

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN AND RELATING TO CLAMPING CIRCUITS

(71) We, RCA CORPORATION (formerly known as Radio Corporation of America), a corporation organized under the laws of the State of Delaware, United States of America, of 30 Rockefeller Plaza, City and State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to video amplifiers and more particularly to biasing circuits for video amplifiers.

In a video amplifier for use in a television receiver there is normally a requirement that the d.c. component of the video signal be preserved. In television amplifier channels such as luminance or chrominance, a.c. coupling, although not conventional, might be utilized, provided the magnitudes of the coupling capacitors are large enough to accommodate the relatively wide bandwidth.

This presents problems in transistorized circuits because of the impedance levels associated therewith. Accordingly, using a.c. coupling in transistor amplifier circuits is not particularly feasible due to the magnitude of capacitance required for suitable operation.

Other approaches use coupling capacitors, as in the a.c. approach, with d.c. restoration. These techniques employ suitably poled diodes, constant bias potential sources, and coupling capacitors. A typical restoring circuit is responsive to, for example, the sync tips present in the video signal to charge the coupling capacitor to a suitable d.c. level.

Such approaches have problems in that the charge time constant should be small, because of the limited energy in the sync pulse, while the discharge time constant

[Price 25p]

should be long to prevent a change in brightness across a television line. Since d.c. restorers operate as peak detectors they are sensitive to noise pulses when present in a video signal.

In general a.c. coupling, and a.c. coupling with d.c. restoration provide inferior noise immunity. Therefore many conventional television receivers utilize video amplifiers which are d.c. coupled over two or more stages to avoid these problems. In general the design of cascaded d.c. coupled amplifiers presents a problem in that the d.c. voltage required at an output of one amplifier is usually incompatible with that d.c. voltage required at an input of a succeeding stage. In order to circumvent this problem one approach uses a battery coupled between two video amplifying stages. This technique has apparent disadvantages in that it is expensive to implement and is extremely dependent upon the impedance and voltage rating of the battery.

Transistor d.c. coupled amplifiers and stages using the above a.c. techniques possess similar disadvantages; coupled with the fact that their input circuits draw current and hence serve to deplete charge from capacitors as used in typical d.c. restorers. Furthermore, transistor characteristics are susceptible to temperature. Temperature compensation on a per stage basis is expensive as requiring additional components.

It is an object of the present invention to provide an improved video amplifier which can be so incorporated in a television receiver as to alleviate some or all of the mentioned difficulties.

According to the invention a signal amplifier for a television or like video signal having repetitively occurring synchronising intervals therein, comprises a video input circuit for applying said signal to an input electrode of an amplifying device

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through a capacitor, and a capacitor charging circuit for additionally supplying a predominant charging current to said capacitor during said intervals through a unidirectionally conductive device so coupled to the capacitor and to said input electrode as also to apply a disabling bias to the amplifying device in such intervals, the capacitor becoming charged during such intervals to a level effective between said intervals to bias the amplifying device for operation about an operating point primarily determined by said charge.

More specifically, in a particular embodiment of the invention a diode is coupled between the input electrode of an input stage transistor of the amplifier and a point of reference potential. The input electrode of the transistor is also coupled through a capacitor to a low impedance video signal source and to a separate source of pulses generated in the synchronizing intervals: these may be derived from a horizontal retrace pulse source present in a conventional receiver. The diode is so poled, and the pulses are of such polarity, that during the pulse the diode is forward biased but the transistor is cut-off. Pulse current flowing through the diode charges up the coupling capacitor to provide at the junction of the diode and the input electrode of the transistor, a potential of such polarity as to forward bias the transistor and reverse bias the diode for the subsequent line interval, during which the transistor is accordingly allowed to conduct. The value of the capacitor is made relatively small as the retrace pulse is selected to be of relatively high magnitude. A greater percentage of charge on the coupling capacitor is derived from the retrace pulse and a smaller, but appreciable amount of charge due to the peak excursions of the video signal or sync tips. Accordingly, the circuits then tend to follow video fluctuations while maintaining a desired black level with good noise and pulse interference immunity. Moreover, because of the polarity of the diode as coupled to the input electrode of the transistor amplifier, temperature compensation is afforded by the circuit and therefore voltage changes in the amplifier due to temperature are compensated for.

In the accompanying drawings, which illustrate exemplary embodiments of the invention:

Figure 1 is a schematic diagram partially in block form of a television receiver embodying a video amplifier according to this invention.

Figure 2 is a schematic diagram partially in block form of a television receiver embodying an alternate version of a video amplifier according to this invention.

Figure 3 is a schematic diagram partially in block form of a color television receiver embodying amplifiers according to this invention.

Referring to Figure 1 the television antenna 10 receives radio frequency television signal transmissions and couples them to the television signal processor 12. Processor 12 conventionally performs the functions inherent in television processing circuitry. Therefore processor 12 develops suitable waveshapes synchronized to components contained within the composite television signal for deflecting the electron beams supported by the kinescope 31. Accordingly, there is shown outputs from receiver 12 to the deflection yoke 34 associated with the kinescope 31. A portion of the circuitry included within processor 12 functions to process video information contained in the composite signal for providing at a suitable output a detected video signal. The detected video signal is shown coupled to a resistor 14 and through a coupling capacitor 16 to the base electrode of a transistor 20 arranged in a common collector configuration. Coupled between the junction of the base electrode of transistor 20 and capacitor 16 is the cathode electrode of a semiconductor diode 18 having the anode electrode coupled to a point of reference potential such as ground.

Conventionally the emitter electrode of transistor 20 is coupled to the point of reference potential through a resistor 22 while the collector electrode is returned to a source of potential designated as B+.

A second transistor 24 arranged in a common emitter configuration has its base electrode drive supplied by the coupling path between the emitter electrode of transistor 20 and the base electrode of transistor 24. A self-biasing network comprising a resistor 28 and a shunt capacitor 30 is coupled between the emitter electrode of transistor 24 and a point of reference potential. A load resistor 26 couples the collector electrode of transistor 24 to a source of operating potential designated as V+. The collector electrode is utilized as an output for driving or applying to a suitable electrode of the kinescope 32, the amplified video signal. The junction between capacitor 16 and resistor 14 is also coupled through a resistor 36 to the variable arm of a potentiometer 38 labelled brightness control. Potentiometer 38 has one terminal thereof coupled to a point of reference potential and a second terminal coupled to the anode electrode of diode 40. The cathode electrode of diode 40 is coupled through the secondary winding of transformer 42 to a point of reference potential. The primary winding of transformer 42 is coupled between the point of

reference potential and a pulse source output derived from the television signal processor 12.

The television signal processor 12, as indicated above, furnishes suitable deflection waveshapes for application to the kinescope 32. Such waveshapes are commonly referred to as horizontal and vertical sweep signals. The horizontal signal in a typical receiver is generated by means of a suitable sawtooth waveform generator which operates under the influence of horizontal synchronizing pulses contained in the composite signal and retrieved by a sync separator circuit included in processor 12. Such sawtooth waveshapes have a transition referred to as retrace or flyback and occurring at the end of the horizontal scan. During this interval a retrace pulse is generated by such circuitry and it is this pulse of a negative polarity which is applied to the primary winding of transformer 42. As will be seen subsequently other suitable pulse sources conventionally developed by television signal processing circuitry might be utilized as well.

The operation of the video amplifier described above is as follows. The negative horizontal retrace pulses cause diode 40 to conduct. The diode 40 serves to clip or eliminate any ripple which might otherwise appear across potentiometer 38, from appearing during the line or scan interval of the display. The negative pulse is applied through resistor 36 and coupling capacitor 16 to the base electrode of the emitter follower including transistor 20. During the horizontal retrace interval the negative pulse serves to forward bias diode 18 and serves to cutoff transistor 20. The pulse current flowing through diode 18 and capacitor 16 into the retrace pulse source via diode 40 and the secondary winding of transformer 42, charges up capacitor 16 to provide a positive potential at the junction between capacitor 16 and the cathode electrode of diode 18. At the termination of the retrace interval, the pulse source represents ground potential, so that the positive charge on capacitor 16, reverse biases diode 18 and forward biases transistor 20. Transistor 20 as indicated above is d.c. coupled to the power output stage 24 which serves to apply the amplified video signal to a suitable electrode of kinescope 32.

In operation of the above circuit, the clamping action, the video black level maintenance; and the noise and interference pulse immunity are dependent upon the charge furnished across capacitor 16.

Due to the selection of the magnitude of the retrace pulse and the impedance associated therewith the charge across capacitor 16 is primarily dependent upon

the current furnished by the negative retrace pulse and not that dependent upon the video signal. In a practical example the retrace pulse energy contributed is approximately ten times that due to the video energy as represented by the magnitude of the sync pulse. The value of capacitor 16 can be selected relatively small because the available charging current is large. Conversely, the value of the input impedance at the base electrode of transistor 20 can be reduced quite substantially before the discharge time constant becomes too small. Accordingly arranging transistor 20 in a common collector configuration is not a necessary requirement for proper circuit operation.

As indicated above the timing of the clamping action occurs during the blanking interval but the clamping level is dependent mainly upon the amplitude of the clamping pulse or horizontal retrace pulse. In conventional clamping circuits the clamping level is set by the signal where, for example, the sync tips or the back porch pedestal are used as a reference.

In the above-described circuit, noise pulses occurring during the line period can not have sufficient amplitude to reverse bias the diode 18 and charge capacitor 16 because of the limited voltage swing of the preceding stages. As the noise coincides with sync tip, the disturbance is still small because the heavy diode 18 conduction results in an integration of the total energy and the noise pulse energy is relatively small. As indicated above, during the horizontal retrace interval when the pulse is present at the base electrode of the transistor 20 the pulse polarity serves to reverse bias or cutoff transistor 20, which in turn, because of the d.c. coupling path, cuts-off current flowing in transistor 24. The collector electrode potential of transistor 24 goes towards $V+$ which transition is applied to the cathode electrode of the kinescope 32 causing current conduction or beam current therein to cease.

Consequently this action eliminates the need for specific circuits for horizontal blanking due to the relative accuracy of black level maintenance in the circuits. Special provision for vertical blanking would not appear necessary in actual operation. Any drift in preceding amplifying stages which can be a.c. or capacitively coupled will not disturb the value of the black level as evidenced by the charge on capacitor 16 because of the large energy content of the flyback or retrace pulse. The brightness control potentiometer 38 adjusts the amplitude of the retrace pulses which in turn results in a change in the charge developed across capacitor 16. This

charge or voltage across capacitor 16 establishes the desired quiescent operating points of transistor 20 and therefore of transistor 24. An increase in the pulse amplitude will increase the brightness level and vice versa.

As can be seen the circuit also provides a means of brightness limiting. During the condition where the kinescope begins to draw excessive beam current the horizontal circuitry of a typical receiver becomes over-loaded as the horizontal circuitry is a conventional source for developing operating potentials for the kinescope 32. In this manner the magnitude of the retrace pulse decreases because of this overload. Therefore during this condition the charge across capacitor 16 decreases which action tends to bias the kinescope 32 in the reverse direction. This action tends to reduce the magnitude of the beam current and therefore serves to restrict the amount of beam current conduction for the kinescope 32.

The operating quiescent points of transistors 20 and 24 are temperature stabilized by diode 18 in the following manner. With increased temperature of the environment the collector currents of transistors 20 and 24 will increase which effect by itself will result in an increase in brightness of the kinescope 32. However, due to the increasing temperature of the environment the reverse current flowing through diode 18 will also increase. This results in a lower effective reverse resistance of diode 18. This lower effective resistance at high temperature reduces the voltage stored across capacitor 16 and therefore reduces the effective positive bias applied to transistor 20 during the line scan. This type of temperature stabilization produces a magnitude collector voltage change of transistor 24 or less than 5% with a temperature increase from 25°C to 60°C.

In summation some of the advantages of the circuit described in Figure 1 are as follows. The circuit permits capacitive coupling in the video stages of a television receiver, while providing d.c. restoration for the entire a.c. coupled chain. Current practice usually resorts to d.c. coupling between two or three video stages because of the inferior noise immunity of conventional d.c. restorers, and of a.c. coupling in general. The circuit provides noise and interference pulse immunity because of the magnitude of the energy supplied to the coupling capacitor 16 from the retrace pulse source. No additional blanking circuits are necessary. Temperature compensation is inherently provided by the circuit while the frequency response of the output amplifier is maintained optimum because there are no brightness or other such con-

trols coupled directly to the video circuitry which would tend to increase the capacitive loading. A 20% or better reduction of collector power dissipation is afforded by use of the described video circuit because of the fact that transistors 20 and 24 are cut-off during the blanking interval.

In general television receivers using this circuit can employ simpler automatic gain control (AGC) circuits, for example, average type AGC because the d.c. is continuously restored by the circuit and the black level is controlled mainly by the setting of potentiometer 38. Furthermore, due to the location of the clamp diode 18 in the base electrode circuit of transistor 20, a low voltage general purpose diode can be employed, as compared to the type utilized, for example, to provide d.c. restoration directly at a suitable kinescope electrode.

Referring to Figure 2, there is shown a similar amplifier configuration as that of Figure 1 with the addition of a d.c. feedback path from the collector electrode of transistor 24 to the base electrode of transistor 20. Diode 18 instead of having the anode electrode returned to a point of reference potential, such as ground, has the anode electrode coupled to the junction of resistors 40 and 41 for d.c. negative feedback operation. The subsequent feedback further improves temperature stability while offering the overall advantages of negative feedback as keeping the gain characteristics of transistors 20 and 24 relatively constant and so on.

Capacitor 16' coupled to the base electrode of transistor 20 is charged during a repetitive interval by the negative pulse shown applied thereto by the low output impedance common collector stage 43 comprising transistor 44.

The base electrode of transistor 44 is coupled to a variable pulse source 45. It is noted that the source of pulses may occur during the horizontal or vertical period. The intention again is that such pulses be of sufficient energy to charge capacitor 16 to the required level for biasing transistor 20. The low impedance, large current characteristics of the pulse source being necessary for a fast charge rate with high energy content.

Referring to Figure 3 there is shown a color television receiver employing three amplifiers according to this invention.

A television signal processor 51 is coupled to an antenna 50, which receives transmitted radio frequency (R.F.) television signals. The signal processor 51 contains suitable amplifiers and circuitry for converting the R.F. signals to video and audio intermediate frequency (I.F.) components. The audio I.F. is coupled to a sound channel 52 for demodulation of sound in-

formation and application of the recovered audio signal to a speaker 53.

The video I.F. is detected within signal processor 51 and applied to a luminance amplifier channel 55 and a chrominance amplifier 56. The detected video is also applied to the sync, AGC and high voltage circuitry 57, where the sync components are retrieved or "stripped" from the video signal and applied to suitable deflection generators, horizontal and vertical, for application to a deflection yoke 58 associated with the kinescope 60. High voltage supplies for biasing and operating the kinescope 60 are conventionally developed by suitable circuitry operating on horizontal retrace pulses developed in circuitry 57. Accordingly, there is shown a lead for applying ultor potential to the second anode 61 of the kinescope 60.

An output from the chroma amplifier 56 is coupled to the input of a burst amplifier 62 having another input thereof coupled to the output of the sync, AGC and deflection circuits 57. The burst amplifier 62 is keyed by a suitable pulse developed in the deflection circuits 57 for separating out a color burst signal from the chrominance signal during a color transmission. An output of the burst amplifier 62 is used to lock a color subcarrier oscillator 64. The output of oscillator 64 is coupled to an input of color demodulators 66 having another input coupled to an output of the chrominance amplifier 56. The function of the color demodulators 66 is to demodulate the chrominance signal under control of the reference subcarrier oscillator signal to provide at suitable outputs thereof the color difference signals as R-Y, B-Y and G-Y. Also shown coupled to the burst amplifier 62 is an input of a color killer circuit 67 having an output coupled to a suitable input of the chroma amplifier 56. The function of the color killer circuit 67 is to detect the presence of the burst signal to provide a disable signal for turning off or blocking the chroma amplifier 56 during a monochrome transmission.

In conventional receivers the color difference signals as obtained from the output of the color demodulator 66 may be applied directly to suitable electrodes of the kinescope 60, while the luminance signal as obtained at the output of luminance amplifier 55 may be applied to other electrodes of the kinescope 60. The kinescope 60 performs matrixing internally. In this receiver the output of the luminance amplifier 55 is applied to one terminal of a potentiometer 70 having the other terminal connected to a point of reference potential. The variable arm of potentiometer 70 is coupled to the base electrode 65 of a transistor 72 through a capacitor 71.

Transistor 72 is arranged in a common emitter configuration and has a load resistor 73 connected between the collector electrode and a source of potential $+V_b$. The emitter electrode of transistor 72 is coupled through suitable peaking circuitry, necessary for assuring a suitable high frequency response of transistor amplifier 72 to accommodate the relatively wide band luminance signals. A second transistor 74 has its base electrode coupled to the collector electrode of transistor 72 via a luminance delay line 75 in series with a peaking inductor 76. Transistor 74 is arranged in a common collector configuration. The emitter electrode is returned to ground through a self biasing resistor 78 and is coupled to the base electrode of transistor 72 via a feedback resistor 77 used for gain and impedance stability. Accordingly, the emitter electrode of transistor 74 furnishes the delayed luminance signal or Y signal as conventionally generated in most color television receivers. It is again noted that capacitor 71 coupling potentiometer 70 to the base electrode of transistor 72 a.c. couples the luminance amplifier 55, which may actually be a suitable output from the video transistor amplifier stage according to stages comprising in part transistor 72 and 74. The outputs of the color demodulators 66 as the B-Y, R-Y and G-Y color difference signals are respectively a.c. coupled each to a separate input electrode of a video transistors amplifier stage according to Figure 1. In this manner the G-Y output for example, is coupled through a capacitor 80 to the base electrode of a transistor 81 arranged in a common collector configuration. A semiconductor diode 82 is coupled between the base electrode of transistor 81 and ground. Transistor 81 has the emitter-electrode coupled to ground through a resistor 83. The emitter electrode of transistor 81 is directly coupled to the base electrode of transistor 84 arranged in a common emitter configuration. Transistor 84 has a collector load resistor 85 having one terminal coupled to a source of potential $+V_{cc}$. The emitter electrode of transistor 84 is returned to ground through a self biasing resistor 86 which is bypassed at high frequencies by a capacitor 87. One cathode electrode of the kinescope 60 is directly coupled to the collector electrode of transistor 84 which supplies drive thereto. In a similar manner there are shown two other amplifying stages identical to that described above for applying the two other color difference signals R-Y and B-Y to the two other cathode electrodes of the kinescope 60. The operation of the circuits will be described with reference to the above-mentioned circuit, comprising in

part, transistors 81 and 84. A retrace pulse source providing negative pulses of high energy content during the horizontal retrace interval is coupled to the junction between an output of the color demodulators 66 and capacitor 80 through a semiconductor rectifying diode 90 having its anode electrode coupled to the $+V_b$ supply through a potentiometer 91. The variable arm of potentiometer 91 is coupled to the aforementioned junction through a current limiting resistor 92. The same junction is also coupled to the emitter electrode of transistor 74 through a resistor 93 to provide thereat the luminance or Y component associated with the video signal. In this manner, both the color difference signal and the Y signal are matrixed at said junction due to the coupling thereto of the color demodulator 66 and the luminance amplifier comprising in part transistor 74. As described in Figure 1, the horizontal retrace pulse as coupled via diode 90 serves to charge capacitor 80 in a direction to provide a positive potential at the base electrode of transistor 81. During this charging time or for the presence of the horizontal retrace pulse, transistor 81 is biased in cutoff and diode 82 is forward biased hence providing blanking of the kinescope by causing transistor 84 to cutoff. The positive potential due to the high energy blanking pulse permits transistor 81 and therefore transistor 84 to be biased on during the line scan thus providing the amplified color signal at the respective electrode of the kinescope 60. The circuit as described provides the full advantages and operates according to the same principles disclosed in Figure 1 and is particularly useful for the R, B and G type color receiver of Figure 3. The common brightness control 91 as adjusting the magnitude of the horizontal retrace pulse for charging the coupling capacitors as 80, operates with a minimum cross-talk between color channels because of the resistive isolation afforded by the limiting resistor 92. Similarly, the operation of the brightness control 91 does not appreciably load the video circuit and hence does not disturb the video frequency response. The contrast control potentiometer 70 could alternatively precede the chrominance take-off point for providing a combined contrast and chroma control, provided that the color burst signal is not in consequence so affected as to disturb the performance of the circuits it controls: for instance the chroma signals could be taken from the base of transistor 72 to the chroma amplifier 56 if some form of gated burst by-pass circuit were provided between the input end and tap of the potentiometer 70.

A circuit operating in a television receiver as indicated in Figure 3 utilized the following components.

Transistor 72	TA2605	
Transistor 74	TA2529	70
Transistor 81	TA2605	
Transistor 84	TA2529	
Resistor 70	100 ohms variable	
Resistor 73	1800 ohms	
Resistor 77	470 K ohms	75
Resistor 78	1,000 ohms	
Resistor 83	1,000 ohms	
Resistor 85	5,600 ohms	
Resistor 86	100 ohms	
Resistor 91	100 ohms variable	80
Resistor 92	1,000 ohms	
Capacitor 71	10 microfarads	
Capacitor 80	1.6 microfarads	
Capacitor 87	680 micromicrofarads	
Diode 82	OA85	85
Diode 90	OA85	
$+V_b$	30 volts	
$+V_{cc}$	140 volts	

The other video amplifier circuits including representative components as shown in Figure 3 and not referenced to by any particular numerals, utilized the same values for corresponding circuit components with transistor stages identical to that comprising in part transistors 81 and 84.

WHAT WE CLAIM IS:—

1. A video signal amplifier for a video signal having repetitively securing synchronizing intervals therein, comprising a video input circuit for applying said signal to an input electrode of an amplifying device through a capacitor, and a capacitor charging circuit for additionally supplying a predominant charging current to said capacitor during said intervals through a unidirectionally conductive device so coupled to the capacitor and to said input electrode as also to apply a disabling bias to the amplifying device in such intervals, the capacitor becoming charged during such intervals to a level effective between said intervals to bias the amplifying device for operation about an operating point primarily determined by said charge.

2. An amplifier according to claim 1 wherein, with said amplifying device able to be biased into operation by a bias potential of one polarity applied to said input electrode, the unidirectionally conductive device is connected to said input electrode so as to be forward biased by the opposite polarity thereat and said capacitor is connected between said input electrode and an input point having a first connection thereto for said video signal and a second connection thereto from means for providing during said intervals pulses of said opposite polarity such as to cause charging of the capacitor through the unidirectionally con-

part, transistors 81 and 84. A retrace pulse source providing negative pulses of high energy content during the horizontal retrace interval is coupled to the junction between an output of the color demodulators 66 and capacitor 80 through a semiconductor rectifying diode 90 having its anode electrode coupled to the $+V_b$ supply through a potentiometer 91. The variable arm of potentiometer 91 is coupled to the aforementioned junction through a current limiting resistor 92. The same junction is also coupled to the emitter electrode of transistor 74 through a resistor 93 to provide thereat the luminance or Y component associated with the video signal. In this manner, both the color difference signal and the Y signal are matrixed at said junction due to the coupling thereto of the color demodulator 66 and the luminance amplifier comprising in part transistor 74. As described in Figure 1, the horizontal retrace pulse as coupled via diode 90 serves to charge capacitor 80 in a direction to provide a positive potential at the base electrode of transistor 81. During this charging time or for the presence of the horizontal retrace pulse, transistor 81 is biased in cutoff and diode 82 is forward biased hence providing blanking of the kinescope by causing transistor 84 to cutoff. The positive potential due to the high energy blanking pulse permits transistor 81 and therefore transistor 84 to be biased on during the line scan thus providing the amplified color signal at the respective electrode of the kinescope 60. The circuit as described provides the full advantages and operates according to the same principles disclosed in Figure 1 and is particularly useful for the R, B and G type color receiver of Figure 3. The common brightness control 91 as adjusting the magnitude of the horizontal retrace pulse for charging the coupling capacitors as 80, operates with a minimum cross-talk between color channels because of the resistive isolation afforded by the limiting resistor 92. Similarly, the operation of the brightness control 91 does not appreciably load the video circuit and hence does not disturb the video frequency response. The contrast control potentiometer 70 could alternatively precede the chrominance take-off point for providing a combined contrast and chroma control, provided that the color burst signal is not in consequence so affected as to disturb the performance of the circuits it controls: for instance the chroma signals could be taken from the base of transistor 72 to the chroma amplifier 56 if some form of gated burst by-pass circuit were provided between the input end and tap of the potentiometer 70.

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Resistor 86	100 ohms	
Resistor 91	100 ohms variable	80
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2. An amplifier according to claim 1 wherein, with said amplifying device able to be biased into operation by a bias potential of one polarity applied to said input electrode, the unidirectionally conductive device is connected to said input electrode so as to be forward biased by the opposite polarity thereat and said capacitor is connected between said input electrode and an input point having a first connection thereto for said video signal and a second connection thereto from means for providing during said intervals pulses of said opposite polarity such as to cause charging of the capacitor through the unidirectionally con-



ductive device while disabling the amplifying device.

3. An amplifier according to claim 2 wherein said unidirectionally conductive device is a diode connected between said input electrode and a reference potential point.

4. An amplifier according to claim 2 wherein said unidirectionally conductive device is connected in a d.c. negative feedback path from an output point in said amplifier to said input electrode.

5. An amplifier according to any one of claims 2-4 wherein said second connection includes a variable impedance for varying the amplitudes of said pulses as supplied to the capacitor and thereby varying said operating point.

6. An amplifier according to any preceding claim wherein said amplifying device is a transistor in the first of two transistor amplifier stages directly coupled in cascade, the first stage having a common collector configuration and the second stage a common emitter configuration.

7. A video signal amplifier substantially as hereinbefore described with reference to Fig 1 or Fig 2 of the accompanying drawings.

8. A signal amplifier according to any preceding claim having its output coupled

to an electrode of a kinescope to apply the amplified video signal thereto.

9. A signal amplifier as claimed in claim 8 provided in conjunction with at least one other such amplifier, said amplifiers having their outputs coupled to respective electrodes of a color kinescope to apply respective color representative amplified video signals thereto.

10. A signal amplifier as claimed in claim 8 provided in conjunction with at least one other such amplifier for amplifying respective color video signals, said amplifiers having their said input electrodes further coupled through their said capacitors to common means for supplying a luminance signal, and having their outputs connected to respective electrodes of a color kinescope to apply thereto the amplified color signals matrixed with said luminance signal.

11. A video signal amplifier arrangement for a color television receiver, substantially as hereinbefore described with reference to Fig 3 of the accompanying drawings.

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