

April 20, 1937.

I. G. MALOFF

2,077,574

TELEVISION RECEIVER

Filed April 21, 1934

2 Sheets-Sheet 1

Fig. 1.

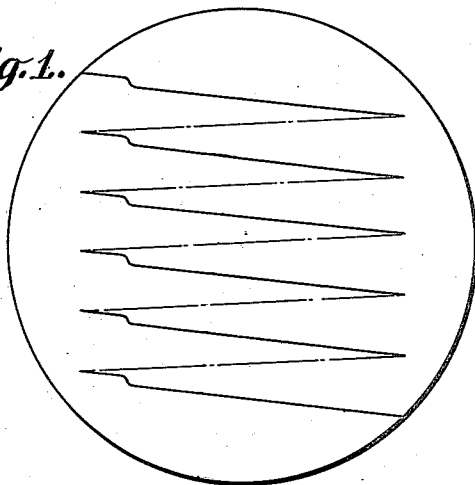
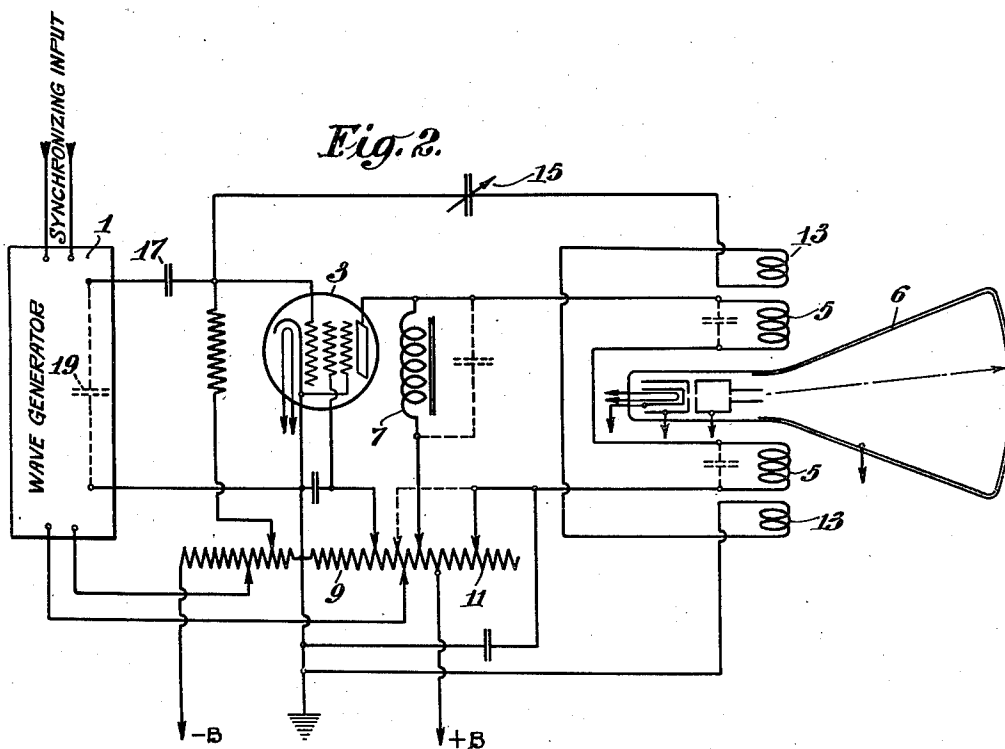


Fig. 2.



INVENTOR:
Ioury G. Maloff
BY *JR Goldborough*
ATTORNEY.

April 20, 1937.

I. G. MALOFF

2,077,574

TELEVISION RECEIVER

Filed April 21, 1934

2 Sheets-Sheet 2

Fig. 3.

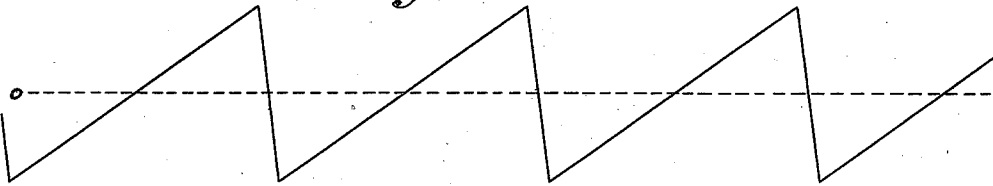


Fig. 4.

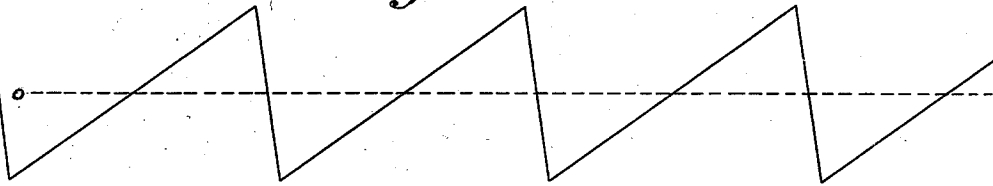


Fig. 5.

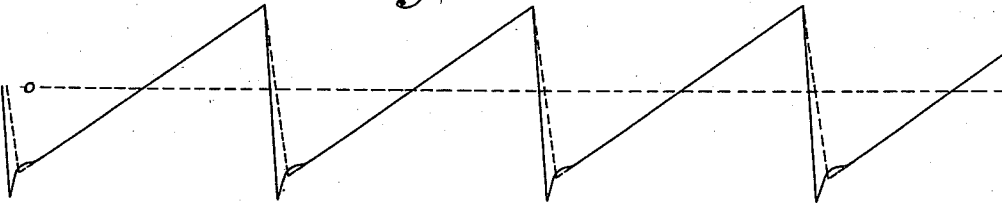
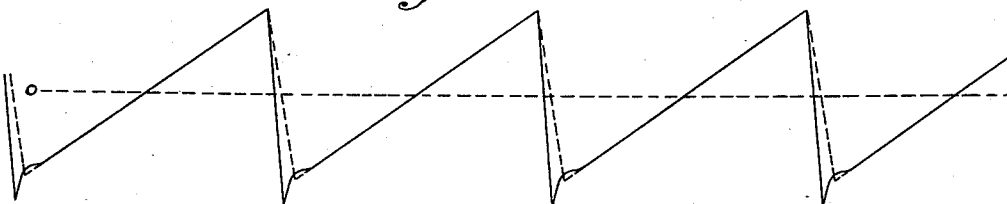


Fig. 6.



INVENTOR:
Ioury G. Maloff
BY *DR Goldborough*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,077,574

TELEVISION RECEIVER

Ioury G. Maloff, Philadelphia, Pa., assignor to
Radio Corporation of America, a corporation of
Delaware

Application April 21, 1934, Serial No. 721,680

4 Claims. (Cl. 178—6)

My invention relates to television receivers and more particularly to methods of and means for improving the scanning operation in television receiving tubes of the cathode ray type.

When a cathode ray tube is utilized for the purpose of translating incoming radio signals into a visible reproduction of the view at a television transmitter, it is desirable that the ray shall be caused to repeatedly travel across the fluorescent screen, horizontally, in one direction at a predetermined constant velocity and shall be caused to repeatedly return to the starting edge of the screen with relatively higher velocity. To this end, it has been proposed to provide a plurality of ray-deflection coils, symmetrically disposed about the longitudinal axis of the tube, through which coils an alternating current wave of the so-called saw-tooth type is forced. Such current, theoretically, would give rise to an alternating magnetic flux, transversely of the electron stream, which would build up relatively slowly, at a constant rate, during the scanning-line period and would rapidly die out, or reverse, at the end of each line to cause the ray to return to the starting edge.

To one not skilled in the art it might seem a simple matter to force a saw-tooth current wave through the deflecting coils by including them in the output circuit of a thermionic tube of the power-amplifier type, to the input terminals of which are applied current impulses having the proper saw-tooth wave shape.

In actual practice, however, the scanning pattern on the fluorescent screen of the tube, when the ray is subjected to both horizontal and vertical deflecting fields, is not of the perfect saw-tooth type expected, but is distorted at the starting edge of the screen. If it is assumed, as is usually the case in the receiver, that the starting edge is at the left when the screen is viewed from the exterior of the tube, the horizontal velocity of the ray increases toward the left near the end of each return line and it starts back to the right with a high velocity which decreases to normal shortly after it leaves the starting edge. Unless a compensating factor is introduced, therefore, the starting edge has substantially the same appearance it would have if the beam, by reason of inertia, actually "overshoots", at the end of the return line.

Obviously, since the cathode ray is devoid of inertia, the distortion must be attributed to non-linear variation in the magnetic field caused by departure of the current in the deflection coils from the predicted saw-tooth wave shape.

According to my investigations, there are a number of factors that might cause the deflecting current to be distorted. Among these may be mentioned the inductance and distributed capacity of the coils and hysteresis losses in their cores.

There is a still further phenomenon, apparently occurring in the amplifier tube itself, which actually causes distortion of the grid potential thereof and which seems to be the principal reason for the existence of the output current distortion under discussion. The nature of the phenomenon is somewhat obscure. It does not seem to be regeneration, as usually understood, since the amplifier tube utilized is of the screen-grid pentode type wherein the screen and suppressor grids presumably prevent feed-back through inter-electrode capacity from the anode to the control-grid. At any rate, the negative peaks of the input saw-tooth potential wave are accentuated considerably while the positive peaks are relatively unaffected. Such accentuation, according to my present tentative theory, may be attributed to an electro-mechanical shock imparted to the tube electrodes as a result of the appearance on the anode of a potential impulse having a steep wave front and high amplitude.

In view of the foregoing, it is the principal object of my invention to provide an improved ray deflecting system for a television receiving tube of the cathode ray type.

Another object of my invention is to provide a system of the type described whereby a current wave, having a true saw-tooth shape, may be forced through ray-deflecting coils associated with the cathode ray tube, or through coils of any other type such, for example, as those associated with an oscilloscope or with a cathode ray transmitting tube.

A still further and more specific object of my invention is to provide means for compensating the hereinbefore described shock-phenomenon that occurs in a thermionic amplifier tube when the potential of the anode with respect to the other electrodes thereof is caused to abruptly change.

The foregoing objects and other objects ancillary thereto I prefer to accomplish by feeding energy from the deflecting coils associated with a cathode ray tube to the input circuit of the thermionic amplifier tube which supplies energy to the said deflecting coils. More especially, I prefer to feed such energy to the said input circuit over a frequency-discriminating network

including a capacitor and I so adjust phase and amplitude of the fed-back energy that the effect of electro-mechanical shock on the electrodes of the amplifier tube is compensated.

5 The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment, when read in connection with the accompanying drawings, in which:

10 Fig. 1 is a conventionalized view of the fluorescent screen in a cathode ray tube, exemplifying distortion of the scanning-pattern,

Fig. 2 is a simplified diagrammatic view of a portion of a television receiver, of the cathode ray tube type, including a preferred embodiment of my invention,

20 Figs. 3, 4, 5 and 6 are potential and current graphs to which reference will be made in explaining my invention.

In Fig. 1 of the drawings an attempt has been made to illustrate the scanning pattern as it appears on the fluorescent screen in the absence of an incoming signal representative of a view at the transmitter. Only a few of the scanning and return lines are shown and it is to be understood that the vertical spacing between successive lines is greatly exaggerated to more clearly exemplify distortion of the type which my invention obviates. Such distortion appears as a "jog" in each scanning line shortly after it leaves the left hand edge of the scanned area. This irregularity indicates that the ray starts with higher than normal velocity, slows down considerably and then resumes normal velocity over the remainder of its travel toward the opposite edge of the scanned area.

As hereinbefore explained, the distortion in the deflecting coil current has been traced back to a rather obscure phenomenon in the amplifier tube which supplies it, through the influence of which the grid of the tube swings negatively in excess of the negative peaks of its input excitation. The manner in which I compensate the grid potential distortion will be clear from an inspection of Fig. 2.

50 A television system, of the type to which my invention may be applied, includes a wave generator 1 for supplying an alternating potential, at the horizontal deflection frequency and having a saw-tooth wave form, to the input terminals of a power-amplifier tube 3 of the screen-grid pentode type. A plurality of ray-deflection coils 5, associated with a cathode ray receiving tube 6, and a choke-coil 7 offering very high impedance to saw-tooth current at the horizontal deflection frequency, are included in parallel in the output circuit of the tube 3.

A single unidirectional source, exemplified in the drawing by a bleeder resistor 9, provides high anode potential and a negative grid biasing potential of approximately 13 volts to the amplifier tube. The same source may be utilized to supply potential to the thermionic tubes (not shown) in the wave generator.

To ensure that the cathode ray, when not under the influence of the deflecting field, shall be centered on the fluorescent screen directly, direct current may be caused to flow in the deflecting coils from the bleeder resistor, the direction and amplitude of the current being determined by connecting the low potential terminal of the coils

through a variable resistor 11 to the positive terminal of the bleeder resistor or by variably connecting it to the bleeder resistor itself as indicated in dotted lines.

To simplify the drawing, the vertical deflection coils have not been shown. Both sets of coils, usually, are mounted upon a single laminated iron yoke (not shown).

In the operation of the system thus far described, if a fluctuating potential wave, having a saw-tooth form such as is exemplified by Fig. 3 in the drawings, is impressed across the input terminals of the amplifier tube from the wave generator, the alternating component of the output potential should cause a current flow in the deflection coils which could be represented by Fig. 4. This is not the case, however, the actual wave form being analogous to that exemplified by Fig. 6 and the actual grid excitation giving rise to it having a wave form similar to that illustrated by Fig. 5.

The transient impulse causing the distortion, obviously, is derived in some manner from the output circuit although it is difficult to see how it can be transmitted to the grid of the amplified tube through inter-electrode capacity. The electro-mechanical shock theory at least offers a working hypothesis and, according to my invention, the provision of means for introducing an equal shock, opposite in phase to the shock causing the disturbance, into the grid circuit of the amplifier tube has effectively solved the problem.

Specifically, referring once more to Fig. 2 in the drawings, the means I prefer for introducing the corrective impulses into the grid circuit of the amplifier tube is constituted by a plurality of coils 13, hereinafter designated correction impulse coils, inductively coupled to the horizontal ray-deflection coils. The ray-correction coils are serially connected in a circuit that may be traced from the cathode of the amplifier tube, through a variable condenser 15, a coupling condenser 17 between the tube and the wave generator, a condenser 19 in the wave generator itself and back to the cathode over the low potential output terminal of the generator. The details of the wave generator per se are not material to my present invention, it being sufficient to note that the condenser therein is effectively connected as described.

In a satisfactorily operating system the variable condenser 15 has a capacity of 30 mmfd., the coupling condenser 17 a capacity of .05 mfd., and the condenser 19 in the wave generator a capacity of the order of .002 mfd. These condensers constitute what might be styled a capacitor-potentiometer and, through proper manipulation of the variable condenser 15 the amplitude of the correction impulse, on the grid of the amplifier tube, may be adjusted to the proper value to compensate the distortion. The phasing of the correction impulse naturally depends upon the polarity of the wave correction coils with respect to the deflection coils. In the drawings, the connections to the correction coils are shown reversed to indicate that the correction impulse must be properly phased. No other electrical significance is attached to the reversal, since it is within the scope of my invention to similarly correct wave distortion of other types in wave utilization circuits differing widely from the circuit disclosed.

From a consideration of the foregoing it will be apparent that I have provided an improved method of and means for improving the scan-

ning pattern in a cathode ray when coils are utilized for ray deflecting purposes. My invention also has advantages when used in connection with oscilloscopes and the like and it is generally applicable to any system wherein it is desired to force a saw-tooth current through a circuit having inductance and distributed capacity.

Although I have disclosed a specific circuit to exemplify my invention, modifications thereof will be apparent to those skilled in the art. My invention, therefore, is not to be restricted except insofar as is necessitated by prior art and by the spirit of the appended claims.

I claim as my invention:

1. In a deflecting circuit for a cathode-ray tube having deflecting coils, a vacuum tube having a cathode, a grid and an anode, said vacuum tube having an input circuit, including said grid and said cathode and having an output circuit including said anode and said cathode, said coils being coupled to said output circuit, means for impressing a voltage upon said input circuit having the proper wave form to produce a flow of saw-tooth current through said coils whereby transient electrical impulses are unavoidably produced on said grid due to the reaction of said output circuit, and means for applying a voltage from said output circuit to said grid in such phase and of such amplitude as to compensate for said transient impulses.

2. In a deflecting circuit for a cathode-ray tube having deflecting coils, an electric discharge tube having a cathode, a control grid, a screen

grid and a plate, said electric discharge tube having an input circuit including said cathode and said control grid and having an output circuit including said cathode and said anode, said coils being coupled to said output circuit, means for impressing a fluctuating voltage upon said input circuit, said voltage having a wave form such that current having a saw-tooth wave form is caused to flow in said coils whereby said output circuit unavoidably reacts upon said input circuit, and means for applying the voltage appearing across said coils to one of said grids in such phase and of such magnitude as to compensate for said reaction.

3. The invention according to claim 2 characterized in that said last means comprises an inductance coil coupled to said deflecting coils and connected between said cathode and one of said grids.

4. In a deflecting circuit for a cathode-ray tube having deflecting coils, a vacuum tube having a grid electrode, said vacuum tube having an input circuit and an output circuit, said coils being coupled to said output circuit, means for impressing a voltage upon said input circuit having the proper wave form to produce a flow of saw-tooth current to said coils whereby transient electrical impulses are unavoidably produced in said input circuit due to the reaction of said output circuit, and means for applying a voltage from said output circuit to said grid electrode in such phase and of such amplitude as to compensate for said transient impulses.

IOURY G. MALOFF.