

Jan. 10, 1939.

E. L. C. WHITE

2,143,398

TELEVISION TRANSMISSION SYSTEM

Filed June 9, 1936

2 Sheets-Sheet 1

Fig. 1

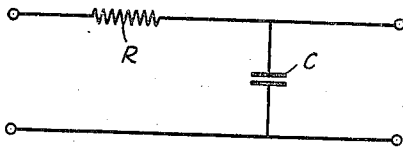


Fig. 3

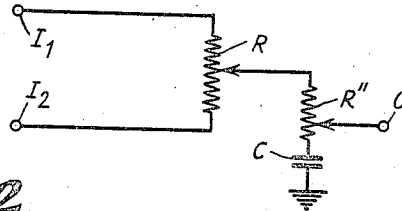


Fig. 2

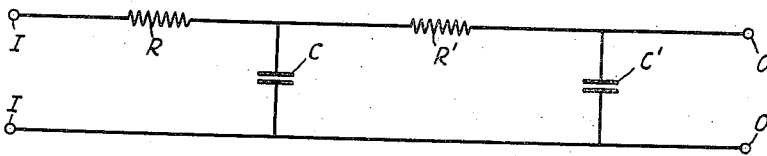


Fig. 4

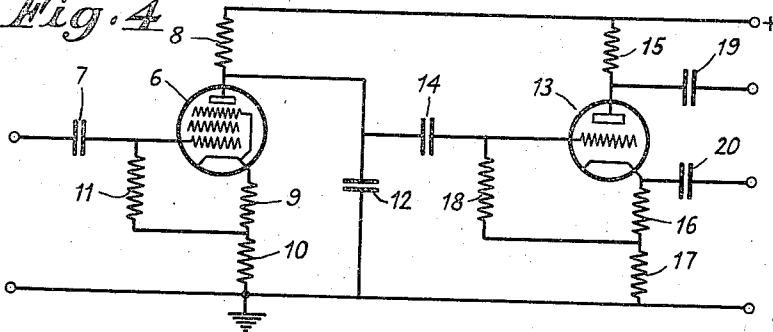
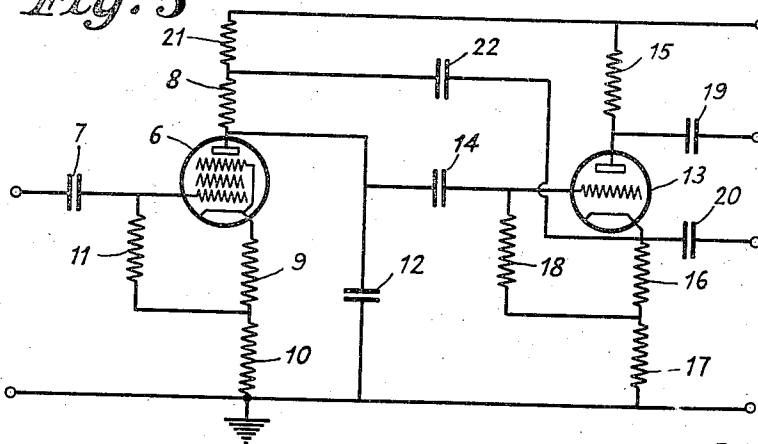


Fig. 5



INVENTOR
E. L. C. WHITE

BY *H. S. Brown*
ATTORNEY

Jan. 10, 1939.

E. L. C. WHITE
TELEVISION TRANSMISSION SYSTEM

2,143,398

Filed June 9, 1936

2 Sheets-Sheet 2

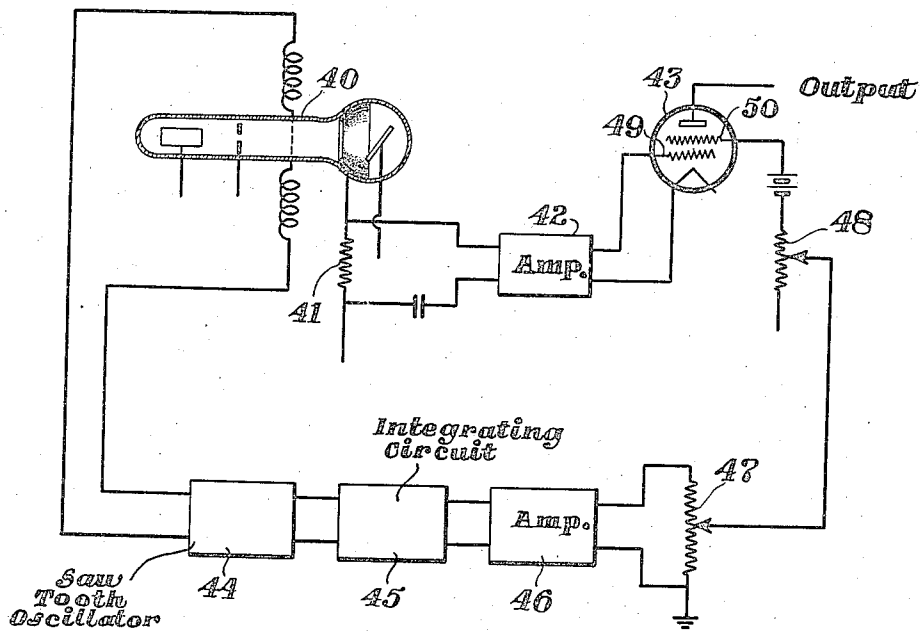


Fig. 6.

Inventor
ERIC L. C. WHITE

BY

H. S. Snow,
ATTORNEY

UNITED STATES PATENT OFFICE

2,143,398

TELEVISION TRANSMISSION SYSTEM

Eric Lawrence Casling White, Hillingdon, England, assignor to Electric & Musical Industries, Ltd.

Application June 9, 1936, Serial No. 84,241
In Great Britain June 24, 1935

7 Claims. (Cl. 178—7.2)

The present invention relates to television, and is concerned more particularly with television transmission systems embodying cathode ray tubes such for example as Iconoscopes.

5 An Iconoscope is a cathode ray tube having a mosaic screen comprising a multiplicity of photo-electrically sensitive elements insulated from one another and from a common signal plate; an image to be transmitted is formed on the photo-electric elements and means are provided for scanning the elements periodically with the cathode ray of the tube to bring the potentials of the elements to a datum value. Picture signals are usually derived from a signal resistance associated with the signal plate. Scanning of the screen is usually carried out in a series of parallel lines, the pattern traced out by the scanning beam usually being periodically retraced at a frequency which will be referred to as the frame frequency.

20 It is found that in transmission systems employing an Iconoscope, the picture signals developed include spurious components, there being usually one such component at line frequency and one at frame frequency. The effect of such spurious signal components at a receiver, assuming that the scanning takes place from left to right in horizontal lines proceeding from top to bottom, is usually found to be that the average brightness is greater on the right than on the left and greater at the bottom than at the top.

30 Similar spurious signals arise also in systems employing mosaic-screen transmitting tubes other than Iconoscopes, such for example as certain tubes embodying mosaic screens which are not photo-electrically sensitive. In such tubes, an electrostatic image is formed on the mosaic screen, in a manner such as is described in British Patent No. 442,666, and the mosaic screen is scanned by the cathode ray tube as in an Iconoscope. The generation of the spurious signals is believed to be due to the fact that as each element of the mosaic screen is scanned, secondary electrons are emitted therefrom; some of these secondary electrons flow to a separate collecting electrode, which may form part of the electron gun, but others are collected by neighbouring elements of the screen, these latter electrons giving rise to the spurious signals.

45 It has been proposed, in an attempt to compensate for spurious signals of the kind discussed, to superimpose rectilinear saw tooth waves of line and frame frequencies, and of suitable amplitude and sense, upon the picture signals, with the object of cancelling out the spurious signals and rendering the base line thereof substantially straight.

50 It has been found however, that only partial correction can be obtained in this way, and it is the object of the present invention to provide

means whereby more complete cancellation of spurious signals of the character discussed can be obtained.

According to the present invention, in television transmitting apparatus in which a cathode ray tube having a mosaic screen is employed to develop picture signals, the screen being scanned in a plurality of straight, parallel lines, and in which the arrangement is such that the picture signals developed include spurious components of the character set forth, there are provided means for developing a corrective signal comprising an oscillation having a wave form which is substantially proportional to an integral of a rectilinear saw tooth wave, and means for superimposing said corrective signal upon the picture signal derived from said tube so that the spurious components of said picture signals are eliminated or reduced. Preferably two such corrective signals, one of line frequency and one of frame frequency are superimposed upon the picture signals. The wave form of the corrective signal may comprise a component proportional to the simple integral or to some higher integral of a rectilinear saw tooth wave or the corrective signal may comprise a plurality of components proportional to different integrals.

In the following further description of the invention, reference will be made to the accompanying drawings, in which

Figure 1 illustrates one form of integrating circuit.

Figure 2 represents another form of integrating circuit.

Figure 3 represents still another form.

Figure 4 is an embodiment for producing integrated oscillations.

Figure 5 is another embodiment for producing integrated oscillations, and

Fig. 6 shows a mixing of the integrated oscillations and the picture signals containing spurious oscillations.

The invention will be described, by way of example, as applied to a television transmission system employing an Iconoscope, the cathode ray being deflected for scanning purposes by means of two sets of deflecting coils through which, respectively, saw tooth currents of line and frame frequency are passed; it will be assumed that the scanning oscillations are generated by two blocking oscillators, one operating at line frequency and the other at frame frequency, the saw tooth oscillations being fed to separate power output valves having the line and frame deflecting coils arranged in their respective anode circuits.

For the purpose of developing line frequency corrective oscillations, saw tooth oscillations derived from the line frequency blocking oscillator are fed to an integrating circuit of the kind illustrated in Fig. 1, which comprises a resistance

R in series with a condenser C, integrated oscillations being taken off from the terminals of the condenser to the circuit in which the picture signals are present. The time constant of the condenser C and resistance R is made long compared with the line period. The integrated wave form then consists of two parabolic arcs for each cycle of the saw tooth oscillation, a major arc corresponding to the less steeply inclined portion of the saw tooth wave and a minor arc corresponding to the more steeply inclined portion. The integrated waveform, which if derived may be mixed with a saw tooth oscillation derived from the line frequency blocking oscillator, is applied to the picture signal circuit in appropriate sense and at a suitable amplitude. The amplitude is adjusted, for example with the aid of a potentiometer, not shown, so that the spurious signal of line frequency is substantially compensated as illustrated in Fig. 6 which shows the standard mixing tube arrangement by means of which the integrated compensating signal may be mixed in opposing phase relationship to the spurious signal of line frequency. The amplitude will depend naturally upon the intensity of the spurious signal as shown, for instance, by a monitor tube at the transmitter. The minor arc of the integrated wave form occurs during the return stroke of the scanning cathode ray, that is, during a time when no picture signals are being generated. The corrective signal is preferably injected into the picture signal circuit at a point where the picture signals have undergone one or more stages of amplification.

A frame frequency corrective oscillation can be derived similarly by feeding frame frequency saw tooth oscillations from the frame frequency blocking oscillator to an integrating circuit of the same kind as that above described, but having a time constant long compared with the frame period.

In some cases it may be found that more accurate correction can be obtained by using a corrective wave including, in addition to a saw tooth oscillation and the first integral thereof, a higher integral of the saw tooth wave.

The arrangement shown in Fig. 2 provides at its output terminals O a wave which is the second integral of a saw tooth oscillation applied at its input terminals I, if this wave is mixed with the original saw tooth oscillation and the first integral thereof, in suitable sense, a wave form comprising a saw tooth plus an approximate sine wave can be obtained. In Fig. 2, the time constants RC and R'C' are both long compared with the period of the applied saw tooth oscillation.

Each shunt arm of the networks of Figs. 1 and 2 may comprise a resistance, which is preferably made variable; in this case, the output of the network includes a component of the wave form of the applied saw tooth oscillation, in addition to the integrated wave.

The circuit for developing a corrective signal of either sense which is illustrated in Fig. 3, comprises a resistance R connected between two input terminals I₁ and I₂, a variable tapping point on the resistance R being connected through a resistance R'' and a condenser C to earth. Rectilinear saw tooth oscillations are fed in opposite senses to the terminals I₁ and I₂ respectively from a circuit, such as the output circuit of a push-pull amplifier, which is balanced with respect to earth, and the amplitude and sense of the corrective signals developed across the condenser C are varied by moving the ad-

justable contact along the resistance R. In the arrangement of Fig. 3, the corrective signal set up at output terminal O with respect to earth comprises a saw tooth component and a parabolic component.

Referring now to Fig. 4, which shows a practical circuit arrangement according to the invention, a rectilinear saw tooth oscillation is fed to the control grid of a valve 6, such as a pentode, which has a high impedance, through a condenser 7. The anode of valve 6 is connected to the positive terminal of a source (not shown) of anode current through a resistance 8, and the cathode thereof is connected to earth through resistances 9 and 10 in series; the negative terminal of the anode current source is earthed, and a grid leak resistance 11 is connected as shown to the join of resistances 9 and 10.

A condenser 12 is connected between the anode of valve 6 and earth, and the time constant of resistance 8 and condenser 9 is made long compared with the period of the applied saw tooth oscillation. Part of the anode current of valve 6 flows in resistance 8 and part is integrated in condenser 12, the voltage set up across the condenser 12 being thus of parabolic wave form.

Potential differences set up across condenser 12 are fed through condenser 14 to the control grid of valve 13, the anode of which is connected to the positive terminal of the anode current source through resistance 15, and the cathode of which is connected to earth through two resistances 16 and 17 in series. A grid leak 18 is connected between the join of resistances 16 and 17 and the grid of valve 13. The desired integrated wave form is taken off from the anode or cathode of valve 13, through condenser 19 or 20 respectively, depending upon the sense required.

In the arrangement of Fig. 5, parts which are common to Fig. 4 have the same references; a resistance 21 is arranged in series between the upper end of resistance 8 and the anode current source, and the total value of resistance 16 and 17 in series is made large compared to the reciprocal of the mutual conductance of valve 13 so that the potential of the cathode of that valve substantially follows variations in the grid potential thereof; in other words, valve 13 operates as a cathode follower valve. A condenser 22 is connected between the cathode of valve 13 and the join of resistances 8 and 21.

In operation, the potential at the join of resistances 8 and 21 substantially follows variations in the potential of the control grid of valve 13 and hence of the anode of valve 6; thus a greater proportion of the anode current of valve 6 is integrated in condenser 12 than in the arrangement of Fig. 4, since resistance 8 is effectively much greater. In other words, by the use of valve 13 in the manner described as a cathode follower, the effective time constant of elements 8 and 12 is greatly increased, and the voltage set up across condenser 12 is a more accurate integration of the applied saw tooth oscillation.

The resistance 8 may be regarded as a shunt leakage path across condenser 12, the resistance 8 having the effect of reducing the proportion of the anode current of valve 6 which is integrated in the condenser 12. The feed back from valve 13 has the effect of increasing the effective resistance of the leakage path, and it is pointed out that this method of reducing effective shunt conductance, and consequence leakage, is not limited.

ited in its application to integrating circuits, but is applicable in many other circuits and for many other purposes.

Referring to Fig. 6, there is shown the mixing of the integrated oscillations and the picture signals containing the spurious oscillations as hereinbefore disclosed. A cathode ray transmitting tube or so-called "Iconoscope" 40 has means 41 for developing potentials in accordance with the light values of optical images electrically scanned. As hereinbefore shown, these signals contain spurious oscillations of line frequency. The combined video and spurious signals are fed to an amplifier 42 and thence to a well known form of mixing tube arrangement shown as 43. The control oscillation or saw-tooth generator 44 develops a wave, a portion of which is fed to one of the hereinbefore disclosed integrating circuits 45. The integrated wave may then be fed to a single or plural stage amplifier 46, and the output of this amplifier is fed to a potentiometer 47. This potentiometer is joined to a resistance 48 in the screen grid circuit of the mixing tube 43. The combined video and spurious signals are fed to the control grid 49 of mixing tube 43 and it will be seen that the output current is controlled both by the wave shape of the waves impressed on both the control grid 49 and the screen grid 50 of the tube 43. The amplitude of the integrated signal impressed on the screen grid 50 is controlled from the potentiometer 47, and those skilled in the art will immediately recognize that this integrated wave should be fed in phase opposition to the spurious signal of line frequency occurring in the video signal, thus substantially or entirely eliminating this undesired oscillation.

The invention is not limited to the arrangements described by way of example above, and many modifications within the scope of the appended claims will occur to those versed in the art.

What I claim is:

1. In cathode ray apparatus in which a cathode ray beam is deflected in accordance with electrical oscillations of a definite wave form and electrical impulses are sequentially derived from the apparatus due to the action of the cathode ray, the method of correcting for spurious oscillations occurring due to the deflected wave which comprises the steps of developing a wave form which is an integral of the deflecting wave formation and combining the integrated wave form with the aforementioned derived electrical impulses in phase opposition to the spurious wave forms occurring therein.

2. In cathode ray apparatus in which a cathode ray beam is deflected in accordance with electrical oscillations of a definite wave form and electrical impulses are sequentially derived from the apparatus due to the action of the cathode ray, the method of correcting for spurious oscillations occurring due to the deflected wave which comprises the steps of developing the wave form which is an integral of the deflecting wave form, combining the integrated wave form and the deflecting wave form and then combining the wave form of this combination with the derived electrical impulses in phase opposition to the spurious wave form occurring therein.

3. In cathode ray apparatus in which a cathode ray beam is deflected in accordance with electri-

cal oscillations of a definite wave form and electrical impulses are sequentially derived from the apparatus due to the action of the cathode ray, the method of correcting for spurious oscillations occurring due to the deflected wave which comprises the steps of developing a wave form which consists of the first and higher integrals of the deflecting wave form and then combining the wave form of this combination with the derived electrical impulses in phase opposition to the spurious wave forms occurring therein.

4. A television transmission apparatus comprising a cathode ray tube containing a mosaic adapted to be scanned by the cathode ray, means for deflecting the cathode ray in accordance with a definite wave formation, means for deriving electrical picture impulses from the mosaic as the scanning operation is performed, means for deriving from the deflecting wave formation a wave form which is the integral thereof, and means for combining the integrated wave form with the picture signals in a phase relationship so as to substantially erase spurious oscillation waves included in the picture signals.

5. A television transmission apparatus comprising a cathode ray tube containing a mosaic adapted to be scanned by the cathode ray, means for deflecting the cathode ray in accordance with a definite wave formation, means for deriving electrical picture impulses from the mosaic as the scanning operation is performed, means for deriving from the deflecting wave formation a wave form which is a combination of the first and higher integrals of the deflecting wave form, and means for combining the integrated wave form with the picture signals in a phase relationship so as to substantially erase spurious oscillation waves included in the picture signals.

6. A television transmission apparatus comprising a cathode ray tube containing a mosaic adapted to be scanned by the cathode ray, means for deflecting the cathode ray in accordance with a definite wave formation, means for deriving electrical picture impulses from the mosaic as the scanning operation is performed, means for deriving from the deflecting wave formation a wave form which is the integral thereof, means for combining the integrated wave form with the deflecting wave form, and means for combining the resultant of the aforesaid combination of waves with the picture signals in a phase relationship so as to substantially erase spurious oscillation waves contained in the picture signals.

7. A television transmission apparatus comprising a cathode ray tube containing a mosaic adapted to be scanned by the cathode ray, means for deflecting the cathode ray in accordance with a definite wave formation, means for deriving electrical picture impulses from the mosaic as the scanning operation is performed, means for deriving from the deflecting wave formation a wave form which is a combination of the first and higher integrals of the deflecting wave form, means for combining the integrated wave form with the deflecting wave form, and means for combining the resultant of the aforesaid combination of waves with the picture signals in a phase relationship so as to substantially erase spurious oscillation waves contained in the picture signals.

ERIC LAWRENCE CASLING WHITE.