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Remarks:

Amended claims in accordance with Rule 137(2)  
EPC.

(54) **LIGHT SOURCE IN PARTICULAR FOR SHELVES**

(57) Light source configured to be mounted on a shelf, preferably a glass or acrylic shelf. The light source comprising a housing (1) having an upper arm (2), a lower arm (3) and a rear wall (4), each having a cavity (5, 6, 7) for fixing a printed circuit board (8, 9, 10), and an aperture (11, 12, 13) for transmission of light emitted by a LED source (14, 15, 16). The rear wall (4) joins the upper arm

(2) and the lower arm (3) at their proximal ends (2p, 3p), respectively. A distance (Dp) between these two proximal ends (2p, 3p) is greater than a distance (Dd) between distal ends (2d, 3d) of the upper arm (2) and the lower arm (3), respectively. At least one LED source (14, 15, 16) is mounted in the upper arm (2) and/or the lower arm (3), and/or the rear wall (4).

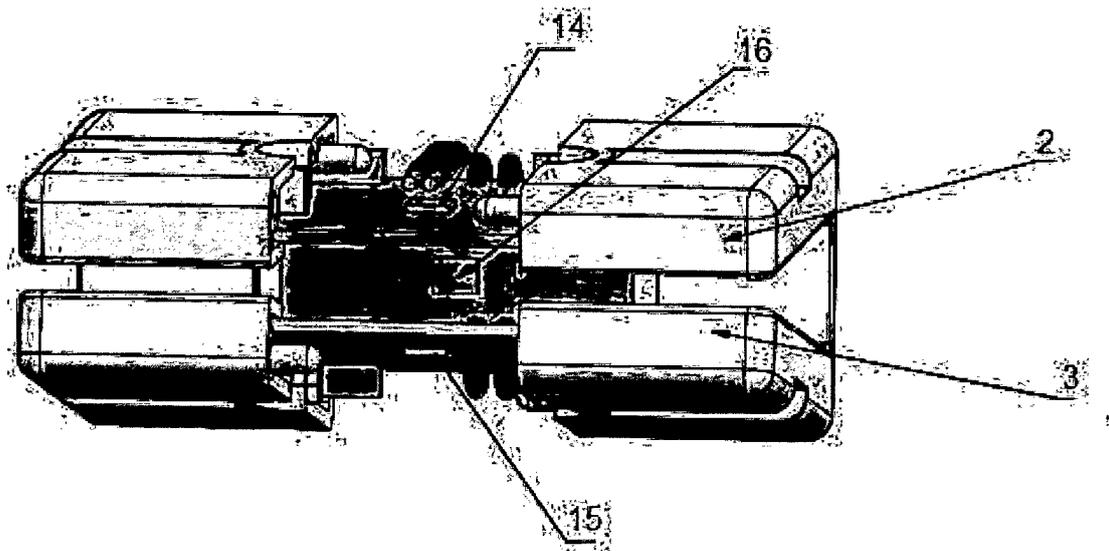


Fig. 2

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## Description

**[0001]** The present invention relates to a compact light source with light-emitting diode (LED) which can be mounted on the edges of thin objects like the shelves or partitions in a bookcase, in particular ground glass or acrylic shelves, or transparent glass/acrylic shelves with ground edges. By shelf edges one should understand here thin, usually vertical walls of the shelf. The invented light source can be also used in a refrigerator to provide even lighting of all shelves and compartments. Besides, it can be applied as a source of light for flat light guides, e.g. information boards.

**[0002]** Many inventions have been proposed related to internal lighting in cabinets, bookcases, refrigerators and the like. In most solutions lighting device is integrated with a shelf itself, its side supports or guide rails.

**[0003]** Chinese utility model CN202813964 U (HEFEI MEILING CO., LTD; publ. 2013-03-20) discloses a refrigerator shelf with an illuminating lamp. The refrigerator shelf comprises shelf guide rails which are arranged on left and right inner walls of the refrigerator body, and a glass plate which can slide forth and back along the guide rails. The rails are made from two parallel strips so that the glass plate can be inserted between the strips. LED light sources are arranged on the circuit board inside the guide rails between the strips and are facing side edges of the glass plate. Emitted light is reflected and refracted in the glass plate thus making a surface source which can emit light from both top and bottom surfaces.

**[0004]** Another Chinese utility model CN203421890 U (HEFEI MEILING CO., LTD; publ. 2014-02-05) also discloses a refrigerator lighting shelf which comprises shelf guide rails fixedly arranged on inner walls on two sides of the refrigerator body. LEDs are arranged in the shelf guide rails, and a glass shelf is sliding back and forth along the guide rails. This invention differs from the arrangement described above in that the guide rails have semi-cylindrical grooves fitting the light blocking semi-cylindrical strips affixed along and close to top and bottom side edges of the glass plate.

**[0005]** American patent application US2004264160 A1 (BIENICK CRAIG, GEMTRON CORPORATION; publ. 2004-12-30) describes an illuminated shelf which includes a tempered transparent glass panel having edges each housed in a slot of a housing defining a chamber through which and/or in which light is generated to illuminate the transparent panel. Each housing is snap-secured together to access the chamber interior for purposes of replacement and/or repair. Each housing can be totally or partially encapsulated and the encapsulation includes conductors which are operative in any position of vertical adjustment or sliding adjustment of the shelf.

**[0006]** Japanese patent document JP2010198792 A (MORE TENSO KK; publ. 2010-09-09) discloses a shelf capable of illuminating the goods placed on a shelf body by a compact lighting device. The shelf body functions as a light guide plate to transmit light. A lighting device

is provided with a frame which is installed detachably on the rear edge of the shelf body and an LED array housed in the frame and facing the rear edge of the shelf body. Light emitted by the LED array is guided inside the shelf body and diffused upwards.

**[0007]** In the above-mentioned inventions, the lighting device and the shelf make a composite panel so none of them can be used separately. The here proposed invention solves this problem by providing an autonomous light source which can be easily applied, displaced or removed and which is not dedicated to particular arrangement of the shelf in its housing, like e.g. in a refrigerator.

**[0008]** The light source according to the invention comprises a housing and at least one LED source of light. The housing has an upper arm, a lower arm and a rear wall, each having a cavity for fixing a printed circuit board, and an aperture for transmission of light emitted by a LED source. The rear wall joins the upper arm and the lower arm at their proximal ends. A distance between these proximal ends is greater than a distance between distal ends of the upper arm and the lower arm, so that the device can be easily slipped and firmly clamped at an edge of a flat object like a shelf or a partition in the rack.

**[0009]** It should be understood that if the claimed illuminating device is mounted on vertical or slanted flat object instead of horizontal one, the terms upper/upwards and lower/downwards shall mean e.g. "[to the] left" and "[to the] right". Similarly, if the device is mounted on an edge of an information panel, these terms should be understood as "front/forward" and "rear/backward", respectively. Obviously, "rear [wall]" turns to be "left", "right", "top" or "bottom [wall]" then, according to particular arrangement. In the detailed description of the invention hereinafter and also in claims this understanding shall be applied.

**[0010]** It should be also understood that the claimed invention is not limited by particular shape of the object on which it is mounted. It is recommended to use it on flat plates like shelves, however it can be applied on any object having more or less flat section of its edge where the illuminating device can be slipped on.

**[0011]** At least one LED source is mounted in the lighting device: in the upper arm and/or the lower arm, and/or the rear wall. According to particular needs one can choose from various embodiments illuminating upper side of the shelf, its lower side, or its rear edge. In the latter case light is introduced into the glass/acrylic shelf which is a light guide and may diffuse light through upper and lower surfaces, or its front edge. Both surfaces and/or front edge can be grounded. Alternatively, the shelf can be made of milk glass.

**[0012]** The lighting device can have multiple LED sources especially if it has a form of a bar. At least one upper LED source is mounted in the upper arm and at least one lower LED source is mounted in the lower arm. Additionally, at least one rear LED source is mounted in the rear wall.

**[0013]** The LED sources can be separately placed in

the cavities of the housing. However, it is recommended to use the printed circuit boards with LEDs. The upper LED source is mounted on the upper printed circuit board, the lower LED source is mounted on the lower printed circuit board, and the rear LED source is mounted on the rear printed circuit board. Preferably all printed circuit boards are identical.

**[0014]** In one embodiment the LED sources are directed inwards into an inner space limited by the upper arm, the lower arm and the rear wall. In this space a glass or acrylic translucent shelf can be placed, and the LED sources illuminate the shelf interior which guides the light towards its upper and lower surfaces, and to its front and side edges. If the shelf material is translucent but is not transparent, whole surface of the shelf diffuses light. In case of transparent material, it is recommended to ground the shelf edges which shine with diffused light. Also selected parts of the glass/acrylic plate can be grounded to make light signs, e.g. information panels with letters, arrows, pictograms, etc.

**[0015]** In other embodiment the rear LED source is directed inwards into the inner space described above, while the upper LED source and the lower LED source are directed outwards. Then the material of the shelf is illuminated by the rear source of light to produce an effect described beforehand, but simultaneously the space above and below the shelf is illuminated directly.

**[0016]** One can easily combine other embodiments with one, two or three LED sources, the upper and/or lower sources being directed upwards or downwards. As was mentioned above, multiple LED sources consisting of e.g. ten LEDs on one printed circuit board can be used in elongated or enlarged illuminating devices.

**[0017]** One can use LEDs emitting white, red, green, blue, yellow and other colours of light, also UV or IR light for special applications. In one device different LED sources can be used, they can produce steady, pulsating or flickering light. LED sources can be switched on/off by heat, movement or pressure detectors. They can also be controlled by a dedicated controller integrated with special input devices like smoke detectors or accelerometers, and may communicate wirelessly with central computer. In this arrangement the claimed light source can be used in security applications, for example in display racks, on exhibitions, etc.

**[0018]** According to particular needs, the LED sources are powered by power cord from external source of energy, or they are powered from the cell, preferably Li-ion cell, or a battery.

**[0019]** Preferably the housing of the illuminating device is divided vertically into left part and right part. These two parts of the housing have mutually matching protrusions and recesses, and are fixed together by pressing, gluing, welding, or screwing. Division of the housing into two parts facilitates mounting of the printed circuit boards in the cavities shaped in upper and lower arms, and in the rear wall, because one half of the cavity is in the left part, and other half - in the right part.

**[0020]** Preferably the claimed light source is configured to be mounted on shelf, e.g. a glass or acrylic shelf having thickness ranging from several millimeters to several dozens of millimeters, usually 3 to 25 mm. Accordingly, in this example a distance between proximal ends of upper and lower arms is included in the range of 3 to 25 mm. A distance between distal ends is slightly smaller to ensure the device is firmly clamped on the shelf edge.

**[0021]** Preferred embodiments of invented light source are shown on the drawings, where:

Fig. 1 shows exploded view of first embodiment of the light source having three LEDs;

Fig. 2 shows the light source from Fig. 1 during assembly;

Fig. 3 shows left part of the housing in perspective view;

Fig. 4 shows left part of the housing in side view;

Fig. 5 shows exploded view of second embodiment of the light source having two LEDs;

Fig. 6 shows the light source from Fig. 5 during assembly;

Fig. 7 shows the light source in side view, and

Fig. 8 shows the light source mounted on a glass shelf.

**[0022]** In the preferred embodiment intended for shelves, the light source according to the invention comprises a housing (1) which has an upper arm (2), a lower arm (3) and a rear wall (4), each having a cavity (5, 6, 7) for fixing a printed circuit board (8, 9, 10), and an aperture (11, 12, 13) for transmission of light emitted by a LED source (14, 15, 16). The rear wall (4) joins the upper arm (2) and the lower arm (3) at their proximal ends (2p, 3p), respectively. A distance (Dp) between these proximal ends (2p, 3p) is greater than a distance (Dd) between distal ends (2d, 3d) of the upper arm (2) and the lower arm (3), respectively. At least one LED source (14, 15, 16) is mounted in the upper arm (2) and/or the lower arm (3), and/or the rear wall (4).

**[0023]** The upper LED source (14) is mounted on the upper printed circuit board (8), the lower LED source (15) is mounted on the lower printed circuit board (9), and the rear LED source (16) is mounted on the rear printed circuit board (10). Preferably the upper printed circuit board (8), the lower printed circuit board (9), and the rear printed circuit board (10) are identical.

**[0024]** In the preferred embodiment the rear LED source (16) is directed inwards into the inner space (17) limited by the upper arm (2), the lower arm (3) and the rear wall (4), while the upper LED source (14) and the

lower LED source (15) are directed outwards.

**[0025]** The LED sources (14, 15, 16) shine with white light and are powered by power cord (20) from external source of energy.

**[0026]** The housing (1) of the illuminating device is divided vertically into left part (1L) and right part (1R). Both left part (1L) and right part (1R) of the housing (1) have mutually matching protrusions (18) and recesses (19), and are fixed together by pressing, with or without the use of glue. A distance (Dp) between proximal ends (2p, 3p) of upper and lower arms is included in the range of 3 to 25 mm.

**[0027]** Reference numbers

- 1 - housing
- 1L - left part of the housing
- 1R - right part of the housing
- 2 - upper arm
- 2d - distal end of the upper arm
- 2p - proximal end of the upper arm
- 3 - lower arm
- 3d - distal end of the lower arm
- 3p - proximal end of the lower arm
- 4 - rear wall
- 5 - upper cavity in upper arm
- 6 - lower cavity in lower arm
- 7 - rear cavity in rear wall
- 8 - upper printed circuit board in upper arm
- 9 - lower printed circuit board in lower arm
- 10 - rear printed circuit board in rear wall
- 11 - upper aperture in upper arm
- 12 - lower aperture in lower arm
- 13 - rear aperture in rear wall
- 14 - upper LED source in upper arm
- 15 - lower LED source in lower arm
- 16 - rear LED source in rear wall
- 17 - inner space limited by the upper arm, the lower arm, and the rear wall.
- 18 - protrusion
- 19 - recess
  
- 20 - power cord
- Dd - distance between distal ends of upper and lower arms
- Dp - distance between proximal ends of upper and lower arms

#### Claims

1. The light source in particular for shelves, comprising a housing and at least one LED source, **characterized in that** the housing (1) has an upper arm (2), a lower arm (3) and a rear wall (4), each having a cavity (5, 6, 7) for fixing a printed circuit board (8, 9, 10), and an aperture (11, 12, 13) for transmission of light emitted by a LED source (14, 15, 16), wherein the rear wall (4) joins the upper arm (2) and the lower

arm (3) at their proximal ends (2p, 3p), respectively, and a distance (Dp) between these proximal ends (2p, 3p) is greater than a distance (Dd) between distal ends (2d, 3d) of the upper arm (2) and the lower arm (3), respectively, and wherein at least one LED source (14, 15, 16) is mounted in the upper arm (2) and/or the lower arm (3), and/or the rear wall (4).

- 2. The light source according to claim 1, **characterized in that** at least one upper LED source (14) is mounted in the upper arm (2) and at least one lower LED source (15) is mounted in the lower arm (3).
- 3. The light source according to claim 1 or 2, **characterized in that** at least one rear LED source (16) is mounted in the rear wall (4).
- 4. The light source according to any of claims 1 to 3, **characterized in that**, the upper LED source (14) is mounted on the upper printed circuit board (8), the lower LED source (15) is mounted on the lower printed circuit board (9), and the rear LED source (16) is mounted on the rear printed circuit board (10).
- 5. The light source according to claim 4, **characterized in that** the upper printed circuit board (8), the lower printed circuit board (9), and the rear printed circuit board (10) are identical.
- 6. The light source according to claim 4 or 5, **characterized in that** the LED sources (14, 15, 16) are directed inwards into an inner space (17) limited by the upper arm (2), the lower arm (3) and the rear wall (4).
- 7. The light source according to claim 4 or 5, **characterized in that** the rear LED source (16) is directed inwards into the inner space (17) limited by the upper arm (2), the lower arm (3) and the rear wall (4), while the upper LED source (14) and the lower LED source (15) are directed outwards.
- 8. The light source according to any of claims 1 to 7, **characterized in that** the housing (1) is divided vertically into left part (1L) and right part (1R).
- 9. The light source according to claim 8, **characterized in that** left part (1L) and right part (1R) of the housing (1) have mutually matching protrusions (18) and recesses (19).
- 10. The light source according to claim 8 or 9, **characterized in that** left part (1L) and right part (1R) are fixed together by pressing, or gluing, or welding, or screwing.
- 11. The light source according to any of claims 1 to 10, **characterized in that** the LED sources (14, 15, 16)

are powered by power cord (20) from external source of energy.

12. The light source according to any of claims 1 to 10, **characterized in that** the LED sources (14, 15, 16) are powered from the cell, preferably Li-ion cell, or a battery.
13. The light source according to any of claims 1 to 12, **characterized in that** the LED sources (14, 15, 16) emit white or red, or green, or blue, or yellow, or IR, or UV light.
14. The light source according to any of claims 1 to 13, **characterized in that** it is configured to be mounted on a shelf, preferably a glass or acrylic shelf.
15. The light source according to claim 14, **characterized in that** distance (Dp) between proximal.

**Amended claims in accordance with Rule 137(2) EPC.**

1. A light source in particular for shelves, comprising a housing and at least one LED source, wherein the housing (1) has an upper arm (2), a lower arm (3) and a rear wall (4), and wherein the rear wall (4) joins the upper arm (2) and the lower arm (3) at their proximal ends (2p, 3p), respectively, and a distance (Dp) between these proximal ends (2p, 3p) is greater than a distance (Dd) between distal ends (2d, 3d) of the upper arm (2) and the lower arm (3), respectively, **characterized in that** the upper arm (2), the lower arm (3) and the rear wall (4) each has a cavity (5, 6, 7) for fixing a printed circuit board (8, 9, 10), and an aperture (11, 12, 13) for transmission of light emitted by a LED source (14, 15, 16), and wherein at least one LED source (14, 15, 16) is mounted in the upper arm (2) and/or the lower arm (3), and/or the rear wall (4), and **in that** the upper LED source (14) is mounted on the upper printed circuit board (8), the lower LED source (15) is mounted on the lower printed circuit board (9), and the rear LED source (16) is mounted on the rear printed circuit board (10).
2. The light source according to claim 1, **characterized in that** at least one upper LED source (14) is mounted in the upper arm (2) and at least one lower LED source (15) is mounted in the lower arm (3).
3. The light source according to claim 1 or 2, **characterized in that** at least one rear LED source (16) is mounted in the rear wall (4).
4. The light source according to any of claims 1 to 3, **characterized in that** the upper printed circuit board (8), the lower printed circuit board (9), and the rear

printed circuit board (10) are identical.

5. The light source according to any of claims 1 to 4, **characterized in that** the LED sources (14, 15, 16) are directed inwards into an inner space (17) limited by the upper arm (2), the lower arm (3) and the rear wall (4).
6. The light source according to any of claims 1 to 4, **characterized in that** the rear LED source (16) is directed inwards into the inner space (17) limited by the upper arm (2), the lower arm (3) and the rear wall (4), while the upper LED source (14) and the lower LED source (15) are directed outwards.
7. The light source according to any of claims 1 to 6, **characterized in that** the housing (1) is divided vertically into left part (1L) and right part (1R).
8. The light source according to claim 7, **characterized in that** left part (1L) and right part (1R) of the housing (1) have mutually matching protrusions (18) and recesses (19).
9. The light source according to claim 7 or 8, **characterized in that** left part (1L) and right part (1R) are fixed together by pressing, or gluing, or welding, or screwing.
10. The light source according to any of claims 1 to 9, **characterized in that** the LED sources (14, 15, 16) are powered by power cord (20) from external source of energy.
11. The light source according to any of claims 1 to 9, **characterized in that** the LED sources (14, 15, 16) are powered from the cell, preferably Li-ion cell, or a battery.
12. The light source according to any of claims 1 to 11, **characterized in that** the LED sources (14, 15, 16) emit white or red, or green, or blue, or yellow, or IR, or UV light.
13. The light source according to any of claims 1 to 12, **characterized in that** it is configured to be mounted on a shelf, preferably a glass or acrylic shelf.
14. The light source according to claim 13, **characterized in that** distance (Dp) between proximal ends (2p, 3p) of upper and lower arms is included in the range of 3 to 25 mm.

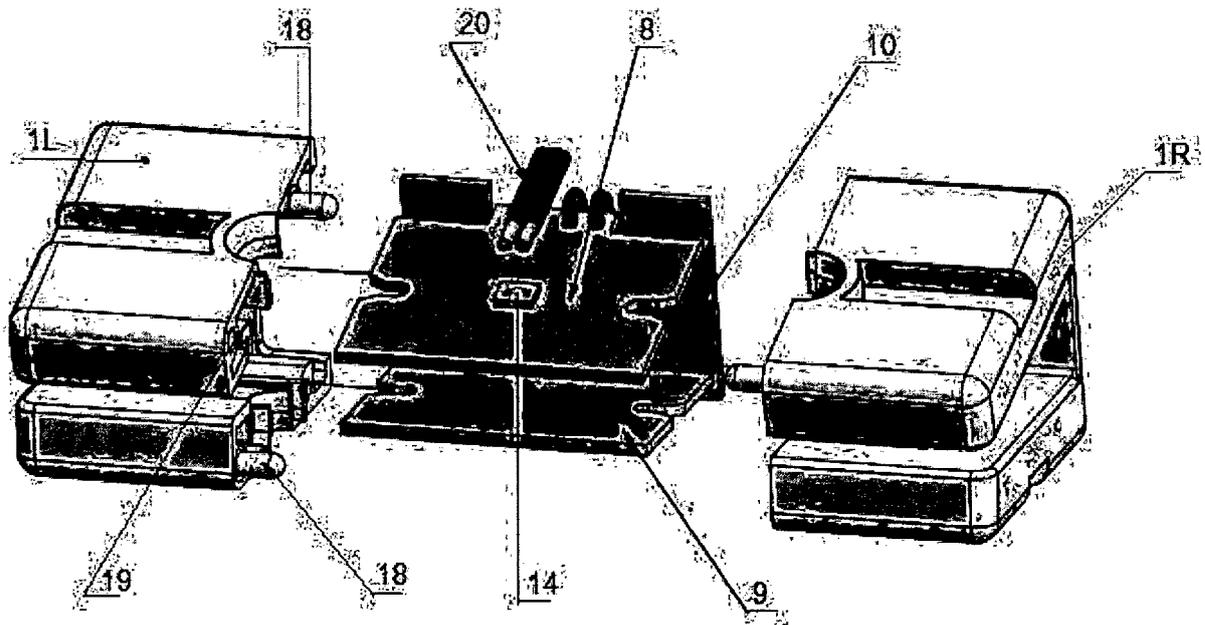


Fig. 1

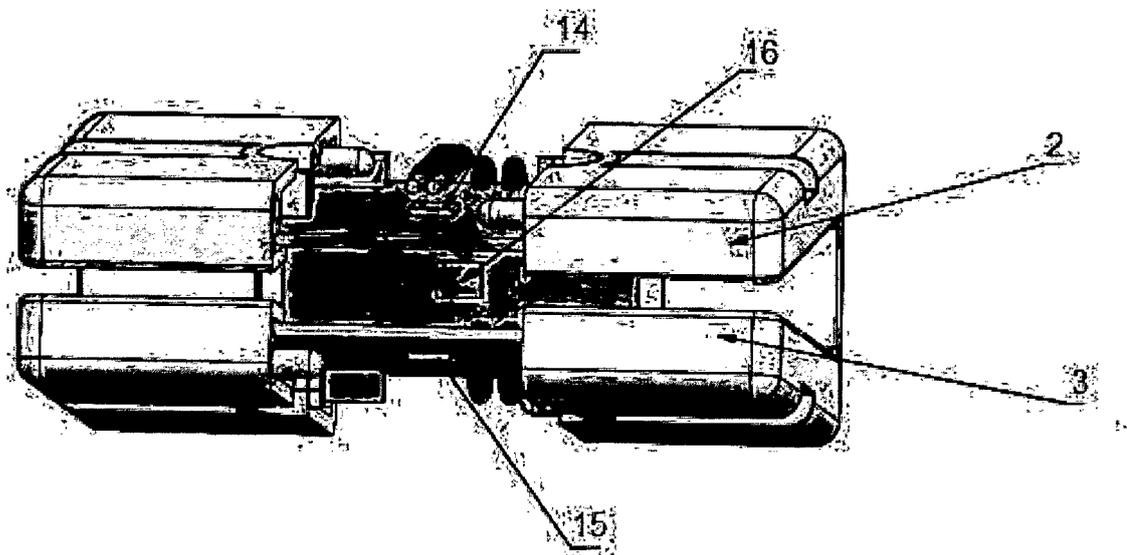


Fig. 2

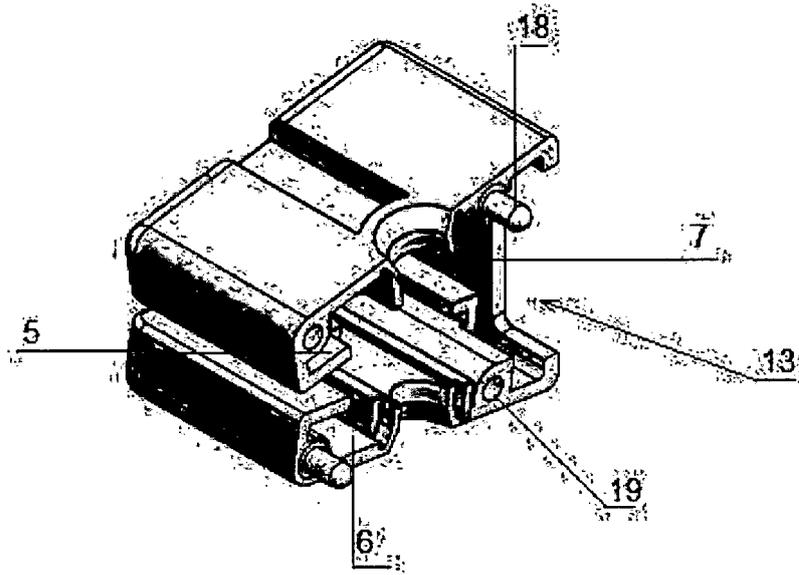


Fig. 3

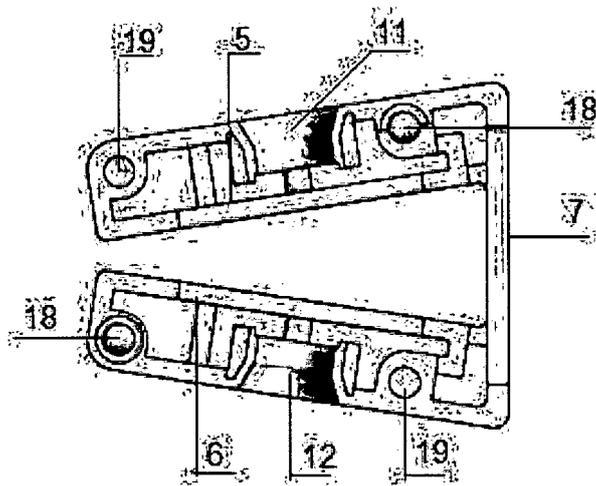


Fig. 4

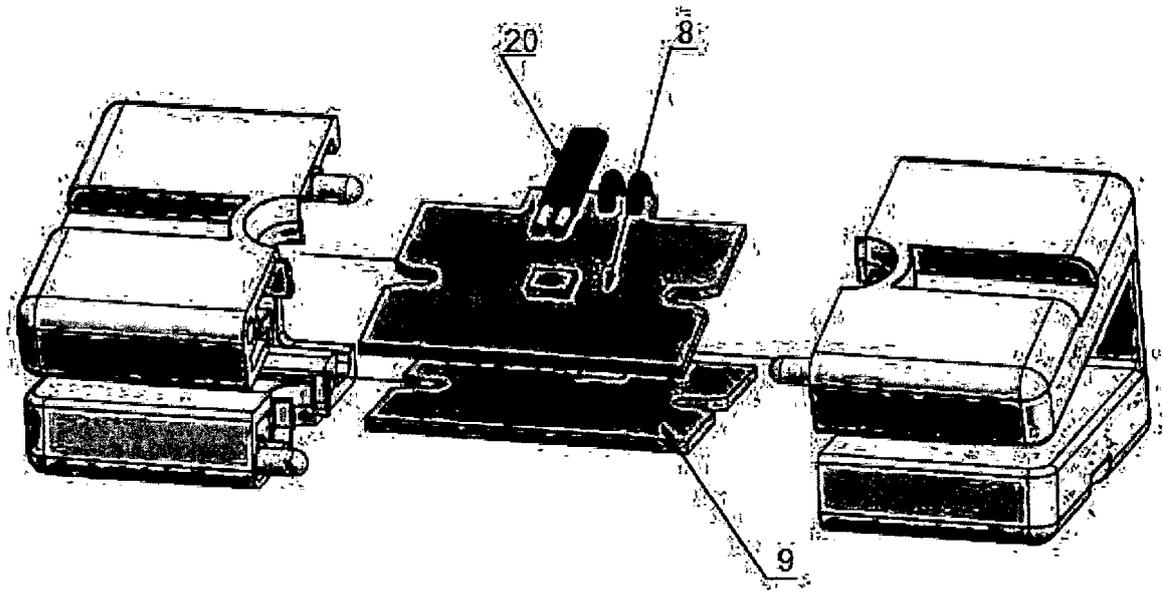


Fig. 5

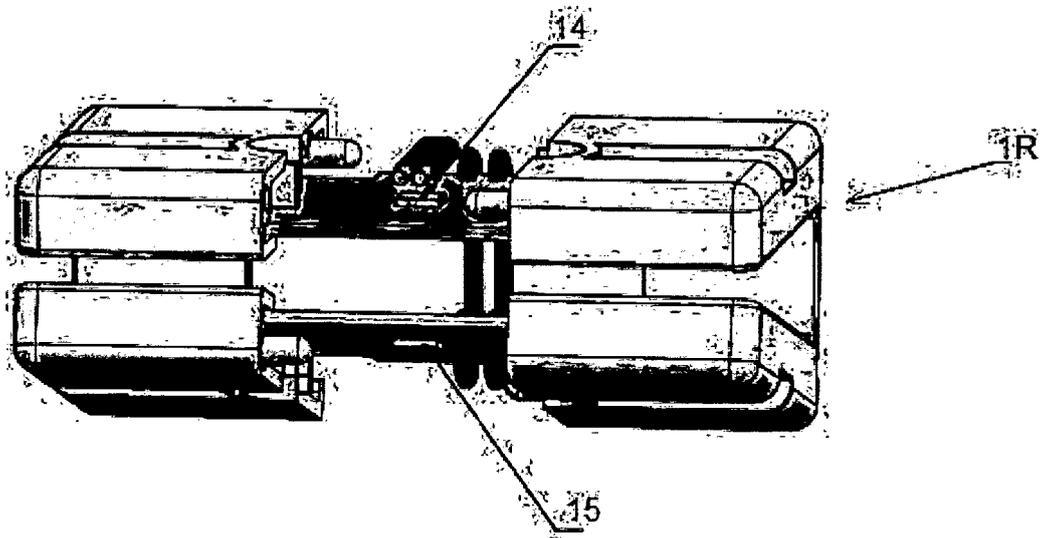


Fig. 6

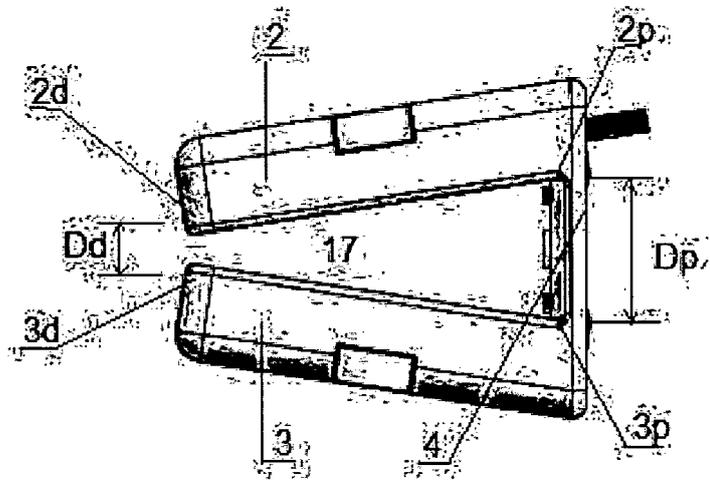


Fig. 7

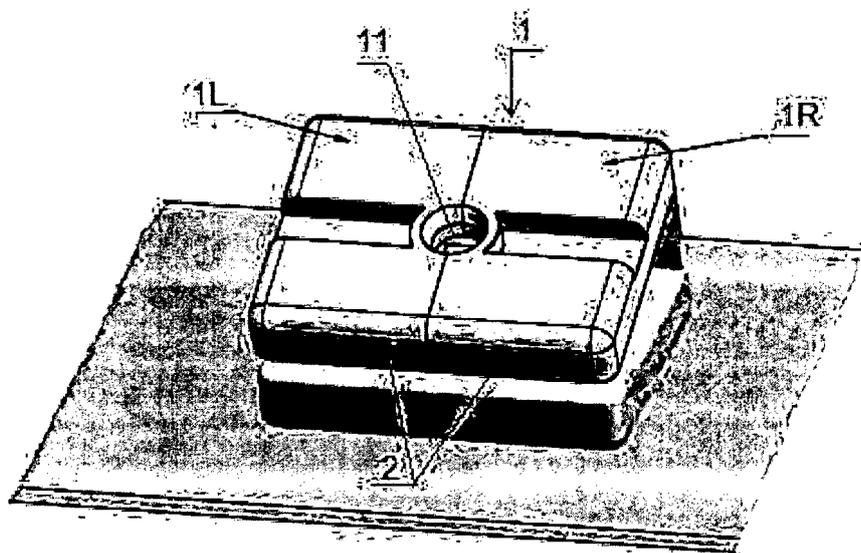


Fig. 8



EUROPEAN SEARCH REPORT

Application Number  
EP 20 46 0033

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The present search report has been drawn up for all claims			
Place of search <b>The Hague</b>		Date of completion of the search <b>16 October 2020</b>	Examiner <b>Menn, Patrick</b>
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

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ANNEX TO THE EUROPEAN SEARCH REPORT  
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