and

introduce an undesirable transient unless means were provided to prevent it.

Curve D of Figure 2 shows the wave which would be produced at the output of the modulator triode 2, 3 with the undesired transient present. This transient consists of a sudden and undesirable rise of the zero or neutral axis of the carrier or sub-carrier voltage wave during the intervals when the wave is not being amplified through tube 3 as is indicated in Figure 2 by the rise from point 1 to point 2 on curve D. This high positive D. C. component would therefore be present at the output of the terminals of Figure 1, without resistor 8, instantaneously after the cutoff of current from the tube 3 and would persist during time T_1, that is, until tube 3 again becomes conducting. Curve C of Figure 2 shows the modulated wave at the output of triodes 2, 3 which is desired.

This transient is prevented by the use of a resistance 8, which is indicated as variable for the purposes of adjustment. When triode 3 is cut off so that plate current ceases to flow through the tube, the drop through resistance 9 is prevented from falling to zero and consequently the voltage at the anode 11 of triode 3 is prevented from rising by the resistance 8 which conducts current through resistance 9, resistance 8 and triode 2. The flow of current through the resistance 8 accordingly will nullify or neutralize the transient effect which would otherwise occur. By proper adjustment of the value of this resistance the upward voltage will be made to appear as shown in curve C of Figure 2.

If the transient effect is not corrected the displacement of the base line, as shown in curve D of Figure 2, will be passed through the output and this undesirable transient may have ill effects on subsequent circuits.

In claiming a particular triode section as illustrated in the drawing as a tube I do not mean to exclude from the scope of such a claim a tube in which there may be other electrodes performing other functions; and where I refer to separate tubes it will of course be understood that this may include separate electron discharge systems in a single envelope. Therefore I do not desire to be restricted to the precise form shown, but only within the scope of the appended claims.

What is claimed is:

1. The transientless modulator system of keying comprising a signal generator for producing a square signal wave, an oscillation generator, means for supplying said signal wave and the output of said oscillation generator to a modulator, means whereby said modulator passes current of oscillation frequency only during negative half cycles of said signal wave, and means for eliminating transients in the output of said modulator during positive half cycles of said signal wave.

2. A transientless modulator system of keying comprising an amplifier, means for supplying a carrier wave to said amplifier, means for periodically interrupting the flow of said carrier current through said amplifier, and means for maintaining the anode of said amplifier at a potential during said interruptions which is its average potential between said interruptions.

3. A transientless modulator system of keying comprising an electronic relay, means for supplying a carrier wave to said electronic relay, means for periodically interrupting the flow of said carrier current through said electronic relay, and means for maintaining the anode of said relay at a potential during said interruptions which is its average potential between said interruptions.

4. A transientless modulator system of keying comprising two electron discharge systems, means for applying a signal wave to the grid of one system, means whereby the cathode of said system becomes positive by the flow of current therethrough, means for maintaining the cathodes of said systems at the same potential whereby current through the second system is cut off when said cathodes become positive due to a positive pulse of signal current on the grid of the first system, and means for maintaining the anode of the second system at a reduced voltage when no current is flowing therethrough comprising a resistance element connected between the anodes of the two systems.

5. A transientless modulator system of keying comprising a tube having two elements acting as grids and two elements acting as anodes in effect constituting two electron discharge systems, a condenser, means for applying positive signal pulses to the grid of the first system through said condenser whereby said system draws grid current, an impedance element between the grid and cathode of said system whereby said grid is prevented from following the signal voltage on negative pulses of said signal voltage, an impedance element in the cathode circuit of said system whereby the flow of current through said system makes said cathode become positive, a connection between the cathodes of the two systems whereby the potential of the second cathode follows the potential of the first to cut off the flow of current through the said second system when said cathodes become positive, a second signal wave applied to the grid of said second system, and means for reducing the positive potential at the anode of said second system when current through it is cut off comprising an impedance element connected between the two anodes.

6. A transientless modulator system of keying comprising two electron tubes, a signal wave applied to the grid of each tube, means whereby positive pulses of signal applied to one grid cut off the flow of current through the other tube, and a resistance connected between the anodes of said tubes for preventing transient effects due to the cutting off of current through the second tube.

7. A transientless modulator system of keying comprising two electron tubes, a signal wave applied to the grid of each tube, means whereby positive pulses of signal applied to one grid cut off the flow of current through the other tube, and means comprising an impedance connected between the two anodes for preventing transient effects due to the cutting off of current through the second tube.

8. A transientless modulator system of keying comprising two electron tubes, a signal wave applied to the grid of each tube, means whereby positive pulses of signal applied to one grid cut off the flow of current through the other tube, and means comprising a resistance connected between the two anodes for preventing transient effects due to the cutting off of current through the second tube.

9. The method of keying a signal wave by means of two vacuum tubes comprising periodically interrupting the flow of current through one of said tubes and diverting said current through the other tube during said interruptions.

10. The method of preventing transients in a modulator system of keying employing two tubes which comprises applying a keying signal wave to one of said tubes, causing the current through the other tube to be periodically interrupted in response to said keying signal and causing current to flow between the anodes of said tubes during said interruptions.

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