Aug. 26, 1930. E. W. KELLOGG 1,774,382

VARIABLE LIGHT PRODUCING APPARATUS

Filed March 25, 1927

Fig. 1.

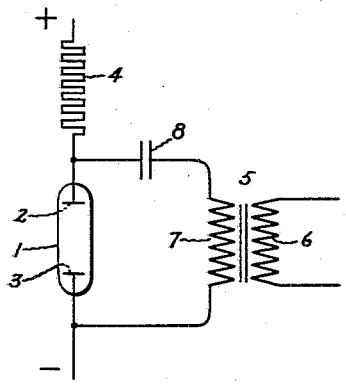


Fig. 2.

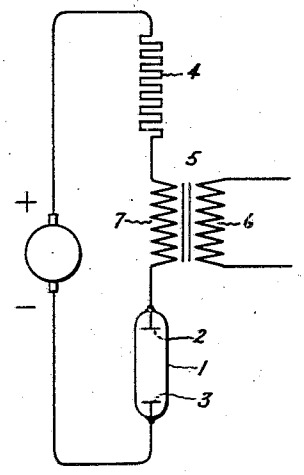
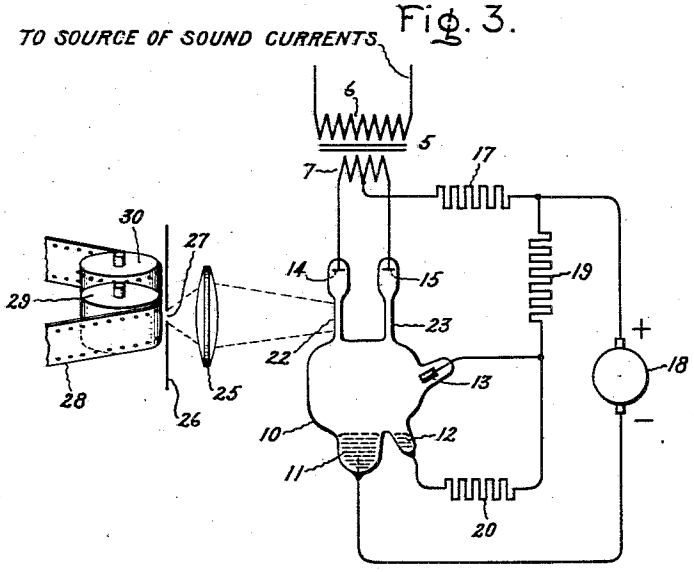


Fig. 3.



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UNITED STATES PATENT OFFICE

EDWARD W. KELLOGG, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

VARIABLE-LIGHT-PRODUCING APPARATUS

Application filed March 25, 1927. Serial No. 178,478.

My invention relates to apparatus for producing light variations in accordance with current variations and particularly to apparatus which includes a light source, the illumination of which is caused to vary in accordance with a varying current supplied thereto. It is an object of my invention to provide improved apparatus of this character which shall be simple and efficient and provide a relatively low impedance path for the varying current supplied to the light source.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing, Figs. 1 and 2 show diagrammatically two arrangements over which my invention is an improvement; and Fig. 3 shows diagrammatically one embodiment of my invention.

In Fig. 1 I have shown at 1 a discharge lamp having electrodes 2 and 3 connected to a direct current exciting circuit through the controlling resistance 4. The transformer 5 is adapted to have its primary 6 connected with a source of current variations such as telephone transmitter or other device not shown, by means of which sound waves are transformed into corresponding electrical waves and has its secondary 7 connected across the lamp 1 through the condenser 8 whereby variations in the secondary current produce variations in the discharge between the electrodes 2 and 3. Another arrangement of producing variations in the discharge of the lamp 1 is shown in Fig. 2 where the secondary 7 of transformer 5 is arranged in series with the lamp 1 and resistance 4. It is well-known that an electric arc is unstable unless a resistance is connected in series with it, hence stabilizing resistances 4, are shown in Figs. 1 and 2. In neither of the forms shown by Figs. 1 and 2, however, is full advantage taken in the transformer secondary circuit of the low resistance of the arc itself, for in the one case a condenser 8 having such a large capacity that its reactance is of the same order of magnitude as the arc resistance is impracticable and in the other case the high ballast resistance 4 is in series with the secondary 7. On the contrary, full advantage of the low arc resistance may be taken with the arrangement devised by me and shown in Fig. 3.

In this figure I have shown the mercury vapor device 10 having the cathode 11, the starting anode 13 and the two similar anodes 14 and 15 which are connected to opposite ends of the secondary 7 of the transformer 5. The middle point of the secondary 7 is connected through suitable ballast resistance 17 with the positive side of the direct current source 18, which may be a D. C. generator or other source of direct current. Another suitable ballast resistance 19 is included in the connection between the maintaining anode 13 and the source and also the resistance 20 as usual in the circuit of the starting anode 12.

The two anodes 14 and 15 are shown arranged at the upper ends of two similar tubes 22 and 23 respectively which tubes extend upwardly from the body of the device 10. The arc maintaining direct current will thus traverse the tubes 22 and 23 in parallel and the varying currents from the transformer 5 will cause a variation in the relative distribution of the direct current in the tubes. The arc has zero or perhaps a slight negative resistance and therefore consumes substantially no power from the varying current circuit. Enough external resistance must be inserted in series with the transformer secondary to insure stability, but even with a slight margin of positive resistance the power consumption is very small. Hence a transformer having a large step-down ratio may be used and, without using an amplifier of very large output capacity, a considerable modulation of the direct current in the tubes 22 and 23 is obtained by the varying current. By this arrangement the arcs in the two tubes 22 and 23 are balanced one against the other one arc being used as a source of light, as for example for making a photographic record of the variations. In Fig. 3 I have shown diagrammatically an arrangement of apparatus for making a film record of the light variations

from one of the anode tubes, namely tube 22. This apparatus is particularly adapted for making a photographic film record of sound waves, the primary 6 of the transformer 5 being connected with a microphone or other sound pick-up device, the sound currents from which preferably are amplified before reaching the transformer. The apparatus comprises the lens 25, the screen 26 having therein the narrow light opening 27 arranged parallel with the tube 22, and a film 28 arranged to be moved uniformly over the drum 29 by the sprocket wheel 30 in a direction at right angles to the light opening and close to the screen 26. For convenience in illustration, I have omitted showing the structure by which the various parts are supported and by which the film is protected from light except that passing through the narrow opening 27 and coming from tube 22. I have also purposely omitted showing the means by which the film is given a uniform movement past the narrow light opening.

In operation, the arc maintaining direct current from the source 18 divides at the secondary 7 of the transformer, the two halves traversing the two tubes 22 and 23 in parallel. The potential induced in the secondary 7 at any given instant augments the direct current in one tube and reduces it in the other tube, the net current passing either tube at any instant being that due to the algebraic sum of the two potentials applied to the tube at that instant. Light from one tube only, namely tube 22 in the illustration, reaches the film 28 through the narrow aperture 27. The other tube 23 then forms a low resistance shunt path for the exciting current since an arc is maintained at all times in that tube as well as in tube 22, whereby a large step-down in the ratio of the transformer may be used resulting in a corresponding increase in the modulation of the exciting current traversing tube 22.

Where I refer to the term "light" in the present disclosure I desire that term to be given its broadest interpretation and not to be restricted to that narrow band of vibrations comprising the visible spectrum.

I have chosen the particular embodiment described above as illustrative of my invention and it will be apparent that various modifications may be made without departing from the spirit and scope of my invention which modifications I aim to cover by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In apparatus for producing light variations in accordance with variations in a controlling current, the combination of a discharge lamp having means providing for a plurality of arcs therein in parallel, means supplying exciting current for said arcs, and means for causing the controlling current to vary the relative distribution of exciting current to said arcs.

2. In apparatus for producing light variations in a controlling current, the combination of a discharge lamp having a cathode and a plurality of anodes, a source of exciting current for the lamp connected to the cathode and to the anodes in parallel for producing continuous arcs in parallel between said cathode and said anodes, and means for causing the controlling current to vary the relative distribution of exciting current supplied to the anodes.

3. Apparatus for photographically recording a varying current comprising a discharge lamp having a cathode and a plurality of anodes connected in parallel to an exciting circuit, means whereby light from the arc extending from one of said anodes is adapted to affect a light sensitive member, and means controlled by said varying current for causing the arcs from said anodes to vary inversely relative to each other.

4. Apparatus for photographically recording varying currents corresponding to sound waves comprising a discharge lamp having a cathode and a pair of similar anodes, an exciter having its terminals connected respectively with said cathode and with said anodes in parallel, a transformer having its secondary terminals connected respectively with said anodes, and means adapted to direct on a light sensitive member light from an arc from one only of said anodes.

5. Apparatus for photographically recording varying currents corresponding to sound waves comprising a mercury vapor discharge lamp having a cathode and two tubular extensions each containing an anode, a transformer having its secondary terminals connected respectively with said anodes, an exciter connected with said cathode and with said transformer secondary at the midpoint thereof, a movable photographic film, and optical means for directing the light from one of said tubular extensions upon said film.

6. In apparatus for producing light variations in accordance with variations in a controlling circuit, the combination of electric discharge means providing a plurality of arcs in parallel, means supplying exciting current for said arcs, and means responsive to the variations in the controlling circuit for causing variations in the relative distribution of exciting current supplied to said arcs.

In witness whereof, I have hereunto set my hand this 24th day of March, 1927.

EDWARD W. KELLOGG.

CERTIFICATE OF CORRECTION.

Patent No. 1,774,382. Granted August 26, 1930, to

EDWARD W. KELLOGG.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 69, claim 2, before the word "in" insert the words "in accordance with variations"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of September, A. D. 1930.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)