April 2, 1935. A. WHITAKER 1,996,359

PHOTOGRAPHIC RECORDING OF ACOUSTIC OR THE LIKE OSCILLATIONS

Filed June 11, 1929

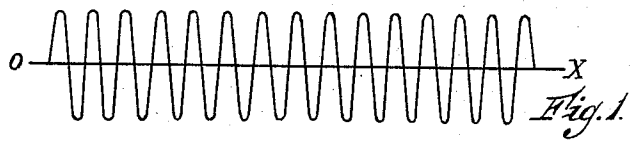


Fig. 1.

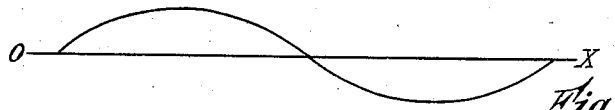


Fig. 2.

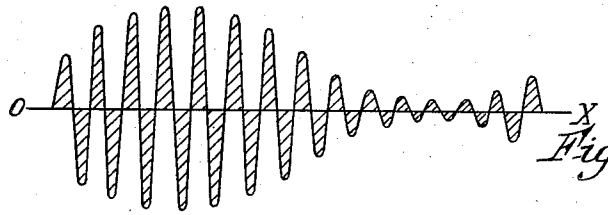


Fig. 3.

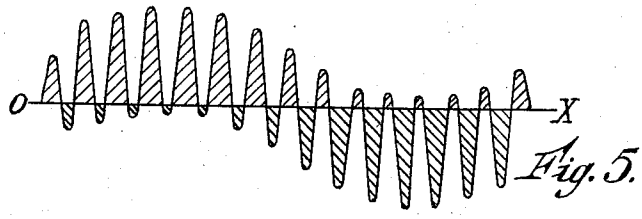


Fig. 5.

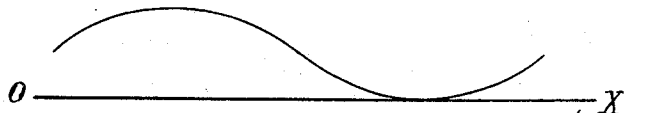


Fig. 4.

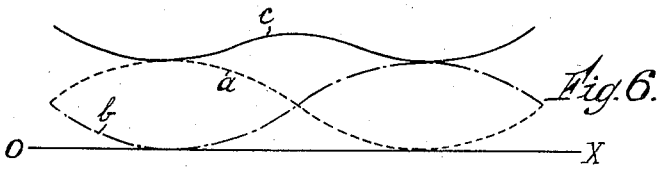


Fig. 6.

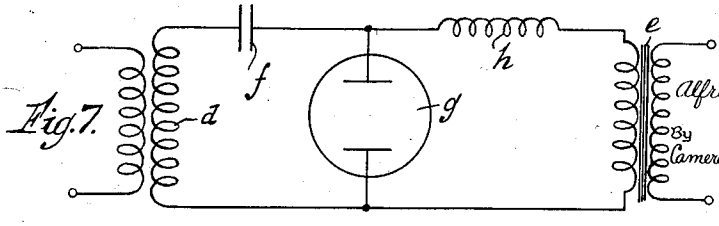


Fig. 7.

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PHOTOGRAPHIC RECORDING OF ACOUSTIC OR THE LIKE OSCILLATIONS

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11 Claims. (Cl. 179—100.3)

The present invention relates to the production of a light beam having an intensity which varies in accordance with acoustic or the like oscillations, more particularly for the photographic recording of such oscillations.

Where high frequency electrical oscillations, modulated with acoustic currents, are used to light a discharge tube the total light emitted by the tube, varies in accordance with the modulation, since modulation of high frequency oscillations consists in varying the amplitude of these oscillations in accordance with the acoustic currents.

According to the present invention a glow discharge tube is employed and to the electrodes thereof are applied two sets of electrical oscillations, one set of oscillations being of substantially constant amplitude and frequency and the other set of oscillations corresponding to the oscillations in accordance with which the light intensity is to be varied. In this way, the light emitted by the gas in the region of the two electrodes of the tube, taken separately, is varied in accordance with the oscillations to be recorded.

The invention will be described with reference to the accompanying drawing in which

Figs. 1–6 are diagrams illustrating the method of the present invention in contrast with the known method using modulated high frequency oscillations, and

Fig. 7 is a circuit diagram in accordance with the invention.

In the diagrams of Figs. 1 to 3 and Fig. 5, one electrode of a glow discharge tube is assumed to be at earth potential and the instantaneous voltage of the other electrode is plotted as ordinate, the line OX representing zero voltage and positive voltages being plotted in an upward direction. In Figs. 4 and 6, light intensity is plotted as ordinate, the axis OX representing zero intensity. In all these diagrams, time is plotted as abscissa, the scale being uniform in all the figures. The high frequency ripple is disregarded in Figs. 4 and 6.

Fig. 1 shows a high frequency oscillation of constant amplitude and Fig. 2 shows one complete period of a low frequency oscillation with which it is desired to modulate the intensity of the light emitted by the glow discharge tube. Fig. 3 illustrates the effect of modulating the oscillation of Fig. 1 by that of Fig. 2, the amplitude of the high frequency oscillation being varied in accordance with the low frequency oscillation. The total light emitted by the tube is a function of the total shaded area irrespective of which electrode is at the higher potential. The total light emitted by the tube is shown in Fig. 4.

Fig. 5 illustrates the method according to the present invention in which the two oscillations of Figs. 1 and 2 are added together. It will be noticed that the high frequency oscillation has retained its constant amplitude but that, in effect, the center line OX in Fig. 1 has in Fig. 5 been deformed into the shape of the low frequency curve in Fig. 2. The light emitted by one electrode is a function of the shaded area above the line OX while that emitted by the other electrode is a function of the shaded area below the line OX. The intensity of the light emitted by the former electrode is indicated by the plain dotted curve *a* in Fig. 6 and that emitted by the other electrode is indicated by the chain dotted curve *b*. The total light emitted by the lamp is the sum of these two dotted curves and is represented by the full line curve *c*. It will be seen that although the intensity of the light emitted by each of the electrodes separately varies in accordance with the low frequency oscillation in Fig. 2, that emitted by the lamp as a whole is of much smaller amplitude and of double the frequency. In applying the method of the present invention, therefore, the light from the two electrodes must be kept separate. Both electrodes may, however, be used simultaneously as light sources provided that they are used to make separate records.

A suitable circuit for carrying the present invention into effect is shown in Fig. 7. High frequency oscillations are fed into the primary winding of the transformer *d* and the low frequency oscillations are fed into the primary winding of the transformer *e*. A condenser *f* serves to prevent low frequency oscillations from circulating in the circuit to the left of the glow discharge tube *g* while a high frequency choke coil *h* prevents high frequency oscillations from circulating in the circuit to the right of the discharge tube *g*.

The oscillations of constant frequency and amplitude have, preferably, a frequency above audibility but they may have an audible frequency to which the apparatus is not sensitive. Where an optical slit is used for recording oscillations, it can be shown that when the ripple wave length of the oscillations (that is to say the distance between successive bands of light or shade upon the record) is equal to the slit width, no variation in the light transmitted by the slit takes place. The apparatus, therefore, shows no response and is insensitive to the frequency corresponding to this wave length. In

some cases, therefore, oscillations of this frequency can be used in combination with the oscillations to be recorded as above described.

I claim:

1. A method of producing light varying in intensity in accordance with acoustic or the like oscillations which consists in applying separately to the electrodes of a glow discharge tube each of two sets of mutually independent electrical oscillations, one set of oscillations being of substantially constant amplitude and frequency and the other set of oscillations corresponding to the oscillations in accordance with which the light intensity is to be varied.

2 A method according to claim 1, in which said oscillations of constant amplitude and frequency have a frequency above audibility.

3. A method of producing light varying in intensity in accordance with acoustic or the like oscillations which consists in applying separately to the electrodes of a glow discharge tube each of two sets of mutually independent electrical oscillations, one set of oscillations being of substantially constant amplitude and high frequency, and the other set of oscillations corresponding to the oscillations in accordance with which the light intensity is to be varied.

4. A method of producing light varying in intensity in accordance with acoustic or the like oscillations which consists in applying directly to the electrodes of a glow discharge tube electrical oscillations of substantially constant amplitude, and simultaneously, but separately applying directly to said electrodes electrical oscillations corresponding to the oscillations in accordance with which the light intensity is to be varied, but without substantially changing the amplitude of said first-named oscillations.

5. A method of producing light varying in intensity in accordance with acoustic or the like oscillations which consists in applying directly to the electrodes of a glow discharge tube electrical oscillations of substantially constant amplitude, and simultaneously, but separately applying directly to said electrodes electrical oscillations corresponding to the oscillations in accordance with which the light intensity is to be varied, said second named oscillations being applied to said electrodes in such a manner that the light emitted by one electrode of said glow discharge tube is, at substantially every instant, of different intensity than that emitted by another electrode.

6. A method of producing light varying in intensity in accordance with acoustic or the like oscillations which consists in applying directly to the electrodes of a glow discharge tube electrical oscillations of substantially constant amplitude, and simultaneously, but separately applying directly to said electrodes electrical oscillations corresponding to the oscillations in accordance with which the light intensity is to be varied, said second named oscillations being applied to said electrodes in such a manner that the light emitted by one electrode of said glow discharge tube is, at substantially every instant, of different intensity than that emitted by another electrode, while the amplitude and frequency of the light wave representing the light emitted by said glow discharge tube as a whole remains a function of that emitted by each of said electrodes.

7. In the method of recording acoustic or the like oscillations photographically by means including a glow discharge tube and a light slit, the step which consists in applying directly to the electrodes of said tube electrical oscillations of constant amplitude and frequency and having a ripple wave length equal to the width of said slit.

8. In a system for recording sound by means of light, the combination of a glow discharge device including a pair of electrodes, means for applying high frequency oscillations directly to said electrodes, and means for separately applying, also directly to said electrodes, oscillations of relatively lower frequency.

9. In a system for recording sound by means of light, the combination of a glow discharge device including a pair of electrodes, means for applying high frequency oscillations directly to said electrodes, and means independent of said first-named means for separately applying, also directly to said electrodes, oscillations of relatively lower frequency.

10. In a system for recording sound by means of light, the combination of a glow discharge device including a pair of electrodes, means for applying directly to said electrodes oscillations of substantially constant amplitude and frequency, and means independent of said first named means for separately applying, also directly to said electrodes, oscillations of varying amplitude and frequency.

11. In a system for recording sound by means of light, the combination of a glow discharge device including a pair of electrodes, means for applying directly to said electrodes oscillations of substantially constant amplitude and frequency, and means independent of said first named means for separately applying, also directly to said electrodes, oscillations corresponding to the sound being recorded.

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