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(54) Light source

(57) The application targets in improving the ability to realize details. In general, a light source according to the invention comprises an illuminant emitting radiation with wavelengths of 500nm to 550nm and/or of 585nm to 640nm. The light source may comprise a light emitting diode (LED), a discharge tube and/or a laser. Such a light source may be utilized in a lamp for elder people, in a lamp for a microscope, in street lighting or in automobile front light.

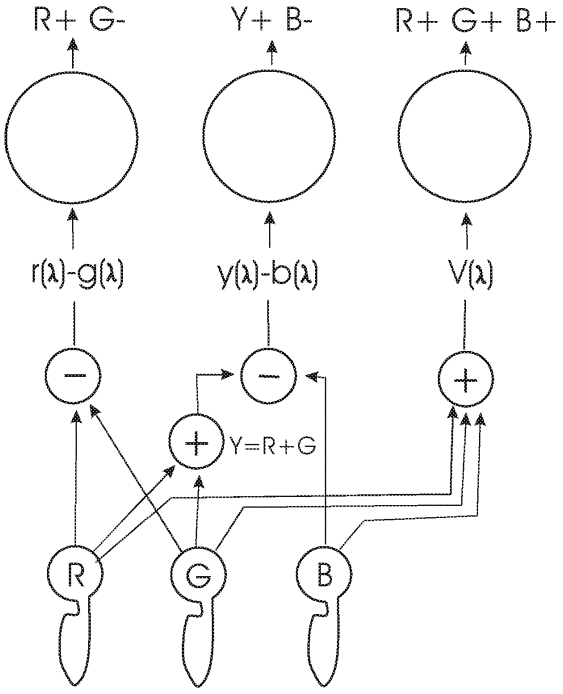

Fig. 2

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a light source. In particular, the invention relates to a lamp including the light source.

BACKGROUND OF THE INVENTION

[0002] In some applications it is important to recognize things or aspects of things. The ability of realizing details may depend on the possibility to see something with a good contrast, for example, if elder people want to read something, if scientists want to differentiate structures with a microscope, or if movable objects on a street have to be recognized to avoid an accident.

SUMMARY OF THE INVENTION

[0003] The invention targets in improving the ability to realize details. It is an object of the invention to provide a light source addressing said target.

[0004] This is achieved by the subject matter of each of the independent claims. Further embodiments of the invention are described in the dependent claims.

[0005] In general, a light source according to the invention comprises an illuminant emitting radiation with wavelengths of 500nm to 550nm and/or of 585nm to 640nm. Preferably, the illuminant emits radiation with wavelength of 515nm to 535nm and/or of 600nm to 620nm. That is, the illuminant may emit radiation with wavelength of about 525nm, which may be between 523nm and 527nm, and/or of about 610nm, which may be between 608nm and 612nm.

[0006] It is noted that either the wavelengths in the green spectrum of visible light (500nm to 550nm) or the wavelengths in the red spectrum of visible light (585nm to 640nm) are suitable to achieve the intended effect of providing a better contrast.

[0007] The contrast or at least the comfort in utilizing such a light source, may also be enhanced by a combination of the mentioned spectra. In other words, an illuminant emitting radiation with wavelengths of the green spectrum and of the red spectrum, simultaneously, will provide for a better contrast.

[0008] According to a first embodiment of the invention, the light source comprises a light emitting diode (LED). It will be understood, that a light source may comprise a plurality of LEDs to have a better brightness. For a light source emitting green light together with red light, a number of red LEDs may be combined with a number of green LEDs in one light source or lamp.

[0009] For example, the light emitting diode may include an element out of the group consisting of an AlInGaP-LED and an InGaN-LED.

[0010] According to a second embodiment of the invention, the light source comprises a discharge tube. With an appropriate choice of the emitting medium, it is possible to emit radiation with a spectrum of green and/or red light. Green light wavelengths may be achieved by the use of Chrome or Copper. Red light wavelengths may be achieved by the use of Lithium or Calcium.

[0011] Furthermore, the LEDs or discharge light source may be provided with selective filters to narrow down the emission spectrum of the light source.

[0012] According to a third embodiment of the invention, the light source comprises a laser. Such a laser may comprise a diode pumped Nd-YAG element which frequency is subsequently doubled and/or a red diode laser.

[0013] The light sources in accordance with the invention may be utilized as a lamp for elder people, as a lamp for a microscope, as street lighting or as automobile front light, wherein the lamp includes a light source as described above.

[0014] It has to be noted that a person skilled in the art will gather from the above and the following description that, unless other notified, in addition to any combination of features belonging to one embodiment also any combination between features relating to another embodiment is considered to be disclosed with this application.

[0015] The aspects defined above and further aspects, features and advantages of the present invention can also be derived from the examples of the embodiments to be described herein after and are explained with reference to examples of embodiments also shown in the figures, but to which the invention is not limited.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a schematically illustration of light processing in an eye.
Fig. 2 illustrates the processing of different colors.

Fig. 3 shows an absorption spectrum of blue, red and green cones.
Fig. 4 is a diagram showing a spectral sensitivity of green/red-cells and of blue/yellow-cells.
Fig. 5 shows an exemplary embodiment of a laser-based lamp.
Fig. 6 shows an exemplary embodiment of a LED-based lamp.
Fig. 7 shows an exemplary embodiment of a discharge-based lamp.

DETAILED DESCRIPTION OF EMBODIMENTS

[0017] As an explanation of why a light source according to the invention is capable of enhancing the contrast of something visible, the processing of light by an eye will be described in a first step.

[0018] Fig. 1 is a schematically illustration of light processing in an eye. The retina of an eye comprises neurons of the ganglion 10, cross-linked neurons 20, cone-cells 30, and rod-cells 40. An incidence of light 100 onto the retina will trigger an activity of the neurons and cells so as to send pulses to the visual nerve by the nervus opticus 50.

[0019] A retina comprises three receptors for color vision, i.e. cones which are sensitive for red light, cones which are sensitive for green light, and cones which are sensitive for blue light.

[0020] An important aspect is that the information of these three different receptors will be processed by the retina, immediately, for example by the cross-linked neurons 20.

[0021] From fig. 2, it may be gathered that the information of the red, green and blue cones (R, G, B) are processed such that firstly a difference of red and green is generated. Secondly a difference of yellow and blue is generated, wherein yellow is an addition of red and green. Thirdly an addition of red, green and blue is generated.

[0022] It is noted that the result of the addition of red, green and blue is substantially relevant for the brightness $V(\lambda)$. For especially visualization with a high contrast of small structures, the red-green vision $r(\lambda)$-$g(\lambda)$ is relevant. This may be gathered from the fact that the most red and green cones can be found in the area of the yellow spot or macula of the retina.

[0023] Consequently, the absorption spectra in fig.3 show peaks of the respective cones in the blue B, green G and red R spectra. The dotted line indicates the absorption of the rods which are relevant for the black-and-white vision.

[0024] Another illustration of the different sensitivity of the different cones, may be seen in fig. 4, showing peaks of a green-red-cell (G-R), a red-green-cell (R-G), and of a blue-yellow-cell (B-Y) and a yellow-blue-cell (Y-B).

[0025] According to fig.4, there exists a cell which is especially sensitive for radiation with 525nm, and further a cell which is especially sensitive for radiation with 610nm.

[0026] In the following, exemplary embodiments of lamps are described, having an illuminant emitting light within the ranges stated above.

[0027] According to a first embodiment, shown in fig. 5, a lamp comprises a laser 200 which usually provides for a selective and small band emission. A laser emitting a green beam 210 may be realized on the basis of a diode pumped NdY-AG laser with subsequent frequency doubling. Such a laser may have a wavelength of 532nm of its radiation.

[0028] According to a second embodiment, shown in fig. 6, a lamp 300 comprises two different LEDs with emission wavelengths of about 525nm (310) and 610nm (320), respectively. For example, LEDs on the basis of AlInGaP- and InGaN-LEDs have such emission wavelength.

[0029] According to a third embodiment, a lamp 400 comprises a plurality of discharge light sources, which have collectively emission wavelengths of about 525nm and about 610nm. For example, discharge light sources with at least one element out of the following group are usable.

Sodium (Na)	589,0nm and 589,5nm
Barium (Ba)	553,5nm
Magnesium (Mg)	518,4nm, 517,3nm and 516,7nm
Thallium (Tl)	535,1nm
Chromium (Cr)	520,5nm and 520,8nm
Lithium (Li)	610,4nm and 670,0nm
Copper (Cu)	521,8nm, 522,0nm, 515,3nm and 510,5nm
Mercury (Hg)	546,1nm
Calcium (Ca)	610,2nm, 612,2nm and 616,2nm

[0030] Additionally, a discharge light source may comprise mercury and/or a noble gas as start gas or buffer gas. The above mentioned elements may also be provided as compound like halogenide, oxide and chalkogenide.

[0031] According to a fourth embodiment, a lamp comprises a combination of at least one type of LEDs and at least one discharge light source.

[0032] While the invention has been illustrated and described in detail in the drawings and afore-going description, such illustrations and descriptions are to be considered illustrative or exemplary and not restrictive, the invention is not limited to the disclosed embodiments.

[0033] Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word 'comprising' does not exclude other elements, and the indefinite article 'a' or 'an' does not exclude a plurality.

[0034] The mere fact that certain measures are recited and mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage. Any reference signs in the claims should not be construed as limiting the scope.

LIST OF REFERENCE SIGNS:

[0035]

10	neurons of the ganglion
20	cross-linked neurons
30	cone-cells
40	rod-cells
50	nervus opticus
100	light
200	laser
210	laser beam
300	LED lamp
310	first LED
320	second LED
400	discharge lamp
R	red
G	green
B	blue
Y	yellow

Claims

1. A light source, comprising:

an illuminant emitting light with wavelengths of 500nm to 550nm and/or of 585nm to 640nm.

2. The light source of claim 1,
wherein the illuminant emits light with wavelength of 515nm to 535nm and/or of 600nm to 620nm.

3. The light source of claim 1,
wherein the illuminant emits light with wavelength of 523nm to 527nm and/or of 608nm to 612nm.

4. The light source of claim 1,
wherein the illuminant comprises a light emitting diode (LED)(310, 320).

5. The light source of claim 1 or 4,
wherein the illuminant comprises a discharge tube.

6. The light source of claim 1,
wherein the illuminant comprises a laser.

7. The light source of claim 4,
wherein the light emitting diode (310, 320) includes an element out of the group consisting of an AlInGaP-LED and an InGaN-LED.

8. The light source of claim 5,
wherein the discharge tube includes at least one element out of the group consisting of Sodium, Barium, Magnesium, Thallium, Chromium, Copper, Lithium, Mercury and Calcium.

9. The light source of claims 7 or 8,
wherein the light source further comprises a filter for selectively narrowing down the emission spectrum of the illuminant.

10. The light source of claim 6,
wherein the laser comprises a diode pumped Nd-YAG element which frequency is subsequently doubled.

11. The light source of claim 6,
wherein the laser comprises a red diode laser.

12. A lamp (200, 300, 400) having
a light source according to any one of claims 1 to 11.

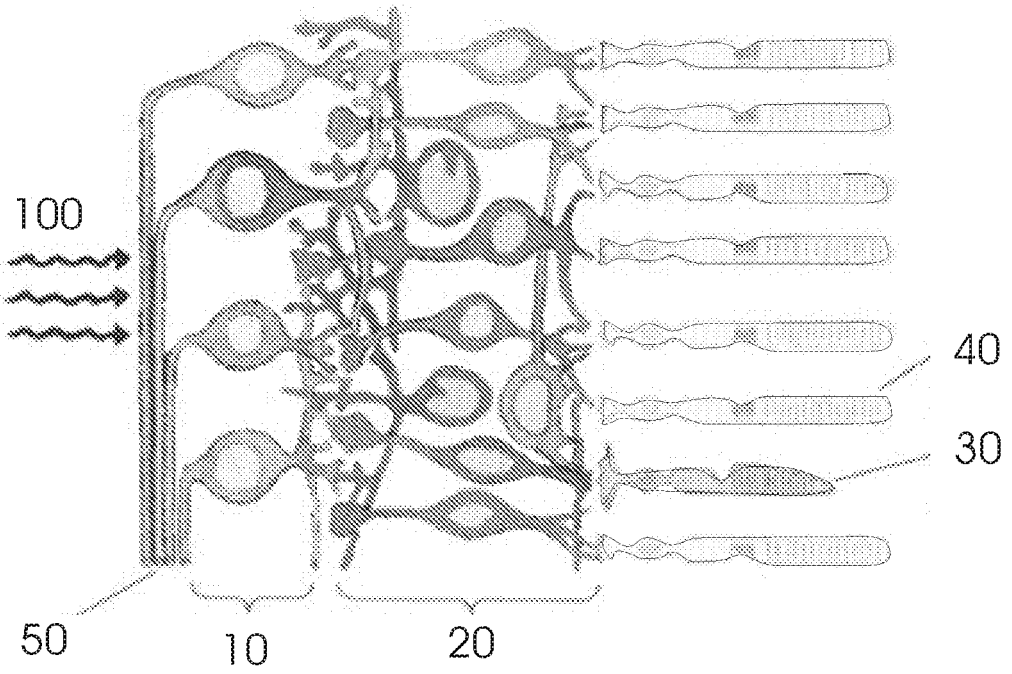

Fig. 1

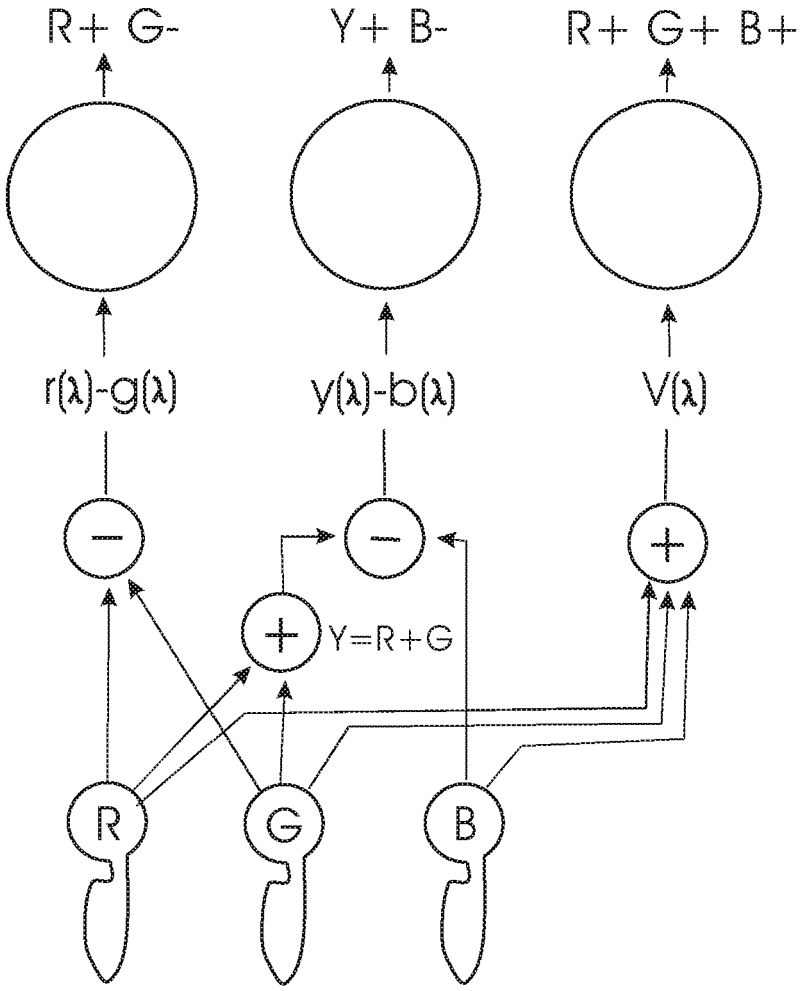

Fig. 2

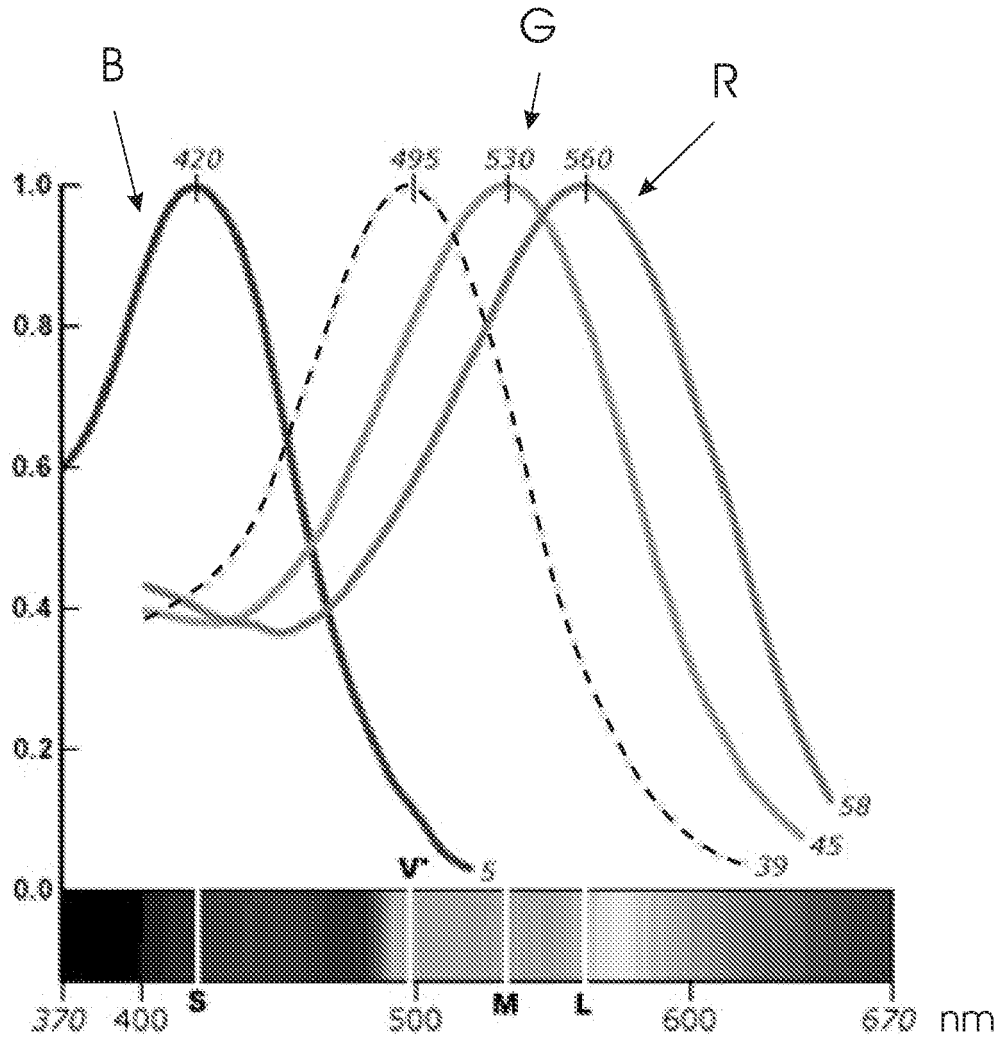
B
G
R
420
495
530
560
1.0
0.8
0.6
0.4
0.2
0.0
V*
5
39
45
58
370
400
S
500
M
L
600
670
nm

Fig. 3

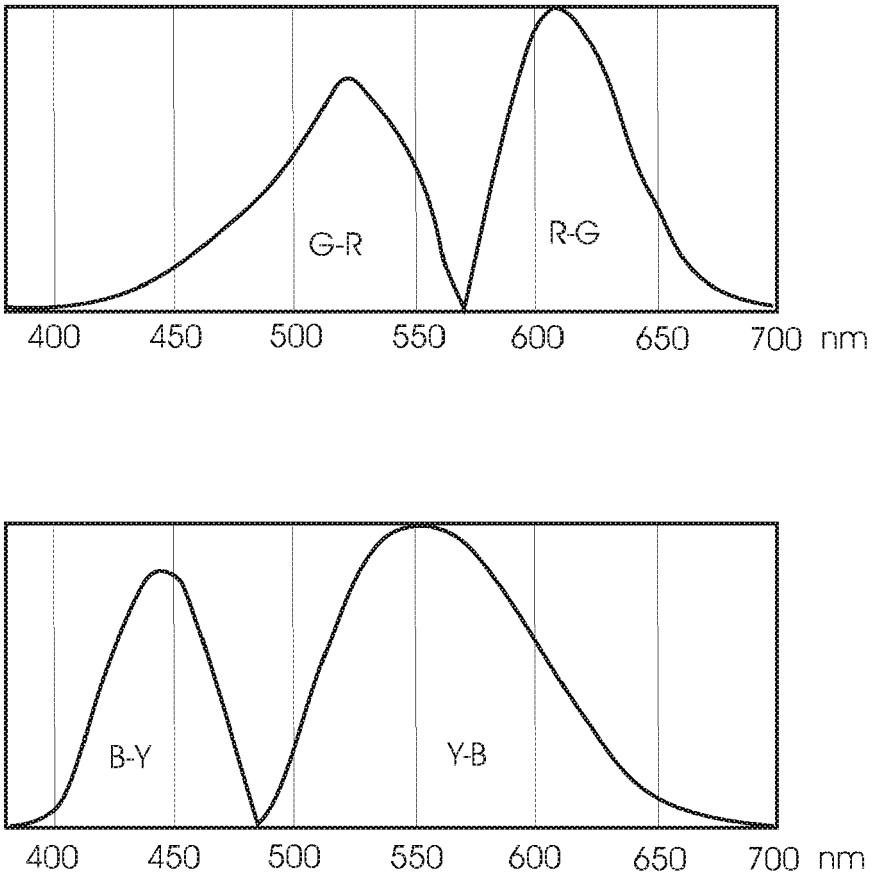
G-R
R-G
400
450
500
550
600
650
700
nm
B-Y
Y-B
400
450
500
550
600
650
700
nm

Fig. 4

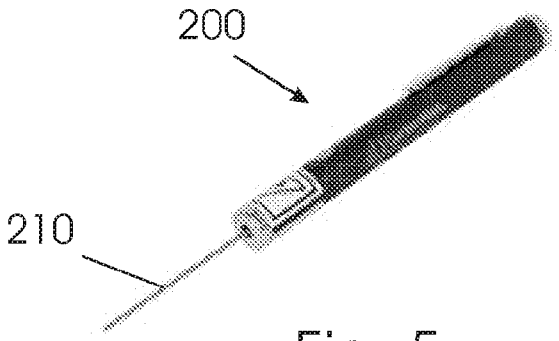

Fig. 5

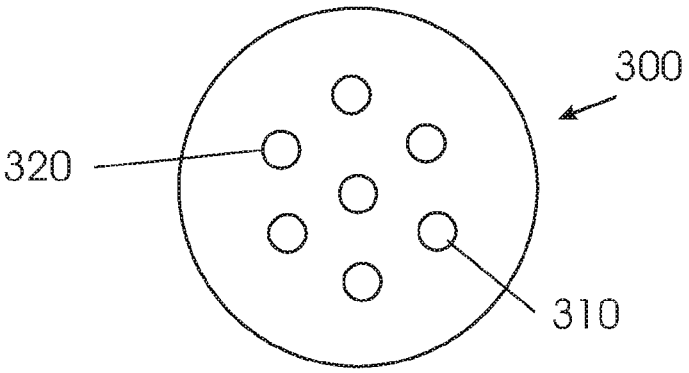

Fig. 6

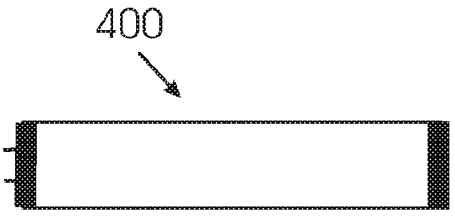

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 0812

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	G. Schröder, H. Treiber: "Technische Optik" 2007, Vogel Buchverlag , Würzburg, Germany , XP002603206 ISBN: 978-3-8343-3086-4 , pages 131-150 * paragraph [4.4.4]; tables 4.4.5, 4.4.7 * -----	1,2,4,6, 7,9-12	
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TECHNICAL FIELDS SEARCHED (IPC)
G01N
H01J
H05B
F21K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	4 October 2010	Brison, Olivier

CATEGORY OF CITED DOCUMENTS

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1 EPO FORM 1503 03.82 (P04C01)

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 0812

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 2002/071287 A1 (HAASE MICHAEL ALBERT [US]) 13 June 2002 (2002-06-13) * paragraph [0011] *	1,5,8	
			TECHNICAL FIELDS SEARCHED (IPC)

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04-10-2010

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