Feb. 9, 1960 K. TEER 2,924,655

DEVICE COMPRISING A CATHODE-RAY TUBE FOR PRODUCING A SIGNAL DELAY

Filed Feb. 6, 1957

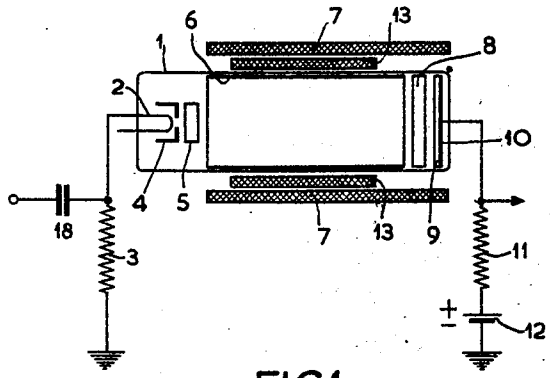

FIG.1

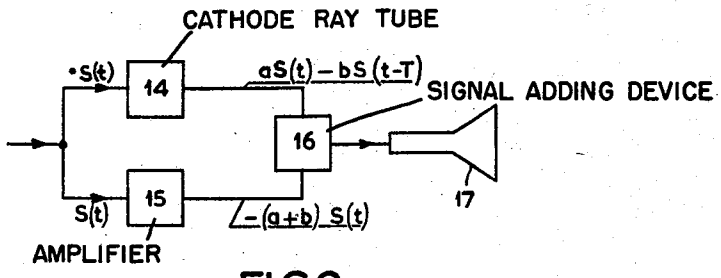

FIG.2

INVENTOR
KEES TEER

BY Frank R. Trifari
AGENT

United States Patent Office 2,924,655 Patented Feb. 9, 1960

2,924,655

DEVICE COMPRISING A CATHODE-RAY TUBE FOR PRODUCING A SIGNAL DELAY

Kees Teer, Eindhoven, Netherlands, assignor, by mesne assignments, to North American Philips Company, Inc., New York, N.Y., a corporation of Delaware

Application February 6, 1957, Serial No. 638,653

Claims priority, application Netherlands February 18, 1956

2 Claims. (Cl. 178—7.5)

This invention relates to devices comprising a cathode-ray tube with a target plate which is scanned by the electron beam, to which tube an input signal is supplied and from the output electrode, which is coupled to the target, a signal is derived which comprises the difference of a part of the input signal and a part of the input signal occurring a scanning-period earlier.

A device of this type is known, in which the cathode-ray tube is of a type in which the target is scanned by high-velocity electrons, the scanning electrode consisting of photoemissive and secondary emissive material and being provided in an insulated manner on the output electrode. In scanning an element of the target, the potential of this element is brought substantially to the potential of the output electrode. The input signal is supplied to the output electrode so as to produce also the aforesaid difference signal in the output circuit which is coupled to said output electrode. In order that this difference signal may be separated from the input signal, additional steps should be taken and for this purpose the scanning electron beam is interrupted in the rhythm of a high-frequency oscillation so that the difference signal in the output circuit is modulated on this high-frequency oscillation.

The present invention has for its object to provide a device in which the input signal and the desired difference signal are separated in a simple manner.

The device according to the invention has the feature that the cathode-ray tube is of a type in which the potential of an element of the target, on scanning this element, is caused substantially to assume the potential of the cathode of the tube, and the potential of the cathode is controlled by the input signal, while the potential of an element of the target rises, prior to scanning this element, to a value exceeding the cathode potential at the instant of this scan.

An advantageous form of the device according to the invention has the feature that the cathode-ray tube is of the Vidicon type and the output electrode, which carries the target made from semi-conductive material, is supplied with a direct voltage exceeding the maximum amplitude of the input signal supplied to the cathode of the tube.

In order that the invention may be readily carried into effect, an example will now be described in detail with reference to the accompanying drawing, in which—

Fig. 1 shows one form of the device according to the invention, and

Fig. 2 represents diagrammatically a part of a television receiver comprising the device according to the invention and adapted to receive dot interlace television signals or colour television signals, the signals comprising colour information being modulated onto an auxiliary carrier within the frequency-band of the brightness signals.

The device according to the invention as shown in Fig. 1 comprises a tube 1 of the Vidicon type. The cathode 2 of this tube is earthed through a resistor 3. A

control-grid 4 is negatively biassed in known manner. The accelerating electrode 5 is maintained to be at a constant potential of, say, approximately 300 volts. A focussing electrode 6 which, together with a focussing coil 7, focusses the electron beam, also has a constant potential, for example of from 200 to 300 volts. An electrode 8 serves as the decelerator and has the same potential as that of the electrode 6. A target 9 consisting of semi-conducting material is provided on an output electrode 10. This output electrode is connected through a resistor 11 to the positive terminal of a battery 12, the negative terminal of which is earthed. The battery voltage may, for example, be 30 volts.

The target 9 is scanned by deflecting the electron beam by means of a deflection coil system 13. With the aid of this deflecting system either the whole target or a part of the target or again a line of the target or any other desired pattern can be scanned in known manner. It will be assumed that the time elapsing between two scans of a same element of the target is T sec., T being, for example, $\frac{1}{50}$ or $\frac{1}{25}$ sec.

The input signal, which depends on the time t and will be represented by $S(t)$, is supplied via a capacitor 18 to the resistor 3 connected in the cathode circuit. The maximum amplitude of the signal across the resistor 3 should be smaller than the voltage of the battery 12.

In a tube of the aforesaid type, the potential of an element at the instant of scanning is caused substantially to assume the value of the cathode potential then occurring. This permits a charge image to be formed on the target. The next scan of an element yields, in the current through the output circuit, not only a component proportional to the instantaneous signal value $S(t)$ then being supplied to the cathode, but also a component which is proportional to the charge image formed by the preceding scan and being proportional to $S(t-T)$.

When supplying an input signal $S(t)$ and with a scanning period T a voltage $aS(t)-bS(t-T)$ is consequently set up across the resistor 11, a and b being constants.

For obtaining this result, it is necessary for each element to have, just prior to the instant of scanning this element, a potential higher than that which the cahode will have at the instant of scanning. Hence, the potential of a given element should sufficiently rise between the instants of scanning this element so that, if the potential was very low at the first scan, this potential will nevertheless exceed the potential set up at the cathode during the next scan. This requirement if fulfilled, since the voltage of the battery 12 is higher than the maximum amplitude of the input signal and the resistance of the semi-conductive material of the target 9 is not excessively high.

It will be evident that with known values of the constants a and b, determined by the properties of the tube, by combining the output signal $aS(t)-bS(t-T)$ and the input signal $S(t)$ in a given ratio and with given polarity both a signal only consisting of $S(t-T)$ or consisting of the sum $S(t)+S(t-T)$ or the difference $S(t)-S(t-T)$ may be derived.

The signal $S(t)-S(t-T)$ may, for example, be used in a television transmitter in order to transmit information only relating to variations of the image to be transmitted, so that repeated transmission of non-varying parts of the image is avoided.

Alternatively, the signal $S(t)-S(t-T)$ may be used in radar receivers in order to distinguish between moving and stationary objects.

An important use of the device according to the invention is found, in receiving television signals transmitted by dot interlacing or with which colour television transmission occurs by means of an auxiliary carrier onto which the colour information signals are modulated,

which auxiliary carrier is within the frequency-band of the brightness signals, such as, for example, in the United States colour television system. In the last-mentioned system, as is known, the signal supplied to the picture tube also comprises the auxiliary carrier. If this auxiliary carrier occurs in a given line of, say, the even raster in a given phase, it appears in the same line of the next even raster in the opposite phase. Owing to persistence of vision, it may be expected that this appearance will not practically be perceptible, but as a result of stroboscopic effects it is found, in practice, that this is not entirely true and such an auxiliary carrier, although perceptible to a lesser degree as a result of the aforesaid phase relationship, yet invariably involves a troublesome effect.

However, the integration performed by the eye may advantageously be taken over by an arrangement, comprising a device according to the invention. As a result of complete integration, this permits a better reproduction in a simple manner.

Such a device may be inserted in the channel supplying the video signal to the picture tube of a television receiver, which may otherwise be of known and irrelevant construction. As shown in Fig. 2, the signal $S(t)$ is supplied to a device **14** of a type according to the invention so as to produce a signal $aS(t)-bS(t-T)$ at the output of this device. The signal $S(t)$ is also supplied to an amplifier **15** having an amplification factor $(a+b)$ in which the polarity is moreover reversed so that the amplification is $-(a+b)$, hence a signal $-(a+b)S(t)$ appears at the output of the device **15**. The output signals of the devices **14** and **15** are added in the device **16** and, if desired, reversed in polarity so that a signal $b[S(t)+S(t-T)]$ appears at the output of the device **16**, which signal is supplied to a picture tube **17**.

If, in the signal $S(t-T)$, the auxiliary carrier has a phase opposite to that of the auxiliary carrier of the signal $S(t)$, this auxiliary carrier will not be present in the signal supplied to the picture tube. If the time period T, in which the auxiliary carrier varies in phase by 180°, corresponds to the picture frequency, then T will be chosen to be $=\frac{1}{25}$ sec.

In dot interlacing, the delay time T will likewise be made such that, in accordance with the nature of the transmission system, the integration otherwise performed by the eye is taken over by the device according to the invention. The use of such a device in a television receiver does not impose stringent additional requirements, since the cathode-ray tube may be of simple construction and the required deflection currents may be taken from deflection devices initially present in the receiver. Moreover, this deflection need not satisfy stringent requirements such as are usual in the reproducing device, it being only necessary for the scanning period T to be the same for each picture element. Finally, the material of the target **9** need not be photoconductive in the device according to the invention.

What is claimed is:

1. A cathode-ray device comprising a cathode for providing an electron beam, means for applying an input signal to said cathode, a target plate, means for causing said electron beam to repetitively scan said target plate, means connected to bias said target plate at a positive potential with respect to said cathode, and means connected to derive an output signal from said target plate simultaneously with the signal scanning thereof, said target plate being made of a material capable of temporarily storing voltage charges on elemental areas thereof so that each elemental area assumes substantially the instantaneous signal potential of said cathode at the moment of being scanned by said electron beam, the potential of each said elemental area rising towards said positive potential between the scansions thereof, whereby said output signal comprises the difference between the present scanning signal and the signal of the next preceding scansion, said target plate comprising a semi-conductive material, and said bias means having a positive potential greater than the maximum amplitude of said input signal.

2. In a television receiver having a periodically scanned image reproducing device and having a video signal which includes periodic interference signals, a cathode-ray device comprising a cathode for providing an electron beam, means for applying said video signal to said cathode, a target plate, means for causing said electron beam to repetitively scan said target plate, means connected to bias said target plate at a positive potential with respect to said cathode, means connected to derive an output signal from said target plate simultaneously with the signal scanning thereof, said target plate being made of a material capable of temporarily storing voltage charges on elemental areas thereof so that each element area assumes substantially the instantaneous signal potential of said cathode at the moment of being scanned by said electron beam, the potential of each said elemental area rising towards said positive potential between the scansions thereof, whereby said output signal comprises the difference between the present scanning signal and the signal of the next preceding scansion, means for combining said output signal with said video signal with a polarity to cause compensation of said interference signals, and means for supplying the combined signal to said image reproducing device.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 24,070	Pierce	Oct. 4, 1955
2,211,145	Miller	Aug. 13, 1940
2,303,924	Fandell	Dec. 1, 1942
2,527,632	Graham	Oct. 31, 1950
2,547,386	Gray	Apr. 3, 1951
2,617,963	Arditi	Nov. 11, 1952
2,700,151	Flory	Jan.18, 1955
2,702,356	Flory	Feb. 15, 1955
2,786,880	McKay	Mar. 26, 1957

OTHER REFERENCES

Vine et al.: "Performance of the Vidicon," R.C.A. Review, March 1952, pages 3 to 10.