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1,947,484

MEANS FOR CHANGING THE WAVE FORM OF ALTERNATING CURRENTS

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Fig. 1.

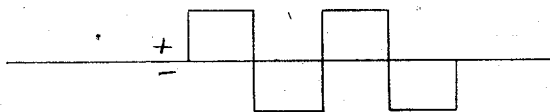


Fig. 2.

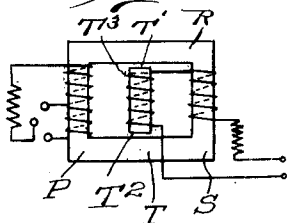
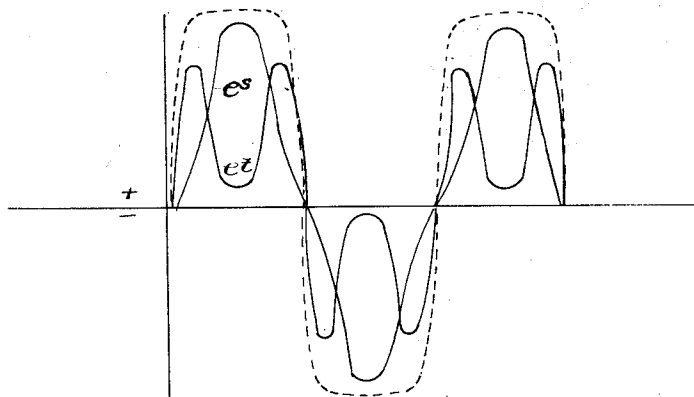


Fig. 3.



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MEANS FOR CHANGING THE WAVE FORM
OF ALTERNATING CURRENTS

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3 Claims. (Cl. 171—119)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

5 This invention relates to an improved method of employing alternating current and has for its object the heating of filaments of vacuum tubes and the minimizing of the objectionable distortion resulting from such use.

10 An object of this invention therefore is to minimize the variations in filament temperature by minimizing the length of time of small current during change of direction; that is, to make the change of current from maximum plus value to
15 maximum minus value very quickly so as to render the average current as nearly as possible equal to the maximum value of current.

To this end I propose to change the connections and relative sizes of the transformer windings and
20 cores to produce a more nearly square or flat-topped wave form of current used to light the filaments of vacuum tubes.

With the foregoing and other objects in view, the invention consists in the matter hereinafter
25 set forth in the following description and illustrated in the accompanying drawing, in which:

Fig. 1 is a hypothetical showing of a rectangular wave form.

Fig. 2 is a diagrammatical showing of a ring
30 transformer with a separate spaced iron core.

Fig. 3 is a diagrammatical showing of an oscillogram showing the wave forms of the resulting
35 electromotive forces. The dotted line represents the total electromotive force of the secondary and tertiary windings in series aiding.

Referring more particularly to the drawing, one method of obtaining a wave closely approximating the desired rectangular wave form, as shown in Fig. 1, is by the use of a ring transformer R (with
40 primary and secondary windings P and S, respectively, as shown in Fig. 2) in which is placed a third coil on a separate iron core, T, which is separated at its ends from the ring core by a small air gap, T—1 and T—2. This third winding, T—3,
45 is connected in series aiding with the secondary winding S. The ring transformer is operated in such a way that the flux in the core is well above magnetic saturation, and the reluctance of the all-iron path through the secondary will become
50 so great during a portion of the cycle, that a major portion of the flux will pass through the tertiary path, the reluctance of which is lower at high flux periods by reason of the presence of the unsaturated air gaps. Thus, at low flux periods the
55 major portion of the flux follows the all-iron path.

By properly proportioning the turns in each winding, the rates of change of flux in each core, and hence the induced voltages in secondary and tertiary, will vary non-uniformly, as shown in Fig. 3, because the reluctance of the magnetic paths through T—2 and T—3 varies unequally as the
60 flux through P changes.

Fig. 3 shows the electromotive forces which result when the transformer is so operated, and the resultant when these forces are placed in series
65 aiding. Each ordinate of the dotted curve is the sum of the ordinates of the other two curves at the same instant. To make this curve approach the desired rectangular wave form, the number of turns in each winding must be properly adjusted.
70 The correct adjustment depends upon the size of, and material constituting, the cores; the space between the third core and ring core; and upon other things.

This arrangement incorporated in the step-down transformer would necessitate only the third
75 core and winding in addition to the usual equipment.

The basis of the invention is the idea of applying to the filament or heating element of a vacuum
80 tube an alternating current the wave form of which is altered to approach the rectangular form. A method of obtaining this form of wave has been hereinbefore set forth.

I claim:

1. Means for changing the wave form of alternating currents, comprising in combination with
85 a source of alternating current, a transformer assembly having a main core provided with primary and secondary windings; and a tertiary wound core spaced from and encompassed by
90 said main core and having its windings series connected with the windings of said secondary whereby the voltages in the secondary and tertiary will vary non-uniformly to produce a substantially
95 rectangular wave form.

2. Means for changing the wave form of alternating currents, comprising in combination with
100 a source of alternating current, a transformer assembly having a ring core provided with primary and secondary windings; and a tertiary wound core spaced from and encompassed by
105 said ring core whereby the magnetic reluctance of said tertiary is lower at high flux periods, said tertiary having its windings connected in series with said secondary to produce an aiding effect
and whereby the voltages in the secondary and tertiary will vary non-uniformly to produce a
110 substantially rectangular wave form.

3. In a device employing alternating current

adapted for heating vacuum tube filaments, the combination in a transformer assembly, which includes a two core component having primary and secondary windings, of a tertiary wound core having its windings in series and having an aiding action with the windings of said secondary, the core of said tertiary being spaced relative to said component to form unsaturated air gaps, whereby the magnetic reluctance of said tertiary is lower at higher flux periods, and whereby the induced voltages in the secondary and tertiary will vary non-uniformly to produce a substantially rectangular wave form.

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