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(54) **LED LIGHTING APPARATUS WITH IMPROVED THERMAL DISSIPATION**

LED-BELEUCHTUNGSVORRICHTUNG MIT VERBESSERTER WÄRMEABLEITUNG

APPAREIL D'ÉCLAIRAGE À DIODES ÉLECTROLUMINESCENTES DOTÉ D'UNE DISSIPATION THERMIQUE AMÉLIORÉE

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(73) Proprietor: **de Bevilacqua, Carlotta**

20122 Milano (IT)

(72) Inventor: **de Bevilacqua, Carlotta**

20122 Milano (IT)

(74) Representative: **Studio Torta S.p.A.**

Via Viotti, 9
10121 Torino (IT)

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Description

Technical Field

[0001] The present invention relates to an LED lighting apparatus with improved thermal dissipation.

Background art

[0002] As is known, LED lighting apparatuses, which have the advantage of enabling a considerable energy saving, together with a considerable lifetime of the LEDs, are becoming increasingly common.

[0003] But a problem which is felt with these lighting sources consists in that LEDs are particularly sensitive to heat levels, since at temperatures higher than 100°C the LEDs can be damaged, to the point where they fail permanently when a threshold of around 140°C is exceeded.

[0004] Current solutions which use LEDs couple them with thermal dispersion systems that are typically used for electronic components, such as computer microprocessors and the like, which are constituted by blocks of aluminum or copper that are formed with fins or needles in order to increase the dissipation of the heat from the rear of the component, thereby increasing the exposed surface.

[0005] This embodiment, while being valid in many ways, can be criticised with regard to the aesthetic appearance of the lighting apparatus, since the use of this dissipation technology perceptibly limits the freedom to obtain the final appearance of the lighting apparatus to be achieved.

[0006] US 2007/165405 discloses a water-resistant illumination apparatus for machining equipment, comprising a lighting device disposed in a transparent barrel. The lighting device comprises: an aluminum mounting seat in the form of a curved elongate plate extending along the axial direction of the barrel and having a pair of engaging flanges extending inwardly from the inner surface of the curved plate; a heat dissipating plate mounted on the mounting seat and positioned movably below the engaging flanges of the mounting seat; a circuit board mounted on the heat dissipating plate by heat-resistant glue so as to be in thermal contact therewith; a plurality of lighting units each having a light emitting diode mounted on the circuit board and a lens condensing member disposed around the light emitting diode; and a driving unit connected electrically to the circuit board adapted to be coupled electrically to an external power source for activating the light emitting diodes.

[0007] US 2007/133203 discloses a water-resistant illumination apparatus for machining equipment, comprising: a housing made of heat conductive material and configured with a receiving space; a lighting device disposed in the receiving space of the housing and including an aluminum heat dissipating plate, a circuit board provided with a printed circuit thereon and attached to the

mounting surface of the heat dissipating plate by means of heat conductive glue so as to be in thermal contact therewith, a plurality of lighting units each having a high power light emitting diode mounted on the circuit board and a lens condensing member disposed around the light emitting diode, and a driving unit disposed in the housing and connected electrically to the circuit board and adapted to be coupled electrically to an external power source for activating the light emitting diodes.

Disclosure of the invention

[0008] The aim of the present invention is to solve the above mentioned problem, by providing an LED lighting apparatus with improved thermal dissipation, which makes it possible to maintain the functional structural integrity of the LEDs, by using particular heat sinks which make it possible to not impose particular limits on the designer in outlining the aesthetic appearance of the apparatus.

[0009] Within this aim, an object of the invention is to provide a lighting apparatus in which it is possible to use, for the LEDs, optical collimation systems that provide light beams with an aperture angle comparable with that of halogen light sources constituted by low-voltage lamps associated with aluminum reflectors for collimating the light beam.

[0010] Another object of the present invention is to provide a lighting apparatus that, thanks to its distinctive implementation characteristics, is capable of offering the widest guarantees of reliability and safety in use.

[0011] A further object of the present invention is to provide an LED lighting apparatus with improved thermal dissipation that can be easily made from elements and materials that are easily sourced on the market.

[0012] In accordance with the invention, there is provided an LED lighting apparatus as defined in the appended claims.

Brief description of the drawings

[0013] Further characteristics and advantages of the invention will become better apparent from the description of a preferred, but not exclusive, embodiment of an LED lighting apparatus with improved thermal dissipation, illustrated by way of non-limiting example in the accompanying drawings wherein:

Figure 1 is a schematic perspective view of the lighting apparatus, according to the invention;

Figure 2 is a plan view of the lighting apparatus, seen from the side with the light sources;

Figure 3 is a side elevation view of the lighting apparatus.

Ways of carrying out the invention

[0014] With reference to the figures, the lighting appa-

ratus, generally indicated with the reference numeral 1, comprises a plate 2 for supporting a plurality of LEDs 3, which are provided with a conventional collimator, which are distributed on a relatively wide surface, according to a scheme which is basically determined by the dimensions of the lenses of the collimators which, typically, have a diameter of 20 mm or more.

[0015] The plate 2 is made of thermally conducting material which, advantageously, is constituted by an aluminum dissipation sheet that has a thermal conductivity that is measurable as 237 W/mK and, at the same time, is lower in cost than materials with higher thermal conductivity, such as, for example, copper or silver.

[0016] In order to obtain the desired value of thermal dissipation, a heat sink is provided which consists of a flat sheet 10, also made of thermally conducting material, which is aluminum, and which is intimately connected to the supporting plate 2 by means of interposing a thermally conducting paste for minimizing thermal resistance between the two elements.

[0017] With this arrangement it is possible to use a distribution of LED sources that is particularly advantageous with regard to the law of transmission of heat on a flat and parallel sheet, according to which the power transmitted by conduction is directly proportional to the area of the surface and to the difference in temperature between the faces of the sheet and is inversely proportional to the thickness of the sheet.

[0018] With this embodiment, it is possible to provide a heat sink that extends along a plane and therefore does not create particular restrictions in the aesthetic interpretation of the light, but which in any case makes it possible to obtain the desired degree of thermal dissipation.

[0019] From experimental tests it has been found that, using an aluminum sheet measuring 150x150 mm² with a thickness of 3 mm for the heat sink, according to the claimed invention, a junction temperature of 92°C of the LED is obtained with an ambient temperature of 25°C, having 12 LEDs in series with a power of 19.5 W, while the temperature is 81°C for 9 LEDs in series with a power of 14.5 W.

[0020] The experimental test was carried out with the apparatus arranged horizontally and in a clear area.

[0021] From the foregoing it can thus be seen that the adopted solution of having the plate supporting the LEDs made of thermally conducting material and intimately connected to a heat sink which is flat in shape makes it possible, by using an inexpensive material like aluminum, to achieve optimal results in terms of the temperatures that can be obtained during operation.

[0022] The invention, thus conceived, is susceptible of numerous modifications and variations, as long as they fall within the scope of the appended claims.

[0023] Reference is made to the disclosures in Italian Patent Application No. MI2010A000185 from which this application claims priority.

[0024] Where technical features mentioned in any claim are followed by reference signs, those reference

signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An LED lighting apparatus (1) with improved thermal dissipation, comprising a flat plate (2) supporting a plurality of LEDs (3) which can be connected to an electric power source, and a heat sink consisting of a flat sheet (10) made of aluminum and which is intimately associated with said flat supporting plate (2) and protrudes beyond said flat supporting plate (2) such that said flat supporting plate (2) and said flat sheet (10) are arranged mutually parallel to each other, a thermally conducting paste being placed between said flat supporting plate (2) and said flat sheet (10) for minimizing thermal resistance; **characterized in that** said heat sink consisting of said flat sheet (10) extends between two opposite flat surfaces, parallel to each other and to said flat plate (2), and **in that** also said supporting plate (2) is made of aluminum and said flat sheet (10) measures 150x150 mm² with a thickness of 3 mm and there are provided twelve of said LEDs (3) in series with a power of 19.5 W, or nine of said LEDs (3) in series with a power of 14.5 W.
2. The lighting apparatus according to one or more of the preceding claims, **characterized in that** said LEDs (3) are mutually spaced by a distance that is at least equal to the dimensions of the collimators connected to each one of said LEDs (3).
3. The lighting apparatus according to one or more of the preceding claims, **characterized in that** said plate (2) has a thermal conductivity of 237 W/mK.

Patentansprüche

1. LED-Beleuchtungsanordnung (1) mit verbesserter Wärmeableitung, mit einer flachen Platte (2), die eine Vielzahl von LEDs (3) trägt, die mit einer elektrischen Stromquelle verbunden werden können, und einem Kühlkörper, der aus einer flachen Platte (10) aus Aluminium besteht und die eng mit der flachen Trägerplatte (2) verbunden ist und über die flache Trägerplatte (2) hinausragt, so dass die flache Trägerplatte (2) und die flache Platte (10) parallel zueinander angeordnet sind, wobei eine wärmeleitende Paste zwischen der flachen Trägerplatte (2) und der flachen Platte (10) angeordnet ist, um den Wärmewiderstand zu minimieren, **dadurch gekennzeichnet, dass** der aus der flachen Platte (10) be-

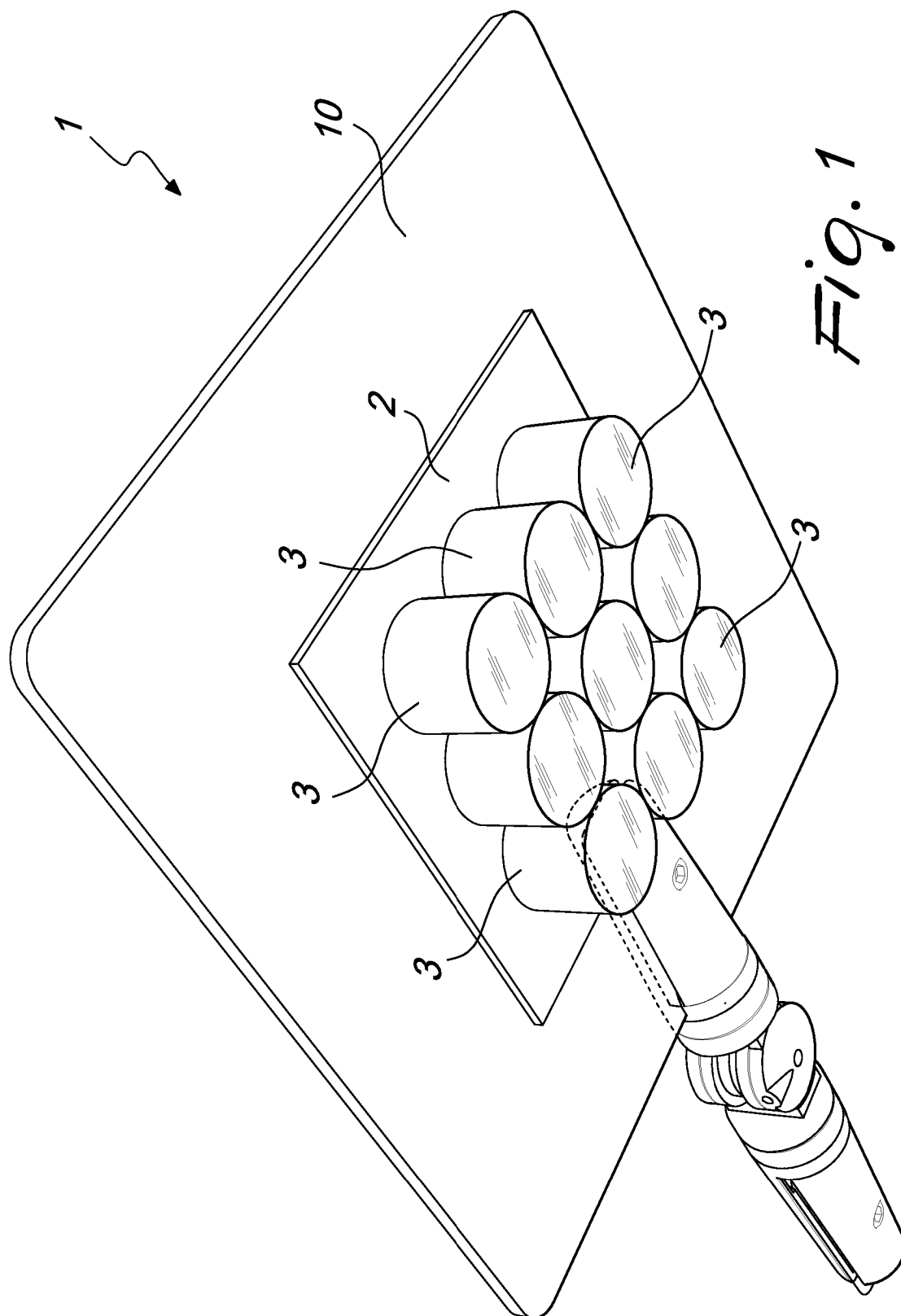
stehende Kühlkörper sich zwischen zwei gegenüberliegenden flachen Oberflächen erstreckt, die parallel zueinander und zu der flachen Platte (2) sind, und dass auch die Trägerplatte (2) aus Aluminium hergestellt ist und die flache Platte (10) aus Aluminium besteht aus Aluminium hergestellt ist und die flache Platte (10) 150x150 mm² mit einer Dicke von 3 mm misst und zwölf der LEDs (3) in Reihe mit einer Leistung von 19,5 W oder neun der LEDs (3) in Reihe mit einer Leistung von 14,5 W vorgesehen sind.

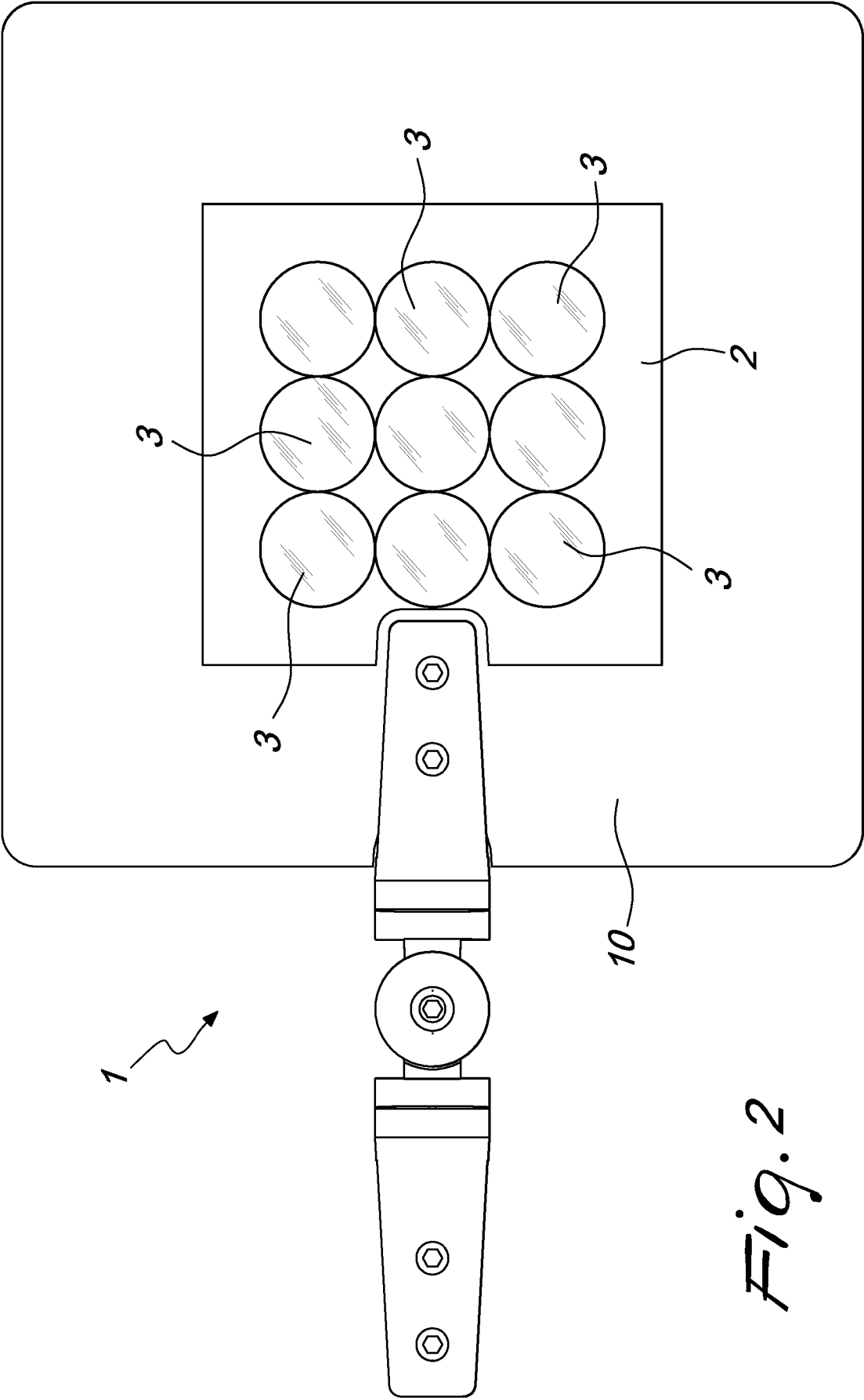
2. Beleuchtungsanordnung nach einem oder mehreren der vorhergehenden **dadurch gekennzeichnet, dass** die LEDs (3) in einem Abstand zueinander angeordnet sind, der mindestens gleich den Abmessungen der mit jeder der LEDs (3) verbundenen Kollimatoren ist.
3. Beleuchtungsanordnung nach einem oder mehreren der vorhergehenden **dadurch gekennzeichnet, dass** die Platte (2) eine Wärmeleitfähigkeit von 237 W/mK aufweist.

vendications précédentes, **caractérisé en ce que** ladite plaque (2) a une conductibilité thermique de 237 W/mK.

Revendications

1. Appareil d'éclairage à DEL (1) ayant une dissipation thermique améliorée, comprenant une plaque plate (2) supportant une pluralité de DEL (3) qui peuvent être connectées à une source d'alimentation électrique, et un dissipateur thermique consistant en une tôle plate (10) faite d'aluminium et qui est intimement associée à ladite plaque de support plate (2) et fait saillie au-delà de ladite plaque de support plate (2) de façon que ladite plaque de support plate (2) et ladite tôle plate (10) soient disposées mutuellement parallèles l'une à l'autre, une pâte thermiquement conductrice étant placée entre ladite plaque de support plate (2) et ladite tôle plate (10) pour minimiser la résistance thermique ; **caractérisé en ce que** ledit dissipateur thermique consistant en ladite tôle plate (10) s'étend entre deux surfaces plates opposées, parallèles l'une à l'autre et à ladite plaque plate, et **en ce qu'**également ladite plaque de support (2) est faite d'aluminium et ladite tôle plate (10) mesure 150 x 150 mm² avec une épaisseur de 3 mm et douze desdites DEL (3) sont disposées en série avec une alimentation de 19,5 W ou neuf desdites DEL (3) sont disposées en série avec une alimentation de 14,5 W.
2. Appareil d'éclairage selon une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdites DEL (3) sont mutuellement espacées d'une distance qui est au moins égale aux dimensions des collimateurs connectés à chacune desdites DEL (3).
3. Appareil d'éclairage selon une ou plusieurs des re-





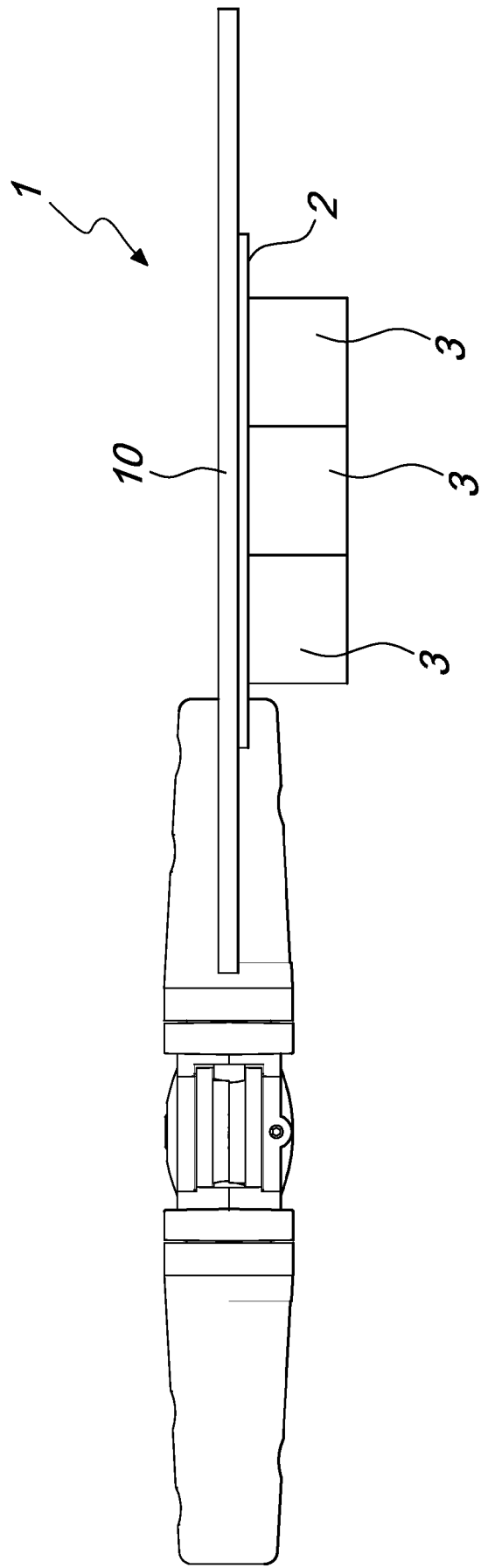


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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