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(54) **LIGHTING INSTALLATION**

(57) The invention relates to means for illuminating a territory, mainly under emergency conditions. It is intended for use when electric power is off due to emergency or disaster, and also during construction works, repair works or search-and-rescue operations in the night time. Its technical result is enhanced reliability and improved operational performance of the installation. The lighting installation comprises a base, an inflatable shell secured to the base, an air blower communicated to a chamber formed by the shell, and at least one electric light source placed inside the shell. The lighting installation is equipped with a hollow unit secured inside the shell; the light source is installed on the hollow unit; a cave of the hollow unit is communicated with a cooling system for the light source. The light source is a LED light source; the cooling system is a liquid cooling system comprising a pump communicated with the cave of the hollow unit by flexible pipes.

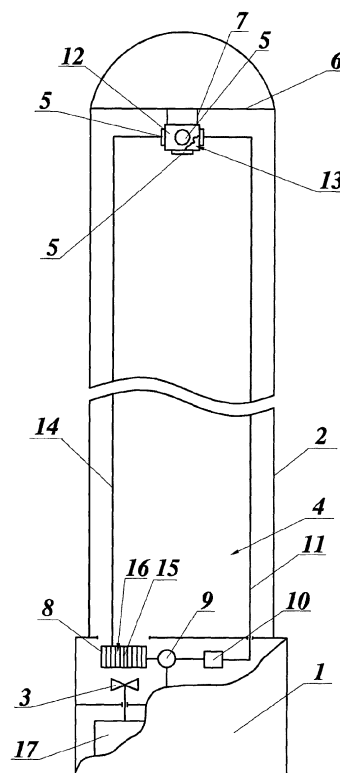


Fig.1

Description

[0001] The engineering solution relates to means for illuminating a territory, mainly under emergency conditions. It is intended for use, when electric power is off due to emergency or disaster, and also during construction works, repair works or search-and-rescue operations in the night time.

[0002] Some inflatable lighting installations are known from patent publications (US 6322230 B1, published on 27.11.2001; RU 2192581 C1, published on 26.02.2001; RU 2286510 C9, published on 10.04.2006; WO 02/063207 A1, published on 15.08.2002), each of which comprises an elastic inflatable shell providing a support for a light source secured inside the shell in the upper part thereof, wherein the support comprises a base linked to ground or any usual structural load-bearing member (a floor, a building, a frame).

[0003] A drawback of the known lighting installations is that they are not configured for using LED (light emitting diode) light sources for illuminating, which would provide an illumination level comparable with conventional gas-discharge lamps, in particular, with sodium-vapor lamps commonly used in such installations.

[0004] A known emergency lighting installation (RU 139894 U1, published on 27.04.2014) comprises a base and a support linked to the base, wherein the support comprises a flexible transparent air-tight shell forming a closed inner chamber of the support and having a separable zip fastener and an insert configured to adjust the support height, means for securing the shell to the base and to an upper butt end of the support, at least one light encompassed by a case having a foot configured to secure the case to the upper butt end of the support, and braces connected to the upper part of the support and to ground. The emergency lighting installation comprises at least one overlaid LED-based pulse strob lamp screwed to the butt end of the emergency lighting installation above the light case foot. The braces are made of a retroreflective material or comprise some members made of a retroreflective material. The LED-based lamp is mounted on the top of the support; additionally a required number of similar lamps may be mounted on the outer side surface of the shell at an appropriate height, wherein the LED-based lamps may be mounted using polycarbonate pads positioned on the shell under foots of the LED-based lamps. The LED-based lamp provides more effective signaling functions of the installation and improves its operational performance.

[0005] This installation does not contribute to solving the problem of illuminating a territory with LED light sources, as emergency installations like this do not have means for guaranteed cooling powerful LED light sources. The LED-based strob lamp is intended for signaling only and it cannot be used for providing illumination.

[0006] Meanwhile, LED light sources have a number of substantial advantages in comparison to other known light sources, namely, they have longer life time and lower

power consumption; they are steadily operable in a wide temperature range; they start immediately after powering on and provide a high contrast, which promotes better clearness of the illuminated objects.

[0007] However, a heatsink is required to ensure reliable operation of LEDs. In particular, there is a known lighting device (RU 77024 U1, published on 10.10.2008) comprising an enclosure, a removable cover with a diffuser, LEDs mounted on a board, and a power source, wherein the device is additionally equipped with a heatsink rigidly secured to the enclosure, while the LED board is installed on and fastened to a base surface of the heatsink and is connected to the power source. The device is intended for illumination of production premises, warehouse premises, and other facilities; it may also be used in transportation for illumination of auxiliary chambers and vestibules of railway cars, where a high level of illumination is not required.

[0008] Using devices similar to the above-indicated one in inflatable lighting installations does not comply with relevant requirements regarding illumination, as these installations are mainly used for illumination of large areas during works related to a high level of danger like accident elimination, disaster elimination, etc., when a substantially higher illumination level is required.

[0009] Increase in number and power of LED light sources inevitably causes the need of increasing heat-removing surface of a heatsink and, consequently, to raising its size and weight. There is a known extra-high-power LED floodlight (RU 144224 U1, published on 10.08.2014) provided in an open-frame configuration. The floodlight comprises a rectangular, or round, or elliptical frame having a window, in which a light-emitting matrix equipped with a heatsink is mounted, wherein the light-emitting matrix comprises white light emitting members covered with aspheric lenses. Test results of a prototype of the floodlight revealed its luminous flux of 15000 lm and weight of 17 kg, in spite of its open-frame configuration.

[0010] Using a massive heatsink in inflatable lighting installations deteriorates their operational performance, as lifting a light source equipped with such a heatsink by means of an air flow forced into an inflatable shell may be difficult, even impossible in some cases, due to large weight of the heatsink and necessity of maintaining greater pressure inside the shell. Moreover, the heatsink combined with the light source may fall down upon deflation of the shell, and it may cause personal injury of staff and damage of the installation.

[0011] The claimed invention is directed at providing an inflatable lighting installation equipped with a LED light source ensuring a high illumination level, with no sufficient increasing weight of the installation upper part in an operational position thereof.

[0012] A technical result attained by a lighting installation described herein is enhanced reliability and improved operational performance of the installation.

[0013] The technical result is attained by a lighting in-

stallation comprising a base, an inflatable shell secured to the base, an air blower communicated to a chamber formed by the shell, and at least one electric light source placed inside the shell, wherein the lighting installation is equipped with a hollow unit secured inside the shell; the light source is installed on the hollow unit; a cave of the hollow unit is communicated with a cooling system for the light source; the light source is a LED light source; the cooling system is a liquid cooling system; and the cooling system comprises a pump communicated with the cave of the hollow unit by flexible pipes.

[0014] In some embodiments of the lighting installation, its cooling system may be equipped with a heatsink and an expansion tank; the pipes may be spiral-shaped and may be secured to the shell; the heatsink may be placed on a longitudinal axis of the air blower. The cooling system may be positioned inside or outside the lighting installation.

[0015] Fig. 1 shows one example of implementation of the lighting installation according to the claimed engineering solution.

[0016] The lighting installation comprises a base 1, an inflatable shell 2 filled with air and secured to the base 1, an air blower 3 mounted in the base and communicated with atmosphere and with a chamber 4 of the shell. At least one electric light source 5 is placed inside the shell 2 (four light sources are shown in Fig. 1) and is connected to a power source by an electric cord (not shown). The light source 5 is fastened to the shell 2 via a flange 6 and fasteners 7. A powerful LED light source is used in the installation, which emits a considerable amount of heat. In order to remove the heat and to prevent overheating the light source 5, the lighting installation is equipped with a heatsink 8 installed in the base 1 and positioned on an axis of air flow moving from the air blower 3. The heatsink 8 is filled with a liquid coolant. A hydraulic pump 9 and an expansion tank 10 are sequentially communicated with the heatsink 8, and the expansion tank 10 is communicated with a discharge pipe 11. In one embodiment of the installation, the heatsink 8, the hydraulic pump 9 and the expansion tank 10 are installed inside the base 1 (see Fig. 1); in another embodiment, they may be installed outside the base 1.

[0017] The heatsink 8 is communicated with a hollow unit 12 configured to bear the light source 5 and to provide cooling the light source 5. A hermetic cave 13 of the hollow unit 12 is filled with the liquid coolant and is communicated with the heatsink 8 by a pressure pipe 14. If a single light source 5 is used, it is mounted on the lower side of the hollow unit 12; if several light sources 5 are used, they are mounted on different sides of the hollow unit 12. The lighting installation may comprise several hollow units 12 positioned at the same height or positioned one above another or in any other combinations. The pipes 11 and 14 are flexible and resilient. The pipes 11 and 14 may be spiral-shaped so as to increase heat dissipation and avoid twisting thereof.

[0018] The above-indicated hydraulic components

form a liquid cooling system for the LED light source 5. The heatsink 8, which is one of main components of the cooling system, has heat exchanging ribs 15 on its outer surface, wherein the ribs are directed along an air flow forced from bottom to top by the air blower 3. This air flow passes through passages 16 between the ribs 15.

[0019] Owing to a high heat capacity of the liquid coolant, the cooling system may be used without the heatsink 8 under some conditions (favorable climate, low power of the light source, low liquid velocity in the cooling circuit). In this case, heat dissipation happens directly through the walls of the pipes 11 and 14.

[0020] The hollow unit 12 has input and output openings with corresponding sleeves communicated with the pipes 11 and 14. If several hollow units 12 are used, they may be incorporated into a single circuit of a cooling system, either in parallel or in series; otherwise, each of the hollow units 12 may have an autonomous cooling system.

[0021] The installation is equipped with a power unit 17. In different embodiments, the power unit 17 may comprise an electric generator and an internal combustion engine, or an electric accumulator (not shown). The installation is also equipped with startup and adjustment equipment and with control means (not shown).

[0022] The installation operates as follows. Electric current is fed from the power unit 17 to the air blower 3. Rotation of the air blower 3 causes atmospheric air to be forced into the chamber 4 of the shell 2, so the shell gets inflated and rises up along with the hollow unit 12, the light source 5 and the pipes 11 and 14, all attached to the shell. Electric current is fed from the power unit 17 to the LED light source 5, which heats the hollow unit 12 during operation. Electric current is also fed to the hydraulic pump 9, which pumps the liquid coolant through the following root of the cooling system: the hydraulic pump 9 - the heatsink 8 - the pipe 14 - the cave 13 of the hollow unit 12 - the pipe 11 - the expansion tank 10 - the hydraulic pump 9. While the liquid coolant travels through the above-indicated root, it takes heat from the hollow unit 12, which is heated from the light source 5, and loses heat in the heatsink 8. The light source 5 is cooled by the liquid coolant through a wall of the hollow unit 12.

[0023] Heated liquid coolant forced by the hydraulic pump 9 into the heatsink 8 is cooled in the heatsink 8 so as the heat is drawn from the liquid coolant via the ribs 15 of the heatsink 8, which are blown by the air blower 3 during its operation. After cooling in the heatsink 8, the liquid coolant is fed into the cave 13 of the hollow unit 12 and the above-indicated operational cycle is repeated.

[0024] Configuration of the lighting installation allows substantial increasing its power and luminous flux of the light sources owing to use of an effective liquid cooling system with a heatsink blown by a constantly working air blower of the installation. Use of LED light sources makes illumination of a territory more effective in comparison with known solutions of prior art. Reliability of the installation is also improved owing to increased thermal sta-

bility and enhanced endurance of the light source against mechanical impact. It should be noted that components of the cooling system may be positioned in the installation base or even apart from the installation, therefore weight of the upper part of the installation may be considerably reduced, and its size in operational position and power consumption may also be decreased.

Claims

1. A lighting installation comprising a base, an inflatable shell secured to the base, an air blower communicated with a chamber formed by the shell, and at least one electric light source placed inside the shell, wherein the lighting installation is equipped with at least one hollow unit secured inside the shell; the light source is installed on the hollow unit; a cave of the hollow unit is communicated with a cooling system for the light source; the light source is a LED light source; the cooling system is a liquid cooling system; and the cooling system comprises a pump communicated with the cave of the hollow unit by flexible pipes.
2. The lighting installation of claim 1, **characterized in that** the cooling system is equipped with a heatsink.
3. The lighting installation of claim 1, **characterized in that** the cooling system is equipped with an expansion tank.
4. The lighting installation of claim 1, **characterized in that** the pipes are spiral-shaped.
5. The lighting installation of claim 1, **characterized in that** the pipes are secured to the shell.
6. The lighting installation of claim 2, **characterized in that** the heatsink is positioned on a longitudinal axis of an air blower.
7. The lighting installation of of any of claims 1 to 3, **characterized in that** the cooling system is placed inside the lighting installation.
8. The lighting installation of of any of claims 1 to 3, **characterized in that** the cooling system is placed outside the lighting installation.

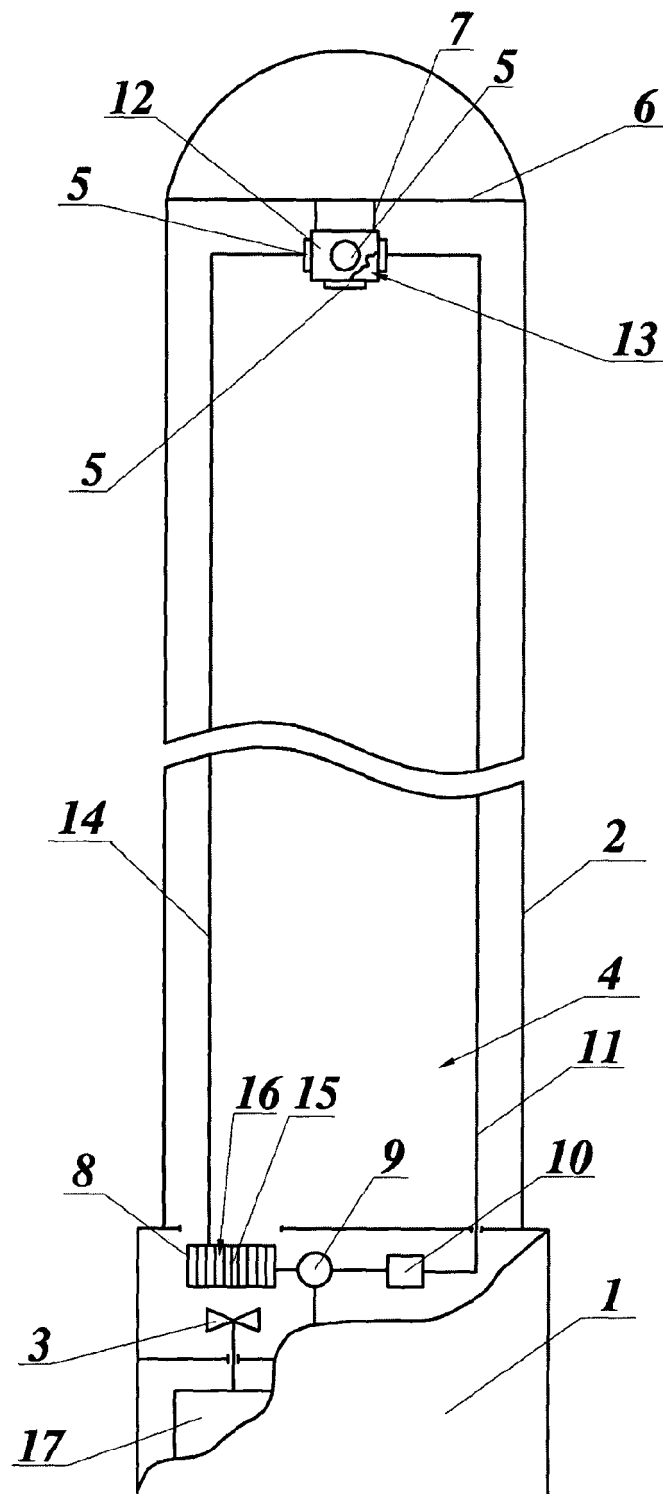


Fig.1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2016/000187

A. CLASSIFICATION OF SUBJECT MATTER F21S 8/00 (2006.01); F21S 13/14 (2006.01); F21V 29/00 (2006.01) According to International Patent Classification (IPC) or to both national classification and IPC																					
B. FIELDS SEARCHED																					
Minimum documentation searched (classification system followed by classification symbols) F21S 8/00, 13/14, F21L 4/00, G09F 21/06, F21V 31/00, 29/00-29/02																					
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched																					
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatSearch (RUPTO internal), Espacenet, PAJ, USPTO, Information Retrieval System of FIPS																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT																					
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>WO 2002/063207 A1 (MEDICI GUIDO) 15.08.2002, the abstract, the drawings</td> <td>1-8</td> </tr> <tr> <td>Y</td> <td>CN 101078507 A (LAS AN S AO) 28.11.2007, the abstract, fig. 1, 7</td> <td>1-8</td> </tr> <tr> <td>Y</td> <td>RU 2403486 C2 (EVONIK DEGUSSA GMBKH) 10.11.2010, p. 3, lines 47-49</td> <td>1-8</td> </tr> <tr> <td>Y</td> <td>SU 374861 A1 (REZHI NASONAL DEZ IUZIN RENO) 11.06.1973, col. 1, 2</td> <td>3</td> </tr> <tr> <td>Y</td> <td>RU 2009147174 A (BSKH BOSH UND SIMENS KHAUSGERETE GMBKH) 27.07.2011, item 10 of the claims</td> <td>4</td> </tr> <tr> <td>Y</td> <td>RU 2487296 C2 (DAVYDENKO ROMAN DMITRIEVICH) 10.07.2013, the abstract, the drawing</td> <td>7</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	WO 2002/063207 A1 (MEDICI GUIDO) 15.08.2002, the abstract, the drawings	1-8	Y	CN 101078507 A (LAS AN S AO) 28.11.2007, the abstract, fig. 1, 7	1-8	Y	RU 2403486 C2 (EVONIK DEGUSSA GMBKH) 10.11.2010, p. 3, lines 47-49	1-8	Y	SU 374861 A1 (REZHI NASONAL DEZ IUZIN RENO) 11.06.1973, col. 1, 2	3	Y	RU 2009147174 A (BSKH BOSH UND SIMENS KHAUSGERETE GMBKH) 27.07.2011, item 10 of the claims	4	Y	RU 2487296 C2 (DAVYDENKO ROMAN DMITRIEVICH) 10.07.2013, the abstract, the drawing	7
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Date of the actual completion of the international search 30 June 2016 (30.06.2016)	Date of mailing of the international search report 15 September 2016 (15.09.2016)																				
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REFERENCES CITED IN THE DESCRIPTION

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- RU 144224 U1 [0009]