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C. L. FAUDELL ET AL
TELEVISION RECEIVING APPARATUS

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Fig. 1

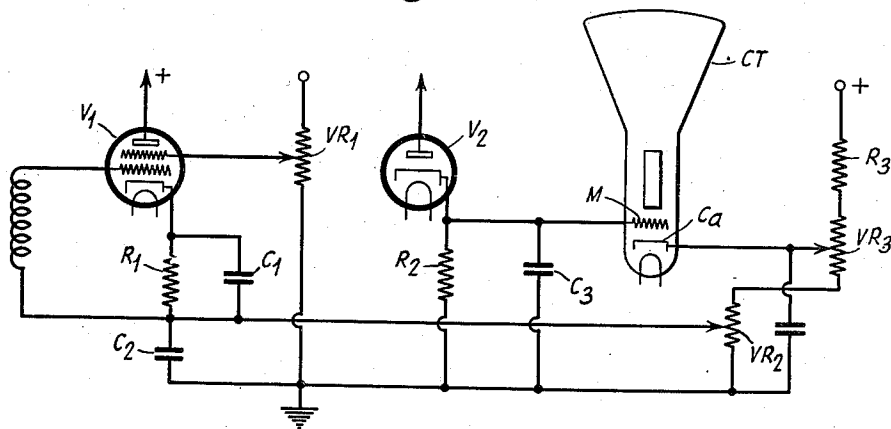


Fig. 2

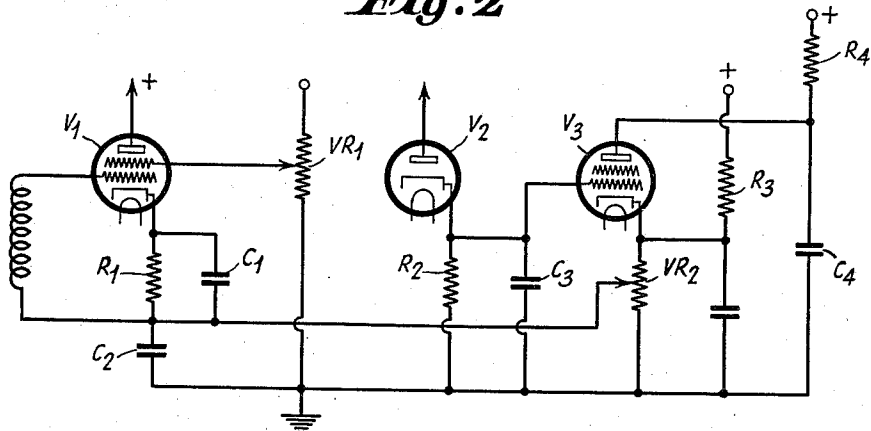
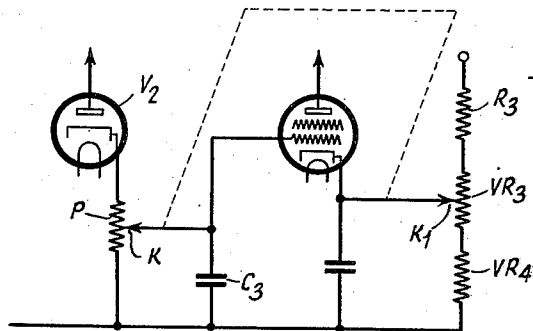


Fig. 3



INVENTORS
CHARLES L. FAUDELL
AND NOEL ATKINSON
BY *W. S. Snow*
ATTORNEY

UNITED STATES PATENT OFFICE

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TELEVISION RECEIVING APPARATUS

Charles Leslie Faudell and Noel Atkinson, London, England, assignors to Electric & Musical Industries Limited, a British company

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4 Claims. (Cl. 178—7.5)

This invention relates to television or picture receiving systems and is particularly but not exclusively concerned with such systems in which there is present in the signals applied to an image or picture reconstituting device a so-called direct current component. The direct current component of the image or picture signals represents the average brightness and slow changes of the average brightness of the object of which a transmitted image is to be received.

Television systems are known in which the picture signals are transmitted together with synchronizing signals along the same channel the synchronizing signals usually being in the blacker-than-black sense. In what are known as stabilized carrier systems in which the direct current component of the picture signals is transmitted, the peaks of the synchronizing signals are represented by zero or approximately zero carrier amplitude, the black level in the transmitted picture is represented by 30% carrier amplitude and the picture signals increase the amplitude of the carrier above this value to the maximum amplitude representing maximum white.

On rectification of the carrier wave at a receiver, the rectifier output will contain in addition to the direct current representing picture brightness from instant to instant, an additional constant direct current depending upon the amplitude of the synchronizing signals. Since it is required to maintain the direct current component of the picture signals, the rectifier will be directly coupled to the signal responsive device and this extra amount of direct current will result in a direct potential being also applied to it.

In a stabilized system employing carrier wave transmission, modulation frequency amplification at the receiver may be dispensed with, the received signals being amplified to the desired extent at carrier frequency; the reason for this is that most simple low-frequency amplifiers are incapable of amplifying direct current, while direct current amplifiers are relatively complex. The brightness of the reproduced picture is then controlled by varying the gain of the carrier frequency amplifier or by otherwise controlling the amplitude of the signals fed to the picture reconstituting device such as a cathode ray tube, and the difficulty arises that the voltage which represents black in the transmitted picture varies in accordance with the setting of the carrier frequency amplifier gain-control device, or other device controlling the amplitude of the picture signals.

If the picture reconstituting device at the re-

ceiver is a cathode ray tube, for example, it is desired that the voltage representing black at the modulator electrode of the tube should always be such that the flow of screen current in the tube is just cut off at that voltage, and if this is realized at one setting of the gain control, it will not hold at another, and in one example, there may be a tendency for black parts of the picture to appear grey when the average brightness of the picture is increased.

It is accordingly an object of the present invention to provide means for compensating for the tendency discussed above.

Furthermore, in a stabilized system, the peaks of the synchronizing signals may be represented at certain times not by zero carrier amplitude, but by a small finite amplitude value; such departures may arise in practice due to fluctuations in the potentials of sources of current supply at the transmitter for example. The amplitude of the residual carrier at the peaks of the synchronizing signals varies at the signal detector of the receiver in accordance with the setting of the carrier frequency amplifier gain control, and thus the voltage representing the peaks of the synchronizing signals at the output of the detector varies correspondingly. In certain forms of synchronizing apparatus, such as are described for example in the specification of Patent No. 455,375 there is provided a thermionic valve which is arranged to be insulating at the peaks of received synchronizing signals, but to be conducting at all other times, and if the variation referred to above in the voltage representing peak synchronizing signal is considerable, the operation of the synchronizing apparatus may be upset.

Spurious signals such as those due to the Schrott and Johnson effects, and to certain forms of interference, may also cause the voltage representing peak synchronizing signal at the output of the detector to vary with the setting of the gain control, since the receiver usually comprises a plurality of carrier frequency amplifying stages, and the level of the spurious signal is accordingly dependent upon the carrier-frequency gain. A similar disadvantage, due to spurious signals, may also be experienced in systems in which the transmission channel is a physical transmission line.

A further object of the invention is, therefore, to provide means for avoiding wholly or in part the disadvantage discussed in the two preceding paragraphs.

In the cases previously discussed it has been assumed that the direct current component of

the picture signals is transmitted as a modulation of the carrier wave and that this component has been preserved in the circuits of the receiving apparatus. The correction required to compensate for change in the high frequency gain or other effect controlling the amplitude of the signals may also be required in systems in which the direct current component is not transmitted, or is transmitted and not preserved at the receiver, but is re-inserted by the methods set forth in the specification of British Patent No. 422,906.

According to the present invention, apparatus for the reception of television signals comprises means for feeding to a signal responsive device signals consisting of picture signals, said signals being such that the signal value at a point in a receiver corresponding to black in the transmitted picture, varies with the amplitude of said signals, amplitude controlling means for controlling the amplitude of said signals, and means associated with said amplitude controlling means for modifying the operating characteristics of said signal responsive device so that the light value in the reconstituted picture corresponding to black in the transmitted picture is maintained substantially constant during operation of said amplitude controlling means. The signal responsive device may be a picture reconstituting device such as a cathode ray tube or an amplifying valve preceding a picture reconstituting device, the operating characteristics of the cathode ray tube or valve being adjusted by the application of bias potentials between the cathode and grid which vary simultaneously with the variation in the amplitude of signals applied to the control grid.

Apparatus embodying the invention may consist of a television receiver including a screen grid amplifying valve supplying a signal responsive device in the form of a cathode ray tube, the gain of the screen grid valve being controlled by adjustment of the voltage applied to the screen grid while the cathode of the cathode ray tube has bias potentials applied to it which vary simultaneously with adjustment of the voltage applied to the screen grid. The invention may also be applied, for example, to synchronizing signal circuits in television receivers, such an application being described more fully hereinafter. In order to facilitate simultaneous adjustment of the amplitude of the signals with adjustment of a bias potential, the operating members of the controlling devices may conveniently be coupled mechanically.

In order that the invention may be more clearly understood and readily carried into effect, circuit arrangements embodying the invention will now be described by way of example with reference to the accompanying drawing in which:

Fig. 1 illustrates the application of the invention to the picture-reproducing apparatus of a television receiver,

Fig. 2 illustrates the manner in which the invention is applied to the synchronizing apparatus of a television receiver, and

Fig. 3 shows a modification which is applicable to either of the arrangements shown in Figs. 1 or 2.

It will be assumed in the description of the apparatus of each figure that the signal to be received is in the form of a carrier wave modulated by picture signals including the direct current component thereof, and, in the blacker-than-black sense, by synchronizing pulses; it will be further assumed that the transmitted carrier amplitude representing the peaks of synchronizing pulses is

nominally zero, but may vary up to 5% of the carrier amplitude representing full white.

Referring to Fig. 1, the screen-grid valve V_1 is an intermediate frequency amplifier of a super-heterodyne television receiver, and V_2 is a diode picture detector. The anode of valve V_1 is coupled through a suitable coupling circuit, not shown, to the anode of diode V_2 , and is connected to the positive pole of a source of anode current not shown, the negative pole of which is earthed. The anode of the valve V_1 may conveniently be coupled to the anode of the diode V_2 by a high frequency transformer the secondary winding of which is tuned. The primary winding is inserted in the anode lead of valve V_1 and the secondary winding is connected across the anode of the diode V_2 and the earthed conductor.

The cathode of valve V_1 is connected to earth through a biasing resistance R_1 shunted by by-pass condenser C_2 , and through the lower half of a potential divider resistance VR_2 ; a decoupling condenser C_2 is connected between the tapping point on resistance VR_2 and earth.

A potential divider resistance VR_1 is connected between the positive terminal of the anode current source and earth, and a variable tapping point in this resistance is connected to the screen grid of valve V_1 . Adjustment of the position of the tapping point in resistance VR_1 varies the screen grid potential of valve V_1 and hence the amplification of that valve.

The cathode of diode V_2 is earthed through a load resistance R_2 shunted by by-pass condenser C_3 , and is also connected to the modulator electrode M of a cathode ray tube CT , the cathode Ca of which is connected to a tapping point in a potential divider resistance VR_3 ; the latter is connected in series with resistances R_3 and VR_2 between the positive terminal of the anode current source and earth.

The cathode Ca of tube CT receives a constant positive bias relative to the modulator electrode M as a result of the flow of current from the anode current source through the lower half of resistance VR_2 and through resistance VR_3 , and an additional positive bias due to the flow of the current in valve V_1 through the lower half of resistance VR_2 . The additional bias depends in magnitude upon the setting of the tapping point in resistance VR_1 and hence upon the amplification of valve V_1 . In the absence of the additional bias, the potential representing picture black at the modulator M would vary with adjustment of VR_1 , due to the causes discussed above, and the additional bias is made such by adjustment of the tapping point in VR_2 , that the variation referred to is avoided or greatly reduced. Preferably, VR_2 is a pre-set potentiometer, and is given a suitable adjustment in the factory. Resistance VR_3 may also be of the pre-set type.

Referring now to Fig. 2, the valve V_3 is the first valve of the synchronizing apparatus of a television receiver, and serves the function of assisting in the separation of frame synchronizing pulses from line synchronizing pulses of shorter duration in the manner described in the co-pending applications above referred to. The anode of valve V_3 is connected to the positive terminal of the anode current source through a resistance R_4 , and to earth through a condenser C_4 , and it is arranged that, in operation, anode current flows in valve V_3 at all times excepting during the peaks of the received synchronizing pulses when its control grid is swung to below the potential corresponding to anode current cut-off and the valve

insulates. A substantially triangular voltage impulse in the positive sense thus builds up across condenser C_4 at each synchronizing pulse, the triangular impulses due to the frame pulses being of greater amplitude than those due to the line pulses. The peaks of the triangular impulses of greater amplitude are then separated by amplitude selection and employed to control the operation of frame scanning.

Now it is essential if valve V_3 is to operate satisfactorily that the control grid thereof shall be swung below anode current cut-off at the peak of each synchronizing pulse, and if the level representing these peaks at the cathode of valve V_2 varies due to changes in the level of residual carrier, noise, interference or a combination of these when gain-control resistance VR_1 is adjusted, this may not be realized, valve V_3 may not insulate at the peaks and synchronizing of the frame scanning operation may be lost.

In the arrangement described, however, the cathode of valve V_3 is given a constant positive bias by connection to the anode current source through resistances VR_2 and R_3 , and also receives an additional positive bias which is dependent in magnitude upon the setting of VR_1 due to the flow of the current in valve V through the lower part of VR_2 . The latter is preferably made preset, and is adjusted in the factory so that valve V_3 becomes insulating at the peaks of the synchronizing pulses at all settings of VR_1 provided that the magnitude of the spurious signal due to residual carrier and the like does not exceed a pre-determined amount. In practice, a residual carrier amplitude of 5% of the amplitude representing full white, and a noise level dependent upon the amount of carrier frequency amplification may be catered for.

While in the arrangements described the amplitude of the signals passed to the rectifier V_2 and therefore to the cathode ray tube CT in the case of Fig. 1, or to the valve V_3 in Fig. 2, is shown to be dependent upon the amplification gain in the valve V_1 , it will be understood that the amplitude of the signals may be controlled in other ways. Thus, for example, as shown in Fig. 3, the potentiometer P may be connected as the load resistance of the rectifier V_2 , and the operating member K of this potentiometer is ganged as indicated by the dotted line, with the operating member K_1 of a potentiometer resistance VR_3 , adjustment of which serves to vary the bias potential applied to the cathode ray tube or valve. The resistance VR_4 serves to determine the standing bias potential between the grid and cathode of either the cathode ray tube or the valve V_3 .

In the description of Figs. 1 and 3, it has been assumed that the direct current component is transmitted to the picture reconstituting device. If this is not so, as is the case if resistance capacity coupling for example is used, or if the direct current component is not present in the transmitted signals, the signal potential representing black will vary with amplitude control at the receiver, but in the opposite sense to that previously discussed.

It will be understood that if the picture signals are amplified, before application to the picture reconstituting device, in a direct current amplifier, the compensating bias can be applied to one of the valves of this amplifier.

What we claim is:

1. In a signalling circuit, a first thermionic amplifying device including a cathode, at least one control electrode, and an anode electrode, means for controlling the normal amplification level of said device, means to supply signals for amplification to the input circuit of said device, a cathode-anode output circuit for said device including means for biasing the cathode relative to the anode, said means including at least one resistor element, a second thermionic device also including a cathode, an anode, and at least one control electrode, and means for applying a pre-determined bias upon the cathode of said second device, said means including the resistor element for biasing the first thermionic device whereby the bias upon the second device is varied in accordance with changes in current flow through the first device resulting from signal level variation of the signals amplified.

2. The circuit claimed in claim 1 comprising, in addition, a rectifier connected to receive the output signals from said first device, and means for supplying the rectified signal output from said rectifier from the control electrode of said second device to vary thereby the electron flow through said second device under the control of received signal variations.

3. An amplifying circuit for television comprising a thermionic amplifier tube having a cathode, an anode, and at least one control electrode, an input and an output circuit for said tube, means for supplying received signal energy to the input circuit, means for controlling the normal amplification of said amplifier tube, means including a resistor element connected in the output circuit of said amplifier tube for biasing the cathode relative to the anode, a cathode ray tube for reproducing electro-optically the received signals, said cathode ray tube having a cathode, a control electrode and an anode for causing the development of an electron beam, means including the bias resistor of said amplifier tube for applying a predetermined bias to the cathode of said cathode ray tube to control the normal average intensity of the developed electron beam, said common resistor means being adapted to vary the bias applied to the cathode ray tube under the control of variations in output from the amplifier due to variations in signal level therein.

4. The circuit claimed in claim 3 comprising, in addition, a rectifier connected to receive the output signals from said thermionic amplifier tube, and means for applying the rectified signal output from the rectifier to the control electrode of said cathode ray tube to control thereby the electron beam of said cathode ray tube under the control of received signal variations.

CHARLES LESLIE FAUDELL,
NOEL ATKINSON.