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(54) Device for detecting reduced vigilance condition

(57) The device incorporates a radiation source (3) fixed in a spectacle frame and photodetectors covering the eyelid shadow borderline, wherein said photodetectors (5) are connected with an electro-acoustic transducer (8) via a microprocessor based light exposure level and time analyser (6), situated in the spectacle frame (2).

The device incorporates a receiver (7) connected with an electro-acoustic transducer (8) and linked with an external information source (9) via a wireless link and a transmitter (7') linked with the external information source (9) via a wireless link.

The photodetectors (5) are incorporated in form of a series of photodetectors situated in a slidable housing (4) fixed to the spectacle frame (2).

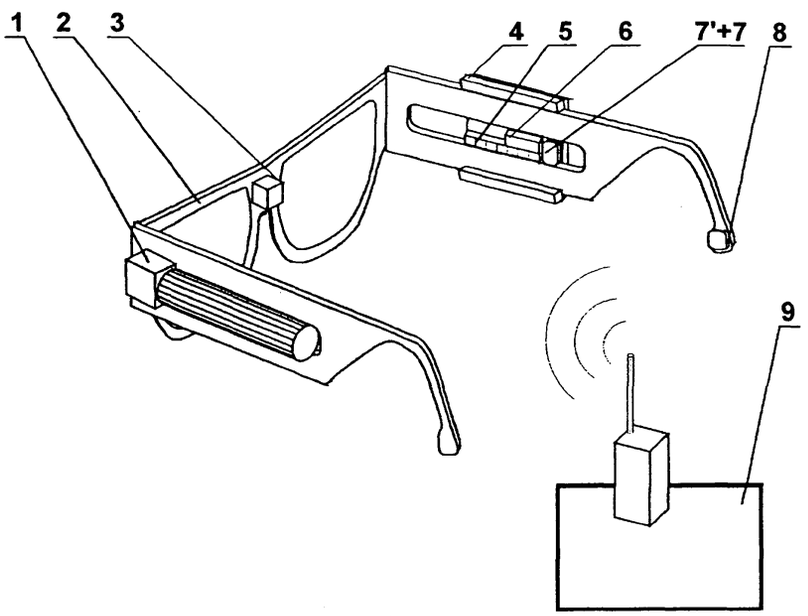

Fig. 1

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Description

[0001] The invention concerns a device for detecting of reduced vigilance condition in case of individuals which may create dangerous situations, particularly those operating the industrial facilities, working in arduous thermal conditions or in environment contaminated with toxic gases.

[0002] The known device incorporates a camera analysing the speed of eyeballs movements or an illuminator and detector of eyelid shadow analysing the closing time of that eyelid. The device designed for assessment of fatigue and weariness of the driver in course of driving has been disclosed in US Patent 5,402,109 in form of spectacle frames with a light source and a photodetector incorporated inside in manner resulting in intersection of the light beam and the eyelid.

The line connecting said light source and photodetector is situated on the level of eyeball and below the edge of open eyelid. The light is prevented to reach the photodetector in case of closed eyelid. When light beam reaching the photodetector is interrupted, an electronic timer will be activated. In case of eyelid drop duration exceeding 0.4s being the symptom of driver weariness, sound alarm is activated as the warning of reduced vigilance condition of the driver.

[0003] The disadvantage of the known device lies in the fact that owing to its functioning based only on the measurement of interception time of the detector of eyelid position change in relation to receptacle and due to other possible disturbances, required reliability and precise early warning of increasing hazard are not ensured by the known device.

[0004] The essence of the present invention consists in connection of photodetectors with an electro-acoustic transducer via light exposure level and time analyser based on microprocessor and situated in spectacle frame. Said device incorporates a receiver connected with an electro-acoustic transducer and favourably linked with external information source via wireless link as well as incorporates a transmitter favourably linked with external information source via wireless link. The photodetectors are incorporated in form of a series of photodetectors situated in slidable housing fixed to the spectacle frame.

[0005] The solution according to the present invention is characterized by increased versatility, precision and reliability of the device owing to its independence on head position in relation to the camera as well as independence on position of spectacle frame in relation to eyeballs and possibility of more comprehensive analysis of operator's condition.

[0006] The subject of the invention has been presented in form of an embodiment in the drawing illustrating the device for detecting reduced vigilance condition in axonometric view.

[0007] The device incorporates spectacle frames 2 with fixed IF radiation point source 3 and a series of photodetectors 5 situated in slidable housing 4 fixed to one of ear arms of the spectacle frame in manner ensuring coverage of eyelid shadow borderline in any probable position of the spectacles. A microprocessor based light exposure level and time analyser 6 as well as alarm levels operation, situated in adjoining slidable housing 4 is electrically connected to the output of photodetectors 5. A receiver 7 - transmitter 7' is incorporated in slidable housing 4, next to microprocessor based analyser 6 and linked via radio link with a stationary transmitter - receiver constituting an external information source 9, particularly in hazard condition. An electro-acoustic transducer 8 fixed on the end of the ear arm is electrically connected with microprocessor based analyser 6 in manner enabling direct warning the endangered person without the use of an external information source 9. The said electro-acoustic transducer 8 electrically connected with the receiver 7 in manner enabling the warning of endangered person by means of an external information source 9, for example the dispatcher.

The device is supplied by means of a battery with an inverter 1 and fixed in another ear arm of the receptacle frame 2.

[0008] The operation of receivers and transmitters is possible in infrared radiation range. The fastening of the series of photodetectors 5 and microprocessor based light exposure level and time analyser 6 in slidable housing 4 enables their precise positioning in relation to eyeball and eyelid as well as functioning of the device in manner independent of head position in relation to the camera and of receptacle frames in relation to eyeballs. The receiver 7 - transmitter 7' are used for communication with the operator when making external decision and for hazard warning in environment. In case of hazard, it is advisable to inform the occupants of adjacent area on alarm condition or on necessity of shutdown of power supply of the vehicle, closing of valves, oxygen supply or evacuation of the operator from endangered area.

[0009] The selection of the band of applied electromagnetic or acoustic waves depends on disturbances and on required range. The communication between the device and operator is established by means of the electro-acoustic transducer 8.

The receptacle frame 2 may be provided with ophthalmic or eye - protection glasses.

Claims

1. A device for detecting of reduced vigilance condition of technical equipment operator, incorporating a radiation source fixed in the spectacle frames and photodetectors covering the eyelid shadow borderline, wherein said photodetectors are connected with an electro-acoustic transducer, **characterized by** the photodetectors (5) connected with an electro-acoustic transducer (8) via a microprocessor

based light exposure levels and times analyser (6), situated in receptacle frame.

2. The device according to claim 1, wherein the receiver (7) is incorporated and connected with an electro-acoustic transducer (8) and favourably linked with external information source (9) via wireless link.

3. The device according to claim 1, wherein the transmitter (7') is incorporated and connected and favourably linked with external information source (9) via wireless link

4. The device according to claim 1, wherein the receiver (7) is incorporated and connected with an electro-acoustic transducer (8) and favourably linked with external information source (9) via wireless link and wherein the transmitter (7') is incorporated and favourably linked with external information source (9) via wireless link.

5. The device according to claim 1, or 2, or 3, or 4, wherein the photodetectors (5) are incorporated in form of a series of photodetectors situated in slidable housing (4) fixed to the spectacle frame (2).

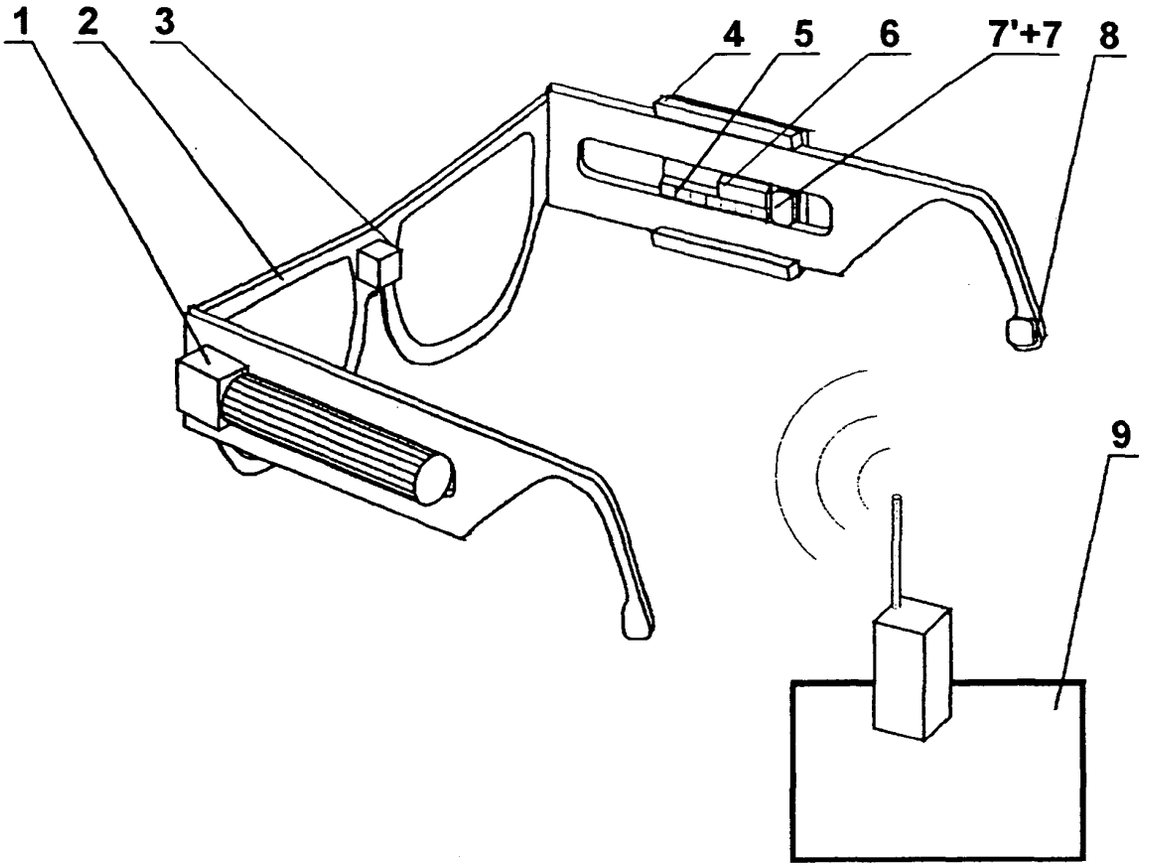

Fig. 1

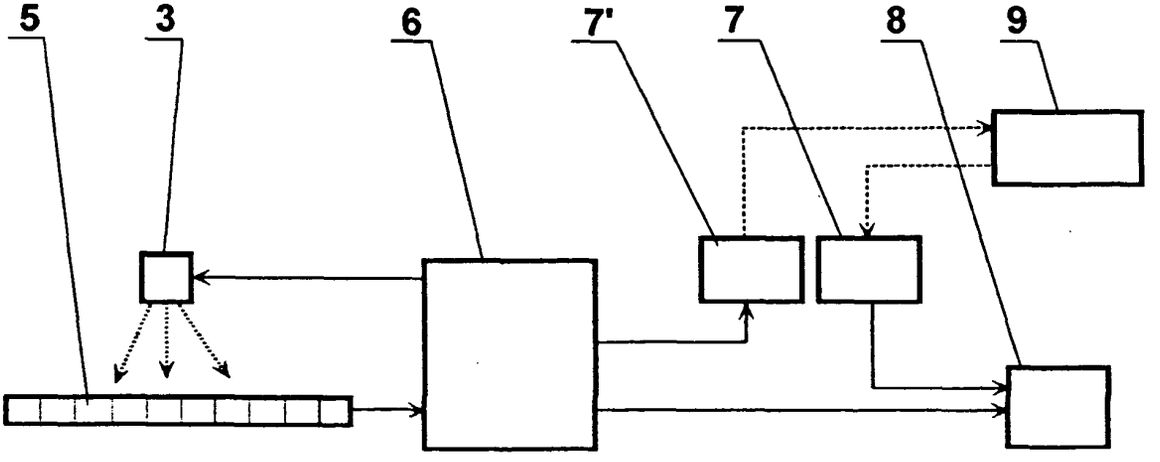

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 04 46 0032

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
D,Y	US 5 402 109 A (MANNIK KALLIS H) 28 March 1995 (1995-03-28) * column 5, line 10 - column 6, line 4; figure 1 * * column 7, line 28 - line 51; figure 14 * -----	1-5	G08B21/06
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Y	WO 02/099766 A (POLITECHNIKA WARSZAWSKA ; GRONOWSKA IRENA (PL); LATUSZEK ANTONI (PL);) 12 December 2002 (2002-12-12) * page 1, line 11 - page 2, line 14; figure 1 * -----	5	
Y	WO 02/45044 A (SMARTSPECS L L C) 6 June 2002 (2002-06-06) * page 8, line 10 - page 9, line 9; figure 2.0 * -----	2-4	TECHNICAL FIELDS SEARCHED (Int.Cl.7) G08B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 October 2004	La Gioia, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 46 0032

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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