

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Television Apparatus

We, RADIO CORPORATION OF AMERICA, a corporation organised under the laws of the State of Delaware, United States of America, of 30 Rockefeller Plaza, City and State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method and apparatus for use in colour television apparatus for obtaining an identification signal for a PAL (Phase Alternation Line) phase inversion electronic switch and a control voltage for a reactance control device.

In the accompanying drawings:

FIGURE 1 is a phase diagram illustrating the phase position of colour difference signals and burst in the PAL system.

FIGURE 2 illustrates the wave form of the phase detector output with oscillating burst obtained in the invention.

FIGURE 3 illustrates a phase detector in accordance with the invention.

FIGURE 4 is a modification of the phase detector of FIGURE 3.

According to the invention there is provided a method of obtaining a substantially square wave identification signal from a phase detector to which periodic colour synchronizing and phase reference signals are applied, said detector serving as part of the circuit of a television receiver the relative phase of said signals changing from line to line, in which the detector-output is used both for a control voltage for a reactance control circuit or device and as a control voltage for a switching circuit or device, comprising taking the output from a resistor network in the detector circuit and substantially preventing the

square wave output for switching from interfering with the output for reactance control.

Further, according to the invention there is provided a television receiver, having a circuit for obtaining a substantially square wave identification signal from a phase detector circuit to which periodic colour synchronizing and phase reference signals are applied, the relative phase of said signals changing from line to line, including at least one resistor network, comprising an output conductor from the resistor network and a coupling of the output to a reactance control circuit or device, a further output conductor for coupling the square wave signal to a switching circuit or device, and means for substantially preventing the square wave output from interfering with the reactance control circuit.

In the PAL system the phase of the R—Y signal (previously the I signal) is phase reversed line by line. In the receiver it is necessary to restore the R—Y (or I or other axis which may be used) signal to the same phase on each line and to achieve this a phase reversing circuit and electronic switch triggered at half horizontal sweep frequency is used. It will be appreciated that the switch must operate in the correct phase relative to the transmitted signal and an identification signal is transmitted for this purpose. A colour signal includes a phase reference signal which is included during the horizontal blanking period and is included for the purpose of synchronising the reference voltage generation in the receiver which is required for demodulating the chroma signal.

In the PAL system presently proposed the identification signal is introduced at the transmitter by oscillating the burst phase approximately $\pm 45^\circ$ about —B—Y axis, as the R—Y signal is reversed as shown in FIGURE

1. This is referred to as "oscillating or swinging burst." The phase of the burst indicates the phase of the (R—Y) signal.

5 It is common practice in NTSC (National Television System Committee—the American authority that established the American colour television standards) colour receivers to use reference generators involving automatic phase control loops. The essential features of such generators are:

- 10 (a) An oscillator circuit (arranged to oscillate at a frequency close to the required sub-carrier frequency in the absence of a control signal).
- 15 (b) A reactance device which modifies the frequency and phase of the above oscillator in accordance with a control signal.
- 20 (c) A phase detection device which generates a control signal when the phase of the above oscillator is different from that of the burst.

25 A purpose of the invention is to provide a substantially square wave output from the phase detection device to switch the phase of the (R—Y) signal line-by-line directly or to synchronise a switching circuit.

Referring to FIGURE 3, 10 is the burst input. 11 leads to hue control if fitted. C3 and C4 are capacitors each having a typical value of 330 pF, connected in series with diodes D1 and D2. These diodes are typically thermionic diodes (or semiconductor devices with modified circuit values). 12 represents the reference voltage input to the phase detector. Each of resistors R1 and R2 connected across the diodes has a value typically of 1 megohm. The output of the phase detector is obtained at point 13 and this point is connected to a low pass filter circuit, C1, R3 and C2. The values of C1, R3 and C2 are determined by the noise bandwidth required. The square wave output of the detector is obtained at A. Between A and point 14 of the low pass filter, there is an impedance such as resistor R4 having a high value, in this instance 47 kilohms. The output of the detector is also passed from point 14 to reactance control B. The resistor R4 is important because without it, the filter comprising R1, R2, C1, R3 and C2 would remove the square wave (due to the oscillating burst). The noise bandwidth is determined by the elements of the filter and is normally 250 cycles per second. Resistor R4 serves to isolate the reactance control circuit from the PAL synchronising circuit. This reduces to some extent the automatic phase control loop gain.

60 FIGURE 4 is a modification which obtains the square wave output A' but avoids reduction of automatic phase control loop gain. Impedances such as resistors R5 and R6 have been included to assist in isolating the output A from the output to reactance con-

65 trol B'. The values of R5 and R6 are typically 330 kilohms each.

The output from the phase detector circuit at A, A' (FIGURES 3 and 4 respectively) will be of the form shown in FIGURE 2 in which a square wave of half the horizontal sweep frequency is superimposed on the normal d.c. component (and noise). The reason why the square wave is half the horizontal sweep frequency is because—due to the line by line alternating phase of the burst (plus and minus 45° on succeeding lines)—the output at point A is on one line a negative half cycle of the square wave and on the next line a positive half cycle. This therefore completes one cycle over two lines and then repeats itself. This output can be used directly or after amplification and/or shaping to switch the phase of the (R—Y) signal line by line directly or to synchronise a switching circuit.

85 Filtering of the control signal to the reactance device can be carried out after extraction of the identification signal has taken place as in FIGURE 3. It will be appreciated that the series element R4 and the noise filter elements C1, R3, C2 should be chosen so that a large amplitude square wave is obtained at A and that the noise bandwidth and pull-performance are not appreciably impaired. The reason for this is as follows: If the output is taken from A (FIGURE 3) and resistor R4 is not included in the circuit, the filter components C1, C2, R1, R2, R3 will normally have a low pass characteristic cutting off at about 250c/s, since the square wave we wish to extract has a fundamental component of 7.8kcs. This is well outside the passband of this control circuit and the square wave will be severely attenuated. Resistor R4 is therefore added to isolate point A from the low pass filter C1 and C2 and by choosing a suitable high value for resistor R4 a square wave will be obtained from point A. However, in adding this resistor R4 the AFPC loop reactance valve control voltage, which contains d.c. and low a.c. components up to approximately 250c/s will be attenuated somewhat. The addition of this resistor therefore reduces the loop gain, i.e., the control accuracy of the AFPC (automatic frequency and phase control) loop. In practice, a compromise is reached and some reduction in the amplitude in the available square wave is acceptable as well as some reduction in the performance of the AFPC loop. Some filtering (not shown) of the square wave output is desirable to remove residual sub-carrier frequency and high frequency noise and the filter elements must be chosen to suit the switching method employed. Such filtering can be achieved by a simple series R and shunt C arrangement having a cut off frequency above 7.8kcs and/or a tuned circuit arrangement tuned to 7.8kcs.

Another method of extracting the square wave is by providing two output points A' and B' (FIGURE 4) isolated from each other by the resistor networks R1, R2 and R5, R6 thus permitting the filtered control voltage to be extracted from B' while the square wave can be taken from A', each circuit having little influence on the other.

This also permits R5, R6 or other suitable arrangements such as inductors to have values to suit the higher frequencies involved in the switching waveform and provides a substantially square waveform at this point A'. Some filtering and/or a high pass filter to remove d.c., as by the insertion of capacitor C in series with point A' in FIGURE 4, may be incorporated to suit the following switching circuits, i.e., to prevent the d.c. from affecting the operation of the following circuits.

The rise time of the square wave will be dependent on the input capacity of the switching network together with the values of R5, R6, FIGURE 4, or R1, R2, FIGURE 3.

The values for C1, C2, C3 will be different for FIGURES 3 and 4 due to the presence of R4 (FIGURE 3) which modifies the overall time constant.

It will be appreciated that a square wave output due to the oscillating burst can also be obtained from the quadrature phase detector used for colour killing on monochrome reception provided the detector axis is not exactly at right angles to that of the burst signal. (A condition normally obtaining in practice.) This output will of course be smaller than that obtainable from the normal loop detector.

The switch fed from point A or A' (FIGURES 3 and 4) may be composed of two diodes arranged back to back through inductors and fed with two inputs, one input of which is a wave-shaped version of the square wave having sharp leading and trailing edges such as may be obtained from a synchronized multivibrator, and the other input of which is an output of the reference oscillator. The two diodes in the switch respectively respond to the alternate half cycles of the square wave input to produce alternately a phase inverted version of the reference input and a non-phase inverted version of the reference input.

WHAT WE CLAIM IS:—

1. A method of obtaining a substantially square wave identification signal from a phase detector to which periodic color synchronizing and phase reference signals are applied, said detector serving as part of the circuit of a television receiver the relative phase of said signals changing from line to line, in which the detector-output is used both for a control voltage for a reactance control circuit or

device and as a control voltage for a switching circuit or device, comprising taking the output from a resistor network in the detector circuit and substantially preventing the square wave output for switching from interfering with the output for reactance control.

2. A television receiver having a circuit for obtaining a substantially square wave identification signal from a phase detector circuit to which periodic color synchronizing and phase reference signals are applied, the relative phase of said signals changing from line to line, including at least one resistor network, comprising an output conductor from the resistor network and a coupling of the output to a reactance control circuit or device, a further output conductor for coupling the square wave signal to a switching circuit or device, and means for substantially preventing the square wave output from interfering with the reactance control circuit.

3. A circuit as claimed in Claim 2, in which the further output conductor for the square wave signal is tapped from the output conductor between the resistor network and the reactance control circuit and the means preventing interference is positioned between the tap and the reactance control circuit.

4. A circuit as claimed in Claim 2 or 3 in which the means for preventing interference is a resistor.

5. A circuit as claimed in Claim 2 in which a second resistor network is provided in the detector circuit, the output to the reactance control circuit is connected to one of the networks and the square wave output conductor is connected to the other of the networks.

6. A circuit as claimed in Claim 5, in which the means for preventing interference comprises the resistors in both resistor networks.

7. A color television receiver for receiving a signal including a color synchronizing component having a first reference phase on odd lines and another reference phase on even lines, and employing a phase detector circuit, a circuit including at least one resistor network for obtaining a substantially square wave identification signal from said phase detector circuit, comprising an output conductor from the resistor network and a coupling of the output conductor to a reactance control circuit, a further output conductor for the square wave signal, and circuit means coupled to said phase detector circuit for preventing the square wave output from interfering with the reactance control circuit.

8. A method of obtaining substantially square wave identification signal from a phase detector to which periodic color synchronizing and phase reference signals are applied substantially as herein described.

9. A circuit for obtaining a substantially square wave identification signal from a phase detector substantially as herein described with



Another method of extracting the square wave is by providing two output points A' and B' (FIGURE 4) isolated from each other by the resistor networks R1, R2 and R5, R6 thus permitting the filtered control voltage to be extracted from B' while the square wave can be taken from A', each circuit having little influence on the other.

This also permits R5, R6 or other suitable arrangements such as inductors to have values to suit the higher frequencies involved in the switching waveform and provides a substantially square waveform at this point A'. Some filtering and/or a high pass filter to remove d.c., as by the insertion of capacitor C in series with point A' in FIGURE 4, may be incorporated to suit the following switching circuits, i.e., to prevent the d.c. from affecting the operation of the following circuits.

The rise time of the square wave will be dependent on the input capacity of the switching network together with the values of R5, R6, FIGURE 4, or R1, R2, FIGURE 3.

The values for C1, C2, C3 will be different for FIGURES 3 and 4 due to the presence of R4 (FIGURE 3) which modifies the overall time constant.

It will be appreciated that a square wave output due to the oscillating burst can also be obtained from the quadrature phase detector used for colour killing on monochrome reception provided the detector axis is not exactly at right angles to that of the burst signal. (A condition normally obtaining in practice.) This output will of course be smaller than that obtainable from the normal loop detector.

The switch fed from point A or A' (FIGURES 3 and 4) may be composed of two diodes arranged back to back through inductors and fed with two inputs, one input of which is a wave-shaped version of the square wave having sharp leading and trailing edges such as may be obtained from a synchronized multivibrator, and the other input of which is an output of the reference oscillator. The two diodes in the switch respectively respond to the alternate half cycles of the square wave input to produce alternately a phase inverted version of the reference input and a non-phase inverted version of the reference input.

WHAT WE CLAIM IS:—

1. A method of obtaining a substantially square wave identification signal from a phase detector to which periodic color synchronizing and phase reference signals are applied, said detector serving as part of the circuit of a television receiver the relative phase of said signals changing from line to line, in which the detector-output is used both for a control voltage for a reactance control circuit or

device and as a control voltage for a switching circuit or device, comprising taking the output from a resistor network in the detector circuit and substantially preventing the square wave output for switching from interfering with the output for reactance control.

2. A television receiver having a circuit for obtaining a substantially square wave identification signal from a phase detector circuit to which periodic color synchronizing and phase reference signals are applied, the relative phase of said signals changing from line to line, including at least one resistor network, comprising an output conductor from the resistor network and a coupling of the output to a reactance control circuit or device, a further output conductor for coupling the square wave signal to a switching circuit or device, and means for substantially preventing the square wave output from interfering with the reactance control circuit.

3. A circuit as claimed in Claim 2, in which the further output conductor for the square wave signal is tapped from the output conductor between the resistor network and the reactance control circuit and the means preventing interference is positioned between the tap and the reactance control circuit.

4. A circuit as claimed in Claim 2 or 3 in which the means for preventing interference is a resistor.

5. A circuit as claimed in Claim 2 in which a second resistor network is provided in the detector circuit, the output to the reactance control circuit is connected to one of the networks and the square wave output conductor is connected to the other of the networks.

6. A circuit as claimed in Claim 5, in which the means for preventing interference comprises the resistors in both resistor networks.

7. A color television receiver for receiving a signal including a color synchronizing component having a first reference phase on odd lines and another reference phase on even lines, and employing a phase detector circuit, a circuit including at least one resistor network for obtaining a substantially square wave identification signal from said phase detector circuit, comprising an output conductor from the resistor network and a coupling of the output conductor to a reactance control circuit, a further output conductor for the square wave signal, and circuit means coupled to said phase detector circuit for preventing the square wave output from interfering with the reactance control circuit.

8. A method of obtaining substantially square wave identification signal from a phase detector to which periodic color synchronizing and phase reference signals are applied substantially as herein described.

9. A circuit for obtaining a substantially square wave identification signal from a phase detector substantially as herein described with

reference to FIGURE 3 or 4 of the accompanying drawings.

10. A circuit for obtaining a substantially square wave identification signal from a phase
5 detector circuit in a television receiver constructed, arranged and adapted to operate substantially as herein described with refer-

ence to FIGURES 3 and 4 of the accompanying drawings.

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