Oct. 31, 1939. R. J. KEMP ET AL 2,177,723

ELECTRICAL SEGREGATION CIRCUIT

Filed April 16, 1937

Fig. 1

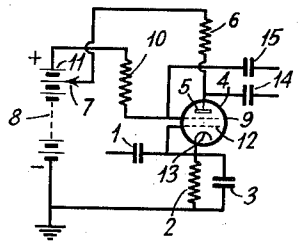


Fig. 2

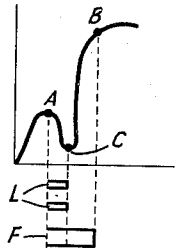


Fig. 3

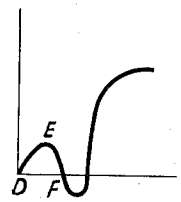


Fig. 4

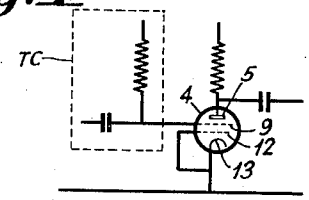


Fig. 5

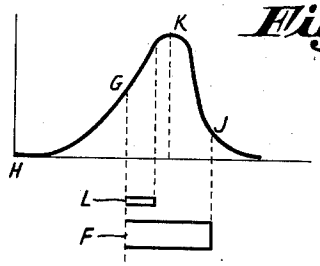


Fig. 6

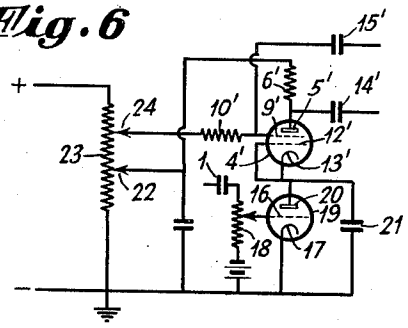


Fig. 7

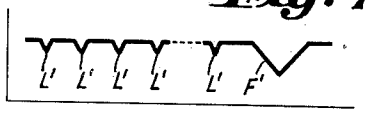


Fig. 8

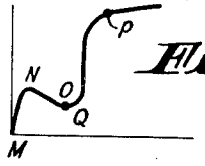


Fig. 9

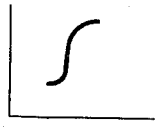


Fig. 10

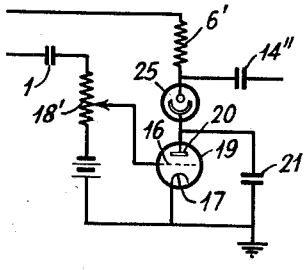
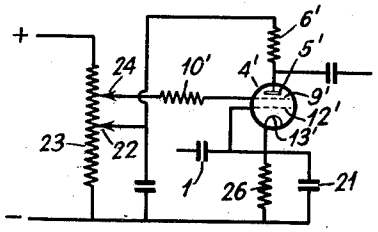


Fig. 11



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UNITED STATES PATENT OFFICE

2,177,723

ELECTRICAL SEGREGATION CIRCUIT

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Application April 16, 1937, Serial No. 137,166
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6 Claims. (Cl. 178—69.5)

This invention relates to television and like receivers and more particularly to synchronizing signal apparatus suitable for use in cathode ray tube television and like receivers.

It is usual in modern television and like practice to transmit square topped line synchronizing signals at the end of each scanning line and square topped framing signals at the end of each frame these line synchronizing and frame synchronizing pulses being employed at the receiver to synchronize scanning action thereat. As a general rule all the synchronizing signals are "blacker than black"—that is to say they are of greater amplitude than the picture signal amplitude corresponding to "black" in the subject of transmission—and the framing pulses are of substantially longer duration than the synchronizing pulses each framing pulse generally extending over several line periods. In some cases the framing pulses are of greater amplitude than the line pulses. It is, however, by no means a simple matter (owing largely to loss of efficiency at the transmitter) to make the difference in amplitude between synchronizing pulses and framing pulses as received great enough to be relied upon for amplitude selection and, moreover, there are obvious practical advantages in transmitting synchronizing signals and framing pulses at the same amplitude and making the difference between the two varieties of pulse one of different duration only.

In modern cathode ray tube television and like receivers intended to co-operate with transmitters of the kind wherein framing signals of substantially longer duration than synchronizing signals are transmitted over a common channel, it is usual practice to rely upon frequency selective networks i. e. networks relying upon resonant circuits, and the like, for selecting the one type of synchronizing signal from the other but in general such frequency selective networks are not very reliable nor effective. They are, moreover, not as simple as is desirable.

The object of the present invention is to provide improved and simplified apparatus for selecting framing signals from line synchronizing signals in a television or like receiver for co-operating with a transmitter of the kind transmitting two varieties of synchronizing signals of different lengths. As will be seen later apparatus in accordance with this invention does not involve the use of tuned circuits or like frequency selective means, but, nevertheless reliable selective action is provided.

According to the main feature of this invention received line synchronizing signals and framing signals appearing in a common channel and distinguished from one another at least in that the two varieties of signals are of different duration or different amplitude, or both, are separated by means including a selective device or circuit having an operating input voltage-output current curve of substantially different slope at different parts thereof. Where the line synchronizing and framing signals as received are of the same amplitude they are first applied to a time circuit network to derive therefrom different amplitude signals which are then applied to the selective device or network. Where, however, the synchronizing and framing signals are of different amplitudes they may be applied direct to the selective device or network. Preferably the selective device or network is such as to transform different amplitude pulses into different polarity pulses.

The invention is illustrated in and further explained in connection with the accompanying drawing, in which

Fig. 1 is an embodiment of our invention,
Figs. 2 and 3 are explanatory curves,
Fig. 4 is a modified arrangement,
Fig. 5 is an explanatory curve,
Fig. 6 is an application of our invention,
Figs. 7, 8, and 9 are explanatory curves,
Fig. 10 is an alternative arrangement, and
Fig. 11 is a further modified arrangement.

Referring to Fig. 1 which shows one way of carrying out this invention as applied to a system wherein the line synchronizing and framing signals as received are of the same amplitude but different durations, the mixed synchronizing signals are applied through a condenser 1 across a time constant circuit which may, for example, consist of a shunt resistance-condenser combination 2, 3, and which is inserted in the cathode lead of a screen grid valve 4 whose anode 5 is connected through a resistance 6 to a point 7 on an anode battery or other source 8, the screen grid 9 being connected through a resistance 10 to a point 11 which is positive with respect to the point 7. The time constant circuit 2, 3, is so designed as to accept the relatively long period framing pulses and heavily to attenuate the relatively short period line synchronizing pulses. The control grid 12 and cathode 13 are tied together. The operating potentials applied to the screen grid valve are so chosen that the operating anode current (ordinates)-anode voltage (abscissae) characteristic curve of the valve is of the well known form represented in Figure 2, exhibiting a rising portion followed by a dip followed by a second more steeply rising portion which ultimately flattens out in the well known way. The valve 4 is operated at a suitable point of this characteristic somewhere on the origin side of the dip e. g. at the point A which is at the "crown" of the first rise. Suppose a series of synchronizing signals of uniform amplitude but different duration be applied across the circuit 2, 3. The action of this time constant circuit 2, 3, will be to transform the pulses of similar amplitude but different dura-

tion into pulses of different amplitudes and short pulses (line synchronizing signals) being transformed into small amplitude pulses such as are represented at L in Fig. 2 while the long pulses (framing signals) will be transformed into larger amplitude pulses such as are represented at F in Fig. 2. The small amplitude pulses L (due to the line synchronizing signals) will cause a diminution of anode current in valve 4 (the valve swing occurring over the negative sloping portion BC of the dip) whereas the large amplitude pulses F will cause a rise in anode current since the valve swing carries over to a point such as B near the top of the second rising portion in the characteristic curve. As a result the line pulses appear in the anode circuit of the valve as of one polarity and the framing pulses appear of the opposite polarity. These pulses, which can be taken off through a condenser 14 from the anode circuit, can, therefore, very easily be separated, e. g. by suitable rectifier circuits (not shown). For example, the anode pulses may be applied directly or through a phase reversing valve to a rectifier circuit and obviously the rectified resultant will consist either of the line pulses only or of the framing pulses only according as to whether the energy channel to the rectifier includes a phase reversal valve or not.

If desired, the above described arrangement may be modified by deriving the one variety of pulse from the anode (through condenser 14) and the other from the screen grid 9 (for example through condenser 15) by means of suitable rectifier circuits energized from these two electrodes, for obviously the pulses from the screen grid will be in reversed phase as compared to those from the anode.

Preferably the screen grid valve and circuit is such that the operating characteristic is as shown in Fig. 3 rather than as shown in Fig. 2, i. e. such that the dip in the anode current-anode voltage curve extends below the abscissa line by an amount approximately equal to the amount by which the first rise in the curve extends above the abscissa line. This will obviously result in improved sensitivity. If desired, where a valve arrangement exhibiting the form of characteristic shown in Fig. 3 is employed, it may be operated over that portion DEF of the curve lying between the origin D and the first point of crossing F of the abscissa line, line pulses causing a swing over the positively sloping part DE of this portion and framing pulses carrying the swing over the negatively sloping part EF. This method of operation is, however, not preferred, it being preferred to operate in the manner already described with reference to Fig. 2.

In the modification diagrammatically represented in Fig. 4 the mixed synchronizing signals of different duration are applied through a time constant circuit within the broken line rectangle TC to the screen grid 9 of a screen grid valve 4 which is so operated as to exhibit an anode current (ordinates)-screen grid voltage (abscissae) characteristic as shown in Fig. 5 said characteristic rising to a maximum and then falling away. For this method of operation the operating point is chosen at a point such as G on the positively sloping part HGK of the curve so that the small amplitude signals such as L (due to short duration line signals) result in a swing up to or near the crown of the curve but the larger amplitude signals such as F (due to long, framing signals) cause a swing well past this point K and down to a point such as J near the abscissa line. As before the control grid 12 and cathode 13 are tied together and the time circuit again attenuates the short pulses just as in Fig. 1, being, however, now inserted in the signal supply lead to the screen grid.

Where the line and framing pulses as received are already of sufficiently different amplitudes the above described and illustrated embodiments may be modified by omission of the time constant circuit.

It is important to note that all the above arrangements transform different amplitude signals of the same polarity into signals of opposite polarity, thus making separation exceedingly simple.

In the arrangement shown in Fig. 6 the mixed synchronizing signals, which are arranged to have their peaks in the positive direction, are applied through a condenser 1 and regulating potentiometer 18 between control grid 16 and cathode 17 of a triode 19 whose anode cathode space 20—17 is shunted by a condenser 21. The anode 20 of the triode receives positive potential from a tap 22 on a potentiometer resistance 23 shunted across a potential source (not shown) through a circuit including a resistance 6' and the anode-cathode space 5'—13' of a screen grid valve 4' whose control grid 12' and cathode 13' are connected together and to the anode 20 of the triode 19. Positive potential exceeding that on the anode 5' is applied from tap 24 via resistance 10' to the screen grid 9'. In the absence of applied signals the condenser 21 charges to a steady potential which depends inter alia on the relative D. C. resistances of the two series connected valves 19, 4'. Each successive positive peak of the applied signals reduces for an instant the resistance of the triode 19 and the condenser 21 discharges slightly through this valve. Obviously a long duration (framing) pulse will cause a greater discharge than a short duration (line) pulse. Between signal peaks the condenser 21 charges up through the screen grid valve and the circuit parameters are so selected that this recharging is reasonably rapid. Thus the voltage at the anode 20 will vary after the manner shown in Fig. 7 the shallow narrow dips L' being due to short signals (line signals) and the deep wide dip F' being due to long signals (frame signals). The voltage across the screen grid valve 4' will clearly vary in an opposite manner, i. e. it will be increased momentarily and slightly for each line pulse and will be increased much more and for a longer period for each framing pulse. The operating potentials on the screen grid valve are so adjusted that it exhibits an anode current (ordinates) anode voltage (abscissae) characteristic curve as shown in Fig. 8 with a rising portion MN followed by a shallow, fairly flat bottomed dip NQ followed by a more steeply rising portion QP which ultimately flattens off. The operating point is chosen at a point such as 0 on the flat bottom of the dip so that the small increases of anode voltage due to line pulses produce little or no change in anode current (the valve swing remains on the fairly flat bottom NQ of the dip) whereas the large increases in anode voltage due to framing pulses swing the valve to or near the top of the second rise QP in the curve thus causing large anode current changes. Accordingly framing pulses may be taken via con-

denser 14' from the anode and due to the flattening which follows the steep rise QP of the curve, these pulses will be fairly flat topped as is required for good synchronizing action. Since the condenser 21 recharges rapidly, the return to the normal operating point is almost immediate. The pulses obtained from the anode will be negative in direction, but if positive pulses are required they may obviously be obtained (e. g. through a condenser 15') from the screen grid 9'.

The screen grid valve in the last described embodiment may be replaced by any other suitable charging device exhibiting an applied voltage (abscissae) output-current (ordinates) characteristic curve part of which consists (as shown in Fig. 9) of a fairly flat portion followed by a rising portion which (preferably) flattens off sharply at the top. For example, a suitably operated diode might replace the screen grid valve.

Again the screen grid valve might be replaced by a neon or other electric discharge lamp 25 as shown in Fig. 10. In this case the triode 19 must be biased practically to cut off and the arrangement made such that on switching on the anode potential the lamp will flash and permit the condenser to charge to a value such that the lamp is extinguished. The signals are applied as in Fig. 6. Each successive signal peak will discharge the condenser 21 slightly so that the voltage across the lamp rises. The parameters of the circuit are so chosen that when a framing pulse arrives the more complete discharging which then occurs allows the potential across the lamp 25 to rise above the ignition potential so that the lamp flashes, recharging the condenser 21. The cycle is then repeated. Framing pulses can therefore be taken through condenser 14'' from that terminal of the lamp 25 remote from the triode 19.

In a further modification illustrated in Fig. 11 the triode 19 of Fig. 6 is replaced by a high resistance 26 which is shunted by the condenser 21. In this case the signals are applied through condenser 1 in the negative sense across the resistance 26 and must be of considerable magnitude—e. g. they may be amplified before application. The operation is much the same as in Fig. 6 except that the condenser 21 is discharged directly by negative pulses and not, as before, indirectly by positive pulses which vary the resistance of a valve (19 of Fig. 6) shunting the condenser.

What we claim is:

1. A circuit arrangement for separating television signals which are of different time duration comprising a selective device having an operating input voltage-output current curve of substantially different slopes at different parts thereof, means for impressing said signals of different time duration onto said selective device, and means for biasing said selective device so that the portion of its characteristic swept over for one amplitude is of positive slope, and the portion swept over for another amplitude is of negative slope, whereby said signals which are of like amplitude and differing duration are transformed into signals of differing amplitudes and differing polarities.

2. A circuit arrangement for separating television signals which are of different time duration comprising a selective device having an operating input voltage-output current curve of substantially different slopes at different parts thereof, said selective device including a thermionic tube having a screen grid, said selective device having an operating input voltage-output current curve of substantially different slope at different parts thereof, means for impressing said signals onto said thermionic device, means for biasing said thermionic device to operate on a portion of its characteristic curve at a point on the positively sloping portion thereof so that input voltages of large amplitudes cause a swing over the crown of the curve into the negatively sloping portion thereof.

3. A circuit arrangement for separating television synchronizing or like signals which are of different time duration, said arrangement comprising means for transforming the signals of different time duration into signals of different amplitudes, a selective device comprising a thermionic valve having an operating input voltage-output current curve of substantially different slope at different parts and means for applying the transformed, amplitude-differentiated signals as input signals to said valve means for biasing said valve whereby signals of one amplitude sweep over a portion of its characteristic of substantially different slope from that swept over as a result of the application of signals of the other amplitude, the valve being so operated that the dip in the anode current-anode voltage curve extends below the abscissae line by an amount approximately equal to the amount by which the first rise in the curve extends above the abscissae line.

4. An arrangement as claimed in claim 3, wherein signals of different duration which are to be separated are applied across a time constant circuit which attenuates the signals of shorter duration relatively to those of longer duration, said circuit being connected in the cathode lead of the valve, said valve being of the screen grid type.

5. An arrangement as claimed in claim 3 wherein said selective valve is of the screen grid type, and a time constant circuit connected in the screen grid circuit thereof, said time constant circuit serving to attenuate the signals of shorter duration relatively to those of longer duration.

6. A circuit arrangement for separating television synchronizing signals, said arrangement comprising a selective device including a valve having anode, cathode and at least one control electrode, said valve having an operating input voltage, output current curve of substantially different slope at different parts of the curve, a diode so operated that its anode current-anode voltage characteristic includes a fairly flat part followed by a steeply rising part, the operating point being chosen on the fairly flat part so that small increases of anode voltage produce little change in anode current whereas large increases of anode voltage cause substantial changes in anode current, said diode being connected in a current carrying electrode circuit of the thermionic valve, and means for applying the signals to be separated as input signals to said thermionic valve, the latter being so operated that for signals of one amplitude it sweeps over a portion of its characteristic of substantially different slope from that swept over as a result of the application of signals of the other amplitude.

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