

Circuit arrangement for a mixer in a HF-tuner.

The invention relates to a circuit arrangement for an RF-tuner, preferably a television tuner, in which an IF-circuit is coupled to the output of a mixer including a transistor operating in common base configuration, an amplifier stage being arranged between the collector of said mixing transistor and the IF-circuit, which stage includes a
5 transistor operating in common emitter configuration, whose base is DC coupled to the collector of the mixing transistor and whose collector is coupled to the IF-circuit.

Such a circuit arrangement is known from GB-A 1,114,204 and is particularly used for switching the tuner between different reception ranges and for ensuring an appropriate amplification for these ranges. The problem is thus solved by
10 means of this known circuit arrangement in that a smooth amplification is achieved by way of appropriate band switching.

A mixer stage including a transistor arranged in common base configuration is known from AT-A 329 637 (DE-A 19 24 680).

It is an object of the invention to improve the circuit arrangement
15 mentioned in the opening paragraph in such a way that a possibly linear mixing process and a high linear amplification are realised.

According to the invention, this object is solved in that the base of the amplifying transistor is coupled to ground *via* a resistor, and in that for the purpose of DC negative feedback the emitter of the amplifying transistor is coupled to the base of
20 the mixing transistor *via* a resistor.

An amplifier is arranged between the mixing transistor and the IF-circuit while the mixing transistor operates in common base configuration. The DC collector currents of the two transistors can be separately adjusted. This provides the possibility of choosing the value of the collector current of the mixing transistor in such a way that
25 it operates with a minimum possible cross-modulation. The current for the amplifying transistor is independently adjustable so that this stage also operates with a minimum cross-modulation.

The coupling of the base of the amplifying transistor to ground *via* a resistor enables the collector current of the mixing transistor to be adjusted to a desired value. The value of the resistor may be chosen to be such that the load impedance of the mixing transistor resulting from said resistance and the input impedance of the
5 amplifier is maintained small, so that no high amplitudes are produced at the collector of the mixing transistor and this transistor operates with a minimum cross-modulation.

It is known to provide a DC negative feedback in the mixer in such a way that collector and base of the mixing transistor are coupled. In order to include the amplifier stages in the negative feedback, it is advantageous to couple the emitter of the
10 amplifying transistor to the base of the mixing transistor *via* a resistor.

An embodiment of the invention will be described in greater detail with reference to the Figures in which:

Figure 1 shows a circuit arrangement for an RF-tuner including a mixer preceding an amplifier, essentially in accordance with GB-A 1,114,204, and

15 Figure 2 shows the circuit arrangement according to the invention with an IF-stage according to Figure 1 with a DC negative feedback between amplifier and mixing transistor.

A circuit arrangement, essentially known from GB-A 1,114,204, with a mixer, an amplifier stage and an IF-circuit is shown in Figure 1. In the mixer a
20 transistor 1 operates in common base configuration whose base is connected to ground *via* a capacitor 2. The base of the emitter of the transistor 1 are connected to the power supply *via* resistors 3 and 4, respectively. The output signal of an IF-oscillator not shown in the Figure and the RF-signal are applied *via* a terminal 5 and a coupling capacitor 6, respectively, to the emitter of the transistor 1. A resistor 7 is arranged for
25 the purpose of DC negative feedback between the collector and the base of the transistor 1.

The mixer is followed by an amplifier stage in which an amplifying transistor 11 operates in common emitter configuration. To this end the collector of the mixing transistor 1 is DC connected to the base of the amplifying transistor 11 and to
30 ground *via* a resistor 12. The emitter of the amplifying transistor 11 is connected to ground *via* the parallel arrangement of a resistor 13 and a capacitor 14. This corresponds to the circuit arrangement according to GB-A 1,114,204 in the UHF/VHF

band III operation.

The output of this amplifier stage, *i.e.* the collector of the amplifying transistor 11 is connected to the IF-circuit. The IF-circuit comprises a capacitor 21 which is connected to ground and a variable inductance 22. The IF-signal is coupled out behind the inductance 22 *via* a coupling capacitor 23. For the power supply of the amplifying transistor 11 the junction point between the inductance 22 and the capacitor 23 is connected to the power supply *via* a further inductance 24. A further capacitor 25 is connected between the power supply terminal of the inductance 24 and ground in order to shunt signal frequencies to ground.

The collector current of the mixing transistor 1 operating in common base configuration can be basically adjusted by the values of resistors 3 and 4. However, the values of the resistors 7 and 12 also play a role, because the value of the resistor 12 influences the voltage at the output of the mixer. A DC negative feedback takes place *via* the resistor 7 and its value is thus dependent on the value of the resistor 12 and also on the value of the DC negative feedback resistor 7. The working point of the amplifying transistor 11 can be adjusted by suitable choice of the resistor 13. Both the mixing transistor 1 and the amplifying transistor 11 can thus operate with a low distortion while achieving a high amplification of the entire circuit and hence a relatively high IF-signal voltage.

The circuit shown in Figure 1 operates with a DC negative feedback in the mixer only. In order to include the amplifier stage in the DC negative feedback, a modification of the circuit according to the embodiment shown in Figure 2 is advantageous according to the invention. The circuit shown in Figure 2 is distinguished from that in Figure 1 in that the DC negative feedback in the mixer between the collector and the base of the mixing transistor 1 is omitted and is replaced by a DC negative feedback between the emitter of the amplifying transistor 11 and the base of the mixing transistor 1 which are interconnected *via* a resistor 31. In this way the amplifier stage with the amplifying transistor 11 is included in the DC negative feedback.

Claim:

1. A circuit arrangement for an RF-tuner, preferably a television tuner, in which an IF-circuit is coupled to the output of a mixer including a transistor (1) operating in common base configuration, an amplifier stage (25) being arranged between the collector of said mixing transistor and the IF-circuit, which stage includes a
5 transistor (11) operating in common emitter configuration, whose base is DC coupled to the collector of the mixing transistor (1) and whose collector is coupled to the IF-circuit (21, 22, 24), characterized in that the base of the amplifying transistor (11) is coupled to ground *via* a resistor (12) and in that for the purpose of DC negative feedback the emitter of the amplifying transistor (11) is coupled to the base of the mixing transistor
10 *via* a resistor (13).