The present invention relates to lighting units of the type which are employed at airfield runways (or on flight-decks) to provide the pilot of a landing aircraft with visual information regarding a path to be followed in making a safe landing.

A system in which such lighting units are employed is described in the specification of British specification 830,943, published 9, 1960, and in an article on "The Theory of Visual Judgment and Its Application to the Design of Landing Aids for Aircraft," by E.S. Calvert, Trans. Inst. Eng., 22, 1957, page 278.

The system as described in the above-mentioned specification uses two pieces of apparatus for producing two beams, one of which is red and the other green, and in operation a beam of light divided horizontally substantially about a medial plane into two contrasting portions, the two lateral or division planes of said beams, respective-ly enclosing a small dihedral angle or being substantially parallel, and so presenting to the view of the approaching pilot one of three visual indications dependent on whether he is inside the angle between said planes or outside said angle in the upward or downward direction.

The specification describes a system for indicating an inclined glide slope plane is which system each apparatus consists of a light source and a reflector in front of the upper half of which is disposed a red-passing filter hav-ing a straight lower edge which extends horizontally and as opaque screen formed with a narrow straight-edged horizontal slot or opening parallel to the straight lower edge of the filter and through which the axis of the reflector extends at right angles. The light source and reflector are so arranged that the beam therefrom is focused upon the slot in the opaque screen from which the light issues in a divergent beam divided at a medial plane defined by the lower edge of the filter and the median line of the slot into an upper white portion and a lower red portion.

In the practical use of such apparatus they are installed close to the runway of airfields in such a position that servicing is not easy at all times. It is essential that such units should be in full operating condition as far as possible all the time and also that the adjustment of the units should be to the required accuracy. In all suggested units considerable skill was needed is adjustment particularly when servicing involved change of the light source.

It is also desirable for the equipment to be light and frangible so as to present the minimum of obstruction in the event of an aircraft colliding with the apparatus.

It is the object of this invention to provide a lighting unit that will require minimum adjustment on site on first installation. It is a further object of the invention to provide a unit in which lamp changes may be made very quickly and without any adjustment being required on the site.

According to the invention in one aspect a lighting unit of the type specified comprises a substantially flat base member adapted to be anchored to and be held rigid by a fixed structural support and a self-contained rigid optical bench comprising a lamp or lamps, a screen with a horizontal slot and, between the lamp or lamps and the screen, or between each lamp and the screen, a filter member divided horizontally into portions imparting two different colors to light transmitted therethrough, where-

In operation a beam of light divided horizontally substan-tially about a medial plane into two contrasting portions is produced, wherein the lamp or each lamp is fixed to a mounting member in preset locations and orienta-tion and wherein the mounting member is releasably held in the optical bench in invariant location and orienta-tion with respect to the bench. According to the invention in yet another aspect a light-ing unit of the type specified comprises a substantially flat base member adapted to be anchored to and held rigid by a fixed structural support and a self-contained rigid optical bench comprising a lamp or lamps, a screen with a horizontal slot and, between the lamp or lamps and the screen, or between each lamp and the screen, a filter member divided horizontally into portions imparting two different colors to light transmitted therethrough, whereby in operation a beam of light divided horizontally substan-tially about a medial plane into two contrasting portions is produced, the optical bench being mounted on the base member by means of adjusting members which enable the orientation of the optical bench relative to the base member to be adjusted and the lamp or each lamp is fixed to a mounting member in preset location and orientation and wherein the mounting member is releasably held in the optical bench in invariant location and orientation with respect to the bench.

The lamp or each lamp may either comprise a separate bulb and reflector, in which case pre-adjustment of the bulb with respect to the reflector is necessary, or a sealed beam unit in which the reflector is constituted by part of the wall of the bulb.

By utilising an optical bench adjustable with respect to a base member and arranging the bench to be a self-contained rigid entity in which lamps are mounted in an orientation determined by factory adjustment and, no service adjustment of such features is required; service adjustment is restricted to adjustment of the orientation of the optical bench with respect to the base member. The adjusting members by means of which the optical bench is mounted on the base member preferably consist of three screw fixings, adjustment of any of which affects the spacing between the base member and the optical bench at the point of the fixing. The fixings are preferably arranged in a triangle having one side transverse of the lighting unit.

The base member does not have to be of heavy con-struction since it acquires its rigidity from the structural support to which it is bolted or otherwise anchored. The whole unit can be provided with a light-weight protective cover suitably slotted to allow emergence of the required beam of light. The whole unit can be of low weight and of frangible construction such as to present very little obstruction to an aircraft striking it.

The invention will now be described in greater detail by way of further example with reference to the accompanying drawings. In the drawings, which are not to scale:

FIG. 1 is a perspective view of the base member of a unit embodying the invention.

FIG. 2 is a perspective view of the optical bench of the unit.

FIG. 3 shows the details of one of three mounting bolts used to fix the optical bench to the base member.

FIG. 4 shows a detail of the optical bench.

FIG. 5 is a perspective view of the complete unit, including a cover.

FIG. 6 is a diagrammatic cross-section of the complete unit.

FIG. 7 is a front view of an alternative construction of a lamp for the unit, and

FIG. 8 is a cross-sectional view of the lamp of FIG. 7.

Referring first to FIG. 1, the base member of the unit...
consists of a flat, rectangular frame of light alloy angle members 10, stiffened by four corner plates 11. Each plate 11 has bolted thereto a pedestal 12 having an aper- tured flange 13 which can be bolted on to a concrete block or other needed structural support.

Three threaded studs 14, 15 and 16 are bolted to the base member at the corners of an isosceles triangle and have conical depressions 17 in their upper ends.

Turning now to FIG. 2 the optical bench of the unit is built up of light alloy angle and tubes and supports in three placed, substantially parallel, vertical planes, a horizontally slotted plate 20, a filter screen 19 and three lamps 18. The filter screen 19 is divided horizontally into a lower clear half and an upper red half and as may be seen in FIG. 4 is fluted vertically in order to give the beam of light the desired lateral spread. This figure also shows how the filter screen 19 is held in a frame 21 which is slidable vertically in channel members 22 either side of the optical bench of the unit. Screws 23 enable the screen to be locked at any desired vertical setting. The slotted plate 20 is similarly adjustable. These adjustments are intended to be made solely in the factory and enable the lamps 18, the division in the filter screen 19 and the slot in the plate 20 to be lined up with the said division and slot truly parallel. It may even be desirable to so lock the filter screen 19 and the plate 20 after factory adjustment has been made that the service mechanic is not able to tamper with the adjustment.

As is best seen in FIG. 6 the lamps 18, each with a source 24 and a reflector 25, screen 19 and plate 20, between them enable a horizontally divided beam of light to be set up, the lower half of the beam 30 emerging from the slot in the plate 20 being red and the upper half being white.

The optical bench (FIG. 2) has three plates 26 in its base plane and bolts 27, 28 and 29 are mounted vertically in the plates respectively. When the optical bench is placed on the base member the ends (which are rounded) of the bolts 27, 28 and 29 stand in the depressions 17 of the studs 14, 15 and 16 respectively. The studs 14 and 15 and the bolts 27 and 28 lie on a line transverse of the unit and the studs 16 and bolt 29 are on the centre line of the unit. Adjustment of the bolts 27 and 28 lifts both the filter screen 19 and the plate 20 together and hence the division of the beam 30 for transverse hori- zontally whilst the bolt 29 enables adjustment of the angle of elevation of the median plane of the beam to be made. Clearly these adjustments are made solely by adjustment of the orientation of the optical bench with respect to the base member. No adjustments within the optical bench are required.

The details of construction associated with the bolt 29 and stud 16 are shown in FIG. 3. The bolts 29 screws through a collar 31 welded to the plate 26 and a nut 32 enables the bolt to be locked against further movement once adjustment has been effected. The stud 16 is fixed to a plate 33 of the base member by a nut 34.

A circlip 35 fits in a groove towards the lower end of the bolt 29 and retains an internally flanged nut 36. The nut 36 is screwed on to the stud 16 and by engage- ment with the circlip 35 holds the bolt 29 firmly in place. As can be seen in FIG. 2 each lamp 18 is mounted on a back-plate 37 which slots into vertical channels 38 being retained by clips 39 which embrace one of the tubes 40 of the framework. Changing a burnt-out lamp is a simple operation and by arranging at the factory that the lamps 18 have an invariant orientation with respect to the plates 38, changing a lamp does not involve any re-adjustments being made. To this end the plates 38 must of course seal in their retaining fixture without play and are not adjustable with respect to the framework.

FIGS. 7 and 8 illustrate a lamp in greater detail and also show an alternative and more positive way of fixing the plates 38 in the optical bench. Each plate 38 is aper- tured to receive its lamp and also has riveted or spot-welded to it a back cover 41 and a front cover or con- denseate drip shield 42. A plug 43 is mounted in the back cover 41 and one lead 44 to a bulb terminal 45 can be seen. The embodiment of lamp shown in a sealed beam unit in which the reflector 25 is constituted by part of the bulb wall.

The reflector 25 has three seatings 46 formed therein at 120° intervals and these rest on three adjusting screws 47 passing through the plate 38. The reflector is clamped against the screws 47, which allow factory adjustment over a small range of angles to be made, by means of a ring 48 fixed to the plate 38 by spring loaded nut and bolt fixings 49.

The plate 38 has four threaded apertures in predetermined locations in its four corners respectively. In the optical bench these are engaged by captive screws 50 in brackets 51 fixed to tubes 52 of the framework. The brackets, which provide seating surfaces for the plate, and screws and corresponding apertures in the plate 38 constitute a fixing giving the plate 38 an invariant position and orientation with respect to the framework of the unit.

Instead of using one elongated rectangular filter screen for all three lamps it may be preferred to provide each lamp with an individual round filter screen mounted on a plate fitted in the optical bench in the same way as the lamp shown in FIGS. 7 and 8. Each screen would accordingly appear much as the lamp as shown in FIG. 7 except that the division into an upper red half and a lower clear half would be apparent. This arrangement has a member of advantages. The risk of fracture of the screen on account of uneven heating is less than is the case with a rectangular screen. However should a screen fracture it can be replaced by the service mechanic with or without any adjustment being required.

As shown in FIG. 5 the complete unit is provided with a three-piece cover 53, 54, 55, the front piece 55 having an aperture 56 around the slot in the plate 20. In the arrangement shown, padlocks 57 and bars 58 prevent unauthorised removal of the cover.

We claim:

1. A lighting unit for use at an airfield runway or the like to provide a pilot of a landing aircraft with visual information regarding a path to be followed in making a safe landing, comprising a substantially flat base member adapted to be anchored to, and be held rigid by a fixed structural support and a self-contained rigid optical bench comprising at least one lamp, a screen with a horizontal slot and, between the lamp and the screen, a filter member divided horizontally into portions imparting two different colors to light transmitted therethrough, whereby in operation a beam of light divided horizontally substantially about a median plane into two contrasting portions is produced, and adjusting members by means of which the optical bench is mounted on the base member, the adjusting members enabling the orientation of the optical bench relative to the base member to be adjusted.

2. A lighting unit according to claim 1, wherein the said adjusting members consist of three screw fixings, adjustment of any of which affects the spacing between the base member and the optical bench at the point of the fitting.

3. A lighting unit according to claim 2, wherein the said screw fixings are arranged in a triangle having one side transverse of the lighting unit.

4. A lighting unit for use at an airfield runway or the like to provide a pilot of a landing aircraft with visual information regarding a path to be followed making a safe landing, comprising an optical bench including at least one lamp, a screen with a horizontal slot and, between the lamp and the screen, a filter member divided horizontally into portions imparting two different colors to light transmitted therethrough, whereby in operation a beam of light divided horizontally substantially about a median plane into two contrasting portions is produced.
a mounting member to which the lamp is fixed in preset location and orientation and means for releasably holding the mounting member in the optical bench in invariant location and orientation with respect to the bench.

5. A lighting unit according to claim 4, wherein the said mounting member is a flat plate and wherein the optical bench includes a plurality of seating surfaces against which the plate is clamped.

6. A lighting unit according to claim 4, wherein the mounting member is a flat plate which fits in slots in the optical bench, clips being provided for holding the plate in place.

7. A lighting unit for use at an airfield runway or the like to provide a pilot of a landing aircraft with visual information regarding a path to be followed in making a safe landing, comprising a substantially flat base member adapted to be anchored to and be held rigid by a fixed structural support and a self-contained rigid optical bench comprising a lamp, a screen with a horizontal slot and, between the lamp and the screen, a filter member divided horizontally into portions imparting two different colors to light transmitted therethrough, whereby in operation a beam of light divided horizontally substantially about a median plane into two contrasting portions is produced, adjusting members by means of which the optical bench is mounted on the base member, the adjusting members enabling the orientation of the optical bench relative to the base member to be adjusted, a mounting member to which the lamp is fixed in preset location and orientation, and means for releasably holding the mounting member in the optical bench in invariant location and orientation with respect to the bench.

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