(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 284 638 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
26.06.2013 Bulletin 2013/26

(21) Application number: **01931208.1**

(22) Date of filing: **18.05.2001**

(51) Int Cl.:
A61B 3/14 *(2006.01)* ***A61B 3/135*** *(2006.01)*
A61B 3/12 *(2006.01)*

(86) International application number:
PCT/AU2001/000570

(87) International publication number:
WO 2001/089375 (29.11.2001 Gazette 2001/48)

(54) **PORTABLE SLIT LAMP**

TRAGBARE SPALTLAMPE

LAMPE A FENTE PORTATIVE

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR

(30) Priority: **19.05.2000 AU PP762500**

(43) Date of publication of application:
26.02.2003 Bulletin 2003/09

(73) Proprietor: **Lions Eye Institute Limited**
Nedlands, W.A. 6009 (AU)

(72) Inventors:
- **YOGESAN, Kanagasingam**
  Nedlands, W.A. 6009 (AU)
- **CONSTABLE, Ian, Jeffrey**
  Mosman Park, W.A. 6012 (AU)
- **SUPLEWSKI, Gabriel**
  Currambine, W.A. 6028 (AU)

(74) Representative: **Piésold, Alexander James et al**
Dehns
St Bride's House
10 Salisbury Square
London
EC4Y 8JD (GB)

(56) References cited:
WO-A1-96/17545
WO-A1-97/14350
WO-A1-97/36537
WO-A2-99/33393
DE-U1- 29 913 602
GB-A- 2 167 919
JP-A- 10 314 119
US-A- 6 003 991
US-A- 6 050 688

EP 1 284 638 B1

Description

Field of the Invention

[0001] This invention relates generally in one aspect to slit-lamps for use in ophthalmic diagnosis. In another aspect, the invention is concerned with the application of a slit-lamp to remote ophthalmic diagnosis.

Background to the Invention

[0002] The cornea of the eye is essential for good vision. It is the outermost tissue of the eye and functions like a window controlling the entry of light into the eye. An established branch of ophthalmic medicine is the examination of optically reflected corneal images as a diagnostic tool in the identification of trachomatous scarring, cataracts, injuries or bacterial and viral infections. These images are captured using slit-lamps to provide a narrow beam of light of elongated slit-shaped cross-section which is projected onto the cornea to study the surface characteristics. The reflected image is in effect an optical section of the anterior part of the eye including the cornea, the anterior chamber, the iris or the lens and the anterior part of the vitreous. For identifying some conditions, the ophthalmologist seeks to identify changes in the reflected image over time.

[0003] Commercial slit-lamp instruments are generally available in relatively expensive fixed installations in clinics and ophthalmologists' rooms. Patients must generally come to the instruments and this presents a problem in monitoring the eye health of populations in more sparsely populated and remote regions.

[0004] DE 29913602 discloses a scheimpfug camera device mounted on a stand for support.

[0005] It is an object of this invention to provide à portable slit-lamp which assists in addressing these disadvantages with the form and siting of conventional slit-lamp instruments.

[0006] At least one portable slit-lamp is commercially available but this instrument is only a partial solution to the problem discussed above in that it does at least allow the ophthalmologist or ophthalmic surgeon to come to the patient.

Summary of the Invention

[0007] In a first aspect, the invention provides a portable slit-lamp apparatus, comprising: a body configured, in use, to be held up in the hand of an operator at a suitable position in front of a patient's eye; solid state lamp means and associated optics carried by said body for generating a narrow beam of light and projecting the beam onto the cornea of the eye for reflection by structures of the eye, when the body is held at said suitable position in front of the eye; and means mounted in cooperation with said body and said solid state lamp means to detect a reflection of said narrow beam of light by structures of the eye and to make an image thereof, which image is, or is processable to provide, a digital record of said reflection wherein said solid state lamp means consists of a pair of solid state lamps whereby the lamp means is generally elongated and said associated optics include an elongated lens of uniform cross-section arranged with its axis generally aligned with said elongated lamp means, for focussing a light beam emitted thereby of elongated cross-section towards said cornea, as said narrow beam of light.

[0008] Further, there are a pair of said solid state lamp means and associated optics selectively operable for generating and projecting respective said narrow beams of light onto the corneas of the patients left and right eyes respectively. The narrow beam is preferable of elongated slit-shaped cross-section.

[0009] The solid state lamp means is conveniently one or more light emitting diodes.

[0010] Preferably, the associated optics include structure defining a slit aligned with and disposed to receive light from said elongated light means, to define a light beam of elongated cross-section.

[0011] The means to detect the reflection and to make a digital record of the reflection of the narrow beam of light may be a CCD camera but is preferably a digital camera and associated optics.

[0012] The portable slit-lamp apparatus preferably further includes means to transmit the digital record for storage, and for review and diagnosis subsequently and/or at a remote location. Such means to transmit the digital record may comprise a cabling link to a local computer for storage and; in one or more embodiments, for online transmission to the remote location.

[0013] Alternatively, the portable slit-lamp may include a radio, microwave or infra-red transmitter for communicating with the local computer.

[0014] Preferably, the portable slit-lamp apparatus further includes means mounted to the body for providing background illumination of the cornea. This illumination is preferably of adjustable brightness.

[0015] Means is preferably provided to adjust the width of the narrow beam of light.

[0016] In a second aspect, the invention provides a method of obtaining a digital image of structures of the eye utilising a portable slit lamp apparatus according to the present invention including: at a first location, projecting a narrow beam of light, generated by said solid state lamp means and associated optics, onto the cornea of a patient's eye; detecting, with said detecting means, a reflection of said beam of light by structures of the eye; and making a digital record of the reflection.

[0017] Preferably, said narrow beam is of elongated slit-shaped cross-section. Preferably, the method further includes the step of transmitting said digital record to a second location remote from the first.

[0018] Advantageously, the digital record is reproduced as a viewable image.

[0019] The transmission of the digital record of the re-

flection may be by transport of a memory device, eg. a computer memory disk, but is preferably online, eg. via the internee or other network means from a local computer at the first location.

Brief Description of the Drawings

[0020] The invention will now be further described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic side elevation, with a portion depicted 3-dimensionally, of portable slit-lamp apparatus according to an embodiment of the invention;
Figure 2 is a plan view of the apparatus of Figure 1, also depicting a cabling link to a local computer; and
Figure 3 is an optical ray diagram of the respective arrangements in the apparatus of Figure 1 for generating and projecting a narrow beam or slit of light onto the cornea of a patient's eye. A typical slit lamp image is also included in Figure 3.

Embodiments of the Invention

[0021] The illustrated portable slit-lamp apparatus 10 includes a portable body 11 made up of a generally cylindrical handle 12 and, atop the handle, a mounting plate 14. Handle 12 is of such a diameter that it is able to be readily and comfortably held in an adult hand by grasping the hand about the handle. Handle 12 is a housing for the electrical circuitry of the device and also optionally carries a power supply such as a battery pack.

[0022] Plate 14 supports, on its upper surface adjacent its front edge 15, a pair of slit-lamp devices 16a, 16b. Each device 16a, 16b contains a pair of adjacent solid state lamps 50, 51 (Figure 3) as light source 55 and associated optics 52 for generating a narrow beam of light of elongated slit-shaped cross-section, and projecting the beam respectively onto the corneas of a patient's left and right eyes, when the apparatus is held (by grasping handle 12) at a suitable position in front of the respective eye.

[0023] Further supported atop plate 14, generally at the centre front of the plate, is preferably a digital camera but may be an analogue camera such as a CCD lipstick camera 22. Camera 22 includes optics whereby the reflection of the aforementioned narrow beam of light by structures of the eye is detected by the camera and a digital record of the reflection thereby obtained. The normal practice is to direct the beam towards the respective eye off the central optical axis, eg. about 20° and typically greater than 5°, in order to avoid red reflex images from the back of the eye.

[0024] Slit-lamp devices may be at a fixed angle as illustrated, or mounted for pivotal adjustment to different angles. Magnification may also be variable.

[0025] The camera image is viewed in real time on a rear-facing LCD screen 40 mounted between upstanding brackets 42 on mounting plate 14. Screen 40 is pivotally mounted at 43 to brackets 42 to allow adjustment of its angular orientation. When it is desired to capture and store an image, the operator triggers image capture button 35 on handle 12, and the captured image is transmitted as a digital record to a local personal computer (PC) 25 via a cabling link 24. When the operator of the lamp apparatus presses button 35, an enable signal is sent to the computer via cabling 24 and the serial (or COM) port 26 of the PC, to trigger customised applications of the software to detect the signals and grab images using a frame grabber in the PC. Thus a particular image or video clip can be selected for saving on file in the PC. In an alternative wireless embodiment, the instrument may be provided with an infra-red or radio transmitter for communicating with the PC to transfer images. In another alternative, with a digital camera the camera may store digital image records on a memory card that can be downloaded to the PC.

[0026] The arrangement of the camera 22 is such that the image captured by the camera is substantially the exact slit image seen directly from the slit-lamp.

[0027] As mentioned, the light source 55 of each slit-lamp device 16 is a pair of adjacent solid state lamps. Suitable such lamps are light emitting diodes (LED) 50, 51 (Figure 3). Use of diodes rather than a small bulb permits a much longer life between replacements of the battery contained within handle 12. A switch 26 is provided at the side of handle 12 for altering output of the diodes and therefore the brightness of the projected narrow beam of light to suit the patient's cornea, for example according to whether the iris is blue or brown or otherwise darker.

[0028] The optics 52 associated with the LEDs 50, 51 of each slit lamp device 16 are depicted in the optical ray diagram of Figure 3. The pair of adjacent diodes 50, 51 forms an elongated light source that generates an initial beam 54 formed by the overlapping cones (typically 20°) of light 53a, 53b emitted by the diodes. Diodes 50, 51 are preferably white LEDs. Beam 54 is laterally trimmed by structure 56 defining a narrow slit 57 which is optionally adjustable but typically of width about 0.1 mm. The beam 58 emerging from slit 57 is focussed by a plano-convex lens in the form of a semi-cylindrical prism lens 60, ie. a prism lens of uniform semi-circular cross-section, so as to be aligned with slit 57 and with the elongated light source. The planar face 61 of prism lens 60 faces the slit and is orthogonal to the beam. Lens 60 focuses beam 58 towards the cornea of the respective eye to form the narrow beam of light 62 projected onto the cornea. Lens 60 also longitudinally trims beam 58 back to a segment formed by the overlapping of the light cones from the LEDs 50, 51.

[0029] Figure 2 also includes a typical slit lamp image 65 captured by camera 22. The image of the reflection of narrow light beam 62 is readily apparent at 62'.

[0030] The apparatus includes a switch (not shown),

typically on handle 12, for selectively operating one or other of slit lamp devices 16a, 16b according to whether a left-eye or right-eye image is required.

[0031] Projecting forwardly from a mount under plate 14 just behind its front edge 15 is an additional diode light source 30 to provide background illumination of the cornea. A second control switch 32 at the side of handle 12 permits adjustment of the brightness of the background illumination to suit ambient conditions.

[0032] As mentioned, the slit 57 of each slit-lamp device 16a, 16b is adjustable so that the width of the slit of light can be varied. For example, when the slit is narrower, an optical section of the anterior part of the eye is seen: from the exterior inwards this consists of a cornea, a dark interval corresponding to the anterior chamber, and either the iris or the lens and the anterior part of the vitreous. When the slit is a little wider, blocks of the transparent tissues are illuminated. It will be understood that light that is brought to focus in a vertical line, ie. a slit, is directed into the eye so that the beam of light cuts a slice through the transparent and semi-transparent structures. In this way, an optical section is cut through the tissue. It is easy to see the shape and thickness of transparent structures and to localise the position or depth of any alterations in these structures.

[0033] To further enhance its flexibility, apparatus 10 is fitted with a red reflex unit 70 comprising a white diode 71 on a projecting arm 72 which is pivotally mounted at 73 above camera 22 on an inverted U sub-frame 74. When unit 70 is in the position shown in Figure 1, the beam from diode 71 is reflected to the eye, on the optical axis of camera 22 and the central optical axis of the eye, by an oblique beamsplitter 75 (on arm 72) that also transmits red reflex images reflected off the back of the eye to camera 22. In this condition the apparatus can be employed for detection of lens opacities (eg. cataract) and abnormalities (eg. subluxation).

[0034] The red reflex unit 70 is rendered inoperable by pivoting arm 72 upwardly about mountings 73 to remove the beamsplitter 75 from the optical axis of the camera 22. A switch device 78 at the back of unit 70 switches diode 71 and the diodes of slit-lamp devices 16a, 16b on and off or off and on according to the position of the unit.

[0035] In a further modification, with the red reflex unit in the position shown in Figure 1, a suitable lens arrangement placed between beamsplitter 75 and the eye makes it possible to obtain, with camera 22 and using lamp 71, an image of the retina, ie. an image normally only able to be obtained with a separate instrument such as an ophthalmoscope or fundus camera.

[0036] It will be appreciated that the illustrated instrument has the great practical advantage that it can be carried to remote locations and employed, perhaps by semi-skilled or non-specialist personnel, to capture and store slit-lamp images in digital format in a computer hard disk or other storage device for transfer to another location for subsequent diagnosis by ophthalmologists or other skilled professionals. In accordance with a preferred aspect of the invention, however, the digital record of the images may be transmitted online, eg via the internet or other network means, to the other location for review and diagnosis. The diagnosis may then be transmitted or forwarded back, eg. as an online response to the forwarder of the image.

Claims

1. Portable slit-lamp apparatus (10), comprising:

   a body (11) configured, in use, to be held up in the hand of an operator at a suitable position in front of a patient's eye;
   a pair (16a, 16b) of solid state lamp means (50, 51) and associated optics (52), each said solid state lamp means (50,51) and associated optics (52) being carried by said body for generating a narrow beam of light and projecting the beam onto the cornea of the eye for reflection by structures of the eye, when the body is held at said suitable position in front of the eye; and
   wherein said pair (16a, 16b) of said solid state lamp means (50,51) and associated optics (52) are selectively operable for generating respective said narrow beams of light and projecting them onto the corneas of the patients left and right eyes respectively;
   means (22) mounted in cooperation with said body and said solid state lamp means to detect a reflection of said narrow beam of light by structures of the eye and to make an image thereof, which image is, or is processable to provide, a digital record of said reflection wherein said solid state lamp means consists of a pair of solid state lamps whereby the lamp means is generally elongated and said associated optics include an elongated lens (60) of uniform cross-section arranged with its axis generally aligned with said elongated lamp means, for focussing a light beam emitted thereby of elongated cross-section towards said cornea, as said narrow beam of light.

2. Apparatus according to claim 1 wherein said narrow beam is of elongated slit-shaped cross-section.

3. Apparatus according to claim 1 or 2 wherein said solid state lamp means (50,51) comprises one or more light emitting diodes.

4. Apparatus according to any preceding claim wherein said associated optics (52) include structure defining a slit (57) aligned with and disposed to receive light from said elongated light means, to define a light beam of elongated cross-section.

5. Apparatus according to any preceding claim wherein said lens (60) is a semi-cylindrical lens.

6. Apparatus according to any preceding claim wherein said means (22) to detect the reflection of said narrow beam of light is a digital camera and associated optics.

7. Apparatus according to any of claims 1 to 5 wherein said means (22) to detect the reflection of said narrow beam of light is a CCD camera and associated optics.

8. Apparatus according to any preceding claim, further comprising means (30) mounted to said body (11) for providing background illumination of the cornea.

9. Apparatus according to claim 8 further comprising means (32) to adjust the brightness of said background illumination.

10. Apparatus according to any preceding claim, further comprising means (26) for adjusting the brightness of said solid state lamp means (50,51).

11. Apparatus according to any preceding claim, further comprising means to adjust the width of said narrow beam of light.

12. Apparatus according to any preceding claim, further comprising means (70) to selectively project a beam of light from a solid state lamp (71) to obtain red reflex.

13. Apparatus according to any preceding claim, further comprising solid state lamp and lens means to selectively project a beam of light to obtain an image of the retina.

14. Apparatus according to any preceding claim, further comprising means to transmit said digital record for storage, and for review and diagnosis subsequently and/or at a remote location.

15. Apparatus according to claim 14, wherein said means to transmit the digital record comprises a cabling link (24) to a local computer (25) for storage or optionally for online transmission to the remote location.

16. Apparatus according to claim 14, wherein said means to transmit the digital record comprises a radio, microwave or infra-red transmitter for communicating with a local computer for storage or optionally for online transmission to the remote location.

17. A method of obtaining a digital image of structures of the eye utilising a portable slit lamp apparatus (10) according to any of claims 1 to 17 including:

at a first location, projecting a narrow beam of light, generated by one of said pair (16a, 16b) of solid state lamp means (50,51) and associated optics (52), onto the cornea of a patient's eye;
detecting, with said detecting means (22), a reflection of said beam of light by structures of the eye; and
making a digital record of the reflection.

18. A method according to claim 17 wherein said narrow beam is of elongated slit-shaped cross-section.

19. A method according to claim 17 or 18 further including the step of reproducing said digital record as a viewable image.

20. A method according to claim 17, 18 or 19 further including the step of transmitting said digital record to a second location remote from the first.

21. A method according to claim 20 wherein said transmission of the digital record is online via the internet or other network means from a local computer at the first location.

Patentansprüche

1. Tragbare Spaltlampenvorrichtung (10), mit:

einem Körper (11), der konfiguriert ist, um im Gebrauch an einer geeigneten Position vor dem Auge eines Patienten mit der Hand einer Bedienungsperson gehalten zu werden;
einem Paar (16a, 16b) von Feststofflampenmitteln (50, 51) und einer zugeordneten Optik (52), wobei sowohl die Feststofflampenmittel (50, 51) als auch die zugeordnete Optik (52) von dem Körper getragen werden, um ein schmales Lichtbündel zu erzeugen und um das Lichtbündel auf die Hornhaut des Auges zu projizieren, um von Strukturen des Auges reflektiert zu werden, wenn der Körper an der geeigneten Position vor dem Auge gehalten wird;
wobei das Paar (16a, 16b) aus den Feststofflampenmitteln (50, 51) und der zugeordneten Optik (52) wahlweise betreibbar ist, um die schmalen Lichtbündel zu erzeugen und sie auf die Hornhaut des linken bzw. des rechten Auges des Patienten zu projizieren; und
Mitteln (22), die in Zusammenwirkung mit dem Körper und den Feststofflampenmitteln montiert sind, um eine Reflexion des schmalen Lichtbündels durch Strukturen des Auges zu detektieren und um hieraus ein Bild zu erzeugen, wobei das Bild entweder eine digitale Aufzeichnung der

Reflexion ist oder verarbeitbar ist, um eine solche Aufzeichnung zu ergeben, wobei die Feststofflampenmittel aus einem Paar Feststofflampen bestehen, wobei die Lampenmittel im Allgemeinen langgestreckt sind und die zugeordnete Optik eine langgestreckte Linse (60) mit gleichmäßigem Querschnitt besitzt, die so angeordnet ist, dass ihre Achse im Allgemeinen auf die langgestreckten Lampenmittel ausgerichtet ist, um ein Lichtstrahlenbündel, das hiervon ausgesendet wird und einen langgestreckten Querschnitt besitzt, auf der Hornhaut als das schmale Lichtbündel zu fokussieren.

2. Vorrichtung nach Anspruch 1, wobei das schmale Bündel einen langgestreckten, spaltförmigen Querschnitt hat.

3. Vorrichtung nach Anspruch 1 oder 2, wobei die Feststofflampenmittel (50, 51) eine oder mehrere Leuchtdioden enthalten.

4. Vorrichtung nach einem vorhergehenden Anspruch, wobei die zugeordnete Optik (52) eine Struktur aufweist, die einen Spalt (57) definiert, der auf die langgestreckten Lichtmittel ausgerichtet ist und angeordnet ist, um hiervon Licht zu empfangen, um ein Lichtstrahlenbündel mit langgestrecktem Querschnitt zu definieren.

5. Vorrichtung nach einem vorhergehenden Anspruch, wobei die Linse (60) eine halbzylindrische Linse ist.

6. Vorrichtung nach einem vorhergehenden Anspruch, wobei die Mittel (22) zum Detektieren der Reflexion des schmalen Lichtbündels eine Digitalkamera samt zugeordneter Optik sind.

7. Vorrichtung nach einem der Ansprüche 1 bis 5, wobei die Mittel (22) zum Detektieren der Reflexion des schmalen Lichtstrahlenbündels eine CCD-Kamera samt zugeordneter Optik sind.

8. Vorrichtung nach einem vorhergehenden Anspruch, die ferner Mittel (30) enthält, die an dem Körper (11) montiert sind, um eine Hintergrundbeleuchtung der Hornhaut bereitzustellen.

9. Vorrichtung nach Anspruch 8, die ferner Mittel (32) enthält, um die Helligkeit der Hintergrundbeleuchtung einzustellen.

10. Vorrichtung nach einem vorhergehenden Anspruch, die ferner Mittel (26) enthält, um die Helligkeit der Feststofflampenmittel (50, 51) einzustellen.

11. Vorrichtung nach einem vorhergehenden Anspruch, die ferner Mittel enthält, um die Breite des schmalen Lichtstrahlenbündels einzustellen.

12. Vorrichtung nach einem vorhergehenden Anspruch, die ferner Mittel (70) enthält, um ein Lichtstrahlenbündel von einer Feststofflampe (71) wahlweise zu projizieren, um einen roten Reflex zu erhalten.

13. Vorrichtung nach einem vorhergehenden Anspruch, die ferner Feststofflampen- und Linsenmittel enthält, um ein Lichtstrahlenbündel wahlweise zu projizieren, um ein Bild der Netzhaut zu erhalten.

14. Vorrichtung nach einem vorhergehenden Anspruch, die ferner Mittel enthält, um die digitale Aufzeichnung für eine Speicherung sowie eine Überprüfung und Diagnose anschließend und/oder an einem entfernten Ort zu senden.

15. Vorrichtung nach Anspruch 14, wobei die Mittel zum Senden der digitalen Aufzeichnung eine Kabelverbindung (24) zu einem lokalen Computer (25) für die Speicherung oder optional für eine Online-Übertragung zu einem entfernten Ort enthalten.

16. Vorrichtung nach Anspruch 14, wobei die Mittel zum Senden der digitalen Aufzeichnung einen Funk-, Mikrowellen- oder Infrarotsender enthalten, um mit einem lokalen Computer für die Speicherung zu kommunizieren oder optional zu dem entfernten Ort online zu übertragen.

17. Verfahren zum Erhalten eines digitalen Bildes von Strukturen des Auges unter Verwendung einer tragbaren Spaltlampenvorrichtung (10) nach einem der Ansprüche 1 bis 17, das umfasst:

an einem ersten Ort Projizieren eines schmalen Lichtstrahlenbündels, das von einem des Paars (16a, 16b) von Feststofflampenmitteln (50, 51) und der zugeordneten Optik (52) erzeugt wird, auf die Hornhaut des Auges eines Patienten;
Detektieren mit den Detektionsmitteln (22) einer Reflexion des Lichtstrahlenbündels durch die Strukturen des Auges; und
Erzeugen einer digitalen Aufzeichnung der Reflexion.

18. Verfahren nach Anspruch 17, wobei das schmale Bündel einen langgestreckten spaltförmigen Querschnitt hat.

19. Verfahren nach Anspruch 17 oder 18, das ferner den Schritt des Wiedergebens der digitalen Aufzeichnung als ein betrachtbares Bild umfasst.

20. Verfahren nach Anspruch 17, 18 oder 19, das ferner den Schritt des Sendens der digitalen Aufzeichnung zu einem zweiten Ort, der von dem ersten Ort ent-

fernt ist, umfasst.

21. Verfahren nach Anspruch 20, wobei das Senden der digitalen Aufzeichnung von einem lokalen Computer an dem ersten Ort online über das Internet oder über andere Netzmittel erfolgt.

Revendications

1. Appareil à lampe à fente portative (10), comportant :

un corps (11) configuré, en utilisation, pour être tenu levé dans la main d'un opérateur dans une position adaptée à l'avant de l'oeil d'un patient ;
une paire (16a, 16b) de moyens de lampe à semi-conducteurs (50, 51) et des composants optiques associés (52), chacun desdits moyens de lampe à semi-conducteurs (50, 51) et des composants optiques associés (52) étant supporté par ledit corps pour générer un faisceau de lumière étroit et projeter le faisceau sur la cornée de l'oeil pour une réflexion par des structures de l'oeil, lorsque le corps est tenu dans ladite position adaptée à l'avant de l'oeil ; et
dans lequel ladite paire (16a, 16b) desdits moyens de lampe à semi-conducteurs (50, 51) et les composants optiques associés (52) peuvent fonctionner sélectivement pour générer lesdits faisceaux de lumière étroits respectifs et les projeter sur les cornées des yeux gauches et droits des patients respectivement ;
des moyens (22) montés en coopération avec ledit corps et lesdits moyens de lampe à semi-conducteurs pour détecter une réflexion dudit faisceau de lumière étroit par les structures de l'oeil et pour produire une image de celles-ci, laquelle image est, ou peut être traitée pour fournir, un enregistrement numérique de ladite réflexion dans lequel lesdits moyens de lampe à semi-conducteurs sont constitués d'une paire de lampes à semi-conducteurs en sorte que les moyens de lampe sont généralement allongés et lesdits composants optiques associés incluent une lentille allongée (60) de section transversale uniforme disposée avec son axe généralement aligné avec lesdits moyens de lampe allongés, pour focaliser un faisceau de lumière émis par ceux-ci de section transversale allongée vers ladite cornée, en tant que dit faisceau de lumière étroit.

2. Appareil selon la revendication 1, dans lequel ledit faisceau étroit est de section transversale en forme de fente allongée.

3. Appareil selon la revendication 1 ou 2, dans lequel lesdits moyens de lampe à semi-conducteurs (50, 51) comportent une ou plusieurs diodes électroluminescentes.

4. Appareil selon l'une quelconque des revendications précédentes, dans lequel lesdits composants optiques associés (52) incluent une structure définissant une fente (57) alignée avec une lumière provenant desdits moyens de lumière allongés et disposée pour recevoir celle-ci, afin de définir un faisceau de lumière de section transversale allongée.

5. Appareil selon l'une quelconque des revendications précédentes, dans lequel ladite lentille (60) est une lentille semi cylindrique.

6. Appareil selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens (22) pour détecter la de réflexion dudit faisceau de lumière étroit est une caméra numérique et des composants optiques associés.

7. Appareil selon l'une quelconque des revendications 1 à 5, dans lequel lesdits moyens (22) pour détecter la réflexion dudit faisceau de lumière étroit sont une caméra CCD et des composants optiques associés.

8. Appareil selon l'une quelconque des revendications précédentes, comportant en outre des moyens (30) montés sur ledit corps (11) pour assurer un éclairage de fond de la cornée.

9. Appareil selon la revendication 8, comportant en outre des moyens (32) pour régler la luminosité dudit éclairage de fond.

10. Appareil selon l'une quelconque des revendications précédentes, comportant également des moyens (26) pour régler la luminosité desdits moyens de lampe à semi-conducteurs (50, 51).

11. Appareil selon l'une quelconque des revendications précédentes, comportant de plus des moyens pour régler la largeur dudit faisceau de lumière étroit.

12. Appareil selon l'une quelconque des revendications précédentes, comportant en outre des moyens (70) pour projeter sélectivement un faisceau de lumière à partir d'une lampe à semi-conducteurs (71) pour obtenir un reflet rétinien.

13. Appareil selon l'une quelconque des revendications précédentes, comportant en outre une lampe à semi-conducteurs et des moyens de lentille pour projeter sélectivement un faisceau de lumière afin d'obtenir une image de la rétine.

14. Appareil selon l'une quelconque des revendications précédentes, comportant également des moyens

pour transmettre ledit enregistrement numérique pour une mémorisation, et pour un examen et un diagnostic ultérieurs et/ou à un emplacement distant.

15. Appareil selon la revendication 14, dans lequel lesdits moyens pour transmettre l'enregistrement numérique comportent une liaison câblée (24) à un ordinateur local (25) pour une mémorisation ou facultativement pour une transmission en ligne à l'emplacement distant.

16. Appareil selon la revendication 14, dans lequel lesdits moyens pour transmettre l'enregistrement numérique comportent un émetteur radio, hyperfréquence ou infrarouge pour communiquer avec un ordinateur local pour une mémorisation ou facultativement pour une transmission en ligne à l'emplacement distant.

17. Procédé pour obtenir une image numérique de structures de l'oeil en utilisant un appareil à lampe à fente portative (10) selon l'une quelconque des revendications 1 à 17, incluant les étapes consistant à :

à un premier emplacement, projeter un faisceau de lumière étroit, généré par un moyen de ladite paire (16a, 16b) de moyens de lampe à semiconducteurs (50, 51) et de composants optiques associés (52), sur la cornée d'un oeil de patient ;
détecter, avec lesdits moyens de détection (22), une réflexion dudit faisceau de lumière par des structures de l'oeil ; et
effectuer un enregistrement numérique de la réflexion.

18. Procédé selon la revendication 17, dans lequel ledit faisceau étroit est de section transversale en forme de fente allongée.

19. Procédé selon la revendication 17 ou 18, incluant en outre l'étape consistant à reproduire ledit enregistrement numérique sous la forme d'une image visible.

20. Procédé selon la revendication 17, 18 ou 19, incluant également l'étape consistant à transmettre ledit enregistrement numérique à un second emplacement distant du premier.

21. Procédé selon la revendication 20, dans lequel ladite transmission de l'enregistrement numérique s'effectue en ligne via Internet ou d'autres moyens de réseau à partir d'un ordinateur local au premier emplacement.

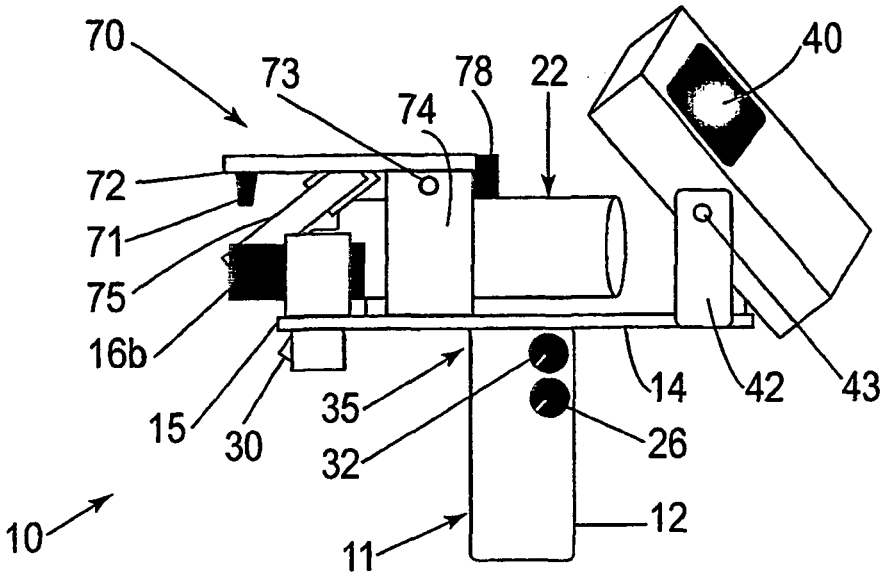

FIGURE 1

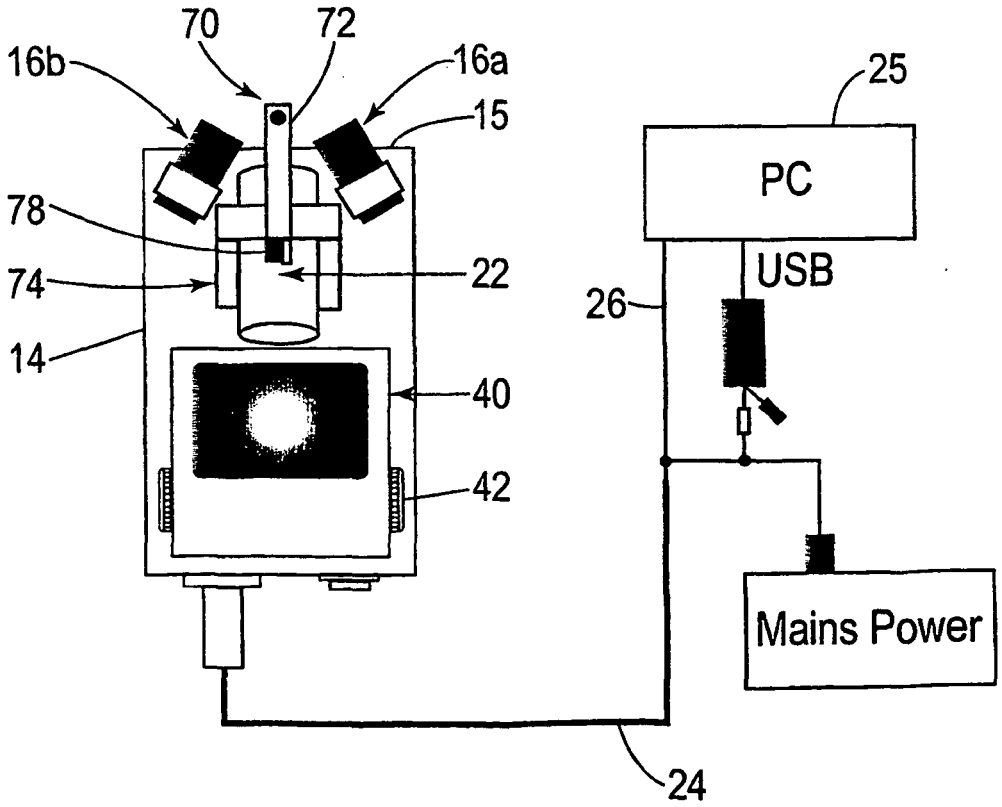

FIGURE 2

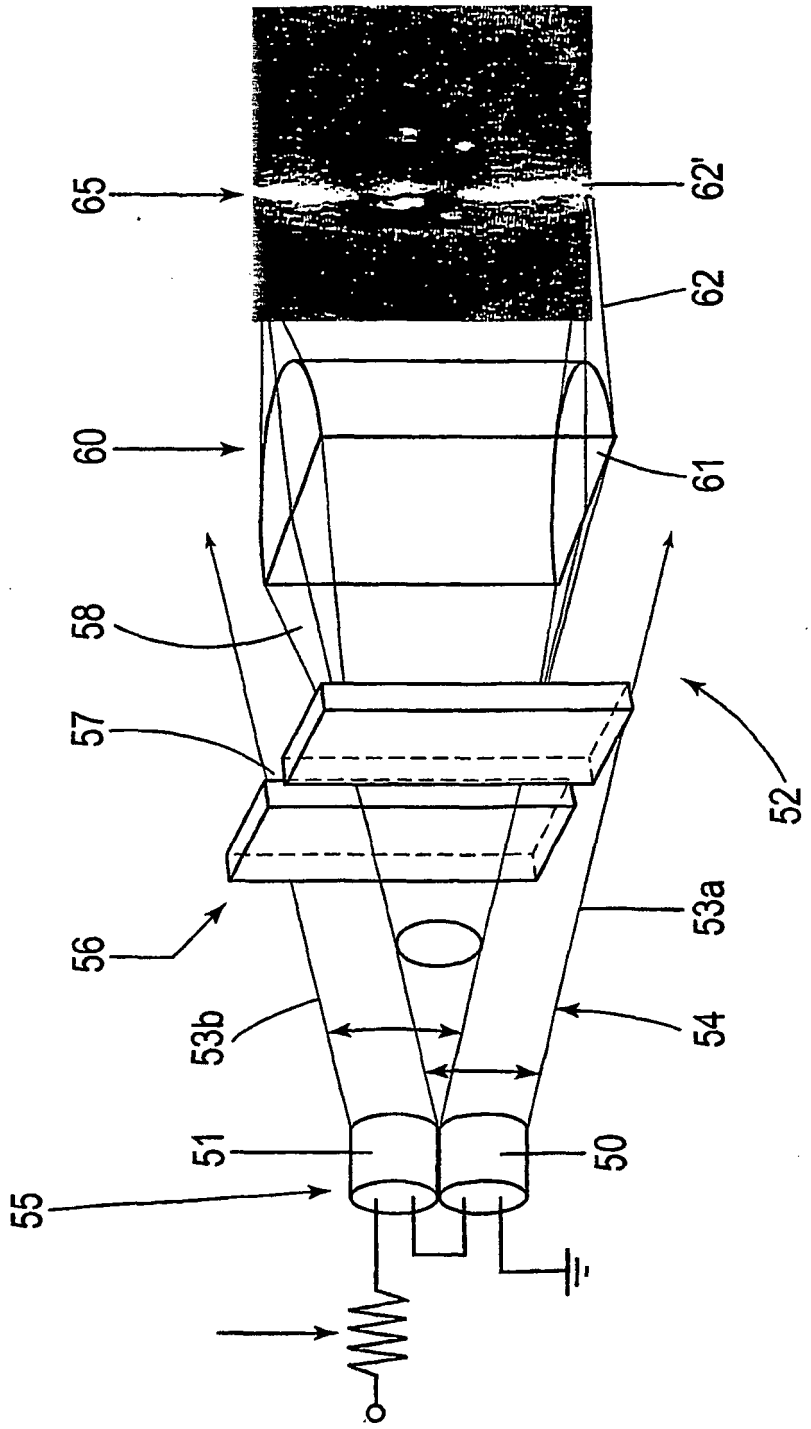

FIGURE 3

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 29913602 **[0004]**

专利名称(译)	便携式裂隙灯		
公开(公告)号	EP1284638B1	公开(公告)日	2013-06-26
申请号	EP2001931208	申请日	2001-05-18
申请(专利权)人(译)	狮子会眼科研究所西澳大利亚州注册成立		
当前申请(专利权)人(译)	狮子会眼科学院有限公司		
[标]发明人	YOGESAN KANAGASINGAM CONSTABLE IAN JEFFREY SUPLEWSKI GABRIEL		
发明人	YOGESAN, KANAGASINGAM CONSTABLE, IAN, JEFFREY SUPLEWSKI, GABRIEL		
IPC分类号	A61B3/14 A61B3/135 A61B3/12 A61B5/00		
CPC分类号	A61B3/12 A61B3/135 A61B3/14 A61B3/185 A61B5/0022		
代理机构(译)	PIÉ出售，ALEXANDER JAMES		
优先权	2000PQ7625 2000-05-19 AU		
其他公开文献	EP1284638A4 EP1284638A1		
外部链接	Espacenet		

摘要(译)

一种便携式裂隙灯装置，包括能够握在操作者手中的主体（11）和固态灯装置（55）以及由主体承载的相关光学器件（52），用于产生窄光束和当身体被保持在眼睛前方的合适位置时，将光束投射到患者眼睛的角膜上以通过眼睛的结构进行反射。装置（22）与主体和固态灯装置配合安装，以通过眼睛的结构检测窄光束的反射并产生其图像，该图像是或可处理的，以提供数字记录的反思。

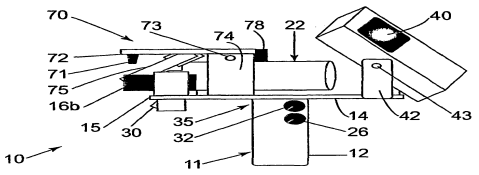

FIGURE 1

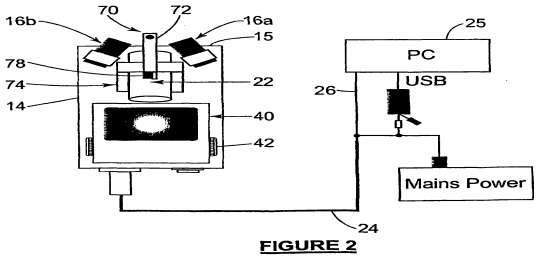

FIGURE 2