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(54) Lighting or flash device

(57) The device has a flash tube (10) with associated ignition circuit and at least two energy stores (2, 3) such as electrolytic capacitors. Individual voltage regulators allow for the stores to be charged to adjustable voltages independently of each other. By appropriate selection of the voltages of the energy stores (2, 3), the colour temperature of the tube (10) can be kept constant within acceptable limits. The voltages of the stores can be varied stepwise or continuously. The stores may have different capacities.

Fig.1

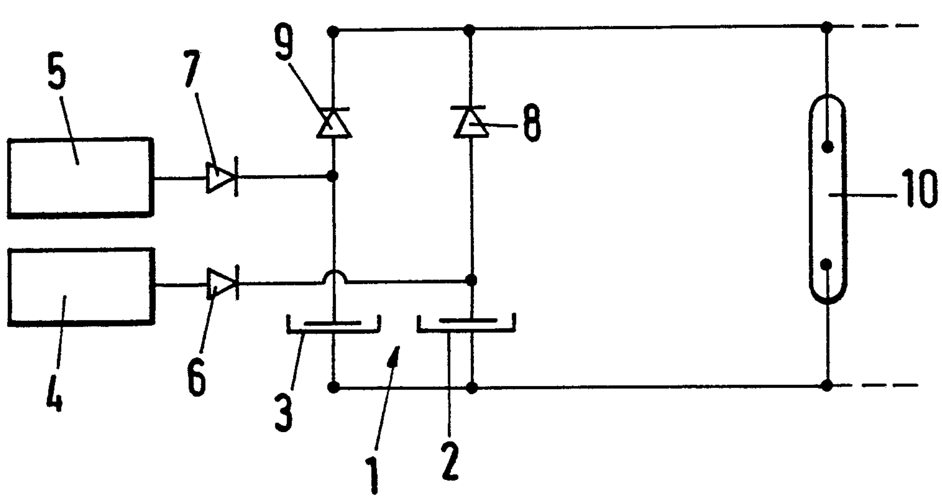

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Fig.1

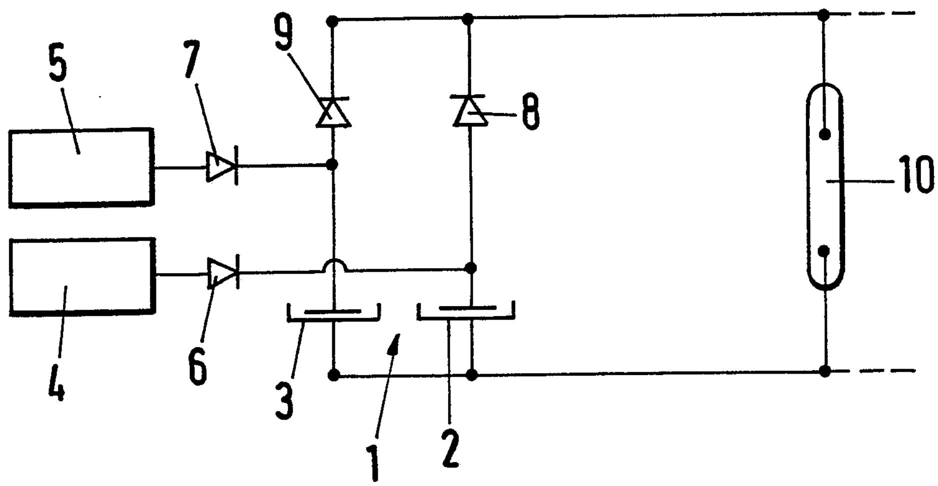
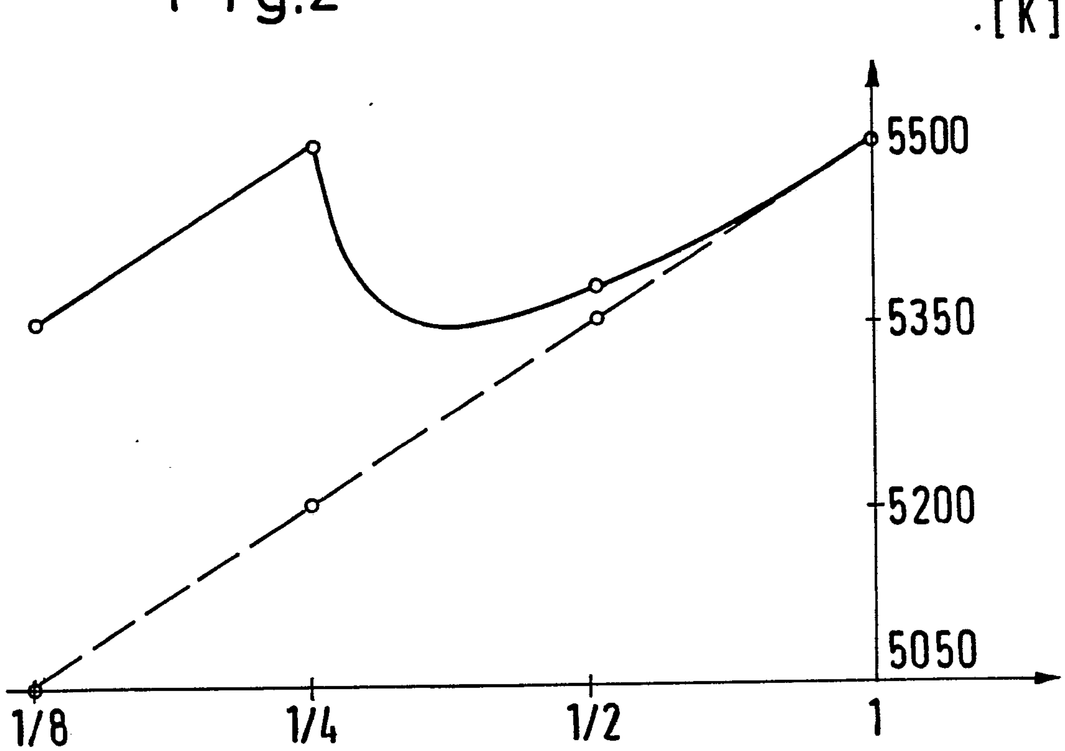
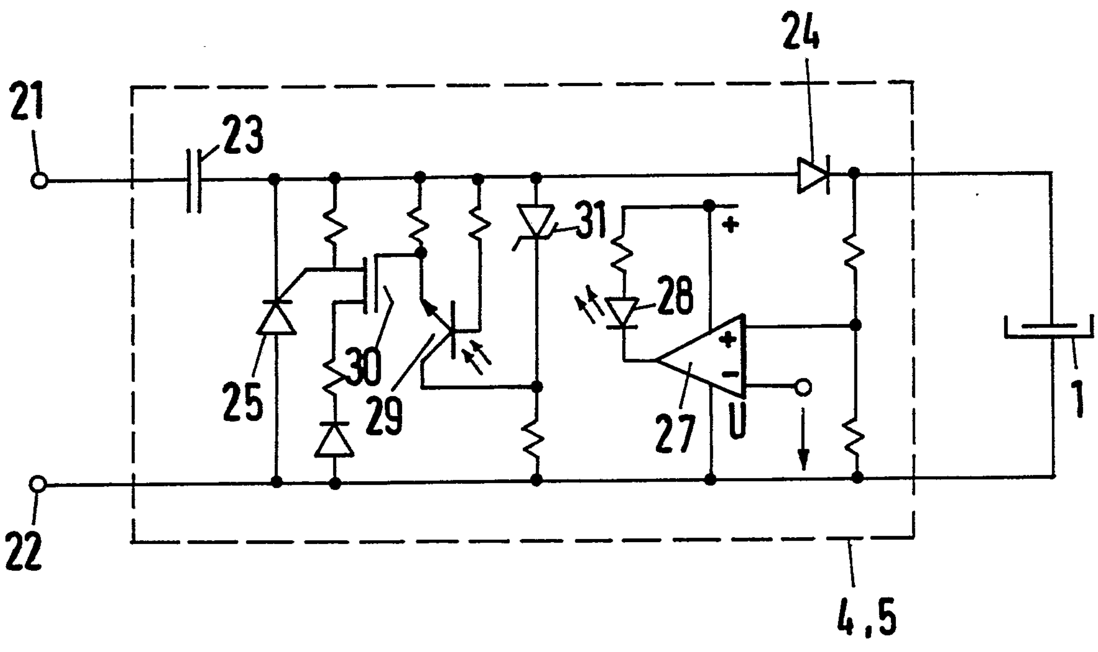


Fig.2



F i g.3



LIGHTING OR FLASH DEVICE

The invention relates to a lighting or flash device according to the preamble of Claim 1.

It is known that the colour temperature of flash units varies, when their output is modified by a variation of the voltage at the energy stores. A higher voltage produces a more bluish light, i.e. a higher colour temperature and a lower voltage produces a deeper colour temperature, i.e. a more yellowish light.

It is known to vary the flash energy by switching on and off energy stores charged to this voltage. Indeed, the energy graduation can consequently only be carried out in rough steps, so that a fine or accurate adjustment of the flash energy is not possible.

It is also known (DE-OS 36 12 164), in a lighting or flash device, to allow an amplitude control and a time control to cooperate in combination so that with the quantity of light emitted, the desired colour temperature is obtained. Due to a suitable choice of the charging voltage, i.e. of the amplitude, and of the flash duration, with a predetermined quantity of light, the desired colour temperature can be adjusted. This device is relatively expensive on account of the necessary output semiconductors.

It is the object of the invention to construct the lighting or flash device of the aforementioned general type so that an at least approximate stabilisation of the colour temperature can be achieved with simple and economical means.

This object is achieved according to the invention in the lighting or flash device of the aforementioned general type, with the characterising features of Claim 1.

In the device according to the invention, the entire energy store is divided into at least two energy stores, which can each be controlled separately as regards their voltage. If the flash energy has to be regulated back from the maximum, at which both energy stores are fully charged, then first of all one energy store is reduced in its voltage successively to zero, whereas the other energy store can still be operated at full voltage. The resulting colour temperature is a mixture of the contributions of the various energy stores; with a corresponding division of these energy stores, the colour temperature can be kept constant within acceptable limits, which are admissible in practice. At the same time, it is possible to achieve a very fine graduation of the metering of light, because the voltage variation at the individual energy stores is possible in fine, i.e. very small steps.

Further features of the invention will become apparent from the other Claims, the Description and the drawings.

The invention will be described in detail with reference to one embodiment illustrated in the drawings, in which:

Figure 1 shows a circuit of a flash unit according to the invention,

Figure 2 shows in a diagram the dependence of the flash energy on the colour temperature in the flash unit according to the invention,

Figure 3 shows a circuit of a charging voltage regulator of the flash light unit according to the invention.

The colour temperature of flash units may be varied, when their output is altered due to a variation of the voltage at the energy stores, which are preferably electrolytic capacitors. A higher voltage leads to a higher colour temperature, i.e. to a more bluish light. A lower voltage accordingly produces a lower colour temperature, or a more yellowish light. With the construction described hereafter, it is possible to keep the colour temperature approximately constant independently of the respective flash energy or to set a predetermined colour temperature. With this flash unit, photographs can consequently be taken which are characterised by an optimum colour temperature. Thus it is quite possible to obtain the same colour temperatures even with different flash energies.

In order to achieve a stabilisation of the colour temperature with simple and economical means, the entire energy store 1, preferably a flash capacitor, of the flash unit, is divided into individual partial sets 2 and 3 of energy stores. The voltage of both partial sets 2 and 3 can be regulated independently of each other. For regulating the charging voltage, a charging voltage regulator 4 and 5 is associated with each partial set 2 and 3, which regulator is followed by a rectifier 6, 7, such as a diode. The partial sets 2 and 3 connected in parallel are connected to at least one flash tube 10 respectively by way of a rectifier 8 and 9. In the embodiment illustrated, only two partial sets 2 and 3 are shown for the sake of simplicity. Naturally, the energy store 1 may be divided into more than two partial sets of energy stores, preferably flash electrolytic capacitors. Even in this case, each partial set can be regulated per se as regards the voltage.

The two charging voltage regulators 4 and 5 advantageously have the same construction. The alternating voltage applied between mains connections 21, 22 (Figure 3) operates a doubler circuit, consisting of a capacitor 23, a diode 24 and a thyristor 25. The doubler circuit charges the flash capacitor 1 as long as the thyristor 25 receives a triggering signal at its gate. The triggering of the thyristor 25 takes place by comparison of the actual flash voltage at the flash capacitor 1 with a predetermined reference value in a comparator 27. If the actual value of the voltage at the flash capacitor 1 is less than the desired reference value, then the comparator 27 switches on an opto-coupler, consisting of a diode 28 and a phototransistor 29, so that the thyristor 25 receives a triggering signal by way of a transistor 29 and an FET 30. As soon as the desired voltage is reached, the comparator triggers and the triggering signal ceases, so that the doubler circuit ceases to charge the capacitor 1. Together with a resistor 32, a zener diode 31 serves for supplying this triggering circuit.

In order to obtain the lowest possible deviation of the colour temperature, the energy is distributed to the partial sets 2 and 3 so that the desired, approximate colour constancy is achieved. If, for example, the flash energy is regulated back from the maximum, then first of all the voltage of an individual partial set is reduced gradually to zero, while the other partial sets are still operated at full voltage. The resulting colour temperature thus represents a mixture of the contributions of the various partial sets. With a corresponding division of these partial sets, the colour temperature can thus be kept constant within acceptable limits. This will be described in detail hereafter with reference to the drawings, for a division of the energy store 1 into the two partial sets 2 and 3.

If the total capacity of the energy store 1 is assumed to be one, then in the embodiment, the partial set 2 has 3/4 of this total capacity and the partial set 3 has 1/4 of this total capacity. The numerical values given hereafter are based on the assumption that the colour temperature varies by 150° K per aperture step, if the flash voltage is reduced by the factor $\sqrt{2}$. In this case, one aperture step corresponds to halving the flash energy. Furthermore, the embodiment described hereafter is based on the assumption that the deviation in the colour temperature should be minimal in a variation range of three aperture steps.

If the full flash energy is available, then the two partial sets 2 and 3 are each 100% charged. When the flash is used, in the embodiment, a colour temperature of 5,500° K results. If the flash energy is now reduced by half, thus to the factor 1/2, then it is sufficient if solely the partial set 3 is 100% charged, whereas the partial set 2 needs solely to be charged to 1/3. Both partial sets together then emit half the flash energy. As shown in Figure 2, the colour temperature in this case (full line) is only reduced a little. The reduction amounts to less than 150° K; such a colour temperature reduction would occur (broken line in Figure 2), if solely one energy store 1 were present. This slight colour temperature reduction is so low that generally it is not perceived as troublesome and is not serious for the majority of photographs.

If the flash energy is halved again, thus is reduced to 1/4, then the partial set 2 is no longer charged, whereas the partial set 3 is charged to 100%. Since, in this case, the partial set 2 does not contribute to the colour temperature, a total colour temperature of 5,500° K is again produced. In the case of a conventional flash unit with only a single energy store, in this case the colour temperature would already have dropped to 5,200° K (broken line in Figure 2).

If the flash energy is halved again, so that it amounts solely to 1/8 of the full flash energy, then the partial set 3 is charged solely to 50%, whereas the partial set 2 is not charged. A slight reduction of the colour temperature to 5,350° K then occurs. With a conventional flash unit with only one single energy store, in this case the colour temperature would already have dropped to 5,050° K.

As the embodiment described shows, the resulting colour temperature is a mixture of the contributions of the various partial sets 2 and 3. The capacity of these energy store partial sets can be chosen so that the colour temperature can be kept constant within relatively narrow limits, independently of the respective flash energy. If more than two partial sets are used for the energy store, then for different flash energies, the variation of the colour temperature can be kept within even narrower limits than is illustrated by means of the above embodiment.

As the embodiment described shows, the colour temperature cannot remain constant theoretically, but can be kept within tolerances which are admissible in practice. At the same time, a very fine graduation of the light metering can be achieved, because the voltage variation at the individual partial sets is possible in fine steps.

In the embodiment described, the method of operation of the flash unit has been described with reference to three aperture step variations. Naturally, less or more variations of the aperture steps are also possible, the individual partial sets of the energy store 2 being constructed as regards their capacity so that the colour temperature remains within predetermined limits, independently of the flash energy. In this case, nothing changes in the method described.

Claims

1. Lighting or flash device with at least one flash tube and associated ignition circuit and with at least two energy stores (flash capacitors), characterised in that the voltage of the energy stores (2, 3) can be adjusted independently of each other.

2. Device according to Claim 1, characterised in that the voltage of the energy stores (2, 3) can be regulated step by step.

3. Device according to Claim 1, characterised in that the voltage of the energy stores (2, 3) can be regulated infinitely.

4. Device according to one of Claims 1 to 3, characterised in that the energy stores (2, 3) have a different maximum capacity.

5. Lighting or flash device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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