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(54) **LUMINESCENT BICYCLE**

LUMINESZIERENDES FAHRRAD

BICYCLETTE LUMINESCENTE

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EP 2 701 948 B1

Description

Field of the Invention

[0001] This invention relates to frame-supported vehicles with high visibility. Such frame-supported vehicles include bi-cycles, tri-cycles, scooters and other like vehicles.

Background of the Invention

[0002] When riding a bicycle or like vehicle in conditions of low light or diminished visibility, it is desirable to increase ability for other vehicles and pedestrians to detect the bicycle and hence protect the rider from accidental impact. Currently there exist a variety of aftermarket lighting systems designed to project light away from the bike.

[0003] Current lighting systems on the market generate narrow light beams projected or reflected away from the bicycle. These options are directional in nature and have limited ability to increase the rider's visibility. The light is projected away from the bike, rather than illuminating the bicycle itself.

[0004] U.S. patent nos. 5,823,653 and 6,779,913 disclose lights that are affixed to the bicycle frame. US patent application no. 2009/0080207 is considered the closest prior art and discloses the use of lights that can be incorporated within a translucent frame, along with the following features of claim 1, a frame-supported vehicle comprising at least one frame component made of a material forming a leaky light pipe, and at least one light source arranged to launch light into the leaky light pipe, whereby the light from the light source propagates internally within the leaky light pipe and is externally visible.

[0005] In these systems, however, the light sources are visible through the translucent frame, and do not give an even illumination.

Summary of the Invention

[0006] According to the present invention there is provided frame-supported vehicle comprising a unitary molded unitary frame incorporating at least one frame component made of a material forming a leaky light pipe, and at least one light source arranged to launch light into the leaky light pipe, whereby the light from the light source propagates internally within the leaky light pipe and is externally visible.

[0007] The term externally visible means that the light is visible by an observer at a distance from the bicycle. The light itself of course propagates internally within the bicycle frame.

[0008] In one embodiment the frame-supported vehicle is a bicycle, but it may also be a tricycle, scooter, and other like vehicle that is based on a frame structure.

[0009] Light propagates within the light pipe, but unlike an optical fiber, for example, the light pipe is deliberately designed to be "leaky" so that the light propagating within it is externally visible. It will be understood that the light pipe can be in the form of a tube or a rigid rod.

[0010] Thus, in accordance with an embodiment of the present invention the bicycle frame, or part thereof, is made of a transparent or translucent light diffusing material illuminated by a source located at one or both ends and arranged such that light propagates within the walls of the frame and is diffused by the material over a wide area.

[0011] The invention actually causes the bicycle, to become illuminated, rather than simply projecting light away from the bicycle and rider.

[0012] Embodiments of the present invention generally take the form of a unitary molded bicycle unitary frame manufactured from transparent or translucent polymers. The frame is then fitted with a series of lighting elements, which project light into the end of the frame structure such that it propagates along the wall of the frame. Due to the light transmission capability of the frame materials, all the major frame sections can be illuminated in this method so that the major part of the bicycle becomes luminescent.

[0013] The frame structure propagates the light along its length within the material of the structure, which can be in the form of a rod or tube.

Brief Description of the Drawings

[0014] The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation in embodiment of the invention; in accordance with one non-claimed
FIG. 2 is a diagrammatic side view of a frame component with a solid light pipe;
FIG. 3 is an end view of the frame component;
FIG. 4 shows a detail of FIG. 2;
FIG. 5 shows a non-claimed embodiment where the frame component is in the form of a hollow tube;
FIG. 6 is a perspective view of a molded unitary frame in accordance with an embodiment of the invention; and
FIG. 7 is a sectional view of the molded frame; and
FIGS. 8a to 8d show respectively a side view, bottom view top view and sectional view of the frame.

Detailed Description of the Invention

[0015] Figure 1 shows a prototype that has been constructed using fabricated sections of rod, which are joined by steel intersection points taken from a commercial bike frame. Major frame components 1 and 2 have been replaced by polycarbonate rods. Each polycarbonate rod forms a light pipe with LED lighting elements (not shown in Figure 1) mounted at each end for launching light into the light pipe.

[0016] The lighting elements are designated 3 in Figure 2, which shows a frame component 1 made of a solid rod as employed in Figure 1, with the lighting elements mounted at each end. The lighting elements 3 are set in recesses 3a in the ends of the solid rod.

[0017] The lighting elements 3 are powered either via battery 5 or bicycle tire generator (not shown). A switch 4 can be provided for turning the lighting elements on and off. This can be mounted on the handlebars if desired. In the non-claimed embodiment shown in Figure 1, there are four
lighting elements and four switches, one at each end of each rod, but of course it will be appreciated that the lighting elements can be connected to a common switch.

[0018] The light elements can conveniently be recessed into cavities at the end of the frame components.

[0019] As shown in Figure 2, light rays 6 propagate within the solid light pipe partly by total internal reflection, in much the same manner as an optical fiber, except unlike an optical fiber the light pipe is designed to be leaky so that light rays 8 leak out of the rod in part due to the diffusive properties of the material. Also, because of the large diameter of the rod as compared to an optical fiber, not all the rays will strike the walls at an angle above the critical angle, and these rays, such as ray 13, will also leak out due to refraction at the frame air interface. This gives the frame component illuminated at one end a luminescent appearance similar to a toy lightsaber. Such a structure can be generally considered as a leaky light pipe.

[0020] The diffusion properties can be enhanced if necessary by including small beads of glass or other polymer of different refractive index, for example nanoparticles, in the frame members to increase the light diffusing properties of the material.

[0021] The frame components 1, 2 can be manufactured with various textures and etchings 9, shown in more detail in Figure 4. These etchings have facets 10 which will refract the light out and illuminate the bicycle in various decorative designs. As the light strikes the facets, light that would otherwise be above the critical angle will be at an angle of incidence less than the critical angle for total internal reflection and thus emerge through the facet. This effect will give the facet, and hence the associated etching or engraving, the appearance of being illuminated against the background of the luminescent frame. The rays that would have struck the walls below the critical angle will also of course still be refracted out.

[0022] The frame components 1, 2, can be made from similar polymeric or other materials to polycarbonate that have light diffusing properties. They can be in the form of hollow tubes or solid rods.

[0023] Figure 5 shows an example where the frame component is in the form of a hollow tube. In this case, the light will propagate within the walls of the tube, and as more rays will strike the boundary at an angle above the critical angle, less light will leak than in the case of the rigid rod shown in Figure 2. While the light sources are typically LEDs, other sources could be used if desired.

[0024] Also, while the light sources are preferably installed at the ends of the structures, they could also be installed at other locations where the light will be launched directly into the frame components for propagation along their length. However, the light sources will not normally be externally visible along the entire length of the frame component.

[0025] Thus, in accordance with non-claimed embodiments of the invention, light from these sources is directed into the tubes, diffusing along its path to light the entire frame section.

[0026] It is also possible to include fluorescent material within the molded frame to enhance the luminescent effect. One possibility would be to use UV LEDs with fluorescent material mixed embedded or mixed with the polycarbonate frame.

[0027] The embodiment shown in Figures 6, 7 and 8a - 8d comprises a molded polycarbonate frame member having the major sections 20, 23, and 24 made in one piece. The sections 20 and 23 can be solid, whereas the section 24 can have a hollow end to receive a supporting post of a saddle. The forward section of the frame member has a vertical bore receiving a steel bushing 25 for the front frame member supporting the front wheel. The rear junction of the sections 23, 24 has a bore receiving a steel bushing 26 for the receiving the bicycle cranks.

[0028] LED lighting elements 27, 28, 29, 30 are recessed into the ends of the frame members 20, 23, causing these members to become luminescent as explained with reference to Figure 2. The LED lighting elements can be in the form of an array of LEDs, or a single high intensity LED.

[0029] A battery is inserted in recess 31 with a snap fit cover. A switch can be provided (not shown). This battery can power the rear end lights 27, 30. Likewise a battery can be fitted into recess 40 in the rear end of the frame also fitted with a snap cover to power the front end LEDs 28, 29. The recesses can be closed by covers once the components have been installed. The wiring can be external or incorporated into channels in the frame members during the molding process. As the current is very small, only very fine wires are required, although in one example ¼" channels were provided to accommodate the wires.

[0030] For marketing purposes, patterns can be engraved into the frame sections including sports team logos, corporate logos, cartoon characters, skulls, and the like for marketing purposes.

[0031] These will then appear bright, being illuminated by refracting the internal light that is transmitted along the frame members.

[0032] Unlike the prior art systems, the light sources need not be visible, yet the illuminated frame has a luminescent quality that makes it highly visible.

Claims

1. A frame-supported vehicle comprising a unitary molded unitary frame (20, 23, 24) incorporating at least one frame component (1, 2, 20, 25, 23) made of a material forming a leaky light pipe, and at least one light source (3, 27, 28, 29) arranged to launch light into the leaky light pipe, whereby the light from the light source propagates internally within the leaky light pipe and is externally visible.

2. A frame-supported vehicle as claimed in claim 1, wherein the at least one light source (3, 27, 28, 29) comprises an LED.

3. A frame-supported vehicle as claimed in claim 1 or 2, wherein the at least one light source (3, 27, 28, 29) is mounted at the end of the leaky light pipe.

4. A frame-supported vehicle as claimed in claim 1 or 2, wherein the at least one light source (3, 27, 28, 29) is mounted at both ends of the frame component.

5. A frame-supported vehicle as claimed in any one of claims 1 to 3, wherein the frame component (1, 2, 20, 25, 23) is made of a polymeric light diffusing material.

6. A frame-supported vehicle as claimed in claim 5, wherein the polymeric material contains beads or particles to enhance the light diffusing properties.

7. A frame-supported vehicle as claimed in claim 5, wherein the polymeric material has fluorescent properties.

8. A frame-supported vehicle as claimed in any one of claims 1 to 7, wherein the frame component is etched or engraved to form indicia that become illuminated by light refracted from within the frame component.

9. A frame-supported vehicle as claimed in any one of claims 1 to 8, wherein the at least one light source (3, 27, 28, 29) is recessed into the ends of the frame component (1, 2, 20, 25, 23).

10. A frame-supported vehicle as claimed in any one of claims 1 to 9, wherein the unitary molded frame (20, 23, 24) is made of polycarbonate.

11. A frame-supported vehicle as claimed in any one of claims 1 to 10, which is a bicycle.

Patentansprüche

1. Rahmengestütztes Fahrzeug, umfassend einen einheitlich geformten einheitlichen Rahmen (20, 23, 24), der mindestens eine Rahmenkomponente (1, 2, 20, 25, 23), die aus einem Material hergestellt wird, das eine durchlässige Lichtröhre bildet und mindestens eine Lichtquelle (3, 27, 28, 29) aufnimmt, die angeordnet ist, um Licht in die durchlässige Lichtröhre zu schicken, wobei sich das Licht von der Lichtquelle innen in der durchlässigen Lichtröhre ausbreitet und außen sichtbar ist.

2. Rahmengestütztes Fahrzeug nach Anspruch 1, wobei die mindestens eine Lichtquelle (3, 27, 28, 29) eine LED umfasst.

3. Rahmengestütztes Fahrzeug nach Anspruch 1 oder 2, wobei die mindestens eine Lichtquelle (3, 27, 28, 29) an dem Ende der durchlässigen Lichtröhre befestigt ist.

4. Rahmengestütztes Fahrzeug nach Anspruch 1 oder 2, wobei die mindestens eine Lichtquelle (3, 27, 28, 29) an beiden Enden der Rahmenkomponente befestigt ist.

5. Rahmengestütztes Fahrzeug nach einem der Ansprüche 1 bis 3, wobei die Rahmenkomponente (1, 2, 20, 25, 23) aus einem polymeren lichtstreuenden Material hergestellt wird.

6. Rahmengestütztes Fahrzeug nach Anspruch 5, wobei das polymere Material Kügelchen oder Partikel enthält, um die lichtstreuenden Eigenschaften zu verbessern.

7. Rahmengestütztes Fahrzeug nach Anspruch 5, wobei das polymere Material fluoreszierende Eigenschaften aufweist.

8. Rahmengestütztes Fahrzeug nach einem der Ansprüche 1 bis 7, wobei die Rahmenkomponente geätzt oder graviert wird, um Zeichen zu bilden, die von Licht angestrahlt werden, das aus dem Inneren der Rahmenkomponente gebrochen wird.

9. Rahmengestütztes Fahrzeug nach einem der Ansprüche 1 bis 8, wobei die mindestens eine Lichtquelle (3, 27, 28, 29) in die Enden der Rahmenkomponente (1, 2, 20, 25, 23) eingebaut ist.

10. Rahmengestütztes Fahrzeug nach einem der Ansprüche 1 bis 9, wobei der einheitlich geformte Rahmen (20, 23, 24) aus Polycarbonat hergestellt wird.

11. Rahmengestütztes Fahrzeug nach einem der Ansprüche 1 bis 10, das ein Fahrrad ist.

Revendications

1. Véhicule sur cadre comprenant un cadre unitaire moulé de manière unitaire (20, 23, 24) composé d'au moins un composant de cadre (1, 2, 20, 25, 23) réalisé dans un matériau formant un tube perméable à la lumière, et d'au moins une source de lumière (3, 27, 28, 29) agencée pour émettre de la lumière dans le tube perméable à la lumière, moyennant quoi la lumière issue de la source de lumière se propage à l'intérieur du tube perméable à la lumière et est visible depuis l'extérieur.

2. Véhicule sur cadre selon la revendication 1, dans lequel l'au moins une source de lumière (3, 27, 28, 29) comprend une LED.

3. Véhicule sur cadre selon la revendication 1 ou 2, dans lequel l'au moins une source de lumière (3, 27, 28, 29) est montée à l'extrémité du tube perméable à la lumière.

4. Véhicule sur cadre selon la revendication 1 ou 2, dans lequel l'au moins une source de lumière (3, 27, 28, 29) est montée aux deux extrémités du composant de cadre.

5. Véhicule sur cadre selon l'une quelconque des revendications 1 à 3, dans lequel le composant de cadre (1, 2, 20, 25, 23) est réalisé dans un matériau polymère à diffusion lumineuse.

6. Véhicule sur cadre selon la revendication 5, dans lequel le matériau polymère contient des billes ou particules visant à accroître les propriétés de diffusion lumineuse.

7. Véhicule sur cadre selon la revendication 5, dans lequel le matériau polymère présente des propriétés de fluorescence.

8. Véhicule sur cadre selon l'une quelconque des revendications 1 à 7, dans lequel le composant de cadre est gravé par voie chimique ou mécanique pour constituer des marques qui s'illumineront sous l'effet de la lumière réfractée depuis l'intérieur du composant de cadre.

9. Véhicule sur cadre selon l'une quelconque des revendications 1 à 8, dans lequel l'au moins une source de lumière (3, 27, 28, 29) est renfoncée dans les extrémités du composant de cadre (1, 2, 20, 25, 23).

10. Véhicule sur cadre selon l'une quelconque des revendications 1 à 9, dans lequel le cadre unitaire moulé (20, 23, 24) est réalisé en polycarbonate.

11. Véhicule sur cadre selon l'une quelconque des revendications 1 à 10, consistant en une bicyclette.

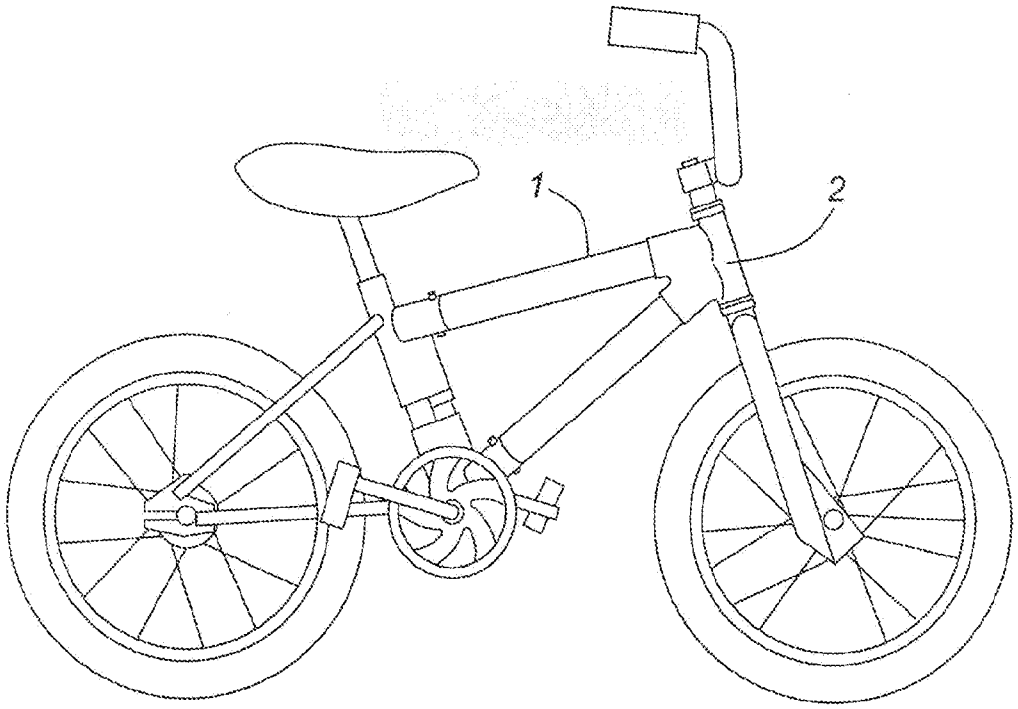

Fig. 1

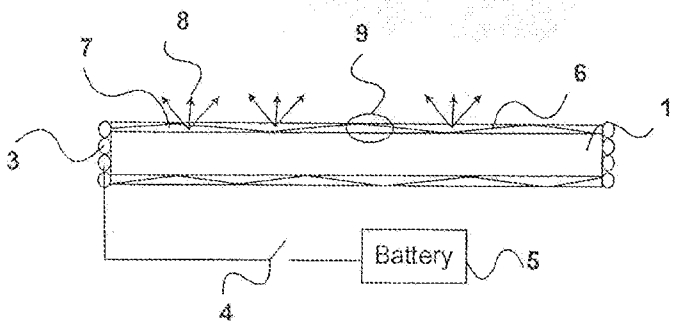

Fig. 2

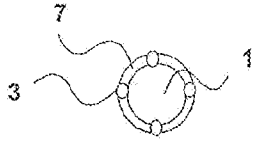

Fig. 3

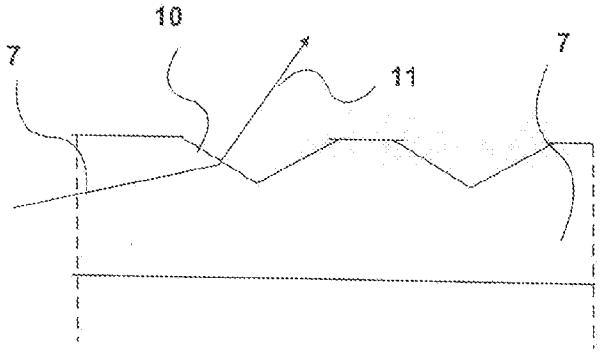

Fig. 4

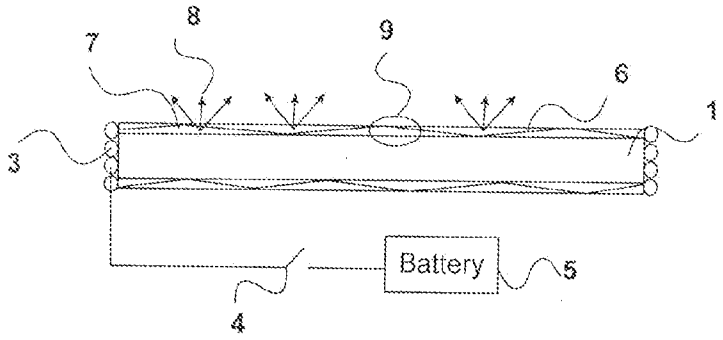

Fig. 5

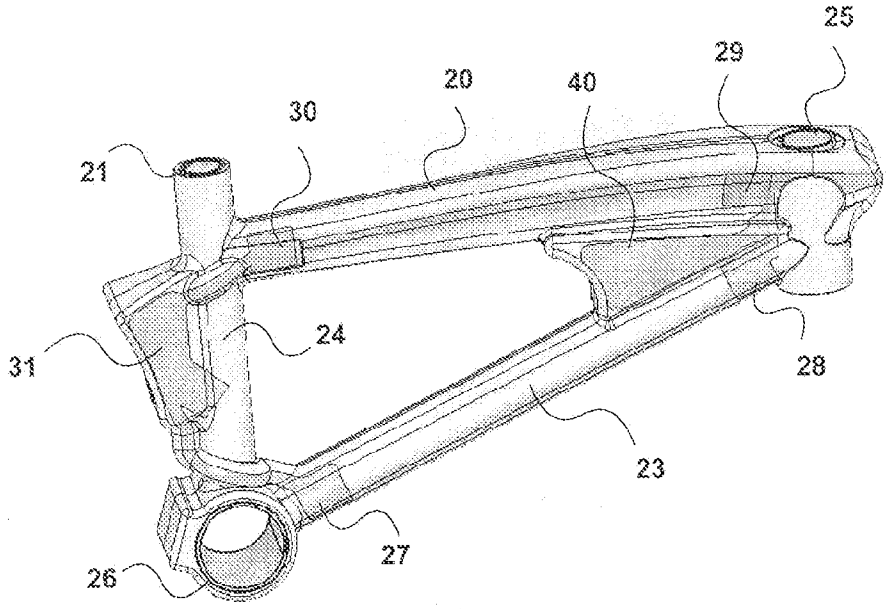

Fig. 6

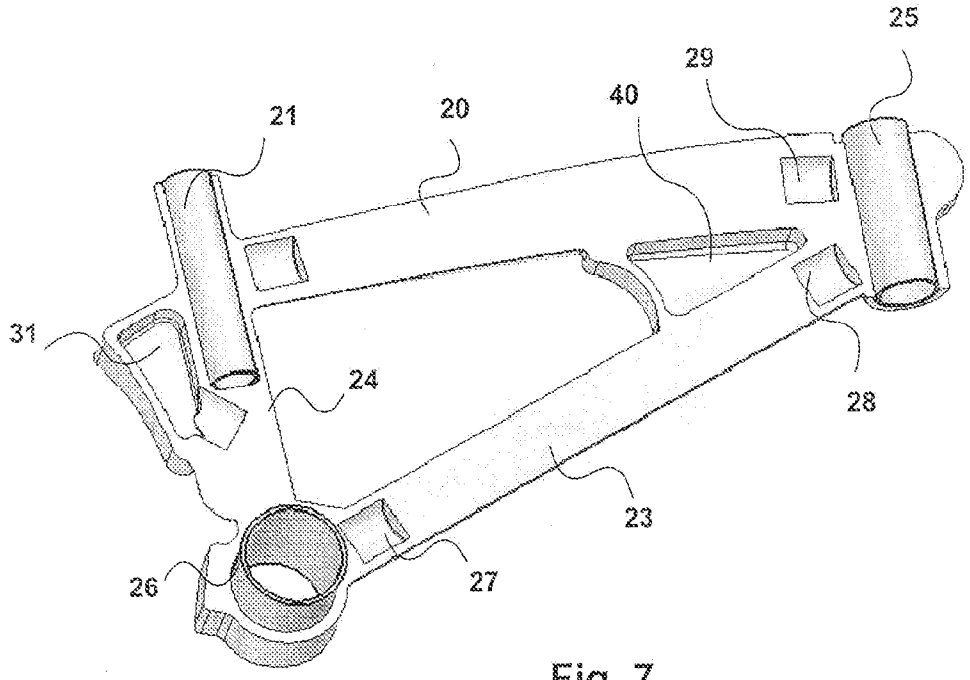

Fig. 7

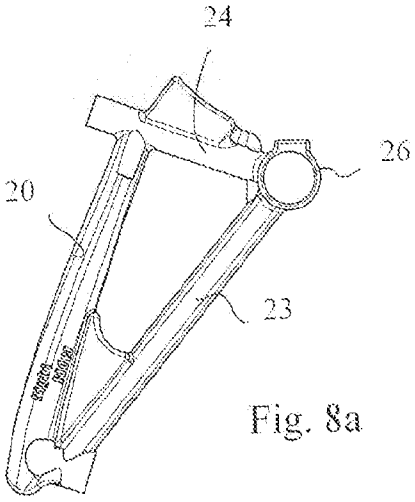

Fig. 8a

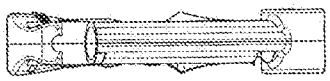

Fig. 8b

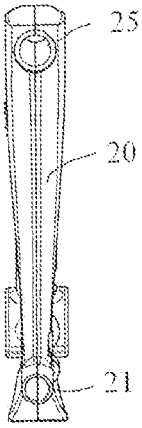

Fig. 8c

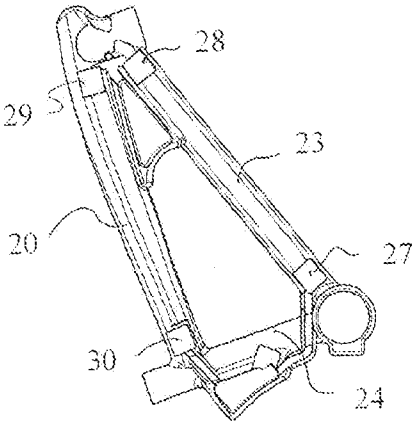

Fig. 8d

REFERENCES CITED IN THE DESCRIPTION

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Szabadalmi igénypontok

1. Keret által hordozott jármű, amely tartalmaz egységesen kialakított egységes keretet (20, 23, 24), amely magában foglal legalább egy keret komponenst (1, 2, 20, 25, 23), amely áteresztő fénycsövet formáló anyagból van kialakítva, és legalább egy fényforrás (3, 27, 28, 29) van elhelyezve, hogy fényt bocsásson az áteresztő fénycsőbe, miáltal a fényforrásból a fény az áteresztő fénycsövön belül terjed és kívül látható.

2. Keret által hordozott jármű az 1. igénypont szerint, ahol a legalább egy fényforrás (3, 27, 28, 29) LED-et tartalmaz.

3. Keret által hordozott jármű az 1. vagy 2. igénypont szerint, ahol a legalább egy fényforrás (3, 27, 28, 29) az áteresztő fény cső végén van szerelve.

4. Keret által hordozott jármű az 1. vagy 2. igénypont szerint, ahol a legalább egy fényforrás (3, 27, 28, 29) a keret komponens mindkét végén van szerelve.

5. Keret által hordozott jármű az 1-3. igénypontok bármelyike szerint, ahol a keret komponens (1, 2, 20, 25, 23) polimer fényt szóró anyagból van készítve.

6. Keret által hordozott jármű az 5. igénypont szerint, ahol a polimer anyag tartalmaz golyócskákat vagy részecskéket, hogy javítsa a fényt szóró tulajdonságokat.

7. Keret által hordozott jármű az 5. igénypont szerint, ahol a polimer anyagnak fluoreszcens tulajdonságai vannak.

8. Keret által hordozott jármű az 1-7. igénypontok bármelyike szerint, ahol a keret komponens be van maratva vagy gravírozva, hogy jelet képezzen, amely ki van világítva a keret komponensen belül megtört fény által.

9. Keret által hordozott jármű az 1-8. igénypontok bármelyike szerint, ahol a legalább egy fényforrás (3, 27, 28, 29) a keret komponens (1, 2, 20, 25, 23) végeibe van beépítve.

10. Keret által hordozott jármű az 1-9. igénypontok bármelyike szerint, ahol az egységesen kialakított keret (20, 23, 24) polikarbonátból van.

11. Keret által hordozott jármű az 1-10. igénypontok bármelyike szerint, amely kerékpár.