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## (54) DEVICE FOR DISPLAYING TWO ELECTRICAL SIGNALS

(71) I, MICHAEL JOHN COWHAM, a British Subject of 14 Nightingale Avenue, Kneesworth, Royston, Hertfordshire, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:

*Field of the invention*

This invention relates to apparatus for displaying two electrical signals and in particular to apparatus for displaying the signals from the two channels of a stereophonic signal so as to create visual patterns.

*The invention*

According therefore to one aspect of the present invention apparatus for displaying two electrical signals comprises a device for producing a coloured display by deflection, a first deflection means for deflecting the display index parallel to one of two different axes, second deflection means for deflecting the display index parallel to the other of the two axes, means for deriving two deflection control signals from the two electrical signals, one of the deflection control signals being supplied to the first deflection means and the other being supplied to the second deflection means, means for connecting to the deflection control signal deriving means the two signals, and colour control means for controlling the colour of the display in response to at least one parameter of the two signals.

Preferably the axes of the two deflection means are such that if the same signal is applied to the first and second deflection means a vertical line is produced in the centre of the display and a signal to one but not the other of the said first and second deflection means produces a line in the display inclined at an angle of, typically, 45° to one side in the case of a signal to the first

deflection means and to the other side in the case of a signal to the second deflection means.

Preferably the signal derived from the left-hand channel of a stereo signal source is arranged to produce a line which is inclined to the upper left-hand side of the display and the signal derived from the right-hand channel is arranged to produce a line which is inclined to the upper right-hand side of the display.

It is found that if the first and second deflection means are supplied with signals derived from a stereophonic audio signal of music or speech, the display will show a complex pattern of Lissajous Figures of size and frequency corresponding to the information contained in the audio signal.

The display device conveniently comprises a cathode ray tube or projection television system but is not limited to these devices.

Preferably however the display device is a colour television tube and means is provided for controlling the colour of the light spot in the display, said means being controlled by three electrical colour signals corresponding to blue, red and green (the resulting colour being determined by the relative proportions of the three colour signals) and the individual values of the three colour signals are for example determined by the mean amplitude of the combined audio signal or the mean amplitude of the low frequency, intermediate frequency and high frequency, components of the combined audio signal.

The invention may for example be used as an adjunct to audio amplifying equipment for a discotheque or night club.

The means for deriving the deflection control signals may be supplied with signals from different sources other than a stereophonic signal source. Thus the signals which control the first and second deflection means may be derived from a stereophonic

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broadcast receiver or record player or tape/cassette recorder or microphones or from signal generators or any combination thereof. The invention thus extends to the combination of the display apparatus with any of the aforementioned signal sources so as to produce in the display apparatus two angularly orientated deflections of a display producing light spot.

According to another embodiment of the invention a system based on the invention may be used to indicate the position of a sound source. Thus if used with two spaced apart microphones, the position of the point source of sound between the two microphones will be indicated by the angle the display makes to the vertical.

According to another embodiment of the present invention a pre-programmed signal source may be employed so as to produce a stationary display or a monogram or trade mark or signature or a pattern (which may be stationary or moving) of light in the display.

Preferably means is provided for switching the display from one signal source to another which switching means may be programmed or automatic and caused to operate as soon as the signal from one source ceases.

The invention will be described by way of example with reference to the accompanying drawings.

#### *In the drawings:-*

Figure 1a is a circuit diagram of the deflection systems of a television tube modified so as to produce a display when supplied with signals in accordance with the invention.

Figure 1b is a representation of a typical display obtained by using the two signals from the two channels of a stereophonic audio signal in accordance with the invention.

Figure 2 is a circuit diagram of the two power amplifiers of Figure 1a and includes a refinement by which the effective angle between the two deflection axes can be varied.

Figure 3 is a circuit diagram of a preamplifier for processing audio signals before they are supplied to the left or right hand inputs of the power amplifiers shown in Figure 2 and

Figure 4 is a circuit diagram of a complete system adapted to operate two separate sources and to produce signals for controlling a colour television tube.

#### *Description of the embodiment*

Figure 1a shows how the deflection signals are used to deflect an electron beam in a cathode ray tube. The left hand audio channel from a stereo source provides input

signals to one power amplifier and the right hand audio channel from the same stereo source provides input signals to a second power amplifier. The output currents from the two amplifiers are supplied to two pairs of deflection coils which are labelled L and R. Those labelled L are driven by the deflection currents produced from the left-hand channel signal and those labelled R from the right-hand channel signal.

The axes of the deflection coil are arranged at 90° to each other and are offset by 45° to the vertical axis. In this way equal signals on both channels will produce a vertical line in the display.

In a typical stereophonic audio signal the majority of sound will be found to come from a central area particularly when the stereo effect has not been artificially enhanced, and accordingly the display will tend to show an elliptical envelope with the longer axis in the vertical direction for a typical audio signal (see Figure 1b).

To overcome the poor utilisation of a typical television screen area the screen can be arranged with its longer dimension in the vertical direction. Alternatively the angle between each axis and the vertical may be increased so that the two axes are no longer orthogonal. The "movement" of the axes may be achieved by altering the position of the scan coils and/or the deflection plates in the case of an electrostatic deflection tube or by distorting the deflection signals to produce a similar result. One circuit for achieving this is shown in Figure 2.

In the circuit of Figure 2 a proportion of the signal from each channel is added to that of the other channel in antiphase. The amount of signal which is added will determine the angle of deviation from the vertical.

Alternatively signals from the rear two channels of a quadrophonic system may be added in a similar manner to modify the apparent angle between the two deflection systems.

Audio signals for use with apparatus of the type described may be processed to advantage to improve the visual effect in the display.

1. Low frequency signals, such as turntable rumble, create a false signal which results in low amplitude Lissajous Figures. This may be removed by means of a high pass filter C1 and R1 as incorporated in the preamplifier circuit of Figure 3.

2. High frequency signals, in particular stereo sub-carrier in radio receivers, can cause a blurring of the image and are best removed. This is achieved using a low pass filter R1, R3 and C2 in Figure 3. High frequencies also contain a much greater amount of information than low frequencies and as such can cause the complexity of the

display to be too great for best visual effect. Hence the low pass filter may be adjusted so as to produce a greater degree of high frequency attenuation than would at first sight seem necessary.

3. Audio signals cover a very wide dynamic range from zero to maximum amplitude. Low volume (i.e. small amplitude) signals will produce only a very small central display and this problem can be overcome by using a non-linear amplifier. In the preamplifier of Figure 3 a voltage dependent resistor VDR1 is employed in a potentiometer link R4, R5 and VDR1 to limit the high amplitude output signals.

4. When no audio signal is present a spot or line may appear in the centre of the display and preferably means is provided for blanking the display in the presence of "no signal". This is particularly important in the case of a cathode ray tube where the screen phosphor could be damaged by a high intensity stationary spot or line.

A coloured display is obtained, the colour content of which varies with the dominant frequency content of the signals by the use of frequency selective circuits. Three separate frequency selective circuits may be employed each one controlling a separate colour of the display. Thus the low frequency signals can control the amount of blue illumination, the mid frequencies the amount of red illumination and the high frequencies the amount of green illumination. Other parameters such as overall audio amplitude may be used to effect a colour change such that the display can completely change colour at specific amplitudes or the display can change colour in steps, or gradually, creating a circular colour spectrum, for example, like a rainbow or the display can be divided into, say, four quadrants, the colour of the spot in each of which may be controlled independently, the two stereo channels can be allocated a separate colour or range of colours in any combination of the above and in a multi-channel audio system (such as a quadrophonic system) the different channel signals may be used to control different colours. The colours may also be controlled from a completely separate source such as by separate manual controls or a single audio signal channel which may be one of the multi-channel system channels or an entirely separate channel.

The colours may be controlled by switching i.e. simply on or off or may be increased or decreased in steps or varied by merging.

Increase in brightness may be made proportional to distance from a point (such as the centre) in the display, or proportional to the predominant frequency or to the highest frequency or the lowest frequency or an external control which may be linked for

example to a musical instrument.

In a projection system colour changes may be achieved by electro-mechanically operated colour filters interposed in the light beam, or separate filters to each of three light beams.

When using a colour television tube the colour changes are internal and are obtained by energising the different phosphors deposited on the screen. Where a black or white cathode ray tube is used, colour changes may be effected by means of filters in front of the screen.

A system incorporating some of the foregoing techniques is shown in Figure 4. This consists of a colour cathode ray tube (not shown) having its beam deflected by signals from two amplifiers 10, 12 operated from a stereophonic audio source (not shown) in which the colour is governed by the relative amplitudes of three frequency selected signals derived by three filters 14, 16 and 18 and mean voltage generating circuits 20, 22 and 24.

In the absence of an input signal the amplifier 26 produces a blanking signal. Alternately (not shown) the amplifier 26 produces a signal which automatically switches the input of the system to the output of another source which may be external oscillators or pre-recorded audio signals so that a pattern is continuously displayed.

An input signal for the amplifier 26 is derived from a summing amplifier 28, inputs for which are derived from buffer amplifiers 30 and 32 in the two audio channels.

The preamplifiers 34 and 36 correspond to the preamplifier circuit of Figure 3 which has already been described.

The remainder of the circuit of Figure 4 is based upon the circuit of Figure 2 except that the output stages of the power amplifiers 10 and 12 are shown in more detail as comprising pairs of complementary transistors.

The invention is applicable in whole or in part to any display system that is capable of producing a display by a scanning or deflecting a light or electron beam, in two more directions.

The invention is primarily adapted for use with a television tube as the display device and a colour cathode ray tube of any construction including shadow mask, Trinitron, or beam penetration system or a system employing one, two, three or multiple electron guns may be used. In addition however the invention may be applied to a projection system using any type of cathode ray tube with an optical system, a projection system using electromagnetic deflectors such as mirror galvanometers, a projection system as used for the display of television pictures such as a system using an Eidophor (Trade

Mark), single or multiple lasers or any other projection system that allows a light beam to be steered around a screen, being front or back projected. The invention may also be applied to a projection system which does not utilise a screen but in which a light beam is projected across a room and is deflected so as to produce images on persons or objects on which it impinges.

In addition the invention may be used with a colour display device comprising a matrix display system such as using light emitting diodes, gas discharge displays, plasma displays, liquid crystal displays, displays using light guides or fibres, and displays using a moving light source physically moved such as by a motor or similar propulsion technique.

#### WHAT I CLAIM IS:

1. Apparatus for displaying two electrical signals comprising a device for producing a coloured display by deflection, a first deflection means for deflecting the display index parallel to one of two different axes, second deflection means for deflecting the display index parallel to the other of the two axes, means for deriving two deflection control signals from the two electrical signals, one of the deflection control signals being supplied to the first deflection means and the other being supplied to the second deflection means, means for connecting to the deflection control signal deriving means the two signals, and colour control means for controlling the colour of the display in response to at least one parameter of the two signals.

2. Apparatus as claimed in claim 1 in which the axes of the two deflection means are such that if the same signal is applied to the first and second deflection means a vertical line is produced in the centre of the display and a signal to one but not the other of the said first and second deflection means produces a line in the display which is inclined to one side in the case of a signal to the first deflection means and to the other side in the case of a signal to the second deflection means.

3. Apparatus as claimed in claim 2 which is so arranged that a signal derived from the left-hand channel of a stereo audio signal source will produce a line which is inclined to the upper left-hand side of the display and a signal derived from the right-hand channel will produce a line which is inclined to the upper right-hand side of the display.

4. Apparatus as claimed in any one of claims 1 to 3 in which the display device comprises a cathode ray tube.

5. Apparatus as claimed in claim 4 in which the cathode ray tube is a colour television tube and colour control means is provided for controlling the colour of the

light spot in the display in response to at least one parameter of a stereophonic signal.

6. Apparatus as claimed in claim 5 in which the colour control means controls three electrical colour signals corresponding to blue, red and green, the resulting colour being determined by the relative proportions of the three colour signals.

7. Apparatus as claimed in claim 6 in which the colour control means is responsive to the amplitudes of the low frequency, mid-band frequency and high frequency components of the stereophonic audio signal, the resulting colour being dependent on the relative amplitudes of the different frequency components.

8. Apparatus as claimed in claim 6 in which there is means for producing a mean value of the LH and RH components of the stereophonic signal and the colour control means controls the colour in dependence on the amplitude of the said mean value signal.

9. Apparatus as claimed in any one of claims 5 to 8 in combination with a signal source constituted by a stereophonic broadcast receiver or stereophonic record player or stereophonic tape/cassette recorder.

10. Apparatus as claimed in any one of claims 5 to 8 in combination with a signal source constituted by two spaced apart microphones, wherein the position of the point source of sound between the two microphones is indicated by the angle the brightened up figure in the display makes to the vertical.

11. Apparatus as claimed in claim 1 in combination with a pre-programmed signal source for producing two electrical signals which will produce a figure such as a monogram or trade mark or signature or a pattern of light in the display.

12. Apparatus as claimed in any one of the preceding claims further comprising means for switching from one signal source to another, which switching means may be programmed to switch according to a prescribed sequence or automatic and caused to operate as soon as the signal from one source ceases.

13. Apparatus for producing a display of two electrical signals constructed arranged and adapted to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.

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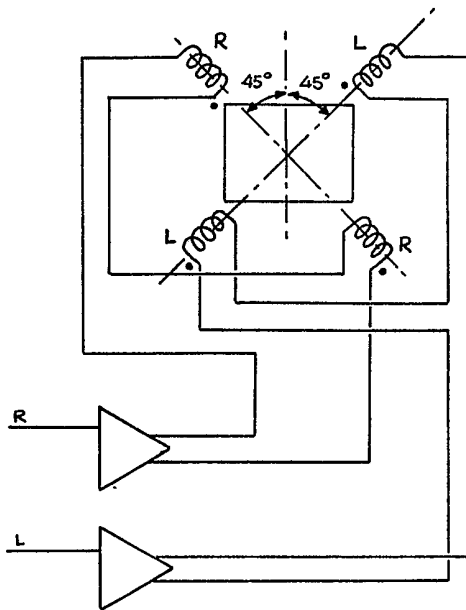


FIG. 1a

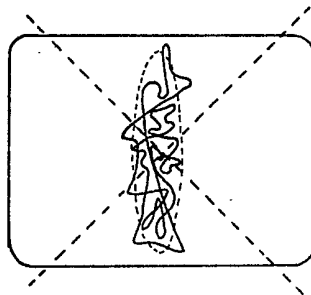


FIG. 1b

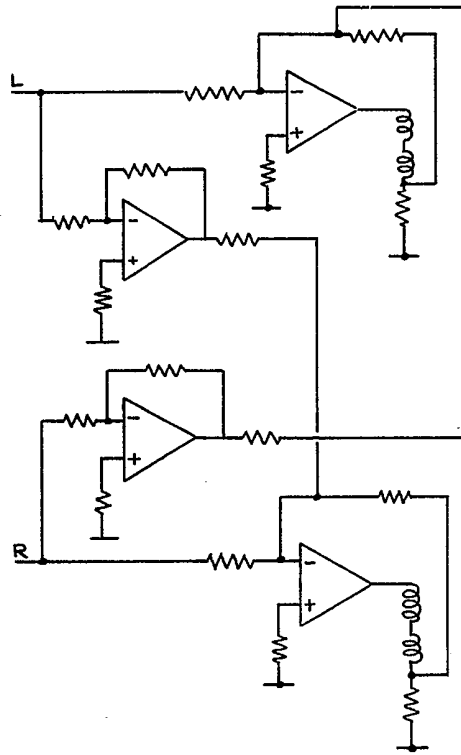


FIG. 2

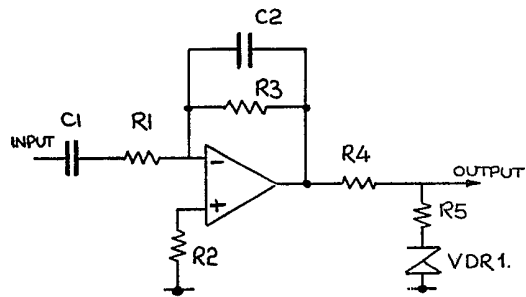


FIG. 3

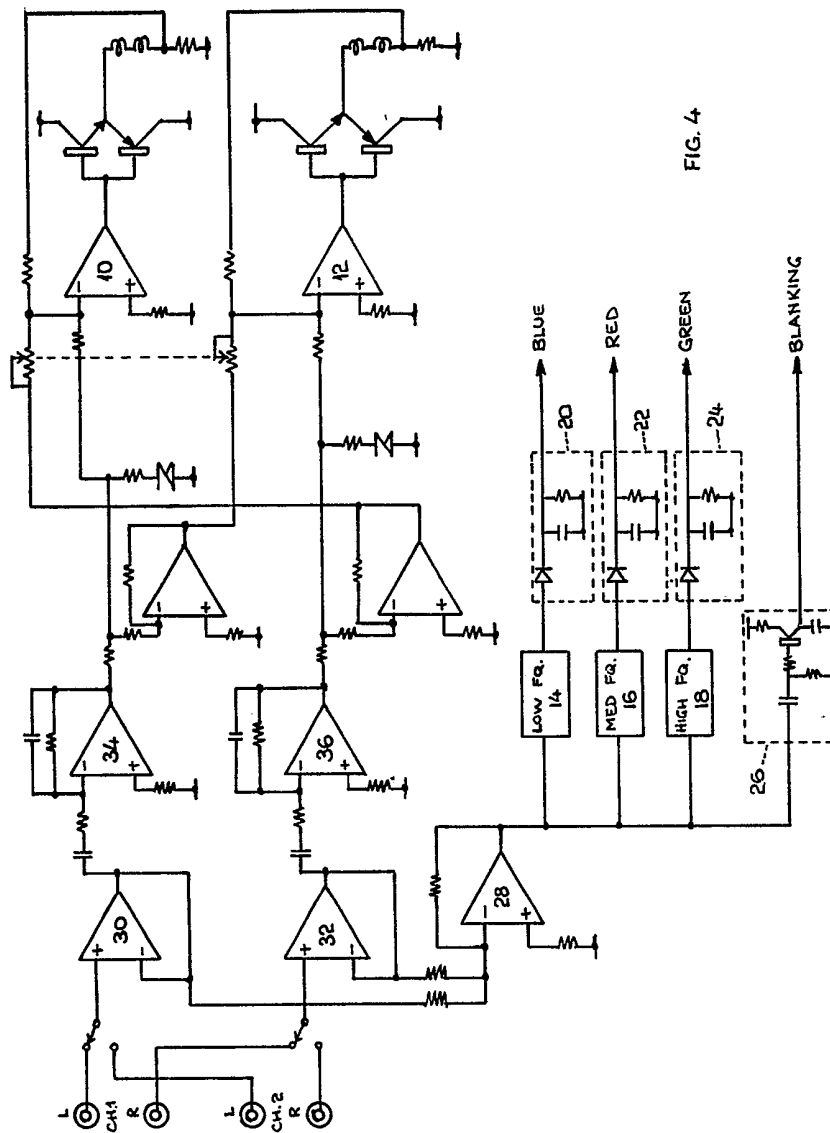


FIG. 4