Chapter 2

LANDING LAMPS

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LIST OF ILLUSTRATIONS

Introduction

1. Landing lamps are fitted to aircraft primarily to assist landing at night in cases where ground lighting is reduced to a minimum, or where, as in the case of forced landings, ground lighting is non-existent. They are of value also in aircraft employed in air-sea rescue work.

2. Any landing lamp, to function satisfactorily, must have been set correctly in relation to the axis of the aircraft. The settings which

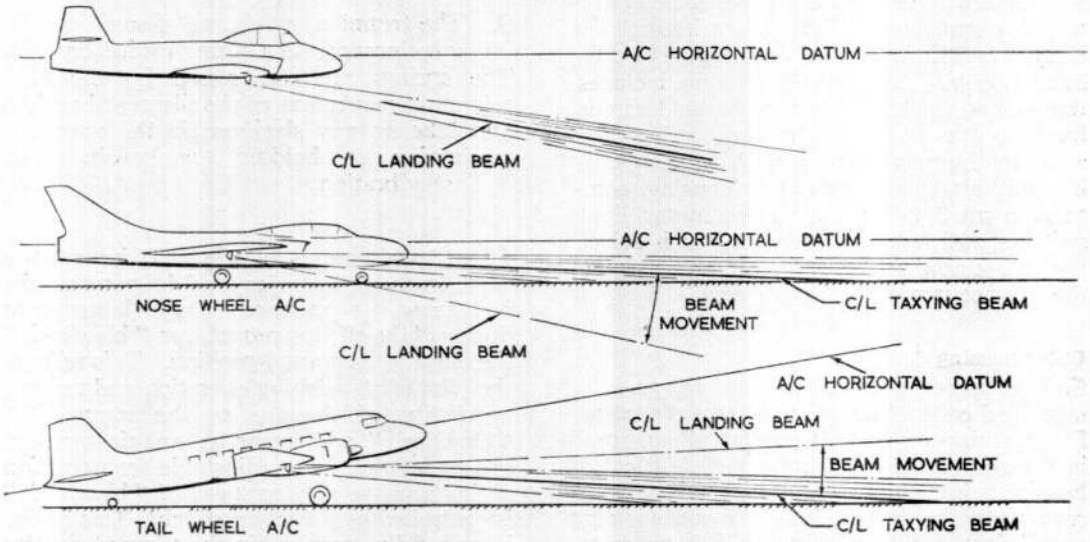

Fig. 1. Beam movement with attitude change

give the best results are decided for each particular type of aircraft, after night flying trials on the prototype, and these settings are used on subsequent production aircraft of that type. The setting of the beam in the horizontal plane depends upon the field of view of the pilot. Setting the beam in the vertical plane depends upon the change of attitude of the aircraft from the beginning of the approach to touchdown. This change of attitude varies between types of aircraft as indicated at fig. 1.

3. When the change of attitude is considerable the beam will have to be moved from the "landing" to the "taxying" position. This is usually arranged by selecting alternative "out-limits" switches of the operating unit which give "low" or "high" beam settings. Fig. 1 indicates the beam movement, relative to the horizontal datum of the aircraft, necessary on changing from "flying" to "taxying" attitudes in differing types of aircraft.

4. When the change of attitude is small it may be sufficient to use a double filament bulb in which, by selection of filaments from "flying" to "taxying", the centreline of the beam is very slightly depressed and the beam more diffused, as preferred for the taxy condition. Certain landing lamps are provided with alternative filaments for this purpose.

DESCRIPTION

Assembly (*fig.* 2)

5. Landing lamps generally consist of three major assemblies, (1) The outer housing or body, (2) The operating unit, (3) The filament housing. The outer housing includes the mounting flange by which the lamp is fixed to the airframe structure and which supports the weight of the lamp. The operating unit, attached to the outer housing, comprises a small, reversible, electric motor, limit switches and reduction gearing which drives the retractable filament housing containing the light source, reflector and lens.

Outer housing

6. The outer housing of some lamps is a machined casting incorporating the mounting flange which supports its weight when fitted in the aircraft. Some lamps have fabricated housings in which the supporting flange requires to be clamped in a mounting rig, supplied as a separate item. This separate mounting rig is secured to the aircraft structure and permits small adjustments of the lamp, within the rig, to provide for any necessary slight offset of the beam from the fore-and-aft line of the aircraft.

Operating units

7. In a few instances, e.g. some helicopters, the extending and retraction control may be through hand operated teleflex cables. In some cases the power operating unit may be remote from the lamp which it operates by teleflex or linkages. In most installations, however, the operating unit is a self-contained, removable, electric motor assembly or actuator attached to the outer housing of the lamp. Design detail varies between types of actuators and description of particular types will be found in A.P.4343D, Vol. 1, Sect. 14 and 16.

8. The power operating unit generally comprises a series motor, having alternative field windings, which is reversible by selection of the field winding. The motor has a spring loaded brake to reduce over-run when power is switched off. The brake is released when the brake solenoid, connected in series with the motor, is energized. The motor drives into a clutch set to slip at a pre-determined air pressure on the front of the lamp housing when extended. This reduces possible damage if the lamp is extended at high airspeed. The clutch is coupled to the reduction gear which, in turn, transmits power to the operating mechanism of the pivoted filament housing.

9. The trunnion end fitting of some operating units incorporate a spring loaded bracket. The springs are compressed by the final retracting movement of the filament housing, and take up any slackness in the operating mechanism so holding the housing firm against vibration.

10. Certain lamps, e.g. Type L, incorporate a "blowback" device which permits the increasing air pressure on the lamp front during take-off to retract, or "blowback" the lamp to its housed position. This relieves the pilot of a switching operation and reduces possibility of damage to the lamp. The "blowback" will occur at an air pressure pre-set against an adjustable compression spring and the rate or speed of "blowback" is controlled by a friction clutch. This device is more fully described in the relevant chapter of A.P.4343E, Vol. 1, Sect. 7.

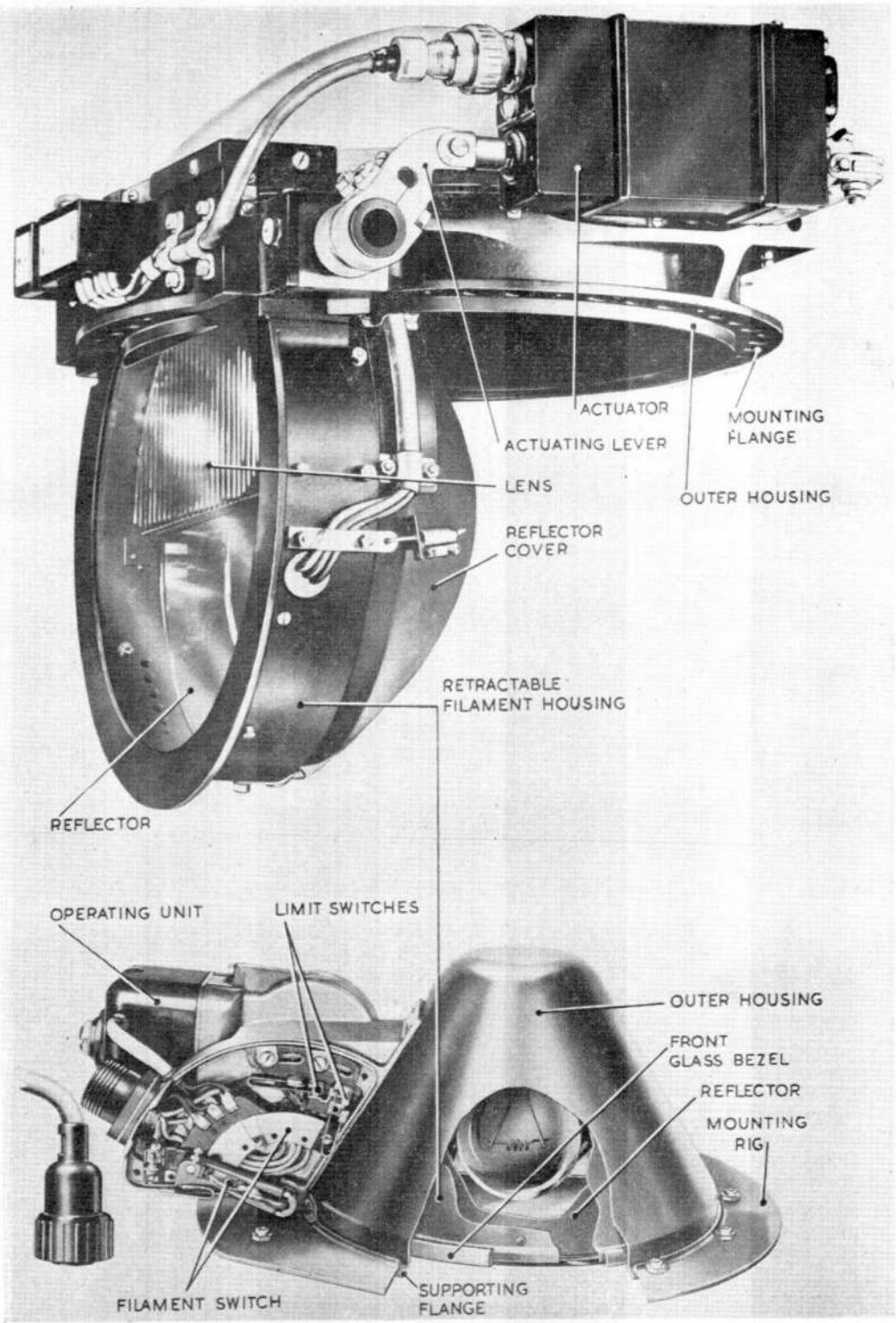

Fig. 2. Typical lamp assemblies

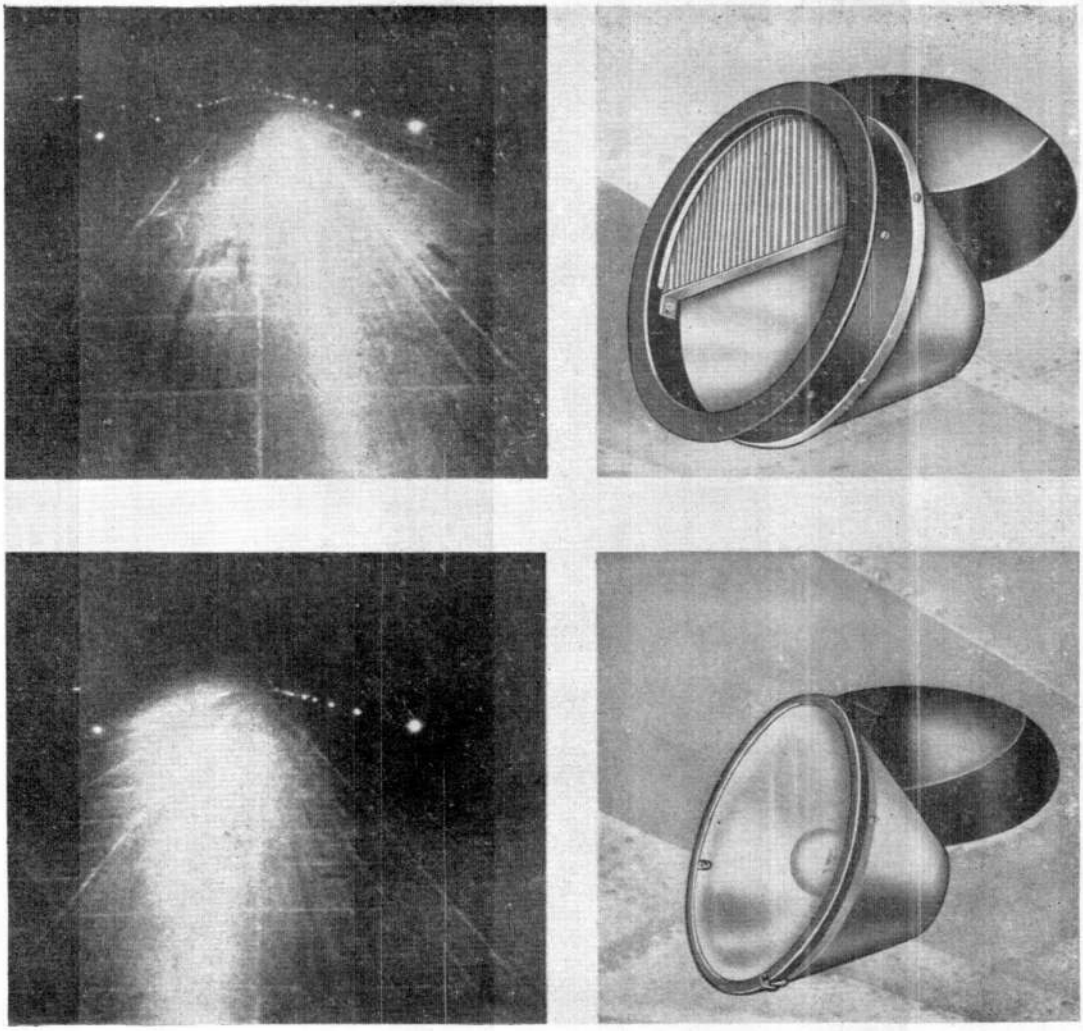

Fig. 3. Typical lamps and beams

Filament housing (*fig. 2*)

11. The retractable housing for the filament may be a casting or a fabricated unit; it is hinged or pivoted to the outer housing. Power to rotate the lamp housing may be transmitted through the hinge or through an operating arm or quadrant. Flexible cables, between the outer fixed housing and the retractable filament housing, convey power to the filament lamp holder terminals. The filament housing also contains the reflector, usually of anodised aluminium, the detail of its mounting varying in differing general designs of lamps. Especial care is necessary when handling these reflectors to prevent distortion or abrasion of the highly polished surface. The front glass of the lamp is fitted with a sealing ring. Some lamps have a diffusing lens fitted behind the front glass. The combination of filament, reflector and lens, aims to produce a beam having good illuminating power at distance without harsh glare effects. The diffusing lens in effect, flattens the top of the beam and spreads it to give a wider field of illumination at distance. Fig. 3 depicts typical landing lamps and the corresponding beams.

The light source (*fig. 4*)

12. The source of light in aircraft landing lamps is a gas-filled filament lamp in which the position of the actual filament relative to the lamp holder is kept within very close limits, indicated as dimension "$X \pm 0{\cdot}5$ m.m." in fig. 4. This is essential to ensure correct positioning of the filament of the focal point

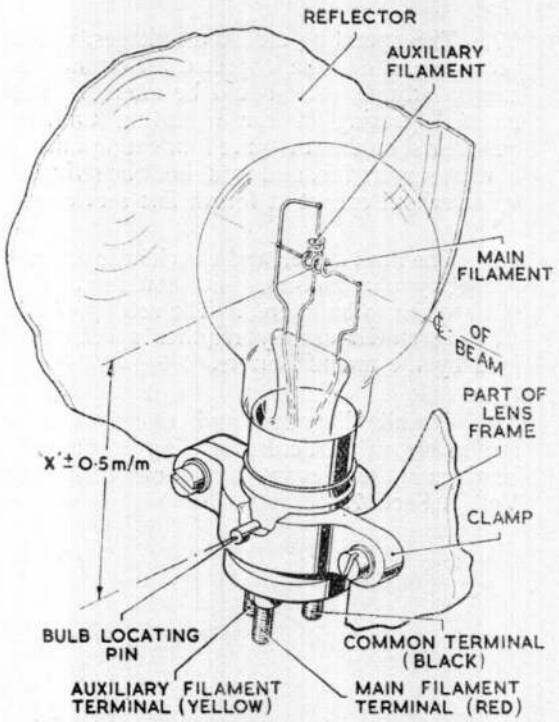

Fig. 4. Typical filaments and bulb caps

of the reflector, when renewing the bulb. The glowing filament is concentrated into as small volume as practicable to obtain a small light source and so reduce light dispersion. The filament lamp cap is usually of the prefocus type but other special types are in use. Fig. 4 shows typical filament arrangements and lamp caps. Particular detail of lamps will be found in A.P.4343E, Vol. 1, Sect. 7.

13. The power consumption ratings of filaments vary with specific applications and range from 240 watts in small lamps to 1000 watts for lamps in large aircraft. In general the filaments are designed to have an average BURNING life of 50 hours. Some lamps have two filaments, the main (or landing filament), and an auxiliary (or taxying filament) often of different power rating and always having separate switching. This permits choice of beam, provides a standby beam should one filament fracture and saves power in those instances where the auxiliary filament is of less power than the main filament. The filaments should not be switched on for long periods in still air, except in emergency, since the heat generated will, in time, adversely affect the efficiency of the bulb.

Power supply and controls

14. Power is taken from the 28-volt d.c. source in the aircraft, for both filament and operating units. Control of the filaments may be by direct switching by the aircrew, indirectly through switches incorporated in the operating mechanism or, in the case of high power, heavy current filaments, through relays. In the latter case the relay circuit may incorporate a series switch operated by the final retracting movement of the filament housing which ensures the filament circuit is OFF when the lamp is fully retracted. The power extending and retracting control will usually be a two-way switch selecting alternative field windings of the operating motor. This switch may, in some instances, incorporate a position permitting further selection of the out-limit switches to give either " high " of " low " beam positions.

SERVICING

Reflector and lens

15. The servicing necessary for particular designs of landing lamps will be found detailed in A.P.4343E, Vol. 1, Sect. 7. A servicing feature common to all landing lamps is to ensure that the bulb, reflector and lens are clean. These items must be carefully handled to avoid abrasion. A clean soft, but

not fluffy, cloth should be used to avoid finger-printing the reflector. When replacing a filament bulb ensure that it is correctly positioned in its holder and is secure. Inspect cable terminal connections and connector plugs for security and the flexible cable to the lamp housing for security and clearance when operating the lamp. The filament bulb should be renewed if the interior of the glass shows signs of blackening or if white streakes, indicative of a leaking glass seal, appear on the glass.

Operation check

16. Power operation should be checked by extension and retraction a few times. The filament should be switched on in turn for a short period, never exceeding five minutes. Where two "out" limits are possible, check the operation of the lamp between these positions, i.e. between "low" and "high" beam positions. Where filament relay switches are fitted, check that power to the filament is cut off before the lamp is housed.

17. The operating unit and linkages, where accessible, should be inspected for cleanliness but no adjustments should be altered. The internal gearing of the operating unit, or actuator should not require lubrication during normal service life, and would not be stripped for overhaul except at fourth line servicing.

18 The limit switch and clutch adjustments are set by manufacturers and should normally not require to be altered. The setting of the slipping clutch usually requires special rigs held by the manufacturers.

19. Circuit diagrams and electrical tests applicable to particular landing lamps will be given in the relevant chapter of A.P.4343E, Vol. 1, Sect. 7.

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