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LIGHT-SOURCE IN CONNECTION WITH A FILTER

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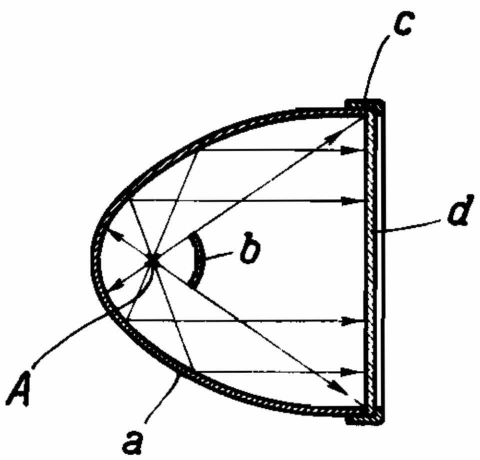

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LIGHT-SOURCE IN CONNECTION WITH A FILTER

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Knowledge has been obtained of a suggestion whereby a light-source is to be connected with a filter which transmits part of the radiation emanating from the light-source and which reflects the remaining part of such radiation. The device was intended to transmit the visible radiation while the infra-red invisible radiation was to be thrown back upon the light-source, so as to increase the temperature of the latter and thus to enhance the output of energy. The filter to be used in this connection was to consist of a thin layer of metal such as of gold for instance.

According to the invention however the problem in question cannot be solved unless the filter resorted to is one of the interference type, i. e., a filter consisting of several thin layers where the radiation is split up by interference phenomena into a transmitted and a reflected portion of light. The material difference between said filters and those consisting of a single thin layer of metal lies in the following: A single metal layer, though being capable of transmitting the visible and reflecting the infra-red radiation, is not however adapted for bringing about an improvement in the energy output, since, if by means of such a metal layer the infra-red radiation, is to be substantially reflected, the visible radiation will be absorbed by said layer to such a high degree that the increase in the temperature of the light-source occasioned by the radiation being thrown back upon it just about suffices to compensate the loss of visible radiation caused by said absorption. Interference filters, however, can be so designed that the desirable radiation will be transmitted to a high degree while at the same time the undesirable radiation is reflected to a high degree. Interference filters are for this reason adapted for increasing the entire output of light and for achieving the approximate state of cold radiation outside of the device.

The following is cited as a numerical example. Supposing, for instance, that in accordance with the aforegoing suggestion a 20 mμ gold layer be used, then its reflexion for infra-red rays of a wavelength of 1 μ will amount to about 85% and its transmission for yellow light of 578 mμ about 40%. Hence, as demonstrated by a computation, the influence of the reflexion of the intra-red rays upon the light rays only just suffices to compensate the loss caused by the absorption of the visible radiation, i. e. the energy output is not being increased. A silver layer of 25 mμ thickness would likewise result in the reflexion of the radiation of a wavelength of 1 μ amounting to about 85%, while its transmission for for light of a wavelength of 578 mμ would amount to anly about 20%, so that the energy output would be inferior to that obtained with a thin gold layer or in other words, the output would be less satisfactory than without the employment of a filter altogether. However, when using an interference filter consisting of two silver layers of 25 mμ thickness each and of a collodium layer of 1 μ thickness a reflexion of 95% is obtained for infra-red radiation and thereby a transmission of 35% for yellow light. A computation shows that, with the energy requirements being reduced to a half, the same output of visible radiation is obtained as would be the case without the employment of any filter at all.

The device in question can be designed in many varying ways. What it will be expedient to avoid if possible, is that the rays fall on absorbing layers prior to falling upon the interference filter as the radiation so absorbed is practically no longer available for increasing the temperature of the light-source. Hence, when using an incandescent lamp as a light-source, purposes will best be served if the filter is provided for in the interior of the bulb.

A particularly suitable design of the invention results if the light-source is disposed in a searchlight projector which essentially projects parallel light rays and if the opening of said projector is closed by an interference filter. In the case of such an arrangement the projector may be one of the usual design, it requiring but the interposition of the filter to impart to it the advantages achievable by the invention.

In the annexed drawing a constructional example of the invention is illustrated in section. A light-source A is situated in the focal point of a parabolic metal reflector *a*. Concentrically to the light-source a spherical-reflector *b* is disposed. The opening of the parabolic reflector *a* is closed by an interference filter *d* held by a mount *c*. The dimensions of the spherical reflector are so chosen that it reflects upon the light-source all rays which would fall upon the interference filter, without having previously fallen upon the parabolic reflector.

The rays reflected by the parabolic reflector fall upon the interference filter. Unless not absorbed, but reflected by said filter, the parabolic reflector will reflect them upon the light-source whose temperature they will increase.

The constructional example illustrated in the annexed drawing contains a searchlight projector of the usual type to which an interference filter has been added.

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