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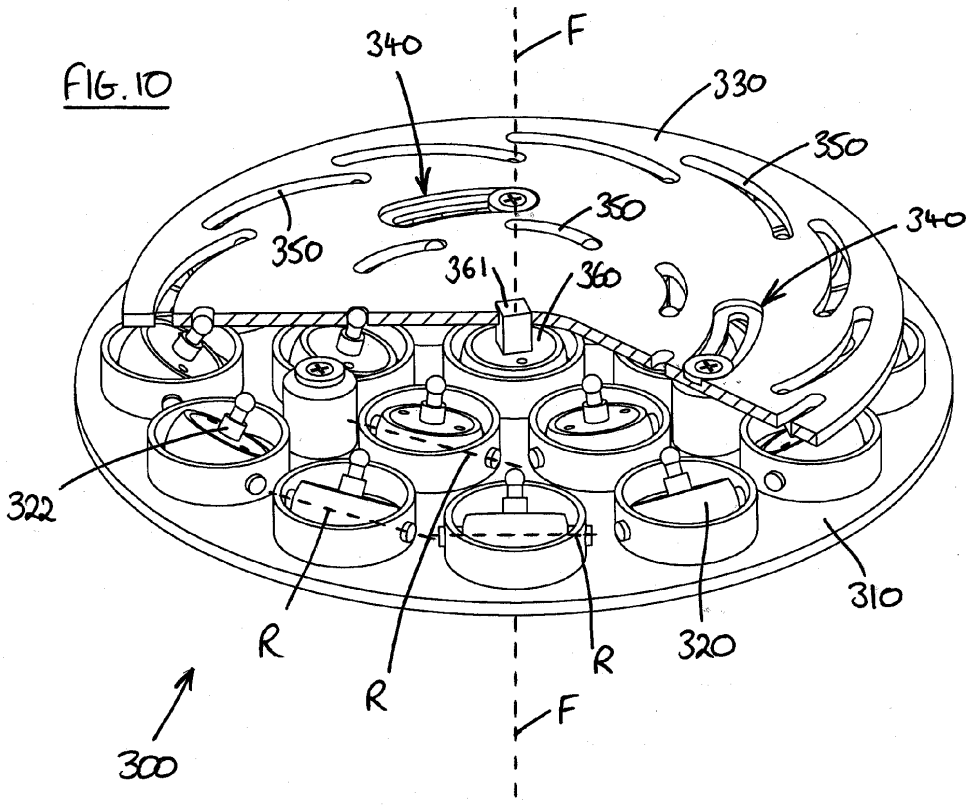
(54) Light fixture

(57) A light fixture (300) is disclosed, which has a plurality of lighting elements, such as eyeball LED lighting elements (320), mounted in a support plate (310). The lighting elements (320) are movable in a convergent and divergent manner by means of a rotatable cam plate (330) which rotates the lighting elements such that their beam axes (A) move in radial planes extending from a central focus axis (F). The invention provides a convenient, low-profile mechanism for focusing movable lighting elements in a light fixture.



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Description

[0001] The present invention relates to a light fixture, and in particular to a light fixture comprising movable lighting elements which enables the light beam from the fixture to be directed and/or focused.

[0002] There are many light fixtures on the market which comprise movable lighting elements (individual bulbs, spot lamps or LEDs for example) which allow direction or focusing of the light beam from the fixture by individual positioning of each lighting element. As a development of this, US 2009/0237924 to Ladewig discloses a beam adjustment mechanism for a light fixture in which a central LED lighting unit is moved axially relative to a ring of pivoted LED lighting units mounted around the central unit, such that the "focus" of the combined LED beam can be adjusted.

[0003] The applicant has however recognised that there is a need for a light fixture comprising movable lighting elements which can more conveniently be directed and/or focused than prior art designs.

[0004] In accordance with a first aspect, the invention provides a light fixture comprising a plurality of lighting elements each movable within or relative to the light fixture, and an actuating member which, when moved, moves each lighting element simultaneously, in the same direction.

[0005] Through the provision of a single actuating member which moves more than one lighting element at the same time, and in the same direction, a simplified means of directing (and optionally focusing) the combined beam from the lighting elements is provided.

[0006] Preferably, each lighting element is directional. In other words, it provides a directed beam of light as opposed to providing generally diffuse light. The directed beam of light will have a beam axis, being the major axis of the beam of light provided by the directional lighting element (which is typically cylindrical or conical).

[0007] It will be understood that the beams from the lighting elements can converge and diverge during movement of the actuating member, while they are still being moved in the same direction, and this can provide some degree of beam focusing combined with directional adjustment. In a preferred embodiment, the beam axes of the lighting elements remain in the same relative orientation during movement, so that the lighting elements move in unison. This provides a means of directional adjustment of the combined beam of light from the lighting elements, by movement of the single actuating member. In this embodiment, the beam axes could of course be parallel, but they could also be fixed in another relative orientation such as converging or diverging.

[0008] The light fixture preferably includes a support member on which the lighting elements are mounted. In this case, movement of the lighting elements is achieved by relative movement between the actuating member and the support member. The support member could have any suitable design to suit the purpose or specific application intended for the light fixture, and any specific design is not essential to the invention. The support member can effectively function as a bezel for each lighting element. While the support member could be curved, convex or concave, or indeed any other three-dimensional form, the preferred embodiment employs a planar support member or support plate. This provides a less complex fixture which also has the benefit of having a low profile, making it suitable for applications where the profile or depth of the light fixture may be important.

[0009] The lighting elements are preferably rotatably mounted on the support member. In this case, the direction of movement refers to the direction of rotation, so that the lighting elements all rotate in the same direction when moved by the actuating member. They may further also rotate by the same amount, i.e. through the same angle. Each lighting element can have a single axis of rotation, which may be a central axis (in other words, it runs through the centre of the lighting element), or it may be offset to one side of the centre of the element. With a single axis of rotation, relative angular movement in one plane is permitted. Alternatively, each lighting element may be rotatably mounted with at least two axes of rotation on the support member. This could for example be achieved by having two orthogonal axes of rotation, or the lighting element may be mounted to the support member by means of a ball-and-socket joint (or "eyeball") which allows relative angular movement of the lighting element in any plane. Considering this second type of movement in another way, each beam axis of a directional lighting element is movable within a conical volume of sweep.

[0010] When a lighting fixture in accordance with the invention includes a support member which is planar and the lighting elements are rotatably mounted on the support member, the one or more axes of rotation of each lighting element are preferably parallel to the plane of the support member.

[0011] In order to move each lighting element, the actuating member is in mechanical engagement with each element. The actuating member could take a variety of forms in order to move each lighting element. It could for example comprise a series of linkages or rods which are in engagement with each lighting element, the overall structure acting as a single actuating member. Alternatively, the actuating member may comprise a plate which is generally planar and which is provided with projections or apertures for engagement with corresponding features on the lighting elements.

[0012] Mechanical engagement means that movement of the actuating member causes movement of the lighting element. In order to simplify the light fixture, the actuating member preferably directly engages each lighting element, although mechanisms involving an intermediate component between the actuating member and the lighting element will also be possible (e.g. a link rod or connecting member).

[0013] Depending on the design of actuating member

employed, the engagement with each lighting element may be fixed or it may permit a degree of freedom of movement in one or more directions (including rotational). For example, in the case where the lighting elements are rotatable and are provided with projections (such as pins) which engage with an actuating member in the form of a plate, the projections may change in height depending on the position of angular rotation of the lighting element. Consequently, the connection between the actuating member and the lighting element will need to allow for this change in height, and this could be achieved by providing the actuating member with apertures into which or through which the lighting element pins project and slide as they rotate. Effectively, some freedom of movement in the z-direction may be needed.

[0014] The mechanical engagement between the lighting element and the actuating member may be through any suitable type of mechanical connection or joint, including frictional engagement, sliding engagement, swivel joint, ball joint, pin and slot, or pin and recess/aperture.

[0015] As discussed above, the actuating member may take one of several suitable forms, but in a preferred embodiment, the actuating member is planar, such as in the form of a plate for example.

[0016] When a lighting fixture in accordance with the invention includes an actuating member which is planar and the lighting elements are rotatably mounted on the support member, the one or more axes of rotation of each lighting element are preferably parallel to the plane of the actuating member.

[0017] Preferably, the actuating member is planar and is configured to move linearly or translationally in its plane to effect movement of the lighting elements. Translational movement is intended to mean linear movement in any direction within the same plane as the actuating member, without any rotation of the actuating member. One way of constraining the planar actuating member such that it can only move translationally is to employ a parallel-linkage mechanism, as discussed further below in relation to a preferred embodiment of the invention. An alternative method would be to employ two slots or guides for the actuating member, disposed at right-angles. Linear movement may be achieved by providing a slot or guide in just one direction, of course.

[0018] A planar actuating member has the advantage of reducing the height or depth of a light fixture, and this is considered to be an important development, particularly when the actuating member is also permitted only to move in its plane. In accordance with a second aspect, therefore, a light fixture is provided which comprises a plurality of lighting elements mounted on a support member, each lighting element being movable relative to the support member and being in mechanical engagement with an actuating member, in which the actuating member is planar and is movable in its plane relative to the support member to effect movement of the lighting elements.

[0019] As discussed above in relation to the first aspect, each lighting element in the second aspect may be rotatably mounted about a single axis of rotation on the support member, such that movement of the actuating member causes rotation of each lighting element about its axis of rotation. Alternatively, two axes of rotation may be provided for each lighting element, or the lighting element may be mounted to the support member by means of a ball-and-socket joint (or "eyeball") which allows relative angular movement of the lighting element in any plane.

[0020] In this second aspect, each lighting element may be moved or rotated by the actuating member simultaneously, in the same direction. Each lighting element may be moved by the same amount (or through the same angle) or by a different amount or angle. The beam axes of the lighting elements may be arranged to converge or diverge during movement of the actuating member.

[0021] A preferred feature of this second aspect is that the planar actuating member is configured to move linearly or translationally in its plane to effect movement of the lighting elements, such as by the use of a guide or parallel-linkage mechanism for example, as discussed above in relation to the first aspect. This may be achieved by providing the actuating member in the form of a plate with projections or apertures which engage with corresponding parts of each lighting element.

[0022] However, when each lighting element has a single axis of rotation, it is possible for the actuating member to be configured to rotate in its plane to effect movement of the lighting elements, which also provides the benefit of a compact design. This may be achieved, for example, by providing the actuating member in the form of a plate with slots or grooves which are shaped to control the angular position of each lighting element as the actuating member rotates. In this way, the beam axes of the lighting elements can be made to converge or diverge during movement of the actuating member.

[0023] In a preferred embodiment, the axes of rotation of the lighting elements are arranged to lie orthogonally to radii or radial planes from a point or axis on the light fixture, which effectively provides a focus point or axis. The actuating member provides a radial force in either direction on each lighting element to rotate the element. The light fixture itself could be any suitable shape or design in this embodiment, provided that the lighting elements are arranged to lie on radii or radial planes. For example, the light fixture may be circular, semi-circular, square or rectangular. The point or axis from which the radii or radial planes project may be centrally-located on the light fitting or may be offset or to one side. In a preferred embodiment, the light fixture or support plate is circular and the radii or radial planes project from the central point of the circle which forms the focus point or axis. The lighting elements can be arranged in concentric circles around the focus axis, for example. The actuating member can then rotate about the focus point or axis to effect convergence or divergence of the lighting element

beams as appropriate.

[0024] This is also considered to be an important development, and therefore in accordance with a third aspect, the invention provides a light fixture comprising a plurality of directional lighting elements each having a beam axis and each being rotatably mounted on a support member such that the beam axis moves in a radial plane towards and away from a focus axis of the fixture, each lighting element being in mechanical engagement with an actuating member which is rotatable relative to the support member about the focus axis to effect rotation of each lighting element and to effect convergence or divergence of the beam axes.

[0025] In this aspect, the actuating member is preferably planar and is rotatable in its plane relative to the support member.

[0026] In accordance with a fourth aspect, the invention provides a light fixture comprising a plurality of directional lighting elements each having a beam axis and each being rotatably mounted about a single axis on a support member, in which the axis of rotation of each lighting element is orthogonal to and intersects its beam axis, each lighting element being in mechanical engagement with an actuating member which is movable relative to the support member to effect rotation of the lighting elements and movement of the beam axes.

[0027] This aspect also has the advantage of providing a more compact light fixture, due to the fact that the axis of rotation of each lighting element is orthogonal to and intersects its beam axis. This single, central axis of rotation reduces the protrusion of each lighting element to a minimum.

[0028] This fourth aspect may include any of the features of the other embodiments discussed above which are appropriate for and compatible with the single axis of rotation requirement. For example, the planar actuating member (having linear, translational or rotational movement) would be suitable for use in this embodiment.

[0029] The beam axes may be arranged to converge or diverge during movement of the actuating member, or they may stay in the same relative orientation (e.g. parallel). Each lighting element may be rotated by the actuating member simultaneously, in the same direction, and by the same amount or angle or by a different amount or angle. The axes of rotation of the lighting elements could be arranged to be parallel to one another, or alternatively they may lie orthogonally to radii from a predetermined point on the light fixture, as discussed in relation to the second and third aspects.

[0030] In terms of operating the light fixture and controlling the position of the lighting elements by moving the actuating member, there are various options. The actuating member could be moved through the use of one or more motors, such as servo motors for example. Alternatively, the actuating member could be moved by means of an operating rod, slider, projection or dial connected to it which is accessible from the front of the light fixture.

[0031] When the light fixture includes a support member on which the lighting elements are mounted, as mentioned above, the important requirement is that there is relative movement between the actuating member and the support member to effect movement or rotation of the lighting elements. This could be achieved by moving either component relative to the other, of course, so if the actuating member is sufficiently constrained in the light fitting or installation, movement of the support member or support plate relative to it would have the same effect, and would move the lighting elements. As discussed above, this could be relative linear or translational movement, or relative rotational movement.

[0032] A preferred way of moving the lighting elements is to use one of the lighting elements themselves. Preferably therefore, the actuating member is movable through movement of a lighting element (an actuating lighting element), which in turn moves the other lighting elements. Some mechanisms are of course "one-way" and it may not be possible to apply a force in reverse through one specific lighting element, via the actuating element, to the other lighting element(s). It essentially depends on the type of mechanism being employed, and the skilled person will appreciate which mechanisms can operate in a two-way manner and which cannot. Embodiments in which the actuating member moves in a linear or translational direction (i.e. in two linear directions) can typically be reversed to permit control by an actuating lighting element. Those embodiments in which there is no play (i.e. possibility of relative movement) between the actuating lighting element and the actuating member may also be suitable for this method of operation, and particularly where there is no play between any of the movable lighting elements (such as the embodiments in which all of the lighting elements move in the same direction and by the same amount).

[0033] It may be possible simply to move the actuating lighting element directly to effect movement of the other elements via the actuating member, or the operation may be facilitated by providing a rod or other mechanical device which engages the actuating lighting element to provide better control.

[0034] In relation to the embodiments described above which have a planar, rotatable actuating member, there is a further possibility for operating the light fixture. An actuating lighting element can be located at the centre of rotation of the actuating member and connected to it, for example by means of a square drive or interference fit. Rotation of the actuating lighting element relative to the light fixture will then rotate the actuating member, which in turn moves the other lighting element(s). This provides a very elegant design of light fixture, in which the beams of each lighting element can be made to converge or diverge relative to a focus axis of the fixture, by simple rotation of an actuating lighting element which lies on the focus axis. The actuating lighting element beam axis is effectively co-axial with the focus axis of the light fixture.

[0035] Again, it may be possible simply to rotate the actuating lighting element directly to effect movement of the other elements via the actuating member, or the operation may be facilitated by providing a rod or other mechanical device which engages the actuating lighting element to provide better rotational control. For example, a rod provided with a T-bar on the end which engages with slots in the actuating lighting element could be suitable for the purpose, but other possibilities will be readily apparent to the skilled person.

[0036] It will be understood that a wide variety of designs and types of light source can be used in or as the lighting elements of all aspects of the invention as described above. The lighting elements may comprise individual bulbs, eyeballs, reflector lights, downlights, spotlights or LEDs for example, or they may comprise clusters of such individual light sources. The light fixture is also suitable for use with decorative lasers, as will be readily apparent to the skilled person.

[0037] The light fixture can be used in a variety of fittings or applications, including as a downlight (interior or exterior, recessed or surface-mounted), as a pendant light, floor light, uplight, table light, task light, in-ground uplight, wall light, street light, utility light or architectural light for use outside or inside buildings. The light fixture may also be used as an insert for practically any type of light fitting.

[0038] It will be understood that technical features described in relation to one aspect of the invention may be employed in one or more of the other aspects, where technically compatible, and the present application should be considered to disclose all such compatible combinations.

[0039] In summary, the various aspects of the present invention described above provide many advantages over prior art designs. They can, in some aspects, be used to provide a slim, unobtrusive light fitting which may be useful where depth of the fitting is of importance. They also have the ability to direct light to where it is needed, and/or to provide the ability to focus or spread light. The mechanisms employed for directing or focusing the beams provide elegant, cost-effective ways of directing or focusing movable lighting elements in a light fixture.

[0040] Embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Fig. 1 shows a perspective front view of a light fixture in accordance with a first embodiment, in which all the lighting elements are movable in the same direction in unison;

Fig. 2 shows a perspective front view of the light fixture of the first embodiment, with all the lighting elements pointing in a second direction;

Fig. 3 shows a perspective view of the reverse side of the light fixture of Fig. 2, showing the directing plate;

Fig. 4 shows the same view as Fig. 3, with parts of the directing plate and the support plate cut away;

Figs. 5, 6 & 7 show front, reverse and cut-away views of a rectangular version of the light fixture of the first embodiment;

Figs. 8A and 8B show front and side views of a light fixture in accordance with a second embodiment, in which the lighting elements are movable in a convergent and divergent manner, the lighting elements in these figures being in a convergent or focused position;

Figs. 9A and 9B show front and side views of the light fixture of Figs. 8A and 8B with the lighting elements being in a divergent or spread position; and

Fig. 10 shows a reverse perspective view of the second embodiment, with the cam plate cut away.

[0041] With reference to Figs. 1 to 4, a light fixture 100 is shown in accordance with a first embodiment. The light fixture comprises a round, planar support plate 110 in which are mounted a plurality of "eyeball" lighting elements 120. Each lighting element 120 comprises a partly spherical body 121 inside which one or more LEDs (not shown) are mounted. The lighting element 120 may also have a lens (not shown) for directing, focusing or otherwise manipulating the beam produced by the element. The beam produced by each lighting element will have a major axis A, as shown in Figs. 1 and 2. The lighting elements 120 are mounted in an arrangement comprising a single, central lighting element which is surrounded by two concentric circles of lighting elements. All of the beam axes are parallel to one another, and the resulting beam from the light fixture 100 has a major axis F as shown in Figs. 1 and 2.

[0042] With reference to Fig. 4, each lighting element 120 has a pin 122 on its top surface which engages actuating member or directing plate 130 as will be described in more detail below. Pin 122 includes a spherical end to allow smooth engagement with directing plate 130 at all positions of the lighting element. As further shown in Fig. 4, the lighting elements 120 are each mounted in support plate 110 by means of a ball-and-socket or eyeball arrangement, by virtue of the spherical body 121 of the lighting element 120 being retained in a socket 111 on the support plate. Socket 111 comprises two vertically-spaced annular projections 112 which retain the lighting element 120 in the socket while permitting rotation of the lighting element about any axis parallel to the plane of the support plate 110. It will therefore be understood that the beam axis A will be able to sweep out a conical volume assuming the pin 122 is not restrained in any particular direction by the directing plate 130.

[0043] Turning to Figs. 3 and 4, directing plate 130 is circular and is provided with small apertures 131 each of which accepts a spherical end of pin 122 from a lighting element 120. While the directing plate 130 controls the movement of the pin 122 in the x and y directions, the apertures 131 are designed to allow the pins 122 to rise and fall through the directing plate in the z-direction as

they rotate.

[0044] Directing plate 130 is adapted for translational movement only, i.e. it can move in two dimensions within its plane, but it cannot rotate. This is achieved through the use of a parallel linkage mechanism 140 comprising two equal-length pivoted arms 141 each having one end rotatably attached to the support plate 110 and the other end rotatably attached to the directing plate 130. A central bar 142 links the two arms 141 at their pivots, which serves to keep the respective pairs of attachment points in a parallel orientation. Directing plate 130 rests and slides on supports 113, which also serve as stops to prevent the directing plate moving further than desired.

[0045] In operation, translation of the directing plate will move each pin 122 of each lighting element 120 in the same direction, thereby rotating each lighting element 122 about parallel axes of rotation in the plane of the support member 110, and consequently the beams of each lighting element will rotate in the same direction simultaneously and by the same angle. As shown in Figs. 1 and 2, the beam F of the light fixture 100 therefore also rotates by the same angle, with the beams A of each lighting element 120 remaining in the same parallel orientation.

[0046] With reference to Figs. 5, 6 & 7, a rectangular version of the light fixture of the first embodiment is shown, but the principle of operation is exactly the same. Light fixture 200 comprises a rectangular, planar support plate 210 in which are mounted a plurality of lighting elements 220 of the same design as the circular version, each having a beam axis shown as A. Pins 222 on each lighting element engage with apertures 231 on rectangular directing plate 230.

[0047] Directing plate 230 is adapted for translational movement only by means of parallel linkage mechanism 240, and supports 213 are provided to serve as rests and stops for directing plate 230. Operation of this embodiment is the same as for the circular embodiment, and the beam F of the light fixture 200 is capable of moving in any direction, effectively being able to sweep out a conical volume as in the first embodiment.

[0048] Either of the above embodiments may be adapted for linear operation. Rather than the beam axes A (and therefore light fixture beam F) being capable of angular movement in any angle by virtue of the eyeball mounting arrangement, the lighting elements 120/220 could be mounted with a single axis of rotation such that angular movement of each lighting element is restricted to one plane (orthogonal to the axis of rotation). With all of the axes of rotation being parallel, it will be understood that the directing plate 130/230 also only needs to be able to move linearly, in one direction, to move the pins 122/222 in the appropriate direction to rotate each lighting element simultaneously. The parallel linkage mechanism 140/240 would not be required in this embodiment.

[0049] In the above embodiments, movement of the lighting elements may be achieved by moving the directing plate 130/230, by moving the support plate 110/210, or by moving one of the lighting elements 120/220 which in turn moves the other lighting elements by transmission of the force through the directing plate 130/230.

[0050] A further embodiment of the invention will now be described, with reference to figures 8A, 8B, 9A, 9B and 10. In this embodiment, the lighting elements are movable in a convergent and divergent manner. Many of the features of the light fixture 300 shown in these figures are similar to the other embodiments described above, and therefore do not need detailed explanation. Light fixture 300 comprises a circular, planar support plate 310 in which are mounted a plurality of lighting elements 320 of a similar design to previous embodiments. The lighting elements 320 are mounted in an arrangement comprising a single, central lighting element which is surrounded by two concentric circles of lighting elements. Each lighting element has a beam axis shown as A, and pins 322 on each lighting element engage with actuating member or circular cam plate 330.

[0051] The main differences compared to previous embodiments will now be explained. Firstly, the lighting elements are mounted with a single axis of rotation such that angular movement of each lighting element is restricted to one plane (orthogonal to the axis of rotation). It will further be seen from Fig. 10 that the axis of rotation of each lighting element 320 (shown as R in the figure) is orthogonal to the radius on which the lighting element lies from the central point of the light fixture (which in this case is also the light fixture beam axis F), so that in effect, the beam axis A of each lighting element 320 moves only in a radial plane.

[0052] Secondly, cam plate 330 is designed for rotational movement in its plane rather than linear or translational movement. Cam plate 330 is able to rotate about light fixture beam axis F through the provision of curved sliders 340. Cam plate 330 has a series of curved slots 350 with which the spherical ends of pins 322 on each lighting element engage, and it will be seen that rotation of the cam plate 330 about its axis will cause each pin 322 to move in or out along its radius, thereby rotating the lighting elements 320 in a converging or diverging manner.

[0053] Although the lighting elements 320 could all be rotated by the same angle, a true convergent/divergent effect (similar to focusing of the light fixture beam) can be achieved by rotating the outer lighting elements 320 through a greater angle than the inner ones. This can be achieved by appropriate profiling of the curves of each slot 350, and in the shown embodiment, the inner ring of slots is profiled to move rotate the corresponding set of lighting elements 320 less than the outer ring of slots.

[0054] The third main aspect of this embodiment is that the central lighting element 360, whose beam axis is coaxial with the axis of rotation of the cam plate 330 and the light fixture beam axis F, is in rotational engagement with cam plate 330. Unlike the other lighting elements 320 which have a single axis of rotation in the x-y plane, lighting element 360 is free to rotate about its beam axis

which extends in the z-direction. Through the provision of a square-drive engagement 361 between the two components, rotation of the lighting element also rotates cam plate 330, thereby converging or diverging the other lighting elements 320. A key or T-bar (not shown) could be employed to rotate the central lighting element 360 and cam plate 330, through engagement of the key or T-bar in slots (not shown) in the lighting element 360.

[0055] Variations to the embodiment of Figs 8A-10 are envisaged, in which for example the lighting elements are arranged with their axes of rotation to be parallel to one another. The actuator plate could be constrained to move only in a linear direction, but convergence and divergence of the beams may be achieved by providing angled slots in the actuator plate which push out or pull in the lighting element pins as the actuator plate is moved in the same direction as the axes of rotation. Such an arrangement could be used to provide a linear array of lighting elements which all rotate in the same direction but which converge or diverge as they go, or to provide a linear array of lighting elements having groups which rotate in opposite directions but still converge or diverge relative to a central axis of the light fixture. These may be considered to be a "linear focusing" arrangements.

Claims

1. A light fixture comprising a plurality of directional lighting elements each having a beam axis and each being rotatably mounted on a support member such that the beam axis moves in a radial plane towards and away from a focus axis of the fixture, each lighting element being in mechanical engagement with an actuating member which is rotatable relative to the support member about the focus axis to effect rotation of each lighting element and to effect convergence or divergence of the beam axes.

2. The light fixture of claim 1, in which each lighting element is rotatably mounted with a single axis of rotation on the support member.

3. The light fixture of claim 1 or 2, in which the light fixture further comprises an actuating lighting element which is connected to the actuating member such that rotation of the actuating lighting element causes rotation of the actuating member, which in turn effects rotation of the lighting elements.

4. The light fixture of claim 3, in which the actuating lighting element is located on the focus axis.

5. The light fixture of any preceding claim, in which the actuating member is planar and is configured to rotate in its plane to effect rotation of each lighting element.

6. The light fixture of claim 5, in which the actuating member comprises a plate having grooves or slots into which part of each lighting element projects, the groove or slot profile determining the relative movement of each lighting element.

7. The light fixture of any preceding claim, in which each lighting element includes a pin which engages with the actuating member.

8. The light fixture of any preceding claim, in which the support member is a planar support plate.

9. The light fixture of claim 8, in which the support plate is circular and the lighting elements are arranged in concentric circles on the support plate.

10. The light fixture of any preceding claim, in which the lighting elements are spot lights.

11. The light fixture of any preceding claim, in which the lighting elements comprise one or more LEDs.

12. The light fixture of any preceding claim, in which each lighting element is mounted in a ball-and-socket or eyeball joint.

FIG. 1

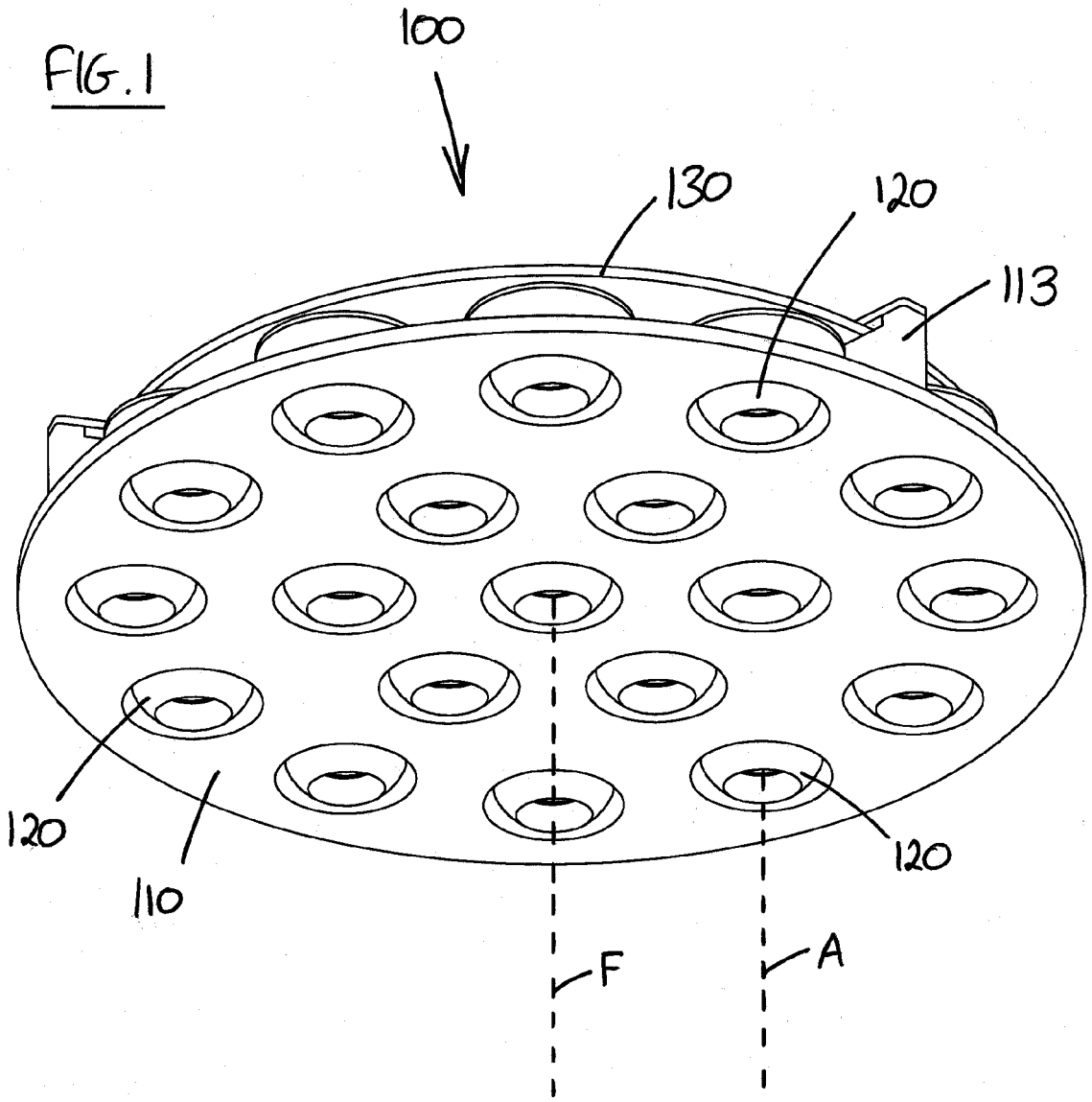


FIG. 2

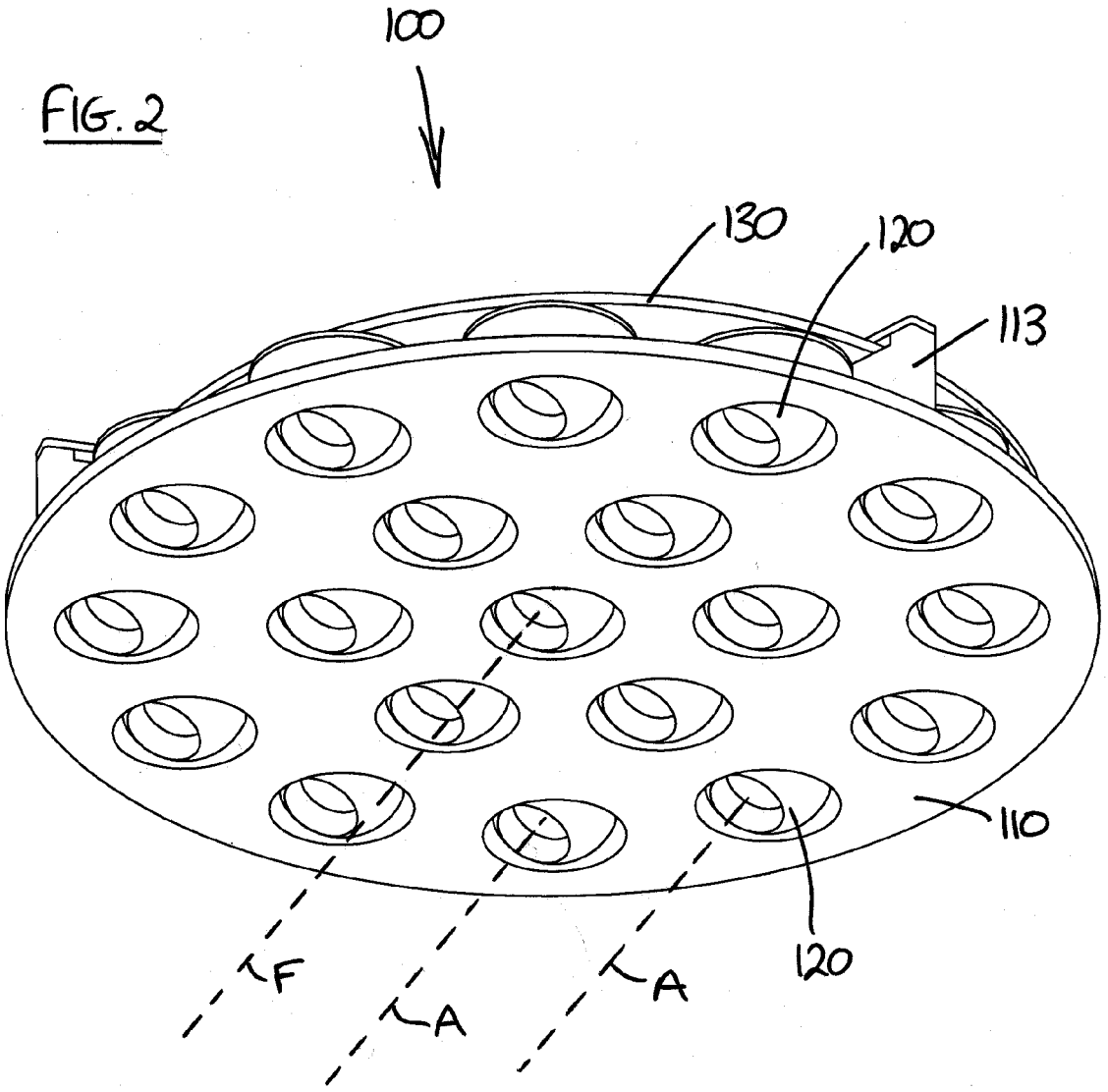


FIG. 3

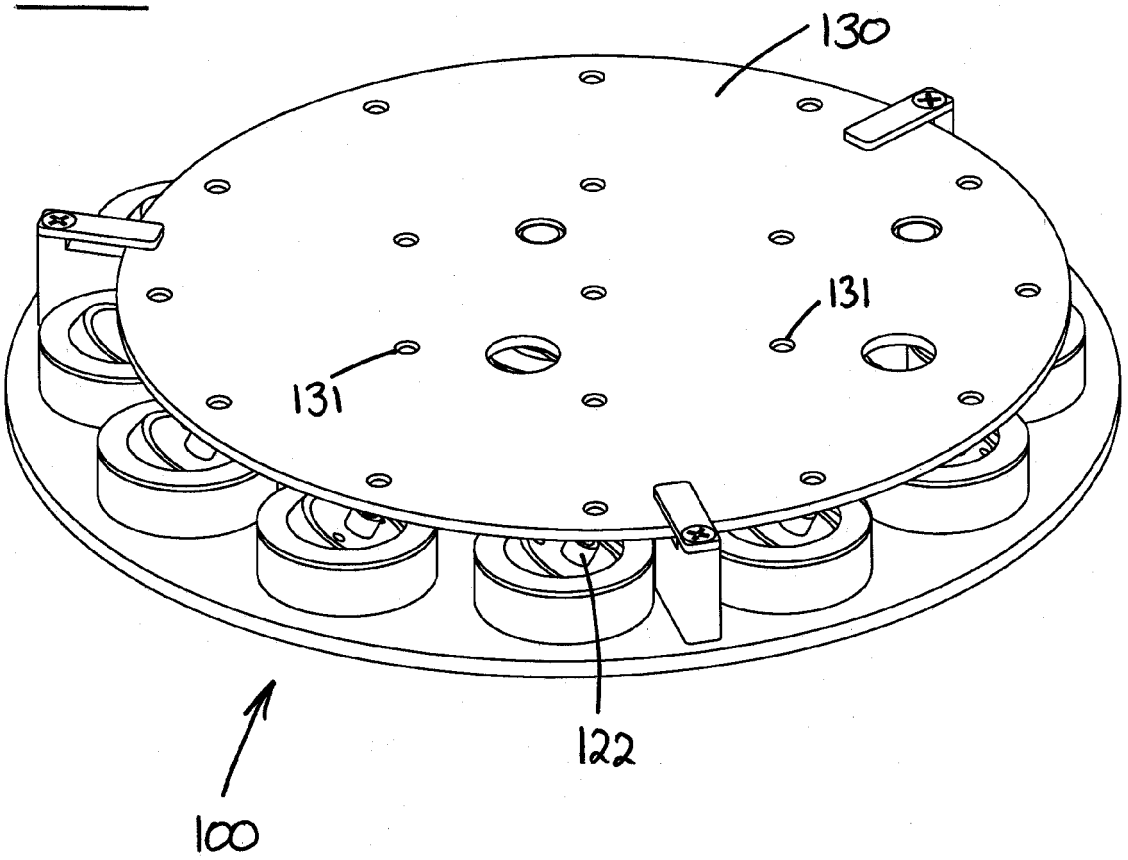
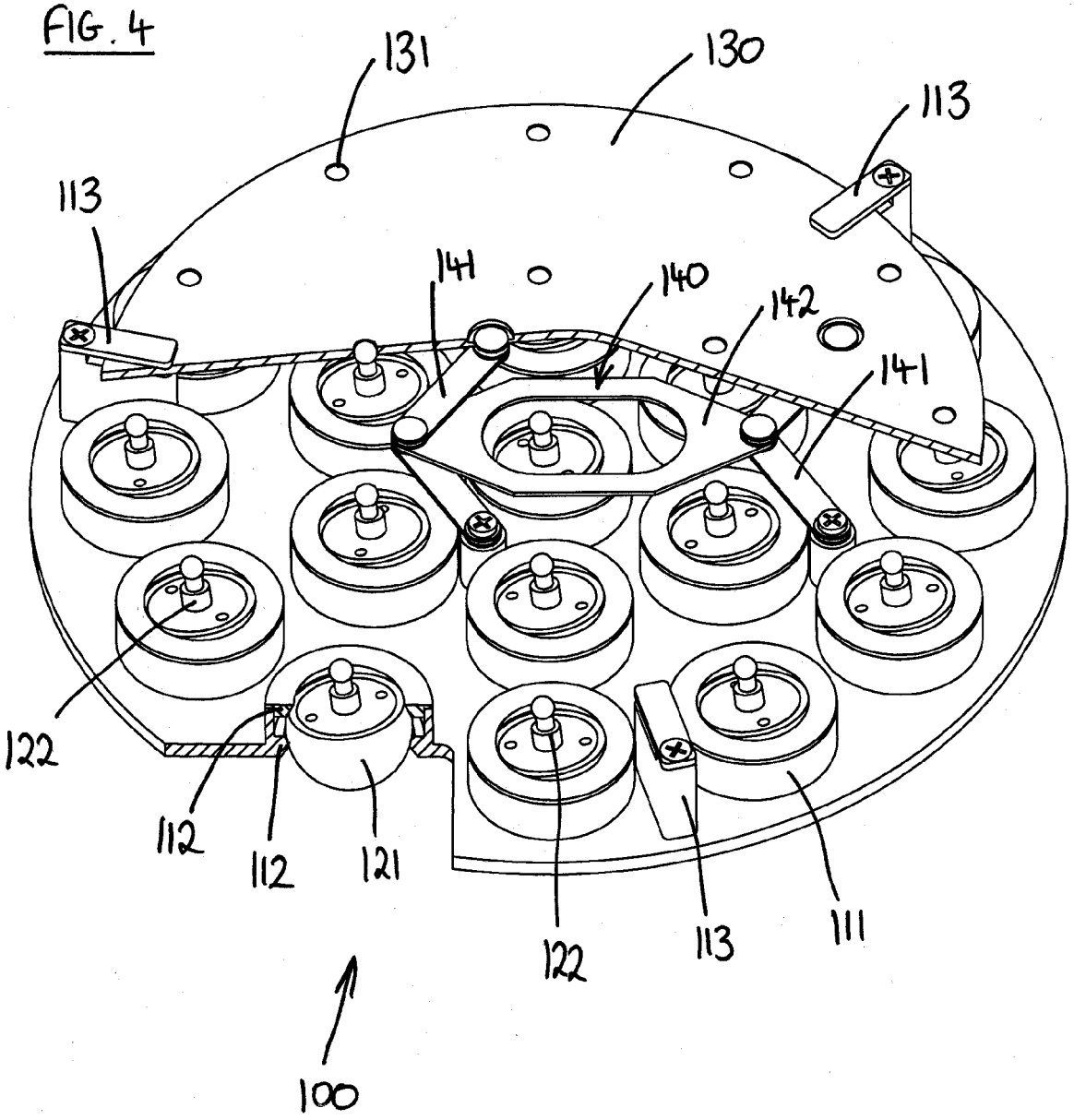


FIG. 4



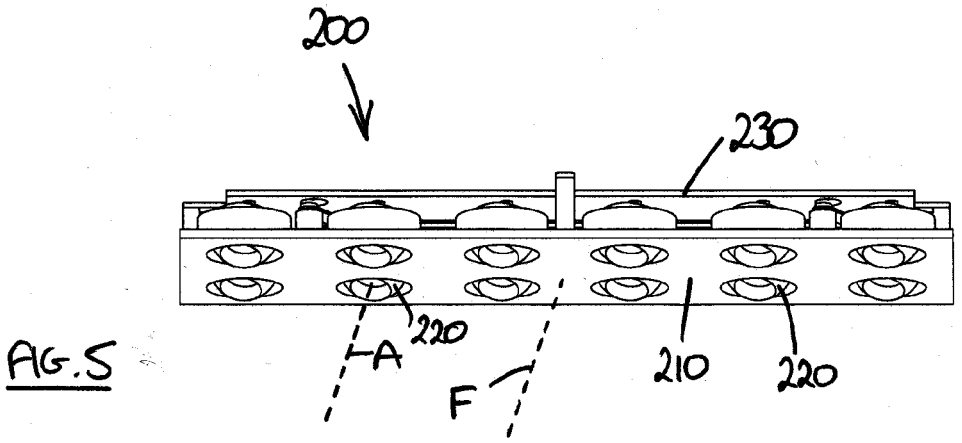


FIG. 5

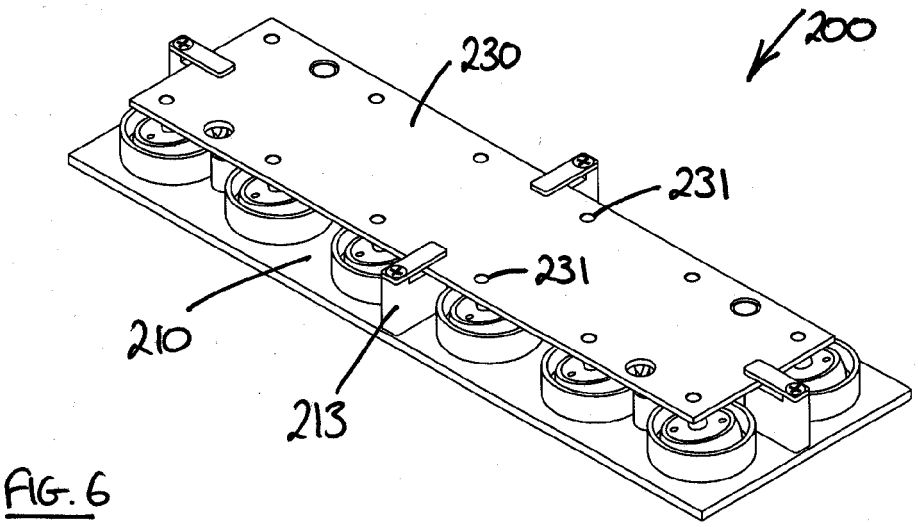


FIG. 6

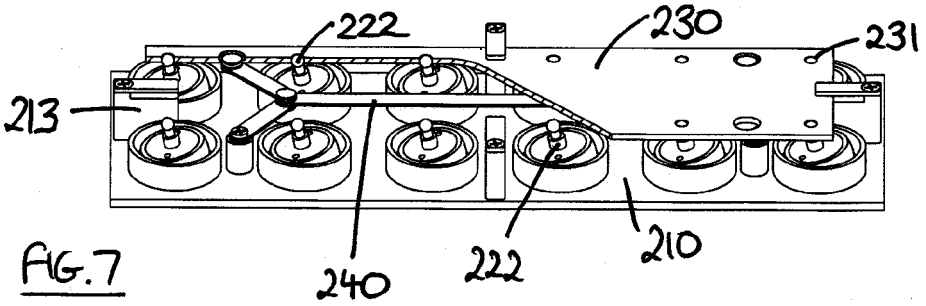


FIG. 7

FIG. 8A

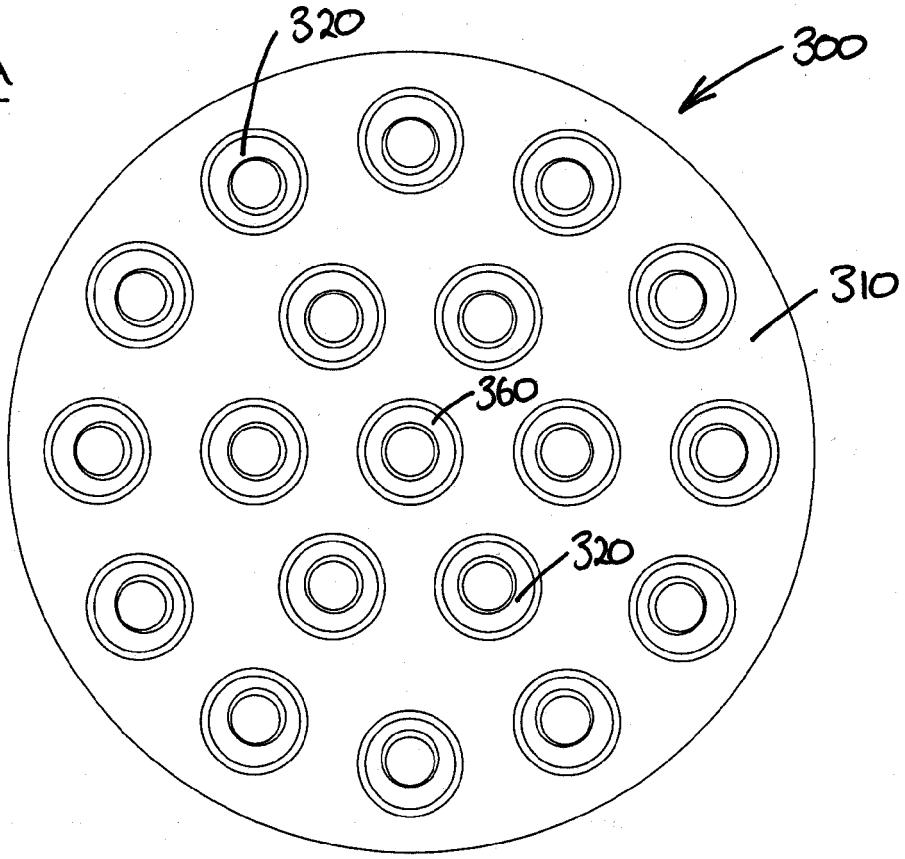


FIG. 8B

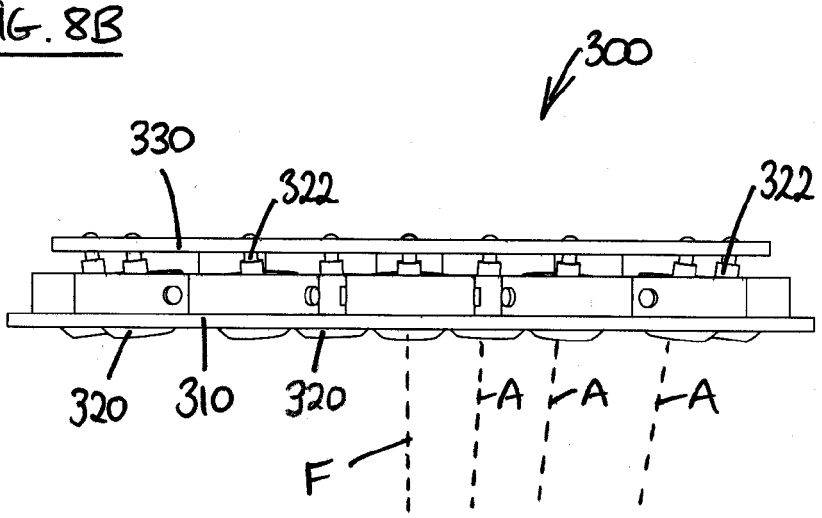


FIG. 9A

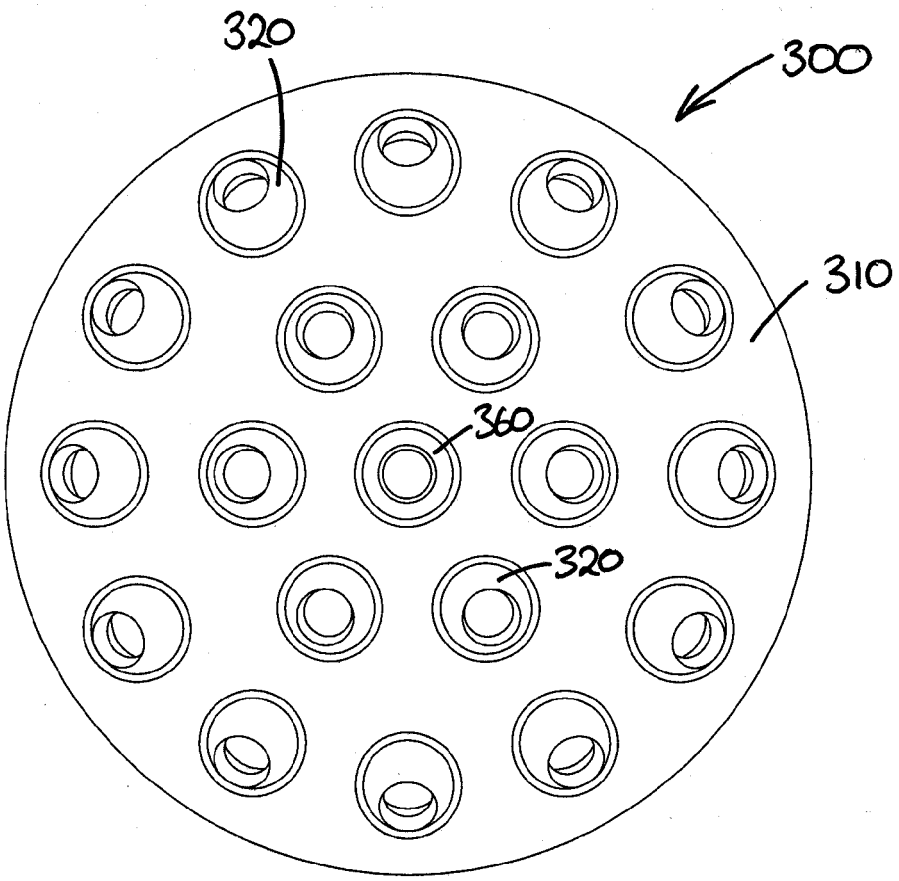


FIG. 9B

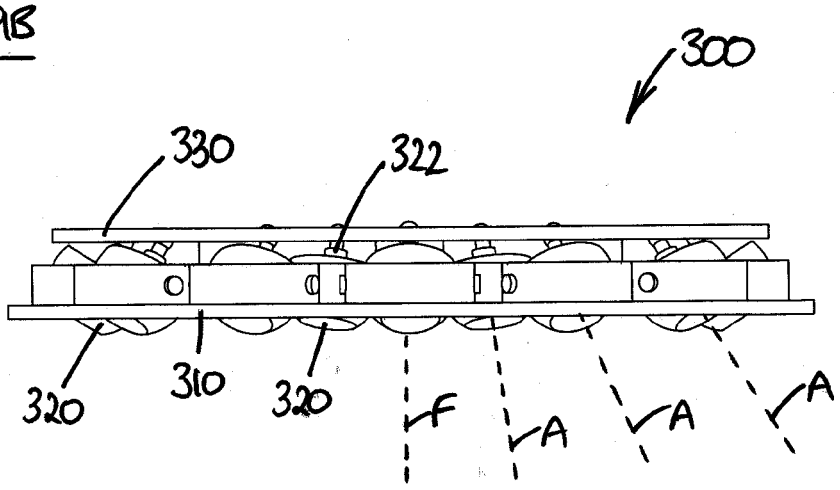
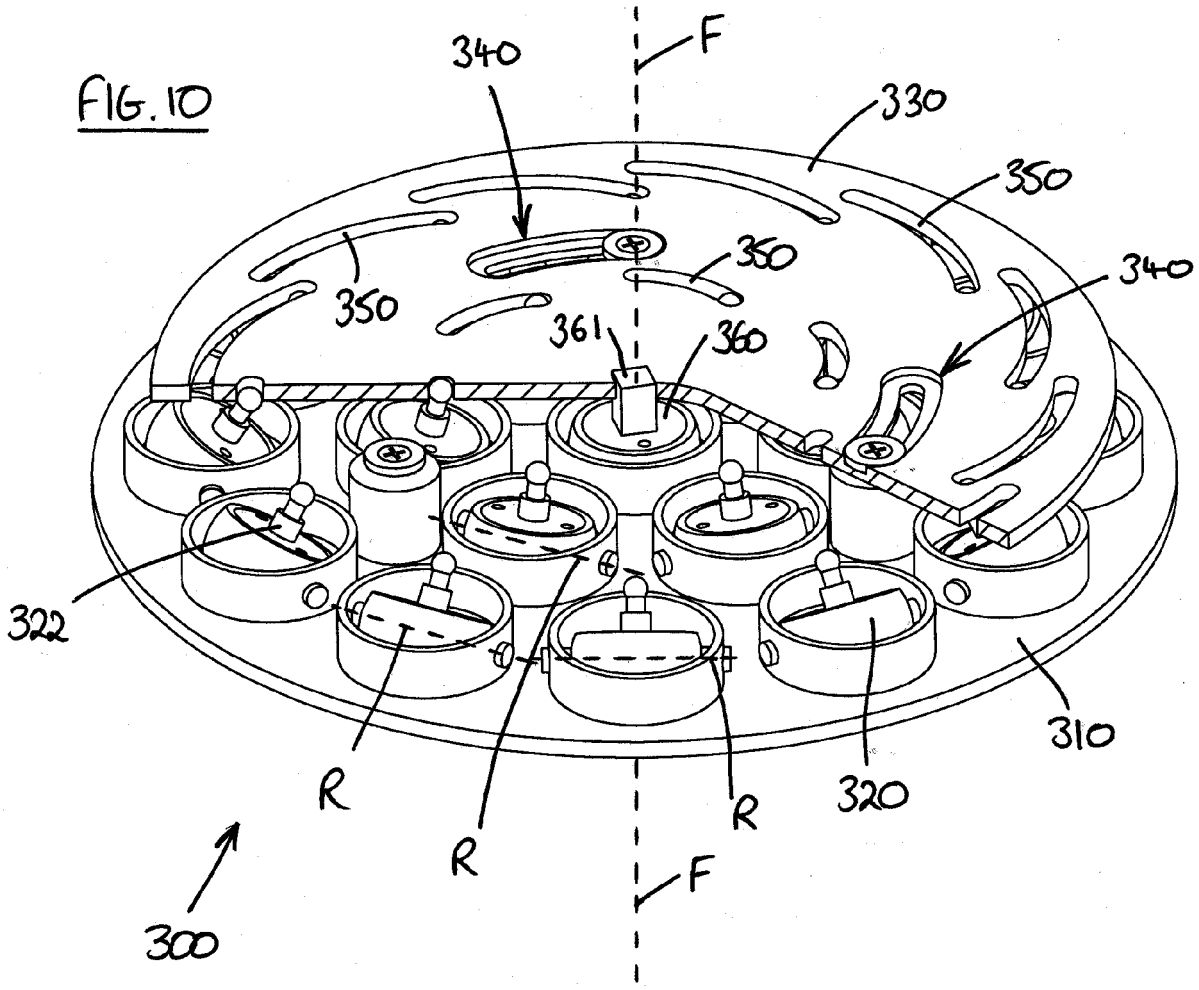


FIG. 10



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Patent documents cited in the description

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