

PATENT SPECIFICATION

(11) 1431885

1431885

- (21) Application No. 38786/72 (22) Filed 19 Aug. 1972
 (23) Complete Specification filed 30 July 1973
 (44) Complete Specification published 14 April 1976
 (51) INT CL² H04N 9/38//9/46 9/50
 (52) Index at acceptance
 H4F D1B3 D1K3 D30Q D30T
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(54) IMPROVEMENTS IN OR RELATING TO CIRCUIT ARRANGEMENTS FOR PAL COLOUR TELEVISION RECEIVERS

(71) We, E M I LIMITED, a British company of Blyth Road, Hayes, Middlesex, 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:—

The present invention relates to circuit arrangements for PAL colour television receivers, and it relates more particularly to such receivers as employ means for separating the received chrominance signals into components bearing (R-Y) and (B-Y) information before the stage of demodulation. Typically, though not necessarily, this separation is achieved by means of a transit time signal separating circuit which includes a delay line having a delay of one line period, arranged in the path of received chrominance signals, an adding circuit for adding delayed and undelayed signals to provide the (B-Y) component of the chrominance signals and a subtracting circuit for subtracting delayed signals from undelayed signals to provide the (R-Y) component of the chrominance signals. The two components are then applied to respective demodulating circuits, which circuits are also supplied with demodulating oscillations of the colour sub-carrier frequency and the appropriate phase.

Problems arise in ensuring that the demodulating oscillations commence and/or remain in the correct phase relationship with the phase alternations of the received chrominance signals.

It is an object of this invention to overcome or reduce such problems by means of a simple and inexpensive circuit arrangement.

According to the present invention there is provided a circuit arrangement for a colour television receiver adapted to receive information encoded in accordance with the PAL system, the receiver having means for separating from one another the (R-Y) and (B-Y) components of said information and for applying said components to respective demodulating circuits, the arrangement including an

oscillator for providing demodulating oscillations of the colour sub-carrier frequency, means for deriving, from said information, colour synchronising signals of constant phase, means for utilising the derived synchronising signals to determine the phase of said demodulating oscillations, means for supplying to the demodulating circuit receiving said (B-Y) component demodulating oscillations which are offset by substantially 45° from the +(B-Y) axis, and means for supplying to the demodulating circuit receiving said (R-Y) component demodulating oscillations which are offset by substantially 45° from the +(R-Y) axis on alternate lines and from the -(R-Y) axis on intervening lines in accordance with the phase alternations of the PAL system.

In order that the invention may be clearly understood and readily carried into effect, one embodiment thereof will now be described, by way of example only, with reference to the drawings filed with the Provisional Specification, in which:—

Figure 1 shows, in block diagrammatic form, a circuit arrangement in accordance with one example of the invention, and

Figure 2 shows vector diagrams explanatory of the operation of the circuit of Figure 1.

Referring now to the drawings, the received chrominance signals are applied via a terminal 1 to a transmit time signal separating circuit which includes a delay line 2, having a delay of one line period, an adding circuit 3 connected so as to add the delayed and undelayed chrominance signals, and a subtracting circuit 4 connected so as to subtract the delayed chrominance signals from the undelayed chrominance signals. The signals derived from circuit 3 bear the (B-Y) component of the received chrominance information and are applied to a demodulating circuit 5 known as the (B-Y) demodulator. The signals derived from circuit 4, on the other hand, bear the (R-Y) component of the received chrominance information and are applied to a second

demodulating circuit 6 known as the (R-Y) demodulator.

The demodulators 5 and 6 are respectively fed with demodulating oscillations of the colour sub-carrier frequency derived from a local oscillator 7, which may be a passive oscillator, such as a ringing crystal, or an active oscillator. It is well known that, in accordance with the PAL system of colour television, the phase of the (R-Y) component of the chrominance information is reversed on alternate lines, whereas the phase of the (B-Y) component is maintained unchanged from line to line. It is therefore necessary to ensure that, on alternate lines, the demodulating oscillations passed to the (R-Y) demodulator 6 are shifted in phase by 180° . This is achieved by means of a 180° phase shifting circuit 14 and a switch 8, known as the PAL switch, which is adapted to change its condition for successive lines of received chrominance information.

As described thus far, the circuit would not operate satisfactorily since there is no control over the phase of operation of the PAL switch 8 with respect to the phase alternation of the received chrominance information, and moreover the phase of the oscillations derived from oscillator 7 can be arbitrary. These two difficulties can result in oscillations of unsuitable phase for correct demodulation being fed to either or both demodulators.

In order to resolve the two difficulties described above, line frequency pulses 9, derived for example from line flyback pulses generated in the receiver, are divided by two in frequency by means of a bistable circuit 10 and used to enable a burst gate 11 to pass alternate colour synchronising signals (or colour bursts) to oscillator 7 to synchronise the phase of operation thereof. It is assumed that the oscillator 7 generates oscillations having the phase of the colour synchronising signals applied thereto via gate 11. It is known that the colour synchronising signals associated with alternate lines of chrominance information comprise several cycles of oscillation of one phase at the sub-carrier frequency, and the colour synchronising signals associated with the intervening lines of chrominance information are of the same duration and frequency but a different phase. By enabling the burst gate 11 to pass only alternate colour synchronising signals, it will be appreciated that the selected signals applied to oscillator 7 will all be of one phase and it is a feature of this invention that it is irrelevant which set of alternate colour synchronising signals is selected. The PAL switch 8 is linked in operation to the operation of the bistable circuit 10, so that when the latter moves into its set, or '1' condition, the PAL switch connects contact 12 to demodulator 6 and when the bistable circuit 10 moves into its reset or '0' condition, PAL switch 8 connects contact 13 to demodulator 6.

The operation of the arrangement will now be described with reference to Figure 2. As mentioned previously, the phase of the (R-Y) component of the chrominance information alternates from line to line, and there is also an alternation in the phase of the colour synchronisation signals. In Figures 2(a) and 2(b), the phase of the (R-Y) component of the chrominance information is designated "R", that of the (B-Y) component is designated "B" and the phase of the colour synchronising signal is designated "S."

The line flyback pulses 9 are effective to change the condition of the bistable circuit 10 during each inter-line period, and the arrangement is such that the gate 11 is enabled to pass signals (i.e. it is opened) when the colour synchronising signals are present if the bistable circuit is in its "1" condition. This can be achieved, for example, by means of a monostable circuit (not shown) connected between the "1" state of circuit 10 and gate 11. The effect of this arrangement, therefore, is that every second colour synchronising signal is passed via gate 11 to the oscillator 7 to synchronise the phase of the oscillations generated thereby. It will be appreciated, then, that the colour synchronising signals applied to the oscillator 7 will be consistently of one phase, either SA or SB as shown in Figure 2(a).

In Figure 2(a) it is assumed that the gate 11 is opened to pass the colour synchronising signals SA which are associated with lines n , $n+2$, $n+4$ etc. of the received television information. The oscillator 7 is thus caused to generate oscillations having the phase of the vector SA. In these circumstances, the (B-Y) demodulator 5 is supplied consistently with oscillations of the phase $(-SA)$, as shown in Figure 2(a), derived from the 180° phase shifting circuit 14. The (R-Y) demodulator 6, on the other hand, receives demodulating oscillations which alternate in phase between SA and $(-SA)$ on alternate lines. This is achieved by means of the PAL switch 8 and the 180° phase shifting circuit 14. The operation of the switch 8 is, as previously mentioned, linked to the bistable circuit 10 so that when the circuit 10 is in its "1" condition the oscillations generated by the oscillator 7 are applied directly to the (R-Y) demodulator 6. Conversely, when the bistable circuit 10 is in its "0" condition the oscillations supplied to the (R-Y) demodulator 6 are derived from the 180° phase shifting circuit 14.

By means of the arrangement just described, and as can be seen from Figure 2(a), the phase of the demodulating oscillations supplied to the (R-Y) demodulator 6 follows the sequence SA, $-SA$, SA, $-SA$ etc for successive lines, whilst the (R-Y) component of the chrominance information follows the

sequence RA, RB, RA, RB etc. for the same set of successive lines.

In Figure 2(b) it is assumed that the gate 11 is opened to pass colour synchronising signals of the phase SB to the oscillator 7. It is considered unnecessary to explain the operation of the circuit arrangement in detail, since the operation is the same as that described with reference to Figure 2(a), but it will be appreciated that, in the circumstances assumed for Figure 2(b), the (B-Y) demodulator 5 is supplied consistently with oscillations of the phase (-SB), whereas the demodulating oscillations supplied to the (R-Y) demodulator 6 follow the phase sequence SB, -SB, SB, -SB etc. for successive lines whilst the (R-Y) component of the chrominance information follows the phase sequence RB, RA, RB, RA etc. for the same set of lines.

It will thus be observed that it is irrelevant as far as the operation of the circuit arrangement is concerned, which phase of colour synchronising signals is passed to the oscillator 7 via the gate 11. The arrangement thus requires no additional circuits for monitoring the phase of operation of the PAL switch 8 in relation to the alterations in phase of the (R-Y) component of the received chrominance information.

It will be seen from Figure 2 that the demodulating oscillations are in every case 45° displaced from the ideally required phase for demodulation, but since the two components of the chrominance information have already been separated, the operation is satisfactory.

It has been shown in practice that the above principle of operation (i.e. of utilising demodulating oscillations which are 45° offset from the ideal phase) introduces no substantial errors in saturation or hue.

WHAT WE CLAIM IS:—

1. A circuit arrangement for a colour television receiver adapted to receive information encoded in accordance with the PAL system, the receiver having means for separating from one another the (R-Y) and (B-Y) components of said information and for applying said components to respective demodulating circuits, the arrangement including an oscillator for providing demodulating oscillations of the colour sub-carrier frequency, means for deriving, from said information, colour synchronising signals of constant phase, means for utilising the derived synchronising signals to determine the phase of said demodulating oscillations, means for supplying to the demodulating circuit receiving said (B-Y) component demodulating oscillations which are offset by substantially 45° from the

$+(B-Y)$ axis, and means for supplying to the demodulating circuit receiving said (R-Y) component demodulating oscillations which are offset by substantially 45° from the $+(R-Y)$ axis on alternate lines and from the $-(R-Y)$ axis on intervening lines in accordance with the phase alternations of the PAL system.

2. An arrangement according to Claim 1 wherein said means for separating comprises a transit time signal separating circuit.

3. An arrangement according to either of Claims 1 or 2 wherein said means for deriving comprises a burst gate opened in response to every second one of a series of line frequency pulses derived from line flyback circuits in the receiver.

4. An arrangement according to Claim 3, wherein the said pulses are applied to a bistable circuit which permits the opening of said gate when it assumes one of its two stable conditions.

5. An arrangement according to any preceding claim wherein the demodulating oscillations provided by the oscillator are applied to a 180° phase shifting circuit so that in-phase and anti-phase components of said oscillations are available.

6. An arrangement according to Claim 5 wherein the demodulating circuit receiving said (B-Y) component is supplied continuously with the anti-phase component of said demodulating oscillations.

7. An arrangement according to either of Claims 5 or 6 wherein the demodulating circuit receiving said (R-Y) component is supplied on alternate lines with the in-phase component of the demodulating oscillations and on the intervening lines with said anti-phase component.

8. An arrangement according to Claim 7 wherein the two components of said demodulating oscillations are applied to respective contacts of a switch device which is arranged to change its condition between each two lines of received information, the pole of the switch device being coupled to the demodulator receiving said (R-Y) component.

9. An arrangement according to Claim 8 as limited by Claim 4 wherein the operation of said switch device is determined by the condition of said bistable circuit.

10. A circuit arrangement for a PAL colour television receiver substantially as herein described with reference to the drawings.

11. A PAL colour television receiver including a circuit arrangement according to any preceding claim.

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* C L M S *

sequence RA, RB, RA, RB etc. for the same set of successive lines.

In Figure 2(b) it is assumed that the gate 11 is opened to pass colour synchronising signals of the phase SB to the oscillator 7. It is considered unnecessary to explain the operation of the circuit arrangement in detail, since the operation is the same as that described with reference to Figure 2(a), but it will be appreciated that, in the circumstances assumed for Figure 2(b), the (B-Y) demodulator 5 is supplied consistently with oscillations of the phase (-SB), whereas the demodulating oscillations supplied to the (R-Y) demodulator 6 follow the phase sequence SB, -SB, SB, -SB etc. for successive lines whilst the (R-Y) component of the chrominance information follows the phase sequence RB, RA, RB, RA etc. for the same set of lines.

It will thus be observed that it is irrelevant as far as the operation of the circuit arrangement is concerned, which phase of colour synchronising signals is passed to the oscillator 7 via the gate 11. The arrangement thus requires no additional circuits for monitoring the phase of operation of the PAL switch 8 in relation to the alterations in phase of the (R-Y) component of the received chrominance information.

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(B-Y) axis, and means for supplying to the demodulating circuit receiving said (R-Y) component demodulating oscillations which are offset by substantially 45° from the (R-Y) axis on alternate lines and from the (R-Y) axis on intervening lines in accordance with the phase alternations of the PAL system.

2. An arrangement according to Claim 1 wherein said means for separating comprises a transit time signal separating circuit.

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5. An arrangement according to any preceding claim wherein the demodulating oscillations provided by the oscillator are applied to a 180° phase shifting circuit so that in-phase and anti-phase components of said oscillations are available.

6. An arrangement according to Claim 5 wherein the demodulating circuit receiving said (B-Y) component is supplied continuously with the anti-phase component of said demodulating oscillations.

7. An arrangement according to either of Claims 5 or 6 wherein the demodulating circuit receiving said (R-Y) component is supplied on alternate lines with the in-phase component of the demodulating oscillations and on the intervening lines with said anti-phase component.

8. An arrangement according to Claim 7 wherein the two components of said demodulating oscillations are applied to respective contacts of a switch device which is arranged to change its condition between each two lines of received information, the pole of the switch device being coupled to the demodulator receiving said (R-Y) component.

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10. A circuit arrangement for a PAL colour television receiver substantially as herein described with reference to the drawings.

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