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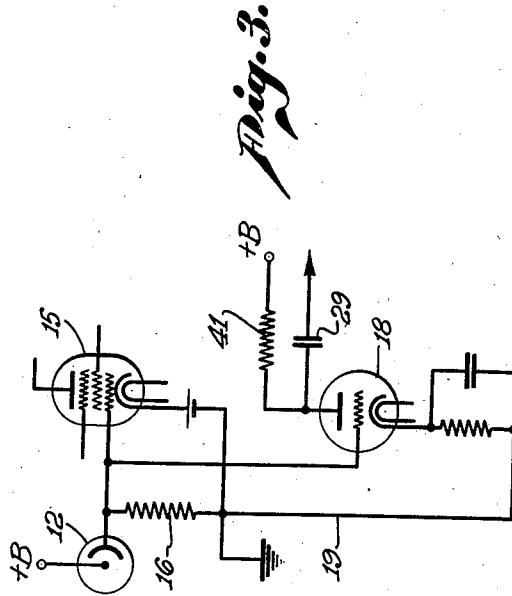
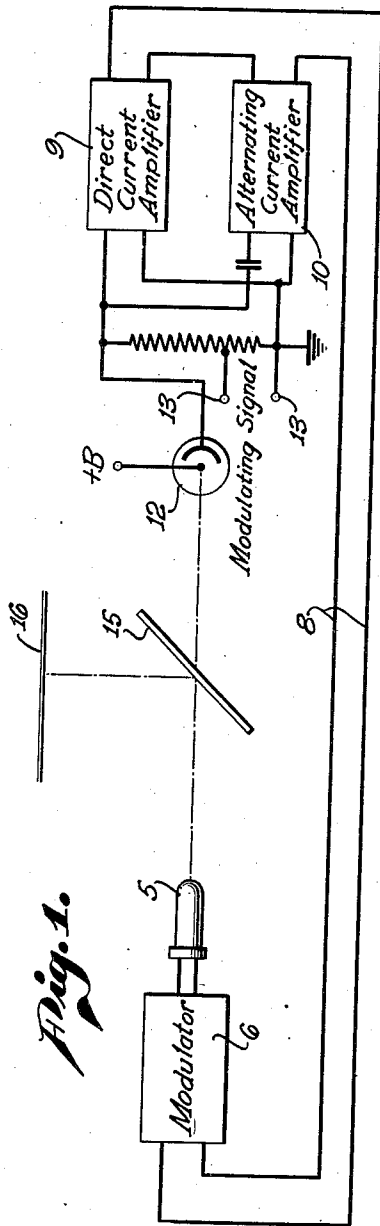
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2,360,012

LAMP MODULATED RECORDING METHOD AND SYSTEM

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2 Sheets-Sheet 1



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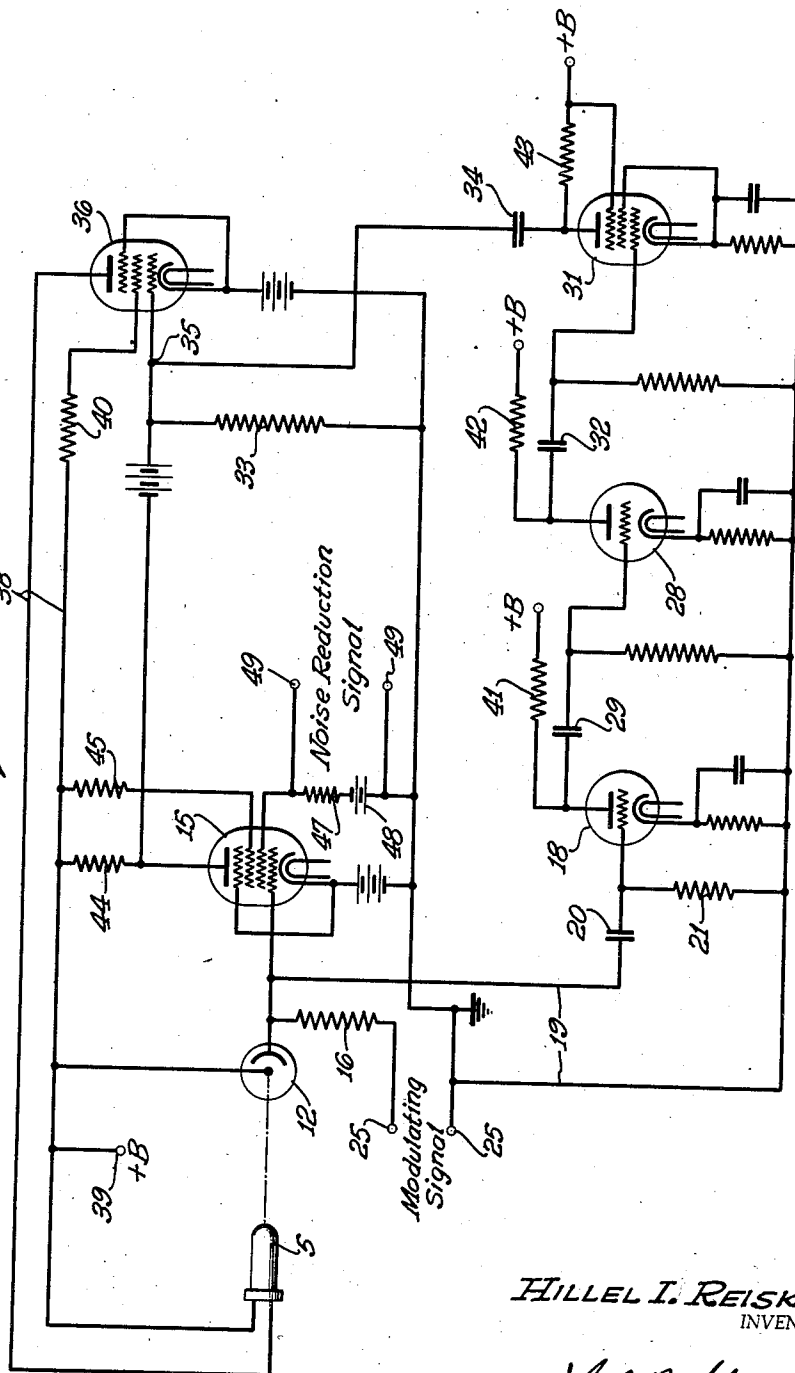
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Fig. 2.



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LAMP MODULATED RECORDING METHOD
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10 Claims. (Cl. 179—100.3)

This invention relates to sound recording and reproducing systems and particularly to a stabilizing system for light sources employed in sound recording systems.

It is well known that in photographic sound recording systems, it is necessary to employ a light source which may or may not be directly modulated by sound waves to be recorded, while in a sound reproducing system a light source of constant intensity is used to scan the recorded sound track. In variable density recording systems, it is common practice to employ a light source whose light output or quanta, as impressed upon the film, is varied by varying the voltage thereon in accordance with the sound waves being recorded. The present invention is particularly applicable to the stabilization of such light sources since any variations in their light output, not produced by the sound waves, will introduce distortion or vary the average predetermined level. Unwanted light variations may be produced by fluctuations in the lamp energizing source, by deterioration of the light producing elements, blackening of the lamp envelope and other reasons.

It has been found that the maintenance of a constant voltage at the lamp terminals does not compensate for variation in lamp temperature, deterioration of electrodes, and certain other causes of unwanted light variations mentioned above. The present invention, therefore, obtains stabilization by detecting a portion of the light output from the lamp and regulating the energy to the lamp in accordance with the variations in the detected light. The general principle of such an optical feedback stabilizing system is known in the art, such a system being disclosed and claimed in U. S. Patent No. 2,242,638, of May 20, 1941. In this patented system which provides direct current feedback, the impedance of an electronic device connected in series with the lamp and the primary power source is varied in accordance with the light variations. The amount of feedback in such a system is limited by the size of the photocell load resistor and the load resistor of the first vacuum tube and when these resistors are increased to increase the feedback, the effect of stray capacity is also increased, and it is thus difficult to obtain sufficient amplification in the feedback circuit with a linear frequency characteristic.

The present invention is directed to a system wherein two feedback paths are provided in parallel, one a direct current path of moderate gain and the other an alternating current path of high

gain, the outputs of the two paths providing an accurate and sensitive control of the average energy supplied to the light source. Such a system will reduce distortion to a minimum and provide maximum sensitivity to small light variations.

The principal object of the invention, therefore, is to improve light source stabilizing systems.

Another object of the invention is to provide an optical feedback system which has minimum distortion and maximum sensitivity.

Another object of the invention is to provide an optical feedback system for stabilizing a light source for a sound recording system wherein the modulating input is transmitted by the feedback circuits.

Although the novel features which are believed to be characteristic of this invention are pointed out with particularity in the claims appended herewith, the manner of its organization and the mode of its operation will be better understood by referring to the following description, read in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram of the system embodying the invention.

Fig. 2 is a schematic diagram of the circuits used in the system of Fig. 1, and,

Fig. 3 is a partial schematic circuit showing modifications of the modulating portion of the system.

Referring now to Fig. 1, a light source 5 which may be a mercury vapor gas discharge lamp is fed from a modulator 6 which in turn is connected over conductors 8 with the output of a direct current amplifier 9 and an alternating current amplifier 10. The inputs of the amplifiers 9 and 10 are in parallel with the photoelectric cell 12 and terminals 13, these terminals being connectable to a microphone or other source of modulating signal. The photoelectric cell 12 receives light from the lamp 5 transmitted through a partially reflecting mirror 15, the reflected portion of the light being impressed upon a film 16 when the lamp 5 is used in a sound recording system.

Referring now to Fig. 2, the light source 5 and photoelectric cell 12 are shown in an arrangement whereby a portion of the light from lamp 5 is impressed on the cell 12 as in Fig. 1. The output of the cell 12 is impressed on the first grid of the direct current amplifier tube 15 and on the grid of the first tube 18 of the alternating current amplifier across the photocell load resistor 16 and

over conductors 19, coupling condenser 20 and resistor 21. The modulating signal is impressed on the same grids in series with resistor 16 when a signal source is connected to terminals 25. A noise reduction signal, if desired, may be impressed across resistor 47 in series with a polarizing source 48 when connected to terminals 49.

The output of the first tube 18 of the alternating current amplifier is impressed upon a second tube 28 over condenser 29, while the output of the second tube 28 is impressed upon a third power tube 31 over condenser 32. The output of the tube 31 is connected over condenser 34 to the output of direct current amplifier tube 15 at point 35, point 35 being connected to the control grid of a modulator tube 36. The output of the tube 36 is connected to the lamp 5 over conductors 38 and resistor 40. The proper anode potentials for the tubes 15 and 36 are obtained from the plus B terminal 39 over resistors 44 and 45 while the anode potentials for the A. C. amplifier tubes 18, 28 and 31 are supplied over their respective plate resistances 41, 42 and 43, as indicated.

In operation the output of photoelectric cell 12 is impressed on tubes 15 and 18, the output of tube 18 after amplification in tubes 28 and 31 being impressed in parallel with the output of tube 15 on power tube 36. The input coupling resistor 16 is low enough so that the high frequency attenuation in the coupling circuit is kept at a reasonably low value. Tubes 15 and 31 are high impedance pentodes and thus function as constant current generators permitting the outputs thereof to be connected in parallel. Since two high impedance voltage sources are connected in parallel to a load of relatively low impedance, the voltage across resistor 33 will be equal to the sum of the output voltages of the tubes 15 and 31. Thus, the effect of the circuit of Fig. 2 is the same as that of Fig. 1. In this manner the alternating current feedback path including tubes 18, 28 and 31 will respond to rapid variations in light intensity and thus compensate therefor, while the direct current path including tube 15 will compensate for the slower light variations, the two outputs being additive to maintain the light output of lamp 5 at its predetermined light output average constancy.

To eliminate the effect of the time constant of the coupling elements 20-21 in the input circuit of the first tube 18 of the A. C. amplifier, this stage may be connected as a D. C. stage, as shown in Fig. 3. The same numerals in Fig. 3 identify corresponding elements in Fig. 2.

The above feedback stabilizing and light modulating system provides a sensitive and rapid control of the output of a light source by providing a pair of feedback paths, one an alternating current path to control the lamp during rapid light fluctuations and having sufficient gain to produce the required amount of feedback to give a flat frequency characteristic and low distortion, and the other a direct current path of moderate gain to control the lamp during slower light variations and providing stabilization of the average illumination. In this manner, high frequency attenuation and distortion are eliminated in the above described type of sound recording systems.

What is claimed is:

1. The method of controlling the light intensity of a light source comprising translating a portion of the light from said source into electrical currents, transmitting said electrical currents over two independent transmission paths, and

combining the output currents in said transmission paths for impression on said light source.

2. The method of controlling the light intensity of a light source in accordance with claim 1 in which one of said paths transmits the components of said translated currents corresponding to the slow variations in light from said source and the other path transmits the components of said translated currents corresponding to the rapid variations in the light from said source.

3. The method of controlling the light intensity of a modulated light source comprising translating a portion of the light from said source into electrical currents, separately amplifying said translated currents, combining said separately amplified currents, and impressing said combined currents on said light source.

4. The method of controlling the light intensity of a modulated light source comprising translating a portion of the light from said source into electrical currents, separately amplifying said translated currents, combining said separately amplified currents, impressing said combined currents on said light source, and combining a modulating signal with said separately amplified currents.

5. A stabilizing system for a light source comprising means for translating a portion of the light from said source into corresponding electrical currents, a plurality of transmission paths interconnecting the output of said translating device with the input of said light source, and means for combining the outputs of said transmission paths for impression on said light source.

6. A stabilizing system for a light source comprising means for translating a portion of the light from said source into corresponding electrical currents, a plurality of transmission paths interconnecting the output of said translating device with the input of said light source, and means for combining the outputs of said transmission paths for impression on said light source, one of said paths including a direct current amplifier and the other of said paths including an alternating current amplifier.

7. A stabilizing system for a light source comprising means for translating a portion of the light from said source into corresponding electrical currents, a plurality of transmission paths interconnecting the output of said translating device with the input of said light source, and means for combining the outputs of said transmission paths for impression on said light source, and means for impressing a signal on one of said transmission paths.

8. A stabilizing system for a modulated light source employed in recording sound comprising means for utilizing a portion of the light from said source for recording sound and another portion of said light for generating electrical currents, a plurality of transmission circuits for said generated electrical currents, means for combining the output of said transmission circuits for impression on said light source, one of said transmission circuits amplifying the components of said generated currents corresponding to the slow variations in light from said source, and the other of said transmission circuits amplifying the components of said generated currents corresponding to the more rapid variations in light from said source, and means for impressing a signal to be recorded on said transmission circuits.

9. A stabilizing system in accordance with claim 8 in which the output impedance of said

transmission circuits are high relative to the load impedance, said outputs being connected in parallel.

10. In combination, a light source adapted to be modulated about a point of predetermined intensity, means for modulating said light source, means for generating currents from said light source, means automatically energy controlling

said light source to compensate for departures from said point of predetermined intensity, said automatic means including a pair of independent transmission channels for said generated currents, and means for impressing the outputs of said independent transmission channels on said light source.

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