United States Patent

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[33] **Germany**
[31] **G 47,741, G 50,749**

[54] **PHOTORESISTOR CIRCUIT FOR LIGHT MEASURING ARRANGEMENTS**
12 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **95/10,** 95/64, 250/209, 250/220, 356/222
[51] **Int. Cl.** **G01j 1/44,** G03b 7/04
[50] **Field of Search** ..... 95/10A, B,C, 64; 250/208, 209, 210, 220, 229; 356/218, 222, 225, 226, 230, 233; 317/124, 127, 148.5; 356/177

[56] **References Cited**
UNITED STATES PATENTS

2,050,737	8/1936	Schriever	250/210
3,024,695	3/1962	Nisbet	356/226X
3,214,593	10/1965	Killpatrick	250/209X
3,225,646	12/1965	Nagai	356/222
3,321,630	5/1967	Durig et al.	250/209
3,340,764	9/1967	Bergson	356/177
3,441,835	4/1969	Hekrole	356/222

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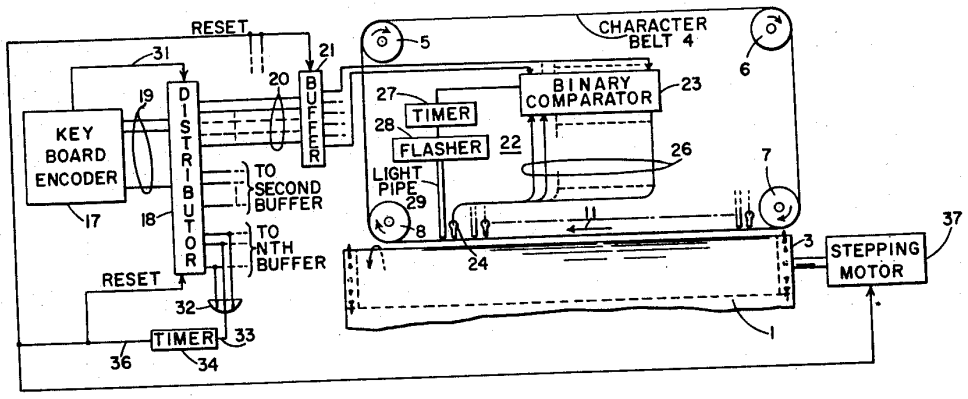
ABSTRACT: A photoresistor circuit for light measuring devices for use with photocameras in which a pair of photoresistors are connected in a voltage divider relationship across a source of potential and are under constant illumination by a light source. While one of the photoresistors is also illuminated by the light received from the object being photographed, whereby the time delay and light memory effects adversely accompanying the photoresistors are eliminated.



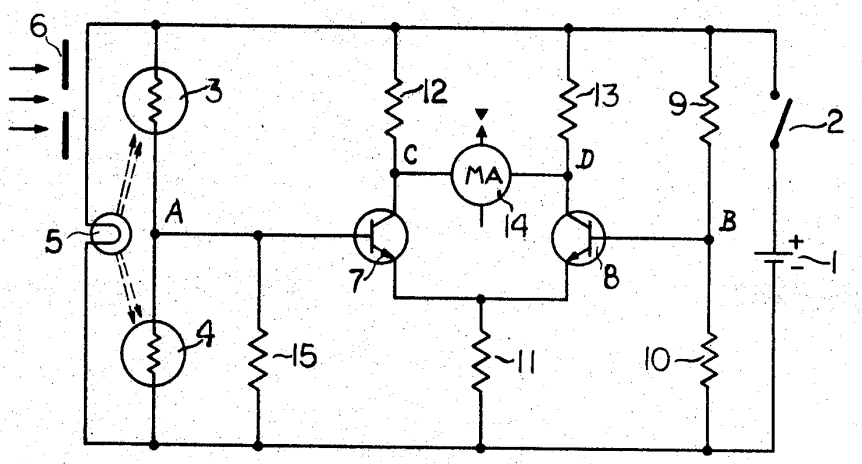


Fig.1

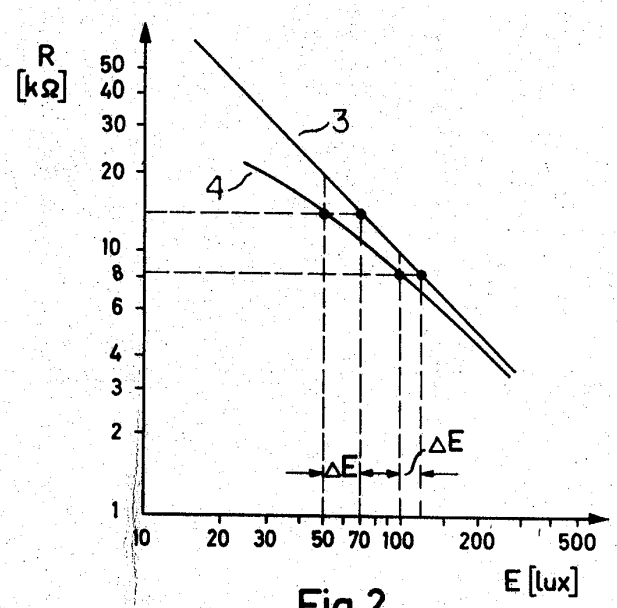


Fig.2

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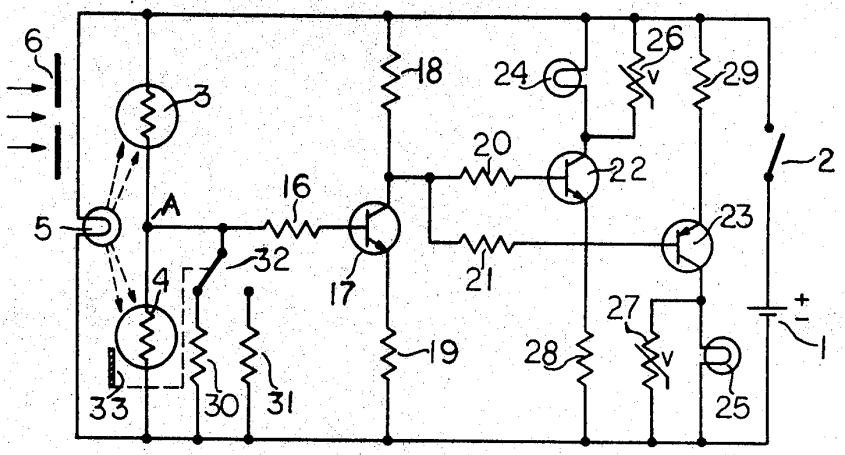

Fig.3

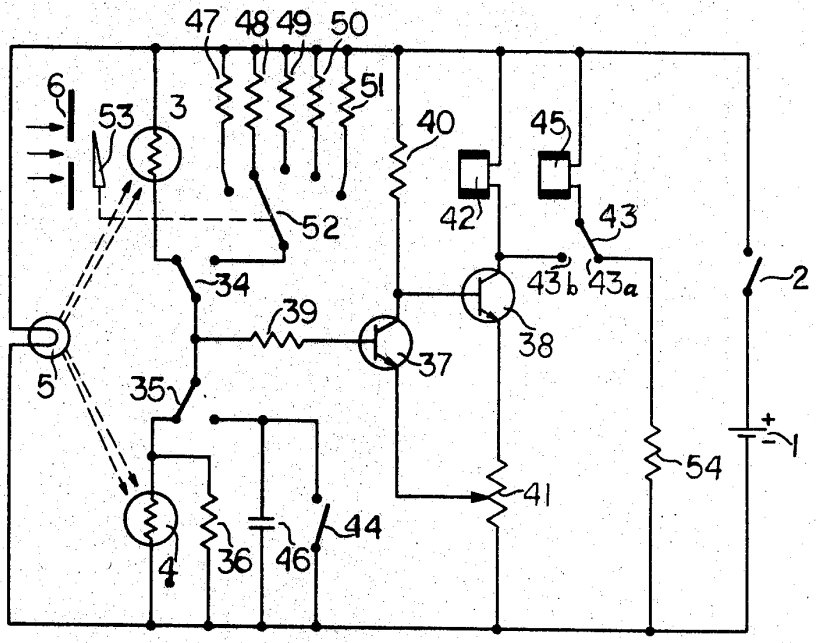

Fig.4

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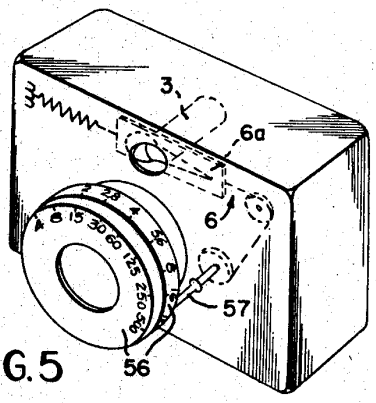

FIG. 5

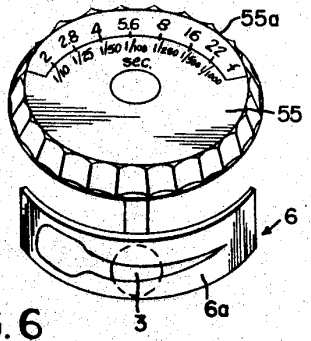

FIG. 6

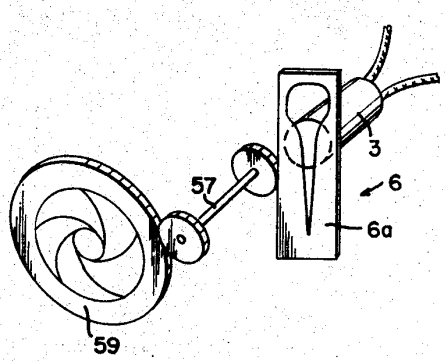

FIG. 7

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PHOTORESISTOR CIRCUIT FOR LIGHT MEASURING ARRANGEMENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a light measuring circuit arrangement and, more particularly, to a circuit arrangement having photoresistors therein connected in voltage divider relationship with a source of potential and being exposed to a constant and to a differential light intensity.

2. Description of the Prior Art

Photoresistors, instead of photo-voltaic elements, have found a steadily growing application in photographic exposure meters and exposure control units, since by means of the former a higher sensitivity can be attained. A disadvantage accompanies the photoresistors in that they require the use of a battery. However, with the advance of the technology electronic circuits are more frequently employed in exposure meters and exposure control units, which circuits require the presence of a battery in any case. Therefore, the above-mentioned drawback of photoresistors when compared with those of selenium photoelectric elements, for example, is negligible. Nevertheless, even in the case of electronic circuits, there are still two undesired properties of photoresistors present, namely the time delay and the so-called light memory. The time delay is longest when the illumination intensity is low; the light memory more adulterates the result of measurement when the difference between the light intensity to which the photoresistor has been exposed before the measurement, and that which is being measured is greatest.

SUMMARY OF THE INVENTION

It is, therefore, the primary object of this invention to eliminate effectively the above-mentioned defects, namely the time delay and light memory in electronic exposure meters and exposure control units.

According to the present invention, this object is attained, so that a pair of photoresistors are connected to form a voltage divider, both photoresistors being permanently and constantly illuminated by an internal light source and that one of the photoresistors is additionally exposed to the light reflected by the object being photographed.

It is the advantage of this arrangement that, due to the additional illumination, the actual measuring photoresistor operates at a higher light level whereby its time delay is considerably reduced.

Furthermore, in view of the additional illumination, the ratio between both illumination intensities to which the photoresistor is exposed during the measurement of two different objects, is diminished so that the error arising from the light memory is considerably reduced.

As a consequence of the constant illumination of both photoresistors, the intensity variations of the light source which constantly illuminates both photoresistors have no influence on the measurement.

The manner in which the above objects of the invention are accomplished is more fully described below with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of one embodiment of the photoresistor circuit according to this invention;

FIG. 2 is a graph showing the relation between the resistance of the photoresistors of FIG. 1 and the illumination;

FIG. 3 is a schematic diagram of another embodiment of the photoresistor circuit for exposure meters or exposure control units;

FIG. 4 is a schematic diagram of the photoresistor circuit according to this invention as used in connection with a light responsive adjustment of electronically controlled shutters in cameras;

FIG. 5 shows a camera with adjusting means for the light attenuator coupled to the camera settings;

ring of a manual exposure meter; and

FIG. 7 illustrates in more detail the coupling of the light attenuator to the objective diaphragm.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The first exemplary embodiment of this invention is shown in FIG. 1, representing an electronic balanced exposure meter or exposure control unit provided with a null galvanometer. Both photoresistors 3 and 4 are connected in a series with battery 1 and switch 2. A small pilot lamp 5 is arranged in parallel to the photoresistors and after switching on switch 2, it illuminates constantly both photoresistors 3 and 4. In front of the photoresistor 3 there is provided an adjustable light attenuator 6, such as an adjustable diaphragm. A differential amplifier is operatively connected to the photoresistor voltage divider which is formed by photoresistor 3 and photoresistor 4. For this purpose, the top A of the photoresistor voltage divider is connected to the base of a first transistor 7, whereas a second transistor 8 has its base connected to the top B of a voltage divider which is formed by ohmic resistors 9 and 10 having their end terminals connected also in series with battery 1 and switch 2. The emitters of both transistors 7 and 8 are connected via a resistor 11 to the minus pole of battery 1, whereas the collectors are connected via resistors 12 and 13, respectively, to the plus pole of battery 1. Between the connection point C of transistor 7 and resistor 12 on the one hand and the connection point D of transistor 8 and resistor 13 on the other hand, a null galvanometer 14 is connected. A resistor 15, connected in parallel to the photoresistor 4 is used to adjust the characteristic curve of the latter to that of photoresistor 3.

The above-described arrangement operates as follows: After the switch 2 has been closed, the pilot lamp 5 illuminates both photoresistors 3 and 4. The photoresistor 3 is in addition also exposed to the light reflected from the object being photographed and passing through the adjustable diaphragm 6. The photoresistor voltage divider formed by photoresistors 3 and 4 controls transistor 7, whereas transistor 8 is controlled by means of an ohmic voltage divider formed by resistors 9 and 10. In response to the illumination intensity upon photoresistor 3 which is affected by the incident light, electric current flows through the null galvanometer 14 either in the one direction or in the opposite one. The null instrument current may be set or balanced by adjusting the light attenuator 6, to vary the illumination intensity on photoresistor 3.

As shown in FIG. 6, the adjusting member of the light attenuator 6 is, in case of a manual exposure meter, coupled with a knob 55 provided with a scale means, such as, for example, a graduated ring 55*a*. Provided that the exposure control unit is present in the camera 58, as illustrated in FIG. 5, then the adjusting member 6*a* is coupled by coupling means 57 with the setting means 56 of the camera.

The mode of operation of the resistor 15 will now be described in more detail. Even if the pilot lamp 5 transmits less light due to its natural aging or due to low voltage in the battery, no adulteration of the measurement will occur. Be assured that no current flows through the galvanometer 14 if an equal voltage drop is on photoresistors 3 and 4, the characteristic curves of which, $R=f(E)$ (whereby R = the resistance of photoresistors in K ohms and E = the illumination in lumen) being graphically illustrated in FIG. 2. For example, the pilot lamp 5 illuminates the photoresistors 3 and 4 by 100 lumen, respectively. Due to this action, the photoresistor 3 has a resistance value of 10K ohms and the value of the photoresistor 4 is 8.2K ohms. Now, when the light reflected from the object being photographed increases the illumination intensity on the photoresistor 3 to an extent when a resistance ratio 1:1 sets in, then the galvanometer 14 is without current again. In the aforementioned example, an additional illumination $\Delta E=20$ lumen is necessary to attain the above result.

If the photoresistors 3 and 4 due to the decreased brightness of the pilot lamp 5 are illuminated by 50 lumen each, the re-

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