

The invention relates to a circuit arrangement for the degaussing of the shadow mask in a colour picture tube of a colour picture reproduction device with the aid of a degaussing coil which is arranged thereon and is connected in the alternating current circuit of a bridge rectifier arrangement in whose direct current circuit there is connected a controlled electronic resistor which allows the degaussing current to decay to the value zero.

Known arrangements for the degaussing of the shadow mask include resistors having positive temperature coefficients (PTC) which are in mutual thermal contact. These PTC's allow the alternating current flowing through the degaussing coil to continuously fall in a time dependent manner to a quiescent current predetermined by the value of the resistors (Limann, Fernsehtechnik ohne Ballast, 10th edition 1973 page 159). Devices such as a relay or a TRIAC for example are then provided in order to also cut-off this quiescent current (e.g. Schaltbild SABA Schauinsland T 3715 telecommander G, 1971). This cut-off occurs in an abrupt manner whereby a residual magnetic field remains which can lead to errors in the uniformity of the white balance.

It is also known to allow the degaussing current to decline to the value zero in that a controlled electronic variable resistor in the direct current branch of a bridge rectifier is controlled to be continuously high ohmic ("Patents Abstracts of Japan"), Vol 12, No 308 (E-647), 22nd August 1988; & JP-A-6 373 788). Here, the electronically controlled variable resistor is subjected to the maximum starting value of the degaussing current of ca 6 Ampere from the beginning of the control process and must therefore be correspondingly large dimensioned which increases the cost of the component.

The object of the invention is to diminish the increased extraneous field effect, especially in large format colour picture tubes, in order to thereby ameliorate the landing reserves of the electron beams in that the degaussing of the shadow mask, especially following arbitrarily short switch-on sequences, is ensured whereby the variable resistor used is not exposed to heavy loads and can therefore be small. This object is achieved by the features given in the claim. Further advantageous embodiments of the invention are specified in the appendant claims.

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

Figure 1 shows the circuit arrangement for the degaussing

Figures 2 to 4 show the current and voltage waveforms produced by the circuit arrangement in accordance with Figure 1 for explaining the functioning of the circuit arrangement.

The arrangement described causes the degaussing each time the apparatus is switched on, including, by means of remote control. As is currently well known, the degaussing of all conventional television sets is carried out by means of a double PTC. This arrangement is relatively cheap but only functions after the first actuation of the mains switch. In the stand by mode, the PTC is hot so that the degaussing process does not run if the apparatus is switched on by means of remote control.

In Figure 1, the alternating mains voltage, which supplies the television apparatus 3 with current via a mains switch 2 and which reaches the degaussing circuit as well, is applied to the terminals 1. The degaussing circuit consists of the degaussing coil 4 which is in series with the PTC 5. A capacitor 6 which has the task of short circuiting the line frequency voltages is connected in parallel with the degaussing coil 4. The series circuit comprising the degaussing coil 4 and PTC 5 is applied to the mains via a bridge rectifier 7. Hereby, the alternating voltage terminals A, B are respectively connected to the mains and to the series circuit of the degaussing coil 4 and the PTC 5. The two direct voltage terminals C, D of the bridge rectifier arrangement 7 are connected to a controllable electronic variable resistor which, in the embodiment depicted, consists of a transistor 8 whose collector and emitter are each connected to a respective direct voltage terminal C and D of the bridge rectifier arrangement 7 and to whose base and emitter, the still to be described control circuit is connected. The transistor 8 must be fully driven into saturation at the beginning of the degaussing process since the maximum collector current then flows and, for the protection of the transistor, switching losses are avoided. The reversion to control of the collector current only occurs when this has already been reduced to a relatively small value by the PTC 5.

After switching on the apparatus 3, the line transformer delivers, via an additional winding 9, line pulses that are rectified by the diodes 10 and 11. A direct voltage builds up on the capacitor 12 having the parallel connected resistor 13 as well as on the capacitor 14. Expediently, the rectification of the secondary voltage received at a secondary winding from the winding 9 occurs in the forward direction of rectification i.e. during the time in which the electron beam in the picture tube

is deflected and the primary winding of the line transformer is applied via the booster diode to the operating voltage since the forward sweep voltage is regulated. However, it is equally conceivable to obtain the operating voltage by forward rectification from a winding of a line frequency synchronised switching power supply. The capacitor 15 is charged via the resistor 16 and the diode 10 and a slowly falling charging current flows which delivers a control voltage for the transistor 18 to the base resistor 17 whereby this is rendered conductive. The transistor 18, which acts as a current amplifier, has a line frequency feed back via the capacitor 19. Via the resistor 20, the conducting transistor 18 opens the transistor 21 which applies the operating voltage present on the base resistor 22, that was rectified by the diode 11 and stored on the capacitor 22, via the voltage divider 23, 24 to the base of the transistor 8. With the charging of the capacitor 15, the control voltage for the transistor 18 reduces in time dependent manner so that the voltage on the voltage divider 23, 24 also decreases whereby the transistor 8 is continuously high ohmic. The consequence is a like reduction of the collector current and hence of the degaussing current through the degaussing coil 4 until this has fallen to the value zero. This process lasts ca 30 seconds. After the degaussing has finished, the transistors 18, 21 and 8 are blocked. When the apparatus is switched off, the direct voltage on the capacitor 12 drops away through the parallel connected resistor 13. The diodes 25 and 26 also discharge the capacitor 15 via the resistor 13 in the shortest possible time. Even with a short term interruption of the mains, the circuit runs under the same starting conditions so that directly thereafter, the whole degaussing process can be repeated.

After the apparatus is switched on, the direct voltages on the capacitors 12 and 14 only attain their nominal value after approximately 30 msecs. Consequently, the base current of the power transistor 8 also only attains its maximum value after the elapse of this time span in order to drive the transistor 8 into saturation. A delaying arrangement is therefore provided which only makes the maximum base current available after e.g. 500 msecs. This switch on delay is effected by means of a predetermined time constant provided by a resistor 27 in combination with a capacitor 28. The voltage building up on the capacitor 28 reaches, via a decoupling diode 29, the base resistor 30 of a switching transistor 31 whose emitter/collector path connects the emitter of the transistor 18, which up till then was kept at the potential of the capacitor 12 via the resistor 34, to reference potential. As soon as the transistor 31 begins to conduct, it is very quickly driven into saturation.

This happens with the help of a feed back within a time period of 1 msec in that the voltage on the collector of the transistor 21 is connected via the capacitor 32 and the resistor 33 to the base of the transistor 31.

The Figures 2 to 4 illustrate the manner of operation of the circuit that has just been described.

The voltage waveform on the capacitor 14 is plotted in Figure 2 and one can see that the voltage on the capacitor 14 attains its nominal value only after ca 200 msecs. The delayed switching on of the transistor 8 is illustrated below in that the full base current is only connected after ca 500 msecs.

In Figure 3, it is illustrated how the base current has already saturated the transistor 8 at the beginning of the first oscillation of the collector current and hence of the degaussing current through the degaussing coil 4 which has a magnitude of ca 6 Ampere.

Figure 4 shows on a greater time scale, that the base current maintains its maximum value over a longer time interval (4 secs) in which the heavy degaussing current is flowing. Only when the degaussing current has adopted a reduced value through the effect of the PTC resistor 5, is the base current regulated downwardly for such time that the transistor 8 is fully blocked after ca 30 secs.



Claims

1. Circuit arrangement for the degaussing of the shadow mask in a colour picture tube of a colour reproduction device with the aid of a degaussing coil which is arranged on the colour picture tube and is connected in the alternating current circuit of a bridge rectifier arrangement in whose direct current circuit there is connected a controlled electronic variable resistor which allows the degaussing current to decay to the value zero,

characterised in that, a resistor (5) having a positive temperature coefficient (PTC) is connected in series with the degaussing coil (4) and that for controlling the electronic resistor (8) there is provided a control circuit which comprises an arrangement (10 - 12, 14, 21 - 24) for delaying the control of the electronic variable resistor (8) and which maintains this at its minimum value until such time as the degaussing current has decayed to a fraction of its original value as a result of the resistor (5).

2. Circuit arrangement in accordance with Claim 1, characterised in that, the control circuit comprises a further arrangement (27 - 31) for delaying the control of the electronic resistor (8) which actuates the degaussing circuit only when it reaches its full operating voltage.

3. Circuit arrangement in accordance with Claim 1, characterised in that, the operating voltage for the control circuit is obtained by forward rectification from an additional winding (9) of the line transformer of the picture reproduction device.

4. Circuit arrangement in accordance with Claim 1, characterised in that, after the end of the time period determined by the delay arrangement (27 - 31), the full conduction of the electronic variable resistor (8) located in the bridge rectifier arrangement (7) is accelerated with the aid of a feed back circuit (32, 33).