

The present invention relates to a circuit arrangement for the production of a deflection current for the vertical deflection of electron beams in a picture reproducing tube with the help of a vertical output stage delivering the deflection current, at whose output, the vertical deflection coil in series with a coupling capacitor are connected to reference potential, with an arrangement for the initiation of a rapid fly back of the electron beams, wherein there is connected to the output of the vertical output stage a capacitor whose other side is connectable on the one hand to a positive operating voltage and on the other hand to a negative operating voltage as well as with a control circuit which generates on this capacitor during the vertical fly back a voltage jump developed by the positive and negative operating voltage.

Such a circuit arrangement is known and is comprised for example in the integrated circuit 7101 from the company Thomson CSF. This circuit includes a fly back generator which ensures a rapid vertical fly back of the electron beam or the electron beams in a colour picture tube. For the duration of the fly back, the fly back generator generates a fly back voltage which is approximately double the magnitude of the operating voltage for the vertical output stage.

A driver circuit for an amplifier for the production of a vertical deflection current which incorporates a fly back generator is described in the US-A-4 289 994. This circuit is not suitable however, if it has to process large changes of amplitudes and frequency such as can occur in monitor devices.

A vertical deflection circuit is described in the FR-A-2 115 406 but from this it is not apparent how the fly back time can be made exactly adjustable.

For the vertical deflection of electron beams especially in monitors and data display devices, the problem arises that the fly back time of the electron beams is too long so that it is desirable for the purpose of improved usage of the screen and the increase of informational content thereby entailed, to reduce the fly back time, during the reproduction, to less than a millisecond e.g. 300 microseconds. Consequently, the fly back voltage must be at least three times higher than the operating voltage. This is not possible with the circuits known up to now.

There are picture reproducing devices which operate with different vertical deflection frequencies. These devices are the so-called multi-standard devices. In these, the deflection amplitudes must be matched to the various deflection

frequencies. As a result, the peak value of the deflection current can vary by 30%. Consequently, it is necessary to match the fly back voltage to this peak value, or, for a constantly maintained fly back voltage, to alter the fly back time correspondingly.

The object of the invention is to shorten the fly back time of the electron beams in such a way that an optimal reproduction of video signals is enabled especially in monitor devices as well as in multi standard devices or data display devices. This object is achieved by the invention defined in the claim 1.

The invention will be explained hereinafter by an embodiment with the help of the drawing.

Figure 1 shows the invention in a circuit diagram

Figure 2 shows voltage diagrams for the explanation of the operation of the circuit in accordance with Figure 1.

In Figure 1, there is applied to the positive input of an amplifier 1, the deflection signal V which controls a vertical output stage consisting of two complementary resistors 2 and 3. The vertical deflection coil 4 with its effective resistance 5 in series with a coupling capacitor 6 are connected from the output of this vertical output stage via a test resistor 7 to the reference potential. A negative feedback voltage proportional to the deflection current is derived from the test resistor 7 and applied to the negative input of the amplifier 1. The vertical output stage 2, 3 is connected via a diode 8 to the positive operating voltage of e.g. 20 V. The deflection circuit described so far is known.

In order to achieve the object of the invention, to substantially shorten the fly back time of the electron beams, a capacitor 9 is connected from the output of the vertical output stage 2, 3 via a resistor 10 to a high negative auxiliary voltage $-U_H$ of e.g. -60 V. The capacitor 9 is large and has a value of about 100 μF and the resistor 10 a value of 1 k Ohm, so that the capacitor 9 is virtually undischarged during a deflection period. Moreover, the control electrode of an electronic switch is coupled via a resistor 11 and a capacitor 12 to the output of the vertical output stage and is connected via the resistor 14 to the reference potential and via a further capacitor 15 to the positive operating voltage $+U_B$. The electronic switch 13, in the form of a transistor, couples the positive operating voltage $+U_B$ to the control electrode of a further electronic switch 16 which, in the conductive state, couples the positive operating voltage to the side of the

capacitor that is not connected to the output of the vertical output stage. A diode 17 in parallel with the electronic switch 16 forms therewith a bipolar switch and ensures that during the fly back, the deflection current can flow to the positive operating voltage $+U_s$ at the time when the electronic switch 16 is in the closed state.

Hereinafter, the manner of operation of the circuit arrangement will be described in connection with the diagrams in accordance with Figure 2. The electronic switch 13 is conductive throughout the whole course of the deflection so that the electronic switch 16 is blocked. The voltage U_s at the output of the vertical output stage sinks from virtually operating voltage $+U_s$ to a value U_{smin} (Figure 2a). As long as the voltage U_s is greater than the voltage U_0 on the capacitor 6, the voltage U_c on the resistor 11 remains clamped via the conducting diode 18 to the voltage U_0 approximately to $U_s/2$. From the middle of the deflection, the voltage U_s sinks below this value so that the voltage U_c also sinks down to a minimum value U_{smin} (Figure 2c). At the start of the fly back, the positive voltage jump of U_c is transferred via the capacitive voltage divider 12, 15 to the control electrode of the electronic switch 13. This positive voltage jump amounts to $U = R_v \cdot I_{pp}$, where R_v represents the ohmic resistance value 5 of the vertical deflection winding 4 and I_{pp} the peak-to-peak value of the deflection current. The positive voltage jump is transferred via the capacitive voltage divider to the control electrode of the electronic switch 13 in such a way that the threshold of the Zener voltage of the base emitter path is not exceeded (Figure 2d). In this manner, the electronic switch 13 is blocked and held in this state by the time constant set up by the resistor 14 and the capacitors 12 and 15. A voltage jump U_D occurs on the base of the electronic switch 13 which is thereby proportional to the peak current I_{pp} . The duration of the blocked state of the electronic switch 13 is determined by the time constant so that the fly back time of the vertical deflection T_R can be influenced in proportion to the voltage U_D and the peak current I_{pp} . The value of the resistor 14 is chosen in dependence on the inductance of the deflection winding 4, the level of the auxiliary voltage U_A and the desired fly back time T_R . Due to the blocking of the electronic switch 13 at the start of the fly back, the electronic switch 16 is conductive and switches the positive operating voltage $+U_s$ onto the capacitor 9 (Figure 2b). As the capacitor 9 does not lose its charge, the potential U_s which previously was virtually at 0 V, increases to a value of +90 V. This high voltage peak ensures a substantially shorter fly back time as this voltage is about three times greater than the operating voltage U_s .

For the case that the vertical deflection frequency is different, the vertical deflection amplitude must be matched to this frequency. The deflection current can alter by 30% so that the fly back voltage U_R is proportional to the deflection current. For a constantly maintained fly back voltage, the fly back time T_R must be varied correspondingly proportionally to the peak deflection current.



Claims

1. Circuit arrangement for the production of a deflection current for the vertical deflection of electron beams in a picture reproducing tube with the help of a vertical output stage (2, 3) delivering the deflection current, at whose output, the vertical deflection coil (4) in series with a coupling capacitor (6) are connected to reference potential, with an arrangement for the initiation of a rapid fly back of the electron beams, wherein there is connected to the output of the vertical output stage (2, 3) a capacitor (9) whose other side is connectable on the one hand to a positive operating voltage and on the other hand to a negative operating voltage, as well as with a control circuit which generates on this capacitor (9) during the vertical flyback a voltage jump developed by the positive and negative operating voltage, characterised in that, the side of the capacitor (9) facing away from the output of the vertical output stage (2, 3) is connected to an auxiliary voltage source ($-U_H$), which delivers the negative operating voltage, that the cathode of a diode (18) is connected to the coupling capacitor (6) and that a resistor (11) is connected to the output of the vertical output stage (2, 3) and that the resistor (11) and the anode of the diode (18) are connected together to the input of the control circuit which consists of a differentiating member (12, 14) which is a part of a capacitive voltage divider (12, 15) and that the differentiating member (12, 14) is connected to an electronic switch (13) that is switched through during the vertical run, which is blocked at the initiation of the vertical fly back, wherein the electronic switch (13) is connected to a second electronic switch (16) which, during the blocked phase of the first electronic switch (13), switches the positive operating voltage ($+U_H$) to the side of the capacitor (9) connected to the negative auxiliary voltage source ($-U_H$), wherein the control circuit controls the duration of the supply of the positive operating voltage ($+U_H$) in dependence on the peak value (I_{pp}) of the deflection current.

2. Switching arrangement in accordance with claim 1, characterised in that, the negative operating voltage ($-U_H$) is at least three times as great in value as the positive operating voltage ($+U_H$) for the vertical output stage.