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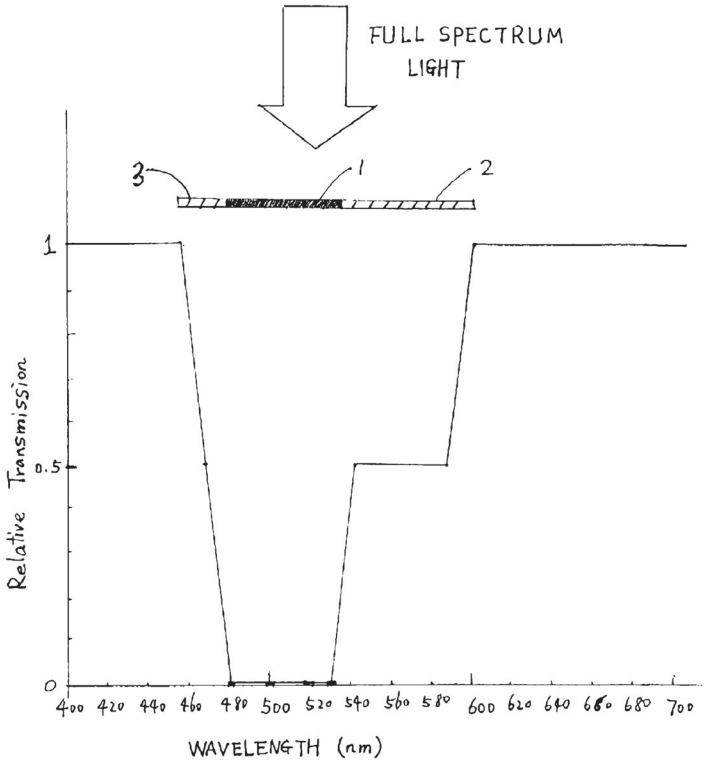
(54) **METHODE ET APPAREIL PERMETTANT D'EVITER LES EFFETS D'UN DECALAGE HORAIRE**

(54) **METHOD AND APPARATUS FOR AVOIDING JET LAG OR SHIFT LAG**



(57) Méthode permettant d'éviter que la lumière, par sa présence sous forme de spectre continu au cours de périodes où le corps humain ne s'attend pas en recevoir, ait un impact sur l'horloge biologique. Cette méthode consiste notamment à filtrer la lumière en spectre continu avant qu'elle atteigne les yeux de l'utilisateur, le filtre de lumière utilisé bloquant en grande partie la lumière incidente sur une bande de longueurs d'onde comprise à peu près entre 480 et 530 nm. Ce filtre atténue en outre au moins la moitié de l'intensité de la lumière sur des

(57) A method of avoiding the influence of light on a biological clock caused by the presence of ambient full spectrum light during intervals unexpected by the human body comprising causing the full spectrum light to pass through a light filter prior to entering the eyes of a user, the filter light substantially blocking incident light in a band of wavelengths between about 480 and 530 nm and substantially restricting at least half of the intensity of light in bands of wavelength between about 460 - 480 nm and between about 530 - 590 nm while minimally

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bandes de longueur d'onde comprises approximativement entre 460 et 480 nm et entre 530 et 590 nm tout en limitant dans une faible mesure l'intensité de la lumière sur les bandes de longueurs d'onde comprises entre 400 et 460 nm et entre 600 et 700 nm. Il suffit d'après cette méthode de poursuivre ses activités normales en tirant parti de la lumière qui a traversé le filtre ainsi que de la lumière visible située sur les bandes de longueurs d'onde extérieures à celles où la lumière est bloquée.

restricting the intensity of light in bands of wavelengths between 400 - 460 nm and between 600 - 700 nm, and conducting normal activites using visible light which has passed through the filter and visible light in bands of wavelengths outside the bands in which light is restricted.

ABSTRACT

A method of avoiding the influence of light on a biological clock caused by the presence of ambient full spectrum light during intervals unexpected by the human body comprising causing the full spectrum light to pass through a light filter prior to entering the eyes of a user, the filter light substantially blocking incident light in a band of wavelengths between about 480 and 530 nm and substantially restricting at least half of the intensity of light in bands of wavelength between about 460 - 480 nm and between about 530 - 590 nm while minimally restricting the intensity of light in bands of wavelengths between 400 - 460 nm and between 600 - 700 nm, and conducting normal activites using visible light which has passed through the filter and visible light in bands of wavelengths outside the bands in which light is restricted.

METHOD AND APPARATUS FOR AVOIDING JET LAG OR SHIFT LAG

FIELD OF THE INVENTION:

This invention relates to a light filter that can be used to adjust the biological internal clock of a human.

BACKGROUND OF THE INVENTION:

It has been observed that humans regulate their internal biological systems according to a daily rhythm. One of the biological systems which is regulated by an internal biological clock controls rhythms of alertness and mental functioning. Should the human internal biological clock which is ordinarily controlled by a daily light-dark cycle be disturbed, such as by the human travelling across a number of time zones or by shift working, a functional disorder can occur resulting from the desynchronization of activity and alertness cycles with the sleep-wake cycle of the human. This desynchronization of the sleep-wake cycle from the desired activity cycle, which sometimes is referred to as jet-lag or shift-lag, results in sleepiness at times when alertness is necessary, an inability to concentrate, reduced mental capacity and agitation and/or depression in some individuals.

In order to avoid jet-lag or shift lag, the sufferers have been told to restrict sunlight from reaching the eyes to avoid the biological internal clock from being reset at an undesired time. However this reduces the amount of light to such a low level that a person cannot function normally.

In my previous patent "Biological Cycle Affecting Goggles" (U.S. Patent 5,402,190, issued March 28, 1995), goggles are described which when used by a person, substantially avoids the above problem. The goggles substantially block the transmission of light at

wavelengths of between about 480 and 530 nm from reaching the eyes, allowing a person wearing the goggles to function normally by viewing surrounding objects using the intensity of other wavelengths of visible light without the biological clock being reset.

However it has now been determined that the eye adjusts its sensitivity depending on the intensity of light to which the retina has been or is exposed and can be similarly affected by recent history of this exposure. Thus, for example, if the ambient light is of high intensity such as over 150,000 lux on a bright sunny day, the eye reduces its sensitivity, and the intensity of light may overwhelm the effects of the goggles. Furthermore, the sensitivity of eyes varies from person to person; that is, the same goggles might be effective for one person but might not be as effective for another person, or as a person having a different recent exposure history. I have determined that under some such conditions the filter described in the aforenoted patent may not be optimum.

SUMMARY OF THE INVENTION:

I have now discovered that the change in sensitivity of the eye can be compensated for by restricting at least half the intensity of incident light in two light bands adjacent the previously discovered band of 480-530 nm, the two adjacent bands being between 460 and 480 nm and between 530 and 590 nm. Wavelengths of light between 400 and 460 nm and between 600 and 700 nm should be minimally restricted.

I have discovered that a device that substantially blocks the transmission of light of wavelengths between 480 and 530 nm and restricts at least half of the intensity of incident light with wavelengths of between 40 and 480 nm as well as 530 and 590 nm and minimally restricts the wavelengths of

between 600 and 700 nm will prevent normal exposure to light from influencing the timing of internal biological clock for a larger number of people than my earlier invention, while still permitting functional vision using the intensity of other wavelengths of visible light that is allowed to reach the retina. This invention thus will prevent people with sensitive eyes and people with less sensitive eyes from having their biological internal clocks being reset at undesirable times caused by exposure to full spectrum light wavelengths.

Using the present invention, people with sensitive or less sensitive eyes can prevent their biological internal clocks from being reset when travelling across different time zones in a short time interval, such as pilots and airline passengers. These persons will be able to fly and arrive at their destinations with increased safety. Such persons can also attend meetings without the detriment of jet-lag dulling their thinking acuity. Thus the ability to interact completely in the local environment without the jet-lag detriment provides a major benefit.

An embodiment of my invention includes a light filter that substantially blocks light in wavelengths of between 480 and 530 nm and substantially restricts at least half of the intensity of the light in the band of wavelengths between 460 to 480 nm and in the band of wavelengths between 530 to 590 nm from reaching the eyes of the user. The light in wavelengths of between 400 and 460 nm and between 600 and 700 nm should be minimally restricted.

The light blocking material of the filter can be formed by a combination of three different blocking filters, of which one filter blocks light having wavelength in a band of between about 480-530 nm, one

filter restricts at least one half of the light having wavelength in a band of between about 530-590 nm and the other filter restricts at least one half of the light having wavelength in a band of between about 460-480 nm.

An embodiment of my invention includes a goggles which is made of the filter or filters as descried above.

Another embodiment of my invention includes a contact lens which can be worn to avoid resetting of the biological clock caused by the presence of full spectrum light during intervals unexpected by the human body, the contact lens being comprised of the filter or filters described above.

The present invention can be made in the form of flying goggles, contact lenses, reading glasses, driving glasses, etc., the glasses (spectacles) or goggles preferably having side flaps for blocking light which has not passed through the light blocking material from entering the eye, or which themselves are formed of filter material having the characteristics described above.

BRIEF INTRODUCTION TO THE DRAWINGS:

A better understanding of the invention will be obtained by reference to the detailed description below, and to the following drawings, in which:

Figure 1 is a spectral graph and a light filter illustrating characteristics of the filter in accordance with an embodiment of the invention;

Figure 2 is a spectral graph and a light filter of a different form than that of the embodiment of Figure 1, in accordance with another embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION:

Figure 1 illustrates a representative spectrum of visible light which reaches the eye after passing

through a light filter, and a light filter in accordance with an embodiment of the present invention. Figure 2 illustrates another filter than can produce a similar spectrum.

The filter in accordance with the embodiment of Figure 1 can be divided into three parts, shown in the frequency domain: part 1 is made of a blocking material which blocks a band of incident light wavelengths between about 480 and 530 nm and parts 2 and 3 are made of a blocking material which partially blocks the intensity of the incident band of light wavelength between 530-590 nm and between 460-480 nm respectively. All of these three parts are formed into one piece to make a filter.

The filter in accordance with the embodiment of Figure 2 and which is also shown in the frequency domain is formed of three different filters which respectively block or partially block light of different bands of wavelengths: filter 4 blocks the wavelength of between 480-530 nm; filter 5 restricts at least half of the intensity of the incident light of wavelength between 460-480 nm and filter 6 restricts at least half of the intensity of incident light of wavelength between 530-590 nm.

Light in the remainder of the spectrum on both sides of the blocked and partly blocked bands in Figure 1 and Figure 2, and in particular wavelengths between 400 - 460 nm and between 590 - 700 nm are received by the eye substantially without bandwidth restriction.

It should be noted that the filters of Figures 1 and 2 are wavelength diagrams and are not spacial diagrams. Thus the parts 1, 2 and 3 of the filter of Figure 1 permeate and are homogeneous throughout the filter. The parts 1, 2 and 3 of the filter of Figure 2 are layered, and may be laminated together with or

without a clear substrate or be coated on a clear substrate.

A person who has normal or at least temporarily sensitive eyes or desensitized and rapidly travels across different time zones and wishes to avoid resetting of his biological clock caused by the presence of full spectrum light during intervals unexpected by that person's body, wears an appliance which carries or is formed of filters as described above through which light is passed to his eyes. The appliance is worn during exposure to the light at times that the biological clock of the wearer expects it to be dark, while the wearer can still function normally by using the remaining of the visible light that is not blocked by the said goggles.

The filters can be formed of or formed into the lenses of the goggles, contact lenses or spectacles themselves. Alternatively filters, such as gel filters can be coated on or fixed to clear lenses, or can be removably attached to them as in a pair of clip-on sunglasses which attach to spectacles.

A person understanding this invention may now conceive of alternative structures and embodiments or variations of the above. All of these which fall within the scope of the claims appended hereto are considered to be par of the present invention.

I Claim:

1. A method of avoiding the influence of light on a biological clock caused by the presence of ambient full spectrum light during intervals unexpected by the human body comprising causing the full spectrum light to pass through a light filter prior to entering the eyes of a user, the filter light substantially blocking incident light in a band of wavelengths between about 480 and 530 nm and substantially restricting at least half of the intensity of light in bands of wavelength between about 460 - 480 nm and between about 530 - 590 nm while minimally restricting the intensity of light in bands of wavelengths between 400 - 460 nm and between 600 - 700 nm, and conducting normal activities using visible light which has passed through the said filter and visible light in bands of wavelengths outside the bands in which light is restricted.

2. A method as defined in claim 1 in which said normal activities include flying an airplane.

3. A method as defined in claim 1 in which said normal activities include driving a vehicle.

4. A method as defined in claim 1 in which said light filter is a gel coating on a light transmissive glass or plastic lens.

5. A method as defined in claim 1 in which said light filter is formed by a combination of three different blocking filters, of which one filter blocks incident light having wavelength in a band of between about 480 - 530 nm, one filter restricts at least one

half of the intensity of light having wavelength in a band of between about 530 - 590 nm and the other filter restricts at least one half of the intensity of light having wavelength in a band of between about 460 480 nm.

6. A method as defined in claim 1 in which the light filter forms at least an effective portion of one of a pair of goggles, a pair of spectacles, a pair of contact lenses and a pair of clip-on filters for a pair of spectacles.

7. Contact lenses comprising one of plastics and glass which block visible light in a band of wavelengths between about 480 - 530 nm and restrict at least half of the intensity of incident light in bands of wavelengths between about 460 - 480 nm and 530 - 590 nm and which allow visible light having wavelengths of said bands to pass substantially unrestricted.

8. Spectacles having lenses comprised of material which blocks visible light in a band of wavelengths between 480 - 530 nm and which restrict at least half the intensity of light in bands of wavelengths between 460 - 480 nm and 530 - 590 nm and which allow visible light having wavelengths outside of said bands to pass substantially unrestricted.

9. Spectacles as defined in claim 8, further including light blocking flaps connected to opposite side edges of the lenses for blocking light which has not passed through said material from entering the eye.

10. Goggles comprising one of plastics and glass which block visible light in a band of wavelengths between about 480 - 530 nm and restrict at least half

of the intensity of incident light in bands having wavelengths between about 460 - 480 nm and 530 - 590 and which allow visible light having wavelengths outside and on each side of said band to pass substantially unrestricted.

11. A light filter for filtering ambient light prior to entering the eye of a user comprising material which blocks visible light in a band having wavelengths of between about 480 - 530 nm and restricts at least half of the intensity of incident light in bands of wavelengths between about 460 - 480 nm and 530 - 590 nm, and which minimally restricts light having wavelengths between about 400 and 600 nm and between 600 and 700 nm.

12. A light filter as defined in claim 11 formed of plural laminated filters and restricting light in a respective band of said wavelengths between about 460 and 590 nm.

13. A light filter as defined in claim 11 supported on a clear substrate.

14. A light filter as defined in claim 13 in which the filter is coated on the substrate.

15. A light filter as defined in claim 11 forming an effective portion of one of a pair of goggles, a pair of spectacles, a pair of contact lenses and a pair of clip-on filters for a pair of spectacles.

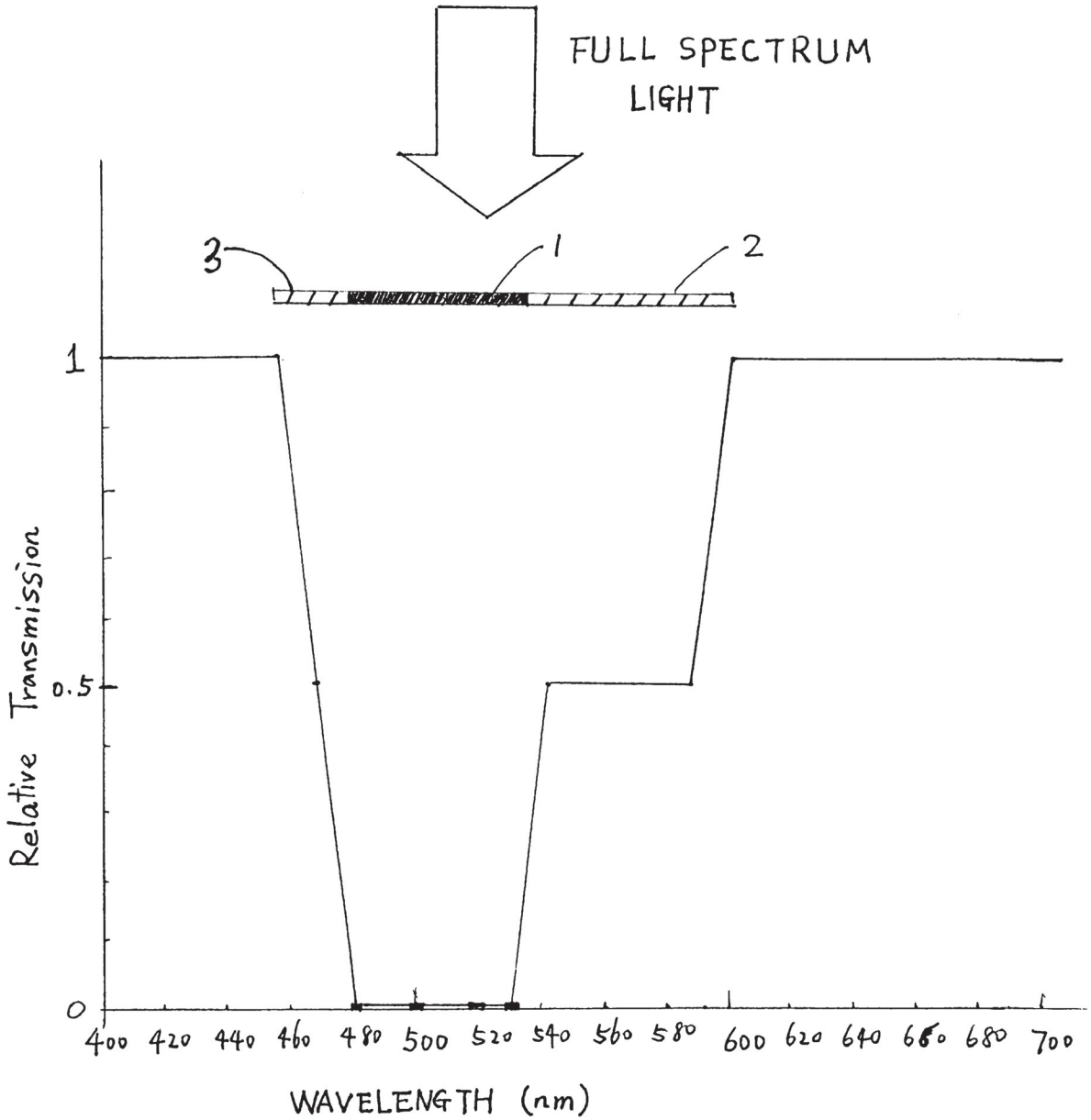
FULL SPECTRUM
LIGHT
3
1
2
1
0.5
0
Relative Transmission
400 420 440 460 480 500 520 540 560 580 600 620 640 660 680 700
WAVELENGTH (nm)

FIG. 1

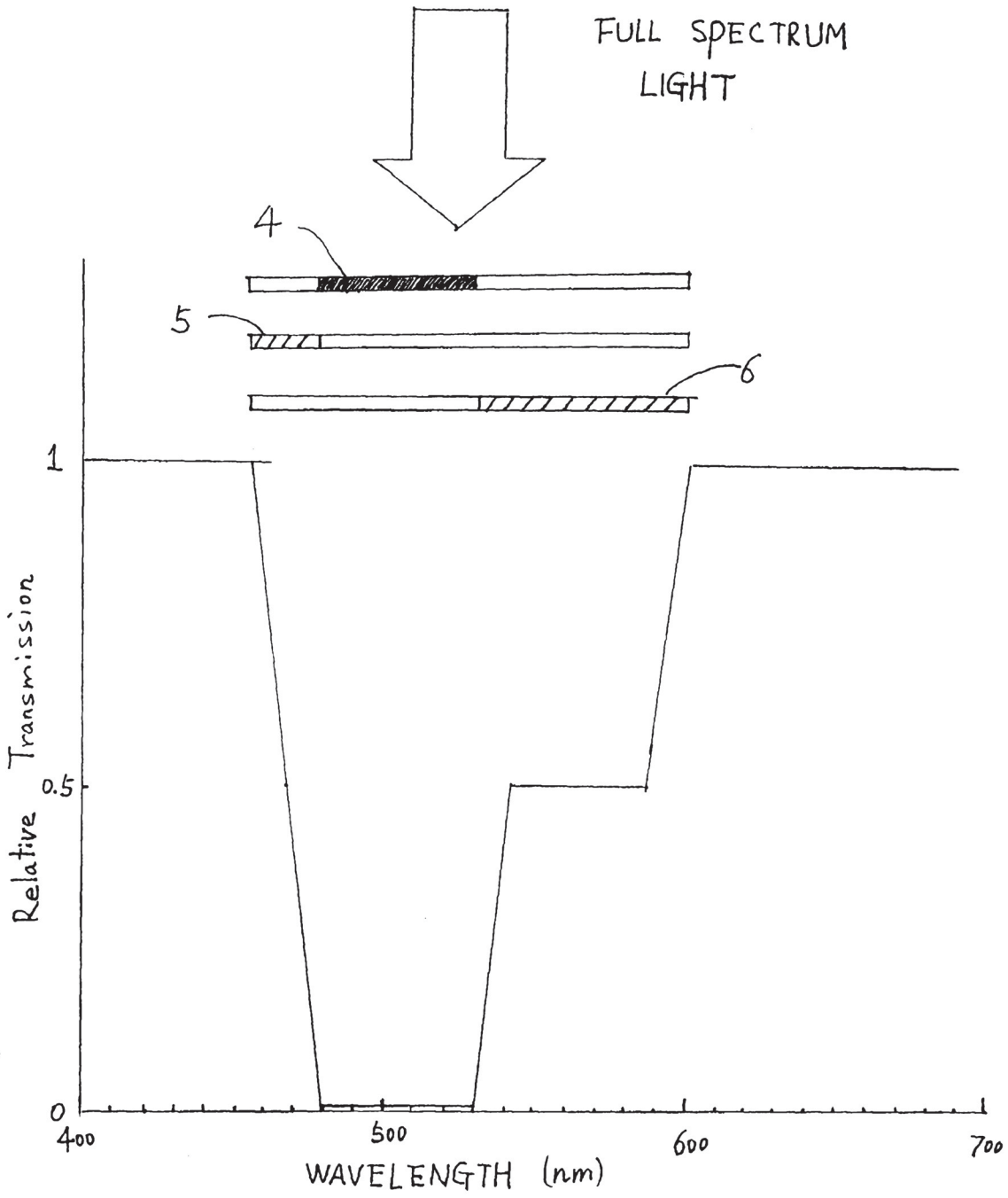
FULL SPECTRUM
LIGHT
4
5
6
1
0.5
0
Relative Transmission
400
500
600
700
WAVELENGTH (nm)

FiG. 2