

March 26, 1940.

K. SCHLESINGER
TELEVISION APPARATUS

2,194,572

Filed March 18, 1937

2 Sheets-Sheet 1

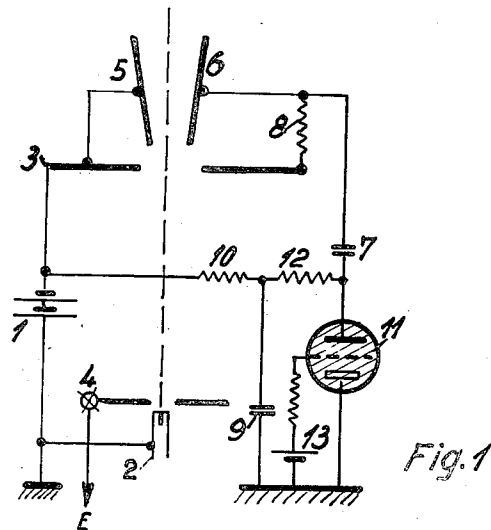


Fig. 1

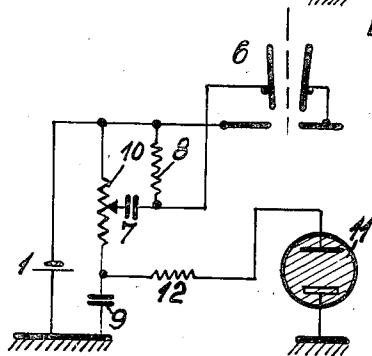


Fig. 2

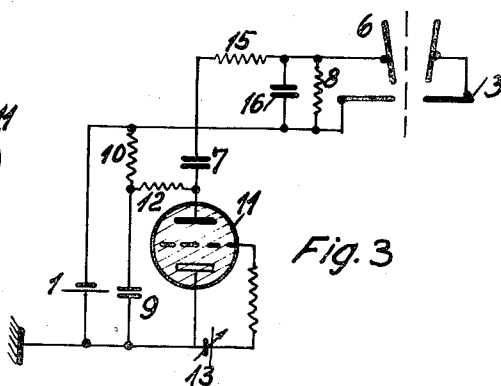


Fig. 3

Inventor :

Ante Gulerung.

March 26, 1940.

K. SCHLESINGER

2,194,572

TELEVISION APPARATUS

Filed March 18, 1937

2 Sheets-Sheet 2

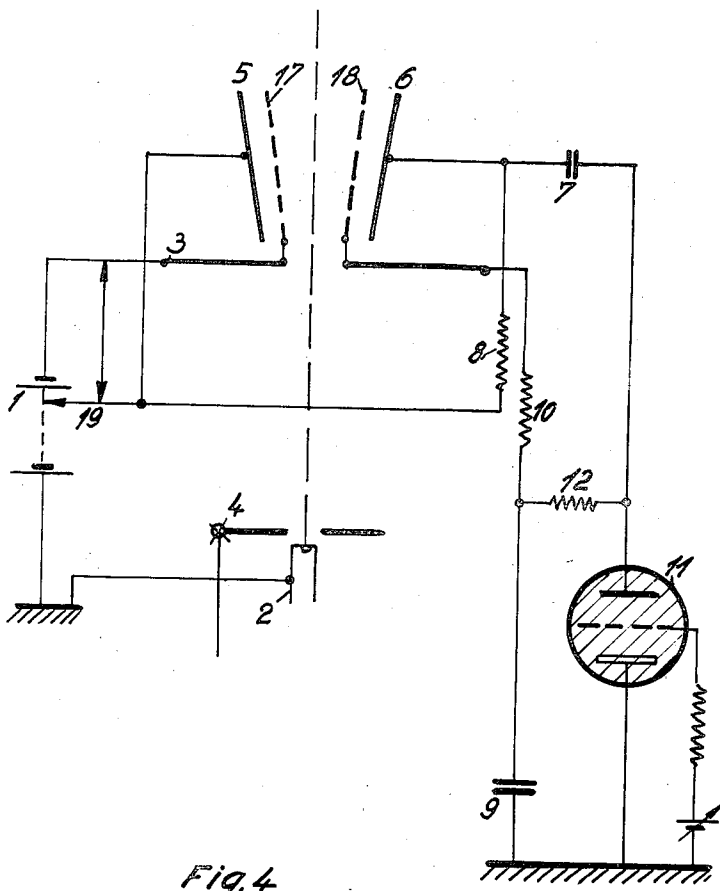


Fig. 4

Inventor:

Vester L. Manning.

UNITED STATES PATENT OFFICE

2,194,572

TELEVISION APPARATUS

Kurt Schlesinger, Berlin, Germany, assignor, by
mesne assignments, to Loewe Radio, Inc., a cor-
poration of New York

Application March 18, 1937, Serial No. 131,688
In Germany March 21, 1936

3 Claims. (Cl. 250—27)

The present invention relates to relaxation cir-
cuits for television arrangements and represents
an improvement for the known relaxation circuit
used for performing the deflection of the cathode
ray in Braun tubes.

It is known to perform the deflection of the
ray in cathode ray tubes by means of deflecting
plates, simply by the fact that the anode poten-
tial source of the tube charges a relaxation con-
denser by way of a charging resistance, and that
the relaxation oscillation of the charging con-
denser produced by any desired discharge tube—
for example a hot-cathode grid controlled glow
discharge tube or controlled high-vacuum tube—
is generated in immediate fashion so as to be of
the order of several hundred volts, i. e., in such
intensity that a special amplifier for coupling
between relaxation condenser and deflecting
plates is no longer required. The known ar-
rangements certainly operate only with earthed
anode of the cathode ray tube. In a circuit of
this nature the control electrode of the tube is
linked up negatively with high potential against
earth. This causes difficulties in the television
modulation. Using an earthed cathode there
arises the difficulty that for the purpose of with-
holding the anode potential a capacitive coup-
pling requires to be performed between the relaxa-
tion circuit and the deflecting plates.

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

Fig. 1 shows the relaxation circuit generally
used by means of which the foundations of the
present invention are explained.

Figs. 2, 3 and 4 show embodiments of the
invention.

Fig. 1 explains the principle of such a circuit.
The anode battery 1 of the cathode ray tube,
amounting to several thousand volts, is earthed
with its one pole, which is simultaneously con-
nected with cathode 2. The anode 3 is con-
nected with the high potential. 4 is the control
grid, which is connected with a receiver E. The
one deflecting plate 5 is connected with the anode.
The other deflecting plate 6 must be coupled by
way of a condenser 7 with the relaxation circuit,
and simultaneously it is connected with the anode
by way of a leak resistance 8. The relaxation
circuit consists of a charging condenser 9 and
charging resistance 10. For charging purposes
there is employed the anode potential 1. The
discharge may be performed in any known
manner. In Fig. 1 there is shown a hot cathode
grid controlled glow discharge tube 11. In this

circuit a resistance 12 is necessary in any case,
and the coupling with the plates preferably takes
place, not at the condenser 9, but at the hot
cathode grid controlled glow discharge tube 11.

When using such a circuit the following diffi-
culty occurs: The electronic current passing to
the deflecting plate 6 is already so considerable
in powerful high-vacuum tubes of to-day that
no more than approximately 0.3 megohm can be
used for the leak resistance 8. If on the other
hand the condenser 7 is made so large that the
relaxation curve for the slow image change is
transmitted without distortion, i. e., for example
0.5 mf., the circuit 7/8 represents a load on the
relaxation circuit amounting to 0.3 megohm.
This load is already large as compared with the
charging resistance 10, or the charging resist-
ance 10 would require to be made still smaller
than 0.3 megohm if the relaxation arrangement
is to operate in the idle condition. If, however,
the charging resistance 10 is chosen to approxi-
mately 0.1 megohm and the condenser 9, corre-
sponding to the time constant, several micro-
farads, a much too powerful output is brought
about in the relaxation circuit, and the hot
cathode grid controlled glow discharge tube 11
is very quickly overloaded upon the discharge of
the large condenser. This represents one solu-
tion of the problem being the foundation of an
invention. In this case a time constant is given
by the condition:

$$R_{10} \cdot C_9 \geq 3 \cdot \tau_K$$

and the alternating relaxation potential required
at the condenser, which potential may be ad-
justed at the grid bias 13 of the hot cathode grid
controlled glow discharge tube. According to the
invention, R_{10} itself is made smaller than R_8 .
Numerical example:

$$\begin{aligned} R_8 &= 0.3 \text{ megohm,} \\ R_{10} &= 0.1 \text{ megohm,} \\ \tau_K &= \frac{1}{25} \text{ sec.,} \\ C_9 &= 1 \text{ mf.,} \\ E_1 &= 3,000 \text{ volts,} \end{aligned}$$

the potential at condenser 9=approx. 600 volts.
The following output is brought about:

$$L = \frac{E_1^2}{R} = 100 \text{ watts}$$

It is to be recognised that this method in prac-
tice calls for dimensions which are incapable of
being performed.

According to the invention, the output in the
relaxation circuit is adjusted to be very much

smaller than in accordance with the above values. The circuit then no longer operates in idle condition, but appears to be very greatly loaded. The relaxation curve at the plate 6 is distorted accordingly. The distortion appears in the form of a flattening effect in the direction towards the ignition point. According to the invention, the coupling between relaxation condenser and deflecting plate is made to be dependent on the frequency viz., in such fashion that low frequencies are transmitted better than high frequencies. By this effect the said distortion underload is again eliminated.

Figs. 2 and 3 show two possible embodiments of such an improved coupling. In Fig. 2 the anode battery 1 charges the condenser 9 by way of resistance 10. The tube 11 discharges the condenser 9. The deflecting plate 6 is coupled with the tapping of the resistance 10 by way of the blocking condenser 7 which is proof against high tension, and with the anode by means of the leak resistance 8. The tapping at the resistance 10 is so adjusted that the part of this resistance, which is connected to the plate 6, is greater than the reactance of the condenser 9 in respect of the lowest relaxation frequency, i. e., the number of relaxations per second. By fine variation of the resistance 10 an adjustment is to be found at which an undistorted relaxation curve appears on the screen. Numerical example:

Relaxation frequency
 $9=0.02$ mf.,
 $=25$ periods,
 $10=3 \cdot 10^6$ ohms,
 $7=0.5$ mf.,
 $8=0.3 \cdot 10^6$ ohms

A disadvantage of the method according to Fig. 2 is a loss of size caused by the potential distribution 10/8. This disadvantage is exhibited to smaller extent by the corrected coupling according to Fig. 3.

In Fig. 3 the relaxation condenser 9 is charged in the usual manner by way of the charging resistance 10 and discharged by way of the hot cathode grid controlled glow discharge tube 11 and resistance 12. Coupling is also effected in usual manner by way of a blocking condenser 7 in direct fashion with the anode of the glow discharge tube 11. The coupling, however, in accordance with the invention is performed via a high-frequency filter 15/16 before it is connected with the deflecting plate 6. By means of the filter 15/16 there is evidently caused, exactly in the same manner shown in Fig. 2, a weakening of the higher relaxation harmonics and there occurs a correction of the distortions arising from the load. The amplitude efficiency is somewhat better than in Fig. 2, as the load is reduced by the filtering series resistance 15. Dimensions:

$15=0.2 \cdot 10^6$ ohms,
 $16=\text{approximately } 0.2$ mf.,
 $8=0.3 \cdot 10^6$ ohms,

otherwise as in Fig. 2.

According to the invention, there is a third and wholly different method of obtaining proper functioning of a circuit diagram according to Fig. 1. This method consists in cutting down the deflection output of the cathode ray tube itself. For this purpose there are required special measures in accordance with the invention. A complete absence of current in the deflecting plates only occurs if it is possible to maintain the plate 6 continuously negative in relation to the ray.

The idea might be conceived of negatively biasing the two plates 5 and 6 in common in relation to the anode 3. This, however, would lead to bad sharpness of the image points and decrease in the output of the ray by braking action. According to the invention, the two plates 5 and 6, in accordance with Fig. 4, are disposed behind a screening means 17/18 of special form. This screening means is directly connected with the anode 3 or is weakly positively biased in relation thereto. It consists of very thin wires, which are disposed in the longitudinal direction, i. e., parallel to the ray. There may also be employed wire nets. The reciprocal of the plates 5 and 6 through these wires should be made as large as possible. The plates 5 and 6 are now linked up directly or by way of the leak resistance 8 with a bias which is negative in relation to the anode potential. This bias may be derived at a tapping 19 of the anode battery 1. The bias 19, negative in relation to the anode, is made to be equal to or greater than the highest positive oscillation peak of the deflecting potential at 6. Subject to absence of current the leak resistance 8 may be made of the order of 10 to 20 megohms. The slowest relaxation frequency may then be transmitted with a correspondingly small condenser 7 of approximately 1,000 cm., and the relaxation apparatus may be allowed to operate with very small output, the charging resistance 10 having several megohms, the charging condenser 9 being comparatively small (0.02 mf.) and the charging output being equal to $\frac{1}{2} C_0 E_0^2$, i. e., proportional to C, so that it accordingly remains small.

I claim:

1. In a television apparatus comprising a cathode ray tube, having a cathode, an anode and at least one pair of deflecting plates, a relaxation oscillator for generating a linear saw tooth voltage deflecting the cathode ray in said cathode ray tube, and a source of high direct voltage, said anode of the cathode ray tube being connected to said high voltage source, at least one of said deflecting plates being for a time more positive than the cathode ray effecting a current in the deflecting circuit, and means to prevent distortions of the deflecting curve of said cathode ray caused by said current in the deflecting circuit loading said relaxation generator.

2. In a television apparatus comprising a cathode ray tube, having a cathode, an anode and at least one pair of deflecting plates, a relaxation oscillator for generating a linear saw tooth voltage deflecting the cathode ray in said cathode ray tube, and a source of high direct voltage, said anode of the cathode ray tube being connected to said high voltage source, the positive terminal of which being connected directly to the anode of said cathode ray tube, to one of said deflecting plates and to the input of said relaxation oscillator, the other deflecting plate being connected via a leak resistance to the anode of said cathode ray tube and via a condenser to the output of said relaxation generator, at least one of said deflecting plates being for a time more positive than the cathode ray effecting a current in the deflecting circuit, and means to prevent distortions of the deflecting curve of said cathode ray caused by said current in the deflecting circuit loading said relaxation generator.

3. In a television apparatus comprising a cathode ray tube, having a cathode, an anode and at least one pair of deflecting plates, a relaxation oscillator for generating a linear saw

tooth voltage deflecting the cathode ray in said cathode ray tube, and a source of high direct voltage, said anode of the cathode ray tube being connected to said high voltage source, at least one
5 of said deflecting plates being for a time more positive than the cathode ray effecting a current in the deflecting circuit, and coupling means be-

tween said relaxation oscillator and said deflecting circuit favouring the lower frequencies in order to prevent distortions of the deflecting curve of said cathode ray caused by said current in the deflecting circuit loading said relaxation
5 generator.

KURT SCHLESINGER.