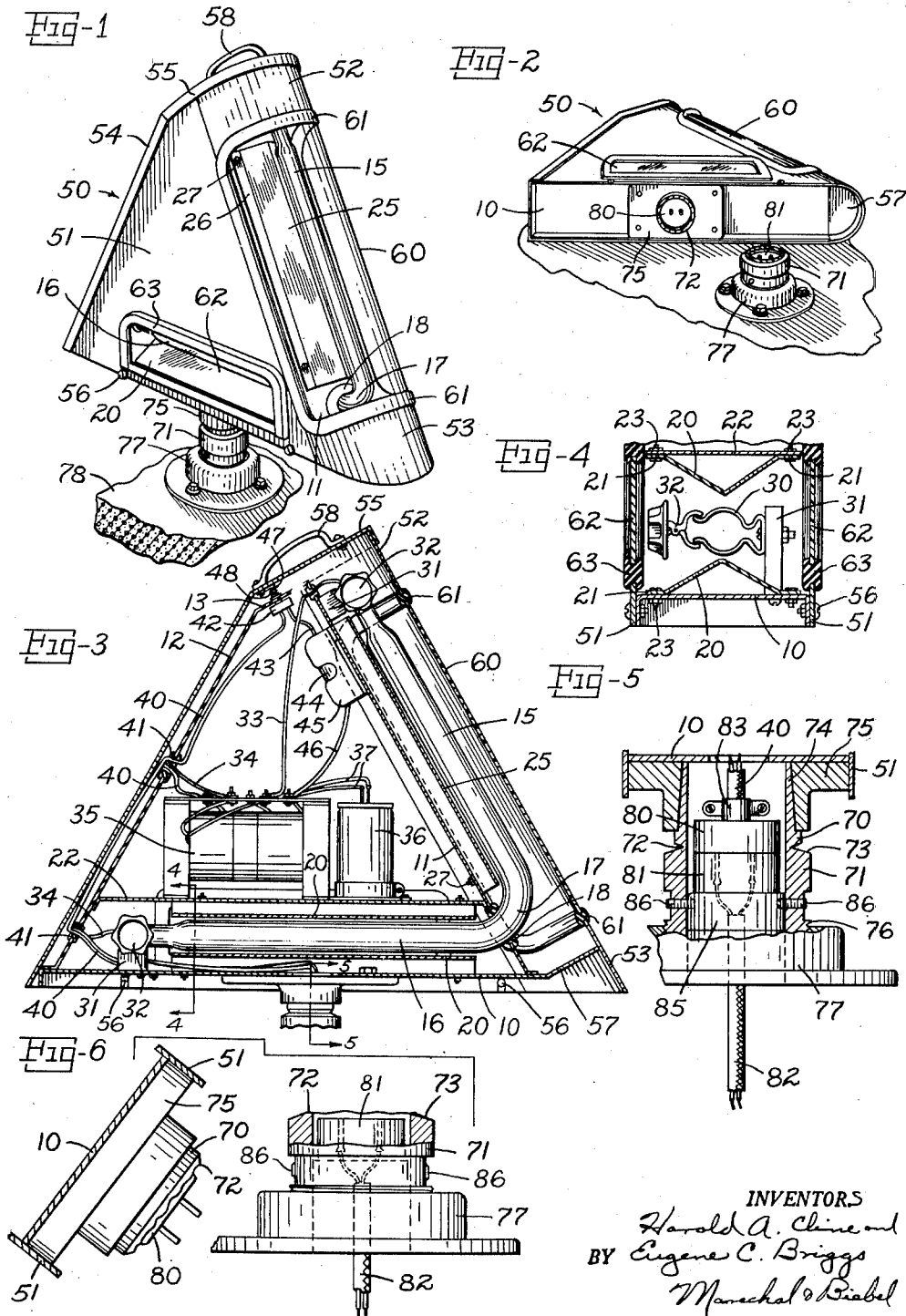


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H. A. CLINE ET AL
AIRPORT LIGHTING DEVICE

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AIRPORT LIGHTING DEVICE

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This invention relates to airport lighting, and more particularly to a lighting device adapted for use in marking paths such as taxi strips on an airplane landing field.

One of the principal objects of the invention is to provide a lighting device adapted for use in marking taxi strips at an airport which is simple but strong and reliable in construction, efficient in operation, and which will afford a clear and distinctive marking signal effective to designate a desired path and visible over a wide angular range along the path.

Another object is to provide such a marking light which is adapted to be positioned substantially above the plane of the landing field for clear visibility but which also is so constructed as to minimize the possibility of damage to an airplane coming in contact therewith.

An additional object is to provide such a marking light which is so constructed as to be readily knocked down if struck by a moving airplane without injury to the plane and also without injury to the device itself.

A further object is to provide an airport marking light having a readily fracturable support which is constructed for readily detachable connection to the light and to a fixed supporting base and which can thus be quickly and easily removed and replaced in the event of fracture as a result of contact with the light by a moving airplane.

Other objects and advantages will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings—

Fig. 1 is a view in perspective of a marker light for an airport taxi path constructed in accordance with the invention;

Fig. 2 is a view in perspective showing the light of Fig. 1 knocked down and broken off from its support as by being struck by a moving airplane;

Fig. 3 is a view in vertical longitudinal section through the marker light of Fig. 1;

Fig. 4 is a fragmentary view taken in section substantially on the line 4-4 of Fig. 3, with the gas-discharge tube removed;

Fig. 5 is an enlarged sectional view through the fracturable support of the light of Fig. 1, the view being taken approximately as indicated by the line 5-5 of Fig. 3; and

Fig. 6 is a view similar to Fig. 5 but illustrating the fracturable support in fractured condition.

Referring to the drawing, which illustrates a preferred embodiment of the present invention, and more particularly to Figs. 1 to 4, the frame of

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the light is generally triangular in outline, and it includes a base panel 10 of sheet steel and an upper portion formed of a strip of sheet steel bent to provide an inclined front panel 11, an inclined back panel 12 and a short top panel 13. The lower ends of the front and back panels 11 and 12 are secured as by bolting or welding to the base panel 10. An elongated light source is mounted in the frame and is shown as formed by a gas-discharge tube bent back on itself at an acute angle, for example 60°, to provide an upper portion 15 and a lower portion 16 together defining a common plane substantially perpendicular to the base panel 10. As shown in Fig. 3, the front panel 11 and base panel 10 together form substantially the same angle as the two tube portions 15 and 16, and each tube portion is accordingly substantially parallel to its adjacent frame panel. The bent middle portion 17 of the tube is supported in a hole adjacent the lower end of front panel 11, a suitable grommet or washer 18 being provided for cushioning purposes as shown in Fig. 3.

Reflectors are provided for directing light emanating from the tube portions 15 and 16 laterally of the plane defined thereby on both sides of the frame. Referring particularly to Figs. 3 and 4, there are two reflectors 20 for the lower tube portion 16, each formed of a strip of aluminum or other suitable sheet metal having a V configuration in cross section. The upper reflector 20 has its outer edges 21 flanged and bolted or otherwise secured at 23 to a shelf portion 22 of the frame formed by a strip of sheet metal positioned above base panel 10 and welded or otherwise secured at its opposite ends to the front panel 11 and back panel 12. The lower reflector 20 is inverted with respect to the upper reflector, and its outer edges 21 are bolted or otherwise secured at 23 to the base panel 10. As shown in Fig. 4, the central edges of the two reflectors 20 are positioned just above and below, respectively, the tube portion 16, and their surfaces adjacent the tube slope away therefrom at angles such that substantially all light emanating from the tube is reflected outwardly on both sides of the frame. Suitable results with respect to such directing of the light have been obtained with the sides of the reflectors 20 forming angles of the order of 30° with the horizontal.

A similar reflector 25 is provided between the tube portion 15 and the front panel 11, this reflector having similarly flanged side edges 26 bolted at 27 to the front panel 11 of the frame, as shown in Figs. 1 and 3, and having its upper

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surfaces similarly inclined at angles of the order of 30° to the surface of front panel 11. The reflector 25 thus acts to reflect light from the tube portion 15 not only laterally on both sides of the frame but also upwardly and forwardly in accordance with the angular inclination of both front panel 11 and the sides of reflector 25.

Referring to Figs. 3 and 4, each end of tube 15—16 is mounted in a suitable supporting clip 30 carried by a holder 31 of insulating material bolted or otherwise secured to front panel 11 and base panel 10, respectively. A pair of clip clamps 32 in turn provide for making the desired electric connections to clips 30 and thus to the terminals at each end of the tube. Referring to Fig. 3, wires 33 and 34 connect the clips 32 at each end of tube 15—16 with the proper terminals of a transformer 35, which is carried by the shelf portion 22 of the frame. Shelf 22 also supports a power factor correction condenser 36 for tube 15—16, which is positioned adjacent transformer 35 and connected thereto at 37 as indicated in Fig. 3.

Electric current is brought in to the transformer and tube by a pair of wires 40, which are supported in the frame by being threaded through holes in back panel 12 provided with suitable grommets 41. One of wires 40 is connected to transformer 35 and the other to one terminal of a switch 42 mounted on the under surface of top frame panel 13. A wire 43 leads from switch 42 to one terminal of a fuse 44 mounted in a clip or bracket 45 bolted or otherwise secured to the undersurface of front panel 11, and another wire 46 connects the other terminal of fuse 44 to transformer 35 to complete the operating circuit for the tube. The operating pin 47 for switch 42 extends through top frame panel 13, as shown in Fig. 3, and is provided with a spring 48 acting to hold it normally in position to open the contacts of the switch.

A cover or housing 50 is provided for enclosing the frame and the tube 15—16. Referring particularly to Figs. 1, 3 and 4, the housing 50 includes side panels 51 formed of a suitable sheet metal and front portions 52 and 53 curved generally concentrically about the axis of tube portion 15. Another sheet of metal forms the back 54 and top 55 of the housing and is welded or otherwise secured to the side portions 51 and front portion 52. In order to provide adequate protection for the frame and tube if the light is struck by a moving airplane or other vehicle, it is desirable to form this housing of relatively strong and rigid material. For example, the side panels 51 and the back and top strip 54—55 may be formed of 20-gage chrome steel, and the front portions 52 and 53 may be formed of 16-gage chrome steel and welded to the side panels and top part 55. With the housing constructed as thus described and shown, and with the frame panels similarly formed of strong sheet metal, the housing and frame thus cooperate to protect the tube 15—16 and other electrical parts against injury if the device is struck by an airplane while in use.

In assembling the housing over the frame and tube, the lower edges of the housing fit firmly over the flanged side edges of the base panel 10 and are bolted thereto as indicated at 56. Also, the base panel 10 is bent upwardly at the front of the frame to form a semicircular bracket portion 57 formed for close engagement with the inner curved surface of the front of the housing, the angle between this bracket portion and the

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remainder of base panel 10 being such that the bracket portion 57 will be substantially perpendicular to the axis of curvature of the front of the housing as shown in Fig. 3. The top 55 of the housing is arranged at such angle as to be substantially parallel to the top panel 13 of the frame, as shown in Fig. 3, and thus to engage and depress the switch pin 47 against its spring 48 to a position closing the contacts of switch 42. Thus when the housing 50 is in place enclosing the frame, the circuit through the tube will be closed, but the circuit will open when the housing is removed, as for servicing the device. A handle 58 may be bolted or otherwise secured to the top 55 for ready manipulation of the housing.

The housing 50 is provided with light transmitting windows overlying the tube portions 15 and 16 and arranged to transmit the light from these tube portions and reflected by the reflectors 23 and 25. As shown, one window 60 is formed of a sheet of suitably strong transparent material which will not splinter if broken, such as tempered glass, methyl methacrylate or other safety glass material curved substantially concentrically with the tube portion 15. The front of the housing 50 is cut away to receive this window, which is mounted therein by means of a channel 61 of rubber or other suitable material as best seen in Fig. 3. This window 60 extends at either side of the housing substantially to the lower level of the reflector 25 and thus provides for transmitting substantially all of the light emitted from the tube portion 15. Windows 62 of similar transparent material are provided at either side of the housing and are arranged in line with the tube portion 16. Each of these windows 62 is generally oblong in shape, and each is similarly mounted in a suitable hole in the side 51 of the housing by means of a rubber channel 63 as shown in Fig. 4. Each of these windows 62 thus serves to transmit laterally of the housing the light emanating from the tube portion 16 and reflected by the two reflectors 20.

A support is provided for mounting the light with the tube portions 15 and 16 and the windows 60 and 62 in marking relation to an airport path, and this support includes a readily fracturable joint such that it will be fractured if the upper part of the light is struck by a moving airplane, thus avoiding damage both to the plane and to the upper part of the light itself. Referring particularly to Figs. 3, 5 and 6 the fracturable joint includes an upper portion 70, a lower portion 71 and an intermediate connecting portion 72 formed by a relatively deep peripheral groove 73 in the outer surface of the joint. The upper end 74 of the upper joint portion 70 is tapered and telescopes into a complementary socket portion of a plate 75 bolted or otherwise secured to the base panel 10 of the light frame. The lower end 76 of the lower joint portion 71 is threaded for mounting in a support such as a standard pipe flange 77, which may be bolted or otherwise secured to a fixed base such as a cement block 78 as indicated in Fig. 1.

The groove 73 in the fracturable joint is formed to a depth such that the intermediate joint portion 72 will be of substantially lesser strength than the upper and lower joint portions 70 and 71, so that when a bending moment is applied to the joint it will readily break at this portion 72. Also, the joint is made of a less strong material than housing 50 and the frame, such as aluminum, so that its intermediate portion 72 is of lesser strength than the housing 50, with the

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result that if the housing is struck in use by a moving airplane, the joint will break and thus permit the housing and light to fall free. This is shown in Fig. 2, which illustrates the light as having been struck in such manner as to break off at the joint portion 72, while the remainder of the light merely falls to the ground and thus will not cause damage to the airplane striking it, nor will it be likely to be damaged thereby itself. It will also be understood, as already pointed out, that the panels of the frame reinforce the housing against damage from an external blow and thus facilitate transmission of the force of such blow to the fracturable portion of the joint rather than absorbing this force within the light structure itself.

The fracturable support also carries the electrical connections to an outside source of operating current for the transformer 35 and the tube 15-16. Referring to Figs. 5 and 6, these electrical connections are provided by complementary plug and socket members 80 and 81, respectively, the plug 80 receiving the lower end of the wires 40 and the socket 81 having a cable 82 leading therefrom to an outside source of current. As shown in Fig. 5, the plug 80 is mounted within the upper joint portion 70, and the socket 81 is secured within the lower joint portion 71, the socket including a collar 85 which is removably secured within this portion of the joint by means of a set screw 86. A screw clamp 83 is mounted on the wires 40 adjacent to the plug 80 to reinforce the interconnection of the plug 80 and the wires 40.

With this construction, when the light is struck and knocked down as illustrated in Fig. 2, the plug 80 and socket 81 will automatically be disengaged as shown in Fig. 6, thus avoiding injury to the electrical connections and similarly avoiding exposed wire ends causing danger of either short circuiting or shock to anyone repairing the broken support. Thus when the joint is broken as indicated in Fig. 6, it may very quickly be replaced and the light again be set up by simply releasing the plug and socket from the broken parts of the joint and removing these broken joint parts, mounting a new joint on the supporting base and securing the socket therein, and then connecting the plug to the socket and erecting the light again by fitting the socket portion of its base plate 75 down over the tapered upper end 74 of the new joint.

In use, a plurality of these marker lights may be mounted along an airplane path with the lower tube portion 16 of each light horizontal and substantially perpendicular to the length of the path and with the tube portion 15 and window 60 facing the path. With this arrangement, the light will form a distinctive signal having at a distance the appearance of an arrow head pointing toward the path, and this signal will be visible for a substantial range along the path. Thus with the lights arranged in pairs on opposite sides of a path, the resulting arrow-like signals will appear to point toward the proper direction to be followed by a taxiing airplane and will clearly and distinctively guide a pilot along the proper path. Highly satisfactory results have been obtained with the lights arranged in this manner and utilizing a gas-discharge tube giving light of predominantly blue, amber or other distinctive color. In this way, substantially all the emitted light can be utilized for marking purposes, instead of employing a colored filter and

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a source of white light, with the resulting loss of light by absorption in the filter.

It will also be seen that the lights of the invention can be mounted an appreciable distance above the plane of the field, in position to be readily visible from the pilot's seat even after the tail of the plane is on the ground with the usual difficulty in vision with respect to ground objects closely in front of the plane. Furthermore, the interior construction of the light as described is such as to minimize the possibility of damage to the light itself as a result of being thus struck and knocked down, and the light may be quickly and easily set up again with relatively little effort and with the only new part needed being the simple and easily replaced fracturable joint which mounts the light above its permanent supporting base.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention and the purview of the appended claims.

What is claimed is:

1. A marker lighting unit of the character described comprising a frame, means supported by said frame forming an elongated light source including two relatively inclined portions together defining an acute angle, means for supporting said frame with one of said light source portions lying in a substantially horizontal plane and with the other of said light source portions inclined upwardly with respect to said first named light source portion, a housing for said frame and light source, means forming a window in said housing overlying said inclined light source portion and in position to transmit light therefrom over a substantial angular range forwardly of said unit, and means forming an additional window in the side of said housing arranged to transmit light from the other of said light source portions laterally of said unit.

2. A marker lighting unit of the character described comprising a frame having a generally triangular outline, means forming an elongated light source including two portions inclined with respect to each other at an acute angle and together defining a common plane, means for mounting said light source portions in said frame with each said portion substantially parallel to one side of said triangular outline, means for supporting said frame with said plane substantially vertical, a housing for said frame and light source, means forming windows in said housing in position to transmit light from said light source portions forwardly and laterally of said unit and at both sides thereof, and reflector means arranged to project light from said light source laterally of said frame and through said light transmitting portions of said housing.

3. A marker lighting unit of the character described comprising a base, a frame supported on said base, means supported by said frame forming an elongated light source including a portion substantially parallel to said base and another portion positioned at the front of said frame and inclined upwardly at an acute angle to said first named portion, a housing enclosing said frame and light source, means forming a window at the front of said housing overlying said inclined light source portion and in position to transmit light therefrom forwardly and laterally over a substantial angular range, means forming additional

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windows in each side of said housing in position to transmit light from said first named light source portion at both sides of said unit, and reflectors supported by said frame in position to direct light from said light source portions through said windows.

4. A marker lighting unit of the character described comprising a plurality of panels of sheet material arranged to form a generally triangular frame of substantially greater height and length than width, means for securing said panels together with each said panel substantially perpendicular to a plane defined by the height and length of said frame, means forming an elongated light source including two portions inclined at an acute angle to each other, means for supporting said light source in said frame with each said portion thereof substantially parallel to one of said panels, a housing of substantially the same general shape as said frame adapted to enclose said frame and light source with said panels cooperating to brace said housing against inward deflection, and means forming windows in said housing arranged to transmit light from said light source laterally at both sides of said housing and forwardly from said housing.

5. A marker lighting unit of the character described comprising a base, a frame supported on said base and including front and rear panels inclined upwardly from said base and inwardly toward each other, a shelf secured to said front and rear panels in upwardly spaced relation with said base, a gas-discharge tube supported by said frame and including a portion substantially parallel to said base and a portion at the front of said frame inclined at an angle to said base and substantially parallel to said front frame panel, a transformer and a condenser for said tube mounted on said shelf, a housing enclosing said frame and tube, means forming a window at the front of said housing overlying said inclined tube portion and in position to transmit light therefrom over a substantial angular range, means forming additional windows at either side of said housing in position to transmit light from said first named tube portion laterally on both sides of said unit, a reflector having in cross-section an inverted V configuration mounted on said base in position to reflect light from said first named tube portion through said side windows of said housing, and a similar reflector secured to said front panel in position to reflect light from said inclined tube portion through said front window.

6. A marker lighting unit of the character described comprising a frame, means supported by said frame forming an elongated light source including two relatively inclined portions together defining an acute angle, means for supporting said frame with one of said light source portions lying in a substantially horizontal plane and with the other of said light source portions inclined upwardly with respect to said first named light source portion, means for supporting said frame in marking relation to an airport path, said supporting means including a portion adapted for ready fracture if said unit is struck by a moving airplane, a housing for said frame and light source, means forming a window in said housing overlying said inclined light source portion and in position to transmit light therefrom over a substantial angular range forwardly of said unit, and means forming an additional window in the side of said housing arranged to transmit light from the other of said light source portions laterally of said unit.

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7. A marker lighting unit of the character described comprising a base, a frame supported on said base and including front and rear panels inclined upwardly from said base and inwardly toward each other, a shelf secured to said front and rear panels in upwardly spaced relation with said base, a gas-discharge tube supported by said frame and including a portion substantially parallel to said base and a portion at the front of said frame inclined at an angle to said base and substantially parallel to said front frame panel, a transformer and a condenser for said tube mounted on said shelf, a housing enclosing said frame and tube, means forming a window at the front of said housing overlying said inclined tube portion, means forming windows at either side of said housing in position to transmit light from said first named tube portion laterally of said unit, a reflector having in cross-section an inverted V configuration mounted on said base in position to reflect light from said first named tube portion through said side windows of said housing, a similar reflector secured to said front panel in position to reflect light from said inclined tube portion through said front window, means for supporting said light in marking relation to an airport path, said supporting means including a readily fracturable portion adapted to be broken off if said housing is struck by a moving airplane, and means in said supporting means for connecting said tube and transformer to a source of operating current, said connecting means including relatively detachable complementary connector members arranged to be automatically disconnected from each other in the event of fracture of said supporting means.

8. A marker lighting unit of the character described comprising a base, a frame supported on said base and including front and rear panels inclined upwardly from said base and inwardly toward each other, a shelf secured to said front and rear panels in upwardly spaced relation with said base, a gas-discharge tube supported by said frame and including a portion adjacent said base and a portion at the front of said frame inclined at an angle to said base and adjacent said front frame panel, a transformer and a condenser for said tube mounted on said shelf, a housing enclosing said frame and tube, means forming windows in said housing arranged to transmit light emanating from said tube forwardly and laterally on both sides of said unit, a tubular member for supporting said unit in marking relation to an airport path, said tubular member including upper and lower portions and an intermediate portion of substantially weaker construction than said upper and lower portions for ready fracture upon the application of a bending moment, means for conducting electric current to said light source including cooperating plug and socket members, means for securing said plug member in said upper tubular member portion, and means for securing said socket member in said lower tubular member portion to provide for ready separation of said plug and socket upon fracture of said tubular member at said intermediate portion thereof.

9. A marker lighting unit for airport runways, and the like, said unit comprising a frame having a front and bottom portion, a gas-discharge tube mounted on and supported by said frame, said tube comprising one portion extending upwardly adjacent said front of said frame and another portion extending rearwardly therefrom, a housing enclosing said frame and tube, means

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forming windows in said housing arranged to transmit light emanating from said other portion of said tube laterally on both sides of said unit, and means forming a window in said housing disposed in front of and at the sides of said one portion of said tube for transmitting light emanating from said one portion of said tube forwardly and laterally of said unit.

10. A marker lighting unit for airport runways, and the like, said unit comprising a frame having a front and bottom portion, a gas-discharge tube mounted on and supported by said frame, said tube comprising one portion extending upwardly adjacent said front of said frame and another portion extending rearwardly therefrom, a housing enclosing said frame and tube, means forming windows in said housing arranged to transmit light emanating from said tube forwardly and laterally on both sides of said unit, and V-shaped reflector means mounted in said housing adjacent said portions of said tube with the apexes thereof directed toward said portions to reflect light from said tube portions outwardly through said windows.

11. A marker lighting unit for airport runways, and the like, said unit comprising a supporting frame having a front portion, a gas-discharge tube mounted on said frame, said tube comprising one portion disposed in substantially horizontal position and extending rearwardly from said front portion of said frame, and another portion extending upwardly from said one portion adjacent said front portion of said frame, a housing enclosing said frame and tube, means forming windows in said housing arranged to transmit light emanating from said one portion of said tube laterally on both sides of said unit,

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means forming a window in said housing forwardly of said frame and extending across the front and the two adjacent longitudinal sides of said other portion of said tube in a manner for transmitting light emanating from said other portion of said tube forwardly and laterally of said unit, and V-shaped reflector means mounted in said housing adjacent said portions of said tube with the apexes thereof directed toward said tube to reflect light from said one tube portion outwardly through said first mentioned windows laterally of said unit, and to reflect light from said other tube portion outwardly through said second mentioned window forwardly and laterally of said unit.

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