Chapter 62

LANDING LAMP, HARLEY, TYPE 500 MK. 1

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LIST OF ILLUSTRATIONS

LIST OF APPENDICES

LEADING PARTICULARS

Landing lamp, Harley, Type 500 Mk. 1	*Ref. No. 5CX/6202*
Actuator, Plessey Type CZ.53681/11/C	*Ref. No. 5W/2836*
Motor Western, Type 4A	*Ref. No. 5UD/*
Gearbox, Western, Type 6	*Ref. No. 5UD/*
Filament lamp, Harley Type 10B/91 26 volt 500 watt/28 volt 280 watt	*Ref. No. 5L/9959703*
Front glass, Pt. No. 7/1.109	*Ref. No. 5CX/6283*
Sealing ring, Pt. No. 7/1.154	*Ref. No. 5CX/6308*
Extended angle of lamp housing	90 *deg.*
Speed of rotation of lamp housing	7—10 *rev/min.*
Maximum operating frequency (linear actuator)	10 *cycles/hr.*
Maximum lighting time	
Main filament, on ground or in still air	10 *min.*
Main filament, in flight	20 *min.*
Auxiliary filament, on ground or in still air	20 *min.*
Auxiliary filament, in flight	*Continuous*
Maximum permissible forward speed with lamp extended	180 *knots*
Weight	10 *lb.*

Introduction

1. The Harley, Type 500 Mk. 1, landing lamp is a retractable lamp which incorporates azimuth control, allowing the filament housing to be rotated in a horizontal plane. The filament housing may be continuously rotated in either direction, or turned to any selected position to aid search or landing operations. Designed principally for use in helicopters, the lamp has a 7 in. light source provided by a twin filament lamp (26 volt/500 watt, 28 volt/280 watt), and a polished aluminium reflector.

2. A 4-way single-pole switch, Harley, Part No. L85/001, details of which may be found in A.P.4343C, Vol. 1, Book 1, Sect. 1, is used to control selection of the lamp both in elevation and azimuth. The operating unit for elevation is a Plessey actuator, Type CZ53861/C11 and the operating unit for rotation is a Western motor, Type 4A with a Type 6 gearbox. Details of these units may be found in A.P.4343D, Vol. 1, Books 3 and 4 respectively.

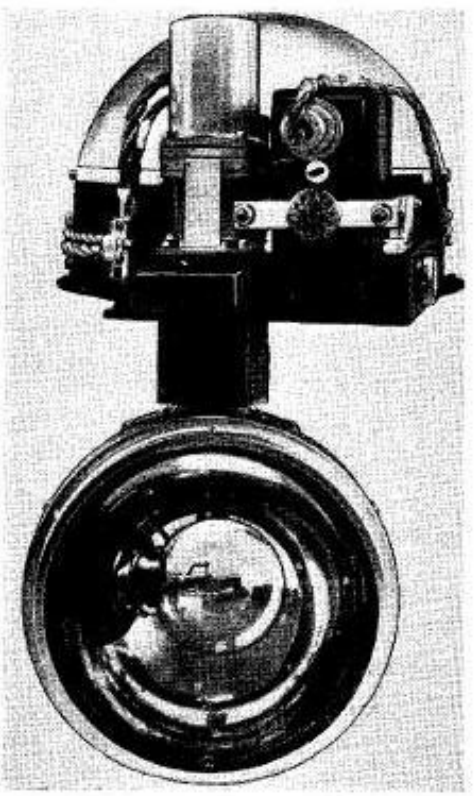

Fig. 1. Landing lamp, general view couplings (Post-Mod. 1)

DESCRIPTION

General

3. The Harley, Type 500 Mk. 1, landing lamp consists basically of two assemblies, the frame casting assembly and the column

casting assembly. The frame casting assembly accommodates the elevation mechanism, the terminal blocks and the back cover. The column casting assembly is the moving portion of the lamp and incorporates the rotation mechanism, the slipring and contact pick-up assembly and the light source. The light source consists of the filament lamp and the reflector.

4. Two models of the lamp are in service, the earlier model, Pre Mod. 1, has a buffer arrangement in the frame casting to absorb vibration in the filament housing when the lamp is retracted (shown in fig. 1). Later models, Post Mod. 1, have improved vibration damping provided by spring loaded couplings in the elevation mechanism (shown in fig. 4).

Frame casting assembly

5. The frame casting is the fixed portion of the lamp and is secured to the airframe by eight 10-32 UNF screws which engage with anchor nuts riveted to the flange of the casting. Three grease impregnated Tufnol bearings are fitted in the casting and carry the elevation spindle to which the column casting is fitted.

6. The elevation actuator is pivoted to the frame casting at the trunnion end by a link pin which passes through two lugs on the casting and is secured by two split pins. The body of the actuator is held by a "U" shaped clamp secured to the casting by four screws, two rubber packing pieces between the bracket and the motor allow for dimensional tolerances and absorb vibration.

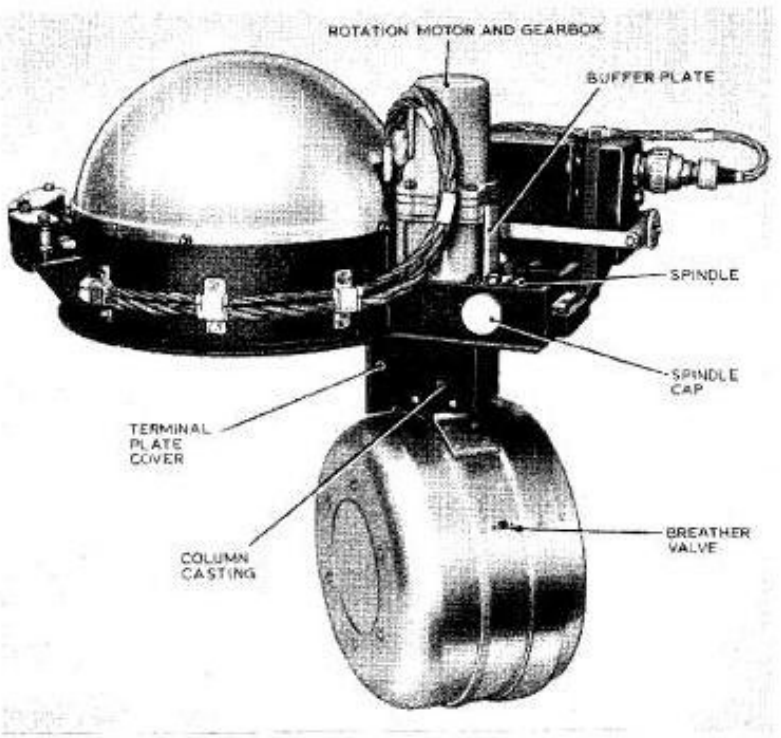

Fig. 2. Landing lamp, side view with filament housing partially rotated (Pre-Mod. 1)

Column casting and elevation mechanism

7. The column casting is the portion of the lamp which accommodates the rotation mechanism and to which is fitted the filament housing, the whole assembly moves in the vertical plane to extend or retract the lamp. The casting, which is shown sectioned in fig. 5, is secured to the elevation spindle by two 10-32 UNF socket-headed screws. Two operating levers are clamped to the spindle and have fork-ends into which the connecting links are secured by clevis pins.

8. The connecting links are secured at the other end to a ram end bar which is screwed on to the actuator and locked to a knurled locknut by a single screw. In early models the links are fitted to spindles machined on the ends of the ram end bar and are secured by split pins passed through the spindles. Later models, Post Mod. 1, have spring loaded couplings between the links and the ram end bar as shown in fig. 4.

Rotation mechanism

9. The split-field series motor and gearbox of the rotation mechanism are mounted on the column casting and drive a shaft which passes through the casting. The drive shaft has a drive end of square section which engages in the gearbox drive plate and is carried in two grease impregnated Tufnol bearings which are an interference fit in the housings in the casting. Secured to the saddle end of the drive shaft are the filament housing and the slipring assembly which is mounted on the shaft and secured by three through bolts.

Slipring assembly

10. The slipring assembly serves to connect the supply to the filament lamp and consists of three brass sliprings bearing on which are three brass contact, or pick-up, bars. The sliprings are fitted on Tufnol spacers which are secured to the shaft by three bolts which pass through holes in the drive shaft saddle.

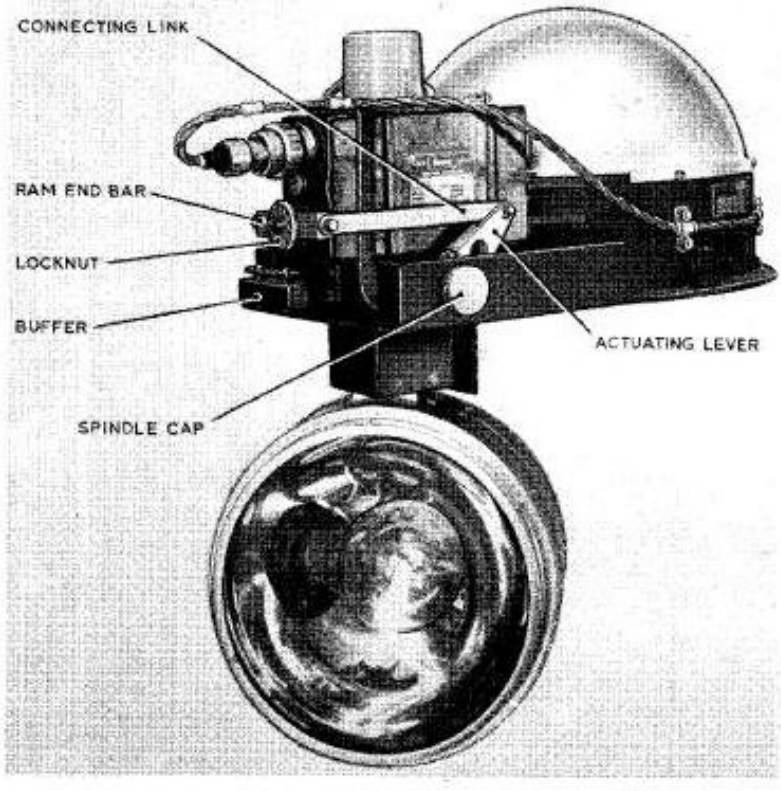

Fig. 3. View showing ram end bar end buffer (Pre-Mod. 1)

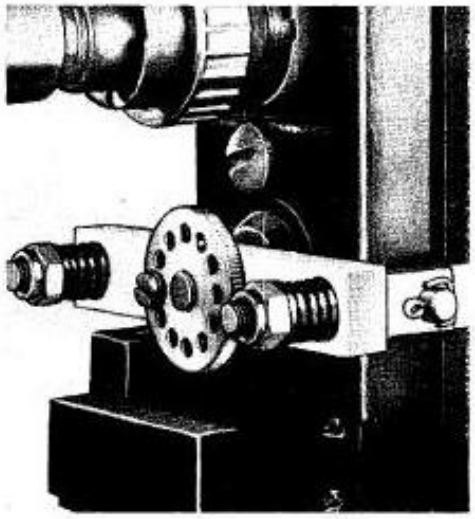

Fig. 4. View showing ram end bar and couplings (Post-Mod. 1)

The through bolts also secure two additional Tufnol spacers, one fitted against the saddle-end bearing and the inner face of the casting and one fitted as an insulating disc on top of the sliprig assembly. Connection to the filament lamp from the sliprings is made by Tersil cables which are soldered to the slip-rings and pass through separate holes in the slipring spacers into the filament housing.

11. The contact, or pick up, assembly to the sliprings is mounted on a Tufnol block and is inserted through a hole in the side of the column casting. Each brass contact bar is a spring-loaded sliding fit on two mounting pillars, each pillar carries a helical loading sping and is riveted to the Tufnol block. The contact block is secured to a terminal plate by three screws which also serve as terminal studs to which are connected the pigtails from each contact bar and the filament lamp supply cables.

12. The terminal plate, which has three other terminal posts to which the rotation motor flying-leads and supply cables are connected, is secured to the casting by three hexagonal studs and a central screw. The studs also serve to mount the terminal plate cover and have threaded holes in the top of the posts to accept the cover securing screws.

Filament housing assembly

13. The filament housing assembly contains the reflector and filament lamp which constitute the light source. The assembly consists of a bowl-shaped reflector cover, secured to the drive-shaft saddle by eight screws and nuts, in which are housed the reflector, the lampholder casting, and the filament lamp. The front of the filament housing is closed by a bezel into which the front glass is held seated on a rubber sealing ring by a clamp ring secured to the bezel by six screws.

14. An additional back cover is fitted over the rear of the reflector cover and the air retained between them serves as a heat sink to conduct heat away from the filament lamp terminal studs and connecting cables. Ventilation for the filament housing is provided by three breather tubes in the reflector cover which permit the passage of air but are calibrated to prevent the normal ingress of moisture.

OPERATION

15. The lamp may be selected to any position in both azimuth and vertical plane by suitable operation of the four-way switch, a typical circuit diagram is given in fig. 6. The lamp will automatically be cut-off in the fully extended or fully retracted position by the internal limit switches in the elevation actuator, but may be continuously rotated in azimuth. When the elevation actuator is operated the extension or retraction of the actuator ram pulls or pushes on the operating levers, clamped to the elevation spindle, through the connecting links. The spindle thus rotates which raises or lowers the column casting and the filament housing.

16. When the lamp is retracted the filament housing is locked in the fully retracted position by a spring loaded arrangement, the

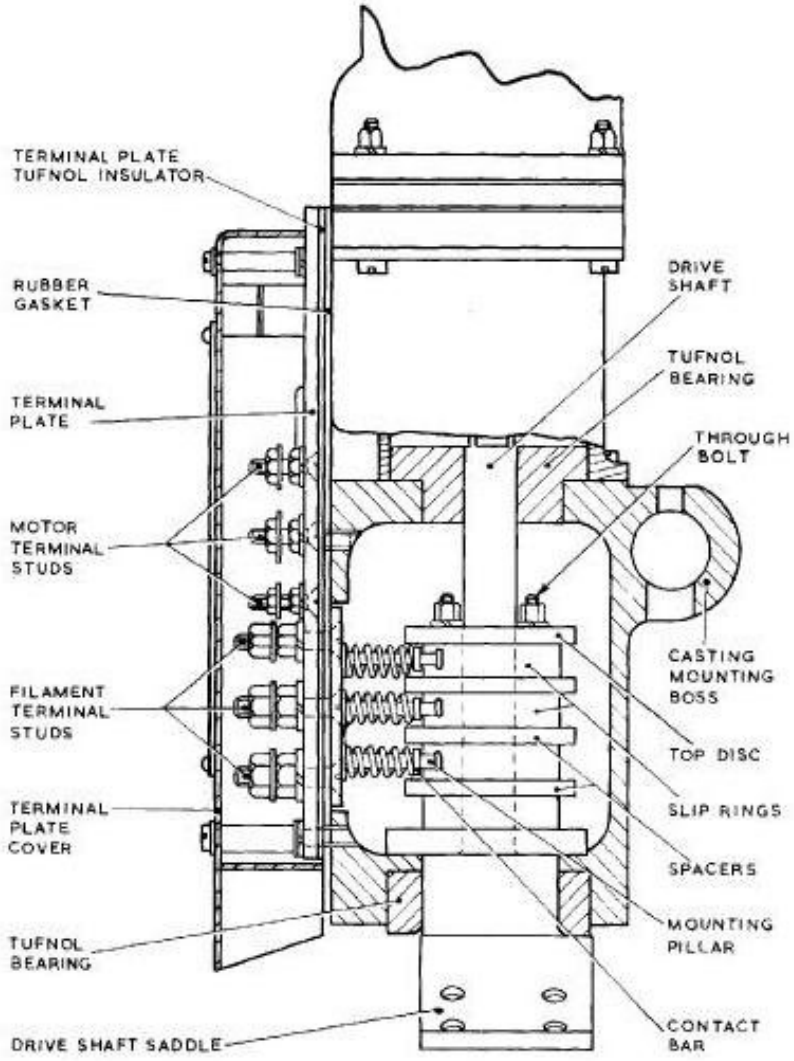

Fig. 5. Part sectional view of column casting showing slip rings and contact bars

springs serving to damp-out the vibration transmitted from the air frame via the frame casting. In early models, (Pre Mod. 1), this is achieved by a buffer on which the buffer plate seats during the final retraction movement. In later models (Post Mod. 1), improved damping is provided by the spring loaded couplings between the connecting links and the ram end bar, the springs of which are compressed after the filament housing has reached its mechanical stops by a short over run period of operation by the elevation actuator.

SERVICING

General

17. The lamp should be examined for mechanical damage or corrosion and the breather tubes checked to ensure that they are clear and free from corrosion. After a functional test the filament lamp should be examined for signs of blackening or white streaks on the glass envelope which indicate a partial failure of the glass seal. If blackening or streaking are evident the filament

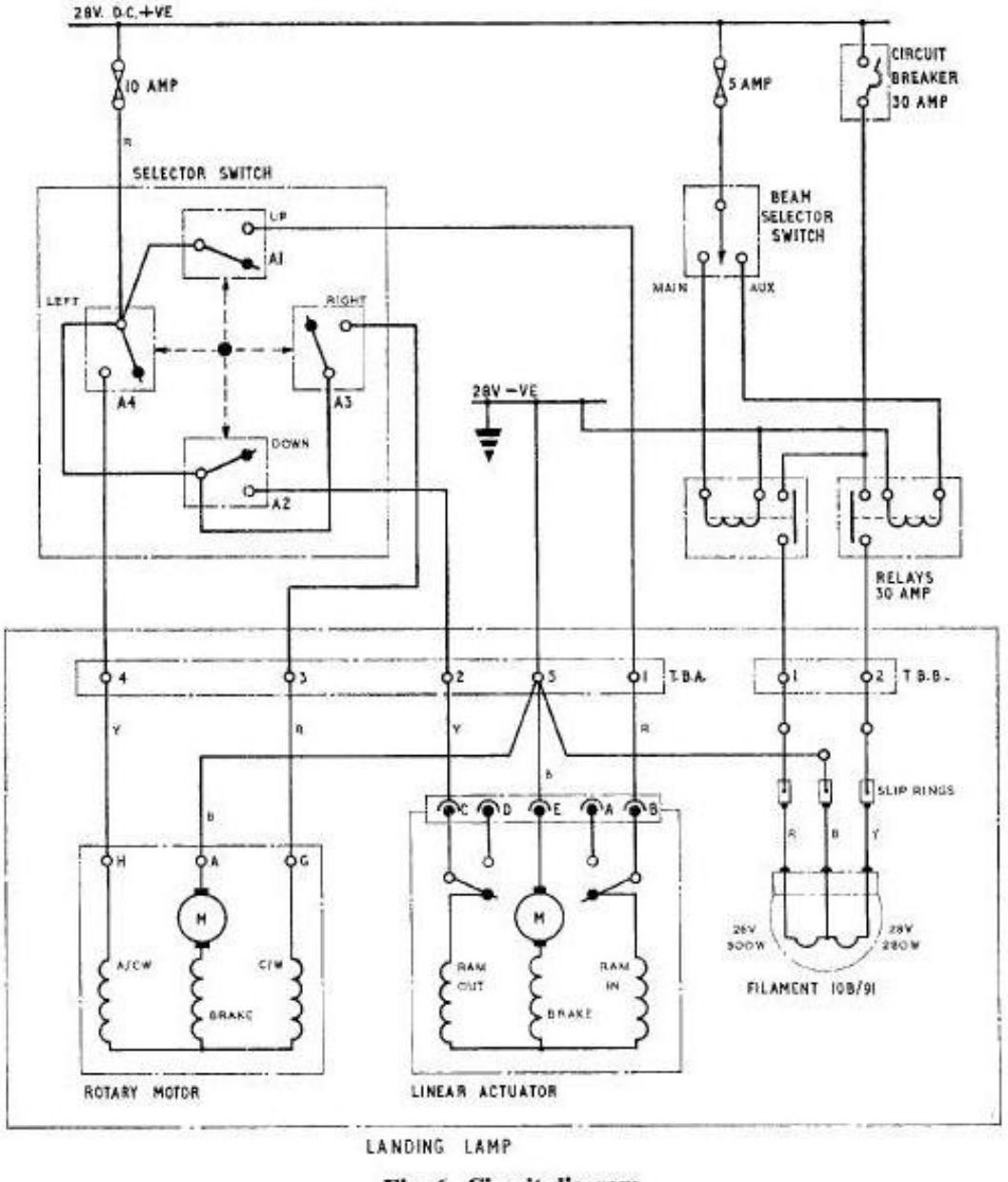

Fig. 6. Circuit diagram

should be renewed to prevent failure during subsequent operational use. The elevation actuator and the rotation motor and gearbox should be replaced if they are suspect or fail to operate, the unserviceable items being serviced in accordance with A.P.4343D, Vol. 1, Books 3 and 4 respectively.

Note . . .

The maximum lighting times for the filaments of the filament lamp are given in the Leading particulars, these times should not be exceeded except in cases of emergency.

18. The front glass and reflector should be examined for cleanliness, if the front glass or reflector are dirty they should be cleaned using a clean soft cloth. Warm soapy water may be used to remove grease or dirt, after which the front glass and reflector should be dried using a soft cloth. Do not use polish or abrasives.

Note . . .

The screws and bolts used throughout the lamp have U.N.F. threads with the exception of the screws and nuts securing the rotation motor to the gearbox and the slipring through bolts (4B.A.) and those which are component parts of separately manufactured items, e.g. actuators.

Component renewal on the aircraft

Front glass renewal

19. To renew the front glass remove the three screws securing the bezel to the reflector cover, these are the screws equally spaced around the rear of the bezel, and withdraw the bezel and front glass. The six screws securing the clamp ring inside the bezel may then be removed and the front glass and the clamp ring pushed from the bezel. Care must be taken in handling the clamp ring which is a light alloy spinning and is easily distorted. Whenever the glass is removed or renewed the rubber sealing gasket should be examined for deterioration and renewed if required. A new front glass may then be fitted in the reverse order, handling of the new glass being kept to a minimum.

Filament lamp and reflector renewal

20. To renew the filament lamp or reflector the bezel and front glass assembly should be removed as given in para. 19 and access gained to the filament lamp terminals by removing the three screws securing the reflector heat sink cover and removing the cover. The filament lamp terminals may then be disconnected and the filament lamp removed by unscrewing the lamp-holder clamp securing screws. At this point the reflector may be removed for renewal or cleaning, if required, by removing the three screws securing the reflector to the locating blocks inside the rim of the reflector cover.

21. A new reflector and filament lamp may be fitted in the reverse of the dismantling procedure, care being taken to avoid finger-printing the reflector and the use of undue force when tightening the nuts on the filament lamp terminal studs. Care should also be taken to align the pin on the lamp cap with the locating hole in the fixed portion of the clamp.

Bench servicing

General

22. The connections at the external connector block and at the column casting terminal plate should be examined for security and the terminal blocks and terminal plates examined for damage. To remove the terminal plate cover, which is a close fit into the back cover when the lamp is retracted and the upper screws of which are inaccessible when the lamp is extended, the following procedure should be adopted. With the lamp in the fully retracted position remove the terminal plate cover securing screws, then extend the lamp approximately 15 deg. and raise and withdraw the cover.

23. To gain access for examination of the sliprings and contact bars retract the lamp to the fully retracted position and remove the three hexagonal cover mounting studs and the central terminal plate securing screw. The spring tension on the contact bars will ease the plate from the casting and the terminal plate and contact bar assembly may then be withdrawn from the aperture of the casting.

24. The sliprings may now be examined for signs of pitting or burning, if it is considered necessary to view the hidden portion of the sliprings the filament housing may be rotated by applying power to the rotation motor. Connection may be made to the terminal plate or to the five-way terminal block, care being taken to ensure that the motor terminals on the terminal plate are not touching any metal portion of the lamp. Should it be necessary to renew the sliprings the procedure given in para. 26 to 28 should be followed.

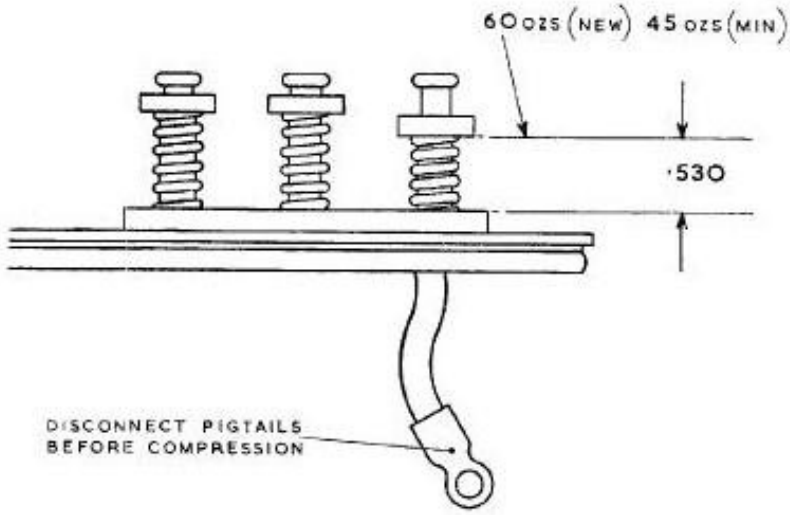

Fig. 7. Checking contact bar spring pressure

Checking contact bar spring tension

25. The spring tension of the contact bars should be checked using a tensiometer on the centre of the bar with the pigtail disconnected from the terminal stud. Depress the bar until the length of each spring is 0·53 in. when the tensiometer reading should be between 45-60 oz., as shown in fig. 7.

Motor and gearbox renewal

26. The rotation motor and gearbox may be removed using the following procedure.

(1) Remove the terminal plate cover, as given in para. 22.

(2) Disconnect the motor flying leads.

(3) Remove the terminal plate, as given in para. 23.

(4) Remove the four screws securing the gearbox to the column casting and withdraw the motor and gearbox from the drive shaft whilst holding the filament housing.

The reverse of the above procedure may be used to fit a new or serviced motor, after smearing the drive end of the drive shaft with grease XG275 before engaging it in the gearbox drive plate.

Note . . .

In early lamps the motor flying leads were extended by an additional length of wire and care should be taken to ensure that the soldered joints are not unduly strained. All lamps Serial No. 1913 and above have flying leads of the correct length.

Dismantling for slipring renewal

27. To remove the sliprings, first remove the front bezel including the front glass, filament lamp and the reflector as given in para. 19 and 20 and then remoxe the rotation motor and gearbox as given in para. 26. The following procedure should then be completed:—

(1) Remove the eight screws and nuts with their respective washers which secure the reflector cover to the drive shaft.

(2) Remove the reflector cover from the drive shaft, feeding the filament lamp cables through the hole in the cover.

(3) Mark the position of each of the actuating levers on the elevation spindle by lightly scribed lines and then remove the clamping screws.

(4) Remove the two socket-headed screws and nuts securing the column casting and remove the buffer plate.

(5) Withdraw the split pin securing the end cap at the column casting end of the elevation spindle and remove the end cap.

(6) Whilst supporting the column casting withdraw the elevation spindle until the casting is free, this will leave the spindle in two of the Tufnol bearings of the frame casting and still engaged with the actuating levers.

(7) Remove the column casting, drive shaft and slipring assembly from the lamp.

(8) Remove the three countersunk screws from each of the side covers on the column casting and remove the covers.

(9) Mark the spacer of each slipring to enable them to be refitted in the correct order and then remove the three through bolts and nuts.

(10) Remove the top insulating disc from the slipring assembly.

(11) Separate the spacers, within the limits of the connecting cables, and unsolder the cables from the sliprings and withdraw them down through the spacers and the saddle end of the drive shaft.

(12) Withdraw the drive shaft from the casting whilst supporting the sliprings and spacers which will then be free.

(13) Remove the sliprings and bearing end spacer through one of the casting apertures.

(14) Remove the sliprings from the spacers.

Slipring renewal

28. On renewing the sliprings the connecting wires should be renewed using 8¼ in., 12½ in. and 8⅝ in. lengths of Tersil 14 cable for the red, blue and yellow cables respectively. Any cracked or chipped Tufnol spacers, or other defective items, should also be renewed.

Assembling after slipring renewal

29. The rotation mechanism may be assembled in the reverse order to that given for dismantling in para. 26 and 27. When fitting the drive shaft and the elevation spindle care must be taken not to damage the Tufnol bearing bushes and spacers. The actuating levers should be fitted in their original positions, where the correct position is unknown they should be reset using the procedure given in para. 31.

Actuator renewal

30. The following procedure should be used to renew the elevation actuator:—

(1) Where possible extend the actuator to remove the tension on the couplings and trunnion pin and then disconnect the actuator.

(2) Remove the four screws, nuts and washers securing the " U " clamp to the frame casting and then remove the clamp and rubber packing pieces.

(3) Remove the split pin securing the trunnion pin and push out the trunnion pin.

(4) Unscrew the locking screw on the knurled locknut and remove the locknut from the actuator ram using a suitably manufactured peg spanner.

(5) Unscrew the actuator from the ram end bar, thereby obviating the need to disconnect the links.

(6) Set the new or serviced actuator limit switches to give:—

(a) A retracted length of 5·937 in.

(b) An extended length of 8·937 in.

when measured between the centre of the trunnion mounting hole and the shoulder of the ram (immediately behind the threaded portion).

(7) Fit the new actuator in the reverse order of the above procedure taking care that no undue strain is placed on the connecting links.

Note . . .

In early models, Pre Mod. 1, the outer face of the ram end bar should be flush with the ends of the connecting links. If the bar is rotated to the incorrect position the ends of the connecting links will protrude beyond the face of the bar due to the off-centre position of the pivots. Consequently in subsequent operation the actuator may attempt to drive the filament housing beyond the mechanical limits causing failure of the motor.

(8) Check the elevation travel limits of the housing as given in para. 31.

Checking elevation and retraction travel limits

31. The travel limits of the filament housing should be checked whenever a new or serviced actuator is fitted, or when the travel of the filament housing is suspect.

(1) Operate the lamp to the fully extended position, actuator fully retracted.

(2) Check that the angle between the face of the filament housing and the mounting face of the frame casting is 90 deg.

(3) Operate the lamp to the fully retracted position, actuator fully extended, and rotate the filament housing square to the mounting face of the frame casting.

(4) Check that the face of the filament housing is flush with the mounting face of the frame casting (not flush with the raised casting lip).

(5) In early lamps Pre Mod. 1 check that the buffer plate is seated on the buffer bar and that the springs are compressed.

(6) In later lamps Post Mod. 1 check that the buffer plate is seated on the casting or fixed block and measure the gap between the shoulder of each coupling and the ram end bar, which should be 0·020-0·040 in.

(7) Ensure that the helical springs of the buffer and couplings are not completely closed by checking that a 0·005 in. feeler gauge can be inserted in at least two places.

Adjusting the elevation and retraction travel limits

32. Should the filament housing travel be outside the limits given in para 31 check the travel limits of the actuator to the settings given in para. 30 (6), if these are correct, set the actuating levers as given in para. 33.

Setting up the actuating levers

33. The position of the actuating levers may be reset using the following procedure:

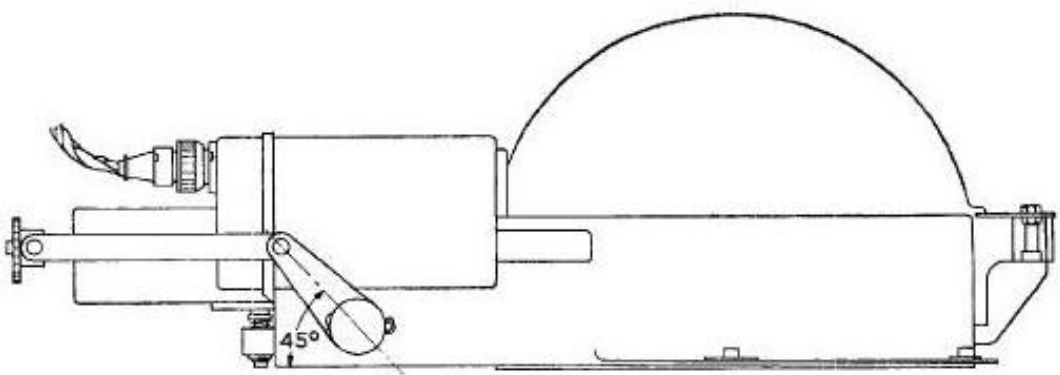

Fig. 8. Checking actuating lever position

(1) Slacken off the nuts of the lever clamping bolts so that the levers remain lightly clamped to the spindle.

(2) Fully retract the lamp and check that the filament housing is flush with the mounting face of the frame casting (not flush with the raised casting lip).

(3) Set the position of the outer lever so that the centre line through the connecting link pin hole and the spindle mounting hole is at 45 degrees to the frame casting mounting flange, as shown in fig. 8.

(4) The position of the inner lever should be similarly set, but this may be more readily attained by setting it to the same height as the outer lever using a suitable height gauge.

(5) Tighten the clamp bolts and recheck to ensure that the setting has not been disturbed.

Lubrication

34. The Tufnol bearings in the column casting and in the frame casting are grease impregnated on manufacture and will not normally require further lubrication. The trunnion pin, the clevis pins, the pivots and the buffer or coupling spring should be lubricated when necessary with a light smear of grease XG-275. The motor and gearbox and the elevation actuator should be lubricated in accordance with the instructions given in the relevant chapters of A.P.4343D.

Testing

35. After all servicing the lamp should be functionally tested as given in the Standard Serviceability Test, Appendix A to this chapter.

Appendix A

STANDARD SERVICEABILITY TEST
for
LANDING LAMP, HARLEY, TYPE 500 Mk. 1

Introduction

1. The following tests may be applied to ascertain the serviceability of a landing lamp, or prior to installation in an aircraft.

TEST EQUIPMENT

2. The following test equipment, or suitable equivalents, will be required:—

(1) A stop watch, Ref. No. 6B/9101001

(2) A four-way Harley selector switch, Ref. No. 5CW/9133.

(3) A single-pole changeover switch with centre-off position, Ref. No. 5CW/6431.

(4) Two single-make 30A relays Ref. No. 5CW/6625 or a 25A changeover relay Ref. No. 5CW/6852.

(5) A 28V d.c. supply with suitable supply protection devices.

(6) A suitable frame for mounting the lamp during test.

TEST PROCEDURE

3. (1) Mount the lamp on the test frame and connect it to a test circuit as shown in fig. 1.

(2) Fully extend the lamp, measuring the time taken to reach the fully open position, which should be not more than 4 seconds.

(3) Measure the open angle of the filament housing with respect to the mounting face of the frame casting which should be 90 deg.

(4) Switch on the auxiliary filament and main filament in turn for not more than the minimum time to ensure satisfactory illumination and not exceeding 2 minutes.

(5) Rotate the lamp in either direction and measure the time taken for one complete revolution which should be between 6-8 seconds.

(6) Repeat operation (5) in the other direction.

(7) Retract the lamp to the fully retracted position and ensure that the filament housing is fully retracted (the face of the filament housing flush with the face of the mounting flange of the frame casting).

(8) (*Post Mod.* 1). Measure the gap between the shoulder of the connecting link couplings and the ram end bar. The gap should be between 0·020-0·040 in.

(9) Extend and retract the lamp a number of times (not exceeding 10 cycles/hour) whilst ensuring that there is no binding, fouling or tendency to sluggishness.

(10) Set all switches to OFF and inspect the filament lamp for blackening or streaking of the glass envelope. Where these are evident renew the filament lamp and repeat the tests detailed above.

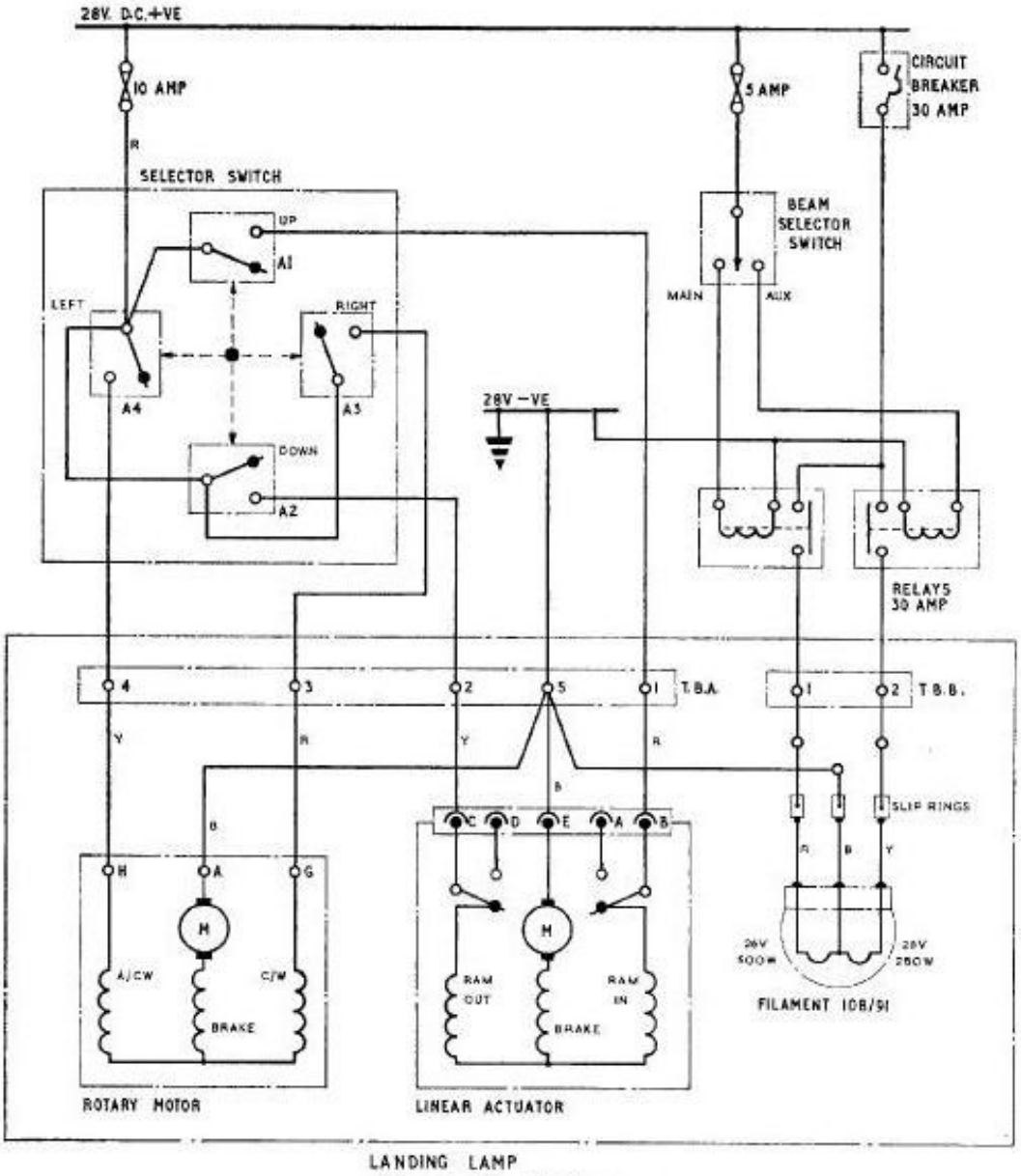

Fig. 1. Circuit diagram

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