

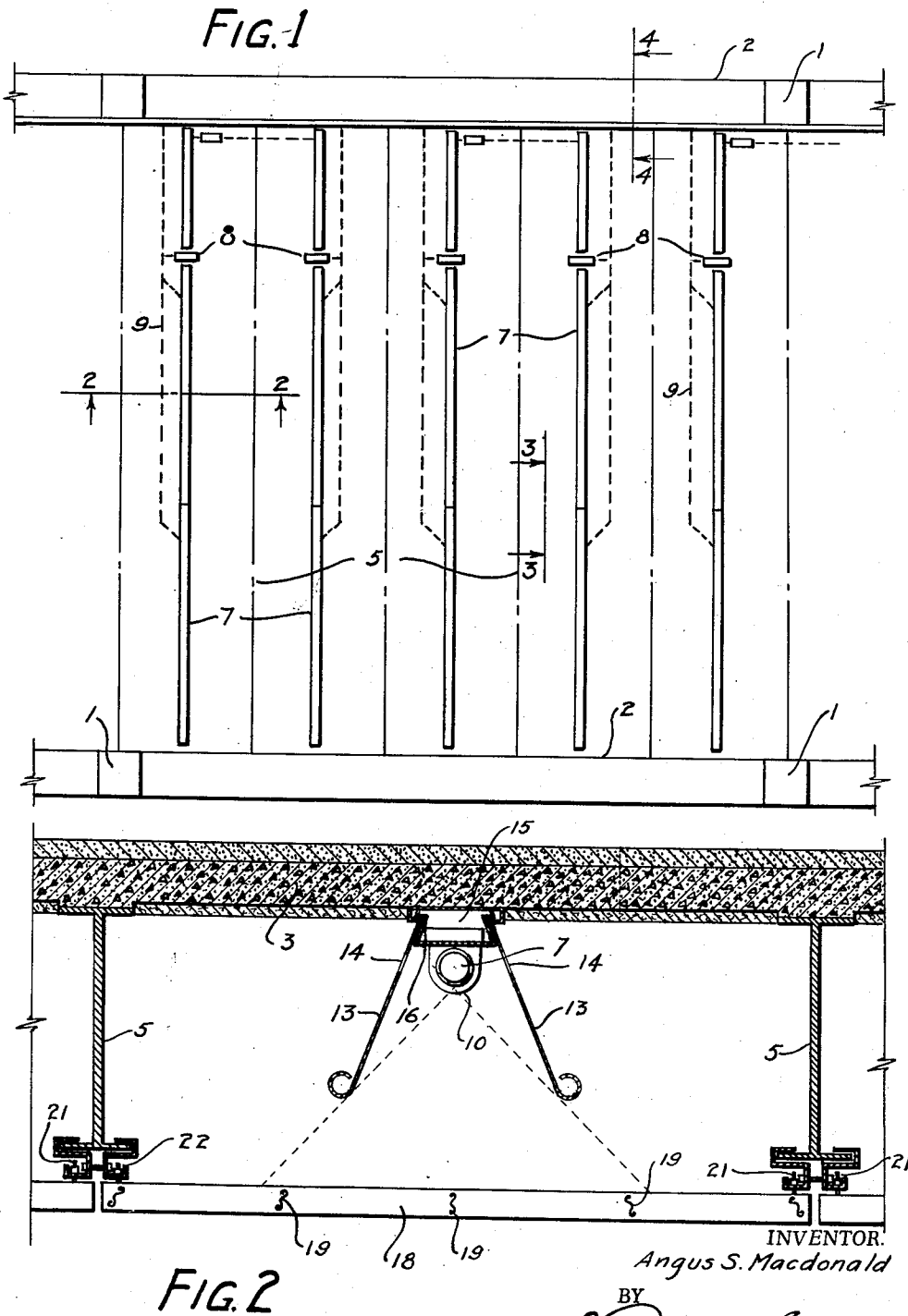
June 8, 1954

A. S. MACDONALD
LOUVERALL LIGHTING DEVICE

2,680,805

Filed July 26, 1949

4 Sheets-Sheet 1



INVENTOR.
Angus S. Macdonald

BY
J. Preston Swicker
ATTORNEY

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4 Sheets-Sheet 2

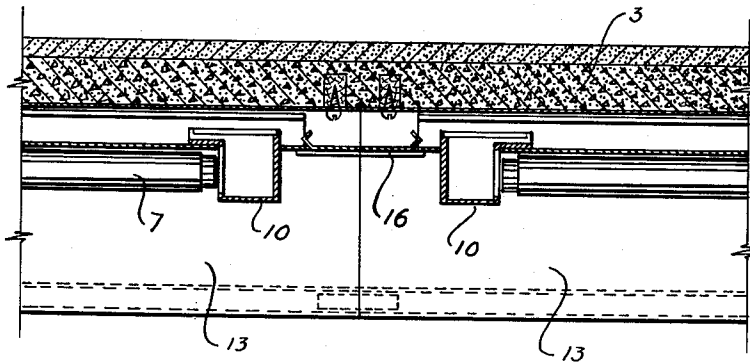


FIG. 3

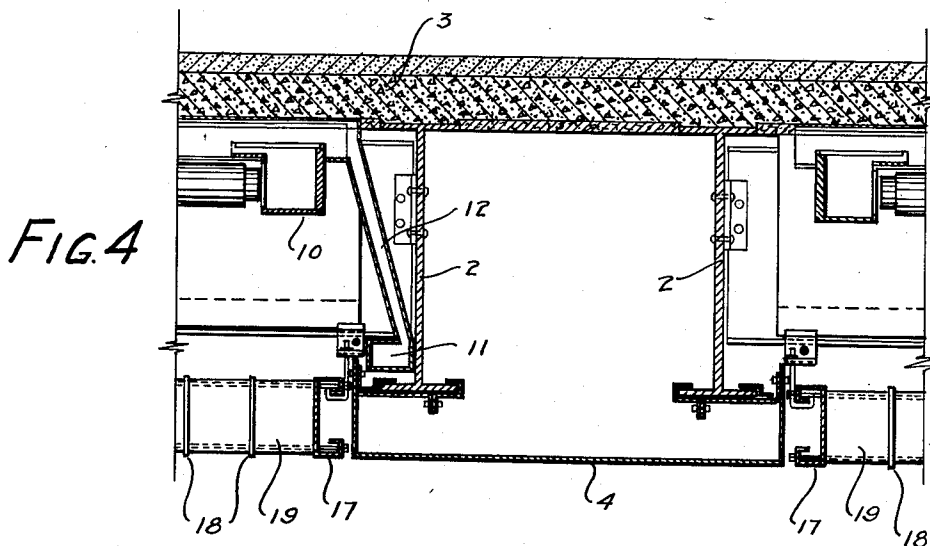


FIG. 4

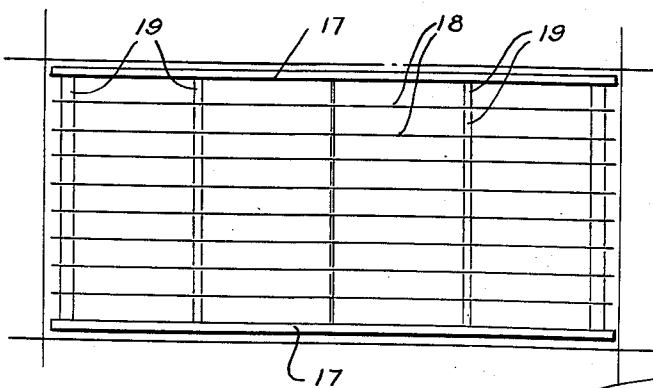


FIG. 5

INVENTOR.
Angus S. Macdonald
BY
J. Peter Luecke
ATTORNEY

June 8, 1954

A. S. MACDONALD
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4 Sheets-Sheet 3

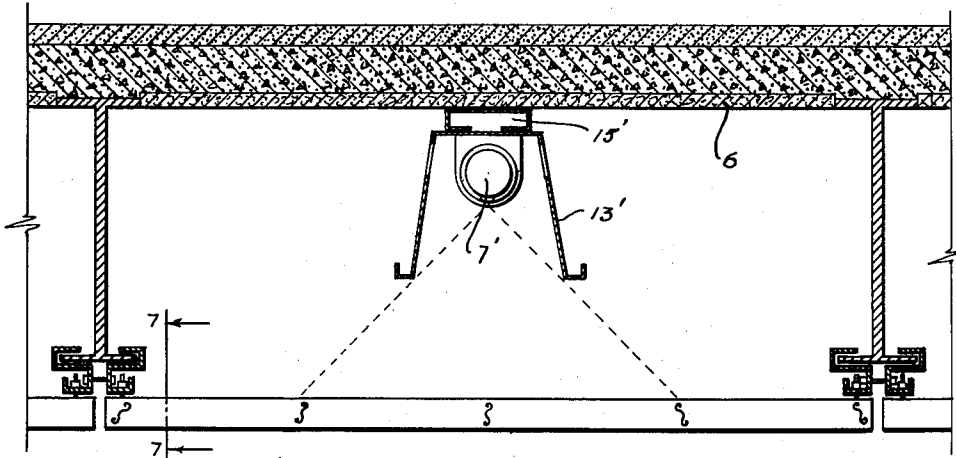


FIG. 6

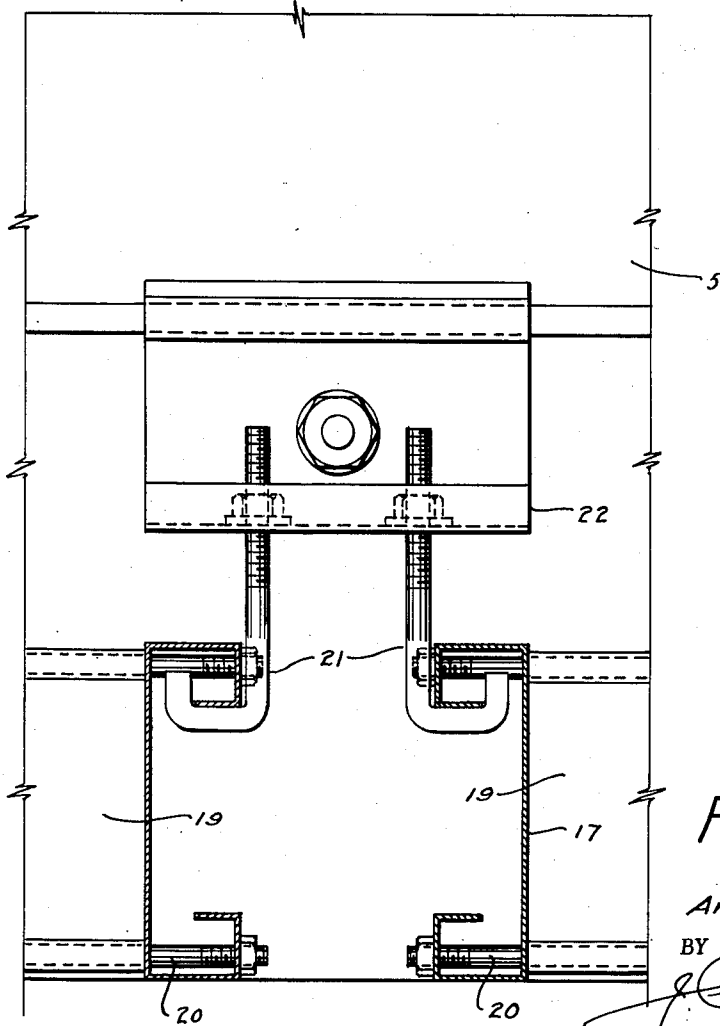


FIG. 7

INVENTOR.
Angus S. Macdonald

BY

J. Gordon Swicker
ATTORNEY

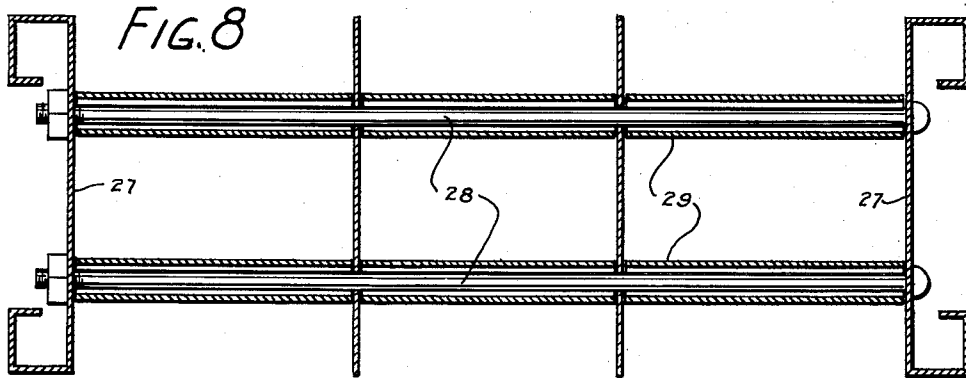
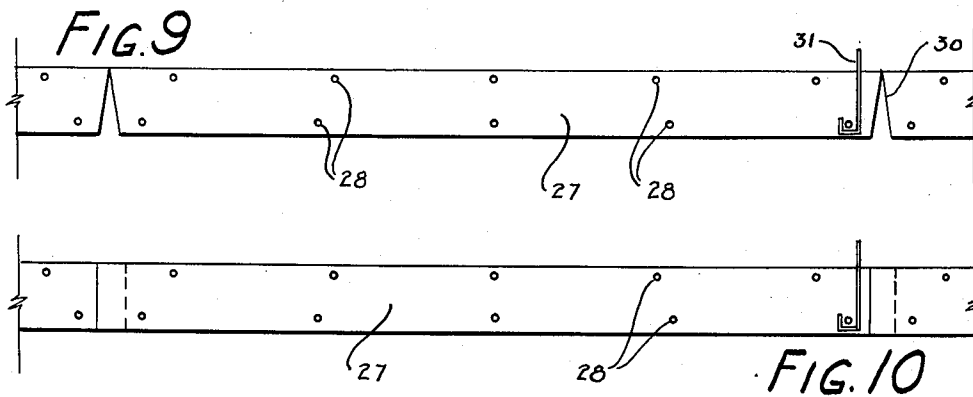
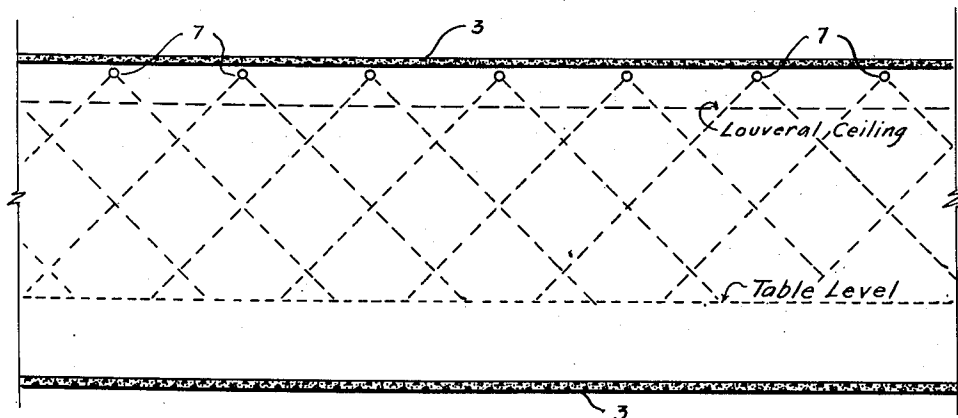
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LOUVERALL LIGHTING DEVICE

2,680,805

Filed July 26, 1949

4 Sheets-Sheet 4



INVENTOR.
Angus S. Macdonald

BY
J. Preston Smeck
ATTORNEY

UNITED STATES PATENT OFFICE

2,680,805

LOUVERALL LIGHTING DEVICE

Angus Snead Macdonald, near Rapidan, Va.

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7 Claims. (Cl. 240—9)

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This invention relates to improvements in louverall lighting devices adapted especially for illuminating large areas of ceilings, for libraries and other places where effective illumination is desired.

Louverall lighting has generally had for its objective the obtaining of a uniformly illuminated ceiling formed by louver panels made up of square cells. In order to get uniform illumination a rough rule has been adopted that the space between the sources of light, usually fluorescent tubes, should be two-thirds of the distance from the center of the tubes to the top of the louver panels. This results in a great multiplicity of fixtures and is expensive in the wiring and outlet costs and in the lighting units themselves. Furthermore, the square-celled louver panels are difficult to clean. In fact, they have to be taken down and blown out or washed if cleaning is to be effective.

One object of this invention is to simplify and improve the character of lighting obtained by a lighting device of this nature while appreciably reducing the cost thereof, as compared with the usual louverall lighting devices in use heretofore. As an example, the louverall lighting devices used heretofore have cost approximately \$3.75 per square foot, whereas the device produced according to this invention has a cost of only about \$2.00 per square foot, a substantial saving where multiplied over large areas.

A further object of the invention is to improve the lighting effects obtained thereby and to eliminate the glaring effect produced where the light area is uniform over the entire ceiling, as was the object heretofore. This object is accomplished by producing wide strips where bright illumination is graded gradually into strips that are not so brightly illuminated, but without sharp contrasts between the different areas and producing fairly uniform illumination at the working level, such as the table height.

Still another object of the invention is to improve the light shielding effect obtained by the device, as contrasted with ordinary louverall light shielding where the louver strips were interlocked with the longitudinal strips in egg-crate fashion. This shielding is secured more simply by means of an open-bottom reflector surrounding the light source, which gives a 45-degree shielding of the light in the direction along the axis of the light source. This reflector has longitudinal slots cut close to the top for spilling some of the light on to the ceiling and adjacent areas of the beams, which brightens up the louver area

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beyond the direct rays from the light source and thereby lessens the variance of illumination between the ends of the louver panels and the middle portions thereof.

A still further object of the invention is to improve the construction of the louver assembly and the suspension thereof from the ceiling. The louver strips or panels are spaced apart by spacers that are set on axes radiating from the light source, which tends to prevent objectionable shadows being cast by the spacers and will also improve the bracing effect obtained thereby between the panels. This louver assembly may be suspended from the floor girders by hooks at the opposite sides thereof, which permits the louver panels being detached at one end simply by turning the suspension hooks and then allowing the free end of a panel to swing downward on the hooks at the opposite end thereof. Such a suspension facilitates the replacement of lamps and cleaning of the panel sections.

An embodiment of the invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a top plan view of a lighting arrangement in a large area to which this invention may be applied, the louverall lighting device being omitted for purpose of illustration;

Fig. 2 is a cross section therethrough, substantially on the line 2—2 in Fig. 1, but showing the louverall lighting device associated therewith;

Fig. 3 is a similar view on the line 3—3 in Fig. 1;

Fig. 4 is a similar view on the line 4—4 in Fig. 1;

Fig. 5 is a top plan view of a louverall lighting panel;

Fig. 6 is a cross section, showing a modified form of reflector device and lamp mounting;

Fig. 7 is a detail side elevation, showing the supports for the louver panels;

Fig. 8 is a cross section through a louver panel with spacing tubes between the louvers;

Fig. 9 is a longitudinal section therethrough;

Fig. 10 is a similar view showing overlapped louver panels; and

Fig. 11 is a diagrammatic view of a room showing the lighting effect produced according to this invention.

Referring to Fig. 1 as an example of an area of a building to which this invention may be applied, there is illustrated a ceiling and floor area in which supporting columns 1 carry floor beams, generally designated at 2, forming the main supporting girders for the floor and ceiling unit, generally indicated at 3. As shown in Fig. 4, these girders 2 are spaced apart and have the space therebetween enclosed at the bottom by a

cover or panel 4. This may be used for circulating air through the building, if desired.

The combined floor and ceiling, generally designated at 3, usually would be formed of concrete in the form of floor slabs supported by the beams 1 and 2, and by cross beams 5 extending between the girders and supported thereby, as shown in Fig. 2. These supporting beams may be formed either of steel or of concrete. The ceiling space between the beams may also be covered with sound-insulating board, shown in Fig. 6 and designated at 6. A board of the character sold under the trade-name "Fiberglas" has been found suitable for this purpose, inasmuch as it serves at the same time as a form for casting the concrete floor slabs in place, as well as a ceiling surface for the area below. It may be finished in white or other shades of color to provide a light reflecting surface.

The light sources frequently used are in the form of fluorescent tubes, generally designated at 7, arranged in rows over the area to be illuminated, as indicated in Fig. 1. Usually a ballast is required, connected with the tubes, as shown at 8, while the source of electrical current is indicated generally at 9, in the form of wires connected with the respective opposite ends of the tubes 7. Receptacles are shown generally at 10 for supporting the opposite ends of the tubes 7, and may be connected with the wires through main and connecting raceways, generally indicated at 11 and 12, respectively.

Each of the light tubes 7 is enclosed on opposite sides by reflectors 13, open at the bottom and extending downward an appreciable distance below the light tube 7, as shown in Fig. 2. These reflectors 13 have longitudinal slots 14 therein close to the top and on opposite sides of the light tube for the purpose of spilling some of the light onto the white-finished ceiling and floor beams. The reflection of this light brightens up the louver area beyond the reach of the direct rays from the lighting source and thereby lessens the variance of illumination between the ends of the louver panels and the middle portions thereof. The slots 14 extend throughout the major portion of the length of the light tubes 7 so as to provide such spilled light along the entire area between the spaced floor beams 5 within which the row of tubes 7 are located.

The reflectors 13 may be formed in one piece extending over and enclosing a wiring channel, generally designated at 15, being attached to the ceiling 3, whereby the wires are carried thereby continuously along the lighting strips. A closing panel is shown at 16, held in place by spring clips, as a cover which also supports the light receptacles, as shown in Fig. 3.

It the form shown in Fig. 6, the reflector 13' is supported beneath the raceway 15' although above the light source 7', being otherwise in the relation and for the purpose described above.

In these forms the light reflector is shown with straight sloping sides, although the shape thereof may be varied as desired. For instance, the sides could be curved so as to reflect the rays of light further over toward the ends of the louver panels as a further aid in diminishing light variations. Such modifications aid in preventing contrast between the areas of illumination, as is desired according to this construction.

The space beneath the light source and between the spaced beams 5 is covered by one or more louver panels, such as shown generally in Fig. 5. Each of these panels comprises a pair of

long side strips 17 between which are spaced strips 18 held apart one from another by means of spacers 19. These parts are connected together in an assembly and secured by tie rods 20, shown more in detail in Fig. 7. The spacers 19 are formed by a two-stage die to give them substantial width for bracing the strips 17 and 18 against longitudinal displacement, and have curled edges to receive the tie rods 20. The tie rods 20 pass through from one side of a louver panel to the opposite side thereof, as shown in Fig. 5. The side strips 17 are made, preferably, of channel shape to give stiffness in a direction transverse to the panel. These strips and spacers, preferably, are coated with a durable light-reflecting finish and may be of white enameled steel with an aluminum or white plastic finish.

The axes of the spacers correspond approximately with lines drawn from the light source 7 to the spacers, as shown in Fig. 2. This tends to prevent objectionable shadows being cast by the spacers. By tilting the spacers slightly upward, the undersides thereof that are visible from below are given some illumination so they will not appear too dark. Furthermore, the directing of the spacers along the radial lines from the light source will brace the louver strips more effectively against longitudinal displacement and thereby tend to maintain the squareness of the panel. The spacing between the spacers is small enough to give the requisite longitudinal stiffness but is not so small as to prevent the louver panels from being cleaned easily with a brush while they are in place.

The louver panels, preferably, are made with the strips 18 spaced apart a distance approximately equal to the height of the strips through the panel, as viewed in Fig. 2. This gives a 45-degree shielding of the light in the direction along the axis of the light source, which is the desired effect because it tends to eliminate glare from the light source in the ordinary use of the room. The strips 18 extend transversely of the light source, as shown in Fig. 2, and the spacers 19 cooperating with the reflectors 13 give effective 45-degree shielding transversely of the light source, as pointed out above.

The panels are supported from the floor beams 5 by hooks 21 adjustably connected with brackets 22 attached to the beams. The suspension hooks 21 have the lower ends thereof turned at 90 degrees to the shanks, substantially in the form of a J-hook, and engage under the upper edge of each of the side strips 17. A pair of hooks 21 supports a louverall panel at each opposite end thereof, as will be apparent from Fig. 2. This suspension permits the panels being detached at one end simply by turning the two suspension hooks at that end through 90 degrees and then letting the end of the panel swing downward on the pair of hooks at the opposite end thereof, forming a hinge therefor. This is convenient for replacing the lamps and for cleaning.

This construction provides the required illumination without lowering the ceiling height to any marked extent when the louver panels are suspended between the floor beams in a construction utilizing floor slabs and supporting beams. A substantial width of floor panel can be illuminated by means of one row of lights. The same device can be adapted to a perfectly flat flooring system without beams merely by lengthening the suspension means for the ends of the louvers.

This form of louverall lighting device makes possible an appreciable reduction in cost, as com-

pared with the egg-crate longitudinal and transverse strips used heretofore, and at the same time the combining of the light reflector with the louverall panels provides an improved lighting effect in the elimination of the glaring, uniformly-bright light that has been thought necessary. On the other hand, this invention provides for the gradual grading of the light into strips which are not so brightly illuminated but without sharp contrasts therebetween that would be objectionable, and yet it obtains a fairly uniform illumination at the working level, such as the table height. Thus a substantial improvement has been made in louverall lighting devices for the purposes described.

This is illustrated diagrammatically in Fig. 11 which shows the light rays emanating from the respective lamps 7. The relatively wide spacing between adjacent lamps 7, approximately four times the vertical distance between the lamps 7 and the top of the louver panel as shown, produces non-uniform illumination of the louvers, but there is direct illumination at any one point at table level from at least three light sources, and at some points, from as many as four. Therefore, although the illumination from the louvers is uneven, the illumination at working level is substantially even. The lack of uniform illumination at the ceiling is not objectionable, and being patterned in grey and bright stripes, may be more restful to the eyes.

In past practice, all louver members stood in a vertical direction and were not sloped to follow the lines of the light rays. Consequently, they caused objectionable shadows and occasioned considerable loss in lighting efficiency. I have eliminated these difficulties by arranging the spacers along radial lines from the light source and at the same time accomplished the desirable object of stiffening the panel so that it cannot be distorted readily into a trapezoidal form. Also, with this radial arrangement, it is no longer necessary to make the spacers of a substantial width and each one in one piece. They can be made more advantageously of tubes or ferrules cut to exact length, not shown at 29 in Fig. 8, to hold the louvers at the proper distance apart and at the same time make the whole assembly rigid. These tubes will be advantageous in catching a minimum amount of dust and are also economical to make. The form of tubular spacers facilitates the hinging arrangement.

The side channels 17 of the louvered panels are perforated only through their webs and not through their bent flanges. This makes a simpler and more rigid construction and gets the heads and nuts of the tie rods 28 entirely out of the way.

Another advantage of this arrangement is that the spacing of the rows of holes in the channels and louver strips is at a uniform distance, measured vertically, and will vary only in longitudinal direction and not in both longitudinal and vertical directions, as is the case with the one-piece spacers.

Most louver panels have stiffening members on all four sides. With the kind of spacers described above, it is unnecessary to have stiffening members at the ends of the panels. I can, therefore, overlap slightly the louver strips 27 so that they will form almost continuous lines entirely across a room, being offset only the thickness of the metal, see Fig. 10. The strips of one panel will not interfere with those of the next panel adjacent at the end when the first panel is

swung downward from its hinging supports. The side channels of the panels, of course, should have gaps 30 (Fig. 9) between their ends or be cut off at a slight angle so that they will not interfere with each other from the operation of the hinges. If cut off at a slight angle, the side channels themselves can be set to form substantially continuous lines from one panel to the next across a room. Cutting at an angle is the preferred form. If desired, the J-hooks 21 may engage directly the spacers 29 or rods 28 to form pivot supports for the ends of the louvers.

While the invention has been illustrated and described in certain embodiments, it is recognized that variations and changes may be made therein without departing from the invention, except as specified in the claims.

I claim:

1. In a lighting device, the combination of a ceiling supported light source, a shade for said light source, a plurality of oppositely disposed spaced ceiling beams having a plurality of hooks depending therefrom, and a louver panel supported on said hooks beneath said light source, said shade comprising a pair of elongated reflectors diverging downwardly away from each other on opposite sides of and below said light source providing direct illumination through said louver panel, each of said reflectors having a longitudinally extending slot formed therein adjacent said light source for transmitting light laterally from said light source providing for reflected light through said louver panel, said louver panel having strips extending transversely of the light source with spacing members therebetween, each of said spacing members being of appreciable width and extending in planes converging on said light source, an elongated rigid channel member on each side of said louver panel connecting the adjacent ends of said spacer members, and the free ends of one arm of each of said channel members being detachably supported on said hooks.

2. In a lighting system, the combination with a light reflecting ceiling, of an elongated light source supported near said ceiling, a louver panel supported beneath the light source, and a shade for the light source having reflectors extending along opposite sides thereof and downwardly below the light source providing direct illumination through the central portion of said louver panel, said reflectors having slots therein for transmitting light laterally from the light source to said ceiling causing the reflection of light through the side panels of said louver panel, said louver panel being spaced below the bottom edges of the reflectors and extending laterally substantial distances beyond the edges of the reflectors and having strips extending transversely of the light source with light reflecting spacing members therebetween arranged approximately on radial lines from the center of the light source, said spacing members being positioned intermediate and adjacent the ends of each of said strips.

3. In a lighting system, the combination with a light reflecting ceiling, of an elongated light source supported near said ceiling, a louver panel supported beneath the light source, and a shade for the light source having reflectors extending along opposite sides thereof and downwardly below the light source providing direct illumination through the central portion of said louver panel, said reflectors having slots therein

for transmitting light laterally from the light source to said ceiling causing the reflection of light through the side portions of said louver panel, said louver panel being spaced below the bottom edges of the reflectors and extending laterally substantial distances beyond the edges of the reflectors and having strips extending transversely of the light source, and a plurality of pairs of light reflecting tubular spacing members positioned between each pair of said strips with the spacing members of each pair being disposed approximately on radial lines from said light source, said spacing members being positioned intermediate and adjacent the ends of each of said strips.

4. The combination with an elongated light source, of a louver panel supported beneath the light source, said louver panel having a plurality of vertical strips extending transversely with respect to the longitudinal axis of said light source, and a plurality of pairs of light reflecting tubular spacing members between each pair of said strips with each of said tubular spacing members extending in a direction parallel to the longitudinal axis of the light source and with the axes of the tubular spacing members of a pair being disposed in a plane inclined toward the axis of the light source.

5. The combination with an elongated light source, of a louver panel supported beneath the light source, said louver panel having a plurality of vertical strips extending transversely with respect to the longitudinal axis of said light source, and a plurality of pairs of light reflecting tubular spacing members between each pair of said strips with each of said tubular spacing members extending in a direction parallel to the longitudinal axis of the light source and with the axes of the tubular spacing members of each pair being disposed in a plane passing through said light source.

6. The combination with an elongated light source, of a louver panel supported beneath the light source, said louver panel having a plurality of vertical strips extending transversely with respect to the longitudinal axis of said light source, a plurality of pairs of light reflecting tubular spacing members between each pair of said strips with each of said tubular spacing members extending in a direction parallel to the longitudinal axis of the light source and with the axes of the tubular spacing members of a pair being disposed in a plane inclined toward the axis of the light source, a plurality of rods extending through said strips and through said tubular spacing members, and means on the ends of said rods for confining said strips and causing them to bear against the ends of the adjacent spacing members.

7. In a lighting system, the combination with a light reflecting ceiling, of a plurality of louver panels supported beneath said ceiling, a plurality

of elongated parallel light sources supported between the ceiling and the louver panels and spaced apart from each other in a direction transverse to their axes so that the distance between adjacent light sources is at least three times the vertical distance from said light sources to said louver panels, and a shade for each light source, including reflectors extending along opposite sides thereof and downwardly below the light source to direct illumination through a portion of said louver panels, said reflectors having slots therein for transmitting light from the light source to the ceiling causing the reflection of light through other portions of said louver panels, each of said louver panels having a plurality of vertical strips extending transversely with respect to the axes of said light sources and being spaced apart from each other by a plurality of light reflecting spacer members between each pair of strips so that the distance between adjacent strips is approximately equal to their height, said spacer members extending parallel to said light sources and being spaced apart from each other a substantially greater distance than the spacing of adjacent ones of said strips and being arranged approximately on radial lines from the center of the nearest light source so that the under surface of each spacer member is illuminated, whereby a pattern of illumination on the under surface of said louver panels is produced wherein the brilliantly illuminated areas beneath said light sources are spaced apart by less brilliantly illuminated areas of varying illumination with no sharp contrasts therebetween.

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