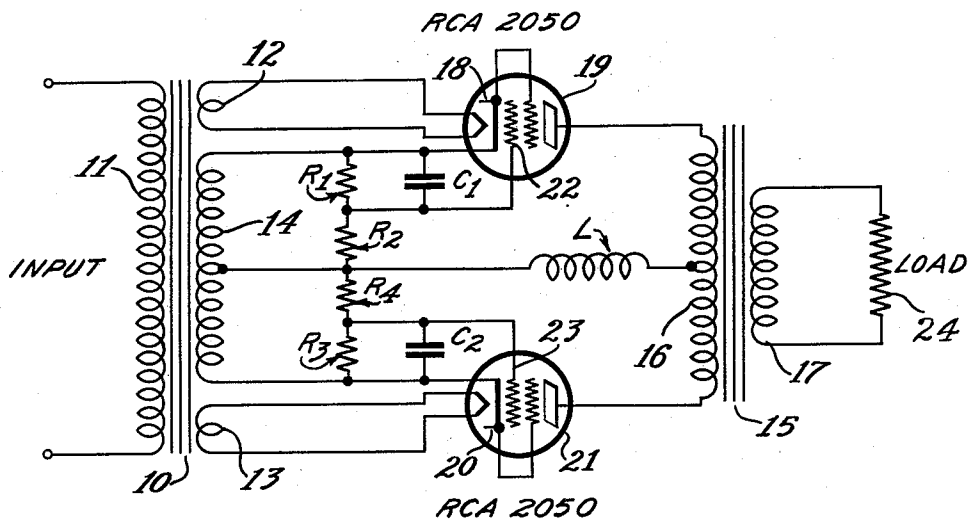


Jan. 2, 1951

R. L. HAYNES
SQUARE WAVE GENERATOR
Filed April 19, 1946

2,536,641



INVENTOR.
Robert L. Haynes
BY *CD Huska*
ATTORNEY

UNITED STATES PATENT OFFICE

2,536,641

SQUARE WAVE GENERATOR

Robert L. Haynes, Indianapolis, Ind., assignor to
Radio Corporation of America, a corporation of
Delaware

Application April 19, 1946, Serial No. 663,419

2 Claims. (Cl. 250—27)

1

This invention relates to square wave generators of the type which are energized from an ordinary commercial alternating potential source and function to produce an output current having a square wave shape. Such a generator is useful for various purposes. In the form herein disclosed, it has special application to cases where a current of substantially constant value is required.

Thus in the reproduction of sound from photographic film records, for example, it is essential that the heating current of the excitor lamp does not vary in brightness at any frequency within the audible range. For this reason, it has been customary to heat such a lamp by direct current or by alternating current having a frequency outside the audible range. This frequently involves special types of apparatus such as motor generators or the like and is subject to various other types of inconvenience.

In accordance with the present invention, these various difficulties are largely avoided by the provision of an improved generator which functions to produce an alternating potential which is substantially square so that it changes almost instantly from its plus to its minus value and maintains constant and equal values throughout its positive and negative half cycles. To this end, a pair of push-pull electron discharge devices of the gaseous conduction type (RCA 2050) have an inductance of relatively large value connected in their common lead and have their grid potentials so controlled as to time very accurately the beginning of each half cycle of the output voltage. Under these conditions, the ripple in the output voltage is decreased to a point where it is not objectionable.

The principal object of the invention is to provide an improved generator and method of operation whereby the value of a square wave potential is maintained constant and equal during its positive and negative half cycles. Additional objects are the provision of an improved circuit for controlling the grid potentials of a pair of push-pull connected gaseous conduction devices, and the provision of improved means for stabilizing the operation of push-pull circuits.

The invention will be better understood from the following description considered in connection with the accompanying drawings and its scope is indicated by the appended claims.

The single figure of the drawing is a wiring diagram of the improved square wave generating circuit.

This circuit includes an input transformer 10

2

which has a primary winding 11 and a plurality of secondary windings 12, 13 and 14. It also includes an output transformer 15 having a primary winding 16 and a secondary winding 17 from which current is supplied to a load device shown as a resistor 24. Current is supplied from the secondary winding 12 for heating the cathode 18 of a gaseous conduction electron discharge device 19 and from the secondary winding 13 for heating the cathode 20 of a similar device 21.

Connected across one half the secondary winding 14 are a resistor R_1 of 10,000 ohms and a resistor R_2 of 100,000 ohms. Similarly connected across the other half of the secondary winding 14 are a resistor R_3 of 100,000 ohms and a resistor R_4 of 10,000 ohms. Capacitors C_1 and C_2 are connected in shunt to the resistors R_1 and R_3 respectively. With these connections, the time required for the control grid 22 to become sufficiently positive to unblock the device 19 is determined by the voltage drop of the resistor R_1 and the charging rate of the capacitor C_1 which may have a capacity of 0.1 microfarad. The potential of the control grid 23 of the device 21 is similarly controlled by the voltage drop of the resistor R_3 and the capacitor C_2 which may have a capacity of 0.1 microfarad.

Connected between the midpoint terminals of the secondary winding 14 and the primary winding 16 is an inductor L . If this inductor could be made infinitely large, it would resist changes in the output currents of the devices 19 and 21 to such an extent that the current flowing through it would be constant and would be flowing half the time through the device 19 and half the time through the device 21. Thus the requirements for constant output voltage are (1) that the value of the inductor L be large, (2) that the devices 19 and 21 conduct alternatively and never at the same time, and (3) that the transformer 15 be an ideal transformer.

It has been determined that with a value of 17 henrys for the inductor L there is a reduction of about 10 decibels in the ripple component of the light output of a 10 volt, 5 ampere excitor lamp, and that increasing the value of this inductance to a value of 80 henrys reduces the ripple in such light output by about 20 decibels. This shows a decided improvement in the constancy of the output voltage.

The problem of so timing the starting of current through the devices 19 and 21 so that they each conduct current only during successive half cycles which are separate and distinct from one

3

another is solved by the R_1C_1 and R_3C_2 networks which allow the grids 22 and 23 to become sufficiently positive to unblock the devices 19 and 21 only at a predetermined point in the half cycles of the alternating potential applied to the primary winding 11.

It has been found that transformers of the ordinary radio "power" type are capable of performing satisfactorily in the circuit herein disclosed.

What the invention provides is a circuit which is energized from a conventional alternating potential source and functions to deliver an alternating potential having a substantially constant value and a square wave shape.

I claim as my invention:

1. The combination of a pair of gaseous conduction devices each having grid and anode circuits, an output means connected between the anodes of said devices and provided with a terminal intermediate its ends, four resistor sections connected between the cathodes of said devices, an inductor connecting said intermediate terminal to said cathodes through different pairs of said resistor sections, and a pair of resistance-capacity networks each including a different one of said resistor sections and each connected in a different one of said grid circuits.

2. A square wave generator including a transformer winding having end terminals and a mid-point terminal, first and second gaseous conduction devices each having an anode, a cathode and a control grid and each having its cathode connected to a different one of said end terminals,

4

an anode circuit for each said device, an inductor connected to said mid-point terminal and common to the anode circuits of said devices, and a pair of resistance-capacity networks each having its input connected between said mid-point terminal and a different one of said end terminals and each having its output connected to a different one of said control grids, the values of the constants of said networks being such as to time the starting of current through said devices at predetermined points in the half cycles of the alternating current potential of said winding.

ROBERT L. HAYNES.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,003,992	Cockrell	June 4, 1935
2,021,888	Dawson	Nov. 26, 1935
2,080,250	Bedford	May 11, 1937
2,097,297	Meir	Oct. 26, 1937
2,148,053	Balmford	Feb. 21, 1939
2,154,284	Rose	Apr. 11, 1939
2,210,690	Slepian	Aug. 6, 1940
2,231,499	Gulliksen	Feb. 11, 1941
2,239,289	Goodhue	Apr. 22, 1941
2,308,752	Hadfield	Jan. 19, 1943
2,309,525	Mohr	Jan. 26, 1943
2,430,310	Stratton	Nov. 4, 1947