Chapter 32

LANDING LAMP, TYPE L

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Landing lamp, Type L	*Ref. No. 5CX/4515*
Lamp, filament, 28V, 500 watts	*Ref. No. 5L/9959801*
Operating unit (Actuator, Western EOJ.150, Mk. 3)	*Ref. No. 5W/1017*
Front glass	*Ref. No. 5CX/5149*
Lens	*Ref. No. 5CX/5151*
Switch, filament	*Ref. No. 5CW/5766*
Maximum lighting time (on ground or in still air)	*10 min.*
Maximum operating frequency (operating unit)	*24 cycles/hr.*

Introduction

1. The Type L landing lamp is designed for use in large, high speed aircraft and can be power operated at speeds up to 175 knots. It has a single filament bulb so that selection of "landing" or "taxying" beam is made by using differing extended positions of the filament housing.

2. This landing lamp is fitted with a "blowback" device which permits the retractable, filament housing to be housed by air pressure on the front of the lamp. The "blowback" device reduces possible damage to the lamp and the airframe should the power retraction of the lamp be delayed after taxying and during "take-off." Increasing air-pressure on an extended lamp, in such case, might otherwise tear the lamp from its mounting.

DESCRIPTION

General

3. The Type L landing lamp consists of three main assemblies, viz.:—the outer frame casting, the inner frame casting, and the lens frame assembly casting. The outer frame has a mounting flange and the bearings which support the inner frame, or filament housing. The inner frame casting incorporates the journals which support this casting in the outer frame. It carries the front glass, the lens frame assembly and the reflector. The lens frame casting supports the lens and the filament bulb, its holder and terminal contacts.

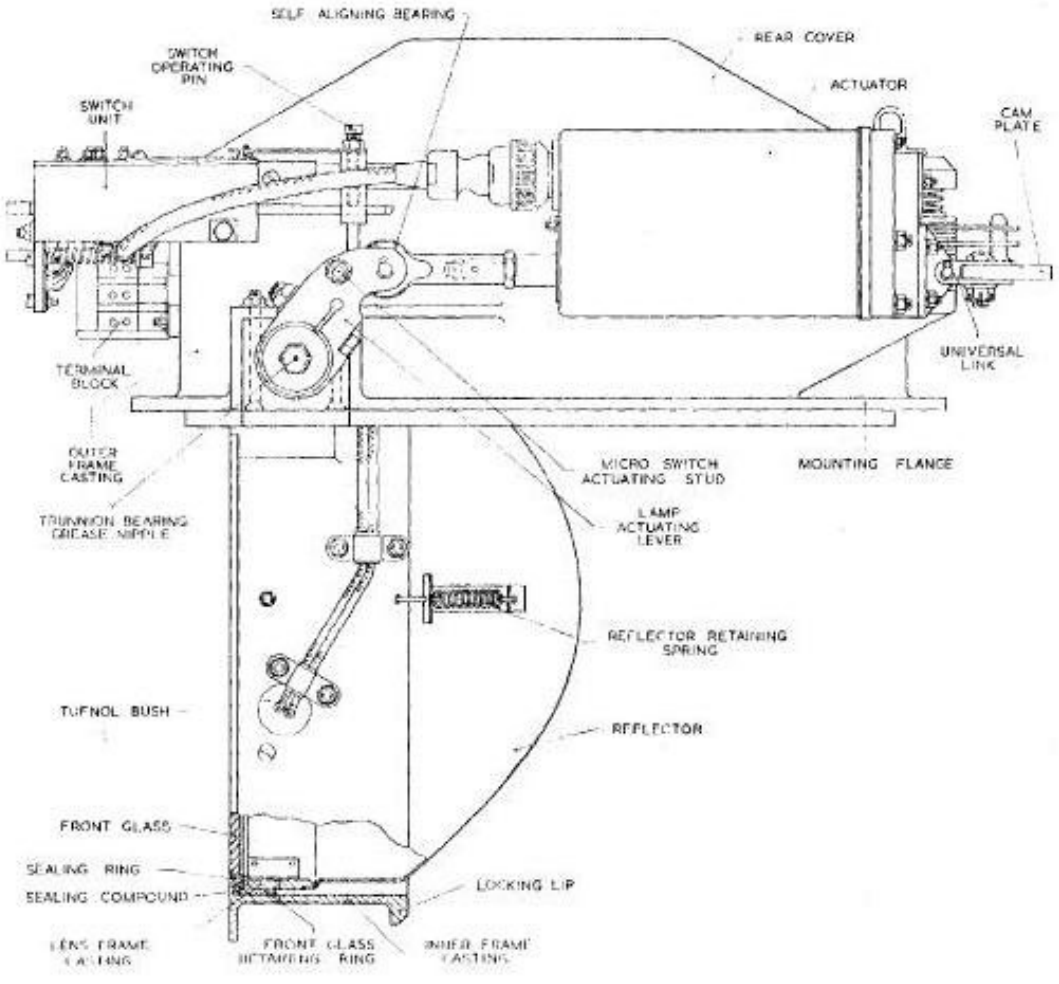


Fig. 1. Landing lamp, Type L

Outer frame

4. The outer frame is a flanged casting machined to form the mounting flange by which the lamp is secured to the airframe structure. Into the bearing housings, incorporated as part of the casting, are bolted the trunnion bearings for the inner frame, or filament housing. These bearings are lubricated from grease nipples and channels through the centre of the bearing journals.

5. At the front of the outer casting are fitted the main terminal block and switch assemblies for filament control and for adjustment of the filament housing extended position. At the rear of the outer frame, and secured by two bolts, is fitted a spring loaded locking plunger. This plunger passes through a bush in the outer frame, and engages behind a lip on the inner frame during the final retracting movement of the inner frame. The filament housing (i.e., inner frame casting) is then held firmly against vibration and possible tendency to extend by under-wing air suction.

6. Brackets, which are integral with the outer frame casting, support the "blowback" device with its spring-loaded adjustment and linkage system. A sheet metal, coned, rear cover is secured by screws to the casting.

Inner frame

7. The front of the inner frame casting is square and has end projections which, when machined, form the journals which support it in the bearings in the outer frame. A projection on this square front face is machined

to form a cam. This cam bears against a roller on the spindle of the filament switch causing it to operate when the lamp housing is approximately 45 deg. extended. This switch has snap action.

8. The inner frame is also machined to accept the front glass with its sealing and retaining rings. The front glass retaining ring is secured by six csk/hd. screws, nuts and washers to the wall of the casting. The lens frame assembly fits into the front glass retaining ring and is secured to the inner frame casting. Cables to the filament bulb are clipped to the wall of this casting and pass through an insulating bush to align with the bulb holder contacts.

9. The reflector, which is a specially curved, aluminium spinning, fits over the rear edge of the lens frame. It is secured in place by four coiled springs fitted to brackets on the back of the reflector, and having hooked ends which engage in holes at the rear edge of the inner frame casting.

Lens frame

10. The lens frame is a machined, circular casting having a cross member which supports the lens and incorporates the fixed half of the bulb support clamp. Attached to this cross member also, is an insulated base to which the filament contact plungers are fitted.

11. A filament mask is attached to the lens frame cross member. This mask, which is a thin, curved, metal plate fitting round the bulb, prevents direct vision of the glowing filament by the pilot, as is possible in those aircraft where the pilot is well forward of the lamp position.

12. The lens is held in its frame by four clips, two at the top curved edge and one at each bottom corner of the lens. The clip fittings at the bottom corners of the lens have a slot in which the straight edge of the lens sits and is supported on a spring loaded plunger. This arrangement allows for slight differences in lens mouldings and for expansion of the lens.

Filament and holder

13. The light source is a 26 volt, 500 watt, single filament lamp (*Ref. No.* 5L/9959801) having a special prefocus cap. It is rated at 50 burning hours. The metal cap case has a locating pin fitted at its side. This pin mates with a hole in the fixed half clamp of the bulb holder, and the bulb is secured by attaching the removable half of the clamp with two 2 B.A. cheesehead screws and spring washers.

14. ◀ Current is fed to the filament lamp by cables which connect directly to two spring-loaded, plunger type contacts. These plungers are held between the arms of U-brackets mounted on an insulated base attached to the lens frame casting, and locate on the top of the bulb terminal chamfer, as shown in fig. 2. To remove a spring or plunger, the spring must be compressed until the plunger can be withdrawn through the hole in the inner arm of the bracket. The plunger can then be tilted in the outer arm of the bracket and lifted out, care being taken to prevent the loss of the spring. ▶

Operating unit

15. The filament housing is power operated by a Western, Type EOJ.150, Mk. 3, actuator details of which will be found in Chap. 7 of A.P.4343D, Vol. 1, Bk. 3, Sect. 14. The plunger of the actuator is coupled to the forked end of an actuating lever clamped to the journal of the filament housing. The trunnion end of the actuator is coupled by a universal link to one arm (*point* X, *fig.* 3) of a double ended lever formed by the steel cam plate of the "blowback" mechanism. In normal operation the cam plate is held fixed by a roller, engaging a toe at the cam edge, and under pressure from the spring "W," but in certain circumstances, it can pivot about the centre (AA) of the friction clutch. The other arm of the cam lever bears against the spring-loaded locking plunger (*point* Y, *fig.* 3), at the rear of the outer frame.

Actuator operation

16. The actuator plunger extends or elongates when the filament housing is being retracted. The actuator limit switch is adjusted so that, when the lamp housing is fully retracted the motor continues to run for a short period. The additional movement

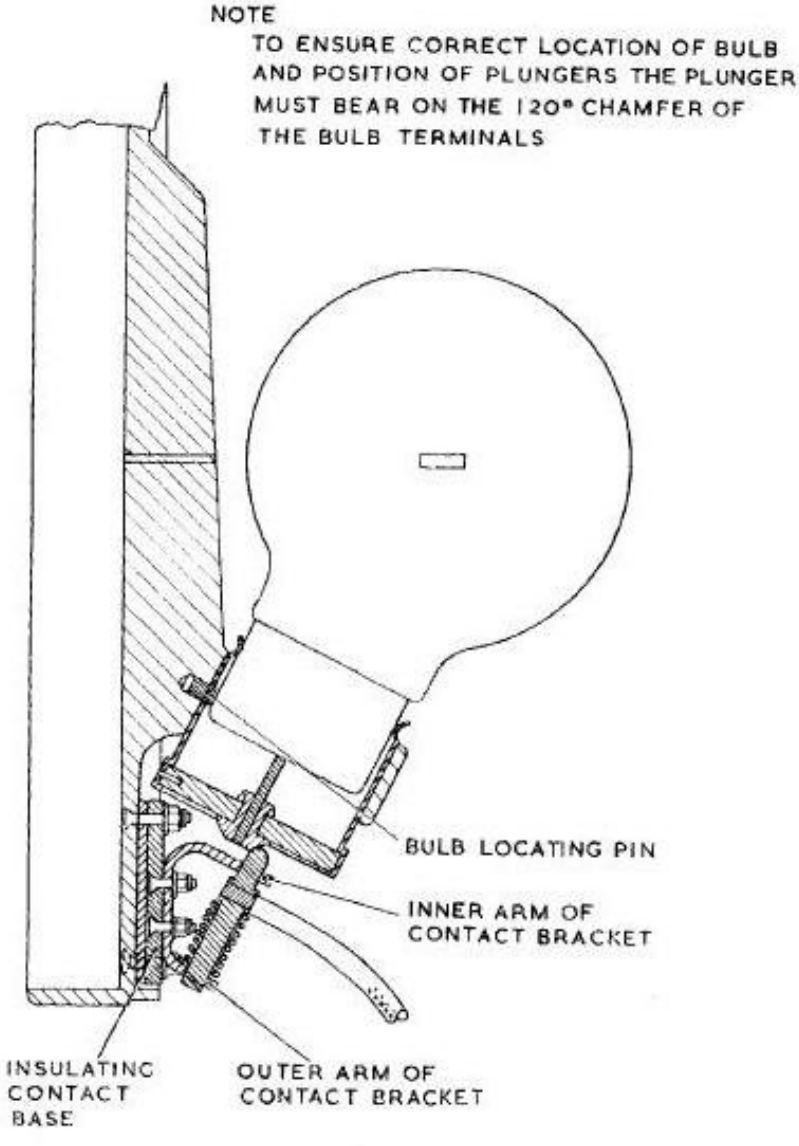


Fig. 2. Filament holder and contacts

of the plunger is then transmitted to the cam-plate which, viewed from above, will turn anti-clockwise. The cam lever will cause the locking plunger to engage behind the lip on the filament housing and hold it firm, at which point the actuating limit switch opens.

17. The locking movement of the cam plate is very small and insufficient to disengage the roller which bears against its edge. The friction clutch does not come into operation because pin "C" (*fig. 5a*) on the cam plate has sufficient clearance in the holes of the friction clutch plates to prevent clutch engagement.

18. The actuator plunger contracts when the filament housing is being lowered. The first movement of the actuator will return the cam plate to its normally locked position. This small movement will cause the cam lever to release the filament housing locking plunger which will be withdrawn by the action of the plunger springs. The lamp housing will continue to be lowered until the actuator circuit is opened by the pre-set "land" or "taxi" micro switches. The "extend" limit switch inside the actuator may not now open since it is set at 94 deg., it does, however, come into operation when

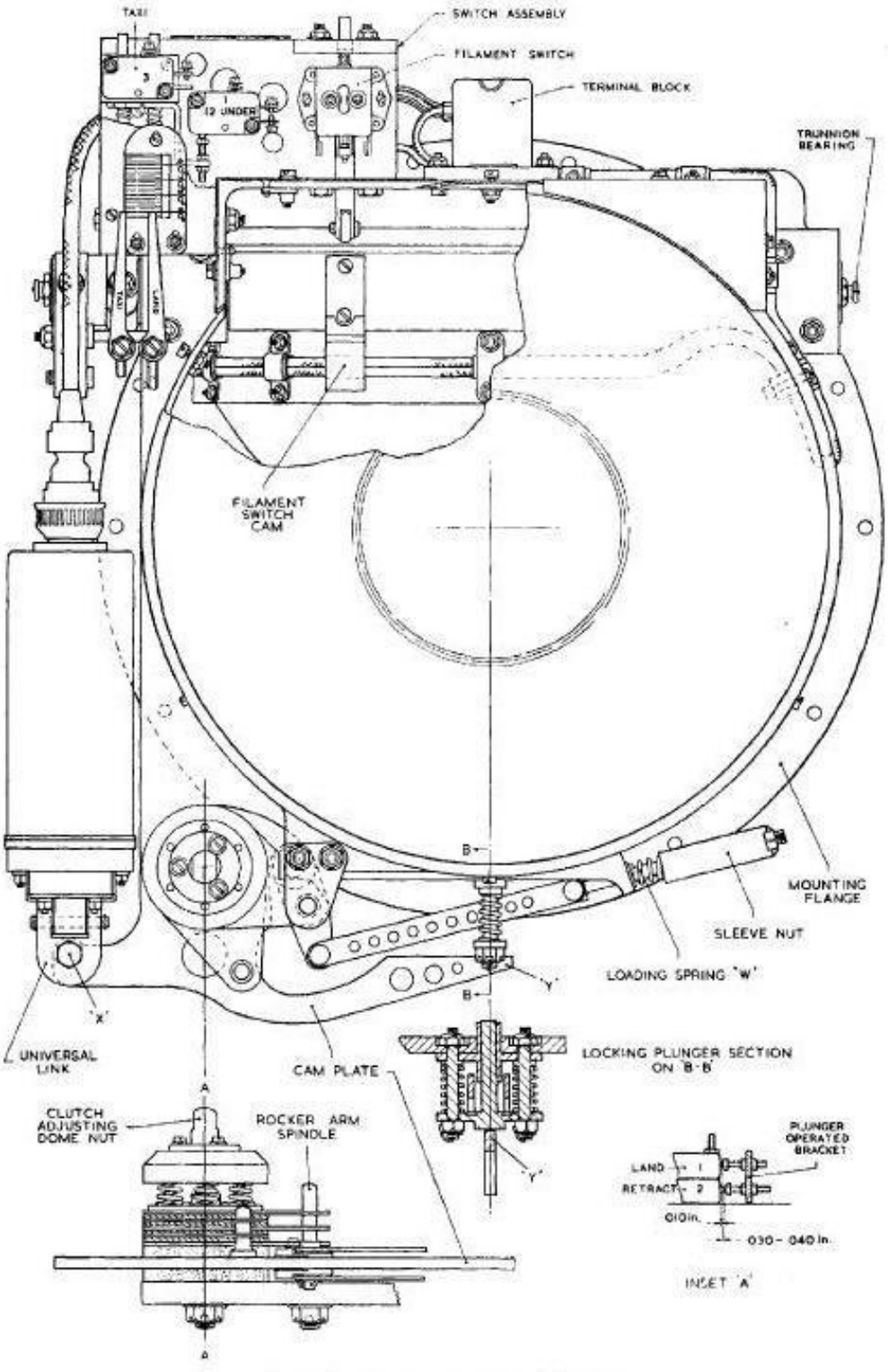


Fig. 3. Plan view, part sectioned

"blowback" mechanism operates, as explained later (*para.* 34).

Electrical connections

19. Control of the movement of the filament housing is from a three-way switch in the cockpit. Positions of this switch are marked RETRACT, LAND and TAXI. The filament circuit is automatically controlled by the lamp housing which operates a 30 amp. snap action switch when the housing is approximately 45 deg. extended. A five way terminal block is fitted at the front of the outer frame casting of the lamp to which the flexible cable to the actuator plug is connected

"Land" and "Taxi" adjustments (*fig.* 3)

20. The extended positions of the filament housing, for both the "land" and the "taxi" beams, are adjustable between the limits of 54 deg. and 94 deg. This is arranged by operating micro switches connected in series with the actuator. These micro switches are fitted in the switch unit assembly attached to the front of the outer frame casting and are operated by spring loaded plungers.

21. To each micro switch plunger is clamped an operating pin which carries an engraved pointer at its upper end and, at its lower end, bears against an actuating stud fitted through the lamp actuating lever (*fig.* 1). The engraved pointers (one LAND and one TAXI) register against a scale on the cover of the switch assembly.

22. The "taxi" plunger operates one switch, i.e., No. 3 switch in fig. 3 and the "land" plunger operates two switches fitted one above the other (No. 1 and 2) through a bracket fitted with two 6 B.A. tappet screws. The settings of these tappet screws are so arranged that No. 1 switch operates (to open its contacts) a little before No. 2 switch, which operates to close its contacts. The tappet settings, to operate 0·03 to 0·04 in. travel apart, are shown at inset "A" to fig. 3.

Electrical operation

23. ◀ The circuit diagram given in fig. 4 shows the landing lamp connected in a typical installation with the lamp retracted and the circuits de-energised. During normal operation micro switch No. 1 will open before micro switch No. 2 closes. When LAND is selected the actuator circuit is completed through switch No. 1 and pins B to E and the motor will run until switch No. 1 opens at the pre-set landing beam angle. ▶

24. If now TAXI is selected the actuator circuit is through switch No. 3 and pins B to E. This further extending movement of the lamp will have caused switch No. 1 to open-circuit and shortly afterward switch No. 2 to close-circuit. The motor will run to further extend the lamp to the pre-set taxying beam angle, i.e., when No. 3 switch open-circuits.

25. If LAND is selected from the TAXI position the lamp must retract a few degrees. The retract circuit in this instance will be through No. 2 switch to terminal 3 and pins C to E of the actuator. The motor will run until No. 2 switch opens; meanwhile No. 3 switch will have closed again.

26. When RETRACT is selected the actuator circuit by-passes all micro switches except the limit switch within the actuator. This limit switch opens circuit when the lamp is fully retracted and locked. The movement of the actuating lever during retraction will cause the "land" and "taxi" micro switches to resume the conditions shown in the circuit diagram.

"Blowback" mechanism (*fig.* 5)

27. This consists of a steel cam plate fitted on a spindle screwed and locked in a bracket cast integral with the outer frame casting. The cam forms a double ended lever (the cam spindle "AA" being the fulcrum), a projection on the cam forming a toe behind which a roller locates to hold the cam from rotating. The roller is attached to one end of a rocker arm (pivoted on the outer frame), the other end of which connects by coupling bars to a coupling rod.

28. The coupling rod passes through a vertical bracket on the outer frame and carries the loading spring "W" secured on the rod by a sleeve nut. Compression of this spring by the sleeve nut determines the pressure of the roller against the cam and hence the air speed at which the mechanism will "fire." The sleeve nut is split-pinned to the coupling rod, at the required loading spring compression during assembly, and normally would not be altered.

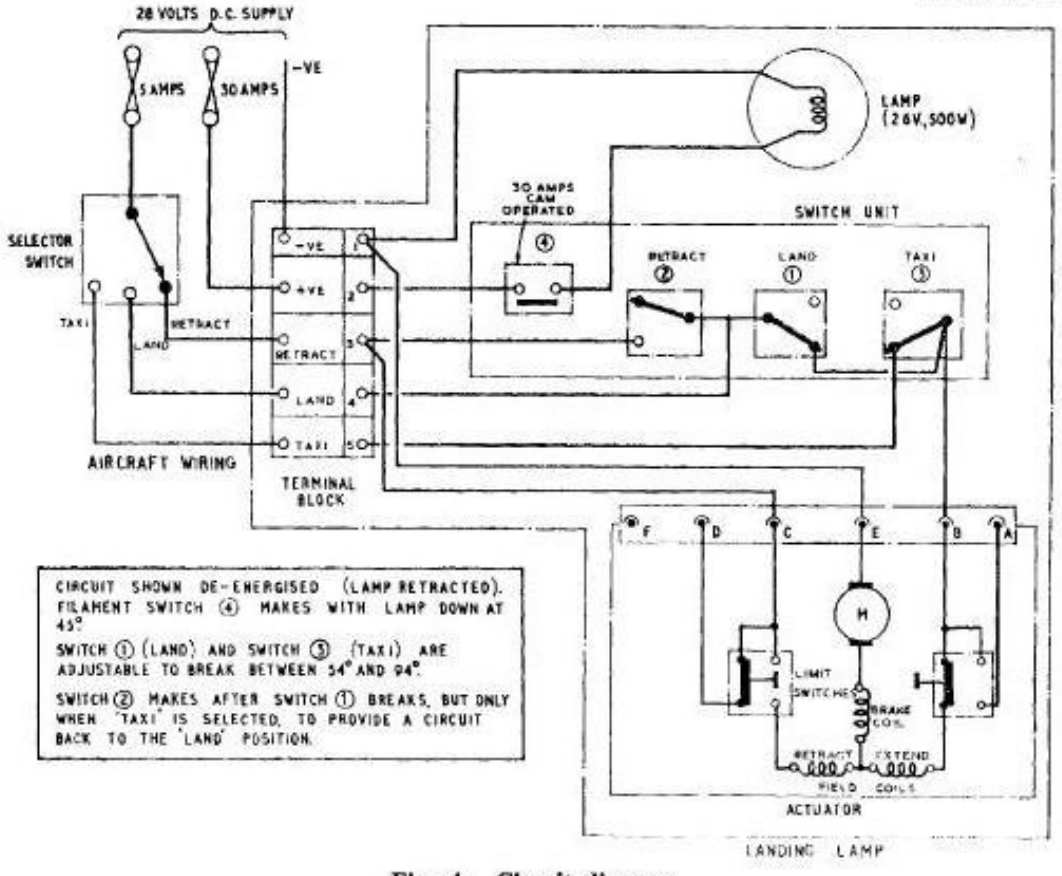


Fig. 4. Circuit diagram

29. The clutch consists of five metal plates, interleaved with cork friction discs. Three clutch plates are anchored on the rocker arm spindle and two have an anchor pin on the cam. The clutch assembly is mounted on the cam spindle, and pressure is obtained by six springs in a circular housing, adjusted by a domed nut on the top of the cam spindle. This domed nut is locked in the required position by three 4 B.A. screws tapped into the spring housing.

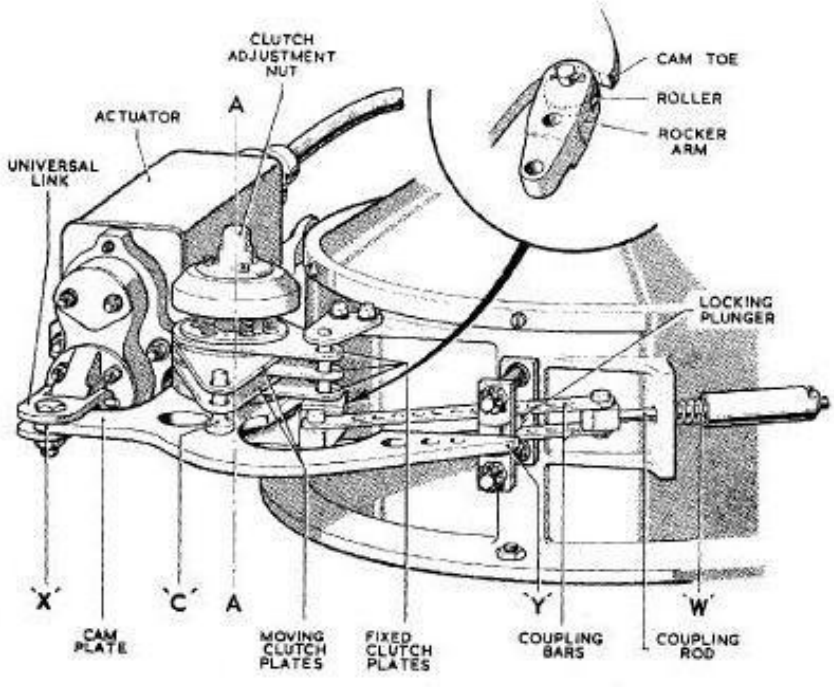
" Blowback " operation

30. This device will automatically operate when air pressure on the front of the extended lamp increases sufficiently to overcome the force of the loading spring, as would be the case during take-off in a high speed aircraft. Since the actuator is not electrically energized it is now virtually a rigid link pivoted between its coupling points. The air pressure force is transmitted through the actuator to the (normally fixed), point " X " (*fig.* 5a) on the cam plate tending to move it in a clockwise direction, viewed from above.

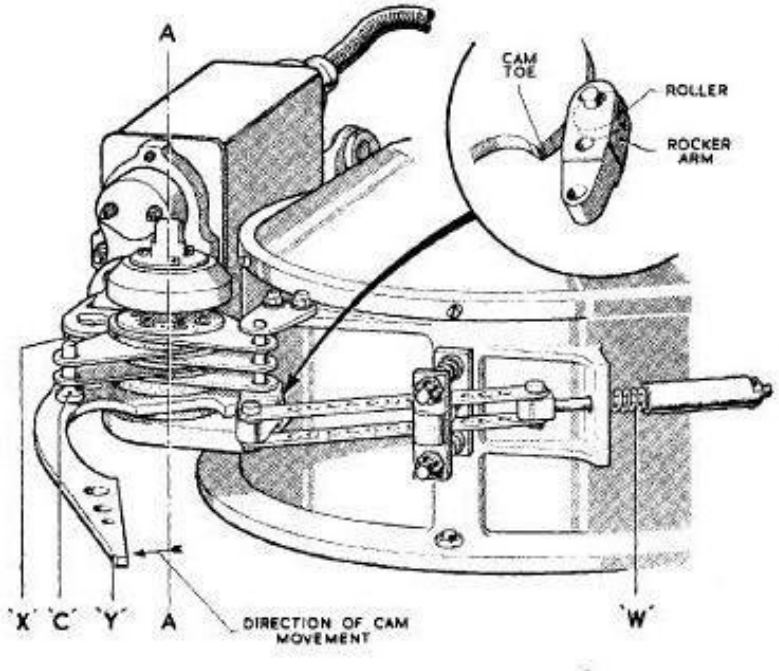
31. As this force increases and overcomes the loading force of the spring the cam will move rapidly and the roller will pass over the top centre of the toe of the cam plate. This is the " firing " action of the mechanism, during which the lamp housing will move quickly toward its housed position. If this movement were not controlled damage might occur but the friction clutch operates to restrain the cam movement.

Note . . .

A force of 45/50 *lbs. applied at the locking lip on the filament housing will cause the mechanism to "fire" and the friction clutch is adjusted so that* 20/25 *lbs. will be required to house the lamp against the clutch friction.*



(a) LOCKED



(b) FIRED

Fig. 5. "Blowback" mechanism

32. The "blowback" mechanism having "fired", the lamp housing will move to a position where the force of air pressure balances the friction clutch force. The lamp may then not be completely housed but it will be safe from damage. The lamp housing will not be locked because point "Y" of the cam lever (*fig.* 5b) will be well clear of the locking plunger. In this state the lamp is held by the friction clutch.

33. After the "blowback" mechanism has operated the lamp will not be housed and locked until RETRACT is selected at the cockpit control switch. The actuator motor will run, and will first rotate the cam anti-clockwise until the rocker arm roller engages the cam toe and locks the cam in its normal position. The point "X" on the cam is again held fixed and further movement of the actuator will be transmitted to the lamp housing, moving it to the fully housed position and operating the lock.

Actuator operation during "blowback"

34. It should be noted that the aircraft "taxi" angle micro switch setting may be less than 94 deg. in which case the internal limit switch of the actuator (set at 94 deg.) will not be operated. Referring to the circuit diagram, with the cockpit switch still at TAXI, when the "blowback" mechanism "fires," then the "taxi" micro switch on the lamp will close the actuator circuit. The actuator motor will run until its internal limit switch opens but this motion will not be transmitted to the lamp because point "X", i.e. the cam, is now free to move. This actuator motion contracts the overall length of the actuator which, in these circumstances, is serving as a solid link.

SERVICING

General

35. ◀ Extend the lamp to the fully open, or TAXI, position and inspect it for freedom from damage or corrosion; check the filament cable for deterioration, and the filament terminals and plunger contacts for pitting or burning. After inspection functionally check the lamp ensuring that, the filament lights at approximately 45 degrees, and that when TAXI is selected from the LAND position the lamp further extends to the TAXI position. Allow the lamp to remain alight for 5-10 seconds and then select RETRACT and ensure that the filament is extinguished at approximately 45 degrees and the lamp retracts fully and is locked in position.

36. After the functional check inspect the filament lamp glass for white streaks or blackening, which indicate a failure of the glass seal, and if present renew the filament. Renewal of defective components on the inner frame assembly, other than the filament lamp, may more conveniently be done on the bench, but with care may be done in situ on the aircraft. Whenever the lamp is removed to the bench for servicing the actuator and blowback mechanism should be inspected for freedom from damage and corrosion, and the inner casting bearings and the rollers lubricated using grease XG-275. ▶

Note . . .

Remove the 30 amp. fuse of the filament circuit before commencing any servicing which involves stripping the lamp.

Cleaning the reflector

37. Extend the lamp to the maximum opening angle. Unclip the four retaining springs and carefully withdraw the reflector. The reflector should be cleaned with a soft dry cloth. Warm soapy water may be used to remove dirt and then dry with a soft cloth. DO NOT USE POLISH OR ABRASIVES. To replace the reflector see that it seats correctly on the rim of the lens frame and clip on the retaining springs.

Renewing the bulb

38. First remove the reflector. Remove the two 2 B.A. cheesehead screws in the bulb clamp and remove the top half of the clamp. Hold the bulb by its metal cap near the contact plungers and lift it out. To fit the new bulb insert the cap into the clamp and see that the locating pin on the cap enters the hole in the clamp when pressed down on the contact plungers. Replace the top half of the clamp and secure with, but do not over-tighten, the two 2 B.A. screws. Wipe the bulb glass with a soft cloth and replace the reflector.

Renewing the lens

39. First remove the reflector and bulb as detailed in para. 37 and 38. Next, remove the cable clamp next to the tufnol bush on

the outside of the inner frame. Release the lamp contact plungers from their brackets by pushing them against their springs, and then lifting upwards. Pull the cables through the bushed hole in the inner frame. Remove two 4 B.A. csk/hd. screws and nuts which clamp the lens frame to the inner frame (sited either side of the nameplate) and withdraw the lens frame complete with lens. To remove the lens, remove the two spring-loaded side clips (one 4 B.A. csk/hd. screw) taking care not to lose the springs and plungers. The lens can now be slipped from under the top clips.

40. Insert the new lens into the slots in the top clips with its fluted side toward the front glass and re-assemble the side clips. Test the lens seating by pressing the lens against the plungers of the side clips. The lens must be able to move 0·03 in. to 0·04 in. to allow for expansion. Replace the lens frame and align with the two 4 B.A. fixing screws, nuts and washers. Push the cables through the inner frame and press home the tufnol bush. Replace the cable clamp. Insert the contact plungers in their brackets, spring end first and press down on domed ends, to insert them into the front holes of the brackets. Replace the bulb and reflector.

Renewing the front glass

41. This is more conveniently carried out on a work bench but with care may be done in situ on the aircraft. Remove the reflector and the lens frame complete with bulb. This will expose the glass retaining ring which is secured by six 6 B.A. csk/hd. screws and nuts. The nuts are outside the frame casting and special care will be necessary not to lose the two upper screws and nuts which are well inside the outer frame casting. Remove the retaining ring and the sealing ring and push the damaged front glass inward. Remove all old sealing compound.

42. Hold the new front glass firmly, with its rebated side in the frame and fill the gap between the edge of the glass and the wall of the frame casting with sealing compound (*Ref.* 5CX/5085). Replace or renew the sealing ring (*Ref.* 5CX/5150). Replace the retaining ring and secure with its six 6 B.A. screws (nuts and washers outside the frame). Clean the front glass inside and out. Re-assemble the lens frame and reflector after cleaning each item.

Bench check

43. If the lamp is removed to a workshop and can be secured by its flange to a suitable bench, the "blowback" operation may be simulated by using a tensiometer, and pulling on the locking lip of the inner frame until the mechanism "fires" at an indicated pressure of 45/50 pounds. With the cam in the "fired" position the domed nut on the clutch can be adjusted so that the tensiometer reads 20/25 pounds while the lamp is being drawn into the retracted position.

Final check

44. After servicing the lamp replace the 30 amp. filament fuse and operate the control switch through all positions. Check that the filament glows and that there is no fouling of moving parts. Clean all dirt from outside the lamp and finally ensure that the front glass is clean. Leave the control switch in the RETRACT position.

(81598) Gp. 375/1. D 5178/WL 72544/172543/L.P.S. 2625/3/62.