

SIGNAL DISCRIMINATING CIRCUIT AND ACTIVE FILTER USING
SAME

The present invention relates to an NTSC/PAL signal discriminating circuit and an active filter using such a circuit, and more particularly to a device adapted for automatically adjusting the trap center frequency of an active filter and trap frequency in accordance with the frequency of an input signal.

It is generally known that a variety of circuits are contrived for automatically adjusting the trap center frequency f_0 of an IC active filter employed in an electronic apparatus such as a television receiver or a video tape recorder. A typical conventional circuit for achieving automatic adjustment of the trap center frequency is so formed that a reference signal is inputted to a filter itself or an integrator or the like constituting the filter, and a phase detection or a level comparison is executed with regard to the output

of the filter and the reference signal to obtain an error signal. And the voltage of such error signal is fed back to automatically adjust the trap center frequency f_0 of the active filter. An exemplary configuration of such automatic frequency adjusting circuit is shown in Fig. 1 of the accompanying drawings.

In this diagram, an input signal S_{in} fed to an input terminal T_{in} is supplied to both a reference filter 1 and a phase detector 2. A signal S_1 produced by shifting the phase of the input signal S_{in} by 90° in the reference filter 1 is supplied to the phase detector 2, where the phases of such two signals S_{in} and S_1 are detected. The terminal voltage of a charge/discharge capacitor C , i.e., the voltage at a point A in Fig. 1, is controlled in accordance with the phase detection output thus produced. The point-A voltage is applied to an inverting input terminal of a comparator 3. Meanwhile a reference voltage V_{ref} is applied to a non-inverting input terminal of the comparator 3, where the point-A voltage is compared with the reference voltage V_{ref} to produce an error detection signal S_2 . The error detection signal S_2 thus obtained from the comparator 3 is then fed back to the reference filter 1 to thereby control the operation of the

reference filter 1 in such a manner that the point-A potential is corrected to a predetermined value, i.e., the error is reduced to zero.

The error detection signal S_2 is supplied to an active filter 4 which is to be adjusted, so that the center frequency f_0 of the active filter 4 is automatically adjusted.

A chrominance subcarrier signal f_{sc} is inputted as the aforementioned reference signal. Since the frequency of such subcarrier signal f_{sc} is different depending on the NTSC system and the PAL system, it is natural that the trap center frequency f_0 of the active filter 4 to be adjusted is also different in each mode. Therefore, in an exemplary case where the reference filter 1 is such that the phase is shifted by 90° at a frequency of 3.58 MHz, the center frequency f_0 of the active filter 4 is adjusted at 4 MHz for example. In this state, when a subcarrier signal f_{sc} of the PAL format is inputted in the circuit of Fig. 1, the reference filter 1 is balanced at a point with a 90° phase shift at 4.43 MHz, so that the trap center frequency of the active filter 4 to be adjusted is deviated from the desired value as follows:

$$f_{\text{Trap}} (\text{PAL}) = 4 \text{ MHz} \times 4.43/3.58 = 4.95 \text{ MHz} \quad \dots (1)$$

For preventing such a disadvantage, it is necessary to add or subtract the offset component, which is derived from the difference between the NTSC and PAL formats, to or from the signal for controlling either the reference filter 1 or the active filter 4. And consequently it has been needed heretofore to input an external switching signal for executing the above action.

It is an object of the present invention to provide an improved signal discriminating circuit and an active filter using such a circuit, wherein adjusting the trap and centre frequency of the active filter and switching the operation mode of a chrominance synchronising circuit and so forth can be performed automatically without the necessity of inputting any external NTSC/PAL switching signal.

According to one aspect of the present invention, there is provided an active filter circuit with a signal discriminating circuit for discriminating between NTSC and PAL television signals, the signal discriminating circuit comprising:

an input signal detector for generating a signal having an amplitude corresponding to the frequency of an input signal and discriminating, in accordance with the amplitude of the signal thus generated, whether said input signal is a subcarrier signal of the NTSC format or that of the PAL format to generate a control signal; and

means for adjusting the trap centre frequency of said active filter circuit in accordance with the control signal;

whereby automatic adjustment of the operation is executed between the NTSC and PAL signals.

Another aspect of the invention provides a signal discriminating circuit comprising:

an input signal detector for outputting a first detection signal in response to an input subcarrier signal of the NTSC format or a second detection signal in

response to a subcarrier signal of the PAL format;

5 a correcting circuit for forming a correction difference signal by comparing the output detection signal of said input signal detector with a preset reference voltage, and then feeding back the difference signal to said input signal detector to thereby correct the operation of said detector; and a circuit for comparing the amplitude of the output signal of said input signal detector with the preset reference voltage and
10 discriminating, in accordance with the result of such comparison, whether the signal supplied to said input signal detector is a subcarrier signal of the NTSC format or that of the PAL format.

The present invention will be further apparent
15 described by way of non-limitative example with reference to the illustrative accompanying drawings, in which:-

Figure 1 is a block diagram of an exemplary circuit configuration for automatically adjusting the centre frequency of a conventional active filter;

20 Figure 2 is a block diagram of a circuit configuration for automatically adjusting the trap and centre frequency of an active filter embodying the present invention.

Fig. 3 graphically represents the frequency characteristic of the circuit shown in Fig. 2; and

Fig. 4 is a circuit block diagram of a modified input signal detector employed in the circuit of Fig. 2.

Hereinafter a preferred embodiment of the present invention will be described in detail with reference to a block diagram of Fig. 2.

As obvious from this diagram, an automatic adjusting circuit for the trap and center frequency of an active filter according to this embodiment comprises an input signal detector 11, a correction output generator 14 and an input signal discriminator 13, wherein the center frequency f_0 of an active filter 20 is automatically adjusted in conformity with the frequency of a reference signal f_{sc} fed to an input terminal T_{in} .

More specifically, as mentioned above, the input terminal T_{in} is fed with a chrominance subcarrier signal f_{sc} as a reference signal in the same manner as in the conventional circuit. The reference signal is

supplied to both a reference filter 15 constituting the input signal detector 11 and a phase detector 16. The reference filter 15 serves to shift the phase of the input reference signal f_{sc} by 90° and outputs the phase-shifted signal to the phase detector 16. Since an operation control signal S_{12} is supplied to the reference filter 15, the phase shift is performed under control with accuracy.

The phase detector 16 controls the terminal voltage of a charge/discharge capacitor C, i.e., the voltage at a point A in Fig. 2, in accordance with the frequency of the input subcarrier signal f_{sc} and that of the signal S_{11} having a 90° phase shift from the subcarrier signal f_{sc} . Thus, when the subcarrier signal f_{sc} fed to the input terminal T_{in} is the one based on the NTSC format, the point-A voltage is controlled to 1.9 volts. Meanwhile, if the subcarrier signal f_{sc} fed to the input terminal T_{in} is the one based on the PAL format, the point-A voltage is controlled to 3.1 volts.

In this manner, the point-A voltage controlled in conformity with the frequency of the input subcarrier signal f_{sc} is supplied to an inverting input terminal (-) of a variable transconductance amplifier (hereinafter referred to as variable Gm amplifier) 17

constituting the correction output generator 14, while being supplied also to a non-inverting input terminal (+) of a comparator 10 constituting the input signal discriminator 13.

A reference voltage V_{ref} is applied to both the non-inverting input terminal (+) of the variable Gm amplifier 17 and the inverting input terminal (-) of the comparator 10, so that the point-A potential is compared with the reference voltage V_{ref} . In this embodiment, the reference voltage V_{ref} is set to 2.5 volts for example.

The variable Gm amplifier 17 produces an output current as an error detection signal S_{12} corresponding to the difference between the point-A potential and the reference voltage V_{ref} , and then supplies such signal S_{12} to a correction current selector 12 while supplying the same signal also to the reference filter 15 in the input signal detector. The comparator 10 compares the point-A potential with the reference voltage V_{ref} to discriminate whether the subcarrier signal f_{sc} fed to the input terminal T_{in} is based on the NTSC format or the PAL format, and then outputs a discrimination signal S_{13} . The discrimination signal S_{13} thus obtained is supplied to the correction

current selector 12 to thereby switch the terminal 12a of the selector 12 in accordance with the discriminated content. Therefore, when the subcarrier signal f_{sc} of the PAL format is fed to the input terminal T_{in} , the terminal 12a is selectively switched to a PAL current source 12b. Meanwhile, if the subcarrier signal f_{sc} of the NTSC format is fed to the input terminal T_{in} , the terminal 12a is selectively switched to an NTSC current source 12c.

Due to execution of such switching control, the correction signal S_{14} conforming with the kind of the input subcarrier signal f_{sc} is outputted from the correction current selector 12. The correction signal S_{14} is supplied to an active filter 20 so that, if the NTSC subcarrier signal or the PAL subcarrier signal is fed to the input terminal T_{in} , the center frequency f_0 of the active filter is automatically adjusted in conformity therewith.

The active filter 20 comprises a first variable Gm amplifier 21 and a second variable Gm amplifier 22 as shown in Fig. 2, and current sources 23 and 24 for supplying operating currents to such amplifiers are controlled by an operation control signal

S₁₄ to achieve automatic adjustment of the frequency characteristics.

Fig. 3 is a frequency characteristic diagram graphically representing the result of measuring the operation of the active filter in the embodiment of the above-described constitution. As obvious from Fig. 3, both the band pass characteristic B and the trap characteristic T of the active filter in the embodiment can be automatically adjusted with accuracy. When the NTSC subcarrier signal f_{sc} is inputted, the band pass characteristic B is so adjusted as to pass the signal of 3.58 MHz, and the trap characteristic T is automatically adjusted for switching the trap frequency to 5.07 MHz.

Meanwhile, if the PAL subcarrier signal f_{sc} is inputted, the band pass characteristic B is so adjusted as to pass the signal of 4.43 MHz, and the trap characteristic T is automatically adjusted for switching the trap frequency f_0 to 5.90 MHz. In case the operation of the active filter 20 is set ready for input of the NTSC subcarrier signal f_{sc} , if the signal f_{sc} fed to the input terminal T_{in} is switched from the NTSC to the PAL when the correction current circuit is not in its operating state, then the trap frequency f_{Trap} of the trap is expressed as

$$f_{\text{Trap}} = 5.07 \times 4.43/3.58 = 6.27 \text{ MHz} \quad \dots (2)$$

It is therefore found that, in the circuit of this embodiment, the trap frequency is automatically corrected by 370 kHz.

The above embodiment represents an exemplary case where the input signal detector 11 is composed of a reference filter 15 and a phase detector 16. However, as shown in Fig. 4 which represents a modified constitution, the input signal detector may be composed of a variable Gm amplifier 31, a peak holder 32, a comparator 33, a switching circuit 34 and a charge/discharge capacitor C_0 . Briefly describing the operation of this input signal detector, one charge and discharge cycle is repeated every frequency period of the subcarrier signal f_{sc} fed to the input terminal T_{in} . And the transconductance of the variable Gm amplifier 31 is so controlled that the amplitude of each triangular wave obtained from an output terminal T_{out} is maintained at a predetermined constant voltage conforming with the frequency of the input subcarrier signal f_{sc} . Consequently, in this circuit also, a discrimination between two input subcarrier signals of the NTSC and PAL formats can be executed by detecting the amplitude of the triangular wave.

According to the present invention, as described hereinabove, a signal of an amplitude corresponding to the frequency of an input signal is generated, and a discrimination between subcarrier signals f_{sc} of the NTSC and PAL formats is executed in accordance with the amplitude of the signal thus generated. And then a correction signal conforming with the kind of the input subcarrier signal f_{sc} is produced in accordance with the discrimination output. Therefore, if the subcarrier signal f_{sc} supplied as a reference signal to the input terminal is based on the NTSC format or the PAL format, it is possible, by the use of such correction signal, to automatically perform various operations inclusive of controlling the action of the circuit to generate a voltage corresponding to the input signal frequency, adjusting the trap and center frequency of the active filter, and switching the operation mode of the chrominance synchronizing circuit and so forth. Consequently, even in case the circuits are formed to be employed in common to both the NTSC and PAL systems, satisfactory operations are achievable therein without the necessity of supplying any external switching signal.



C L A I M S

1. An active filter circuit with a signal discriminating circuit for discriminating between NTSC and PAL television signals, the signal discriminating circuit comprising:

an input signal detector for generating a signal having an amplitude corresponding to the frequency of an input signal and discriminating, in accordance with the amplitude of the signal thus generated, whether said input signal is a subcarrier signal of the NTSC format or that of the PAL format to generate a control signal; and

means for adjusting the trap centre frequency of said active filter circuit in accordance with the control signal;

whereby automatic adjustment of the operation is executed between the NTSC and PAL signals.

2. A signal discriminating circuit comprising:
an input signal detector for outputting a first detection signal in response to an input subcarrier signal of the NTSC format or a second detection signal in response to a subcarrier signal of the PAL format;

a correcting circuit for forming a correction difference signal by comparing the output detection signal of said input signal detector with a preset reference voltage, and then feeding back the difference signal to said input signal detector to thereby correct the operation of said detector; and a circuit for comparing the amplitude of the output signal of said input signal detector with the preset reference voltage and discriminating, in accordance with the result of such comparison, whether the signal supplied to said input signal detector is a subcarrier signal of the NTSC format or that of the PAL format.



3. An active filter circuit with a signal discriminating circuit according to claim 1 further comprising means for varying the value of a correction signal for switching the operation mode of a chrominance synchronizing circuit.

4. An active filter circuit with a signal discriminating circuit according to claim 1 or 3 further comprising:

a correcting circuit for forming a correction difference signal by comparing the output detection signal of said input signal detector with a preset reference voltage, and then feeding back the difference signal to said input signal detector to thereby correct the operation of said detector.

5. A circuit according to claim 1, 2, 3 or 4, wherein said input signal detector comprises:

a first voltage-to-current converter supplied with a first reference voltage at a non-inverting input terminal and also with a second reference voltage at an inverting input terminal, and producing an output current controlled by a control signal;

a peak holder supplied with the output current of said first voltage-to-current converter and serving to hold the peak value of said current;

a second voltage-to-current converter supplied with the output signal of said peak holder at an inverting input terminal and also with said first reference voltage at a non-inverting input terminal;

a capacitor for holding the output current of said second voltage-to-current converter;

an output terminal for delivering a control voltage therefrom while supplying a control signal to said first voltage-to-current converter in response to the output signal of said second voltage-to-current converter;



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a charge/discharge capacitor connected between the input terminal of said peak holder and the second reference potential; and

5 a switching circuit capable of repeating a switching on-off action in response to the input signal.

6. A circuit according to claim 5, wherein the signal for controlling the on-off action of said switching circuit is a video subcarrier signal.

7. A signal discriminating circuit constructed
10 and arranged to operate substantially as hereinbefore described with reference to and as illustrated in Figures 2 to 4 of the accompanying drawings.

8. An active filter circuit including a signal discriminating circuit according to claim 2 or claim 4,
15 or 6 when dependent therefrom.

9. A television receiver or VTR including a circuit in accordance with any one of the preceding claims.
