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PATENT APPLICATIONAmplifier with a tuned output transformer

The invention relates to an amplifier with a tuned output transformer.

5 In the case of cathode ray tubes, in particular in the case of cathode ray tubes with large format, many distortions in the geometry of a displayed screen pattern occur. In the case of large-format rectangular tubes, a geometrical defect in the north-south direction, for
10 example, occurs which is expressed in a parabolic sagging of the lines directed towards the horizontal mid-line. This defect is greatest at the upper and lower edges of the picture and decreases continuously towards the centre of the picture.

15 A further geometrical defect is expressed by the curvature of horizontal lines in the form of two cosine oscillations during one line period, which is therefore referred to as a gullwing defect. It occurs particularly in the upper and lower halves of the picture. This defect
20 is eliminated by a correction current, with double the line frequency, produced with the aid of a modulator circuit. However, after this has been corrected, another defect, which has become known by the term "bending", is produced in which at the right and left edges of the
25 picture the lines are bent towards the centre of the picture, that is to say downwards in the upper half of the picture and upwards in the lower half of the picture. This bending defect occurs in the same region as the



gullwing defect. A circuit arrangement for eliminating the bending defect has already been described in a prior application (P 38 14 563.4), but it is associated with considerable circuit outlay.

5 The object of the invention is to eliminate this bending defect using simpler means. This object is achieved by the measure specified in the patent claim. Further developments of the invention are given in the subclaims.

10 The invention is described below with reference to an illustrative embodiment with the aid of the drawing.

 Figure 1 shows the effect achieved by the amplifier on a geometrical defect typical of large cathode ray
15 tubes

 Figure 2 shows a circuit arrangement of the invention

 Figure 3 shows diagrams of the signals at the points indicated in Figure 1.

20 Figure 1 represents the way in which the measures specified according to the patent claims affect the geometrical defect to be eliminated. Figure 1a represents the bending defect which results after gullwing correction has been achieved. The bent parts in regions A and C
25 at the ends of the displayed lines can be seen. If an attempt is made to eliminate this defect by increased gullwing correction, an overcompensation is produced in the region B (Figure 1b). By virtue of the claimed measure, this overcompensation in the region B is reduced
30 by damping the gullwing correction current, as a result of which the displayed line again becomes straight in the region B (Figure 1c). The object of the invention is therefore to avoid this overcompensation in the region B by suitable measures. As is known, in the case of
35 north-south correction circuits, tuned transformers are used for saving power and for symmetrization of the geometry correction for the right and left sides. However, a tuned output circuit produces problems if very fast amplitude changes are required and must be



transmitted, and this is the case for the elimination of the bending defect. The gullwing correction current must thus be switched very quickly in interval B to a smaller value, in a line period of 64 μ s after interval A, after which it must very quickly return to the starting value in interval C. This is, however, not possible using a modulation of the correction current by corresponding modulation of the input signal fed to the gullwing correction circuit, since because of the Q-factor of the tuned circuit the amplitudes of the oscillations decay relatively slowly owing to the stored energy.

The invention is described below, with reference to the illustrative embodiment for a modified gullwing correction circuit, with the aid of Figure 2 in conjunction with the diagrams according to Figure 3.

The circuit according to Figure 2 is, firstly, a known correction circuit for eliminating the gullwing defect. At the input E1 of an amplifier circuit with negative feedback, the correction signal is fed to the input transistor T1 via the coupling capacitor C1. The input transistor T1 is biased by the voltage divider, formed by the resistors R1 and R2 and connected between the operating voltage source -UB1 and earth, for the purpose of setting the working point of the amplifier. The emitter of the input transistor T1 is earthed via the base-point resistor R3 of the negative feedback network R6, R3, and the collector is connected via the working resistor R4 to the operating voltage -UB1. Via the resistor R5, the signal reaches the input of the power transistor T2, the emitter of which is connected to the operating voltage source -UB1 and the collector of which is earthed via the primary winding of a tuned transformer TR from whose secondary winding the output correction signal can be drawn. The collector of the power transistor T2 is connected via the feed resistor R6 of the negative feedback network R6, R3 to the emitter of the input transistor T1. This is a known negative feedback circuit. The tuned transformer TR is tuned, for example with the aid of the capacitor C2, to twice the



line frequency $2f_z = f_o$. This circuit is then supplemented, according to the invention, by the following components. At the suitable instant, a switching transistor T3, the emitter of which is earthed, connects a
5 further resistor R7 in parallel with the base-point resistor R3 via the coupling capacitor C3. This coupling capacitor C3 represents an AC short-circuit for the signal and serves only to block the operating voltage -UB2 fed to the collector of the switching transistor T3
10 via the resistor R8. By suitably timed driving of the switch T3, the negative feedback of the above-described amplifier is then switched in such a way that the correction current is reduced in the region B (Figure 1). The increased negative feedback means that the internal
15 impedance of the amplifier is reduced and the tuned circuit, consisting of the winding of the transformer TR and the capacitor C2, therefore experiences increased damping. For this purpose, a pulse H (Figure 3a) with the line frequency is fed to the input E2 of the auxiliary
20 circuit via the coupling capacitor C4. This pulse is converted into a sawtooth signal (Figure 3b) with the aid of the resistor R9 and the capacitor C5. The combination, consisting of the resistor R10 and the diode D1, connected to the integrator component R9/C5 serves as a
25 clamp circuit and thereby affects the width, fed to the switching transistor T3, of the drive pulses (Figure 3c) which are applied via the resistor R11 to the switching transistor T3. By its limiting action on the base/emitter voltage, the diode D2 serves to protect the transistor
30 T3. The switching transistor T3 must be driven in such a way that it increases the negative feedback during the region B by being turned off. Because of the inductive load of the power transistor T2, this means that the drive voltage for the switching transistor T3 must be
35 phase-shifted by 90° relative to the correction current. Over the duration of the increased negative feedback, the effective correction current is thereby reduced. In the illustrative embodiment shown, the negative feedback is achieved by disconnecting the parallel resistor R7. The

negative feedback can also be increased by connecting a resistor in series with the emitter resistor R3.

Figure 2d represents the effect on the correction current produced by the circuit.

5 A circuit arrangement achieving the object of the invention was dimensioned according to the following table:

	R1: 470 kohm	C1: 10 nF	D1: 1N4148
	R2: 22 kohm	C2: 0.1 μ F	D2: 1N4148
10	R3: 680 ohm	C3: 1 μ F	
	R4: 2.2 kohm	C4: 10 nF	T1: BC 557
	R5: 1 kohm	C5: 1 nF	T2: BD 137
	R6: 6.8 kohm		T3: BC 557
	R7: 330 ohm		
15	R8: 15 kohm		
	R9: 47 kohm		
	R10: 47 kohm		UB1: -25 V
	R11: 47 kohm		UB2: -15 V

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Patent claims

1. Amplifier with a tuned output transformer for transmitting a signal which in each period consists of at least two oscillations, characterized in that a damping
5 device is provided which reduces the amplitude of the output signal in one time interval (B) compared to the other time intervals (A, C) of the period.
2. Amplifier according to Claim 1, characterized in that the reduced amplitude is produced by increased
10 damping and the increased amplitude is produced by reduced damping.
3. Amplifier according to Claims 1 or 2, characterized in that an electronic switch (T3) for switching the damping is provided.
- 15 4. Amplifier according to Claims 1, 2 or 3, characterized in that the damping is produced by switching the negative feedback of the amplifier.
- 20 5. Amplifier according to Claims 3 or 4, characterized in that the electronic switch (T3) switches the base-point resistor (R3) of the negative feedback network (R6, R3) of the amplifier.
- 25 6. Amplifier according to Claim 5, characterized in that the electronic switch (T3) switches the feed resistor (R6) of the negative feedback network (R6, R3) of the amplifier.

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