The invention relates to a circuit arrangement for producing a correction current for eliminating geometric distortion when reproducing a picture on the picture screen of a television picture tube with the aid of an oscillation circuit which produces a vertical frequency sine voltage, said circuit being connected to the input of a modulator stage for forming a twice line frequency square-wave signal which is vertical frequency modulated in amplitude and phase, said signal producing a correction current for the vertical deflection current, in which a device is provided which allows the correction current to become effective only during certain lines of the television picture.

The larger the deflection angle in a picture tube, the greater are the geometric distortions as is known. The invention relates in particular to eliminating geometric distortions in a north/south direction. For correction, an additional line frequency current is required in the vertical deflection windings. The amplitude of this current has to be modulated at line frequency in parabola shape, wherein this parabola shaped modulation is at its greatest during the first and last lines of the television picture and decreases towards the centre of the picture in a north/south direction. Thus it is possible to eliminate north/south pincushion distortion simply.

New developments in tubes have a geometric error in the north/south direction which is made up of a line frequency pincushion error and an error which has become known by the term "gullwing" having twice the line frequency. In order to compensate for this second error it is known to provide a circuit arrangement as described in DE-PS 26 05 251.

In the PCT patent application WO 86/00 170 a circuit arrangement for eliminating the "gullwing" error is described. This circuit produces a correction current, which increases from the upper edge of the picture to the centre of the upper picture half and decreases from there towards the picture centre again to the value zero, in order to increase from there onwards to the centre of the lower half of the picture again, until it decreases to the lower edge of the picture again to zero. The correction current is consequently effectively only zero during the first line, during the centre line and during the last line of the picture. The correction current is therefore also present during the first and last lines and similarly during the lines around the centre of the picture. However, if there are no "gullwing" errors at these times, additional geometric distortion may arise.

In a newly developed picture tube with an extremely flat picture screen there is a gullwing error which is restricted only to parts of the upper and lower picture screen half, so that

approximately the first and last twenty lines and approximately thirty lines in the centre of the television picture are kept free of errors of the above described type. The error runs approximately sinusoidally so that the picture frequency modulation of the correction current also has to have this type of envelope curve.

The object underlying the invention is to produce the correction current for eliminating the distortion which appears only in some areas of the picture. This object is achieved by the invention stated in the patent claim.

Below the invention is illustrated in a circuit example with the aid of the drawing.

Figure 1 shows the error of a distorted television picture, which is to be eliminated

Figure 2 shows the path of the correction current for eliminating the error;

Figure 3 shows a circuit arrangement for producing the correction current according to Figure 2.

In Figure 1 the path of the error is shown, which is to be eliminated by the circuit arrangement mentioned. It is a question in this view of a horizontal line raster on which the error manifests itself in a north/south direction. In the view according to Figure 1 it is stipulated that the pincushion error is already corrected in a north/south direction. It is apparent that there is no error in the areas a of the first lines, b of the centre lines and c of the last lines of the reproduced television picture, while in the areas d and e the gullwing error occurs in the upper and lower half of the television picture. Therefore, a correction current has to be produced which is supplied to the vertical deflection coils only during the duration of the faulty lines in the areas d and e.

In Figure 2 the correction current which is suitable for eliminating the error is identified as ik. It comprises pulses of twice line frequency as indicated by the hatching, whose amplitude is sinusoidally modulated at picture frequency. In areas a, b and c this correction current is zero. How this correction current is produced is illustrated below with the aid of Figure 3.

Initially, a picture frequency sine voltage V is produced with the aid of an oscillation circuit 1, which arises from connecting

together the transistor 11 and a double-T filter 12. The oscillation circuit 1 is excited with the aid of a vertical frequency saw tooth voltage supplied via the resistor 13 into the cross resistance of the double T filter 12 which cross resistance comprises the resistors 14 and 15. The amplification of the oscillation circuit 1 tuned to picture frequency is reduced by the emitter resistor 16 such that there are no natural oscillations. A picture frequency sinusoidal voltage may be taken across the resistor 17. The sinusoidal signal reaches an input 34 of a modulator stage 3 which serves to produce the correction current via the coupling capacitor 18 via a stage 2 which comprises two antiparallel connected diodes 21 and 22, whose action is explained later. With the modulator stage 3 double line frequency square-wave pulses are produced which are modulated at picture frequency in amplitude and phase. Thus a signal taken from a stage 5 of twice line frequency is applied to the connection 30. The stage 5 is already present in a television receiver and serves for example for tangent correction. The line frequency deflection current is fed into the stage 5 and flows through horizontal deflection coils, which are not shown in greater detail. The circuit 51 is tuned to approximately twice line frequency. The signals having this frequency are isolated via the coupling coil 52 and are applied to the input 30 of the modulator 3 via the capacitor 53. This signal reaches the base of a transistor 33 via a resistor 31 and a diode 32, so that the said transistor is controlled during the positive half wave of the signals into the conductive state.

At the same time a picture frequency sine signal rising from zero is fed in via the input 34, said signal being connected together via the resistor 35 and diode 36 to the signal fed in via the resistor 31. Moreover, the picture frequency sine signal is connected via a diode 37 to the collector of the transistor 33. The emitter of the transistor 33 is connected via a capacitor 38 to the reference potential, which together with the resistor 39 connected parallel thereto forms an integrating element, to which is supplied the picture frequency sine signal via the connection 34.

The square wave signal which may be taken off at the output 40 and which is picture frequency modulated in amplitude and phase is formed in the manner described below. The pulses of twice line frequency which are supplied to the connection 30 switch the connecting point of the two diodes 32 and 36 during the positive half wave respectively to the potential lying at the capacitor 38 including the forward voltage of the diode 32. The potential across the capacitor 38 thus automatically adjusts to the centre line of the picture frequency sine signal as a result of the integrating action of the capacitor 38 with the resistor 39. During the first half of the picture frequency scanning period and the positive half wave of the signals with twice line frequency the diode 36 is conductive so that the picture

frequency signal is connected to the potential of the connecting point of the two diodes 32 and 36. In the second half of the picture frequency scanning period the diode 36 is blocked. However, since the transistor 33 is always conductive during the positive half wave of the signal with twice line frequency, the picture frequency sine signal is connected via the diode 37 to the potential of the emitter of the transistor 33 including its collector / emitter residual voltage and the forward voltage of the diode 37, so that the desired signal arises at the connection 40. This signal is supplied via the capacitor 51 to a Miller integrator 4 which consists of the transistor 42, the capacitor 43 and the resistors 44 and 45 with the parallel connected capacitor 46. The Miller integrator is dimensioned such that only the horizontal frequency square wave pulses are integrated, since the RC element 45., 46 forms a large negative feedback for picture frequency signal components. An amplifier 6 connected to the Miller integrator 4 adds the correction current, which is isolated via a transmitter 61, to the vertical deflection current.

By switching on stage 2 the correction current is suppressed during the desired time periods. In the example of embodiment this occurs with the aid of the two antiparallel connected diodes 21 and 22. As Figure 2 shows, only the forward voltage UD has to be overcome in both directions respectively, so that the signals may reach the input 34. The picture frequency sine voltage V across the resistor 17 of the oscillation circuit 1 is re-shaped into a modified sinusoidal envelope curve voltage V' with flat paths lying therebetween, so that the correction current i_K is modulated by this envelope curve voltage V'.

It is also possible to suppress the correction current in the areas a, b and c by connecting the sine voltage taken from the oscillation circuit, said voltage being near its zero axis crossings, with the aid of an electronic switch to zero potential.

The oscillation circuit may be constructed as a sine generator and synchronised by the vertical deflection signal.

The stage 2 may be constructed differently for example in a form indicated underneath by two transistors connected antiparallel as diodes.

Patent Claim



A circuit arrangement for producing a correction current for eliminating geometric distortion when reproducing a picture on the screen of a television tube with the aid of an oscillation circuit (1) producing a vertical frequency sine voltage, said circuit (1) being connected to the input of a modulator stage (3) for forming a twice line frequency square wave signal which is vertical frequency modulated in amplitude and phase, said signal producing a correction current for the vertical deflection current, in which a device (2) is provided, which allows the correction current to become effective only during certain lines of the television picture, characterised in that the device comprises two antiparallel connected diodes (21, 22) or two transistors connected antiparallel as diodes, which are connected between the output of the vertical frequency oscillation circuit (1) and the input of the modulator stage (3).