

Oct. 15, 1935.

A. WHITAKER

2,017,520

GLOW DISCHARGE DEVICE SUCH AS IS USED IN THE RECORDING OF SOUND

Filed June 5, 1930

2 Sheets-Sheet 1

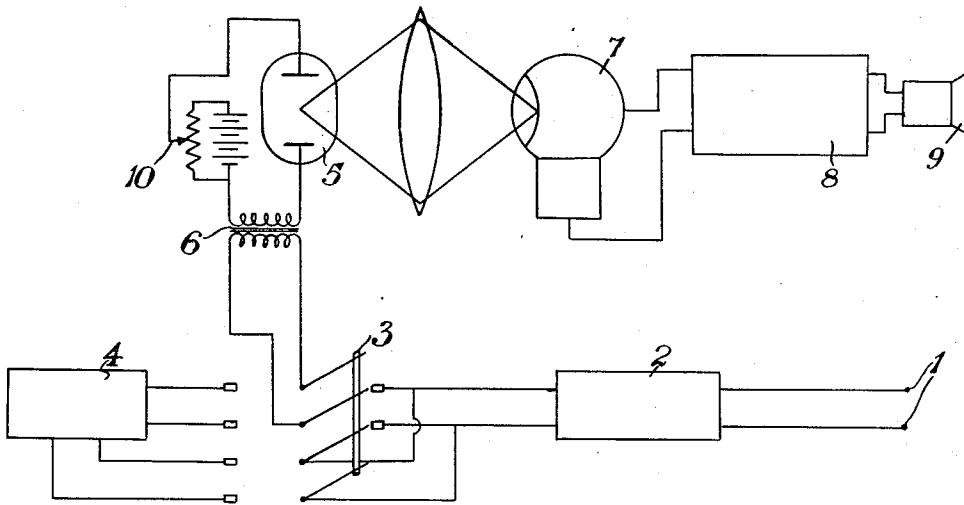


Fig.1.

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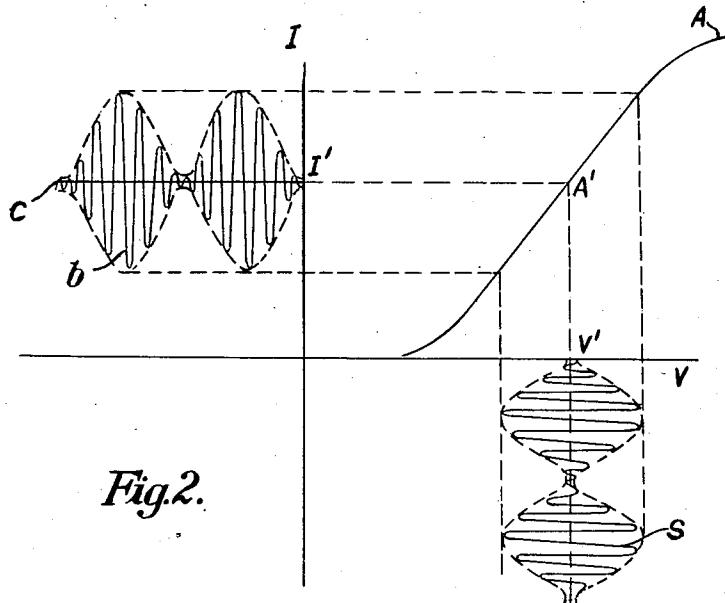


Fig. 2.

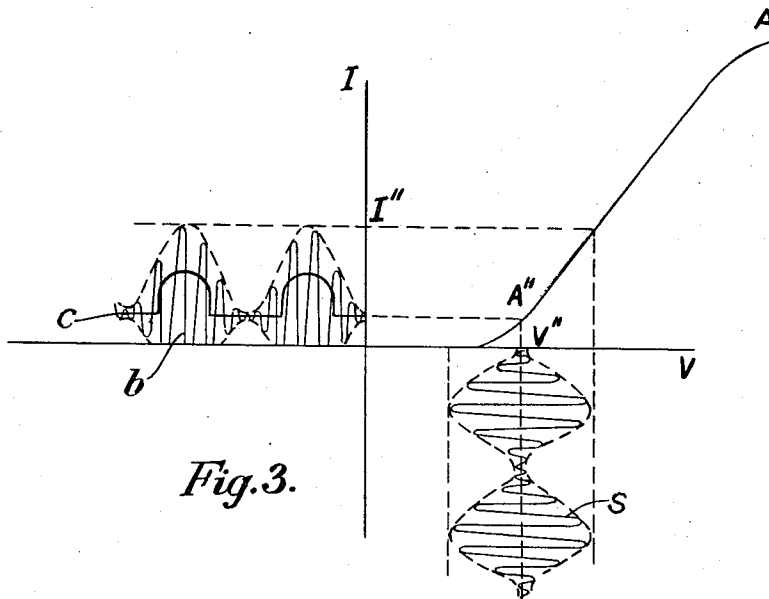


Fig. 3.

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GLOW DISCHARGE DEVICE SUCH AS IS
USED IN THE RECORDING OF SOUND

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8 Claims. (Cl. 179—100.3)

The present invention relates to improvements in glow discharge devices such as are used in the recording of sound.

In recording sound by means of a glow discharge device, the luminosity of the device is made to vary in accordance with the audio frequency vibrations that it is desired to record. This variation of the luminosity can, for example, be effected by electrostatic or electromagnetic controlling means, or by the variation of the potential difference between the electrodes of the device. In order that any variation of the controlling effect should result in a proportionate variation of the luminosity, it is necessary that the device should operate upon the straight portion of its characteristic curve. The adjustments necessary to attain this mode of operation are very critical and difficulty has been experienced in determining exactly when it has been attained.

It is an object of the present invention to provide means for determining when a glow discharge device is operating on the straight portion of its characteristic curve.

According to the present invention, this object is attained by applying to the device a super-audio frequency oscillation modulated at audio frequency, the device being adjusted until no rectification of this modulated super-audio frequency oscillation takes place.

The invention will be described, by way of example, with reference to the accompanying drawings in which

Fig. 1 is a diagram of a recording system embodying the invention, while

Figs. 2 and 3 are diagrams illustrating the principle of the invention.

Referring to Fig. 1, the audio-frequency electrical oscillations to be recorded are applied to the input terminals 1 and are amplified by the modulation amplifier 2.

When it is desired to adjust the glow discharge device so that it works on the straight part of its characteristic, the switch 3 is moved into the left-hand position. The amplified audio-frequency oscillations are then applied to the super audio-frequency generator 4 and serve to modulate the oscillations produced by this generator. The output circuit of the generator is coupled to the input circuit of the glow discharge device 5, for example, by means of a transformer 6. The light emitted by the glow discharge device is received by a photo-electric cell 7, the output of which is connected through an amplifier 8 to a loudspeaker 9. If any rectification of this

modulated super audio-frequency by the glow discharge device is taking place, the intensity of the light emitted by the glow discharge device will have a fluctuating component, and consequently a fluctuating current will be produced in the output circuit of the photo-electric cell, which will produce an audible sound in the loudspeaker. The steady voltage across the glow discharge device is then adjusted by any suitable means, for example, a potentiometer 10 connected across the battery producing this steady voltage, until no sound is heard in the loudspeaker, in which case no rectification of the modulated super audio-frequency oscillation is produced by the glow discharge device.

When this condition is attained, the switch 3 is moved into the right hand position, in which case the audio-frequency oscillations to be recorded are transferred directly to the input circuit of the glow discharge device, and the resulting fluctuations of its luminosity are recorded in any known manner.

The rectifying action of the glow discharge device can be explained more clearly with the aid of Figs. 2 and 3.

Referring to Fig. 2, the characteristic curve A represents the relationship that exists between the potential difference V across the glow discharge device at any instant and corresponding intensity I of the glow. The abscissa V' represents the steady potential difference which is applied to the electrodes of the discharge device, and its value is such that the discharge device works at the point A' , which is approximately the mid-point of the straight portion of the characteristic curve A. At this point, the corresponding intensity of the glow is given by the ordinate I' . The curve S represents the modulated super audio-frequency voltage variations which are superimposed on the steady voltage V' , and these give rise to a corresponding modulated super audio-frequency variation of the glow intensity which is superimposed upon the steady glow intensity, I' and which is represented by the curve L. Assuming that the frequency of the oscillations of the curve L is sufficiently high, this curve can be replaced in effect by the straight line C through the point I' , and hence the superimposing of the varying voltage represented by the curve S upon the direct voltage V' has substantially no effect upon the resultant intensity of the glow.

In Fig. 3, the symbols A, V, I etc., have the same meaning as the previous figure. The direct voltage V'' is chosen so that the working point

A'' is near a bend in the curve. The curve L is now non-symmetrical in form, the lower portion being cut off, and the resultant glow intensity can be represented by a straight line C through the point A'', having an audio-frequency ripple superimposed thereon. This audio-frequency fluctuation in the light intensity of the glow discharge device produces an audible note through the medium of the photo-electric cell and the loudspeaker.

In adjusting the steady voltage across the glow discharge device to the value V', it may be found that there is a band of settings of the adjustment over which no audible note is produced by the loudspeaker. In this case, the adjustment is preferably set to a position intermediate the two settings at which sounds commence to be audible as the control is moved from the silent position.

I claim:

1. In a system for converting low frequency electrical oscillations into light variations and employing a glow discharge device, a source of super audio-frequency oscillations, means including an audio frequency circuit for modulating said super-audio frequency oscillations in accordance with audio-frequency oscillations, means for impressing the modulated super audio-frequency oscillations upon said glow discharge device, means for controlling said device to condition said device so that no rectification of said modulated super audio-frequency oscillations takes place, and means for selectively uncoupling said super-audio frequency source from said device and coupling said audio frequency circuit thereto.

2. In a system for converting low frequency electrical oscillations into light variations and employing a glow discharge device, means for impressing a potential difference across the electrodes of said device, a source of super audio-frequency oscillations, means including an audio frequency circuit for modulating said super-audio frequency oscillations in accordance with audio-frequency oscillations, means for impressing the modulated super audio-frequency oscillations upon said glow discharge device, means for controlling the potential difference impressed across the electrodes of said device to condition said device so that no rectification of said modulated super audio-frequency oscillations takes place, and means for selectively uncoupling said super-audio frequency source from said device and coupling said audio frequency source thereto.

3. In a signal translating system employing a glow discharge device, a source of super audio-frequency oscillations, means including an audio frequency circuit for modulating said oscillations in accordance with audio-frequency oscillations, means for impressing the modulated super audio-frequency oscillations upon said glow discharge device, means associated with said glow discharge device for detecting any rectification of said modulated super audio-frequency oscillations, and means for selectively uncoupling said super-audio frequency source from said device and coupling said audio frequency source thereto.

4. In a signal translating system employing a glow discharge device, a source of super audio-frequency oscillations, means including an audio frequency circuit for modulating said oscillations in accordance with audio-frequency oscillations, means for impressing the modulated super audio-frequency oscillations upon said glow discharge

device, electro-optical means responsive to light emitted by said glow discharge device, translating means associated with said electro-optical means for detecting any rectification of said modulated super audio-frequency oscillations, and means for selectively uncoupling said super-audio frequency source from said device and coupling said audio frequency source thereto.

5. In a signal translating system employing a glow discharge device, means for impressing a potential difference across the electrodes of said device, a source of super audio-frequency oscillations, means including an audio frequency circuit for modulating said oscillations in accordance with audio-frequency oscillations, means for impressing the modulated super audio-frequency oscillations upon said glow discharge device, electro-optical means responsive to light emitted by said device, translating means associated with said electro-optical device for detecting any rectification of said modulated super audio-frequency oscillations, means for controlling the potential impressed across the electrodes of said device to condition said device so that no output is obtained from said translating means, and means for selectively uncoupling said super-audio frequency source from said device and coupling said audio frequency source thereto.

6. In a signal translating system employing a glow discharge device, the combination of an audio-frequency circuit, a source of super audio-frequency oscillations, and means for either coupling said audio frequency circuit to said source of super audio-frequency oscillations and said source to said glow discharge device, or for uncoupling said source of super audio-frequency oscillations from said device and coupling said audio frequency circuit alone to said device at will.

7. The method of conditioning a sound recording system employing a glow discharge device adapted to be energized by an audio frequency circuit coupled thereto during recording which comprises uncoupling said circuit from said device and coupling it to a source of super-audio frequency oscillations, coupling said source to said device, applying to said device a super-audio frequency oscillation from said source modulated at audio frequency from said circuit, adjusting said device until no rectification of said modulated super-audio frequency oscillation takes place, and thereafter uncoupling said source of super-audio frequency oscillations from said device and recoupling said audio frequency circuit thereto whereby said system is set for recording.

8. The method of conditioning a sound recording system employing a glow discharge device adapted to be energized by an audio frequency circuit coupled thereto during recording which comprises uncoupling said circuit from said device and coupling it to a source of super-audio frequency oscillations, coupling said source to said device, impressing a potential difference across the electrodes of said device, applying to said device a super-audio frequency oscillation from said source modulated at audio frequency from said circuit, adjusting said potential difference until no rectification of said modulated super-audio frequency oscillation takes place, and thereafter uncoupling said source of super-audio frequency oscillations from said device and recoupling said audio frequency circuit thereto whereby said system is set for recording.

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