

Description

The present applicant previously proposed various ideas for guiding the solar rays or artificial light focused by a lens or the like into an optical conductor and thereby transmitting it onto an optional, desired place through the optical conductor for the purpose of illumination or for other uses. Such a process would make it possible to by-pass and take out the light-energy transmitted through the optical conductor at the half-way point of transmission. Thereby the effect of the light-energy's use would be increased. Such a device would broaden the use of light energy.

From Bauelemente der Optik, Carl Hauser Verlag, München/Wien, 30.03.1983 several kinds of optical beam splitters are known and described on pages 186 and 187.

In this document, figure 5.8.1 (b) shows a device with a ring-shaped space between the two divider parts. However, with all such known devices it is not possible to selectively by-pass or transmit the light which is transmitted through optical conductors.

It is the object of the present invention to provide a light by-passing device having the function of selectively by-passing and taking out a part of the light energy transmitted through an optical conductor.

A light by-passing device as claimed in claim 1 solves this task.

Figure 1 is a diagram for explaining the usage of the light by-passing device according to the present invention.

Figure 2 is a detailed diagram of the light by-passing device according to the present invention.

Figure 3 is a diagram showing the unitarily combined spacers used in the light by-passing device and a cross-sectional view of the spacers cut along the line III—III as shown in Figure 4.

Figure 4 is a plane view of Figure 3.

Fig. 1 is a diagram explaining the usage condition of the light by-passing device according to the present invention. In Fig. 1, 1 and 2 are cylindrical optical conductors; 10 is a light by-passing device according to the present invention; and 3 is an optical conductor through which the light energy by-passing device 10 is guided and transmitted. The edge surface of the optical conductor 1 is not shown in the diagram and is being arranged at the focus of the lens for focusing the solar rays or the artificial light. The light energy focused by the lens is guided into the optical conductor 1. The light energy thus guided into the optical conductor 1 is transmitted through the light conductor 2 onto the optional desired place and used for illumination or other purposes. On that occasion the light by-passing device 10 is interposed between the optical conductors 1 and 2, and a part of the light energy is by-passed and transmitted through the by-passing optical conductor 3 onto the optional desired place.

Fig. 2 is a detailed, break down diagram of the

above-mentioned light by-passing device according to the present invention. In Fig. 2, 11 is a first transparent, cylindrical member; 12 is a second transparent, cylindrical member; 13 through 15 are transparent spacers interposed between cylindrical members 11 and 12 as shown in Fig. 1. Namely, the first and second cylindrical members 11 and 12 are so formed that their edge surfaces are opposed to each other through the spacers 13 through 15. They are respectively on the first horizontal surfaces 11a and 12a, the inclined surfaces 11b and 12b, and the second horizontal surfaces 11c and 12c. On the other hand, the spacers 13 through 15 are formed in the same thickness. They are also constructed so as to be interposed between the first horizontal surfaces, the inclined surfaces, and the horizontal surfaces respectively. A round hole 14 is bored in the second spacer 14.

Fig. 3 is a diagram showing a side cross-section of the unitarily combined spacers 13 through 15 and a cross-sectional view of spacers cut along the line III—III as shown in Fig. 4. Fig. 4 is a plane view of Fig. 3. The afore-mentioned spacers 13 through 15 are shown independent of each other. When assembled the spacers are unitarily combined by means of optical paste, and then the combined spacers are firmly fixed by means of the same paste so as to interpose them between the cylindrical members 11 and 12. The other respective members, 11 through 15, are independently produced and then assembled with the same optical paste. Therefore the manufacturing and assembling of those members can be done simply and with high accuracy. According to the present invention, the light by-passing device is connected in cascade fashion between the optical conductors 1 and 2 for its usage. However, when the light energy transmitted through the optical conductor 1 reaches the inclined surface 11c of the first cylindrical member 11, the spacer 14, having the hole 14, is interposed on the inclined surface so that the refractive index largely changes at the hole. Then the light energy is reflected by a prism action on the surfaces opposed to the hole 14 of the inclined surface 11c and it is guided in the direction of the radius. Around the light by-passing device 10, the optical conductor 3 for by-passing is bound by the use of an optical paste on the opposite side of the inclined surface. As mentioned heretofore, the reflected light-energy is guided into the optical conductor 3 for by-passing and being transmitted onto the optional desired place for its usage.

An embodiment of the light by-passing device according to the present invention was explained heretofore. However, the present invention is not limited to the afore-mentioned description. Various modifications can be realized. Though the description given above relates to only the case of unitarily fixed members, such as 11 through 15 as an example, if the members are flexibly constructed by the use of optical oil or the like, instead of unitarily fixing the second spacer 14, it may turn out to be possible to adjust the amount

If light energy that is by-passed into the optical conductor 3 i.e. by adjusting the extent of insertion of the spacer 14. Further, supposing that a grasping portion 14a is made longer on the spacer 14 as shown in Fig. 4 with a one-dot-chained line, the insertion and withdrawal of the spacer 14 might become considerably easier. When the hole 14 of the spacer 14 comes out from the inclined surface and the remaining portion 14b of the spacer 14 remains on the inclined surface, the light energy guided into the light by-passing device is transmitted into the optical conductor 2 without being by-passed by the light by-passing device. Further, as to the optical conductor 3 for by-passing, it may be possible to bind the optical conductor having a sufficient desired length required for guiding the by-passed light to the usage position to the light by-passing device 10 by use of an adhesive agent at the actual working spot. Furthermore, it may also be possible to unitarily produce a by-passing optical conductor 3 of a predetermined length as well as a first cylindrical member 11 using the same manufacturing process, and to connect the optical conductor of the desired length co-axially to the by-passing optical conductor at the actual working spot. Though only one example of connecting the single light by-passing device between the optical conductors 1 and 2 is explained heretofore, it may be possible to connect several by-passing devices. On that occasion, supposing that the hole 14 of the by-passing device, connected forward, is larger than the hole of that connected backward in its diameter, it may be possible almost equally to by-pass all the light from the by-passing device.

It is apparent from the above-mentioned description, that the light by-passing device, having the function of effectively by-passing light energy can be manufactured easily according to the present invention.

Claims

1. A light by-passing device interposed between respective end surfaces of two transparent cylindrical optical conductors (1, 2) for the purpose of selectively by-passing or transmitting light transmitted through said optical conductors and comprising:

— a first transparent cylindrical member (11) having a first end surface abutting against the end surface of the optical conductor (7);

— a second transparent cylindrical member (12) having a first end surface abutting against the end surface of the optical conductor (2);

— said first member (11) having a second end face comprising three sections (11a, 11b, 11c), the sections (11a, 11c) being located in planes normal to the axis of the optical conductors (1, 2) and joined by the section (11b) which is located in a plane inclined with respect to said axis;

— and said second member (12) having a second end face opposed to the second end face of the first member (11) in spaced relationship

therewith and comprising three sections (12a, 12b, 12c) respectively parallel to the sections (11a, 11b, 11c) of the second end surface of the first member (11);

— the light by-passing device further comprising three spacers of the same thickness in axial direction from which a first spacer (13) having two faces that respectively abut against the facing sections (11a) and (12a), a second spacer (14) having two faces that respectively abut against the facing sections (11b) and (12b), and a third spacer (15) having two faces that respectively abut against the facing sections (11c) and (12c), said second spacer (14) being provided with a round aperture (14') and being movable in a direction perpendicular to said axis, so that the light can be bypassed or transmitted selectively.

2. A light by-passing device according to claim 1 characterized by a grasping part (14a, 14b) which is fixed on the second spacer (14) to insert or take out said device.

3. A light by-passing device as defined in claim 1 characterized by a by-passing optical conductor (3) which receives the light reflected at said second spacer (14) and which is unitarily mounted on the side wall of said first cylindrical member (11).

Patentansprüche

1. Vorrichtung zur Lichtumlenkung, die zwischen entsprechenden Endflächen von zwei transparenten zylindrischen optischen Leitern (1, 2) angeordnet ist, um das durch die optischen Leiter hindurchtretende Licht wahlweise umzulenken oder weiterzuleiten, mit

— einem ersten transparenten zylindrischen Element (11), das eine erste Endfläche aufweist, die an der Endfläche des optischen Leiters (7) anliegt;

— mit einem zweiten transparenten zylindrischen Element (12), das eine erste Endfläche aufweist, das gegen die Endfläche des optischen Leiters (2) anliegt;

— wobei das erste Element (11) eine zweite Endfläche aufweist, die drei Abschnitte (11a, 11b, 11c) umfaßt und wobei die Abschnitte (11a, 11c) in Ebenen angeordnet sind, die senkrecht zur Achse der optischen Leiter (1, 2) verlaufen und über den Abschnitt (11b), der in einer Ebene geneigt zu dieser Achse verläuft, verbunden sind;

— wobei das zweite Element (12) eine zweite Endfläche hat, die der ersten Endfläche des ersten Elements (11) beabstandet gegenüber liegt und wobei dieses zweite Element drei Abschnitte (12a, 12b, 12c) aufweist, die entsprechend parallel zu den Abschnitten (11a, 11b, 11c) der zweiten Endfläche des ersten Elements (11) sind;

— und wobei die Lichtumlenkvorrichtung weiterhin drei Abstandsstücke gleicher Dicke in Axialrichtung aufweist, von denen ein erstes Abstandsstück (13) zwei Flächen hat, die jeweils an die sich gegenüber stehenden Abschnitten (11a, 12a) angrenzen, wobei das zweite Abstandsstück (14) zwei Flächen hat, die jeweils an die sich gegen-

of light energy that is by-passed into the optical conductor 3 i.e. by adjusting the extent of insertion of the spacer 14. Further, supposing that a grasping portion 14a is made longer on the spacer 14 as shown in Fig. 4 with a one-dot-chained line, the insertion and withdrawal of the spacer 14 might become considerably easier. When the hole 14 of the spacer 14 comes out from the inclined surface and the remaining portion 14b of the spacer 14 remains on the inclined surface, the light energy guided into the light by-passing device is transmitted into the optical conductor 2 without being by-passed by the light by-passing device. Further, as to the optical conductor 3 for by-passing, it may be possible to bind the optical conductor having a sufficient desired length required for guiding the by-passed light to the usage position to the light by-passing device 10 by use of an adhesive agent at the actual working spot. Furthermore, it may also be possible to unitarily produce a by-passing optical conductor 3 of a predetermined length as well as a first cylindrical member 11 using the same manufacturing process, and to connect the optical conductor of the desired length co-axially to the by-passing optical conductor at the actual working spot. Though only one example of connecting the single light by-passing device between the optical conductors 1 and 2 is explained heretofore, it may be possible to connect several by-passing devices. On that occasion, supposing that the hole 14 of the by-passing device, connected forward, is larger than the hole of that connected backward in its diameter, it may be possible almost equally to by-pass all the light from the by-passing device.

It is apparent from the above-mentioned description, that the light by-passing device, having the function of effectively by-passing light energy can be manufactured easily according to the present invention.

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— a first transparent cylindrical member (11) having a first end surface abutting against the end surface of the optical conductor (7);

— a second transparent cylindrical member (12) having a first end surface abutting against the end surface of the optical conductor (2);

— said first member (11) having a second end face comprising three sections (11a, 11b, 11c), the sections (11a, 11c) being located in planes normal to the axis of the optical conductors (1, 2) and joined by the section (11b) which is located in a plane inclined with respect to said axis;

— and said second member (12) having a second end face opposed to the second end face of the first member (11) in spaced relationship

therewith and comprising three sections (12a, 12b, 12c) respectively parallel to the sections (11a, 11b, 11c) of the second end surface of the first member (11);

— the light by-passing device further comprising three spacers of the same thickness in axial direction from which a first spacer (13) having two faces that respectively abut against the facing sections (11a) and (12a), a second spacer (14) having two faces that respectively abut against the facing sections (11b) and (12b), and a third spacer (15) having two faces that respectively abut against the facing sections (11c) and (12c), said second spacer (14) being provided with a round aperture (14') and being movable in a direction perpendicular to said axis, so that the light can be bypassed or transmitted selectively.

2. A light by-passing device according to claim 1 characterized by a grasping part (14a, 14b) which is fixed on the second spacer (14) to insert or take out said device.

3. A light by-passing device as defined in claim 1 characterized by a by-passing optical conductor (3) which receives the light reflected at said second spacer (14) and which is unitarily mounted on the side wall of said first cylindrical member (11).

Patentansprüche

1. Vorrichtung zur Lichtumlenkung, die zwischen entsprechenden Endflächen von zwei transparenten zylindrischen optischen Leitern (1, 2) angeordnet ist, um das durch die optischen Leiter hindurchtretende Licht wahlweise umzulenken oder weiterzuleiten, mit

— einem ersten transparenten zylindrischen Element (11), das eine erste Endfläche aufweist, die an der Endfläche des optischen Leiters (7) anliegt;

— mit einem zweiten transparenten zylindrischen Element (12), das eine erste Endfläche aufweist, das gegen die Endfläche des optischen Leiters (2) anliegt;

— wobei das erste Element (11) eine zweite Endfläche aufweist, die drei Abschnitte (11a, 11b, 11c) umfaßt und wobei die Abschnitte (11a, 11c) in Ebenen angeordnet sind, die senkrecht zur Achse der optischen Leiter (1, 2) verlaufen und über den Abschnitt (11b), der in einer Ebene geneigt zu dieser Achse verläuft, verbunden sind;

— wobei das zweite Element (12) eine zweite Endfläche hat, die der ersten Endfläche des ersten Elements (11) beabstandet gegenüber liegt und wobei dieses zweite Element drei Abschnitte (12a, 12b, 12c) aufweist, die entsprechend parallel zu den Abschnitten (11a, 11b, 11c) der zweiten Endfläche des ersten Elements (11) sind;

— und wobei die Lichtumlenkvorrichtung weiterhin drei Abstandsstücke gleicher Dicke in Axialrichtung aufweist, von denen ein erstes Abstandsstück (13) zwei Flächen hat, die jeweils an die sich gegenüber stehenden Abschnitten (11a, 12a) angrenzen, wobei das zweite Abstandsstück (14) zwei Flächen hat, die jeweils an die sich gegen-



über stehenden Flächen (11b, 12b) angrenzen und wobei das dritte Abstandsstück (15) zwei Flächen hat, die an den sich gegenüberliegenden Abschnitten (11c, 12c) anstoßen und wobei das zweite Abstandsstück (14) eine runde Öffnung (14') aufweist und in einer Richtung senkrecht zu der Achse beweglich ist, so daß Licht wahlweise umgelenkt oder weitergeleitet werden kann.

2. Lichtumlenkeinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß ein Griffteil (14a, 14b) mit dem zweiten Abstandsstück (14) verbunden ist, um die Einrichtung herausnehmen oder einschieben zu können.

3. Lichtumlenkeinrichtung nach Anspruch 1, dadurch gekennzeichnet, daß ein optischer Umlenkleiter (3) vorgesehen ist, der das am zweiten Abstandsstück (14) reflektierte Licht empfängt und der als Einheit auf der Seitenwand des ersten zylindrischen Elements (11) befestigt ist.

Revendications

1. Un dispositif de dérivation de lumière interposé entre des surfaces extrêmes respectives de deux conducteurs optiques cylindriques transparents (1, 2) dans le but de dériver ou transmettre sélectivement de la lumière transmise par l'intermédiaire desdits conducteurs optiques et comprenant:

— un premier élément cylindrique transparent (11) comportant une première surface extrême venant buter contre la surface extrême du conducteur optique (7);

— un second élément cylindrique transparent (12) comportant une première surface extrême venant buter contre la surface extrême du conducteur optique (2);

— ledit premier élément (11) comportant une seconde face extrême comprenant trois sections (11a, 11b, 11c), les sections (11a, 11c) étant

placées dans des plans perpendiculaires à l'axe des conducteurs optiques (1, 2) et étant jointes par la section (11b) qui est placée dans un plan incliné par rapport audit axe;

— et ledit second élément (12) comporte une seconde face extrême opposée à la seconde face extrême du premier élément (11) en étant espacée de celle-ci et il comprend trois sections (12a, 12b, 12c) respectivement parallèles aux sections (11a, 11b, 11c) de la seconde surface extrême du premier élément (11);

— le dispositif de dérivation de lumière comprenant en outre trois organes d'espacement ayant la même épaisseur dans une direction axiale et parmi lesquels un premier organe d'espacement (13) comporte deux faces qui viennent buter respectivement contre les sections de surface (11a) et (12a), un second organe d'espacement (14) comporte deux faces qui viennent buter respectivement contre les sections de surface (11b) et (12b), et un troisième organe d'espacement (15) comporte deux faces qui viennent buter respectivement contre les sections de surface (11c) et (12c), ledit second organe d'espacement (14) étant pourvu d'un trou circulaire (14') et étant déplaçable dans une direction perpendiculaire audit axe, de telle sorte que la lumière puisse être sélectivement dérivée ou transmise.

2. Un dispositif de dérivation de lumière selon la revendication 1, caractérisé par une partie d'accrochage (14a, 14b) qui est fixée sur le second organe d'espacement (14) de façon à permettre une insertion ou un enlèvement dudit dispositif.

3. Un dispositif de dérivation de lumière tel que défini dans la revendication 1, caractérisé par un conducteur optique de dérivation (3) qui reçoit la lumière réfléchie sur ledit second organe d'espacement (14) et qui est monté unitairement sur la paroi latérale dudit premier élément cylindrique (11).

