May 9, 1933. O. SCHRIEVER 1,908,191

STABILIZING GLOW DISCHARGE TUBES

Filed Sept. 7, 1927

Fig. 1

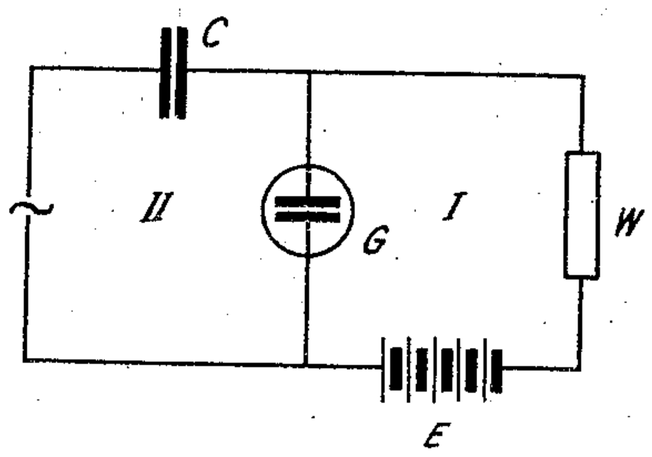


Fig. 2

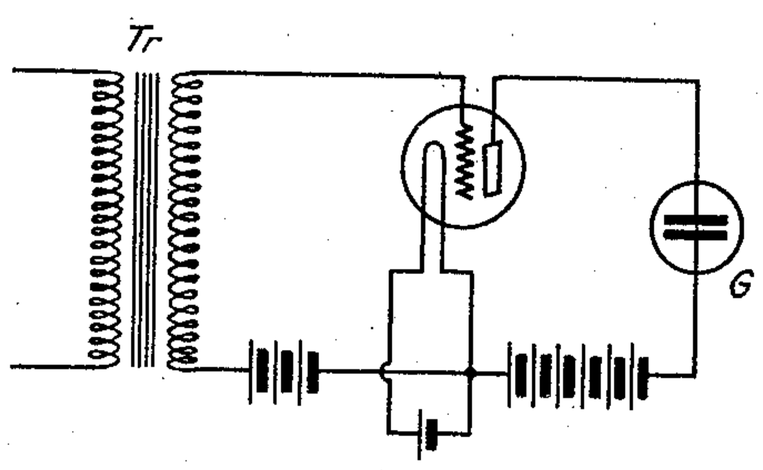
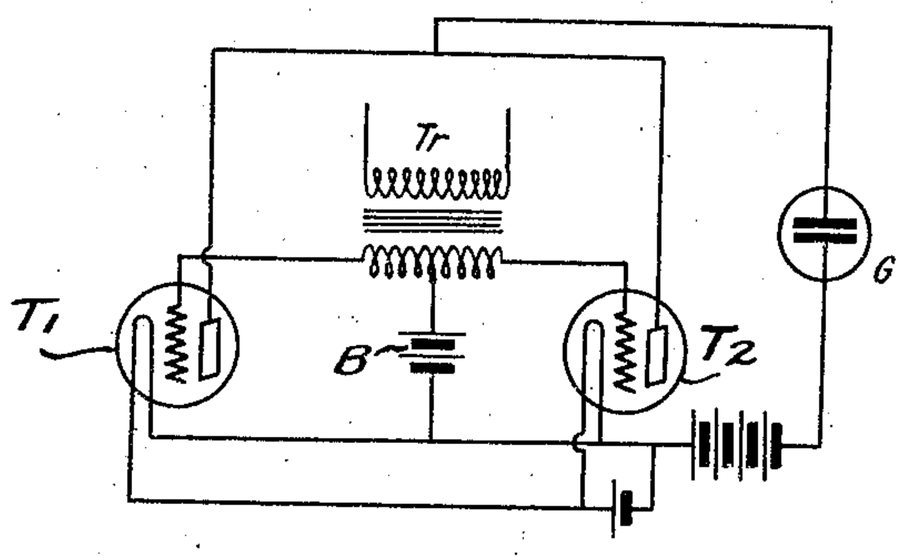


Fig. 3



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STABILIZING GLOW-DISCHARGE TUBES

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This invention relates to an arrangement for stabilizing a glow discharge device and relates also to circuits for providing this stabilized operation.

It is well known that glow-discharge lamps may be used for the purpose of recording current curves of waves of any occurring shape or form. The lamp is mostly used by passing a direct current equalling one-half of the saturation current through the glow-discharge lamp and superimposing the alternating current to be recorded upon the direct current, the mean brightness or brilliancy of the glow-discharge lamp being then nearly constant and equal to the brightness under normal condition. However, in recording or reproducing pictures in picture-telegraphy work, the idle current (bias or direct current) should be as low as possible in order that the mean brightness at any given time may be nearly proportional to the corresponding brightness conditions of the picture. Hence the smaller the direct current, the more delicate and the finer will be the reproduction of low brightness values. However, it is well known that the glow-discharge lamp has the property to go out in the presence of a definite lower limiting value of the voltage and therefore of the current, and is only capable of being restarted when the somewhat higher value of the potential is reached. The fact that extinction occurs, and that distinction has to be made between extinction and starting or striking potentials render the glow-discharge lamp unsuited for toned pictures, while in the reproduction of pure black-white contrast pictures these drawbacks are less serious in practice.

Among the objects of my invention are, therefore, to provide an arrangement for stabilizing the burning of a glow-discharge tube which is especially adaptable for picture telegraphy work.

Other objects of my invention are to provide an arrangement whereby it is possible to superimpose the picture frequencies in the normal current flowing in the glow-discharge lamp so that the mean brightness of the lamp depends upon the mean value of the alternating current potential at any instant.

Other objects of my invention are to provide in a manner hereinafter set forth a means for stabilizing the burning of a glow-discharge lamp which is simple in its construction and arrangement of parts, as well as a stabilizing means which is durable, compact, efficient in its use, conveniently operated, readily set up and inexpensive to install.

The novel features which I believe to be characteristic of my invention are set forth in the appended claims, but the invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, will be best understood by making reference to the following description read in connection with the accompanying drawing wherein:—

Fig. 1 shows a relatively simple arrangement for stabilizing the lamps;

Fig. 2 illustrates a modification of Fig. 1 in which a vacuum tube is substituted for the high ohmic resistance; and,

Fig. 3 is a preferred form of embodiment somewhat similar to Fig. 2 but capable of utilizing both halves of the incoming signal wave for controlling the lamps.

In order that the glow-discharge lamp may be made suited also for the purpose of recording a toned picture in picture telegraphy work, according to the present invention, and as shown diagrammatically in the drawing, a direct current potential E far above the striking voltage of the glow-lamp G is applied to the latter by way of a high-ohmic resistance W in such a manner that the current flowing in circuit I is essentially determined by the relation E : W, which is, in fact, kept so low by the suitable selection of the values of E and W that the light emitted from the glow-discharge lamp under normal conditions (i. e., in the absence of alternating current flow) results in but slight photographic blackening. The lamp will then burn in a stable manner because at the state of extinction the entire potential of the battery E would arise across the electrodes of the glow-discharge lamp and would thus immediately result in renewed striking. The picture frequency currents to be recorded or reproduced are fed to the lamp by way of

circuit path II containing a condenser C to shut off the direct current and being in shunt relationship to path I. Since the resistance W has a high ohmic value, the picture frequency currents will choose the way through the glow lamp G and thus cause the glow-discharge lamp to brighten up in accordance to their particular intensity. It is thus possible to record also very small mean brightness values without the lack of stability of the glow-discharge lamp otherwise present giving rise to distortions. In the work of recording photographs and the like in which the accurate reproduction even of the smallest brightness values is of extremely great importance, this factor is of extremely great value.

As shown in Fig. 2, the high ohm resistance may consist also of an amplifier tube whose grids are provided with such a high negative biasing potential that the desired small residual current will be allowed to flow. The current impulses to be recorded are then most suitably superimposed upon the grid biasing potential of the said tube, for instance, by way of the transformer T*r*.

In order to utilize both cycles for controlling the glow-discharge lamp, two tubes having their outputs in parallel as shown in Fig. 3, may be employed. The grids of these tubes may be controlled in phase-opposition and biased as described in connection with Fig. 2.

So arranged, the grids of the two tubes are controlled in phase opposition and as shown in the drawing the biasing means for the grids of the tubes T1 and T2 is connected between the filament and the midpoint of the secondary of the transformer T*r*. Under such conditions, if the signal is supplied through the transformer T*r* it may be assumed that the grid of the tube T1, shown to the left of Fig. 3, becomes less negative so that the plate current output from this tube will rise which, due to the fact that the grid of the tube T2 is more negative, will cause a decrease in the output from the tube T2, shown to the right of Fig. 3. However, under such conditions the plate current output of tube T2 does not necessarily decrease in the same proportion that the plate current output of the tube T1 rises. When these conditions are reversed, due to a reversal of the current in the transformer, the grid of the tube T2 is made less negative and the grid of the tube T1 becomes more negative, under which condition there will be an increase in the plate current output from the tube T2 and a decrease in the plate current output of the tube T1, but the decrease from normal operating position of the tube T1 need not be in the same proportion as the rise in the plate current output from the tube T2, since the glow tube G will produce varying intensities in glow corresponding to incoming signal impulses and since the variation in glow is all that is desired from the system. In order to provide the aims and objects of this invention, it can be seen that the frequency doubling effect of the arrangement shown by Fig. 3 is merely incidental and makes no difference whatever in the operation of the system, and has no harmful actions whatever in picture telegraphy, for what is of importance in this work is only the value of the currents flowing through the glow-discharge tube.

Having described my invention what I claim and desire to secure by Letters Patent is:

1. A system for stabilizing glow-discharge tubes which comprises a glow-discharge lamp, a pair of vacuum tube amplifiers having their outputs connected in parallel, means for applying a biasing potential to said glow lamp of a value sufficient to continuously flash the said glow-discharge lamp, means for connecting the said glow lamp with the output circuits of said vacuum tubes, means to bias the tubes so that only a small residual current flows therethrough in the absence of impressed signals, means for applying signals to the input circuits of said vacuum tubes, and means for superimposing the output signals from said vacuum tubes upon said biasing potential to said glow lamp.

2. A stabilizing means for glow-discharge tubes comprising a glow discharge tube, a pair of thermionic amplifiers having paralelly connected outputs, a source of plate potential for said amplifiers connected in series with said glow lamp and said amplifiers for normally maintaining said glow discharge tube above the flash potential, biasing means for normally biasing the input electrode of each of said thermionic tubes to such a point that only a small residual current will flow therethrough, and means for differentially supplying signal potentials to the input circuits of said thermionic tubes, whereby the amplified signal potentials are impressed upon said glow tube and the intensity of illumination of said glow tube is varied in proportion to the strength of incoming signal impulses.

3. A system for representing current values as light intensities including a plurality of vacuum tube amplifiers having their output electrodes connected in parallel, means for impressing signals differentially upon the input circuits of said vacuum tubes, means for biasing said tubes to a point where only a small residual current flow occurs therethrough in the absence of signals, a glow discharge lamp connected in the output circuit of said amplifiers, a source of high potential connected in series with said glow lamp and each of said amplifiers, said source of potential being of a value above that required for producing an initial glow in said glow lamp, said output circuit providing

a path for impressing amplified signals from said amplifiers upon said glow lamp whereby fluctuations in the signals appearing in the output circuit of said amplifiers produces proportionate changes in the intensity of glow in said glow lamp.

4. An arrangement for stabilizing glow-discharge tubes which comprises a pair of vacuum tubes having their outputs in parallel, a glow-discharge tube in the common output circuit of said vacuum tubes, means to bias the tubes so that only a small residual current flows therethrough in the absence of impressed signals, and means for differentially supplying signal potentials to said vacuum tubes whereby current fluctuations in the output circuits of said tubes produce proportionate intensity fluctuations in said glow-discharge tube.

5. A stabilizing system for glow discharge tubes comprising a pair of thermionic tubes having their output circuits in parallel connection, means to bias the tubes so that only a small residual current flows therethrough in the absence of impressed signals, means to supply signals differentially to the input circuit of each of said tubes, and a glow discharge tube included in the parallel output circuit of said tubes, said glow discharge tube being responsive to the amplified signal input to produce changes in the intensity of glow therefrom.

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