SUSPENDED CEILING AND LIGHTING SYSTEM

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This invention relates to a ceiling and lighting structure. More particularly it relates to an integrated ceiling and lighting system which is suspended as a unit from a permanent ceiling.


In modern lighting and ceiling construction it has become a common practice to construct an integrated system which provides both a ceiling and a source of illumination. The ceiling may be an acoustical ceiling with rows of tubular lamps integrated into the ceiling or the ceiling may be light-transmitting with tubular lamps separated above to illuminate the ceiling as a whole.

In the past the lighting system and the acoustical and/or light-transmitting ceiling have been suspended independently from the permanent ceiling; or else the lighting fixtures have been suspended from the permanent ceiling and a light-transmitting ceiling is suspended from the lighting fixtures. (By "permanent ceiling" as used herein is meant the roof of a single story structure; or a permanent ceiling installed at the time the building is constructed; or rafters, joists or beams of a building; or a slab or other structure between floors in a multiple story building; or some other permanent or structural part of a building.)

Where independent suspension means are employed there is the disadvantage, among others, that parts and labor are duplicated. Where the ceiling is suspended from the light fixtures, it is difficult to have access to the wiring system of the lamps because they are located above the ceiling. Also, it may be necessary and difficult to coordinate the lamp spacing with the modules or units of the ceiling system. For example, parts of a building such as beams, pillars, rafters and ducts may interfere with the attachment of the ceiling and lighting components of a ceiling and lighting system, in such a way that it is difficult to coordinate these components.

It is an object of the present invention to provide improvements in lighting and ceiling construction.

It is another and particular object of the invention to provide an integrated ceiling and lighting system which is suspended as a unit from the permanent ceiling of a building.

Yet another object is to provide a ceiling and lighting system which is suspended as a unit from a permanent ceiling and in which the wiring system for the lights is readily accessible.

A further object is to provide a unitary, suspended ceiling and lighting system in which the lamp spacing is independent of the ceiling module.

The above and other objects will be apparent from the ensuing description and the appended claims.

Certain forms of the invention are illustrated in the accompanying drawings in which:

FIG. 1 is a fragmentary perspective view of a lighting and ceiling system suspended from the permanent ceiling of a building in accordance with the present invention.

FIG. 1A is a similar view but illustrating a different angular disposition of the tubular lamps with respect to the longitudinal members of the ceiling-panel and tubular-lamp supporting framework than shown in FIG. 1.

FIGURE 2 is a similar view of another embodiment of the invention.

FIGURE 3 is a similar view of a third embodiment of the invention.

FIGURE 4 is a similar view of a fourth embodiment of the invention.

FIGURE 5 is a fragmentary perspective view of a cross channel construction employed in certain forms of the present invention to provide combined conduits for cross wiring for the lighting system.

FIGURE 6 is a fragmentary, perspective exploded view, similar to that shown in FIGURE 5 but showing a different form of the cross wiring conduits.

FIGURE 7 is a fragmentary perspective view of an end closure for the cross wiring conduits of FIGURE 6.

FIGURE 8 is a fragmentary perspective view of yet another form of ceiling and lighting system in accordance with our invention.

FIGURE 9 is a somewhat diagrammatic view showing the manner in which the embodiment of FIGURE 8 operates as a direct and reflected light illuminating system.

Referring now to FIGURE 1, a suspended ceiling and lighting system is there shown and is generally designated by the reference numeral 10. It comprises longitudinal members 11 and cross members 12. The longitudinal members 11 are in the form of relatively long channels 11a which provide a raceway for necessary wiring for the lamps. A cover 13 is provided for each of the channel members 12. On each side of the channel portion 12 are provided vertically aligned guideways 14. A flange 15 projects outwardly from the lower edge of each channel portion 12, the two flanges 15 preferably being coplanar.

Certain other features of the construction of the longitudinal members 11 are described hereinafter with reference to FIGURE 6. Further description, which is unnecessary for present purposes, will be found in our Patent No. 2,888,113.

In the particular embodiment shown in FIGURE 1 the flanges 15 serve to suspend light shielding and/or acoustical baffles 16 each of which comprises a filler 17 of suitable sound-absorbing material and a cover portion 18 which may be perforated for acoustical purposes.

The upper portion of the cover 18 is formed into U-shaped clips 19 for engaging the flanges 15.

A permanent ceiling is shown at 24 from which the longitudinal members 11 are suspended. The suspension means comprises U-shaped hanger members 25, eye bolts 26 adaptably fixed thereto and cables 27 which are secured at their lower ends to the eye portions of the members 26 and at their upper ends by any suitable means (e.g., the eye screw shown) to the permanent ceiling 24.

In the particular embodiment of the invention shown in FIGURE 1 the ceiling member shown at 24 may be a plaster ceiling, a concrete slab, a rafter, a joist or anything else of a structural character or forming a permanent part of the building and to which wires, cables or rods 27 can be attached.

Secured to the tops of longitudinal members 11, as by means of screws 28, are lamp support pedestals 29, each having an upright portion 30, a horizontal base 31 and a horizontal top portion or platform 33. As will be seen, each of the pedestals 29 is preferably constructed in two mating parts so that their half round tubular portions 32 will form a tubular passageway for wiring. Supported on each of the platforms 33 are a pair of socket members 34 to which tubular lamps 35 are attached.
It will be seen that, by this means, the illuminating means (the tubular lamps 35) are supported by the longitudinal members 11 which in turn are suspended from the permanent ceiling structure 24.

The cross members 12 are preferably in the form of T-bars as shown, each comprising an upright vertical portion 36 and a pair of outwardly projecting, horizontal coplanar flanges 37. A connector member is provided for connecting each end of each T-bar 12 to a longitudinal member 11, each such connector member having a head portion 38 which is received in the adjacent vertically aligned guideways 14, and a body portion terminating in a tip 39 which extends through a slot in the adjacent end of each T-bar 12. Details regarding the construction and operation of the connector members will be found in our Patent No. 2,888,113. Suffice it to say that other connection means may be employed insofar as the present invention is concerned, but that shown is preferred because, among other things, it permits connection to T-bars 12 to longitudinal members 11 at any point and it permits moving the connected T-bars lengthwise of the longitudinal members 11 to any point desired. As explained in our Patent No. 2,888,113, the head portions 38 of the connector members are rounded at diagonally opposite corners so that, by rotating them, they can be detached and inserted in the guideways 14.

Light diffusing panels are shown at 40 which may be in the form of glass or plastic construction. They act to diffuse light from the tubular lamps 35 to provide a more diffused and more nearly homogeneous ceiling illumination. The panels 40 are supported by the flanges 37 of the T-bars 12 and also by the clips 9 on flanges 15 of the longitudinal members 11. In connection with FIGURE 1 and elsewhere herein, where a light-transmitting panel or lens is shown or described, it will be understood that various types of light-transmitting members may be used. For example, clear, transparent glass or plastic may be used, which may transmit light without modifying it. However, light-modifying panels and lenses are preferred, such as translucent glass or plastic, prismatic glass or plastic, egg crate or cellular louvres, etc., all of which have the effect of diffusing and softening light and which are referred to collectively herein as "light-modifying" members. It will also be understood that members of these light-transmitting members act also as reflectors, and as will become apparent in some embodiments of the invention their light reflective quality may be of substantial importance.

The electrical system for the tubular lamps (e.g., fluorescent lamps) such as shown at 35 requires cross connections between the longitudinal members 11, which may be provided in the form of connector boxes 45 and pipes or tubes 46. Ballast are also provided as shown at 47 for the lighting system.

It will be apparent that the embodiment of the invention shown in FIGURE 1 provides a combined, unitary, integrated lighting and ceiling system which is suspended as a unit from a permanent roof structure such as that shown at 24 and which has several important advantages among which are the following:

- The ceiling provides diffused ceiling illumination by reason of the fact that the tubular lamps 35 are supported above a translucent ceiling. The entire structure can be suspended by the same means (the hanger members 25, bolts 26 and wires, cables or rods 27) from a permanent ceiling and at any height desired. It is not necessary to suspend or support the lamps and their fixtures by one means and separate ceiling by another means nor is it necessary to hang the ceiling from the lamp fixtures.

- The lamps 35 can be spaced apart independently of the module of the framework formed by the members 11 and 12, and the height of the lamps above the panels 40 can be adjusted at will by appropriate selection of the pedestals 29. The system 10 can be suspended at any distance desired beneath the permanent ceiling 24.

The lamps 35 are shown transverse to the longitudinal members 11, which has as an advantage that the lamps can be spaced apart independently of the spacing of the frame members 11. However, as noted, this requires cross wiring means such as shown at 45, 46. In another embodiment of the invention illustrated in FIG. 1A and which is suggested in both our aforesaid Patents Nos. 2,888,113 and 3,083,152, the pedestals therein designated 29a can be turned 90° from the position of the corresponding prior described pedestals 29, by the platforms 33a thereof lengthened so that they overhand the longitudinal members supporting the same substantially to provide outrigger arms, and the sockets 34a turned 90° thereby to support the lamps 35 parallel to the longitudinal members 11 but spaced outwardly so as to reduce shadow effects. This embodiment simplifies wiring in that the cross wiring means 45, 46 is eliminated, but it does make the lamp spacing dependent upon the spacing of the longitudinal members 11.

Referring now to FIGURE 2, another form of lighting system is there shown which is generally designated by the reference numeral 60. It comprises longitudinal members 61 to which are connected cross members in the form of T-bars 12 which are identical with the T-bars similarly numbered in FIGURE 1 and which are connected to the longitudinal members by similar means. Each of the longitudinal members 61 comprises a raceway channel 62 having a function similar to the raceway channel 11e in FIGURE 1 (i.e., for wiring) although it is shaped somewhat differently. It is equipped with cover plates 63. The longitudinal members 61 also provide a troffer or light reflector in the form of arcuate wings 64, one on each side of the channel member 62 and extending outwardly and downwardly. The two wings 64, together with the closed bottom of the channel 61 provide a downwardly opening, upwardly closed light reflector and recess for tubular lamps.

Supported on the longitudinal member 61 by pedestals 29 are tubular lamps 35 as in the case of FIGURE 1. The suspension means is also identical with that in FIGURE 1, comprising hanger members such as shown at 25, bolts 26 and cables 27 suspended from a permanent ceiling (not shown). Translucent light diffusing panels 67 are provided which are shown as being double thickness plastic members whose walls 68 are spaced apart and whose edge portions 69 rest upon the flanges 37 of the T-bars 12 and flanges 69a of the longitudinal members 61. (As noted above, other types of light transmitting, preferably light modifying members, e.g., louvres may be used.)

Associated with each of the longitudinal members 61 is a light diffusing structure generally designated by the reference numeral 70 which has grooved mounting portions 71 mating with complementary tongues 72 formed on the longitudinal member 61. A tongue and groove connection is thus provided. Further details of this construction will be found in our aforesaid Patent No. 2,956,150. Further description thereof is unnecessary for purposes of understanding the present invention. Also shown in FIGURE 2 is a T-shaped socket support bracket 73 to which sockets 74 are attached. Tubular lamps 75 are supported by and electrically connected to the sockets 74.

Cross wiring conduits are provided one of which is shown at 76 and it comprises a channel member 77 and a cover portion 78.

In certain means, not shown in FIGURE 2 and other figures herein, it will be understood that a modular, grid-like framework is provided in which longitudinal and cross members, lamps, panels, etc. are repeated. For simplicity and brevity such repetition is not shown or is condensed in the various drawings.

It will be seen that the system shown in FIGURE 2 is generally similar to that shown in FIGURE 1. That is
to say, it is an integrated ceiling and lighting system all suspended as one unit from a permanent ceiling and having the feature of a luminous ceiling. However, it has the added feature of tubular lamps at the ceiling level which provide rows or bands of more intense illumination. In such a system a more diffused, less intense illumination is provided by the above ceiling lamps 35 and their diffusers 67; a more intense, less diffused band type of illumination is provided by the ceiling level lamps 75 and their lenses 70; and the two systems of lighting can be operated separately or they can be operated together to energize both circuits.

As in the case of FIGURE 1, the lamps 35 may be supported in parallelism to the longitudinal members 11.

Referring to FIGURE 3, a further embodiment of the invention is there shown which is generally designated by the reference numeral 80. It comprises longitudinal members 11 suspended from a permanent ceiling structure (not shown) by the same means as in FIGURES 1 and 2 (i.e., by hanger members 25, wires, cables or rods 26, etc.). Cross members are provided in the form of T-bars 12 similar to the T-bars 12 shown in FIGURES 1 and 2 and similarly connected to the sides of the longitudinal members 11. In this instance, however, the ceiling is intended to be an acoustical ceiling. To this end acoustical (i.e., sound-absorbing) panels 81 are provided which may be supported by resting on the flanges 37 and 15 but preferably they are slotted so as to provide a tongue and groove connection. Cross wiring conduits are provided at 92. The acoustical ceiling 81 also functions as a light reflecting ceiling. If only light reflection is desired the panels 81 can be replaced by nonacoustical, light-reflecting material.

A further feature of the system shown in FIGURE 3 comprises an egg-crate or open louver type of light diffuser shown at 83 which is suspended from the longitudinal members 11, as by means of hangers 84 and rods 85. The rods 85 are welded or otherwise suitably secured to the louvre and the hangers 84 and attached to the flanges 15 of the longitudinal members 11. Also shown are mounting brackets 86 bolted to the undersurfaces of the longitudinal members 11, such mounting brackets 86 being similar to the pedestals 29 shown in FIGURES 1 and 2 but modified for a suspension type of support rather than a pedestal type of support. To each of the brackets 86 is attached a socket 87 to which a tubular lamp 88 is connected. An upwardly concave, downwardly convex light diffusing lens 89 is provided for each of the lamps 88. Each of the lenses 89 is supported by clips 96 which are attached to the brackets 86.

Further description of the lenses 89 is unnecessary herein except to note that they are preferably tapered in cross section so that they are thickest along their longitudinal axes in registry with the lamps 88 and are progressively thinner toward their edges, whereby a more even and diffused type of illumination is provided. Further details concerning this and related features will be found in our aforesaid Patent No. 2,956,150.

In the system illustrated in FIGURE 3 the auxiliary and/or light reflecting ceiling is provided by reason of the acoustical tiles or panels 81; a light diffusing ceiling is provided by virtue of the louver 83 assisted and augmented by the lenses 89; and the entire assembly, as in the case of the systems of FIGURES 1 and 2, is suspended as a unit from the permanent ceiling framework. In this case an integrated acoustical-light reflecting ceiling is suspended as a unit with the lamp spacing and ceiling panels independent of each other. The lenses and lamps create a luminous indirect lighting effect.

Referring now to FIGURE 4 a further modification of the invention is there shown comprising an integrated ceiling and lighting system generally indicated by the reference numeral 109 and which comprises longitudinal members 11 similar to those in FIGURES 1 and 3 and which are suspended from a permanent ceiling structure (not shown) by similar means, i.e., hanger members 25, bolts 26 and wires, cables or rods 37. Tubular lamps 88 are suspended beneath and from the longitudinal members 11 as in the case of FIGURE 3. (They are shown in transverse relation to members 11, but may be parallel as described hereinafore.) In this instance a ceiling framework 101 is also provided which is suspended from the longitudinal members by means of hanger members 102 and rods 103 which are secured by any suitable means such as threading to the longitudinal members 104 of the ceiling framework 101. Each of the longitudinal members 104 has in general the shape of an I-beam and it comprises vertically aligned guideways 105 which are similar to and have a function similar to the vertically aligned guideways 14 of the longitudinal members 11 shown in FIGURES 1 and 3. Also, each of the longitudinal members 104 has on opposite sides outwardly projecting coplanar flanges 106 which cooperate with the flanges 37 of the T-bars 12 to provide panel support means. The means connecting the ends of T-bars 12 to the longitudinal members 104 is the same as that shown in FIGURES 1, 2 and 3. It will be seen that the framework 101 provides a grid in which the panel supporting flanges 106 and 37 support light diffusing panels 107. The latter may be of any desirable type but they are preferably double thickness, plastic panels like those shown at 67 in FIGURE 2.

The system shown in FIGURE 4 has in common with the system shown in FIGURES 1, 2 and 3, the advantages of being an integrated unitary ceiling and lighting system all suspended as one unit from a permanent ceiling structure. It can provide acoustical qualities insomuch as the hollow, double thickness light diffusing panels 107 function as acoustical members. The ceiling is a luminous ceiling providing a uniform ceiling illumination.

Referring now to FIGURE 8, yet another embodiment of the invention is there illustrated which is generally designated by the reference numeral 120. In this embodiment longitudinal members 11 are provided as in FIGURES 1, 3 and 4 to which are connected cross members in the form of T-bars 12 as in the case of FIGURES 1, 3 and 4. The longitudinal members 11 are suspended in like manner from a permanent ceiling structure (not shown). The coplanar supporting flanges 15 and 37 support light transmitting members such as the louver shown at 121. Alternatively, plastic light diffusers may be employed or other suitable light-transmitting means. It will be observed that, at intervals, adjacent members 12 are located more closely together so as to provide a support for a light diffusing member such as the louver shown at 122. This may be a translucent glass lens or diffuser or a plastic lens or diffuser. If desired, a lens such as that shown at 70 in FIGURE 2 may be employed in which case the grooved connectors 71 will mate with the inwardly directed flanges 37 of the respective T-bars 12. Or a tapered lens such as shown at 89 in FIGURE 3 may be used. As will also be observed, sockets 123 are attached to the side walls of the longitudinal members 11 to which tubular lamps 124 are connected above the light diffusing members 122. Each lamp is centered in relation to its lens 122.

Referring now to FIGURE 9, the ceiling and lighting system 120 shown in FIGURE 8 is shown suspended from a permanent ceiling structure which in this instance is preferably flat and uniform for purposes of uniform light reflection. As will be seen a portion of the light from the tubular lamps 124 provides direct illumination downwardly through the lenses 123. Another portion of the light radiating from the lamps 124 is upwardly directed and it is reflected off the ceiling structure 24 and down through the light diffusing panels 121.

It will be apparent that the embodiment of the invention shown in FIGURES 8 and 9 provides objects which are common to other embodiments of the invention herein illustrated and described, that is to say, it provides an
integrated, unitary lighting and ceiling system all suspended as a single unit from a permanent ceiling or roof structure. But in this instance all of the illumination originates with lamps which are in the same plane as the framework of the ceiling, thereby leading to simplification.

Referring now to FIGURE 5, as noted above, it is frequently necessary to provide conduits for cross connecting electric wires. Particularly between the raceways 11a of the longitudinal members 11. In FIGURE 5 there is illustrated a means whereby such cross conduits for cross wiring are provided and are combined with cross members of the framework. As will be seen, T-bars 131 are provided having an upright plate portion 132 of relatively great height as compared to the T-bars 12 shown in FIGURES 1 to 4 and described hereinafore. Bottom panel-supporting flanges 130 are provided which cooperate with the flanges 15 of the longitudinal members 11 to support panels as described hereinafore.

Each of the cross members or T-bars 131 is of integral extruded construction and includes at the top a channel member 133 integral with the upright plate portion 132. Guide ways are provided at 132a to connect with T-bars (not shown) extending between the T-bars 131, as in our co pending application Serial No. 590,012, filed June 7, 1956, entitled "Ceiling Framework." Connector means is provided to connect the ends of cross members 131 to the longitudinal members 11, such connector means being the same as shown in FIGURES 1 to 4. A top cover 134 is provided which is snapped into the grooved side walls of the channel and which has side wall portions 135 for bridging the open top of the channels 11a.

It will be apparent that, by this means, a simplified, unitary, integral means is provided for providing cross members of the framework and cross conduits for the necessary cross wiring of the lighting system.

Referring now to FIGURE 6 another type of cross conduit construction is there shown comprising channel members 142. The ends of the channel members 142 are connected to the longitudinal members 11 by means including L-shaped brackets 143 each of which is fixed to the bottom surface of the respective channel 142 by means of a screw or rivet 144, and a clip 145. Each of the clips 145 has an upper lip 146 which grips the upper surface of the bottom of the channel 142 and it also has a lower lip 147 which is received in a groove 148 formed in the adjacent side wall of the channel 11a of longitudinal member 11. (It will be seen that the upper edge of each side wall of the channel or raceway 11a is formed with a pair of grooves 148 and 149. The upper groove 149 serves to hold and to provide a snap connection with the cover portion.) A cover is provided for each aligned pair of channels 142 in the form of a member 155 the edges of which at 156 are adapted to snap over the outwardly tapering edges of the channels 142. A bridging portion 157 is provided which is secured to the cover 155 as by means of rivets 159.

Referring to FIGURE 7, an end of the cover member 155 is there shown which is provided with an end flap 159.

The constructions shown in FIGURES 5, 6 and 7 provide convenient means for cross wiring of a tubular lighting system. Among their advantages may be mentioned the following: The forms shown in FIGURES 5 and 6 provide additional strength and rigidity to the ceiling framework, particularly in the form shown in FIGURE 5. In addition it will be apparent that the cross wiring can be connected at any point desired and, having been connected, it can be easily moved along the longitudinal members to any desired position. It is a very important advantage of the structure shown in FIGURE 5, that it combines into one integral extruded structure both a frame member for structural strength and a cross channel for cross wiring.

It will, therefore, be apparent that a combined, integrated lighting and ceiling system has been provided which provides a ceiling illuminating system with or without an acoustical means, such being all suspended as a single unit from a permanent ceiling or roof structure and being efficient from the standpoint of illumination and, in the acoustical variants, being also efficient for acoustical purposes.

We claim:
1. A luminous ceiling comprising a framework formed by spaced, parallel longitudinal members and cross members extending between and attached to said longitudinal members to form a substantially planar, grid-like structure, said longitudinal and cross members being provided with panel support means to support ceiling panels substantially in the plane of said grid-like structure; light transmitting ceiling panels engaging on and being supported by said panel support means; means directly suspending said frame work from a permanent ceiling; tubular lamps disposed intermediate said permanent ceiling and said ceiling panels in position to illuminate substantially the entire expanse of said ceiling panels by passage of light through said panels; means carried by said framework disposed above the ceiling panels and providing the sole supporting means for said lamps; and at least certain of said frame members and said lamp supporting means forming conduit means having wiring therein electrically connected to the terminals of said tubular lamps.
2. The luminous ceiling of claim 1 wherein said lamp supporting means support said tubular lamps above the level of said framework.
3. The lighting and ceiling system of claim 2 wherein said lamp supporting means further support said tubular lamps in spaced, parallel relation with respect to the longitudinal members.
4. The luminous ceiling of claim 2 wherein said lamp supporting means support said tubular lamps substantially in the plane of said framework.
5. The luminous ceiling of claim 1 wherein said lamp supporting means support said lamps above the longitudinal members of the framework; and wherein at least certain of said longitudinal members are in the form of downwardly directed light reflectors, and additional tubular lamps are supported in said light reflectors and extend lengthwise thereof thereby to provide direct downward illumination in the form of bands of illumination which extend between the adjacent panels which are supported by said certain longitudinal members.

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