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PHOTOELECTRIC DEVICE FOR CONVERTING VARIATIONS IN LIGHT-INTENSITY INTO VARIATIONS IN CURRENT

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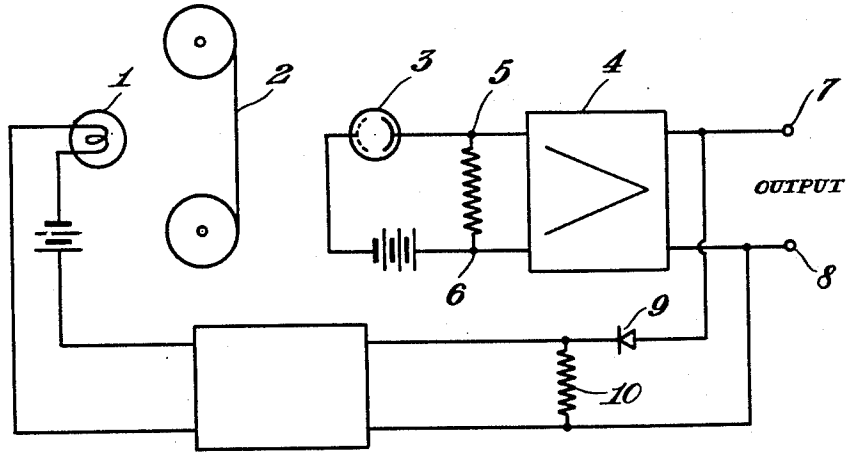


Fig. 1.

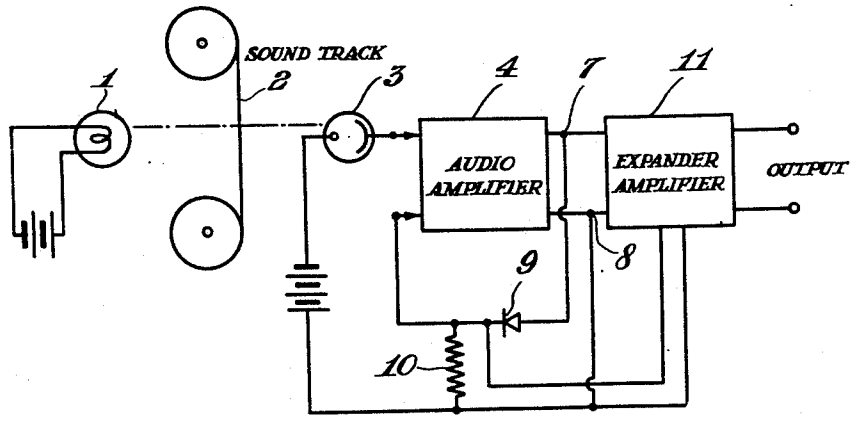


Fig. 2.

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PHOTOELECTRIC DEVICE FOR CONVERTING VARIATIONS IN LIGHT INTENSITY INTO VARIATIONS IN CURRENT

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3 Claims. (Cl. 250—219)

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The present invention relates to a system constituted by a photo-electric cell for converting the variations in light intensity originating from a light source into variations in current, together with an amplifier for the amplification of these variations in current, and more particularly to automatic control means for said system by which the ratio which exists between the variation in current in the photo-electric cell and the variation in light intensity of the light source is rendered greater for small variations in light intensity than for great variations in light intensity.

When in the reproduction of sound use is made of a photo-electric cell for converting variations in light intensity into variations in current, the variations in current have superimposed thereon fluctuations which are due to the irregular electron emission of the sensitive electrode of the photo-electric cell. These fluctuations also give rise to the occurrence of so-called noise in the signal reproduced.

The object of the present invention is to provide means by which the noise in the reproduced signal may be reduced.

According to the invention, this object is achieved by providing automatic control means such that the ratio which exists between the variation in photo-cell current and the variation in the light intensity of the light source is greater for small variations in light intensity rather than large variations in light intensity.

If I is the value of the current in the photo-electric cell originating from the incident light signal, the signal energy is proportional to I^2. The noise energy which occurs is proportional to I, since the variations in current producing noise are proportional to $1\frac{1}{2}$. Consequently, with a strong signal the signal-to-noise ratio will be favourable. With a weak signal, however, this ratio increases and thus becomes less favourable.

According to the invention, by providing an automatic control, as a result of which the photo-electric current with a weak signal acquires a higher value than it would be the case without this control, it is possible to improve, i. e. to reduce the signal-to-noise-ratio even for weak light signals.

In order that the invention may be more clearly understood and readily carried into effect, it will be described more fully by reference to the accompanying drawing wherein:

Fig. 1 is a schematic diagram of one preferred embodiment of the invention, and

Fig. 2 is a schematic diagram of a second preferred embodiment.

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Fig. 1 shows a system for the reproduction of sound recorded on a talking film. The light originating from light source 1 is modulated by the sound track of film 2 and falls upon photo-electric cell 3 included in input circuit 5, 6 of an audio amplifier 4. The amplified signal is taken from output terminals 7, 8. This signal voltage is rectified by rectifier 9 and by means of this rectified voltage light source 1 is controlled in such manner that with a weak signal, i. e. with a small variation in light intensity of the light signal striking the photo-electric cell, the intensity of the light source increases. Thus the variation in current in the photo-electric cell with respect to the variation in light intensity of the light source is made smaller for small variations in light intensity than for great variations in light intensity. Owing to this contrast compression, the photo-electric current produced by weak light signals is greater than it would be the case without the automatic control, resulting in a more favourable (smaller) signal-to-noise-ratio.

It is not necessary for the light intensity of the light source to be controlled by the rectified amplified voltage itself; it is alternatively possible for this voltage to control a device, for example a diaphragm, which regulates the light intensity of the light falling upon the film.

Another form of construction is shown in Fig. 2. In this case the rectified voltage is supplied to photo-electric cell 3 which brings about a displacement of the working point of the photo-electric cell, which is such, that a decrease of the variation in light intensity falling upon the cell involves an increase of the voltage appearing between the electrodes of the cell, resulting in an increase in sensitivity of the latter. As before, it it thus attained that the signal-to-noise-ratio becomes smaller.

The contrast compression resulting from the decrease of noise can be neutralized, if this is desirable for the correct reproduction of the audio signal, for example by providing following audio amplifier 4 another amplifier 11 having contrast expansion, which expander is controlled by the rectified voltage set up at resistance 10. The weak signals are thus weakened with respect to the strong signals, while nevertheless the advantage of the decrease in noise owing to the contrast compression is retained.

What we claim is:

1. In combination, a source of light, a light-sensitive electric device excited by the light of said source, sound track means interposed between said source and said device for varying the

intensity of said light whereby said device produces corresponding current variations, means to amplify said current variations, and compressor means coupled to the output of said amplifying means and responsive thereto for compressing the current variations in said device to cause the ratio existing between the current variations in said device and the average amplitude of said sound track to be greater for relatively small average amplitudes than for large average amplitudes.

2. In combination, an adjustable light source, a light-sensitive electric device excited by the light of said source, a variable width sound track interposed between said source and said device for varying the intensity of said light whereby said device produces corresponding current variations, means to amplify said current variations, and control means coupled to the output of said amplifying means and responsive thereto for adjusting said source to cause the ratio existing between the current variations in said device and variations of the width of the sound track to be greater for relatively small variations of width than for large width variations.

3. In combination, a source of light, a photoelectric cell excited by the light of said source, a variable width sound track interposed between said source and said cell for varying the intensity of said light whereby said cell produces corresponding current variations, an amplifier for said current variations, a rectifier connected to the output of said amplifier to produce a control voltage proportional to the amplified current variations, and means coupled to said rectifier for applying said control voltage to said cell to vary the working point thereof in a direction causing the ratio existing between the current variations in said cell and variations of the width of the sound track to be greater for relatively small width variations than for large width variations.

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