TECHNICAL INSTRUCTION
F.5

Auricon Super-1200 16-mm Motion-picture Camera

First issue November 1962

AMENDMENT RECORD

Amendment Sheet No.	*Initials*	*Date*	*Amendment Sheet No.*	*Initials*	*Date*
F.5-1					
F.5-2					
F.5-3					
F.5-4					
F.5-5					
F.5-6					
F.5-7					
F.5-8					
F.5-9					
F.5-10					
F.5-11					
F.5-12					
F.5-13					
F.5-14					
F.5-15					
F.5-16					
F.5-17					
F.5-18					
F.5-19					
F.5-20					

CONTENTS

ILLUSTRATIONS IN TEXT

DIAGRAM AT END

ACKNOWLEDGMENT

Thanks are due to Bach-Auricon Incorporated, who kindly supplied Figs. 2.8 and 4.1, and also to the British Standards Institution, for permission to reprint from B.S. 677: Part 2: 1958 the material given in Appendix A.

Fig. 1.1 Auricon Super-1200 Camera: Complete Channel

AURICON SUPER-1200 16-mm MOTION-PICTURE CAMERA

SECTION 1

INTRODUCTION

1.1 General

The Auricon Super-1200 motion-picture camera is designed for single-system picture and sound recording on 16-mm film. Both optical and magnetic sound-recording facilities are incorporated.

Film is contained in detachable magazines that are available in two sizes to hold either 600 or 1,200 feet. These lengths give fifteen or thirty minutes respectively of continuous filming at the television picture-repetition rate of 25 frames per second.

The shutter of the camera has a variable exposure-angle which can be continuously adjusted to obtain fade-in and fade-out effects while the camera is running. The maximum exposure angle is 180 degrees which gives an exposure of a fiftieth of a second.

A range of six lenses with C-mounts is normally supplied for use with the camera and a zoom lens is available also. The camera accommodates three lenses on a turret.

Three viewfinder systems are provided:

(a) For focusing the camera taking lens, a reflex viewfinder system is employed. This enables a scene to be viewed through the taking lens, and while it is in use the camera cannot be started. The viewfinder can, however, be brought into use after starting the camera, to check synchronism with a background-projection system or for recording from a television screen.

(b) While film is being exposed, the *Telefinder* viewfinder is used. This utilises the same eyepiece as the reflex system, but in conjunction with a separate objective lens which is mounted on the turret. A Telefinder objective lens is provided for use with each of the taking lenses. When working at short range the Telefinder viewfinder does not give an accurate representation of the image appearing in the camera gate, because the separation between the taking lens and the viewfinder objective lens gives rise to parallax errors.

(c) Provided for close working, where the Telefinder is unsuitable, is the Auricon Auto-parallax Camera View/Range-finder. This is a self contained unit mounted on the side of the camera, and has a focusing lever which also adjusts an arrangement of mirrors to compensate for parallax.

The camera is driven at a constant speed by an induction motor, for which a 115-volt supply is obtained, either from the a.c. mains via a transformer, or from a 12-volt battery supply via a rotary convertor. The camera mechanism floats on resilient mountings inside an acoustically treated housing and a blimp is not required although a blimping hood is supplied to suppress noise radiated by the lens turret.

A complete Auricon Super-1200 channel is shown in Fig. 1.1. The camera is fitted with a 1,200-foot magazine and is mounted on a Vinten light gyro tripod. In the photograph, the blimping hood is shown separated from the camera, exposing to view the turret fitted with three lenses. Also shown are two amplifiers, a portable power supply unit, transformer, battery box and magazine cases.

In this Instruction the terms right-hand, left-hand, forward and rear are used to denote these directions as seen from a position behind the camera.

1.2 Summary of Equipment

1.2.1 Camera

Weight (camera only): 33 lb.

Weight (in carrying case with lenses and cable): 61 lb.

Supplies: 115 volts a.c. (via transformer from the mains or from 12-volt battery via the Auricon Portable Power Supply Unit Type PS-21AL).

Film Stock: 16-mm single-perforated, plain or with magnetic stripe, in 600-ft or 1,200-ft lengths, darkroom loaded. Winding sense *B*.

Lenses: A range of six with C-mounts. Turret will accommodate three lenses. A zoom lens is also supplied.

Camera mounting: $\frac{3}{8}$-in. tapped hole in camera base.

1.2.2 Sound Systems

Comopt: Recording galvanometer in camera driven by an Auricon Amplifier Type NR-25-S7.

Commag: BBC magnetic head assembly in camera driven by BBC amplifier Type AM15/502. Two heads are provided giving facilities for monitoring the sound as it is recorded.

1.2.3 Sound Apparatus

Auricon Amplifier Type NR-25-S7

Weight: 37 lb.

Dimensions: 20 in. by 14 in. by 6½ in.

Power supplies: self-contained dry batteries.

Inputs: 50-ohm microphone and high-impedance high-level.

BBC amplifier Type AM15/502

Weight: 8½ lb.

Dimensions: 10½ in. by 8¼ in. by 3½ in.

Power supplies: self-contained dry batteries.

Inputs: two 30-ohm microphone inputs. A balanced high-impedance line input via an attenuator is paralleled with one microphone input.

1.2.4 Ancillary Equipment

Tripod: Vinten light tripod with gyro head. A floor spider is supplied for indoor use.

SECTION 2

ELECTRO-MECHANICAL ASSEMBLY AND ATTACHMENTS

2.1 General Description of Camera

2.1.1 Main Casting

The camera is constructed on a light-alloy casting which divides the camera housing into two compartments. This casting is supported on four resilient mountings and the housing is lined with sponge rubber. This arrangement obviates the use of a blimp and the camera is termed ' self-blimped.' The film transport mechanism and sound recording heads are mounted on the left-hand side of the casting, while the motor and drive gearing are on the right-hand side. Also on the right-hand side are various linkages which operate the viewfinder, claw-retraction and shutter-angle mechanisms.

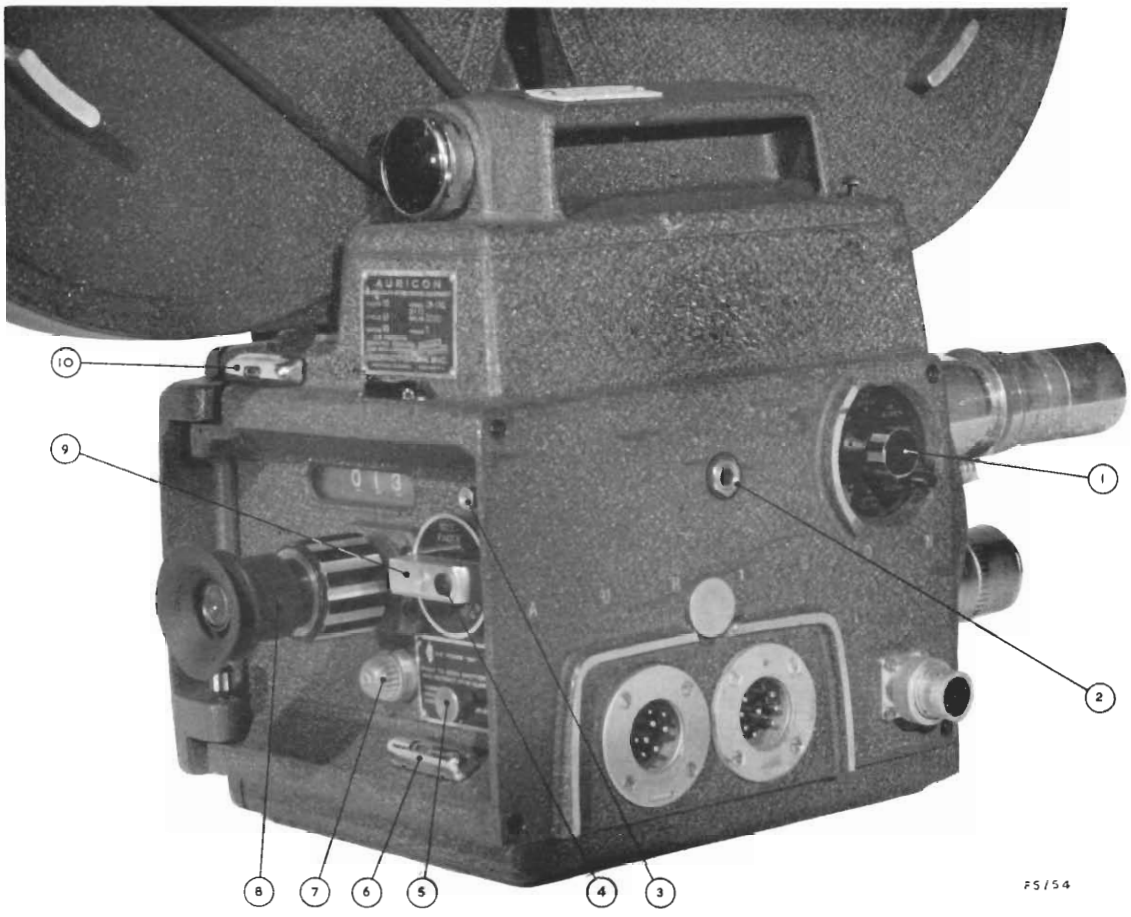


Fig. 2.1. Oblique View of Camera

1. Exposure Control
2. Headphone Jack
3. Stop Button
4. Start Button
5. Claw-retraction Plunger
6. ' Heater On ' Neon
7. ' Mains On ' Neon
8. Viewfinder Eyepiece
9. Viewfinder Control-bar
10. ' Film Running ' Neon

2.1.2 Housing

The housing is a light-alloy cast box, with a

circular opening at the front to accommodate the lens turret. The sides and top of the box are closed by detachable covers. The left-hand side cover is hinged at the rear and a separate assembly, the Auto-parallax View/Range-finder, is mounted on this cover. The view/range-finder obstructs the fitting of a zoom lens and an alternative plain door is supplied. (If a plain door is not available, the view/range-finder can be removed.) The cover on the right-hand side of the camera is secured by four

noise radiated by the lens turret which is mounted outside the sound-proof housing. The hood consists of a light-alloy casting, closed at the front by an optical-glass panel and mounted on the front of the camera on two rods supported by removable cast brackets.

2.1.4 Take-up Motor

A separate motor is provided to drive the take-up spool of the magazine. This motor is mounted in

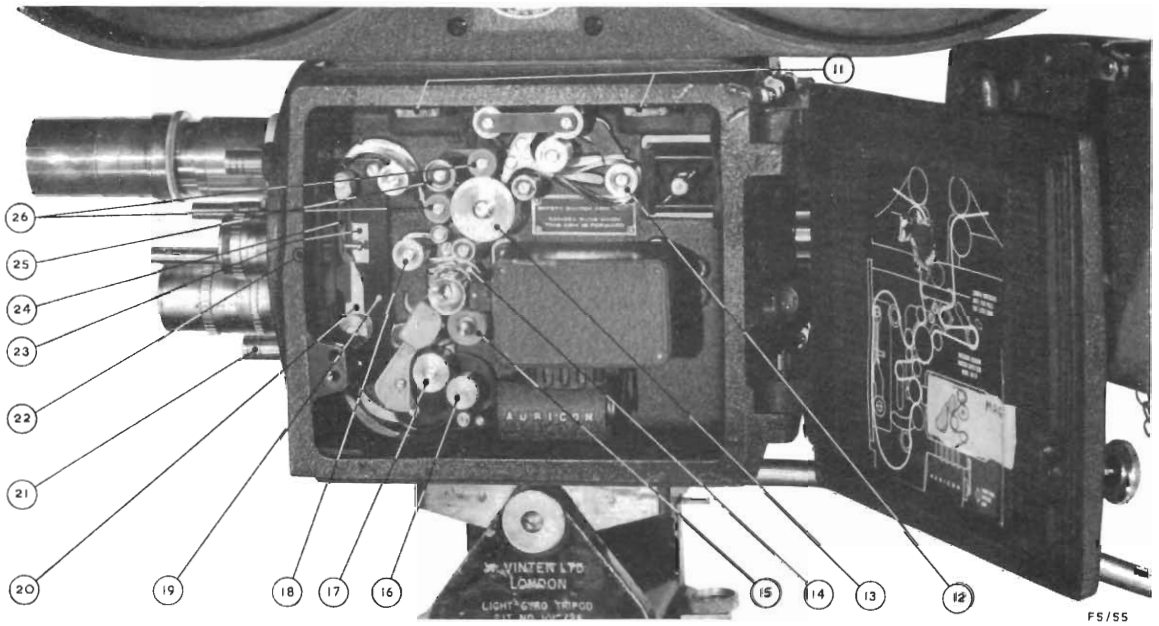


Fig. 2.2. Left-hand Side of Camera with Door Open

11. Magazine Holding-screws
12. Film Take-up Trip Pulley
13. Film Transport Sprocket
14. Sound Drum
15. Tension Roller
16. Loop Adjustment Roller
17. Loop Adjustment Roller
18. Tension Roller
19. Plate carrying Gate Assembly
20. Claw Cover
21. Turret-lock Release Plunger
22. Access to Dovetail Carriage Stop Screw
23. Film Side-pressure Spring
24. Latch
25. Control Knob for Lay-on Rollers
26. Retractable Lay-on Rollers

Allen screws and carries a knob (1, Fig. 2.1) which controls the exposure angle of the shutter, a head-phone jack (2) and three connectors, through which all electrical connections are made to the camera. The top cover is cast to form a carrying handle and contains two red-glazed holders for pilot lamps. In BBC practice, these lamps are not used.

2.1.3 Blimping Hood

The blimping hood is supplied to suppress

the top of the camera housing and access to it is obtained after removing the top cover. The motor and gearing are assembled on a resiliently mounted casting and they drive (through a flexible coupling) a shaft mounted through the housing wall. The outer end of this shaft carries a pulley which transmits the drive through a rubber belt to the take-up drive pulley of the magazine.

2.1.5 Magazine

The magazine is assembled from light-alloy

castings and is supplied in two sizes to accommodate either 600 ft or 1,200 ft of film. The spool boxes are closed by screw-on covers and are separated by a housing which contains light-trap rollers by means of which the film leaves and enters the magazine. The magazine is attached to the film. If this centre is not available, 20 to 30 turns of film may be wound on to the spool to obtain an increased diameter. The 600-ft magazine is fitted with an idler pulley to take up the excess length of belt caused by the reduced size of the magazine.

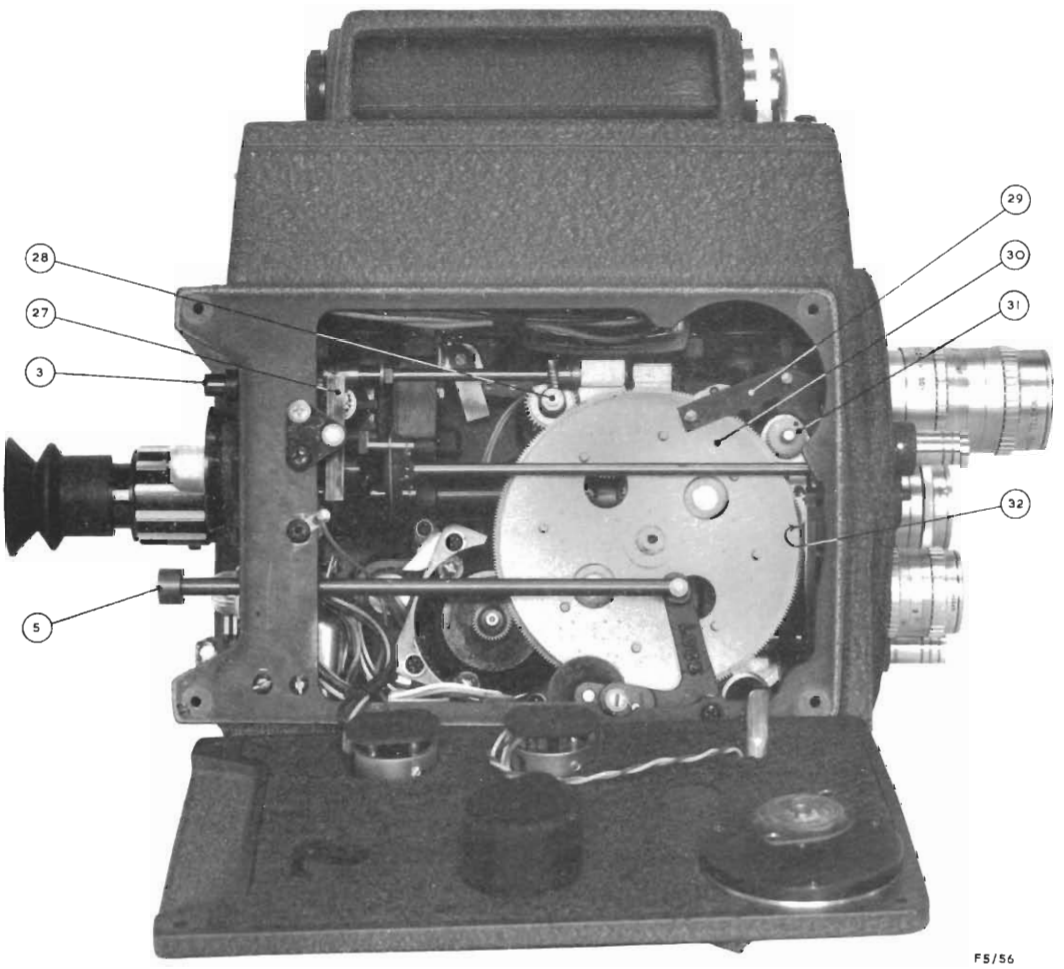


Fig. 2.3. Right-hand Side of Camera with Cover Removed

3. Stop Button
5. Claw-retraction Plunger
27. Mains-switch Rocker Arm
28. Film-transport Sprocket Shaft
29. Coupling to Exposure Control (1, Fig. 2.1)
30. Flywheel
31. Shutter Driving Gear
32. Claw Driving Gear

the top of the camera by two knurled screws accessible when the left-hand side door of the housing is opened. (11, Fig. 2.2.)

The spool spindles accept standard 16-mm centres, but a special 3-in. centre is provided for the take-up spool to ensure prompt take-up of

2.1.6 Turret

The lens turret is a cast disk retained on the front of the main casting by a brass ring. A rubber ring, fitted in a groove on the outside of the brass ring, forms a light-tight seal with the camera housing. The turret can accommodate three C-

mount lenses together with the three associated Telefinder objective lenses. The holder into which each objective lens is screwed forms a ball-and-socket joint with the surface of the turret. Adjustment of the three retaining screws allows the lenses to be aligned to make the image seen in the viewfinder identical with that focused on the film.

The turret is located in each of its three positions by a spring-loaded plunger which engages with depressions in the rear surface of the turret. To allow the turret to be repositioned, the plunger can be thrust clear of a depression by means of push-buttons which are mounted through the turret and form grips to assist in turning the assembly. (21, Fig. 2.2.)

2.2 Drive and Film Transport Mechanisms

2.2.1 Drive Mechanism

The drive motor is mounted at the lower rear right-hand side of the main casting. A brass sleeve, pinned to the motor spindle, is coupled by a pair of wire springs to a nylon gearwheel which runs freely on the spindle. This arrangement provides a shock-absorbing drive and prevents damage to the pinion on starting. A projection on the pinion engages with another on the sleeve to give a positive drive if the springs are stressed excessively.

The pinion drives a large gearwheel; this is mounted freely on a shaft and has two studs, cushioned by felt sleeves, which project into holes in a flywheel (30, Fig. 2.3). The flywheel is fastened to the shaft, which is thus resiliently coupled to the motor. The shaft is supported through the main casting in a bronze bearing and carries at its left-hand end the sound drum (14, Fig. 2.2) which, with the smoothing action of the flywheel, moves the film past the sound recording heads at a constant speed. A ribbed inching knob is mounted on the sound drum.

The large gearwheel drives the following three trains of gears:

(a) Through a wheel compound with itself, a sprocket shaft (28, Fig. 2.3) and a reduction gear-train driving the film-footage counter. The sprocket shaft carries the film transport sprocket (13, Fig. 2.2) at its left-hand end.

(b) The small nylon gearwheel (31, Fig. 2.3). This is pinned to a shaft which is supported in a bearing through the main casting and carries at its left-hand end a bevel gear (34, Fig. 2.5) to which the shutter shaft is coupled.

(c) The small nylon gearwheel (32, Fig. 2.3). This is mounted on a second shaft similar to that mentioned in (b) and carries at its left-hand end a bronze cylinder which operates the film transport claw.

The claw mechanism referred to in (c) is similar in principle to that illustrated in Fig. 2.5 of Instruction F.4. The bronze cylinder is recessed into the main casting so that its left-hand face is flush with the surface. The claw is formed from a metal strip and has a slot at its lower end which registers with a pin pressed into the casting. The upper tip of the claw extends forward and is twice bent through a right-angle to enter the sprocket holes of the film from the front, acting through a cut-out in the aperture plate. The cut-out is lined with a steel clip to protect the plate from wear.

At the upper end of the claw a pin engages with a hole in the driving cylinder, and the claw enters and leaves the holes in the film at instants when the pin is passing through top and bottom dead-centres. At these points in its travel, the pin imparts only a horizontal motion to the claw, so that the film is brought to rest before the claw is withdrawn. A register pin is not therefore necessary.

The claw lies in a recess in the main casting and is covered by a plate (19, Fig. 2.2). This plate, which extends throughout the height of the gate, also covers a cavity containing the bevel gearing which drives the shutter shaft. Mounted on the plate are a latch (24) supporting a back-pressure plate, a leaf spring (23) which applies a side pressure to the film and a spring-loaded pivoted arm (20), the claw cover.

When film is to be laced in the camera it is necessary to position the mechanism so that the claw is withdrawn from the gate. At other times it is required to position the shutter so that the taking lens is unobscured. To facilitate these adjustments, a (green) push-button is provided, which projects through the rear of the camera housing. Pushing this button (5, Fig. 2.3) operates a bell-crank lever, thus forcing a disk against studs which project from the outer face of the flywheel. The flywheel comes to rest in a position where two studs are in contact with the disk and the eight studs are arranged so that any of the rest positions fulfils the above requirements.

2.2.2 Film Transport Mechanism

The path of the film through the camera is shown in Fig. 2.2, while Figs. 2.4(a) and 2.4(b) show diagrammatically the two alternative lacing

methods, for sound recording by the optical or the magnetic system.

The lacing diagram pasted inside the covering door (Fig. 2.2) shows that the film passes over sprocket (13) twice. The sound drum (14), which is driven, also has sprocket teeth to ensure that the recorded sound maintains synchronism with the film in the gate. The film is held in contact with the upper side of the sprocket by the rollers (26) which are mounted on a movable plate controlled by a red-anodised knob (25). This enables the rollers to be retracted to facilitate lacing.

The film passes from the sprocket to the gate mechanism, through which it is pulled by the claw. The aperture plate is fitted with eleven sapphire inserts which present smooth wear-free surfaces to the emulsion side of the film. A twelfth sapphire is mounted in the side of the gate and opposes the side pressure of the leaf spring. The film is held against the aperture plate by the back-pressure plate, which is held by the spring-loaded latch (24). In the region of the claw, the edge of the film is held in position firmly by claw cover (20), the edge of which is hollowed to clear the tip of the claw as this penetrates the sprocket holes in the film.

After leaving the gate, the film is formed into a loop, and passes either over rollers (16) and (17), as in Fig. 2.4(b), or between rollers (16) and (17), as in Fig. 2.4(a). The first arrangement, used for magnetic recording, introduces extra length into the path of the film, and compensates for the change from 26 frames separation between film gate and optical recording head to the 28 frames which are standard in magnetic recording.

The film is tensioned around the sound drum by spring-loaded rollers (15 and 18, Fig. 2.2) so that accurate focus of the light beam is maintained. The correct loop length above and below the gate is indicated by a raised line in the casting.

The film passes from the tension roller round the lower side of the sprocket to roller (12). This roller is mounted on a spring-loaded arm which actuates a micro-switch (S6, Figs. 2.6 and 2.7) which disconnects the main drive motor (and in some cameras sounds a buzzer) should the film break or the take-up mechanism fail.

2.3 Variable-exposure-angle Shutter

Fig. 2.5 shows a cut-away view of the working parts of the shutter mechanism. The shutter consists of two disks, each with a 180-degree sector cut away and a counterbalance added. By rotating one disk relative to the other the exposure angle can be varied between zero and 180 degrees.

The rear disk is attached to a hollow bush, which runs in a bearing in the front of the main casting. At the rear end of the bush is a bevel gear (33) that is driven by a similar gear (34) mentioned in Section 2.2.1. A hollow straight-splined shaft is pressed into the rear end of the bush.

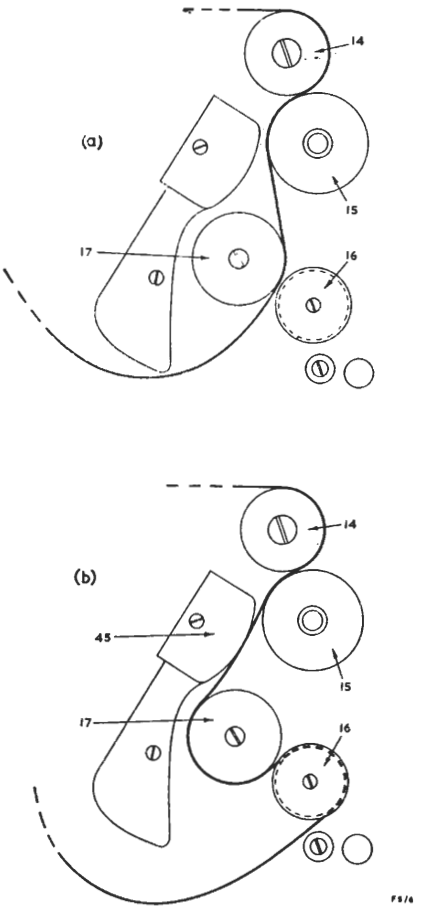


Fig. 2.4. Alternative Lacing Diagrams for Sound Recording Systems
(a) Optical System (b) Magnetic System

14. Sound Drum
15. Tension Roller
16. Loop Adjustment Roller
17. Loop Adjustment Roller
45. Magnetic Sound-recording Head Assembly

The front member of the shutter is attached to a shaft fitted inside the hollow assembly of the rear shutter-member. This shaft has a helical spline cut in its rear end.

The two splined shafts are coupled by a sleeve (35) which slides over them. Inserts pressed into each end of the sleeve engage with the shafts, so that longitudinal motion of the sleeve results in relative rotation of the shafts. The motion of the sleeve is controlled by the pinion wheel (36), which is operated by the exposure-angle control knob (1) on the right-hand side of the camera, through the flexible drive (37) and coupling (29). The rotation of the knob (1) is shown on a twin scale which is calibrated in fractions of a second and also in fractions of the maximum exposure-angle. A simple locking mechanism enables the knob to be locked in any of several definite positions.

which operates the viewfinder mechanism. In the *Telefinder* position, the button engages with a rocker arm (27, Fig. 2.3), which operates a micro-switch (S5, Figs. 2.6 and 2.7) to the run position. When the viewfinder is used in the *G.G. Focus* position this button does not register with the rocker and the camera cannot be started.

To stop the camera, the red button (3) is pressed. This button engages with the other end of the rocker arm.

Figs. 2.6 and 2.7 show alternative control circuits. The heater and thermostat are included so that in adverse weather conditions the working parts and lubricant of the camera can be raised to

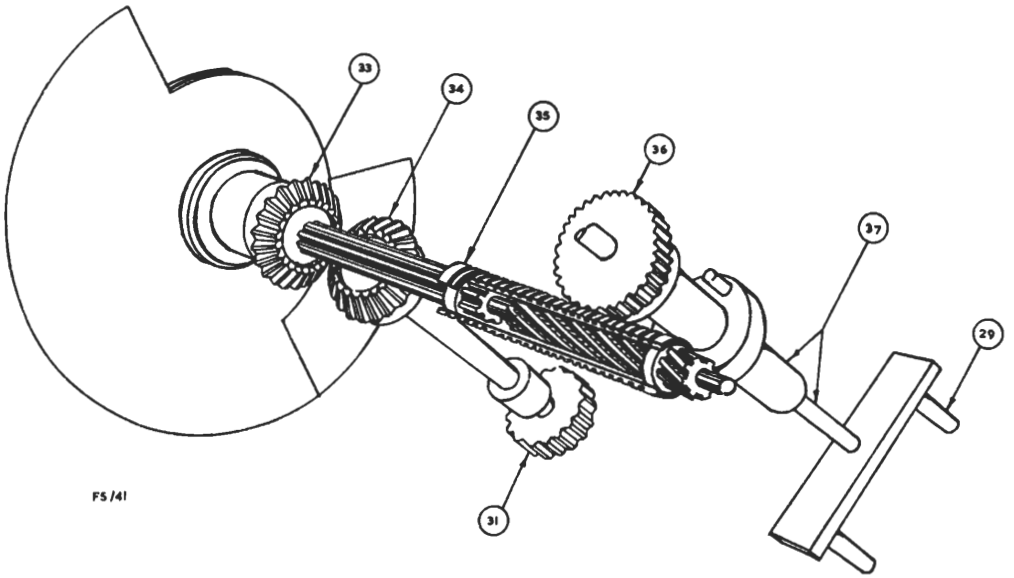


Fig. 2.5. Variable-exposure-angle Shutter and Associated Mechanisms

29. Coupling to Control Knob
31. Shutter Driving Gear
33, 34. Bevel Gears driving Shutter
35. Cylindrical Rack
36. Pinion controlling Exposure Angle
37. Flexible Coupling

The rear end of the compound shutter shaft is supported in a bearing and shims are fitted to adjust the end float.

2.4 Motor Control and Supply

The camera is driven by a synchronous motor (Bodine Type KYC-26) which requires a 115-volt 50-c/s supply. This supply is derived either from the 240-volt mains through a transformer, or from a 12-volt battery using a rotary convertor, the Auricon Portable Power Supply, Model PS-21AL.

The motor is switched on by means of a push-button (4, Fig. 2.1) mounted on the control bar (9) and maintained at a temperature suitable for satisfactory operation.

The camera is normally fitted with a 3-pin mains input plug. Cameras that have been modified to enable them to be used for telerecording purposes have a 9-pin mains input plug fitted and the mating input socket must have pins 6 and 7 strapped for normal use.

The take-up motor is a Bodine Type KC1-23. In cameras with Type numbers ending in C (Fig. 2.7) this motor runs at reduced power immediately the mains input is connected and maintains tension on the take-up trip-switch S6. When the start

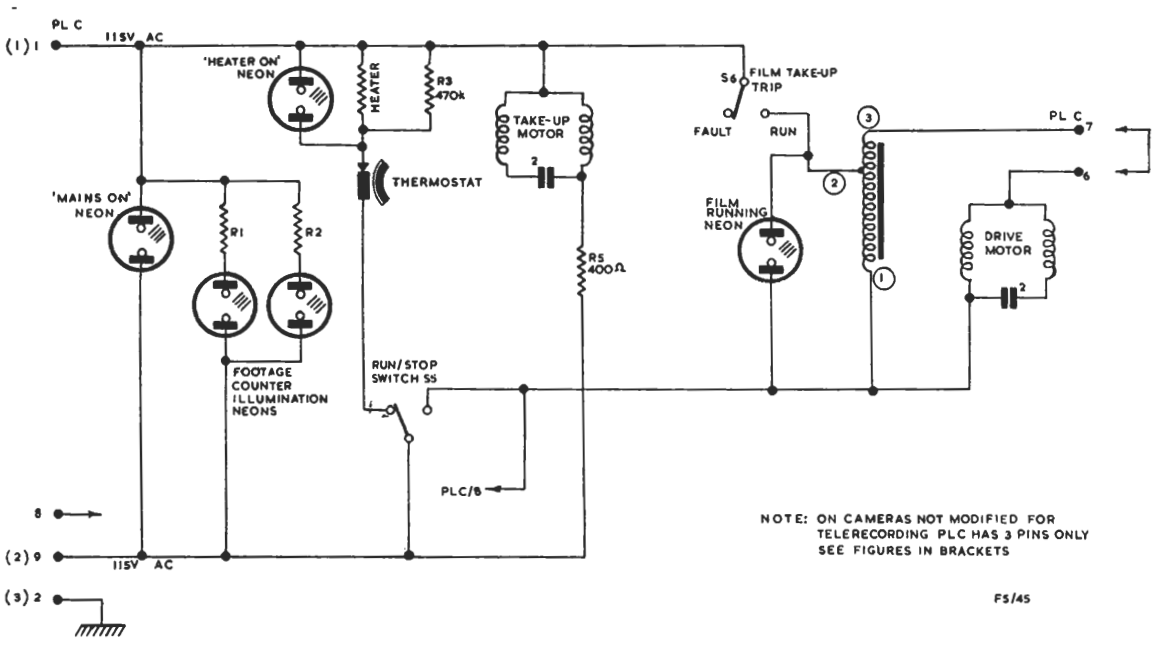


Fig. 2.6. Camera Type CM.74.A: Supply Circuit

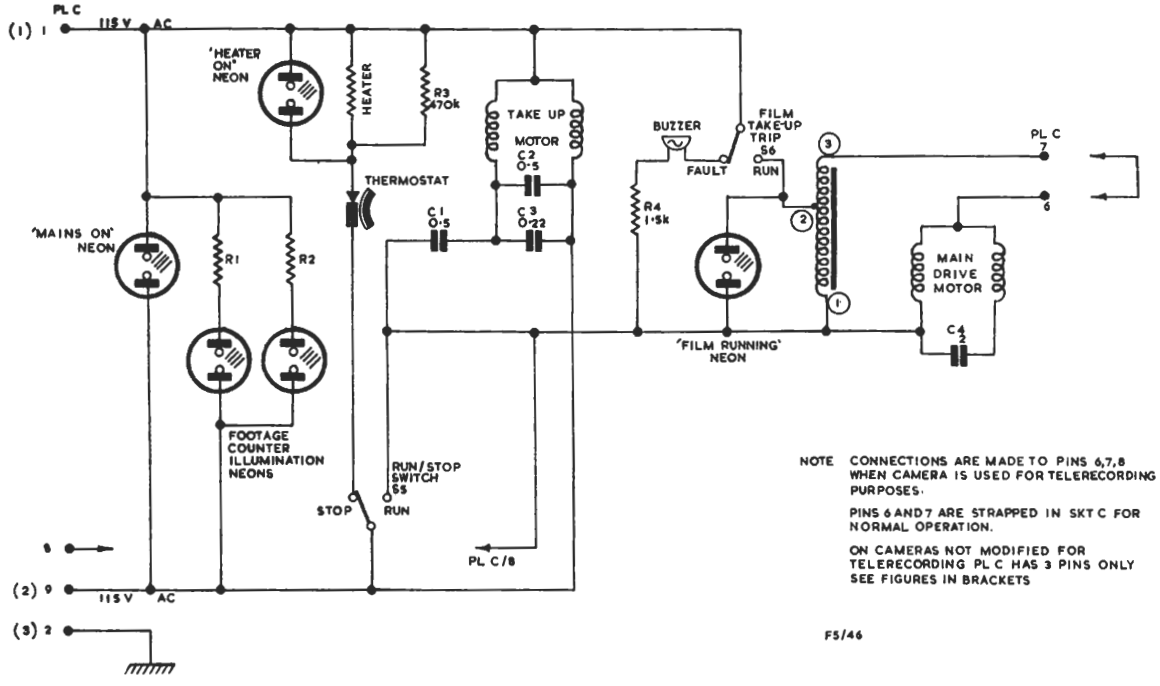


Fig. 2.7. Camera Type CM.74.C: Supply Circuit

button is pressed, capacitor C1 is switched in parallel with C2 and C3, thus increasing the power of the motor for normal operation.

2.5 Viewfinders

The camera has three viewfinder systems:

(a) Reflex viewfinder. (*G.G. Focus*)
(b) Telefinder viewfinder. (*Telefinder*)
(c) Auto-Parallax View/Range-finder, Model EIF-20.

2.5.1 Reflex Viewfinder (*Fig. 2.8a*)

The reflex system uses the taking lens of the camera and the viewfinder object is the image normally formed at the camera gate. With the viewfinder control bar (9, Fig. 2.1) set to *G.G. Focus*, a dovetail-carriage assembly, which moves in a channel in the main casting, is positioned so that a mirror is interposed between the taking lens and the gate. The light from the lens is reflected through 90 degrees to form an image on a ground glass screen, mounted on the carriage, which is at the same optical distance from the lens as the plane of the film. Light transmitted by the screen is reflected through 90 degrees by another mirror so that it enters an optical assembly that forms part of the viewfinder eyepiece. (8, Fig. 2.1).

The dovetail-carriage assembly is positioned by a spring which acts against a stop-screw. (22, Fig. 2.2.) Adjustment of this screw enables the ground-glass screen to be set at the correct optical distance from the taking lens.

2.5.2 Telefinder Viewfinder (*Fig. 2.8b*)

When the control bar is set to *Telefinder*, the dovetail carriage is positioned at the other end of its travel and light passes from the taking lens to the gate. A hole in the carriage is brought into line with the eyepiece assembly so that light from the telefinder objective lens forms the viewfinder image. The telefinder objective lens can be adjusted as explained in 2.1.6.

2.5.3 General Details

The control bar is coupled to the dovetail carriage by a simple lever system which converts the rotary motion of the bar to the linear motion of the carriage.

The eyepiece is supported in a cylindrical housing which is secured to the rear of the camera housing by four screws. The clearance holes for these screws are oversize to allow the eyepiece to be positioned relative to a tube forming part of the assembly but which is attached to the main casting. This arrangement enables compensation to be made for sag and distortion in the resilient mountings of the casting. The mechanical arrangement of the eyepiece is such that rotating it causes longitudinal motion and provides a means of focusing. The eyepiece has a magnification of ten.

2.5.4 The Auricon Auto-parallax View/Range-finder

This viewfinder is a separate unit, assembled in a cast housing and mounted on the left-hand door of the camera. It is used while film is being exposed at short range. Light entering the viewfinder is focused by a lens onto a ground glass screen after being reflected by a compound mirror consisting of two plane mirrors set at 90 degrees. The screen is viewed through a pair of plane mirrors and the final image is a correct representation, in both vertical and horizontal directions, of the scene being shot.

The viewfinder is focused by means of a lever, scaled in feet, which operates two mechanisms. One of these moves the lens longitudinally to bring the image into focus on the screen. The other mechanism positions the compound mirror so that the part of the scene that falls within a clearly defined area of a tinted transparent matte always corresponds to the image at the film gate, thus compensating for parallax errors. When the taking lens of the camera is changed an alternative matte must be inserted in the viewfinder. Mattes not in use may be stowed in a compartment provided in the viewfinder body. The full field of view corresponds to that of a 17-mm lens.

2.6 Lenses

A range of Cooke Ivotal Anastigmat lenses fitted in C-mounts is provided, manufactured by Taylor, Taylor and Hobson. The range of focal lengths supplied is 0·7 in., 1 in., 2 in., 2·8 in., 4 in. and 6 in. A telefinder objective lens is supplied for each of these lenses. A Berthiot zoom lens is available of which there are two types. One has a range of focal length of 25-100 mm with a maximum aperture of *f*3·4 and the other has a range of 17·5-70 mm and a maximum aperture of *f*3·4.

The zoom lens is provided with its own eyepiece attachment through which a correctly aligned picture can be viewed independent of the camera. To fit this lens either a plain door must be fitted to the left-hand side of the camera or the Auto-parallax Viewfinder must be removed. The fixing screws for this viewfinder are accessible through

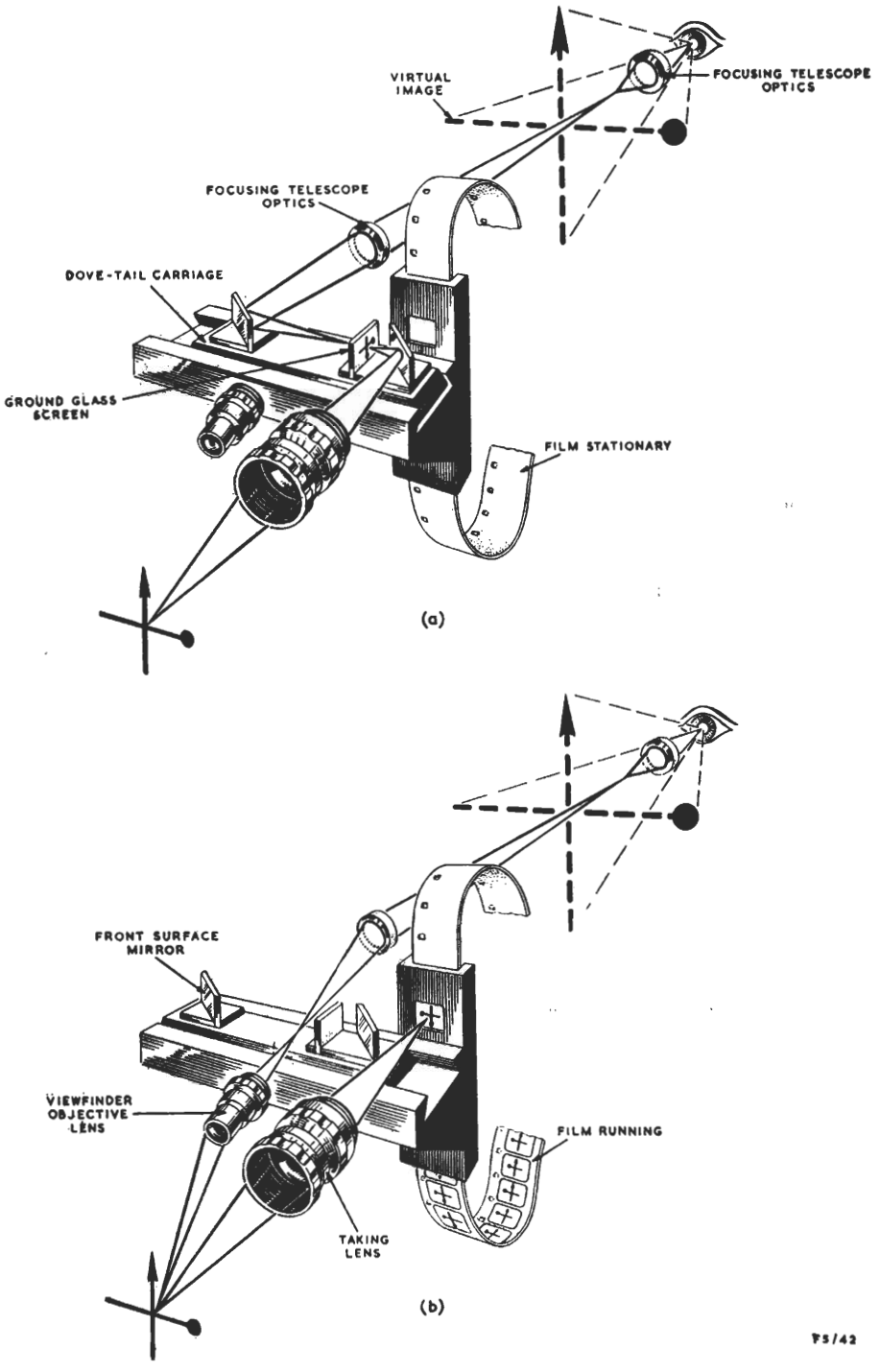


Fig. 2.8. Alternative Optical Arrangements Available by Operation of tne Dovetail Carriage

slits in the rubber lining of the door or by lifting the edge of the rubber.

2.7 Connections to Camera

All connections to the camera are made through plugs and sockets on the right-hand side cover.

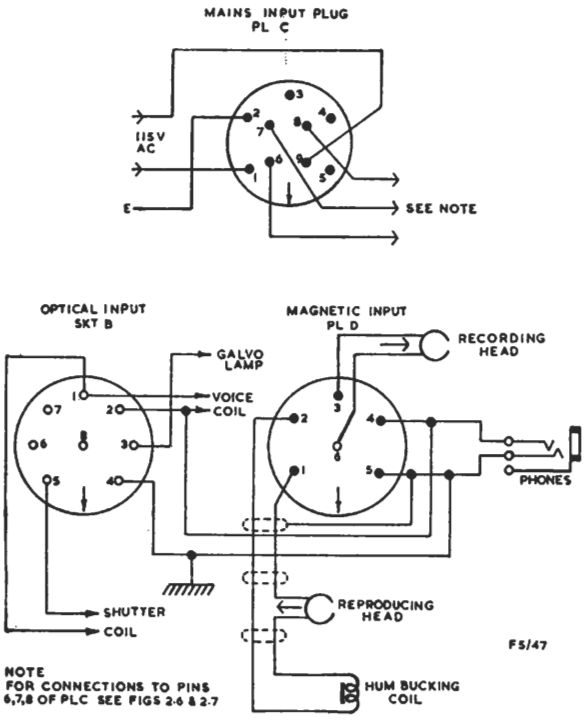


Fig. 2.9. Connections to Camera

Standard cameras are fitted with a three pin plug for connection of 115-volt a.c. mains, but cameras modified for telerecording purposes are fitted with a nine-pin plug; in these cameras it is necessary to strap pins 6 and 7 in the mating socket.

Separate inputs are provided for recording by optical or magnetic means and the connections for these are shown in Fig. 2.9.

2.8 Portable Power Supply PS-21AL (Fig. 2.10)

This unit is contained in an acoustically treated carrying case which provides stowage for the battery lead. An input of 12 volts d.c. is required.

The front panel carries an *On/Off* switch which controls the d.c. supply to the motor, a rheostat controlling the field current of the motor and

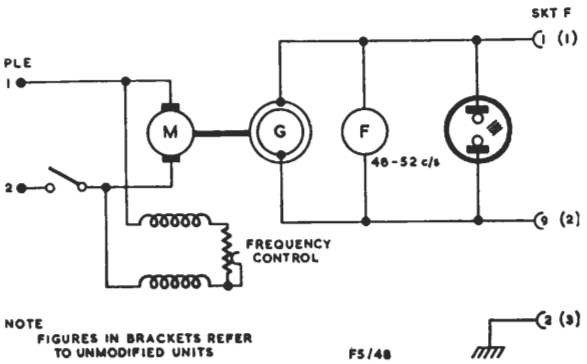


Fig. 2.10. Portable Power Supply PS-21AL: Circuit

labelled *Frequency Control*, a vibrating-reed frequency meter, a neon indicator-lamp connected across the 115-volt output and an output socket which may be either a three-pin or a nine-pin connector depending on the camera with which it is used. (Fig. 2.10.)

The battery lead is fitted with a two-pin plug which mates with a connector fitted to the battery box.

The current drawn by the unit off load is about 4 amps and on load about 7·5 amps.

SECTION 3

SOUND SYSTEMS

3.1 General

The camera is equipped for both optical and magnetic sound recording.

Twin magnetic heads enable the sound track to be monitored as it is recorded, a facility known as ' instant playback.'

faulty lamps.

The noise-reduction shutter is used when prints are to be made and operates so that, for quiet passages, the sound track is closed down to the minimum size. Thus, when a print is produced, dirt and scratches on the sound-track portion of

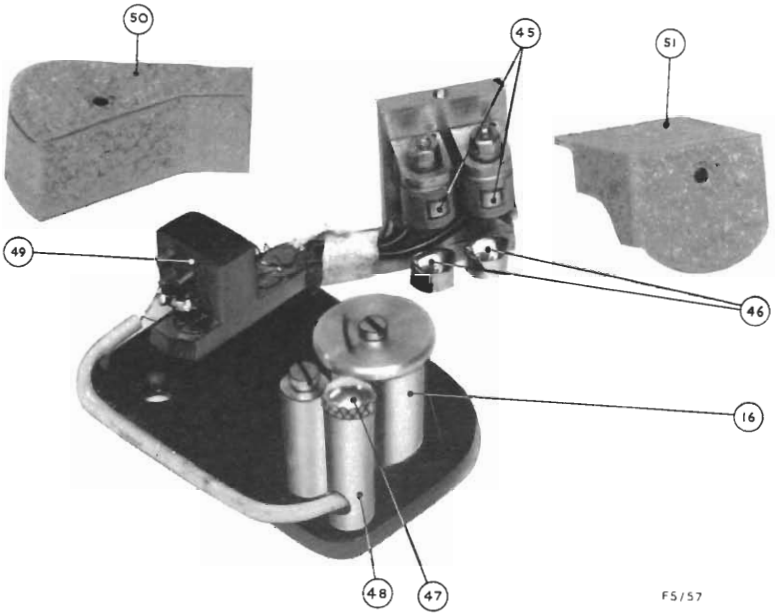


Fig. 3.1. Magnetic Recording Head Assembly
The bearing pin of roller 17 (not shown) also secures the base plate.

16. Loop Adjustment Roller
45. Magnetic Sound Heads
46. Film Supports
47. Hum-bucking Coil Adjustment
48. Pillar containing Hum-bucking Coil
49. Tag Block
50. Tag-block Cover
51. Screening Cover for Magnetic Heads

3.2 Optical Recording

Variable-area optical recording, with noise reduction, is achieved using a recording galvanometer and lamp. These are contained in a cast box mounted on the left-hand side of the main casting; the holes for the fixing screws are made oversize to permit horizontal adjustment of the position of the box as a means of focusing the light beam onto the film. The cover of the galvanometer is pinned on and should not be removed, but the lamp housing is accessible for replacement of

the film are not added to the background noise. Hiss from the photocell in quiet passages is also minimised.

The galvanometer is driven by an amplifier supplied by the manufacturer of the camera. There are several different versions of the amplifier, and a typical one, the NR-25-S7, is described in Section 3.4.

3.3 Magnetic Recording

For magnetic recording a head assembly of

BBC design is used (Fig. 3.1), driven by a BBC amplifier Type AM15/502. The recording and playback heads (45) are mounted with freedom for azimuth and radial alignment on a plate which is secured to the main casting just below the optical sound drum. Two studs with rounded and polished heads (46) provide a bearing surface for the perforated edge of the film. Mounted on the same plate are the extra rollers (16) and (17), mentioned in 2.2.2, which are used to compensate for the different number of frames between the gate and magnetic head (28 frames) and the gate and galvanometer (26 frames).

The pillar (48) contains a hum-bucking coil, the position of which can be adjusted by the knurled knob (47) to obtain minimum hum. Soldered connections are made to the two heads and to the hum-bucking coil at pins held in a tufnol block (49).

A magnetic screening cover (51) is fitted over the assembly.

Connections between the recording heads and associated equipments are made through connectors mounted on the right-hand side cover of the camera. (See Section 2.7.)

3.4 Amplifiers

3.4.1 Amplifier Type AM15/502

The BBC amplifier Type AM15/502 is described in Instruction F.4.

3.4.2 Amplifier Type NR-25-S7 (Fig. 1)

The Auricon Amplifier Type NR-25-S7 is contained in a carrying case, a bottom compartment of which provides stowage for the batteries that power the amplifier, the batteries that supply the recording-galvanometer lamp and for cables.

The amplifier has two individually controlled inputs to permit mixing of two programme sources. Input 1 is a 50-ohm unbalanced input for a microphone and feeds through a matching transformer T1 and the components C1, R1 to the grid of V1. C1, R1 give a falling low-frequency response below about 100 c/s.

V1, V2, V3 and V4 are diode-pentodes, Type 1U5, strapped as triodes. The coupling circuit between V1 and V2, designated by the manufacturer as a Couplet Type PC-81, is an *RC* coupling network with shunt capacitors that gives a falling high-frequency response above about 7 kc/s. The *RC* coupling from V2 to V3 is arranged to give a low-frequency loss, controlled by the setting of R6 (the *Input 1 Tone Control*), and also to provide for control of the overall gain of the channel using R7, the *Input 1 Volume* control.

Input 2 is a high impedance unbalanced input intended for use with a gram unit. The input level is controlled by R10, the *Input 2 Volume* control, and the two inputs are mixed at the grid of V3 through the hold-off resistors R8 and R9.

The output of V3 is *RC*-coupled to the grid of V4, but the interposition of the series-resonant circuit L1 and C9, tuned to approximately 3·5 kc/s, modifies the frequency response of the amplifier to compensate for mechanical resonances in the recording galvanometer.

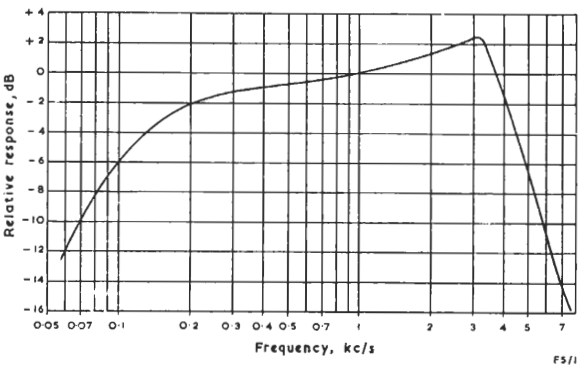


Fig. 3.2. Amplifier NR-25-S7: Frequency Characteristic

The output of V4 is auto-transformer coupled to the grid of V5, the output amplifier valve. Negative-feedback is applied to the output stage by the connection of R16 between the anodes of V5 and V4, while the anode load of V5 is the transformer T3. This transformer has two secondary windings. One of these windings feeds the voice coil of the recording galvanometer, and the output from the other is rectified by the two diodes MR1 and MR2 to obtain a uni-directional control voltage which drives the noise-reduction shutter and volume-indicating meter using V6 and V7.

A push button S5, labelled *Lab. Test*, is provided to allow a length of optical sound-track to be uniformly exposed for test purposes. The switch has two sets of contacts, which perform the following operations when the button is pressed:

(a) The output from the amplifier is disconnected from the galvanometer voice-coil and earthed.
(b) The output from the noise-reduction circuit is disconnected from the galvanometer shutter coil and connected to the voice-coil.

As a result, the noise-reduction shutter is fully opened, and the anode and screen currents of V6 and V7 cause the voice-coil to deflect and fully expose the film. Thus a silent unbiased sound track is recorded for densitometry purposes.

As a safeguard against the amplifier being accidentally left switched on, the battery connections to earth are made via straps in plug PL A, through which connections are made to the camera. A meter M2, mounted at the left-hand end of the control panel, is used in conjunction with switch S2 to monitor the current flowing through the galvanometer lamp. Further contacts of S2 also provide for testing the terminal voltages of the l.t. and h.t. batteries under no signal-conditions, when S2c shorts the grid of V3 to earth.

3.4.3 Batteries for NR-25-S7

The amplifier is powered by a set of batteries as indicated in the accompanying table. Each battery has an integral non-reversible 2-way socket, to which connection is made by one of the plugs PL2 to PL8. These plugs are identifiable by the colours of the leads which they terminate.

3.4.4 Test Procedure for NR-25-S7

1. Connect an oscillator type TS/9 to Input 1 via a 600/60-ohm matching pad.
2. Connect a valve voltmeter across pins 1 and 2 of SKT A, together with a resistive dummy load of 100 ohms.
3. Set *Input 1 Volume* to *5* and *Input 1 Tone* control to *Music Only*.
4. Set the oscillator frequency to 3 kc/s and adjust the input level of the amplifier to give a reading of 9 on the volume indicator meter.
5. Vary the frequency of the input signal and at each setting adjust the oscillator output attenuator to keep the amplifier output level constant. From the settings of the attenuator, plot a frequency response curve for the amplifier. A typical response curve is shown in Fig. 3.2.

TABLE 1: BATTERIES

Ever Ready Type No. (or equivalent)	*Quantity*	*Voltage*	*Function*
B104	4	45	B1 and B2: amplifier h.t. supply (' B ' battery). Red and green leads. B3 and B4: volume indicator and noise reduction supply. Yellow and white leads.
AD32	1	1·5	B5: valve filament supply (' A ' battery). Blue and black leads.
AD31	2	7·5	B6 and B7: film exposure lamp supply. Brown and black leads.

SECTION 4

MAINTENANCE

4.1 Lubrication

Six oiling points are provided, marked by red paint. Four on the left-hand side of the main casting are marked also by the word *Oil*. The two remaining oiling points are located on the front of the camera housing and access to them is obtained by removing a lens from the turret and moving the empty receptacle to positions corresponding to 8 o'clock and 10 o'clock. On some cameras the motors may also be provided with oiling points, but others have packed bearings. The various metal pulleys of the film transport mechanism require occasional lubrication and the exposed pulley driving the belt of the film take-up mechanism requires frequent attention.

Care must be taken that the camera is not over-lubricated; as a rough guide, two drops of Singer Sewing Machine Oil should be applied to each oiling point every month or every 10,000 ft of film.

Nylon rollers and gearwheels must not be oiled and every precaution should be taken to keep these components dry. Oil on nylon units gathers fluff and emulsion dust, causing erratic running.

Resilient mountings and rubber components such as the take-up driving belt should also be kept free of oil.

4.2 The Film Gate

4.2.1 Cleaning

The gate should be cleaned with a soft brush. Any hard deposit of film emulsion which is not dislodged by the brush should be removed by rubbing with a piece of soft wood. A wire brush, pencil point or sharp tool must not be used as these are likely to roughen the polished metal surfaces and cause scratches on the film.

4.2.2 Noisy Operation

Parts of the gate mechanism are subject to wear and in time this may give rise to noisy operation and slight damage to the film by the claw. The following checks should be made:

(a) Ascertain that the film stock is within specification. An extract from the appropriate British Standard Publication is given in Appendix A, but a check can be made by running a piece of film stock from another batch through the camera.

(b) Check that the spacing washer between the claw and the driving cylinder is not worn.

(c) Examine the side of the aperture plate at the bottom of the gate for signs of undercutting by the film. (Undercutting does not take place at the top of the gate because the film bears against a sapphire insert.) When wear of this nature occurs the aperture plate must be changed, but since the alignment of the new gate requires special equipment the camera should be returned to base maintenance.

NOTE: In a practical case, trouble is usually due to a combination of (a), (b) and (c).

4.3 Optical Systems

4.3.1 Lenses

Dust should be removed from lens surfaces by means of a camel-hair brush before any attempt is made to wipe them with a cloth. Grease can be removed by moistening the cloth with ether or a proprietary lens cleaning fluid; methylated spirit should not be used as it contains water.

Focus and aperture rings should be lubricated sparingly with Ragosine Molydest 50 grease.

Lenses must not be dismantled, but should be returned to the manufacturer for repair.

4.3.2. Viewfinder Ground Glass Screen

The ground glass screen should be cleaned with Auricon Ground-glass Cleaning Fluid. Access to the screen is obtained by removing a lens from the turret and setting the viewfinder to the *G.G. Focus* position. The cleaning fluid should not be applied to other optical surfaces.

4.4 Adjustments

4.4.1 Dovetail Carriage

The dovetail carriage is spring-loaded against a stop screw and with use this screw may become indented. Apart from displacing the viewfinder image, this fault makes accurate focusing of the taking lens impossible, because the distance from ground-glass screen to lens is no longer the same as that from film-gate to lens.

The procedure for correcting this error is detailed below, but adjustment can be considerably simplified if an Auto-collimator is available. By means of this instrument the optical distance to

the ground-glass screen can be compared with the distance to the film plane (see Instruction F.1, Appendix B) and operations 1, 2, and 3 are obviated.

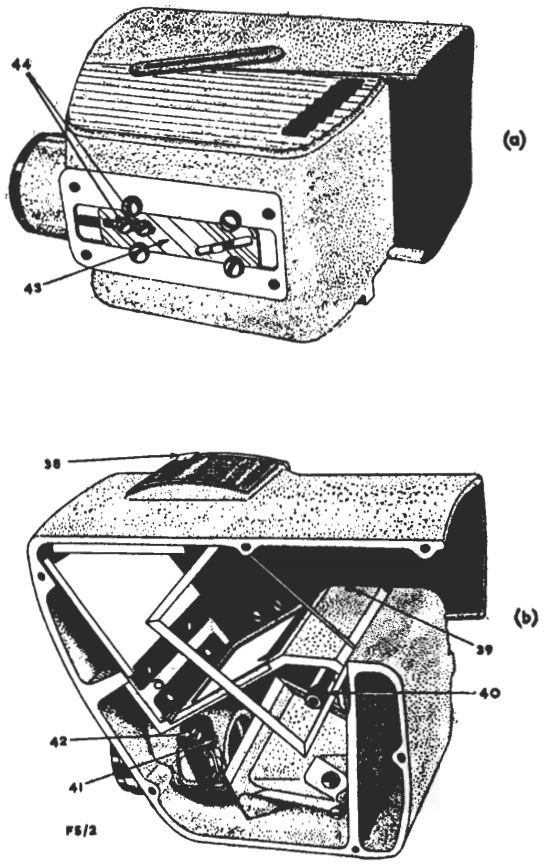


Fig. 4.1. Two views of Auto-parallax Viewfinder, showing Adjustments

38. Focusing Lever and Range Indicator
39. Locking Screw
40. Horizontal Limits Adjustment Screw
41. Locking Screw
42. Range-finder Adjustment
43. Cam Plate
44. Cam-locking Screws

1. Align the camera on a suitable test card and clamp it in position.
2. Expose a few frames of film and process them.
3. Compare the resulting film with the image seen in the viewfinder. The positions of the two images should be identical. If they are not, proceed as detailed below.
4. Loosen the Allen screw that locks the stop screw. This locking screw is tapped into the aperture plate to the left of the gate and is accessible on opening the camera door. The stop screw is adjusted by inserting a screwdriver through the hole (22) in Fig. 2.2. A useful check on the setting of this screw can be made by using a piece of ground film in the gate.
5. Repeat (2) and (3).
6. Re-tighten the Allen screw.

4.4.2 Telefinder Objective Lenses

The holders for these lenses are mounted on the turret in ball and socket joints and each holder is held in place by three screws. Differential adjustment of the screws rocks a holder in any desired direction. The adjustment is made with the camera sighted on a distant object and the correct position for a holder is found by trial and error, turning the viewfinder control bar between its two positions to compare the two images. Although the purpose of making the adjustment is to align the edges of the images correctly, it may be helpful to align the camera so that some object, such as a church spire, registers with the cross-hairs of the ground-glass screen.

4.4.3 Auto-parallax Viewfinder

1. Align the camera on an object at a known distance (say 10 ft) using the reflex viewfinder.
2. Focus the auto-parallax viewfinder and check that the object distance indicated is correct.
3. If the range-finder requires resetting, remove the side cover of the viewfinder and loosen clamping screw (41) in Fig. 4.1b. Hold focusing lever (38) and rotate shaft (42) with a screwdriver until the distance indicator reads correctly. Re-tighten screw (41).
4. Insert the appropriate viewfinder matte, refocus and compare the image with that in the reflex viewfinder. If the limits of the two images are not the same, adjustments (5) and (6) below should be made as necessary.
5. If the horizontal limits do not correspond, remove the side cover from the auto-parallax viewfinder, slide out the rear window and loosen Allen screw (39) in Fig. 4.1b. Turn adjusting knob (40) to eliminate the discrepancy and re-tighten the Allen screw.
6. If the vertical limits do not correspond, remove the bottom cover of the viewfinder and loosen the two cam-locking screws (44) in Fig. 4.1a. Slide cam plate (43) along in its recess to correct the discrepancy, re-tighten the locking screws and replace the bottom plate.

4.5 Performance Checks

4.5.1 Steadiness Test

Unsteadiness in either the vertical or the horizontal direction should not exceed 0·1 per cent of the relevant picture dimension. Unsteadiness is measured using the Branson Steadiness Test Object.

This test object is a chart showing two main scales, one vertical and the other horizontal, each with twenty divisions of two per cent of the chart dimensions. Alongside each main scale is a vernier scale of nineteen divisions so that the chart can easily be read to 0·105 per cent of its height or width.

Means are provided for blanking off either the main or the vernier scales. Film is exposed to one set of scales and then rewound in the camera without disturbing the lacing.* The film is then run a second time through the camera, when it is exposed to the other set of scales.

When the double-exposed film is developed and projected, unsteadiness is shown as relative movement between the two scales and can be read directly as a percentage.

Unsteadiness in the projector affects both scales equally and is eliminated.

*Where this is not possible, the film should be marked before removal from the camera so that it can be replaced with an identical relationship to the moving parts of the transport mechanism. This is of special importance in tests with 35-mm film, where there are several perforations per frame.

4.5.2 Lens Scaling

Accuracy of lens scaling depends on the correct distance being maintained between the lens and the film in the gate. In the Auricon Super-1200 camera, the film is accurately positioned because the sapphire inserts in the aperture plate eliminate wear. If lens mounting arrangements are disturbed, scaling should be checked at infinity using an autocollimator (see Instruction F.1, Appendix B) and by tests at measured distances.

Lenses suspected of incorrect scaling should be returned to base maintenance.

4.5.3 Photographic Resolving Power

Resolution of lenses should not be worse than 50 lines/mm, or 40 lines/mm at the corners of the picture. Resolution is assessed by microscopic examination of negative images obtained under the following conditions:

(a) Test Object: BBC 16-mm Resolution Chart for use with transmitted light.

(b) Stock: Ilford FP3.

(c) Lens aperture: *f*2.

(d) Shutter exposure angle: 180 degrees.

(e) Illumination adjusted to give a reading of 2 on a Weston Master II exposure meter.

(f) Processing: develop to gamma = 0·6. A negative density of 0·7 should be obtained.

SECTION 5

OPERATION

5.1 To Load the Magazine

Magazines must be loaded in the dark or with the aid of a changing bag. The procedure is as follows:

1. Remove the screw-on covers of the magazine and fit a roll of film, wound on a standard centre, to the feed (forward) spindle. The emulsion-coated side of the film should face forward when the free end is allowed to hang.
2. Pass the end of the film through the light-trap rollers and out through the forward hole in the bottom of the magazine.
3. Replace the cover tightly on the feed side of the magazine. The remainder of the operation can be carried out in the light.
4. Fit an Auricon 3-inch centre to the take-up spindle. Pass the end of the film through the rear hole in the magazine base and through the light-trap rollers and secure it to the Auricon centre.
5. Refit the screw-on cover.

5.2 To Fit the Magazine to the Camera

1. Open the left-hand side door of the camera, place the magazine in its seating on top of the camera and tighten the two captive knurled screws. Care should be taken that a loop of film is not trapped between the camera and the magazine.
2. Draw film from the feed spool to form a loop of sufficient length to lace the camera.
3. Press the green plunger (5, Fig. 2.1) to withdraw the claw from the aperture plate.
4. Turn the red knob (25, Fig. 2.2) to retract the rollers (26) from the sprocket, and then lace the camera according to the diagram pasted inside the door. Turn the inching knob to locate the claw in a sprocket hole of the film.
5. Restore the two rollers (26).
6. Check that the film is tightly wound, either by removing the cover from the take-up side of the magazine or by rotating the take-up pulley by hand. The film must be sufficiently tight to operate the interlock switch S6 by means of roller (12). Fit the rubber driving belt to the magazine pulley.
7. Connect the power supply to the camera. The neon indicator (7, Fig. 2.1) should glow and the take-up motor should run.
8. Turn the inching knob to check that the film is being pulled through the camera satisfactorily. Check that the loop of film below the gate is of the correct length by comparing it with the marking on the casting.
9. Reset the film footage counter.
10. Close and fasten the camera door.

5.3 To Remove the Magazine

1. Open the camera door.
2. Press the green knob to withdraw the claw.
3. Turn the red knob to retract the lay-on rollers and free the film from the transport mechanism.
4. Remove the belt and take up the loose film into the magazine.
5. Release the two knurled screws and remove the magazine.

5.4 Operation of the Camera

1. Mount the camera on the tripod by means of the captive screw in the tripod head.
2. Fit the required lenses and the corresponding telefinder objective lenses to the turret. A telefinder lens is mounted diametrically opposite the corresponding taking lens.
3. Fit a magazine and, if required, the blimping hood.
4. Connect the power supply and sound amplifier cables. The operation of the Auricon NR-25-S7 amplifier is described in Section 3 of this Instruction and the operation of the AM15/502 amplifier is described in Instruction F.4.
5. Press the green knob to open the shutter, turn the viewfinder control bar to the *G.G. Focus* position and direct the camera towards a lighted area. Adjust the viewfinder eyepiece to bring into sharp focus the cross inscribed on the ground glass.
6. Sight the camera on a distant object, adjust the iris for maximum aperture and focus the taking lens.
7. Check that the *G.G. Focus* and *Telefinder* images are identical. Any serious difference

is probably caused by the use of a wrong telefinder objective lens. Compare these images with that seen in the auto-parallax viewfinder.

8. Adjust the lens aperture and the shutter exposure angle as required, and focus on the required scene.
9. Start the camera by pressing the button (4) mounted on the viewfinder control bar. Failure to start may be caused by insufficient tension in the film around the take-up trip pulley (12): see Section 5.2(6). The neon (10, Fig. 2.1) lights to indicate that power is applied to the drive motor.
10. Monitor the scene by means of the telefinder viewfinder or the auto-parallax viewfinder. If the control bar is turned to the *G.G. Focus* position no light reaches the film.
11. To stop the camera, press the red button (3).

SECTION 6

MODIFICATION OF CAMERA FOR SUPPRESSED FIELD TELERECORDING

6.1 General

This modification enables a standard Auricon Super-1200 camera to be used to produce suppressed field telerecordings. The modification does not interfere with the normal operation of the camera, which can be removed from the telerecording attachment and restored to use for direct filming in ten minutes.

6.2 Drive Unit

For this application, it is essential that the start of the film-pull-down period of the camera be synchronised with the start of the field-sync pulse of the television system. The most convenient way of achieving this is to drive the camera with a synchronous motor and to arrange that the stator of the motor be capable of being rotated relative to the pull-down mechanism.

The Auricon camera is in fact driven by a synchronous motor, but it is not practicable to rotate the stator. This motor is therefore disconnected from the power supply, by omitting the strap on pins 6 and 7 of the 9-pin input socket SKT C, and the camera is then driven by an external motor. The external motor is a three-phase synchronous machine mounted in a rotating cradle so that the stator can be rotated by means of a handle.

A hole is bored through the camera housing in line with the internal-motor spindle, which is coupled to the external drive by a rubber-loaded split coupling. The external motor and an auxiliary shutter (Section 6.3) are mounted on a base plate together with the camera.

The take-up motor operates in the normal manner.

6.3 Auxiliary Shutter

The auxiliary shutter is provided as a means of monitoring the result of adjustments to the position of the driving-motor stator. The shutter, of similar form to that in the camera, is mounted between the camera and the external drive motor and is driven by bevel gears from the external shaft.

When the display is viewed through this rotating shutter, lack of synchronism is shown by the appearance of travelling horizontal bars.

K.H.G. 8/62

APPENDIX A

DIMENSIONS AND TOLERANCES FOR 16-mm SOUND FILM RAW STOCK

The following table and accompanying diagram, taken from British Standard 677: Part 2: 1958, give the dimensions and tolerances which apply immediately after cutting and perforating to 16-mm sound film negative and positive raw stock.

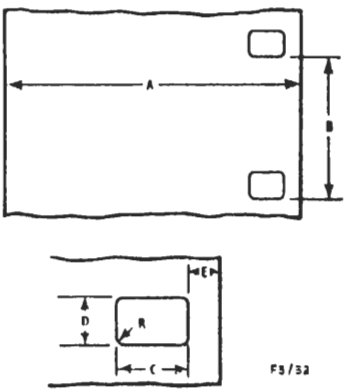
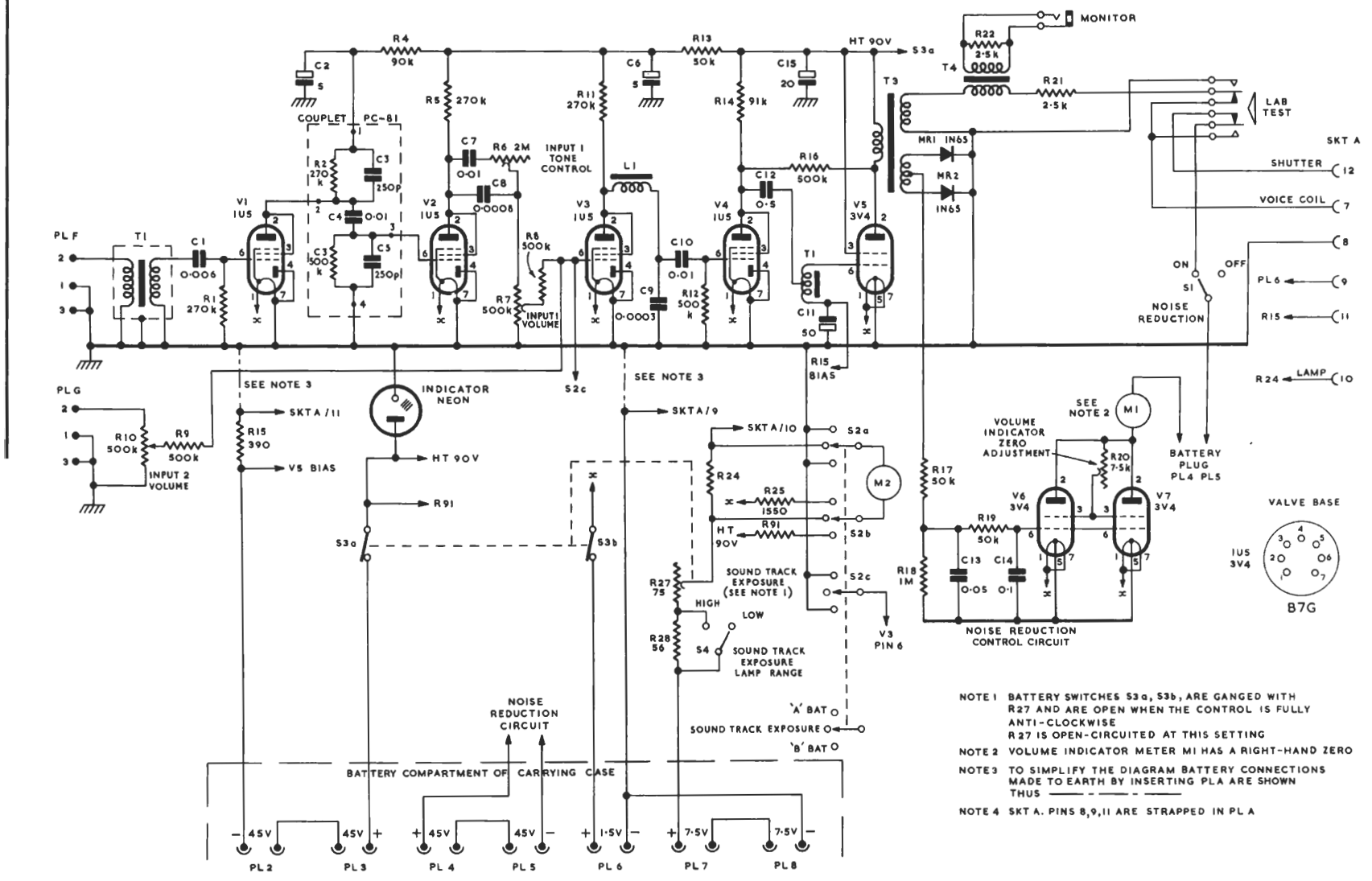


Fig. A.1. Sound Film Dimensions

Dimension in Fig. A.1	*Inches*	*Approximate Millimetre Equivalent*
*A	0·629 +0 −0·002	15·975 +0 −0·05
B	0·300 0 ±0·000 5	7·620 ±0·013
C	0·072 0 ±0·000 4	1·830 ±0·010
D	0·050 0 ±0·000 4	1·270 ±0·010
E	0·035 5 ±0·002	0·90 ±0·05
†L	30·00 ±0·03	762·0 ±0·8
R	0·010	0·25

* Experience shows that it is common for film to expand when exposed to high relative humidity. Allowance should be made for this factor in equipment design and in no case should the equipment fail to accommodate a film width of 0·630 in. (16·00 mm).

† Dimension *L* represents the length of any 100 consecutive perforation intervals.



NOTE 1 BATTERY SWITCHES S3a, S3b, ARE GANGED WITH R27 AND ARE OPEN WHEN THE CONTROL IS FULLY ANTI-CLOCKWISE
R27 IS OPEN-CIRCUITED AT THIS SETTING

NOTE 2 VOLUME INDICATOR METER M1 HAS A RIGHT-HAND ZERO

NOTE 3 TO SIMPLIFY THE DIAGRAM BATTERY CONNECTIONS MADE TO EARTH BY INSERTING PL A ARE SHOWN THUS ——— - ——— - ———

NOTE 4 SKT A. PINS 8,9,11 ARE STRAPPED IN PL A

FIG 1 F5

AURICON AMPLIFIER TYPE NR-25-S7: CIRCUIT

ERRATA

To Editor,

Technical Instructions,

305, *St. Hilda's, Maida Vale.*

The following errors have been noted in **Instruction**

Station............................... *Date*............................ *Signature*..........................

ERRATA

To Editor,

Technical Instructions,

305, *St. Hilda's, Maida Vale.*

The following errors have been noted in **Instruction**

Station............................... *Date*............................ *Signature*..........................

ERRATA

To Editor,

Technical Instructions,

305, *St. Hilda's, Maida Vale.*

The following errors have been noted in **Instruction**

Station............................... *Date*............................ *Signature*..........................

ERRATA

To Editor,

Technical Instructions,

305, *St. Hilda's, Maida Vale.*

The following errors have been noted in **Instruction**

Station............................... *Date*............................ *Signature*..........................