

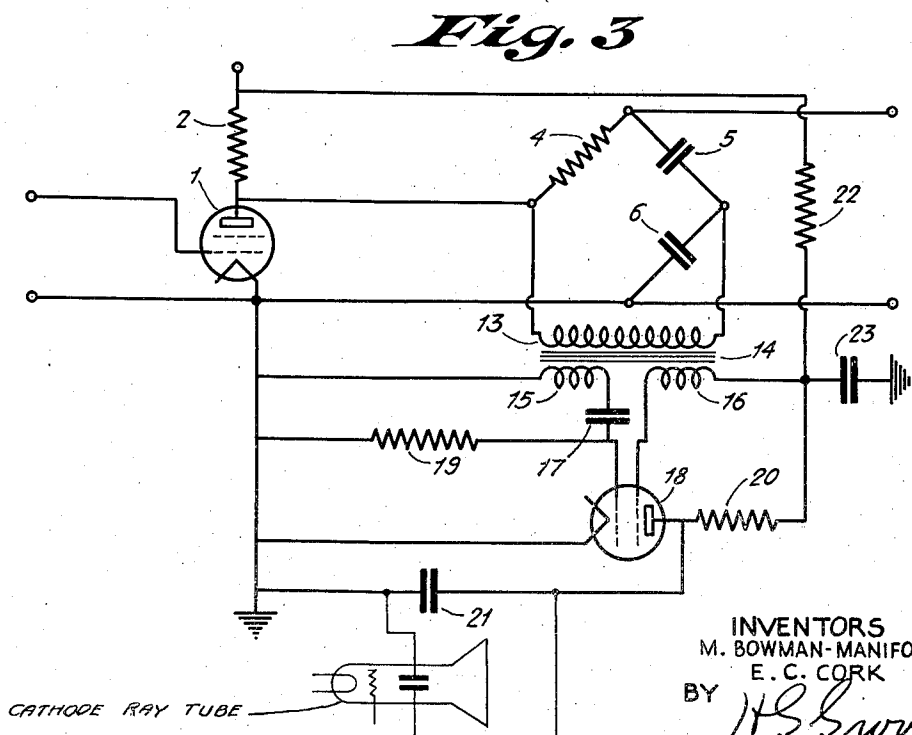
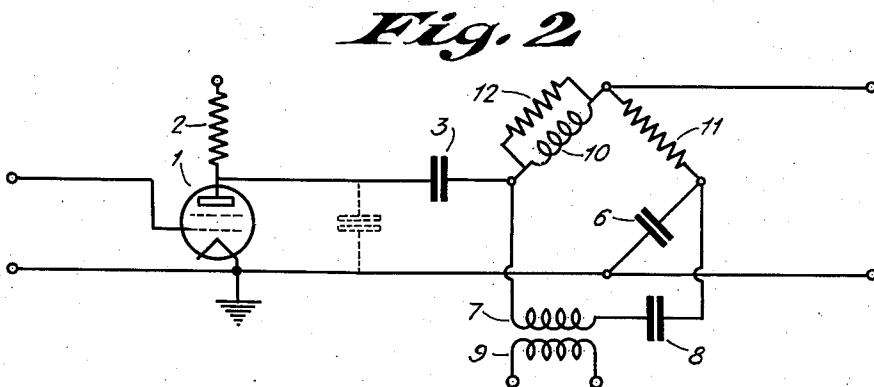
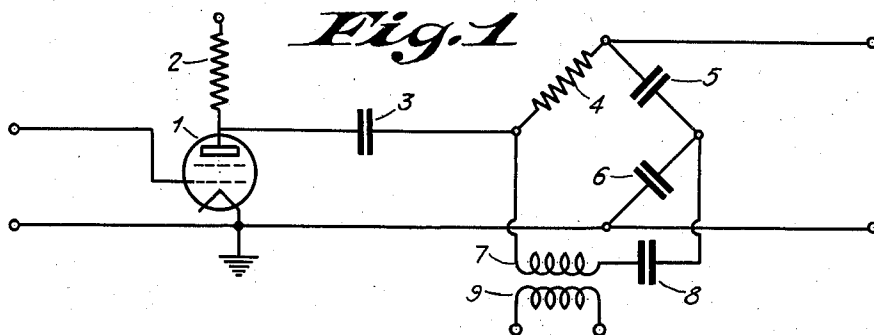
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TELEVISION OR THE LIKE TRANSMISSION SYSTEM

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TELEVISION OR THE LIKE TRANSMISSION
SYSTEM

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The present invention relates to television or like systems for the electrical transmission of pictures, views, images of objects, and the like, of the type in which two sets of synchronizing impulses having different characteristics are sent from the transmitter, and are used to synchro-
nize the apparatus for reconstituting the picture at the receiver. The two sets of synchronizing impulses may be transmitted as a single series of impulses, certain impulses or sets of successive impulses being given different characteristics from the remainder.

In systems of the type referred to, adapted, for example, for the electrical transmission of motion picture films, it is usual to scan each picture frame in a series of parallel transverse lines, and a synchronizing impulse may be generated at the beginning of each scanned line. These impulses are referred to herein as the "line" synchronizing impulses; they are generated at a frequency equal to the number of lines scanned per second, and referred to as the "line" scanning frequency. A second series of synchronizing impulses, one of which may be generated for each frame scanned, is produced at a frequency lower than the line scanning frequency and depending upon the speed of motion of the film through the scanning gate, these impulses being referred to as the "framing" impulses.

The two sets of synchronizing impulses may be mixed together and applied at the transmitter to modulate a carrier wave, or, as stated above, a single set of impulses, of which certain impulses or sets of successive impulses have different characteristics from the remainder, may be generated and transmitted on a suitable channel. At the receiver, the two sets of impulses are separated after demodulation and employed to synchronize the picture-reconstituting apparatus with the scanning apparatus at the transmitter. When a single set of impulses only is transmitted, uniformly spaced groups of, say, four impulses may conveniently be made of longer duration than the remainder, all of the impulses serving as line impulses, for example, and the sets of impulses of longer duration being separated from the remainder and employed as the frame impulses.

In television systems of the type referred to in which a cathode ray tube is employed at the receiver to reconstitute the transmitted image, the synchronizing impulses may serve to control the generation of saw-tooth oscillations by suitable oscillation generators. The saw-tooth oscillations serve to control the deflection of the cathode ray beam over the fluorescent screen of the

tube, and it is essential, if synchronism is to be maintained, that the oscillations from one generator shall be prevented from influencing the other. Thus in arrangements in which controlling impulses are fed to the generators from the same circuit, care must be taken to ensure that there is substantially no coupling between the generators over that circuit.

It is an object of the present invention to provide, in a television or the like transmission system of the type referred to, means whereby two sets of synchronizing impulses may be separated substantially completely from one another.

It is a further object of the invention to provide separating means of such a nature that a circuit to which one of said sets of impulses is fed shall be substantially completely isolated from a circuit to which the other set of impulses is fed.

According to the present invention, in a transmission system of the type referred to, in which there are provided means adapted substantially to isolate a circuit to be fed with one set of impulses from a circuit to be fed, from the same source, with another set of impulses, said means comprise a plurality of impedances arranged as a Wheatstone bridge, the mixed impulses being applied to or taken off from one arm of the bridge, and the separate impulses being taken off from or applied to the diagonals.

The invention will be described by way of example with reference to the accompanying drawing, in which three bridge networks according to the invention are illustrated. Parts which are common to the several figures are given the same references.

Fig. 1 illustrates one embodiment of the present invention.

Fig. 2 diagrammatically represents another modification of the invention.

Fig. 3 illustrates still another embodiment according to the invention.

Referring to Fig. 1, a thermionic screened grid or the like suitable amplifying valve 1 has its anode connected to the positive terminal of a source of anode current (not shown) through an anode resistance 2, and is coupled by means of a coupling condenser 3 to a further resistance 4 constituting a resistance arm of a Wheatstone bridge. The resistance 4 is connected by means of two condensers 5 and 6 in series to the cathode of the valve 1, which is also connected to the earthed negative terminal of the source. The condensers 5 and 6, which are preferably of equal capacity, constitute two further arms of the bridge, and the arrangement is such that the

impedance of the anode-cathode path of the valve 1, in shunt with the anode resistance 2, forms an impedance which, in series with the coupling condenser 3, constitutes the fourth arm of the Wheatstone bridge. The capacity of the coupling condenser 3 is made such that its impedance over the range of frequencies with which the bridge is required to deal is small, and the bridge may be made substantially balanced over this range of frequencies.

The cathode of the valve 1 is preferably earthed, and the value of the resistance 4 constituting the resistance arm of the bridge is made substantially equal to the equivalent resistance of the valve arm of the bridge; the resistance 4 may be shunted by a condenser of a capacity substantially equal to the effective shunt capacity between the anode and cathode of the valve.

The mixed high and low frequency synchronizing impulses, of which there may for example be 2400 per second and 20 per second respectively, are applied between the grid and cathode of the valve 1 and hence appear in the bridge circuit. The values of the impedances constituting the bridge are so chosen that the higher frequencies tend to be suppressed across the diagonal from the cathode of the valve to the junction of the resistance 4 and the condenser 5, and the lower frequency impulses are taken off from this diagonal. Across the other diagonal is connected the primary winding 7 of a transformer, preferably in series with a condenser 8 of such a capacity as to attenuate considerably the lower frequency oscillations, while passing relatively freely higher frequency oscillations. The higher frequency impulses are derived from the secondary winding 9 of the transformer.

In a modified arrangement, illustrated in Fig. 2, the Wheatstone bridge is constituted by a valve arm comprising the impedance of the anode-cathode path of a suitable valve 1, in shunt with an anode resistance 2 and in series with a coupling condenser 3, and three further arms comprising respectively an inductance 10, a resistance 11 and a condenser 6, all connected in series, the condenser 6 being returned to the cathode of the valve 1. The inductance 10 may be shunted by a suitable resistance 12 to compensate for the effective capacity (indicated by broken lines) between the anode and cathode of the valve. In this arrangement, as in that illustrated in Fig. 1, the higher frequency oscillations are effectively suppressed across the diagonal of the bridge from the cathode of the valve 1 to the junction of the elements 10 and 11; the lower frequency oscillations are accordingly taken off from this diagonal, and the higher frequency oscillations are taken off from the other diagonal in the manner described with reference to Fig. 1.

If in the modified arrangement R_1 is the equivalent resistance of the arm containing the valve, and $j\omega L$, R_2 and

$$\frac{1}{j\omega C}$$

are the values of the impedances in the other arms 10, 11 and 6 respectively, then the bridge will be balanced when

$$\frac{j\omega L}{j\omega C} = R_1 R_2$$

i. e., when

$$\frac{L}{C} = R_1 R_2$$

The balance of the bridge is thus substantially independent of frequency over the range of frequencies within which stray capacities and the like produce no disturbing effects.

If R_3 is the value of the shunt resistance across the inductive arm, and C_3 is the value of the effective capacity across the valve arm, then the value of R_3 is given by the expression

$$R_3 = \frac{j\omega L}{R_1 j\omega C_3} \quad 10$$

i. e.,

$$R_3 = \frac{L}{R_1 C_3}$$

In one form of transmission system to which the invention is applicable, the synchronizing impulses comprise trains of oscillations of a radio frequency, which are transmitted on the same carrier oscillation as the picture signal impulses. The synchronizing impulses then appear as modulations of the radio frequency oscillation, which is employed as a sub-carrier. The synchronizing impulses themselves may then be obtained after two demodulation processes; and, if desired, the valve which forms one arm of the Wheatstone bridges above described may serve as the second demodulating detector of the synchronizing impulse channel.

The two sets of synchronizing impulses derived from the diagonals of the separating bridge may be of a form suitable for controlling the picture-reconstituting apparatus directly, or after suitable amplification. In a preferred system, however, in which a cathode ray tube is employed to reconstitute the received picture, the received synchronizing impulses are converted in any known or suitable manner into oscillations of saw-tooth wave form, which in turn are employed for synchronization purposes.

Fig. 3 shows a form of Wheatstone bridge suitable for use in the preferred system referred to; the arrangement is similar to that shown in Fig. 1, but with the omission of the coupling condenser 3; furthermore, the impulses set up across the horizontal diagonal are applied to the primary winding 13 of an iron cored transformer 14 having two secondary windings 15, 16. As in the preceding arrangements, the high frequency impulses are substantially suppressed across the vertical diagonal, and are derived from the horizontal diagonal.

One end of the winding 15 is earthed, and the other is connected through a condenser 17 to the control grid of a screened grid valve 18; the control grid of this valve is connected to the cathode thereof through a grid leak 19, and the cathode is also earthed. The anode of the valve 18 is connected through an anode resistance 20 and a decoupling resistance 22 in series to the positive terminal of the anode current source, and through a condenser 21 to earth. The junction point of the resistances 20 and 22 is also earthed through a decoupling condenser 23. The arrangement is such that the condenser 21 is slowly charged through the resistance 20, and rapidly discharged through the valve 18, and the resultant saw tooth oscillation set up across the condenser 21 serves, after amplification if desired, to assist in controlling the deflection of the cathode ray beam of a cathode ray tube.

The discharge of the condenser 21 through the valve 18 is periodic, and is controlled by the synchronizing impulses in the following manner. It will be assumed firstly that the condenser 17 carries such a charge that the control grid of

the valve 18 is biased negatively to a point more negative than that corresponding to zero anode current, the anode-cathode path of the valve 18 being consequently insulating. The condenser 21 charges up in a substantially linear manner through the resistance 20, and the charge upon the control grid of the valve 18 is gradually dissipated through the leak 19, the latter being given such a value that a higher frequency synchronizing impulse arrives and a potential difference is established across the primary winding 13 of the transformer 14 before the potential of the control grid of the valve 18 has fallen sufficiently to enable the valve to become conducting.

Upon the arrival of the synchronizing impulse, a pulse of electromotive force is set up across the winding 15 of the transformer. The winding 15 is so connected that this pulse drives the potential of the control grid of the valve 18 in the positive direction, and causes the valve to become conductive. The windings 15 and 16 of the transformer 14 are so coupled that the consequent change of current in the screening grid circuit causes the control grid to become still less negative, and the flow of anode current is further increased, the action being cumulative. The condenser 21 is thus very rapidly discharged through the valve 18.

The control grid of the valve eventually reaches a potential at which grid current commences to flow and, by virtue of the grid leak 19, the control grid becomes negatively charged. The change thus produced in the current in the screening grid again has an effect in the control grid circuit, and the control grid potential rapidly becomes more negative than the anode-current cut-off point. The condenser 21 commences to charge up again, and the cycle is repeated for each synchronizing impulse.

It will be appreciated that not only do the arrangements described above serve the function of separating two sets of synchronizing impulses from one another, but since in each case the Wheatstone bridge is substantially balanced over a range of frequencies, they serve also to prevent coupling between the circuits associated with the diagonals of the bridge over that frequency range. The importance of this feature has been pointed out above.

The invention is also readily applicable to the mixing of two sets of synchronizing impulses of different frequency, and may be employed at the transmitter for mixing the two sets of impulses before their application to the modulator. In such a case, the apparatus described above may be used inversely.

Although the invention has been described with relation to a system in which the two sets of synchronizing impulses are the "line" and "framing" impulses, it will be apparent to those skilled in the art that the invention is not so restricted, but may be employed in any system in which two sets of synchronizing impulses of different frequency are required.

We claim:

1. In a system for separating electrical impulses, means for receiving signals having high and low frequency impulses, a thermionic tube so connected to rectify the received impulses, said thermionic tube being arranged to form one leg of a Wheatstone bridge, a resistance element connected to form an adjacent leg of said Wheatstone bridge, a plurality of capacity elements connected to form the two legs of the Wheat-

stone bridge between the resistance element and the thermionic device, a transformer connected across the diagonal of said Wheatstone bridge between the connection of said thermionic device and said resistance element and the point intermediate said two capacity elements, a second thermionic device connected with the secondary of said transformer, a capacity element connected with the output of said thermionic device, means for charging said capacity element and supplying anode voltage to each of said thermionic devices, and a circuit connected across the diagonal of said Wheatstone bridge between the point of connection of said resistor element and one of said capacities and the point of connection of the other of said capacities and said first named thermionic device, whereby high frequency impulses are separated from low frequency impulses in said circuit across the last named diagonal of said bridge and whereby signals of high frequency are applied to the control circuit of said second thermionic device to discharge at periods when said high frequency signals are received the storage charge in said capacity element.

2. In a system for separating electrical impulses, means for receiving signals having high and low frequency impulses, a thermionic tube connected as a detector to rectify the received impulses, said thermionic tube having its output circuit to form one leg of a Wheatstone bridge, a resistance element connected to form an adjacent leg of said Wheatstone bridge, a plurality of impedance elements connected to form the two legs of the Wheatstone bridge between the resistance element and the thermionic device, a transformer connected across the diagonal of said Wheatstone bridge between the connection of said thermionic device and said resistance element and the point intermediate said two impedance elements whereby said high frequency signals are transferred to said transformer, a second thermionic device connected with the secondary of said transformer and arranged to draw current at time intervals when signals are impressed upon the transformer, a capacity element connected with the output of said thermionic device, a work circuit connected across the capacity element, means for charging said capacity element along a linear path and supplying anode voltage to each of said thermionic devices so that the stored charge may be released when said second named tube is conducting, and a circuit connected across the diagonal of said Wheatstone bridge between the point of connection of said resistor element and one of said impedance elements and the point of connection of the other of said impedance elements and said first named thermionic device so that high frequency impulses are separated from low frequency impulses in said circuit.

3. In a system for separating electrical impulses, means for receiving signals having both high and low frequency impulses, a thermionic device connected with the receiver circuit arranged to form one leg of a bridge circuit for separating high and low impulses, a plurality of capacity elements forming two additional legs of said bridge member, and a resistance element forming the fourth leg of said bridge, a circuit connected across the diagonal between said two capacity elements so that signals representing only low frequency signals appear therein, a second circuit connected across the diagonal between one of said capacity elements and said thermionic

device, and means connected in the second circuit for limiting the signals therein to the high frequency signals.

5 4. The combination of a thermionic amplifier and electrical network to form a Wheatstone bridge, means to supply said amplifier with electrical impulses having high and low frequency components, means for deriving energy repre-

sentative only of the high frequency impulses from said network, means for deriving energy representative only of the low frequency impulses from the said same network and terminal connections to the network for supplying the 5 derived energies to separate load circuits.

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