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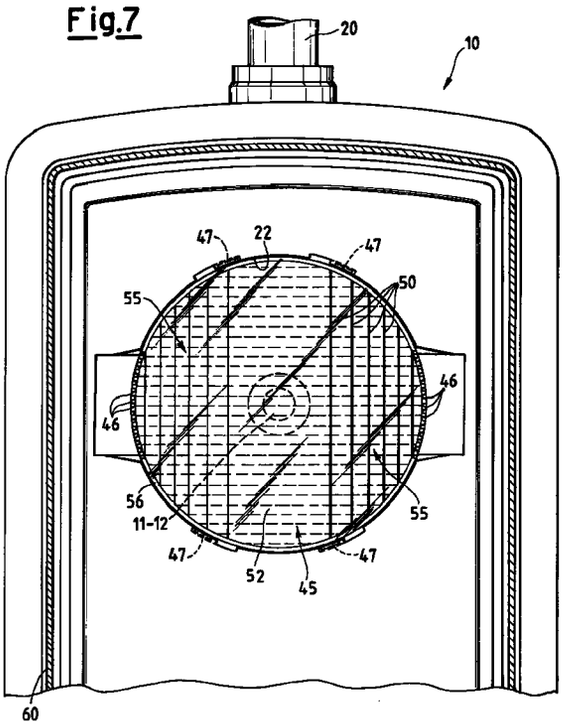
(54) Emergency lighting fixture

(57) An emergency lighting fixture (10) comprising at least three light sources (11,12, 15), one of a fluorescent type (15) destined for ordinary lighting and two of an incandescent type (11,12) destined for the emergency lighting of work sites in industrial premises.

Alternatively, the fixture (10) comprises four light sources (11) of an incandescent type, destined for the emergency lighting of exit routes from industrial premises.

This achieves an intense lighting effect on a ground level, by using incandescent lamps, appropriately inserted in suitable lighting receptacles and capable of concentrating the light beams.

Fig.7



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Description

This invention refers to an emergency lighting fixture, particularly suited for an installation in industrial premises.

Emergency lighting means a lighting system designed to function when ordinary lighting fails; it includes safety and reserve lighting.

Permanent lighting fixtures have been known in the market for many years, in which the same fluorescent tube supplying ordinary lighting is also used to provide lighting during emergencies; in these situations, the tube is fed by accumulator batteries contained in the same fixture and energizing the light source.

However, the lighting intensity emitted by a fluorescent tube in emergency situations is generally inferior to that emitted under ordinary operating conditions, because the available energy supplied by the accumulator batteries is obviously limited.

In particular applications (for example, in spaces destined for public displays), the lighting fixtures in use are equipped with a multiple number of light sources, two of which are typically of an incandescent and one of a fluorescent type.

Under ordinary operating conditions (where network supply power is available) the two low power incandescent lamps are lit and provide a low intensity lighting to illuminate pictograms and/or signs indicating the main routes of exit from the premises, without disturbing the eyes of the viewers.

If the network power supply is interrupted for any reason, the fluorescent tube is automatically switched on and supplies light to illuminate the emergency exits.

On the other hand, industrial premises have an acutely felt need to provide, in emergency situations, a high-powered and locally concentrated light beam (work sites, escape routes, high risk areas).

The legislative decree 626/1994, updated on March 18, 1996 and containing new safety directives on working safety, in fact prescribes new duties, aimed at safeguarding the workers' health and safety on work sites.

In particular, the directive prescribes powerful lighting under emergency conditions, such as dangerous situations or the onset of fires in the so-called high-risk areas.

High risk areas are defined as areas involving dangerous activities for anyone operating within the same, whenever power failures occur or where the safety of other persons depend on the functional capability of the former.

These premises usually employ roof lamps equipped with fluorescent tubes, which are under ordinary conditions capable of providing a diffused light adequate for performing normal work tasks. Under emergency conditions, batteries and conversion devices convert these fixtures into units supplying the necessary lighting to illuminate the premises, even in case of a network power failure.

This solution, while undoubtedly attractive from an economical viewpoint, does not afford the lighting intensity levels needed to satisfy the current prescriptions. The lighting standard recommended for elevated industrial installations (up to 7 meters) is represented by a value of not less than 10% of the ordinary lighting level, with an absolute minimum of 15 lux.

The purpose of the present invention is therefore to offer an emergency lighting fixture, in particular for industrial premises, capable of eliminating the mentioned shortcomings by affording a high lighting intensity on a ground level in high risk areas, work sites and along exit routes, in case of impending danger.

Another purpose of the present invention is to offer an emergency lighting fixture capable of satisfying the safety regulations covered by the legislative decree 626/1994, which contains the rules for implementing the European directives.

A further purpose of the present invention is to achieve an emergency lighting fixture, in particular for industrial premises, capable of being easily and economically implemented, without any recourse to expensive and complex technologies.

These and other purposes are achieved by an emergency lighting fixture, in particular for industrial premises, in accordance with the claim 1, being referred to for brevity.

Advantageously, the fixture according to the present invention simultaneously allows to achieve a ground level lighting satisfying national and international safety prescriptions in industrial premises and adequate technical characteristics capable of performing the main emergency functions.

This is achieved by using incandescent lamps designed for emergency lighting and providing, unlike fluorescent tubes, an intense and essentially concentrated source of light. These lamps are fitted inside the same enclosure and provided in a number of four (if destined for the lighting of exit routes) or in a number of two, combined with a fluorescent light source (if destined for the lighting of work sites).

It can be said, for example, that an incandescent light source having a light flow of 200 lumen from a height of 7 meters allows a ground level lighting of about 15-20 lux, while a fluorescent light source having a light flow of 4,000 lumen from the same height allows a ground level lighting of less than 3-4 lux.

In this regard, it is to be recalled at this point, once and for all, that a lumen is the light flow radiated over a solid angle of one steradian from a point-shaped light source emitting a lighting intensity of one candle in every direction, while a lux is the illumination achieved on a surface of 1 square meter receiving the light flow, in a normal direction, of one lumen uniformly distributed over the same.

It is also possible to further concentrate the light beam of the incandescent lamps ("spot" effect), so as to make it extremely bundled, by appropriate profiling the

parabolic reflectors and using transparent elements equipped with internal prisms.

The lighting of long and narrow areas in industrial premises, such as high-risk areas and exit routes, employs metallic reflectors arranged on reflecting parabolas surrounding the light sources (typically constituted by 10 Watt halogen lamps) and disc-shaped transparent elements, each positioned to face the light source and equipped with internal prisms, designed to reduce the divergence of the emitted light beam as far as possible.

Further purposes and advantages of this invention will become clear from the following description and attached drawings, supplied purely by way of non-limiting examples, in which:

- Figure 1 represents a prospective view of an emergency lighting fixture, according to this invention, installed on an electrified bar;
- Figure 2 is a schematic plan view of a first embodiment of the emergency lighting fixture, according to the present invention;
- Figure 3 is a schematic side view of the emergency lighting fixture described in Figure 2, according to the present invention;
- Figure 4 is a schematic plan view of a second embodiment of the emergency lighting fixture, according to the present invention,
- Figure 5 is a schematic side view of the emergency lighting fixture described in Figure 4, according to the present invention,
- Figure 6 is an enlarged detail of a partial and schematic section of the emergency lighting fixture described in Figure 4, according to the present invention,
- Figure 7 is an enlarged detail of a partial and schematic plan view of the emergency lighting fixture described in Figure 4, according to the present invention,
- Figure 8 is a prospective top view of a transparent element utilized in the emergency lighting fixture, according to the present invention,
- Figure 9 is a prospective bottom view of a transparent element of the emergency lighting fixture, according to the present invention,
- Figure 10 is a plan view of the transparent element described in Figure 8,
- Figure 11 is a side view of the transparent element described in Figure 8,
Figure 12 is a plan view of the transparent element described in Figure 9,
- Figure 13 is a side view of the transparent element described in Figure 9,
- Figure 14 is a Cartesian diagram of the resultant photometric curve of the fixture according to the present invention, as a function of the area covered considering the lamp to be installed at a height of seven meters above the surface mentioned above.

With reference to the mentioned figures, 10 generally indicates the emergency lighting fixture according to the present invention, 20 indicates an electric feed cable, 30 indicates an electric connector installed on am electrified bar 40, suspended at a height of about 7 meters above the work sites and by hooks 51, by one or more chains 500 fastened to the ceiling.

70 indicates an external enclosure of the fixture 10 holding the light sources 11, 12 and 15, while 60 designates a diffusion screen for the light beam.

In particular, 11 and 12 indicate a plurality of light sources of an incandescent type, each constituted by a high-power 10 Watt halogen lamp (as an almost point-form light source) and positioned at the parabolic focal point of a reflector 22. Each reflector is treated with a thin metallic coating to provide a greater reflective effect, and is connected to the housing 70 of the fixture 10 by fastening devices.

On the other hand, 15 indicates a light source of a fluorescent type capable of generating a distributed light beam, whereas 45 indicates a transparent diffusion element ("cover glass") in the form of a disc, placed to cover the reflector 22, at a predetermined distance from the light source 11 , 12. The diffusion element 45 is equipped with grooves 46 on the outer rim 56 and with internal prisms of a regular geometric profile, capable of diffusing light in such a manner as to minimize the angular divergence of the light beam emitted by the light sources 11, 12.

In particular, the mentioned prisms are constituted by a row of projections, indicated by 50 in Figure 8, positioned symmetrically and at regular intervals on two lateral sections indicated by 55 of the outer side 52 of the cover glass 45, while a row of curved-profile grooves are provided on the entire inner side 53 of the cover glass 45, as indicated by 54 in Figure 9, directly facing the light source 11, 12.

47 finally indicates the projecting fastening devices provided opposite to the lateral surface 56 of the cover glass 45 and used to attach the same to appropriate recesses of the reflector 22, after rotating them by a predetermined angular value (for example, 10 degrees).

If the fixture 10 is installed at an approximate height of 7 meters (as happens in the usual applications relating to work sites), every 10-Watt incandescent light source 11,12 generates a cone of light which guarantees an illumination of 30 lux (nominal light flow of 200 lumen, actual light flow of 130 lumen), uniformly distributed over a circular (or square) surface of about one meter radius (or 2 meters per side) of an area set perpendicular to the direction of the beam, at a suitable ground height allowing an operator to carry out his duties.

In emergency situations, the 30 lux illumination allows to evidence the potentially dangerous areas, such as the spaces occupied by tooling machines, the intersections between exit corridors from work sites, the escape routes in corners, the stairways, landings, the

level changes on a same plane, and the vicinities of emergency exits.

Moreover, the angular divergence of the individual cone of light allows to achieve an illumination of at least 2 lux at a distance of about 6-7 meters from the center of the light beam.

On the other hand, the light beams to be considered under the standing regulations must cover illuminated areas formed by a square or circle of maximum extension with a lighting intensity of at least 5 lux (2 lux or 30 lux, for example, for applications such as on exit doors), or by a rectangle of 2.5 meters width and maximum length with an illumination of at least 5 lux (or 30 lux for particular exits), while minimizing direct glare and possible shadows likely to reduce the visibility along escape routes.

These requisites can be satisfied by an adequate combination of light sources of an incandescent and/or fluorescent type and by inserting transparent elements 45, made by traditional micro-optical technologies and fitted with internal prisms of a uniform geometric shape, so as to adequately illuminate both very narrow and long areas (for example, the intersections of exit routes) and very broad and concentrated areas (for instance, the level of an operating machine).

In no case would it be possible to merely employ optics with a cascading transmission, as the strong divergence of the resulting beam would imply a heavily reduced efficiency of the entire system; it would moreover prove to be exceedingly difficult to control the beam's angular distribution. In order to achieve the specifications outlined by the regulations, it is therefore essential to utilize light sources 11, 12 of an incandescent type, and to bundle the light beam emitted by the reflectors 22 as tightly as possible.

More specifically, the illumination of a high-risk area of a work site is achieved by arranging two incandescent light sources 12 in a single fixture 10, each within its own reflector 22, whose parabola follows the direction of an axis set at right angles to the floor; each reflector 22 is fitted with a prismatic cover glass 45, so as to allow the lighting intensity of the beams to reach an adequate figure and to cover the entire operating area in an emergency, or at any rate to never fall below a value of 10% of the ordinary lighting level, with a minimum value of 15 lux, as prescribed.

Moreover, a fluorescent light source 15 is arranged between the parabolas of the reflectors 22, so as to supply the illumination of the work site under ordinary operating conditions.

The Cartesian diagram in Figure 14 in fact refers to an "ISOLUX" DIAGRAM (constant lighting curves) of the fixture 10 according to this invention; the diagram is indicative of the geometry and intensity of the radiated light beam (variation of the light flow per unit area attained), and is calculated by considering the fixture 10 as being mounted at a height of 7 meters.

It can be immediately noted that the minimum specifications set forth by the national and international regulations are observed; in fact, the light beam produces on the impacted surface a substantially rectangular geometric figure, having a width (direction marked by the arrow Y) of about 2 - 2.5 meters and a length (direction marked by the arrow X) of about 15 meters, where its intensity is equal to at least 5 lux (curve A).

In areas of a concentric rectangular shape and greater extension than mentioned above (peripheral areas), the light beam produces an illumination of lower intensity and therefore equal to at least 1 lux (curve B refers to a constant lighting of 4 lux, curve C to a lighting of 3 lux and curve D to 2 lux, while curve E refers to a constant lighting of 1 lux).

The constructive solutions of the reflectors 22 and of the prismatic cover glasses 45 are experimentally determined so as to obtain a better definition of the profiled beams and a maximum bundling of the same, compatibly with the design specifications.

In a first example of a preferred and non-limiting embodiment, reflectors 22 are used having circular emission openings of 90 mm diameter and focal lengths of 10.5 mm; it has been possible to show, in this case, that it is necessary to guarantee a maximum possible tolerance in positioning the incandescent light source 12 (a first estimate of this tolerance value is equal to $\pm$ 0.1 mm).

On the other hand, if the focal length is very short even the positioning of the light source becomes critical. All this means that in this specific case the positioning of the incandescent light source 12 heavily influences the characteristics of the exit beam. A direct consequence of this lies in that the geometric construction of the prisms of the cover glass 45 turns out to be particularly complex; moreover, the characteristics of the emitted light beam essentially depend on the changes of light flow present on the internal surface 53 of the cover glass 45. To guarantee a better definition of the profiled beams, an alternative constructive solution may be applied to the reflectors 22; in a second but not limiting exemplifying embodiment of the fixture 10, the reflector 22 is therefore fitted with a circular exit opening having a diameter of 94 mm and a focal length of 11 mm. This makes it possible to guarantee a good bundling of the light beam and an excellent ratio between the reflected and the direct light beam; moreover, this design is far less sensitive to positioning than the light source 12, and while guaranteeing a good bundling of the beam, also facilitates the construction of the cover glasses 45, which turn out to be slightly curved on their inner sides 53. The above curvature is necessary to broaden the beam up to 2.5 meters in a direction crosswise to that of its propagation. Finally, two more alternative constructive solutions have been studied for the reflector 22; a third embodiment, also of an exemplifying and non-limiting nature, envisions a reflector 22 having a slightly elliptic mouth, of an apparent diameter of 90 mm.

This solution affords gathering the largest part of

the light beam and is less sensitive to tolerances as the focal distance equals about 12 mm, but the beam loses some of its bundling and the construction of the reflectors 22 and cover glasses 45 is more difficult.

On the other hand, if a reflector 22 is used having a slightly elliptical mouth, a maximum apparent diameter of 90 mm and a focal length of 11.5 mm, a better ratio between the reflected and direct bean is obtained and the construction of the cover glasses 45 is simplified, in the sense that the internal side 53 does not require curving to correct the divergence of the beam in a crosswise direction; however, the construction of the reflector 22 presents considerable difficulties, because it is not a rotational geometric solid and the beam generally loses some of its bundling.

As regards the lighting specifications expected for controlling the escape routes in emergency situations, considering the angular divergence of the light beams based on three incandescent light sources installed at a height of 7 meters, an emergency lighting power of at least 2 lux can be achieved along an escape route of 45 meters length by 2 meters width; the same escape route may be lit in an emergency to at least 5 lux by using four incandescent light sources 11,12 jointly arranged in a single fixture 10 and fitted with prismatic cover glasses 45 suitable for bundling the beam.

The above description clarifies the characteristics as well as the advantages of the emergency lighting fixture, in particular for industrial premises, which is the object of this invention.

In particular, these are represented by:

- flexibility, simplicity and rapidity of installing and wiring the fixture;
- conformity to national and international regulations in terms of its safety for industrial premises and work hygiene;
- better lighting on a ground level, `with respect to any known technologies, of the work sites and exit routes in industrial premises, in emergency situations, thanks to a better bundling of the light beam with respect to that of traditional fixtures.

It is clear that numerous other variants may be applied to the emergency lighting fixture, object of this invention, without thereby abandoning the inherent novelty principles of the inventive concept. It is equally clear that in the practical execution of the invention the materials, shapes and sizes of the illustrated details may be of any type depending on the requirements, and that the same may be replaced-by others technically equivalent.

In particular, the fixture in question may be applied to walls or ceilings, even by orienting the light beam on both a longitudinal and transversal plane; it is also suitable for installation in a suspended fashion or on an electrified bar, thanks to the powerful lighting action it manages to develop on a ground level even from considerable heights.

Claims

1. Emergency lighting fixture (10), in particular for industrial premises, capable of lighting, in emergency situations, work sites and/or exit routes, comprising an external enclosure (70), a diffusion screen (60) and at least one first light source (11, 12) destined for emergency lighting, fitted inside at least one parabolic reflector (22) placed next to the diffusing screen (60), in which the light source (11, 12) is of an incandescent type.

2. Fixture (10) according to claim 1, characterized in that said primary light sources (11) are present in a number of four, all of an incandescent type, destined for lighting, in emergency situations, the exit routes from industrial premises.

3. Fixture (10) according to claim 1, characterized in that said first light sources (12) are present in a number of two, of an incandescent type, destined for the lighting in emergency situations of work sites of industrial premises, featuring at least one second light source (15) of an incandescent type, destined for lighting the work sites in ordinary situations.

4. Fixture (10) according to claim 1, characterized in that said first light sources (11,12) are constituted by incandescent halogen lamps.

5. Fixture (10) according to claim 4, characterized in that each of said incandescent halogen lamps has a nominal power of 10 Watts.

6. Fixture (10) according to claim 2, characterized in that said second light source (15) is constituted by a fluorescent lamp, for example a neon lamp.

7. Fixture (10) according to claim 1, characterized in that it provides, in a direction identified by a plane perpendicular to the direction of the parabola constituting each reflector (22), at least one diffusion element (45) positioned next to each of said first light sources (11,12), which bundles the light beam originating from said first light sources (11, 12), so as to render it almost point-shaped.

8. Fixture (10) according to claim 7, characterized in that said diffusion element (45) is a transparent cover glass fitted with a plurality of internal prisms to diffuse the light.

9. Fixture (10) according to claim 7, characterized in that said diffusion element (45) has a disc-like shape.

10. Fixture (10) according to claim 7, characterized in that said diffusion element (45) is fitted with a plu-

rality of grooves (46) positioned in at least one area of the outer rim (56).

11. Fixture (10) according to claim 8, characterized in that said internal prisms are made in such a way as to minimize the angular divergence of the light beam emitted by said first light sources (11, 12).

12. Fixture (10) according to claim 8, characterized in that said internal prisms are constituted by a row of projections (50).

13. Fixture (10) according to claim 12, characterized in that said projections (50) are positioned at uniform intervals on at least one portion (55) of the surface (52) of said diffusion element (45), said surface (52) directly facing said diffusion screen (60) of the fixture (10).

14. Fixture (10) according to claim 8, characterized in that it provides, on at least a portion of the surface (53) directly facing said first light sources (11, 12), a plurality of grooves (54) of a curved profile.

15. Fixture (10) according to claim 7, characterized in that it provides, opposite to said outer rim (56) of the diffusion element (45), at least one fastening device (47) to said reflector (22), said attachment being obtained by inserting the fastening device (47) in appropriate recesses of the reflector (22), after rotating said diffusion element (45) by a section of the circumference equal to a predetermined angular sector.

Fig.1

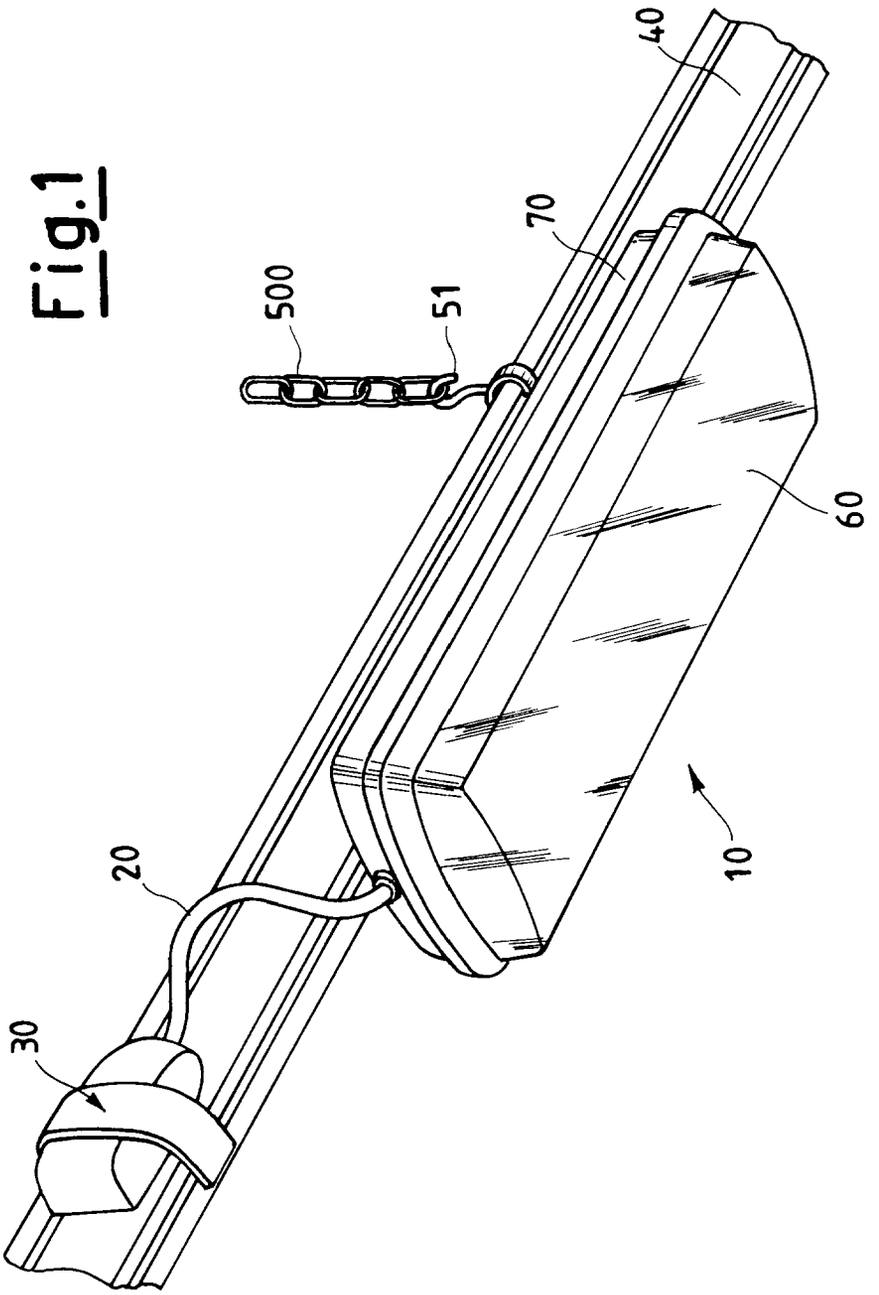

Fig.2

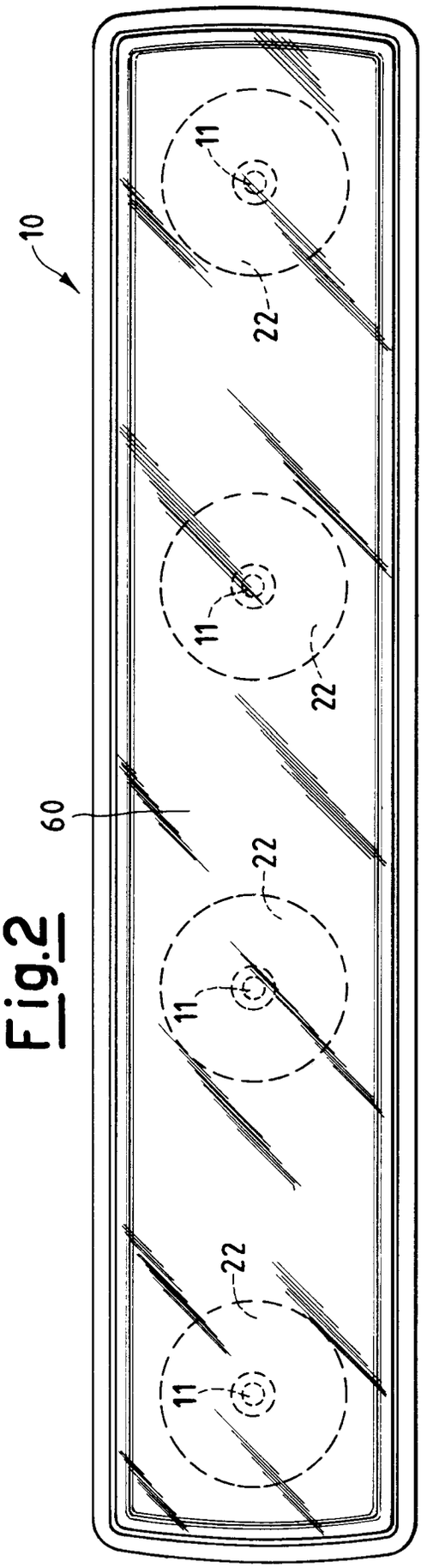

Fig.3

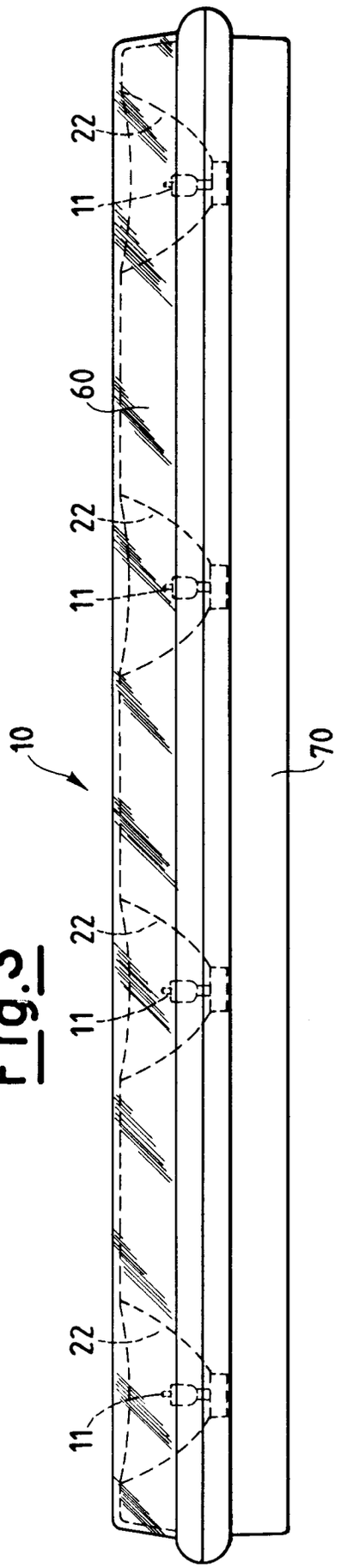

Fig.4

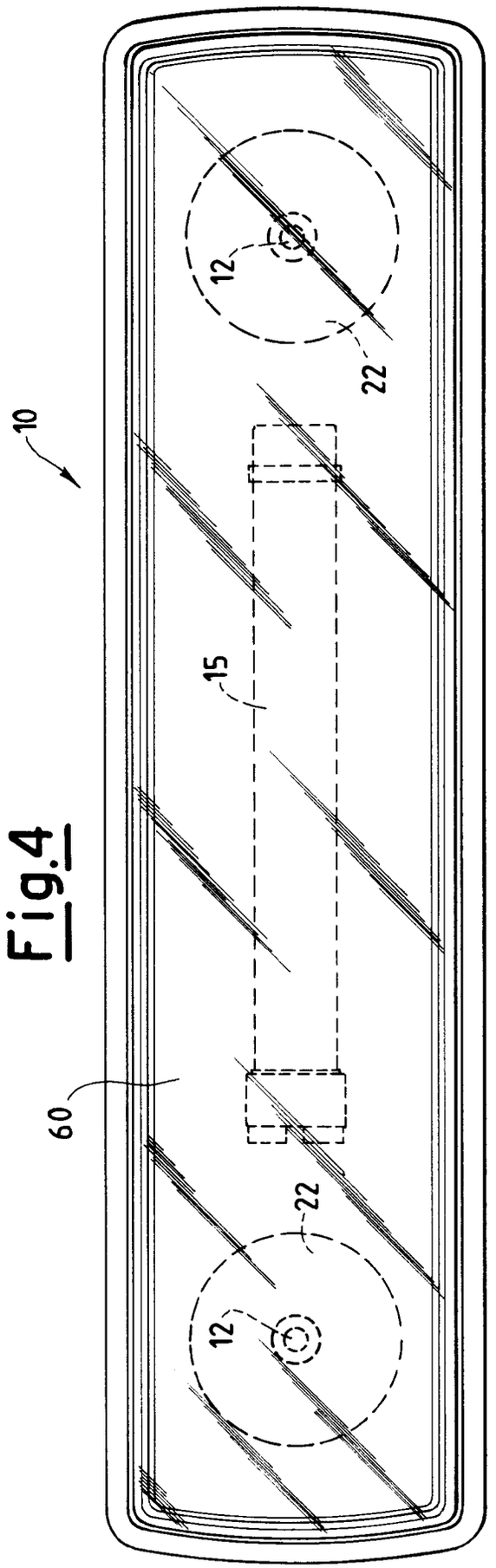

Fig.5

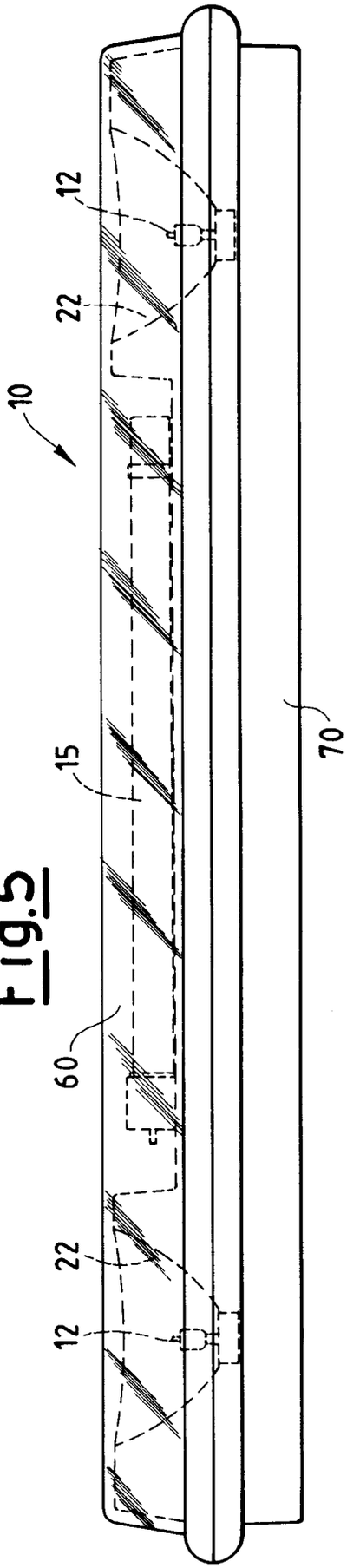

Fig.6

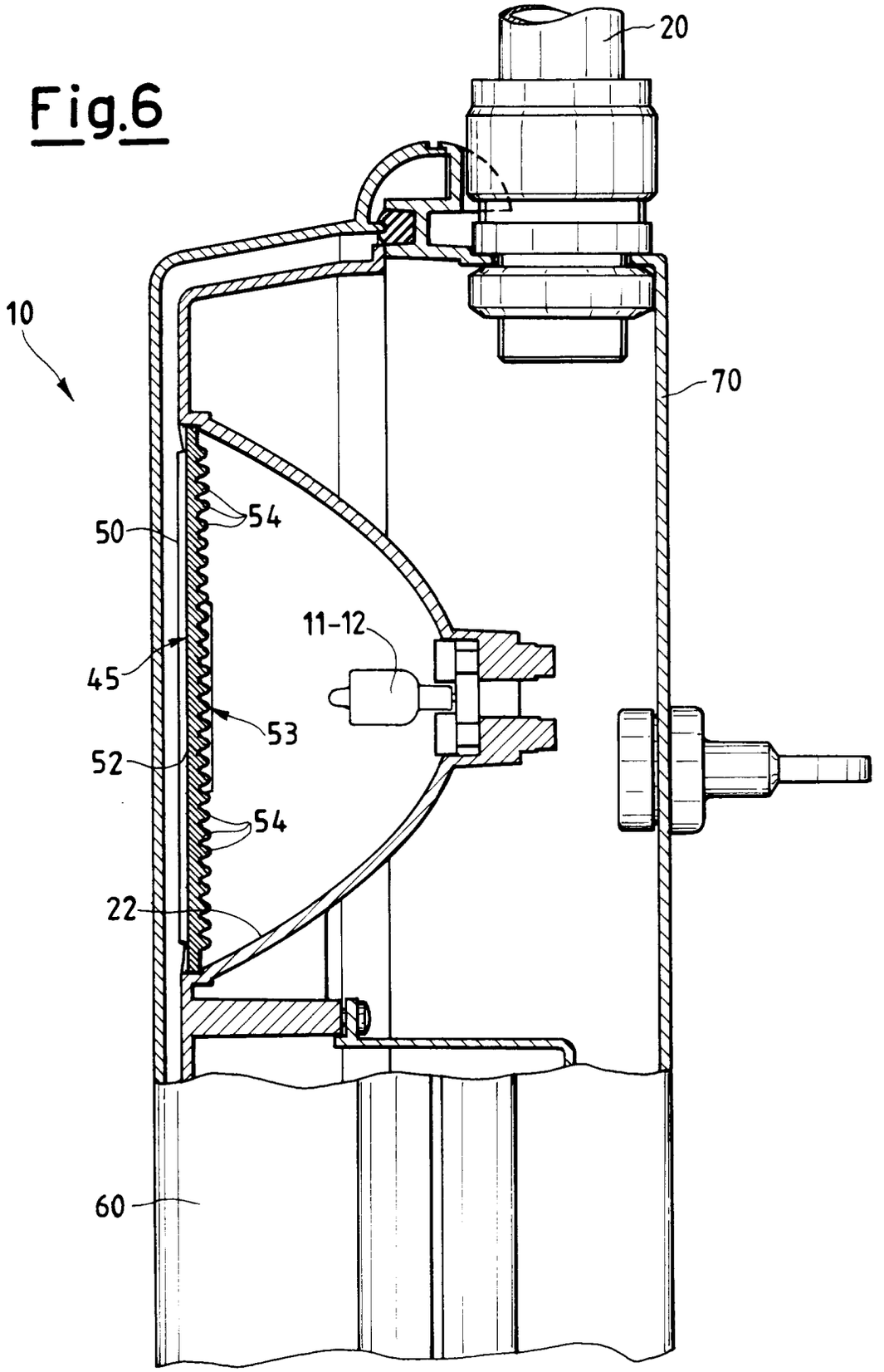

Fig.7

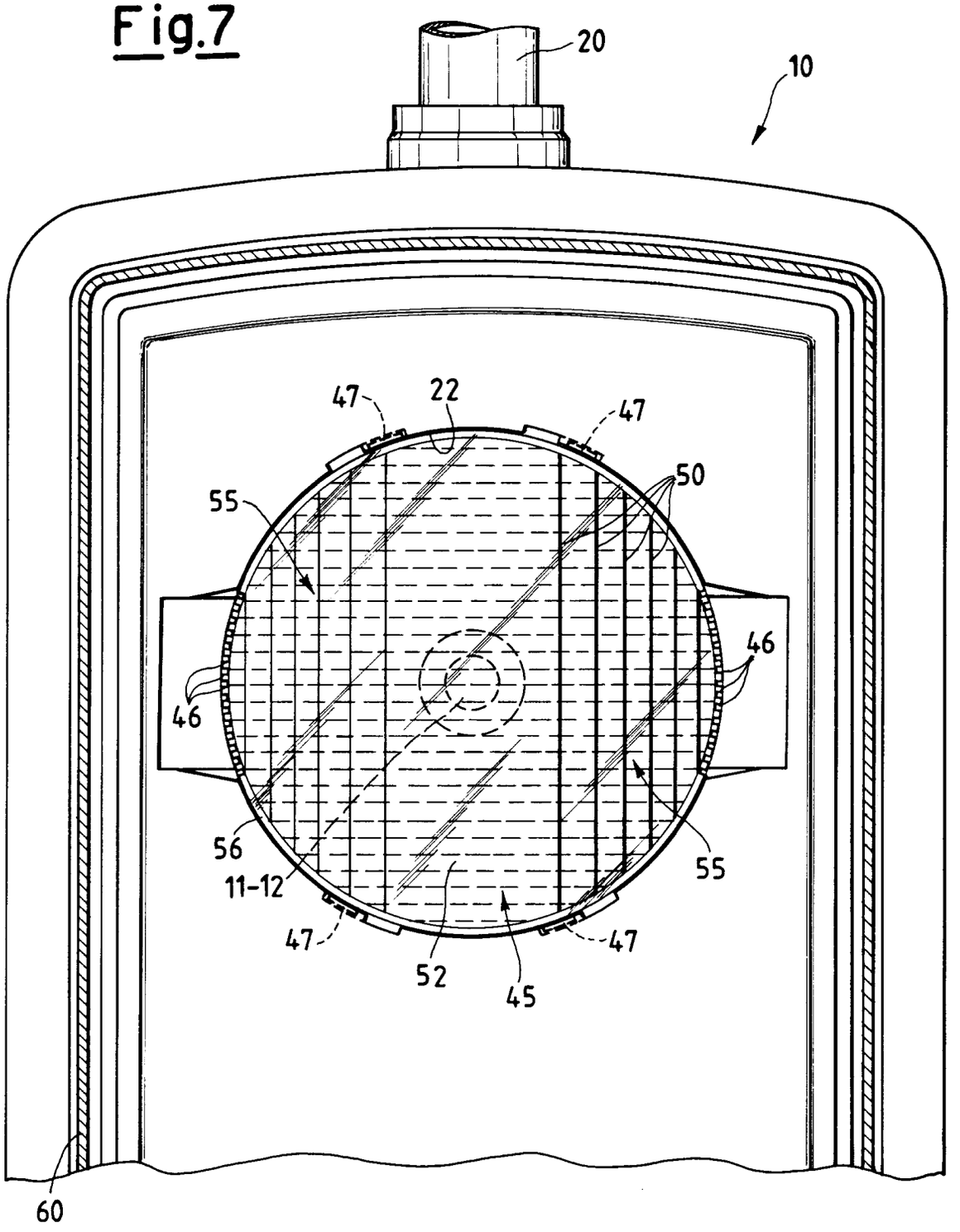

Fig.8

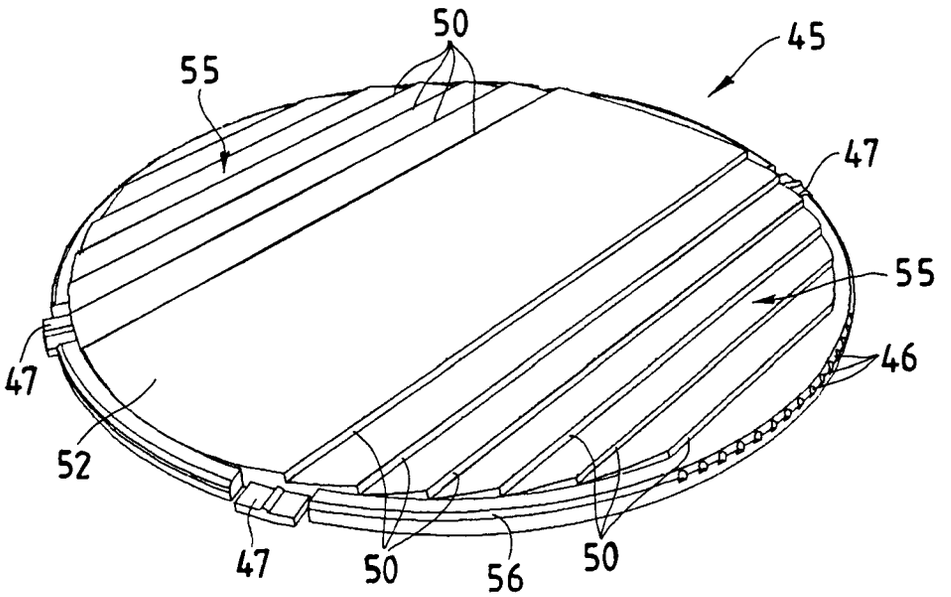

Fig.9

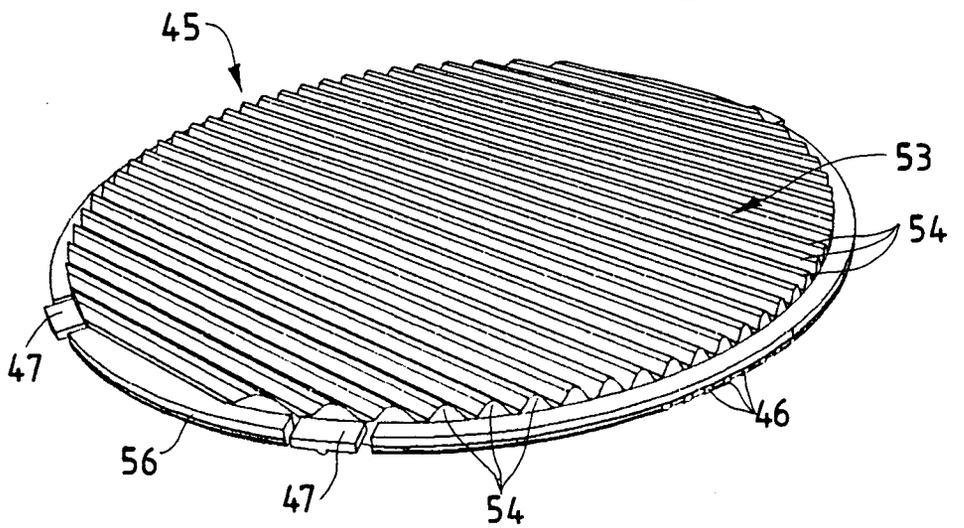

Fig.11

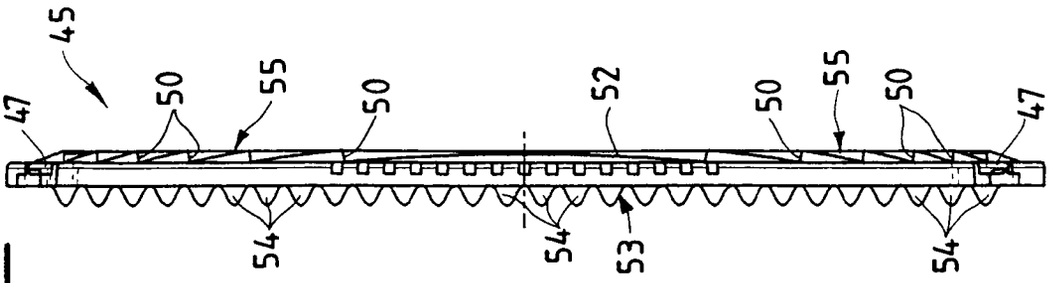
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Fig.10

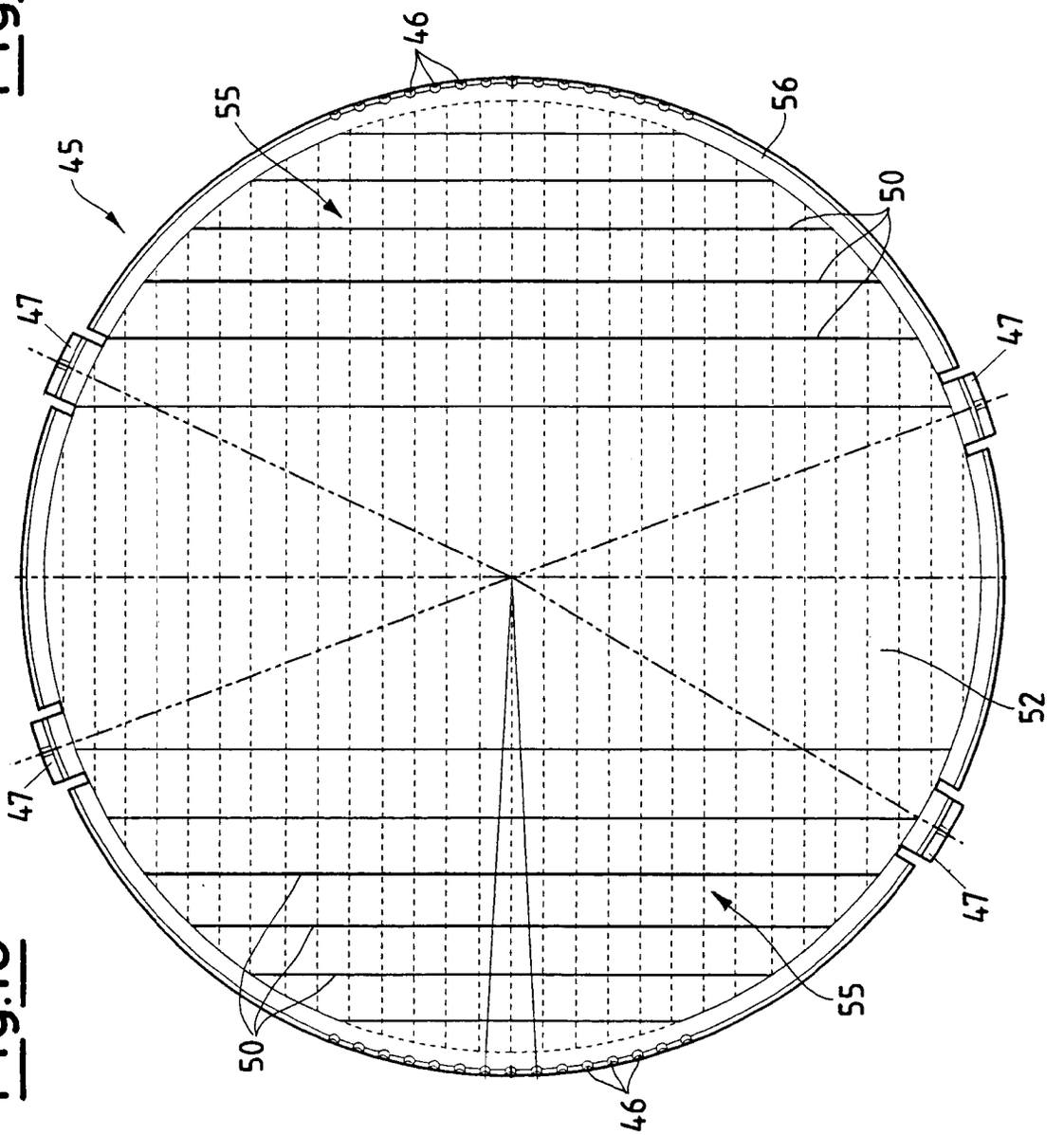
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Fig.12

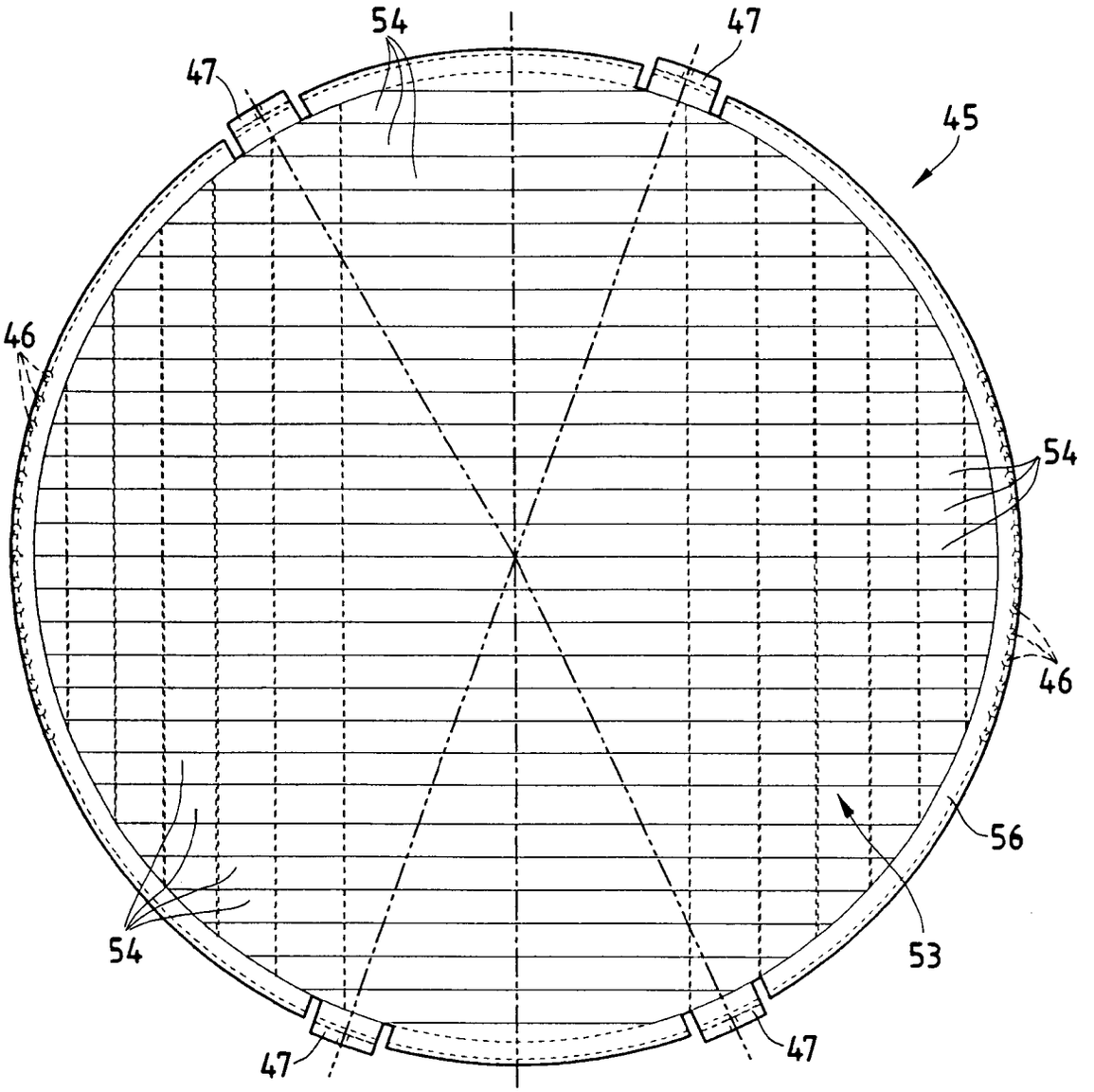

Fig.13

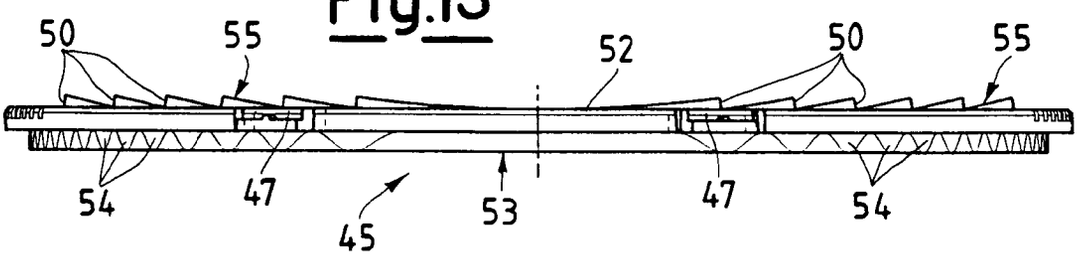

Fig.14