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**Ernst**

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(54) **LUMINAIRE AND LUMINAIRE COMBINATION**

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***F21V 21/005*** (2006.01)

(52) **U.S. Cl.**
CPC ..... ***F21S 2/005*** (2013.01); ***F21V 21/005*** (2013.01)

(58) **Field of Classification Search**
CPC ..... F21S 2/005
See application file for complete search history.

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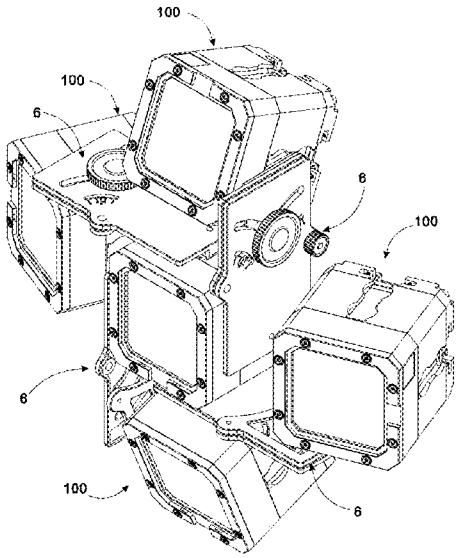
(57) **ABSTRACT**

The disclosure provides a luminaire and a luminaire combination. The luminaire combination includes at least two luminaires. The luminaire includes a housing and a light source module received in the housing. The housing defines a connecting groove therein. The connecting groove is in a flat strip shape and extends from an outer surface of the housing. One end of the connecting groove is opened for insertion of a connector. The connecting groove is provided with a limit portion on each of two opposite side walls thereof. A gap between each limit portion and a bottom surface of the connecting groove forms a channel guide. The connector is provided with a connecting portion on each of two opposite sides thereof. The connecting portion is operable to be inserted into and matched with the channel guide corresponding to the connection portion.

**20 Claims, 14 Drawing Sheets**



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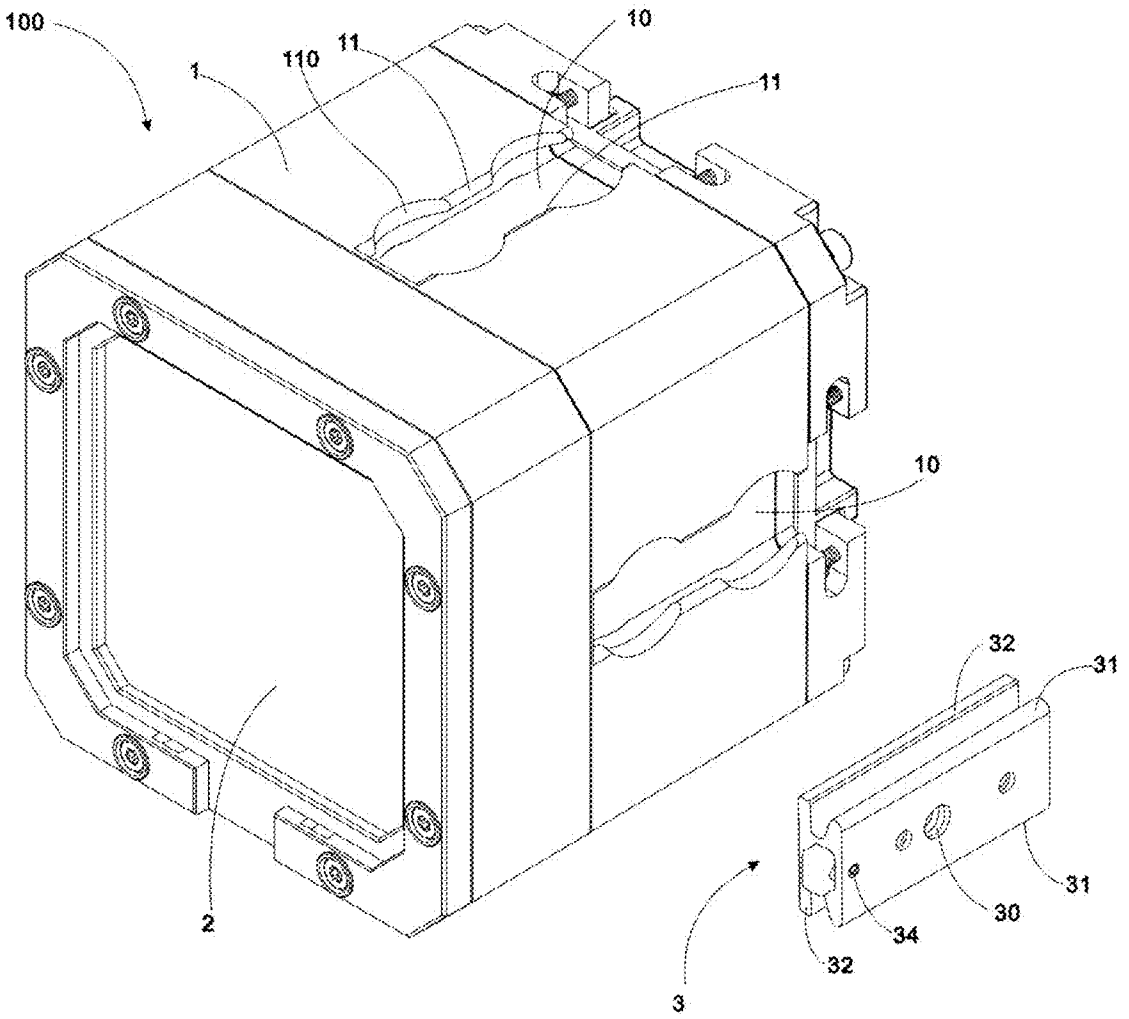


FIG. 1

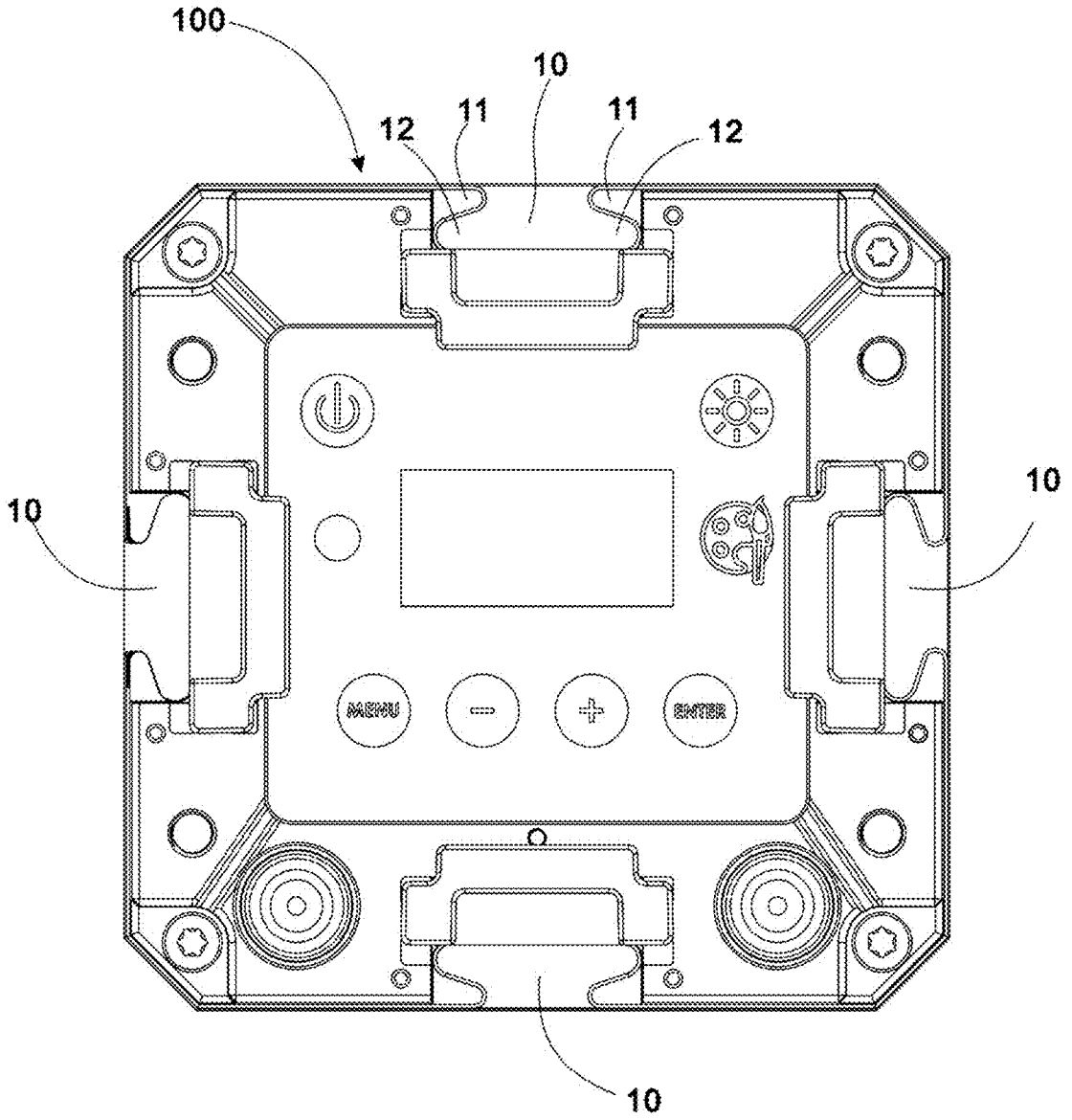


FIG. 2

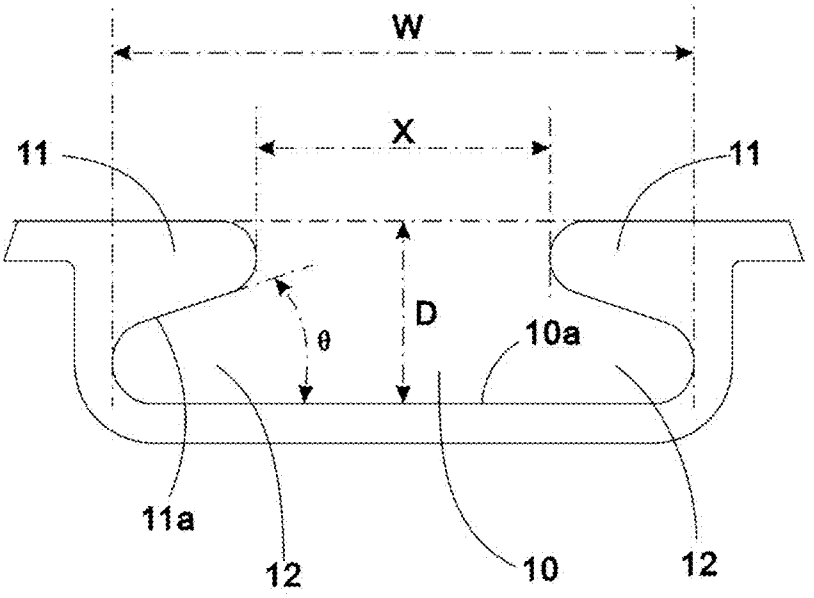


FIG. 3

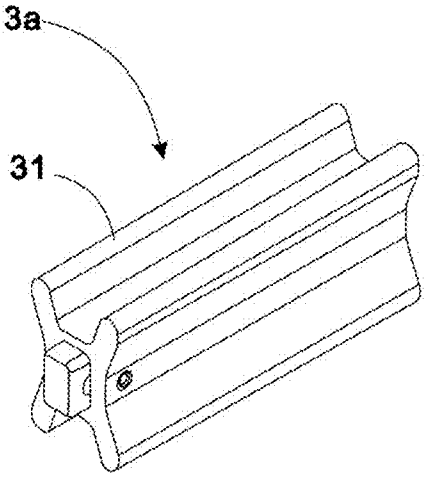


FIG. 4

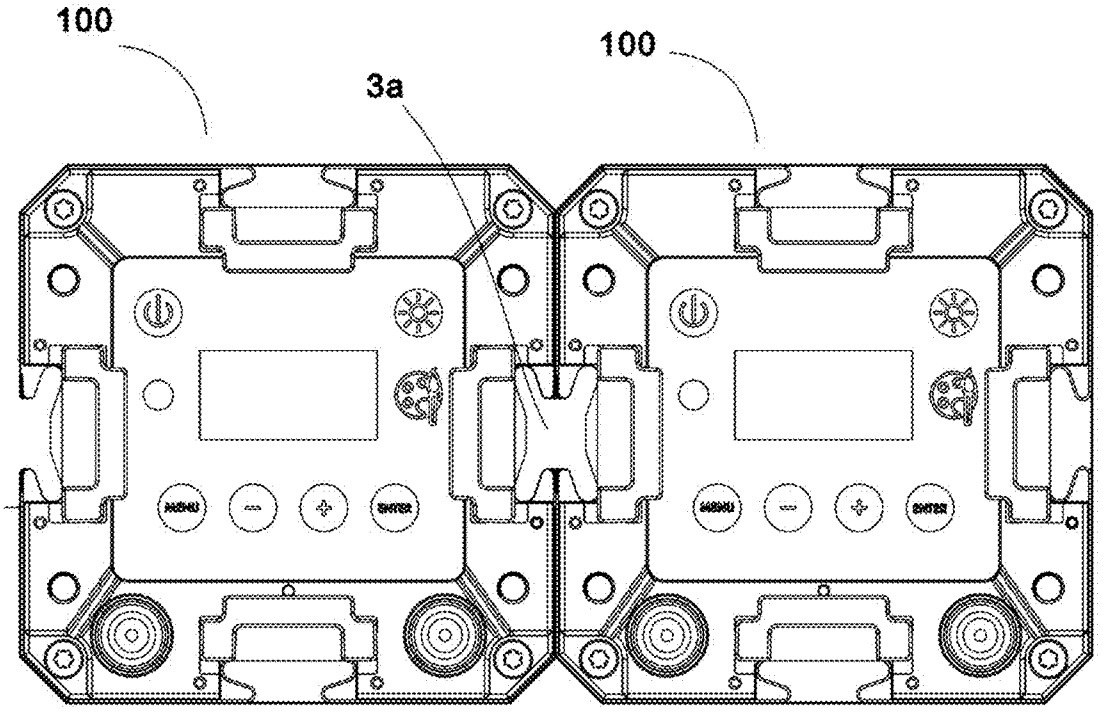


FIG. 5

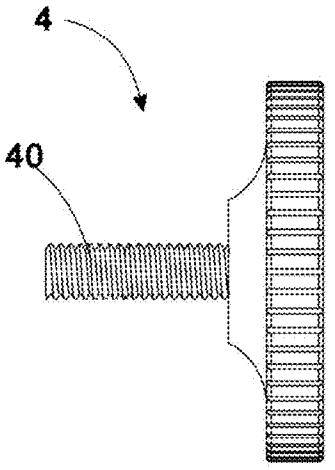


FIG. 6

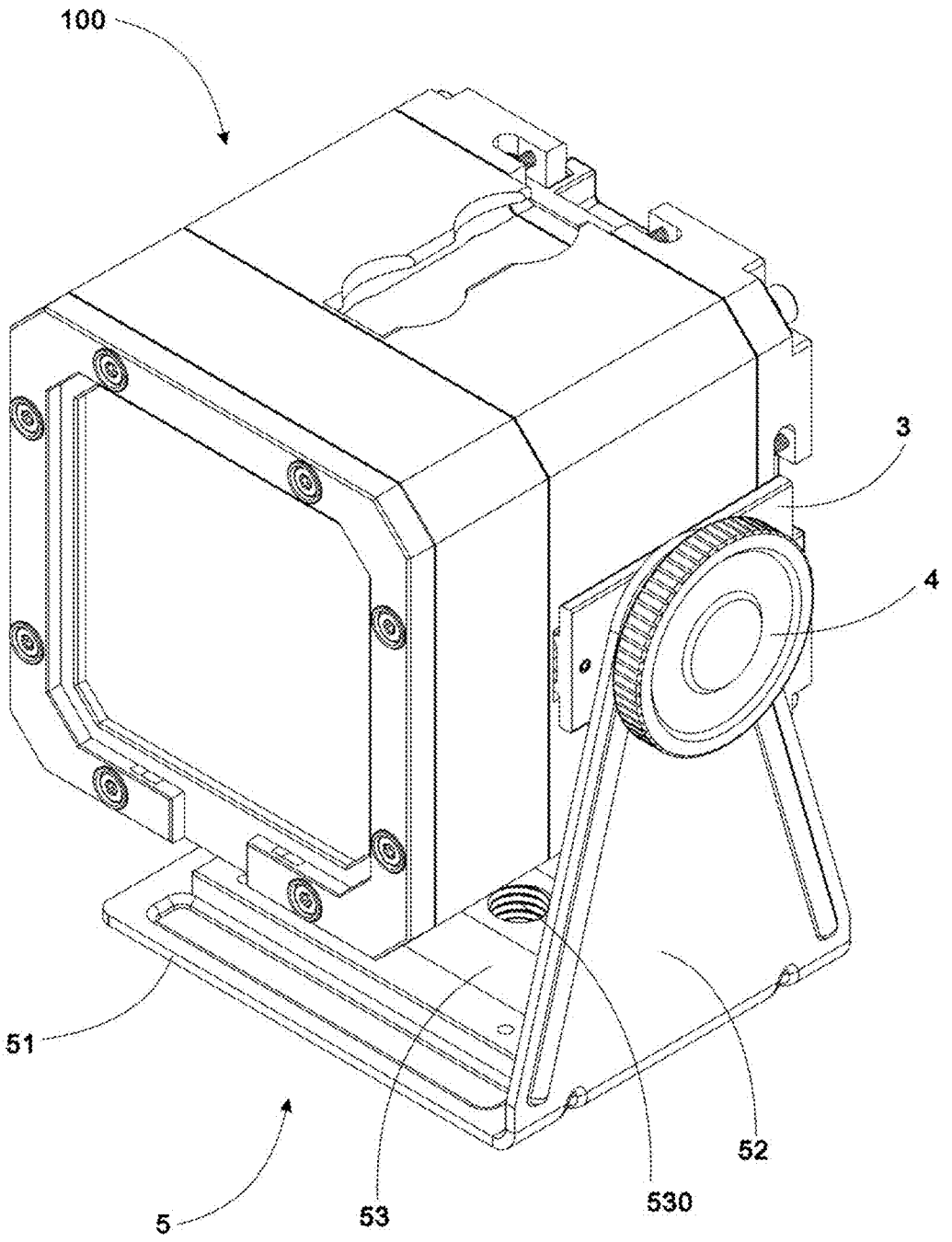


FIG. 7

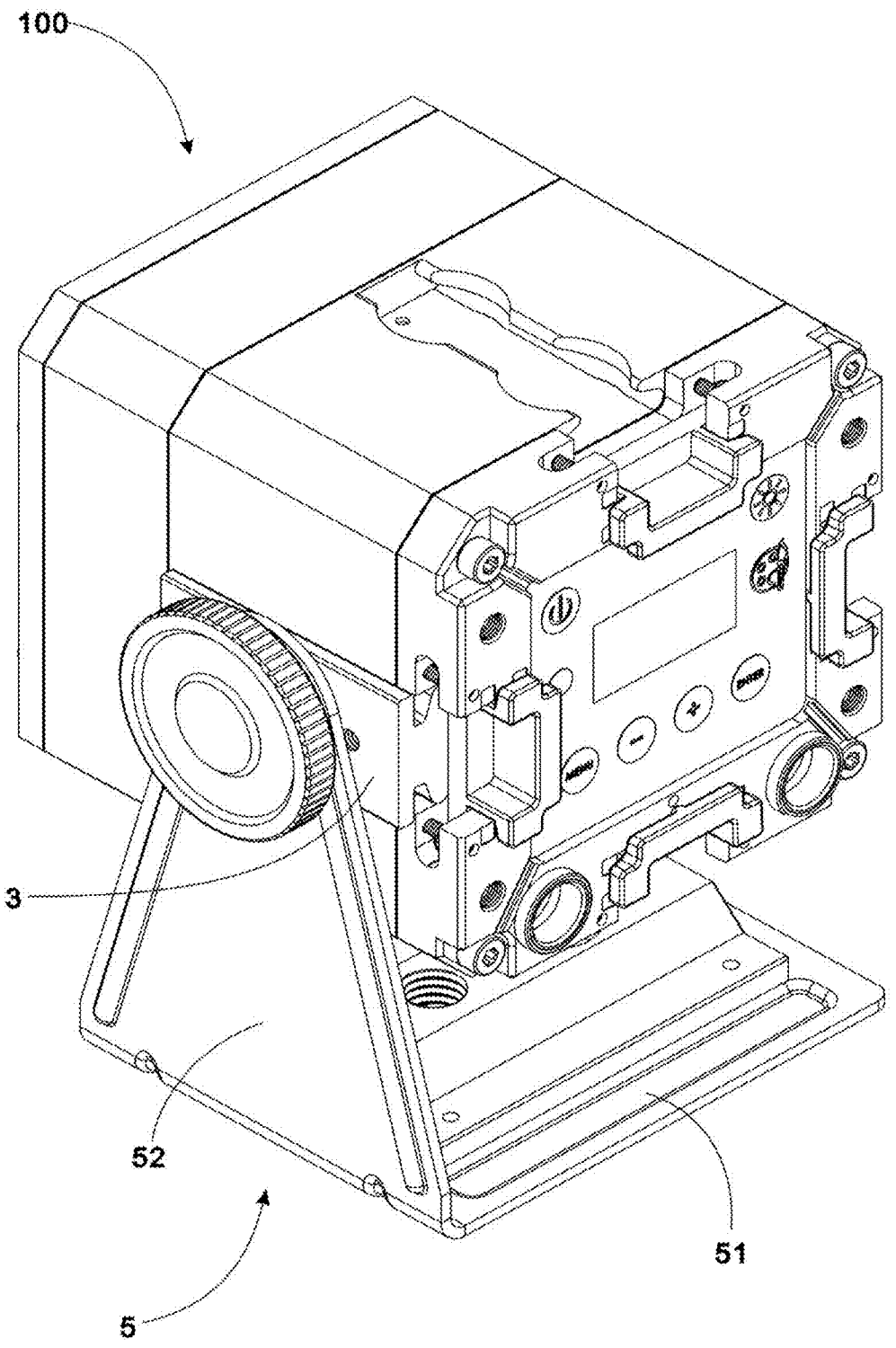


FIG. 8

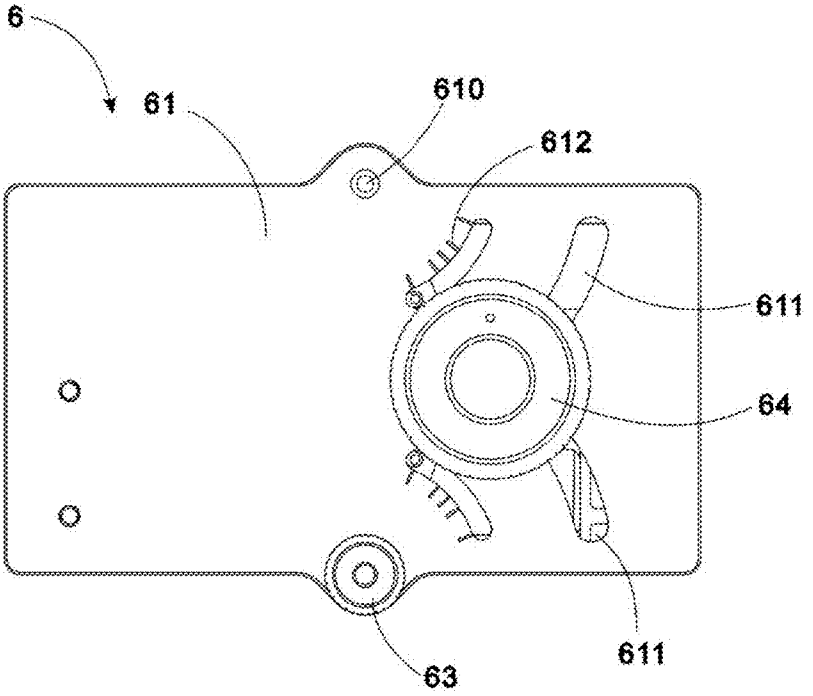


FIG. 9

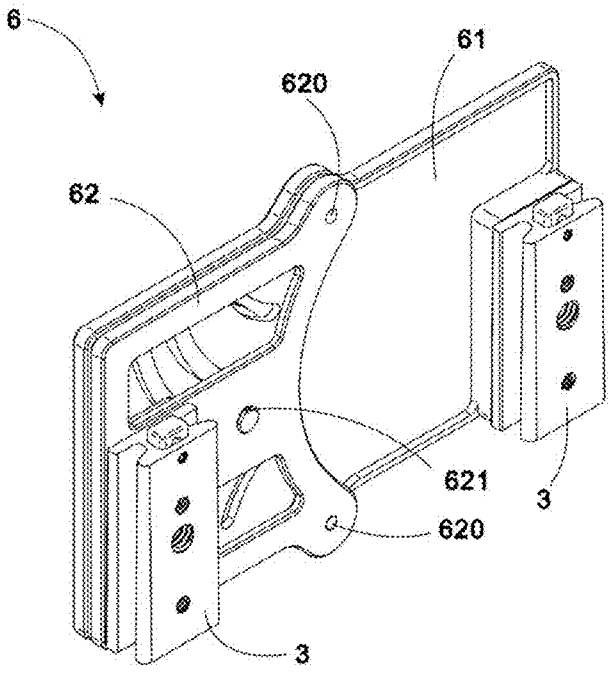


FIG. 10

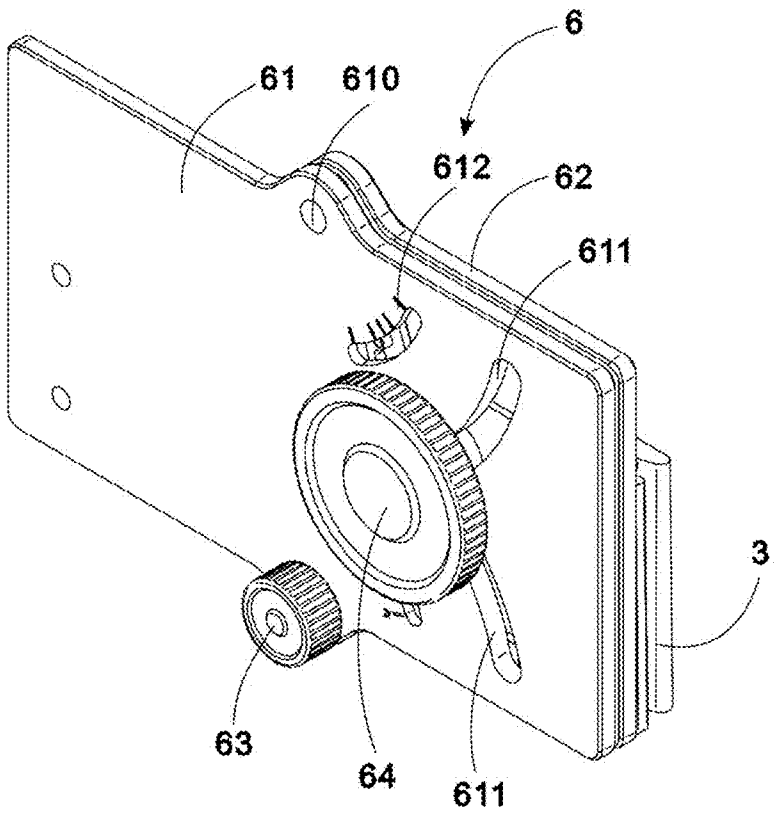


FIG. 11

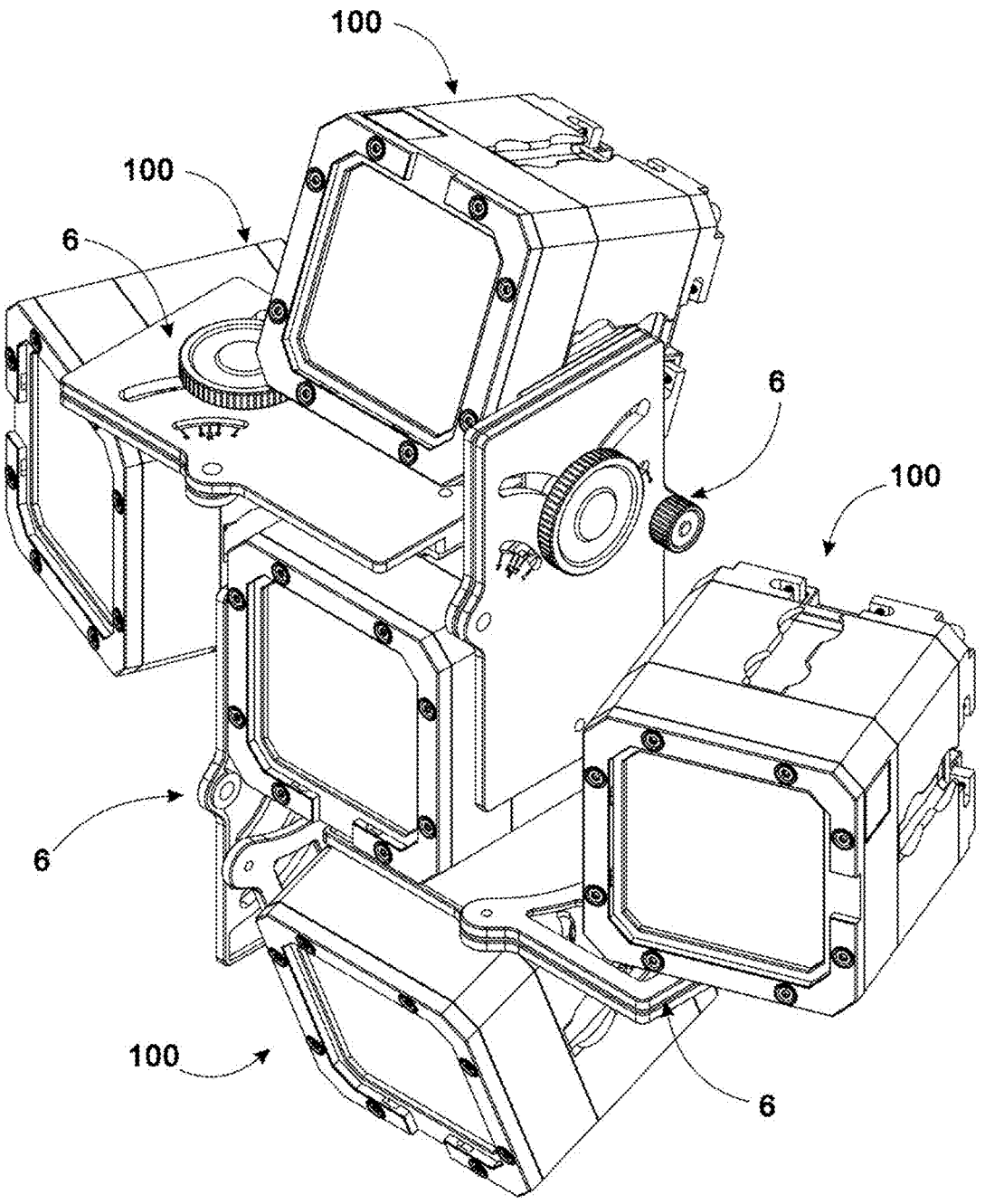


FIG. 12

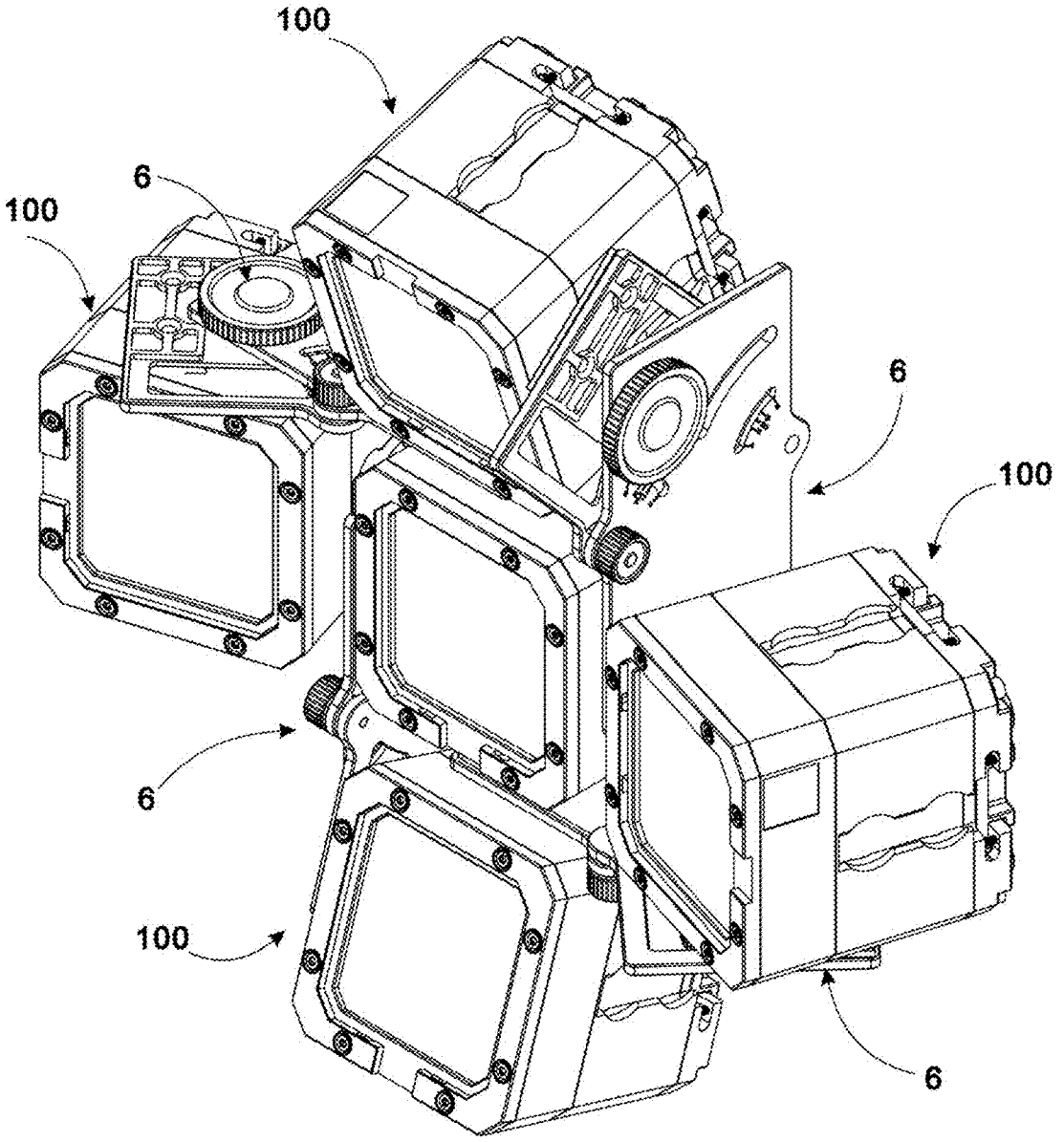


FIG. 13

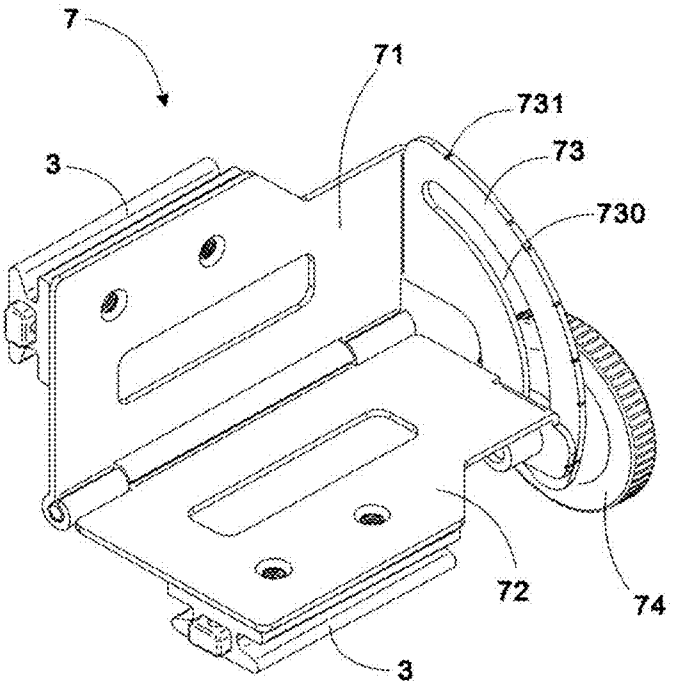


FIG. 14

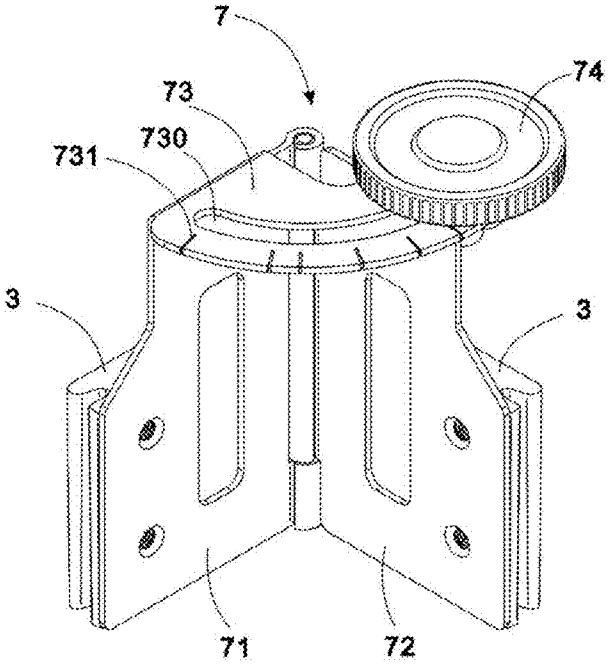


FIG. 15

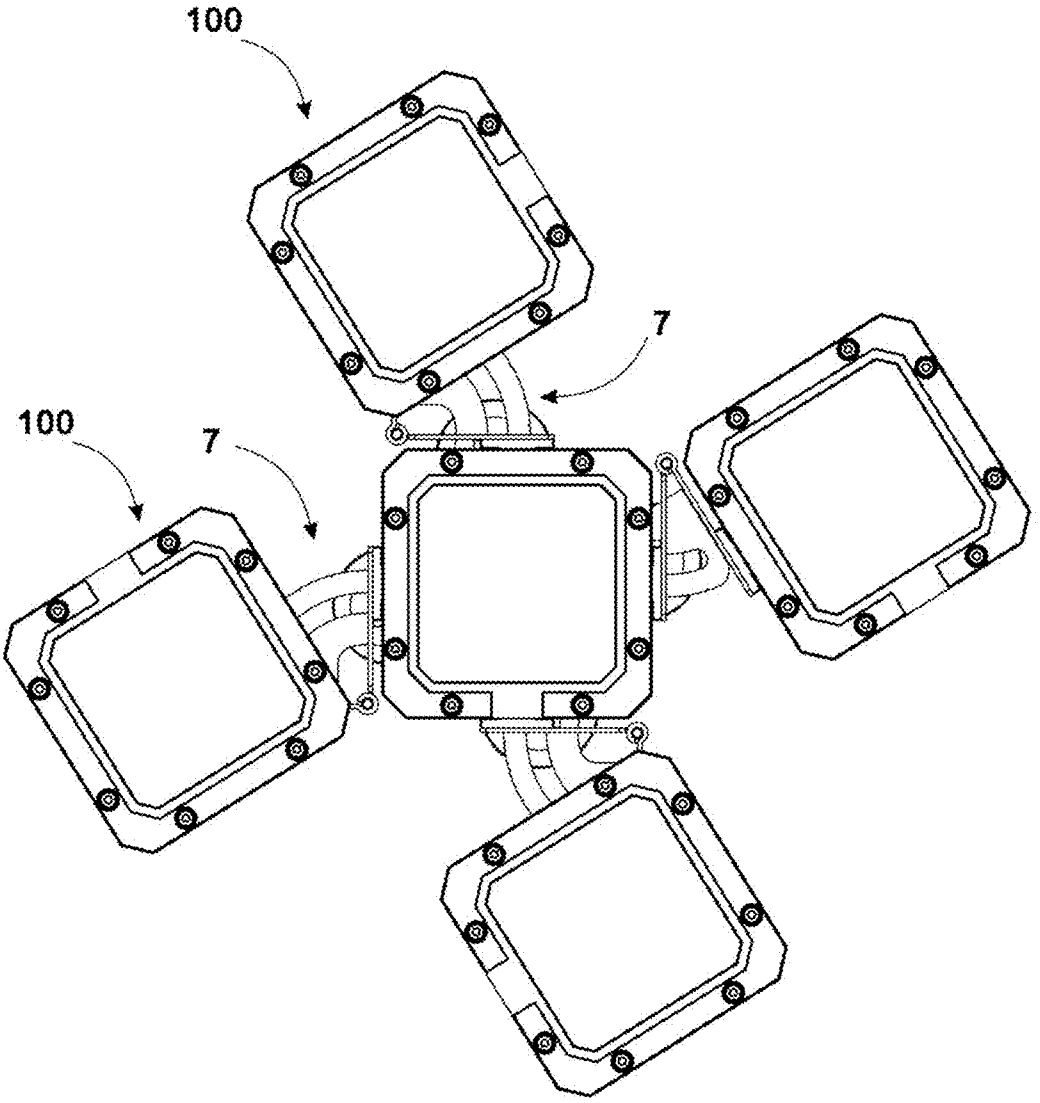


FIG. 16

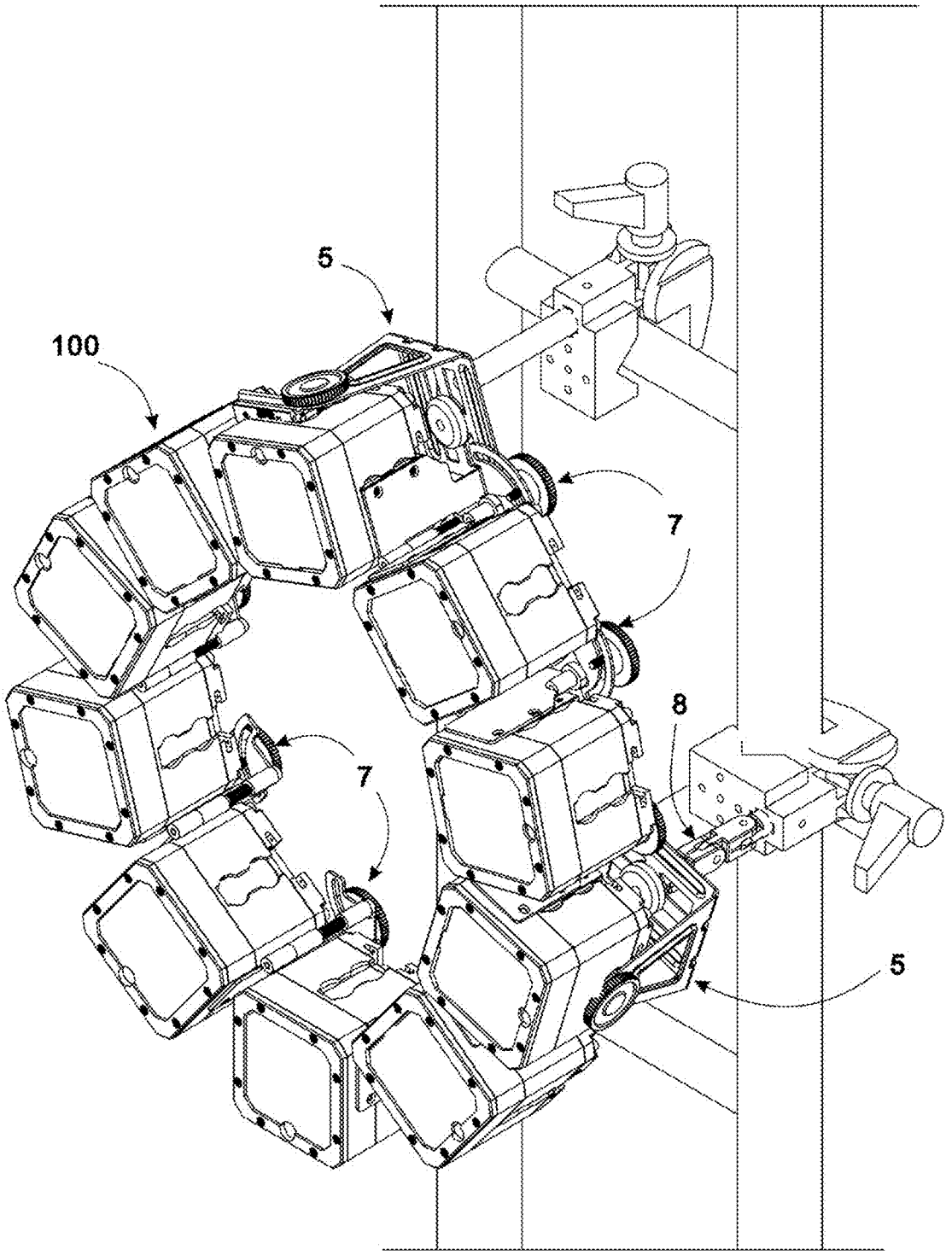


FIG. 17

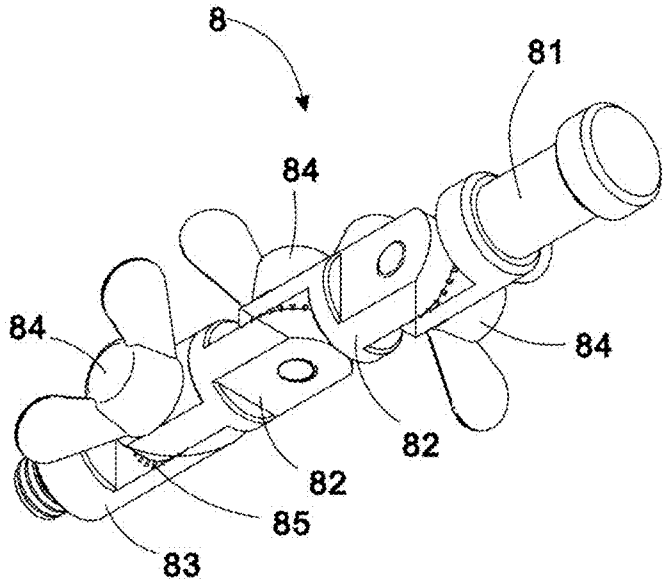


FIG. 18

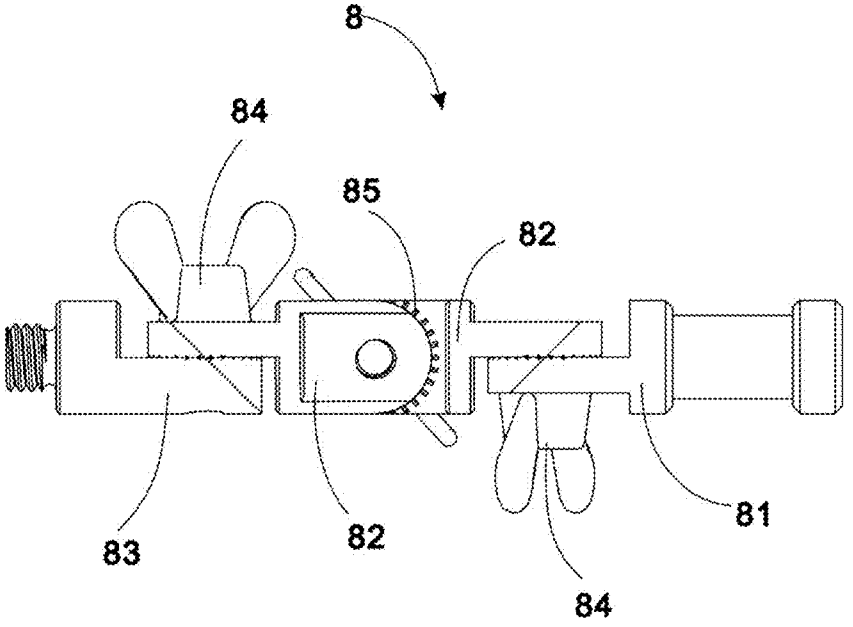


FIG. 19

# LUMINAIRE AND LUMINAIRE COMBINATION

## CROSS-REFERENCE TO RELATED APPLICATION(S)

This disclosure claims priority to and the benefit of Chinese Patent Application Serial No. 202120980786.3, filed on May 8, 2021, the entire disclosure of which is hereby incorporated by reference.

## TECHNICAL FIELD

The disclosure relates to the field of illumination devices, in particular to a luminaire and a luminaire combination.

## BACKGROUND

In illumination for theaters, film and television production, and events, positioning and arrangement of luminaires are very important because illumination requirements of changeable sites and specific areas can be met only by positioning and arrangement of the luminaires. For existing luminaires, luminaire holders are generally mounted on supports or girders through brackets, and mounted with screws. Most of such products adopt a design of rotary mounting and use bolts as hinged bearings to adjust inclination of the luminaires. Most of such products use screw rods or handle screws which are used as brakes by loosening or tightening. Positioning brackets of the luminaires are almost all U-shaped or L-shaped. In order to mount the luminaires to the supports or the girders, the brackets of the luminaires generally adopt standard or customized threaded holes or through holes.

For the existing luminaires, flexibility in arrangement and alignment of the luminaires can sometimes be improved by adding a plurality of alternative screw holes on outer shells, and connecting screw holes are selected according to needs during mounting of the brackets. However, these screw holes require a certain minimum depth to ensure safety in connecting and mounting, thereby resulting in reduction of internal space of the luminaires and influences on available sizes of functional components (e.g., a transformer and a battery pack). Since the outer shells of the existing luminaires are generally die casting parts or extrusion parts, the portion of screw holes is required to extend to a bottom or two ends of each outer shell, so as to avoid undercuts. The existing luminaires are generally not provided with alternative mounting holes, so that the possibility of rotary aligning and compact mounting of the luminaires cannot be realized.

## SUMMARY

In an aspect, a luminaire is provided. The luminaire includes a housing and a light source module received in the housing. The housing defines a connecting groove therein, where the connecting groove is in a flat strip shape and extends from an outer surface of the housing. The luminaire further includes a connector in a strip shape, where one end of the connecting groove is opened for insertion of the connector. The connecting groove is provided with a limit portion on each of two opposite side walls thereof, and a gap between each limit portion and a bottom surface of the connecting groove forms a channel guide. The connector is provided with a connecting portion on each of two opposite sides thereof. The connecting portion is operable to be inserted into and matched with the channel guide corresponding to the connection portion, such that the connecting portion is limited in the channel guide corresponding to the connecting portion via the limit portion corresponding to the connecting portion.

In an implementation, the housing is in columnar shape, a central axis of the housing coincides with a light outgoing direction of the light source module, and a length direction of the connecting groove is parallel to the central axis of the housing.

In an implementation, the housing is in a rectangular columnar shape, and defines one connecting groove on each of four side faces of the housing.

In an implementation, the connector defines a positioning screw hole therein. The positioning screw is operable to be in threaded connection with the positioning screw hole to allow an end portion of the positioning screw to be abutted against the bottom surface of the connecting groove, such that the connector is positioned in the connecting groove.

In an implementation, the connector defines a connecting screw hole in a middle positon along a length direction of the connector, and the connecting screw hole is located at a middle position between two connecting portions disposed on the two opposite sides of the connector.

In an implementation, the luminaire further includes a handwheel, the handwheel is provided with a handle screw at a position of a central axis of the handwheel, and the handle screw is operable to be in threaded connection with the connecting screw hole.

In an implementation, the connector is further provided with a fixing portion on each of the two opposite sides of the connector, and the fixing portion and the connecting portion cooperate to define a limit groove capable of accommodating the limit portion.

In an implementation, the two fixing portions extend away from each other and are in a flat and straight shape. The two fixing portions extend from one side surface, away from the connecting portion, of the connector to form a flat straight surface. Alternatively, the fixing portion and the connecting portion are of the same shape and size, the fixing portion is operable to be inserted into and matched with the channel guide, such that the connector serves as a connecting pin for connecting the housing the luminaire to a housing of another luminaire.

In another aspect, a luminaire combination is provided. The luminaire combination includes at least two luminaires described above.

In an implementation, the luminaire combination further includes at least one of a bracket, an adjusting plate, a hinge, and a cardan shaft.

The bracket is a bent plate in an L shape and has two arms which serve as a base plate in a square shape and a connecting plate in a triangular shape, respectively. The connector of the luminaire is disposed at the connecting plate. The connecting plate defines a connecting hole at a tip end, away from the base plate, of the connecting plate. A handle screw of a handwheel penetrates the connecting hole to be in threaded connection with the connecting screw hole of the connector.

The adjusting plate includes a first bearing plate in a rectangular shape, a second bearing plate, an adjusting handwheel, and a knurled screw. The first bearing plate and the second bearing plate are arranged in parallel. One connector of one luminaire is disposed at one short edge of the first bearing plate, the second bearing plate is arranged at the other short edge of the first bearing plate and another connector is disposed at the second bearing plate. The first bearing plate defines a rotating through hole at a long edge

thereof, the second bearing plate defines a rotating screw hole at a position thereof corresponding to the rotating through hole, and the knurled screw penetrates the rotating through hole to be in threaded connection with the rotating screw hole, so as to form a hinge point between the first bearing plate and the second bearing plate. The first bearing plate defines a guide hole in an arc-strip shape, the second bearing plate defines an adjusting screw hole at a position of the second bearing plate corresponding to the guide hole, an adjusting screw rod is arranged at a position of a central axis of the adjusting handwheel, and the adjusting screw rod penetrates the guide holes to be in threaded connection with the adjusting screw hole.

The hinge includes a first hinge plate, a second hinge plate, and a hinge handwheel, the first hinge plate and the second hinge plate are hinged at their edges. One connector of one luminaire is disposed at the first hinge plate and one connector of another luminaire is disposed at the second hinge plate, and a length direction of each connector is parallel to a pivot between the first hinge plate and the second hinge plate. A brake plate is fixed on the first hinge plate, wherein the brake plate is perpendicular to the pivot between the first hinge plate and the second hinge plate and defines a hinge hole in an arc-strip shape, and a portion of the second hinge plate corresponding to the hinge hole is bent and defines a hinge screw hole therein. A hinge screw rod is arranged at a position of a central axis of the hinge handwheel, where the hinge screw rod penetrates the hinge hole to be in threaded connection with the hinge screw hole.

The cardan shaft includes a fixed end, two intermediate parts, and a free end sequentially rotationally connected. One wing handle screw is arranged between the fixed end and one intermediate part, one wing handle screw is arranged between the two intermediate parts, one wing handle screw is arranged between the other intermediate part and the free end, and the three wing handle screws provide three rotating shafts, and at least one of the three rotating shafts is perpendicular to the other two rotating shafts.

The luminaire and the luminaire combination are provided. Since the connecting groove is a flat shape arranged along the outer surface of the housing, its flat geometric structure occupies a small internal space of the luminaire, an internal reserved space of the luminaire is large and square, and thus a large component can be assembled in the housing. Through matching between the two connecting portions and the two limit portions, the two connecting portions are respectively limited in the two channel guides, so that firm and reliable connection is achieved between the connector and the housing. Mounting and demounting of the connector and the housing are facilitated by an inserting manner. The entire luminaire may be connected to other supports, girders, or the luminaire via the connector.

## BRIEF DESCRIPTION OF THE DRAWINGS

In order to describe the technical solutions in the embodiments of the disclosure or the related art more clearly, the drawings required to be used in descriptions about the embodiments will be simply introduced below. The drawings in the following description are only drawings corresponding to part of the embodiments of the disclosure.

FIG. **1** is a three-dimensional structure schematic diagram of a luminaire of the disclosure.

FIG. **2** is a schematic structural diagram of a back of a housing of the luminaire in FIG. **1**.

FIG. **3** is a schematic structural diagram of a connecting groove of the housing in FIG. **2**.

FIG. **4** is a schematic structural diagram of a connecting pin of a luminaire of the disclosure.

FIG. **5** is a schematic structural diagram of jointing the luminaires of the disclosure into a luminaire combination by the connecting pin.

FIG. **6** is a schematic structural diagram of a handwheel of a luminaire of the disclosure.

FIG. **7** is a schematic structural diagram of a connection between a luminaire and a bracket of the disclosure.

FIG. **8** is a schematic structural diagram of the connection between the luminaire and the bracket in FIG. **7** from another perspective.

FIG. **9** is a schematic structural diagram of a front of an adjusting plate of a luminaire combination of the disclosure.

FIG. **10** is a three-dimensional structure schematic diagram of the adjusting plate in FIG. **9**.

FIG. **11** is a three-dimensional structure schematic diagram of the adjusting plate in FIG. **9** from another perspective.

FIG. **12** is a schematic structural diagram of a luminaire combination formed by luminaires and adjusting plates of the disclosure.

FIG. **13** is a schematic structural diagram of the luminaire combination in FIG. **12** in another state.

FIG. **14** is a three-dimensional structure schematic diagram of a hinge of a luminaire combination of the disclosure.

FIG. **15** is a three-dimensional structure schematic diagram of the hinge in FIG. **14** from another perspective.

FIG. **16** is a schematic structural diagram of a luminaire combination formed by luminaires and hinges of the disclosure.

FIG. **17** is a schematic structural diagram of another form of luminaire combination formed by luminaires and hinges of the disclosure.

FIG. **18** is a three-dimensional structure schematic diagram of a cardan shaft of a luminaire combination of the disclosure.

FIG. **19** is a schematic structural diagram of the cardan shaft in FIG. **18** from another perspective.

## DETAILED DESCRIPTION

The technical solutions in the embodiments of the disclosure will be clearly and completely described below in combination with the drawings in the embodiments of the disclosure. It is apparent that the described preferred embodiments are not all embodiments but merely part of embodiments of the disclosure. On the basis of the embodiments of the disclosure, all other embodiments obtained on the premise of no creative work of those skilled in the art shall fall within the scope of protection of the disclosure.

Referring to FIG. **1** and FIG. **2**, the disclosure provides a luminaire **100** according to a preferred embodiment, including a housing **1**, a light source module **2** arranged in the housing **1**, and a connector **3**. The housing **1** defines connecting grooves **10** therein, the connector **3** can be inserted into the connecting groove **10**, so that detachable connection between the connector **3** and the housing **1** is realized. The connector **3** can be connected to other structural members such as a bracket to mount the luminaire **100** onto other objects such as a support or a girder.

As shown in FIG. **2** and FIG. **3**, the connecting groove **10** is in a strip shape. The connecting groove **10** extends from an outer surface of the housing **1**. The connecting groove **10** is flat. One end of the connecting groove **10** is opened for insertion of the connector **3**. The connecting groove **10** is

provided with a limit portion **11** on each of two opposite side walls of the connecting groove **10**. A gap between each limit portion **11** and a bottom surface of the connecting groove **10** forms a channel guide **12**. As shown in FIG. **1**, the connector **3** is in a strip shape. The connector **3** is provided with a connecting portion **31** on each of two opposite sides of the connector **3**. The connecting portion **31** is operable to be inserted into and matched with the channel guide **12** corresponding to the connection portion **31**, such that the connecting portion **31** is limited in the channel guide **12** corresponding to the connecting portion **31** via the limit portions **11** corresponding to the connecting portion **31**.

Since the connecting groove **10** is a flat shape arranged along the outer surface of the housing **1**, its flat geometric structure occupies a small internal space of the luminaire **100**, an internal reserved space of the luminaire **100** is large and square, and thus a large component incapable of being reshaped or detached to fit a small or complicated space can be assembled in the housing **1**. The connector **3** and the connecting groove **10** are in insertion matching. Through matching between the two connecting portions **31** and the two limit portions **11**, the two connecting portions **31** are respectively limited in the two channel guides **12**, so that firm and reliable connection is achieved between the connector **3** and the housing **1**. Mounting and demounting of the connector **3** and the housing **1** are facilitated by an inserting manner. The entire luminaire **100** may be connected to other supports, girders, or the luminaire **100** through the connector **3**.

As shown in FIG. **3**, it is to be understood that, the connecting groove **10** described in the disclosure is flat, which involves that a groove depth D thereof is less than a groove width W. Due to the small groove depth D, the internal space of the luminaire **100** occupied by the connecting groove **10** is reduced; due to the relatively large groove width W, the structure of the limit portions **11** and the channel guides **12** in a width direction of the connecting groove **10** can be used to achieve a connection with the connector **3**, thereby making a full use of the space along the surface of the housing **1**.

Preferably, the groove width W of the connecting groove **10** is 2.5 to 3.5 times of the groove depth D, and is 1.5 to 2.5 times of a gap X between the two limit portions **11**, so that the structure of the connecting groove **10** may be as flat as possible, while connection strength between the connecting groove **10** and the connector **30** is ensured.

As shown in FIG. **3**, the limit portion **11** has a channel guide face **11***a*, and the channel guide face **11** faces a bottom surface **10***a* of the connecting groove **10**. The channel guide face **11***a* is obliquely arranged, and form an acute angle θ with the bottom surface **10***a* of the connecting groove **10**. The channel guide face **11***a* and the bottom surface **10***a*, as well as the channel guide face **11***a* and the outer surface of the housing **1**, are in curved transition, thereby facilitating machining and shaping, and facilitating assembling between the connecting groove **10** and the connector **3**.

In the embodiment, as shown in FIG. **1**, the housing **1** is in a columnar shape. A central axis of the housing **1** coincides with a light outgoing direction of the light source module **2**. A length direction of the connecting groove **10** is parallel to the central axis of the housing, As such, a light outgoing direction of the luminaire **100** can be conveniently set when the luminaire **100** is mounted onto other objects, thereby facilitating adjustment of the light outgoing direction.

An end opening of the connecting groove **10** faces the back of the housing **1**, i.e., is opposite to the light outgoing direction, the connector **3** can be inserted from the back of the luminaire **100** to avoid affecting the structure of the front of the housing **1**, thereby ensuring a simple and beautiful appearance of the front of the luminaire **100**.

Further, the housing **1** is in a rectangular columnar shape. The housing **1** defines one connecting groove **10** on each of four side faces of the housing **1**. Through the four connecting grooves **10**, a connection between the housing **1** and other objects can be realized through the connectors **3**, and jointing among a plurality of luminaires **100** can also be realized through the connectors **3**. Thus, use is facilitated.

Here, in other embodiments, the housing **1** may also be a cylinder, a triangular prism, or other polygonal prisms, and may also be a sphere, a polyhedron, or the like. The number of the connecting grooves **10** may be one, two or more. With two or more connecting grooves **10**, the luminaire **100** can be connected to other objects, and jointing among a plurality of luminaires **100** can also be realized.

As shown in FIG. **1**, the limit portion **11** is provided with a notch **110** that is communicated to the corresponding channel guide **12**. Through the notch **110**, a user can observe the internal condition of the channel guide **12** conveniently, and can clean foreign matters entering the channel guide **12**, so that normal insertion matching between the connector **3** and the connecting groove **10** is facilitated.

The connector **3** defines a positioning screw hole (not shown in the figure) therein. A positioning screw **34** is operable to be in threaded connection with the positioning screw hole to allow one end portion of the positioning screw **34** to be abutted against the bottom surface **10***a* of the connecting groove **10**, such that the connector **3** is positioned in the connecting groove **10**. When the connector **3** is inserted in the connecting groove **10**, the positioning screw **34** is tightened so that the end portion thereof is abutted against the bottom surface **10***a* of the connecting groove **10**, and thus the connector **3** can be positioned in the connecting groove **10** and cannot slip off the connecting groove **10**. The positioning screw **34** may be arranged at the position close to an end portion of the connector to prevent other objects blocking the positioning screw **34**.

The connector **3** defines a connecting screw hole **30** in a middle position of the along a length direction connector **3**. The connecting screw hole **30** is located at a middle position between two connecting portions **31** disposed on the two opposite sides of the connector **3**. Through the connecting screw hole **30**, a connection between the connector **3** and other structural members may be conveniently realized. For example, threaded connection between the connector **3** and a handwheel **4**, or a cardan shaft **8** may be realized. The connecting screw hole **30** is disposed between the two connecting portions **30**, so that an influence to matching between the connecting portions **31** and the channel guides **12** can be avoided.

A plurality of connectors **3** may be arranged. The different connectors **3** can be used to connect the connecting grooves **10** on different side faces of the luminaire **100** to different objects. The connector is further provided with a fixing portion **32** on each of the two opposite sides of each connector **3**. The fixing portion **32** and the connecting portion **31** cooperate to define a limit groove capable of accommodating the limit portion **11**. A connection between the connector **3** and other objects can be facilitated through the fixing portions **32**. The two fixing portions **32** may extend away from each other and are in a flat and straight shape. The two fixing portions **32** may extend from one side surface, away from the connecting portion **31**, of the con-

nector **3** to form a flat straight surface. As such, it further facilitates fixed connection between the connector **3** and other objects.

Alternatively, the fixing portion **32** of the connector **3** may have the same shape and size as the connecting portion **31**. The fixing portion **32** is operable to be inserted into and matched with the channel guide **12**, which is equivalent to providing four connecting portions **31**. As shown in FIG. **4**, the entire connector **3** may serve as a connecting pin **3***a* for connecting the housing **1** of the luminaire **100** to a housing of another luminaire **100**. As such, it is possible to realize inserted connection with the connecting groove **10** of another luminaire **100**. As shown in FIG. **5**, the connecting grooves **10** of the two luminaires **100** can be simultaneously connected by the connecting pin **3***a*, so that the two luminaires **100** are jointed together. By means of a plurality of connecting pins **3***a*, a plurality of luminaires **100** can be joined together to form a modular structure. The luminaires **100** in different number as needed can be jointed to form a luminaire combination of different size and different lighting area. A dovetail groove is further arranged between the two connecting portions **31**, which can reduce consumable of the connecting pin **3***a*. The connecting pin **3***a* is preferably a solid aluminum part, which is convenient to machine and shape and can ensure the connection strength.

As shown in FIG. **6**, the luminaire **100** further includes a handwheel **4**. The handwheel is provided with a handle screw **40** at a position of a central axis of the handwheel **4**. The handle screw is operable to be in threaded connection with the connecting screw hole **30**. Through threaded connection between the handle screw **40** and the connecting screw hole **30**, other objects can be cluminaireed between the handwheel **4** and the connector **3**, so that fixed connection between the luminaire **100** and the other objects is realized.

The disclosure further provides a luminaire combination, including two or more of the above-mentioned luminaires **100**. The luminaire combination further includes at least one of a bracket **5**, an adjusting plate **6**, a hinge **7**, and a cardan shaft **8**. The bracket **5**, the adjusting plate **6**, the hinge **7**, and the cardan shaft **8** each can be connected to the connector **3** of the luminaire **100**. A plurality of luminaires **100** may be combined and jointed to form different shapes of luminaire combinations through one or multiple of the bracket **5**, the hinge **7**, the adjusting plate **6**, and the cardan shaft **8**. The bracket **5**, the adjusting plate **6**, the hinge **7**, and the cardan shaft **8** will be respectively described below.

As shown in FIG. **7** and FIG. **8**, the bracket **5** is a bent plate in an L shape and has two arms which serve as a base plate **51** and a connecting plate **52**, respectively. The base plate **51** is in square shape. The connecting plate **52** is in a triangular shape. The connector **3** is disposed at the connecting plate **52**. The connecting plate **52** defines a connecting hole (not shown in the figure) at a tip end, far away from the base plate **51**, of the connecting plate **52**. A handle screw **40** of the handwheel **4** penetrates the connecting hole to be in threaded connection with the connecting screw hole **30** of the connector **3**. The handle screw **40** is screwed into the connecting screw hole **30** of the connector **3** to be used as a brake, so that the connector **3** is rotated to adjust an angle between the connector **3** and the bracket **5**, to adjust a light projection angle of the luminaire **100**. The connecting plate **52** is fixed and cluminaireed between the handwheel **4** and the connector **3**, so that fixed connection between the connector **3** and the bracket **5** is realized. The connecting plate **52** is triangular, which can avoid blocking the positioning screw **34**. The connector **3** is inserted into the connecting groove **10**, and the positioning screw is screwed on, so that fixed connection between the luminaire **100** and the bracket **5** can be realized. The base plate **51** is provided with a connecting block **53**. The connecting block **53** is provided with a bracket screw hole **530**. The bracket screw hole **530** has the same structure as the connecting screw hole, so that component universality is improved. The bracket screw hole **530** may be used to facilitate threaded connection with the cardan shaft **8** or other objects.

The bracket **5** is generally used with the luminaire **100** individually, or serves as a coupler between the luminaire **100** or a luminaire combination and a holder, especially when the cardan shaft **8** is required.

The adjusting plate **6** is mainly used for a cross-shaped luminaire combination to achieve straight, divergent, or condensed light projection directions. As shown in FIG. **9**, FIG. **10**, and FIG. **11**, the adjusting plate **6** includes a first bearing plate **61**, a second bearing plate **62**, an adjusting handwheel **64**, and a knurled screw **63**. The first bearing plate **61** and the second bearing plate **62** are arranged in parallel. The first bearing plate **61** is in a rectangular shape. One connector **3** of one luminaire is disposed at one short edge of the first bearing plate **61**. The second bearing plate **62** is arranged at the other short edge of the first bearing plate **61** and another connector **3** is disposed at the second bearing plate **62**. The first bearing plate **61** defines a rotating through hole **610** at a long edge thereof. The second bearing plate **62** defines a rotating screw hole **620** at a position thereof corresponding to the rotating through hole **610**. The knurled screw **63** penetrates the rotating through hole **610** to be in threaded connection with the rotating screw hole **620**, so that a plate aligning hinge point is formed, i.e., a hinged point between the first bearing plate **61** and the second bearing plate **62** is formed. The knurled screw **63** serves as a pivot between the two plates, so that the first bearing plate **61** and the second bearing plate **62** may rotate relative to each other. The first bearing plate **61** defines a guide hole **611** in an arc-strip shape. The second bearing plate **62** defines an adjusting screw hole **621** at a position of the second bearing plate corresponding to the guide hole **611**. An adjusting screw rod (not shown in the figure) is arranged at a position of a central axis of the adjusting handwheel **64**. The adjusting screw rod penetrates the guide holes **611** to be in threaded connection with the adjusting screw hole **621**. When the adjusting handwheel **64** is loosened by turning, the first bearing plate **61** and the second bearing plate **62** may rotate relative to each other, and the adjusting screw rod moves along the guide holes **611**. When the adjusting handwheel **64** is tightened by turning, the first bearing plate **61** is cluminaireed between a wheel body and the second bearing plate **62**, and positions of the first bearing plate **61** and the second bearing plate **62** are fixed. The adjusting handwheel **64** and the adjusting screw hole **621** are matched to form a brake, which can adjust the relative position between the first bearing plate **61** and the second bearing plate **62**, so that the relative position between two connectors **3** can be adjusted, and further, the relative position between two luminaires **100** can be adjusted, thereby changing light projection angles of the two luminaires **100**.

Further, both long edges of the first bearing plate **61** are provided with the rotating through holes **610**, correspondingly, the second bearing plate **62** is provided with two rotating screw holes **620**, and the first bearing plate **61** is provided with two guide holes **611**. The knurled screw **63** may be detached from one of the rotating screw holes **620** and mounted into the other rotating screw hole **620**, so that a rotating shaft between the first bearing plate **61** and the

second bearing plate **62** may be changed to achieve adjustment of different angle directions between the two luminaires **100**.

Since the first bearing plate **61** of the adjusting plate **6** is provided with angle mark slots **612**, an opening angle can be accurately set, thereby facilitating adjustment to make angles, relative to the luminaire **100** at the center position, of the surrounding four luminaires **100** the same.

As shown in FIG. **12** and FIG. **13**, four adjusting plates **6** and five luminaires **100** are used to form a luminaire combination. Four luminaires **100** may be adjustably arranged on four side faces of one luminaire **100**, and by adjusting the first bearing plate **61** and the second bearing plate **62** to rotate relative to each other, overall light condensing or diverging of the luminaire combination formed of the five luminaires **100** can be achieved.

The hinge **7** is used as a connection structural member, and can be used for adjustable connection between two luminaires **100**. As shown in FIG. **14** and FIG. **15**, the hinge **7** includes a first hinge plate **71**, a second hinge plate **72**, and a hinge handwheel **74**. The first hinge plate **71** and the second hinge plate **72** are hinged at their edges. One connector **3** of one luminaire **100** is disposed at the first hinge plate **71** and one connector **3** of another luminaire **100** is disposed at the second hinge plate **72**. A length direction of each connector **3** is parallel to a pivot between the first hinge plate **71** and the second hinge plate **72**. A brake plate **73** is fixed on the first hinge plate **71**. The brake plate **73** is perpendicular to the pivot between the first hinge plate **71** and the second hinge plate **72**, and defines a hinge hole **730** in an arc-strip shape. A portion, corresponding to the brake plate **73**, of the second hinge plate **72** is bent and defines a hinge screw hole (not shown in the figure) therein. A hinge screw rod (not shown in the figure) is arranged at a position of a central axis of the hinge handwheel **74**. The hinge screw rod penetrates the hinge hole **730** to be in threaded connection with the hinge screw hole. When the hinge handwheel **74** is loosened by turning, the first hinge plate **71** and the second hinge plate **72** may rotate relative to each other, the hinge screw rod moves along the hinge hole **730**. When the hinge handwheel **74** is tightened by turning, the brake plate **73** is clamped between the hinge handwheel **74** and the second hinge plate **72**, and positions of the first hinge plate **71**, the brake plate **73**, and the second hinge plate **72** are fixed. The hinge handwheel **74** and the hinge screw hole are matched to form a brake, which can adjust a relative angle between the two plates. In the hinge **7** according to the embodiment, the first hinge plate **71** and the second hinge plate **72**, provided with the connectors **3**, rotate around the pivot parallel to the plates, so that the opening degree of the two plates can be changed to adjust the relative position of the two luminaires **100**. The brake plate **73** of the hinge **7** is provided with degree scale marks **731**, which can achieve setting of the same angle. As shown in FIG. **16**, with one luminaire **100** as the center, four hinges **7** and four luminaires are used on four sides of the luminaire **100** to form a cross-shaped luminaire combination. As shown in FIG. **17**, a plurality of luminaires **100**, a plurality of hinges **7**, brackets **5**, and cardan shafts **8** are used to form a circular luminaire combination.

As shown in FIG. **18** and FIG. **19**, the cardan shaft **18** is provided with three rotating shafts, which can flexibly connect the bracket **5** of the luminaire **100** or a luminaire combination to a support or a girder, or other objects. The cardan shaft **8** includes a fixed end **81**, two intermediate parts **82**, and a free end **83** which are sequentially rotationally connected. The fixed end **81** is used to be connected to other objects such as a support or a girder, and the free end **83** may be used to be connected to the connector **3** or the bracket **5**. In the embodiment, the fixed end **81** adopts an industrial standard plug, and is matched with a general standard clamp on the girder or the support. The free end **83** is provided with an external thread matched with the connecting screw hole **30** of the connector **3**, so that a connection with the luminaire **100** is achieved.

One wing handle screw **84** is arranged between the fixed end **81** and one intermediate part **82**, one wing handle screw **84** is arranged between the two intermediate parts **82**, and one wing handle screw **84** is arranged between the other intermediate part **82** and the free end **83**. The three wing handle screws **84** may provide three rotating shafts, and at least one of the three rotating shafts is perpendicular to the other two rotating shafts. In this way, universal adjustment is achieved. The three wing handle screws **84** can be loosened or tightened manually easily, without the aid of tools. Positioning teeth **85** for preventing relative rotation are arranged between the fixed end **81** and one intermediate part **82** as well as between the two intermediate parts **82**, and between the other intermediate **82** and the free end **83**, which can prevent relative rotation after tightening.

In the luminaire and the luminaire combination provided in the disclosure, with a flat channel guide structure of each connecting groove **10**, interference to the internal mounting space of the luminaire is minimized, the internal reserved space of the luminaire is large and square, and thus a large component incapable of being reshaped or detached to fit a small or complicated space can be assembled.

The connector **3** or the connecting pin **3***a* is matched with the connecting groove **10** of the housing **1** by inserting, the connector **3**, is in matched connection with the bracket **5**, the hinge **7**, the adjusting plate **6**, or the cardan shaft **8**, and all four side faces of the housing **10** are provided with the connecting grooves **10**. Aligning and combining of a plurality of luminaires can be achieved by using the connecting pins **3***a*, the hinges **7**, and the adjusting plates **6**. With the compact structure of the connecting pin **3***a*, the luminaires can be assembled with the maximum density of zero spacing. With the connecting pins **3***a* and the brackets **5**, a compact linear combination can be formed; with the hinges **7**, a cross-shaped or a circular combination can be formed; with the adjusting plates **6**, a linear or a cross-shaped combination in a diverging direction can be formed. Aligning and fixing of a plurality of luminaires can be achieved through the brackets **5** and the cardan shafts **8**. A plurality of luminaires **100** can be combined into a line, a cross shape or a circle as needed, and can be combined into various shapes of luminaire combinations. Thus, unlimited combination possibilities are provided for the luminaires **100**.

The handwheel **4**, the adjusting handwheel **64**, and the hinge handwheel **74** each can be matched with the corresponding screw hole to form a brake. Brakes can also be formed at positions of the wing handle screws **84** of the cardan shaft **8**. After the luminaires are combined, light effects of the luminaire combination such as condensing, diverging, or in any other directions can be achieved by adjusting a vertical axis of each single luminaire, so that high flexibility in light direction and arrangement of the luminaire combination can be achieved. The luminaire combination can be connected to the support or the girder through a single connector or a plurality of joint points. Free alignment or any adjustment can be achieved through the brackets **5**, the hinges **7**, the adjusting plates **6**, or the cardan shafts **8**.

The handwheel **4**, the adjusting handwheel **4**, and the hinge handwheel **74** may have the same shape and size, especially have the same external thread structure, which allow the three to form general components, thereby achieving exchange to facilitate mounting and using.

The connecting accessories such as the brackets **5**, the hinges **7**, the adjusting plates **6** and the cardan shafts **8** each have simple structure, small size, and small space occupation, can avoid use of luminaire brackets with excessive space occupation, thereby facilitating forming of a compact spotlight array.

In summary, although the disclosure has been disclosed as above in the preferred embodiments, the above preferred embodiments are not intended to limit the disclosure. Those of ordinary skill in the art can make variations and modifications without departing from the spirit and scope of the disclosure, and the protection scope of the disclosure is subject to the scope defined by the claims.

What is claimed is:

**1**. A luminaire combination, comprising at least two luminaires and an adjusting plate, a distance between each two adjacent luminaires being adjustable through the adjusting plate, wherein

each of the at least two luminaires comprises a housing and a light source module received in the housing, wherein:

the housing defines a connecting groove therein, wherein the connecting groove is in a flat strip shape and extends from an outer surface of the housing;

the luminaire further comprises a connector in a strip shape, wherein one end of the connecting groove is opened for insertion of the connector, the connecting groove is provided with a limit portion on each of two opposite side walls thereof, and a gap between each limit portion and a bottom surface of the connecting groove forms a channel guide; and

the connector is provided with a connecting portion on each of two opposite sides thereof, and the connecting portion is operable to be inserted into and matched with the channel guide corresponding to the connection portion, such that the connecting portion is limited in the channel guide corresponding to the connecting portion via the limit portion corresponding to the connecting portion; and

the adjusting plate comprises a first bearing plate in a rectangular shape, a second bearing plate, an adjusting handwheel, and a knurled screw; wherein:

the first bearing plate and the second bearing plate are arranged in parallel;

one connector of one luminaire is disposed at one short edge of the first bearing plate, the second bearing plate is arranged at the other short edge of the first bearing plate and another connector is disposed at the second bearing plate;

the first bearing plate defines a rotating through hole at a long edge thereof, the second bearing plate defines a rotating screw hole at a position thereof corresponding to the rotating through hole, and the knurled screw penetrates the rotating through hole to be in threaded connection with the rotating screw hole, so as to form a hinge point between the first bearing plate and the second bearing plate; and

the first bearing plate defines a guide hole in an arc-strip shape, the second bearing plate defines an adjusting screw hole at a position of the second bearing plate corresponding to the guide hole, an adjusting screw rod is arranged at a position of a central axis of the adjusting handwheel, and the adjusting screw rod penetrates the guide holes to be in threaded connection with the adjusting screw hole.

**2**. The luminaire combination according to claim **1**, wherein the housing is in columnar shape, a central axis of the housing coincides with a light outgoing direction of the light source module, and a length direction of the connecting groove is parallel to the central axis of the housing.

**3**. The luminaire combination according to claim **2**, wherein the housing is in a rectangular columnar shape, and defines one connecting groove on each of four side faces of the housing.

**4**. The luminaire combination according to claim **1**, wherein

the connector defines a positioning screw hole therein; and

a positioning screw is operable to be in threaded connection with the positioning screw hole to allow an end portion of the positioning screw to be abutted against the bottom surface of the connecting groove, such that the connector is positioned in the connecting groove.

**5**. The luminaire combination according to claim **1**, wherein the connector defines a connecting screw hole in a middle position along a length direction of the connector, and the connecting screw hole is located at a middle position between two connecting portions disposed on the two opposite sides of the connector.

**6**. The luminaire combination according to claim **5**, wherein the luminaire further comprises a handwheel, the handwheel is provided with a handle screw at a position of a central axis of the handwheel, and the handle screw is operable to be in threaded connection with the connecting screw hole.

**7**. The luminaire combination according to claim **1**, wherein the connector is further provided with a fixing portion on each of the two opposite sides of the connector, and the fixing portion and the connecting portion cooperate to define a limit groove capable of accommodating the limit portion.

**8**. The luminaire combination according to claim **7**, wherein

the two fixing portions extend away from each other and are in a flat and straight shape, and extend from one side surface, away from the connecting portion, of the connector to form a flat straight surface.

**9**. The luminaire combination according to claim **7**, wherein

the fixing portion and the connecting portion are of the same shape and size, the fixing portion is operable to be inserted into and matched with the channel guide, such that the connector serves as a connecting pin for connecting the housing the luminaire to a housing of another luminaire.

**10**. The luminaire combination according to claim **1**, further comprising a bracket, wherein

the bracket is a bent plate in an L shape and has two arms which serve as a base plate in a square shape and a connecting plate in a triangular shape, respectively;

the connector of the luminaire is disposed at the connecting plate;

the connecting plate defines a connecting hole at a tip end, away from the base plate, of the connecting plate; and

a handle screw of a handwheel penetrates the connecting hole to be in threaded connection with the connecting screw hole of the connector.

**11**. The luminaire combination according to claim **1**, further comprising a hinge, wherein

the hinge comprises a first hinge plate, a second hinge plate, and a hinge handwheel, the first hinge plate and the second hinge plate are hinged at their edges;

one connector of one luminaire is disposed at the first hinge plate and one connector of another luminaire is disposed at the second hinge plate, and a length direction of each connector is parallel to a pivot between the first hinge plate and the second hinge plate;

a brake plate is fixed on the first hinge plate, wherein the brake plate is perpendicular to the pivot between the first hinge plate and the second hinge plate and defines a hinge hole in an arc-strip shape, and a portion of the second hinge plate corresponding to the hinge hole is bent and defines a hinge screw hole therein; and

a hinge screw rod is arranged at a position of a central axis of the hinge handwheel, wherein the hinge screw rod penetrates the hinge hole to be in threaded connection with the hinge screw hole.

**12**. The luminaire combination according to claim **1**, further comprising a cardan shaft, wherein

the cardan shaft comprises a fixed end, two intermediate parts, and a free end sequentially rotationally connected; and

one wing handle screw is arranged between the fixed end and one intermediate part, one wing handle screw is arranged between the two intermediate parts, one wing handle screw is arranged between the other intermediate part and the free end, and the three wing handle screws provide three rotating shafts, and at least one of the three rotating shafts is perpendicular to the other two rotating shafts.

**13**. A luminaire combination, comprising at least two luminaires and a hinge, a distance between each two adjacent luminaires being adjustable through the hinge, wherein

each of at least two luminaires comprises a housing and a light source module received in the housing, wherein

the housing defines a connecting groove therein, wherein the connecting groove is in a flat strip shape and extends from an outer surface of the housing;

the luminaire further comprises a connector in a strip shape, wherein one end of the connecting groove is opened for insertion of the connector, the connecting groove is provided with a limit portion on each of two opposite side walls thereof, and a gap between each limit portion and a bottom surface of the connecting groove forms a channel guide; and

the connector is provided with a connecting portion on each of two opposite sides thereof, and the connecting portion is operable to be inserted into and matched with the channel guide corresponding to the connecting portion, such that the connecting portion is limited in the channel guide corresponding to the connecting portion via the limit portion corresponding to the connecting portion; and

the hinge comprises a first hinge plate, a second hinge plate, and a hinge handwheel, the first hinge plate and the second hinge plate are hinged at their edges, wherein

one connector of one luminaire is disposed at the first hinge plate and one connector of another luminaire is disposed at the second hinge plate, and a length direction of each connector is parallel to a pivot between the first hinge plate and the second hinge plate;

a brake plate is fixed on the first hinge plate, wherein the brake plate is perpendicular to the pivot between the first hinge plate and the second hinge plate and defines a hinge hole in an arc-strip shape, and a portion of the second hinge plate corresponding to the hinge hole is bent and defines a hinge screw hole therein; and

a hinge screw rod is arranged at a position of a central axis of the hinge handwheel, wherein the hinge screw rod penetrates the hinge hole to be in threaded connection with the hinge screw hole.

**14**. The luminaire combination according to claim **13**, wherein the housing is in columnar shape, a central axis of the housing coincides with a light outgoing direction of the light source module, and a length direction of the connecting groove is parallel to the central axis of the housing.

**15**. The luminaire combination according to claim **14**, wherein the housing is in a rectangular columnar shape, and defines one connecting groove on each of four side faces of the housing.

**16**. The luminaire combination according to claim **13**, wherein

the connector defines a positioning screw hole therein; and

a positioning screw is operable to be in threaded connection with the positioning screw hole to allow an end portion of the positioning screw to be abutted against the bottom surface of the connecting groove, such that the connector is positioned in the connecting groove.

**17**. The luminaire combination according to claim **13**, wherein the connector defines a connecting screw hole in a middle position along a length direction of the connector, and the connecting screw hole is located at a middle position between two connecting portions disposed on the two opposite sides of the connector.

**18**. The luminaire combination according to claim **17**, wherein the luminaire further comprises a handwheel, the handwheel is provided with a handle screw at a position of a central axis of the handwheel, and the handle screw is operable to be in threaded connection with the connecting screw hole.

**19**. The luminaire combination according to claim **13**, wherein the connector is further provided with a fixing portion on each of the two opposite sides of the connector, and the fixing portion and the connecting portion cooperate to define a limit groove capable of accommodating the limit portion.

**20**. The luminaire combination according to claim **19**, wherein

the two fixing portions extend away from each other and are in a flat and straight shape, and extend from one side surface, away from the connecting portion, of the connector to form a flat straight surface; or

the fixing portion and the connecting portion are of the same shape and size, the fixing portion is operable to be inserted into and matched with the channel guide, such that the connector serves as a connecting pin for connecting the housing of the luminaire to a housing of another luminaire.

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