Dec. 31, 1940. K. SCHLESINGER 2,227,026

AMPLIFIER ARRANGEMENT FOR TELEVISION PURPOSES

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Fig.3.

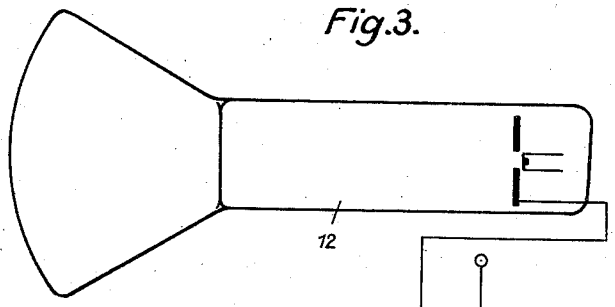


Fig.2a

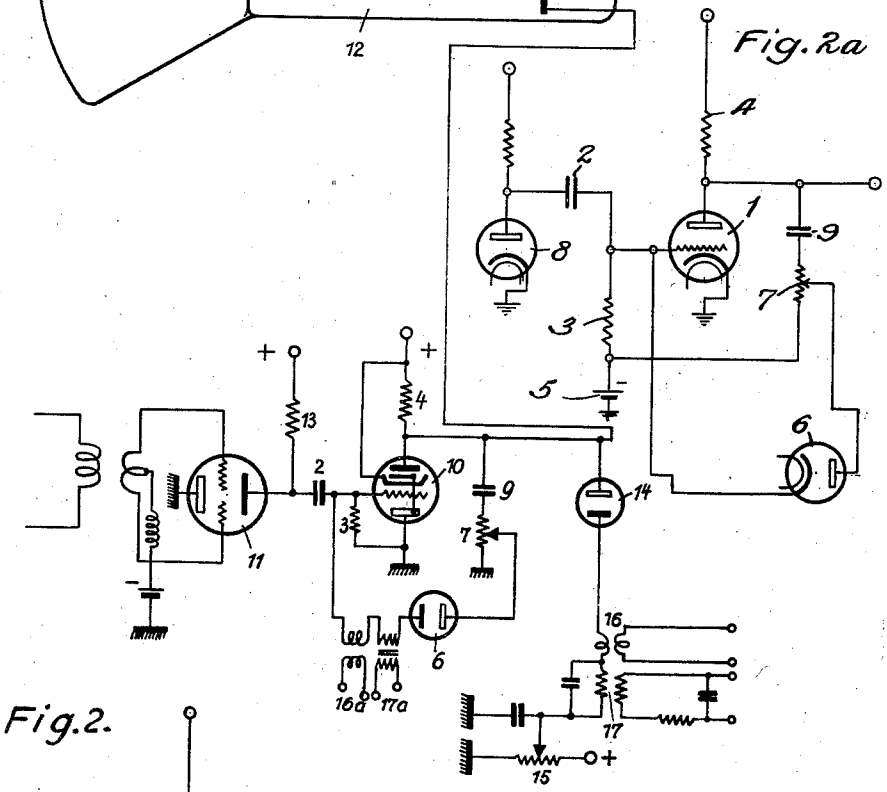


Fig.2.

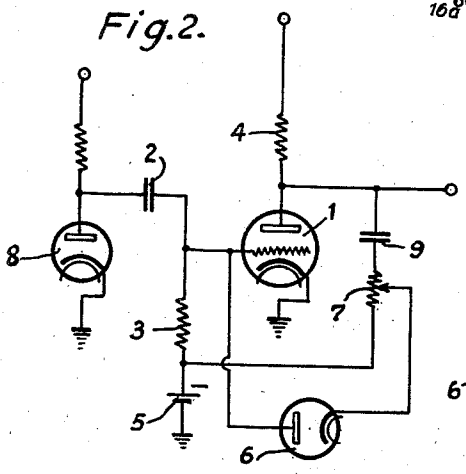
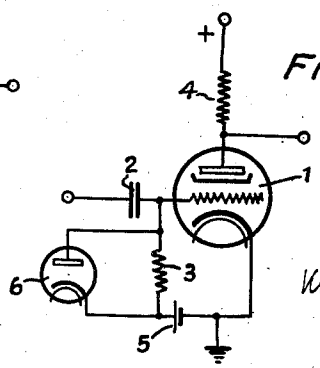


Fig.1.



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AMPLIFIER ARRANGEMENT FOR TELEVISION PURPOSES

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6 Claims. (Cl. 179—171)

The present invention relates to an improvement in television amplifier circuit arrangements.

It is already known that in the television art the disadvantage of resistance amplifiers, which consists in not being able to transmit D. C. values, may be overcome by always adding to the image upon the scanning operation a certain minimum proportion of black impulses. These black impulses are obtained in simple fashion by covering a marginal strip on the scanning surface, through which the scanning light is unable to pass. This having been done it is merely necessary to ensure that the output signal of the amplifier always retains the stationary value of the unexcited condition (which corresponds to complete black) and does not deviate from the same either upwards or downwards. When the edge is scanned peaks occur in the output signal impulse peaks, the peak value of which must be located on this stationary position. It has already been made known and proved in the television art that the problem of transmitting absolute light-intensity values with RC amplifiers amounts fundamentally to a measuring of the peak potential.

The invention will be clearly understood by way of example shown in the accompanying drawing in which

Fig. 1 shows a television amplifier circuit as it is well known,

Fig. 2 shows a circuit arrangement in accordance with the invention, Fig. 2*a* indicates a change of the circuit system of Fig. 2, and

Fig. 3 shows a further embodiment of the invention.

A fundamental and most simple circuit arrangement for making this peak potential measurement capable of utilisation for the present purpose, as it is already known, is shown in Fig. 1 wherein 1 is the output stage of the amplifier, the grid of which is coupled by way of a condenser 2 with the preliminary amplifier and is biased by way of a leak resistance 3 from a source 5. If the Braun tube is directly connected to the tube 1 or if a positive television transmitter system is used, black is produced when the anode of the tube 1 has reached its maximum negative value, i. e., when the grid of the end tube has reached its maximum positive value. In accordance with the above the grid oscillations pendulating about the bias 5 as mean value must be prevented from being ever capable of attaining a higher positive momentary value than the stationary value, i. e., the potential 5 itself. For this purpose a two-electrode tube 6 is connected in parallel to the leak resistance 3 having its anode connected to the grid. The tube 6 in the case of positive oscillations attracts electronic current to its anode for such time until the grid has been negatively charged to the potential of the cathode of tube 6, i. e. to the bias 5. If the grid alternating potential oscillates into negative, the tube 6 remains without current. The circuit arrangement of Fig. 1 nearly realizes that which is required, viz., that the grid alternating potential is never capable of oscillating beyond the value 5 as highest positive peak value, so that the anode alternating potential is also incapable of oscillating below the stationary value of the unexcited condition, i. e. black.

In practice it is found that the circuit arrangement according to Fig. 1 does not solve completely the problem of maintaining the basic value. The two-electrode tube 6 on the one hand operates with the leak resistance 3 and on the other hand its power of emission decreases more and more as the state of equilibrium is approached, as the potential between anode and cathode then proceeds towards zero. The circuit accordingly operates inaccurately insofar as it is unable to prevent entirely the grid potential from being momentarily more positive than 5. The connection system has a detrimental "slip."

The circuit arrangement according to the invention in Fig. 2 represents a great advantage as compared with Fig. 1 insofar as it is possible by means of a potentiometer 7 to adjust this slip exactly to zero, and even to over-compensate the same. As compared with circuits otherwise known for maintaining constant value it has the advantage of simplicity, as no special auxiliary batteries of any kind, stabilizers or the like are required. In Fig. 2 there is shown for the sake of better comprehension a preliminary tube 8, which is coupled by way of the coupling condenser 2 with the output tube 1. The leak resistance 3 is connected with the grid bias 5. At the anode resistance 4 there occurs an amplified image signal potential. According to the invention, the two-electrode tube 6 is in this case excited from the anode circuit of tube 1. An excess of alternating potential, which is there available, is coupled by way of the coupling condenser 9 with the potentiometer 7, and can be connected from there, by a tapping, with the cathode of the two-electrode tube 6. The anode of the tube 6 can be applied directly to the grid of the output tube 1. As charging condenser there is then

employed the condenser 2. The operation of this simple circuit is as follows: A grid alternating potential amplitude $+e_g$ is assumed. This is amplified V times (V=amplification factor) and provides a negative potential peak $-e_a$. The potentiometer 7 is so adjusted that a weakening of the oscillations is effected nearly to an amount of 1/V. At its tapping there is accordingly available the potential $-e_g$, i. e. the reverse curve of the grid alternating potential. If the cathode of the rectifier 6 is excited by this potential, it passes electrons to the anode for such time until anode and cathode have the same negative maximum potential. At times of positive cathode alternating potential the condenser 2 is discharged, i. e. the grid of the tube 1 is discharged slowly by way of the leak resistance 3 back to the normal grid bias 5. From the point of view of bias the grid of the tube, therefore, by reason of the circuit arrangement according to the invention (Fig. 2), is always supplied with an additional negative potential from its anode circuit of exactly the same amount as the maximum positive potential of the grid oscillation. In this way it is accomplished that the potential of the anode line of 1 is never able to drop below the bias value which it had in the stationary condition. All signals are then built up on these black values, in which manner the problem of D. C. addition is solved in general.

As regards conversion to practice, it may be stated that the coupling elements 9 and 7 should preferably allow the passage of all frequencies of the television band which are transmitted by the remaining amplifiers, and that this circuit including condenser 9 and resistance portion 7, therefore, may have the time constant of the coupling condenser 2 and leak resistance 3. If the time constant is made smaller, the D. C. addition can be effected only with comparatively brief impulses, so that useful discharge time is lost. Losses in the rectification by loading and starting current are readily compensated by adjustment of the tapping at resistance 7 for somewhat more powerful exciting potentials. The rate of discharge is regulated solely by the circuit including coupling condenser 2 and resistance 3, which for reasons of general image transmission conditions must have at least the time constant of an image composition, and preferably a multiple thereof.

Suitable sizes for the components are:

Condenser 2=0.5 μf.
Resistance 3=0.3 megohms
Condenser 9=0.1 μf.
Resistance 7=10^5 ohms

Modifications of this may be quoted as follows: By changing the polarity of the rectifier 6 it would be accomplished that positive maximum values of the anode alternating potential would be "prohibited" by corresponding positive additional potentials of the grid. The output signal would then not be located on the black, but on the white of the image. An amplifier of this kind is suitable for the negative transmission of television images, such as is being considered in practice at the present time.

Fig. 2*a* indicates the circuit connection of the rectifier 6 for this case. Then the cathode of the tube 6 is connected to the grid of the tube 1 and its anode is connected to the tap of resistance 7.

If the maintenance of the basic value according to Fig. 2 is carried out in one tube stage, a capacitatively after-connected second stage is in no way also regulated. It is obvious that if desired each stage of the amplifier may be regulated per se to absolute values by the method according to the invention (assuming sufficient alternating potentials are available), if importance is attached to correct D. C. reproduction of the image in this stage, without it being necessary to join up the after-connected stages, for example by D. C. coupling, with a regulated stage.

The method according to the invention, viz. reaction coupling by way of rectifiers, can be employed with advantage not only in transmission amplifiers but also in the end stage of the televsion receiver. Fig. 3 shows a corresponding connection system. The great difficulty in the output receiving stage consisted up to now in the fact that it was necessary to couple the amplifying tube 10 for the image contents frequencies galvanically with the rectifier 11 rectifying the carrier frequency. So long as the rectifier 11 is merely a two-electrode rectifier this method is still capable of being performed. If, however, there is employed a three-electrode tube 11, which requires a special plate potential, there occur in the case of D. C. coupling between the two tubes 10 and 11 very undesirable detrimental couplings, which take effect in such form that the plate potential for the rectifier becomes smaller the more the rectifier is excited. These difficulties do naturally not exist in the case of battery operation, but in operation from a power supply system wherein rectified A. C. is used can be avoided at the most by stabilizing arrangements, i. e. at considerable expense.

In the method according to the invention the D. C. coupling between detector 11 and output stage 10 can be omitted entirely. In place thereof there is selected a condenser coupling by way of the coupling condenser 2, and the output stage 10 is regulated per se on a constant basis by the method according to the invention coupling by way of a rectifier 6. If the reception of positive transmitters is concerned, the end stage 10, in accordance with the invention, is allowed to operate with full emission, and this emission is controlled downwards. In accordance with the invention the procedure is the reverse upon the reception of negative transmitters. In this way the entire length of the characteristic is always available for the image.

In Fig. 3 there is shown the circuit for positive reception. A grid bias, therefore, is unnecessary, and the leak resistance 3 is connected to the cathode (if the plate potential is not selected to be too high). Preferably the output valve 10 is a five-electrode tube. The potentiometer 7 with coupling condenser 9 and the rectifier 6 are connected as described above. It is possible by adjustment of potentiometer 7 so to adjust the signal output of 10 at the working resistance 4, which is directly connected galvanically to the Braun tube 12, that the synchronisation peaks produce exactly on the stationary value and never depart from the same, irrespective of the character of the image modulation. Owing to the possibility of employing a condenser coupling 2 to the detector 11 and the working resistance 13 it is now possible to provide the detector with a sufficiently high plate potential, so that it never flattens off by reason of insufficient plate potential, even under powerful excitations. There is shown as detector a grid-controlled twin grid three-electrode tube, which is already known for

the reception of images having a large number of lines and has the advantage that on the one hand it supplies, as compared with the two-electrode tube, low-frequency amplification, and that on the other hand it eliminates itself the carrier wave of the image.

After the output stage has been regulated to a basic value by the reaction coupling according to the invention by way of the rectifier 6, the rectifier 14 can be applied galvanically with fixed bias 15 to the output, and in this way the synchronisation signals can be separated from the impulse-mixture independently of the particular image modulation by way of transformers 16, 17 which are tuned each one to different frequencies (line- and frame-synchronisation signal). The synchronisation is operative in an amplitude range defended by the bias regulated by the means 7 and 15.

For the reception of negative transmissions there is simply changed the polarity of the rectifier 6, the output tube 10 is furnished with a negative bias up to the point of disappearance of the emission and the polarity of the synchronisation rectifier 14 is also changed, another bias 15 being necessary. It is advantageous in practice to unite the two rectifiers 6 and 14 in a common bulb to form a twin-diode.

The synchronisation can also take place in very simple fashion by connection of the transformers 16, 17 at the points 16*a*, 17*a*, i. e. in the circuit of the reaction coupling rectifier 6. Current only flows in this circuit when the cathode of 6 is at times negative in relation to the anode of 6. In all remaining cases the lead to the rectifier 6 is without current. This, however, is just the condition for the passage of extreme negative impulses of the signals, i. e. for the synchronisation impulses themselves. In this manner it is possible to dispense with a special rectifier 14 for the synchronisation.

I claim:

1. A television amplifier system with resistance-capacity coupling means comprising at least one tube having at least an anode, grid and cathode connected together as to form an input and output circuit with suitable biassing means, an additional circuit between said output and input circuit, said additional circuit including a rectifier tube in series connection with an ohmic potentiometer resistance and a condenser, said potentiometer with its tapping being adjusted in accordance with the amplification factor V so that a constant state of the signal peak potential is attained, said rectifier tube in case of positive television transmission being connected with its anode to the grid of said amplifier tube and with its cathode to the tapping of said potentiometer resistance, said potentiometer resistance being connected with its one terminal via said condenser to the anode of said amplifier and with its other terminal to said biassing means.

2. A television amplifier system with resistance-capacity coupling means comprising at least one tube having at least an anode, grid and cathode connected together as to form an input and output circuit with suitable biassing means, an additional circuit between said output and input circuit, said additional circuit including a rectifier tube in series connection with an ohmic potentiometer and a condenser, said potentiometer with its tapping being adjusted in accordance with the amplification factor V so that a constant state of the signal peak potential is attained, said rectifier tube, in case of negative television transmission, being connected with its cathode to said grid of said amplifier tube and with its anode to said output anode of said amplifier tube via said potentiometer and said condenser.

3. A television amplifier circuit comprising a source of signal energy, a first thermionic tube adapted to be energized by said energy, a thermionic output tube, a capacity-resistance means to energize said second tube from the first tube output, said output tube having at least a cathode, a control electrode, and an output electrode, means for applying a biasing voltage of a predetermined value relative to the cathode to said control electrode, a series connected condenser and resistor element connected between the output electrode and the biasing means, and a unilateral conductor element connected between a point on said resistor and the output tube control electrode so that a supplemental voltage may be applied to the control electrode of the tube to maintain a predetermined and substantially fixed output voltage from the output tube for peak value input signals, and a load circuit connected to receive the output energy from said output tube.

4. The amplifier circuit claimed in claim 3, wherein said unilateral conductor comprises a diode.

5. The amplifier circuit claimed in claim 3, wherein said unilateral conductor comprises a diode having its anode connected to said point on said resistor and its cathode connected to said control electrode so that the input signals may be received with increasing amplitude representing black in the television image.

6. The amplifier circuit claimed in claim 3, wherein said unilateral conductor comprises a diode having its cathode connected to said point on said resistor and its anode connected to said control electrode so that the input signals may be received with increasing amplitude representing white in the picture.

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