INSTRUCTION BOOK
No. 1660

Supa — Mk. 2
CINEMA PROJECTOR

INSTRUCTIONS FOR

INSTALLATION, OPERATION, AND MAINTENANCE

THE BRITISH THOMSON-HOUSTON CO., LTD.,
RUGBY, ENGLAND.

EDITION B

500/0552

IMPORTANT.

The apparatus described in this Instruction Book was designed, manufactured, and tested with care and, with proper attention, should give the purchaser the service that he may reasonably expect.

The purpose of this Instruction Book is to explain the function of the apparatus, and how it should be adjusted and maintained.

If these instructions are not clear, or appear incomplete in any particular, and you desire further information, this will be promptly supplied upon request.

Please address such enquiries to the Company's nearest District Office, or Local Representative, mentioning the particulars stamped upon the apparatus nameplate.

NOTICE.

BEFORE RETURNING APPARATUS FOR REPAIRS OR OTHER REASON, PLEASE COMMUNICATE WITH HEAD OFFICE, NEAREST DISTRICT OFFICE, OR LOCAL REPRESENTATIVE—QUOTING SERIAL NUMBER—WHEN THE NECESSARY INSTRUCTIONS WILL BE SENT.

COMPLIANCE WITH THIS REQUEST WILL AVOID DELAY AND INCONVENIENCE.

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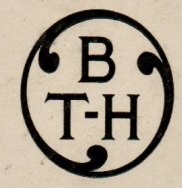
Supa—Mark 2
35 mm. CINEMA PROJECTOR



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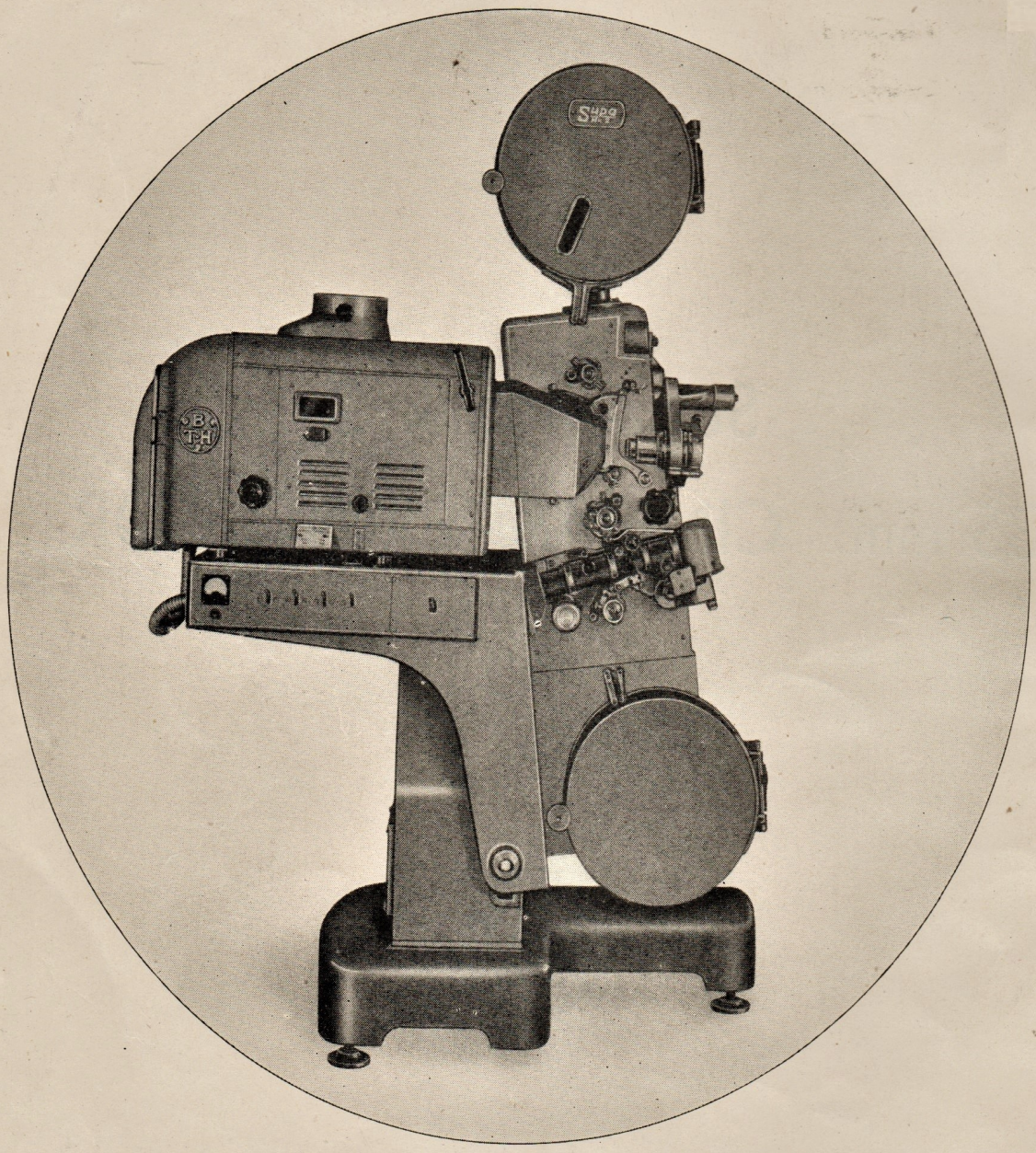

Supa—Mark 2

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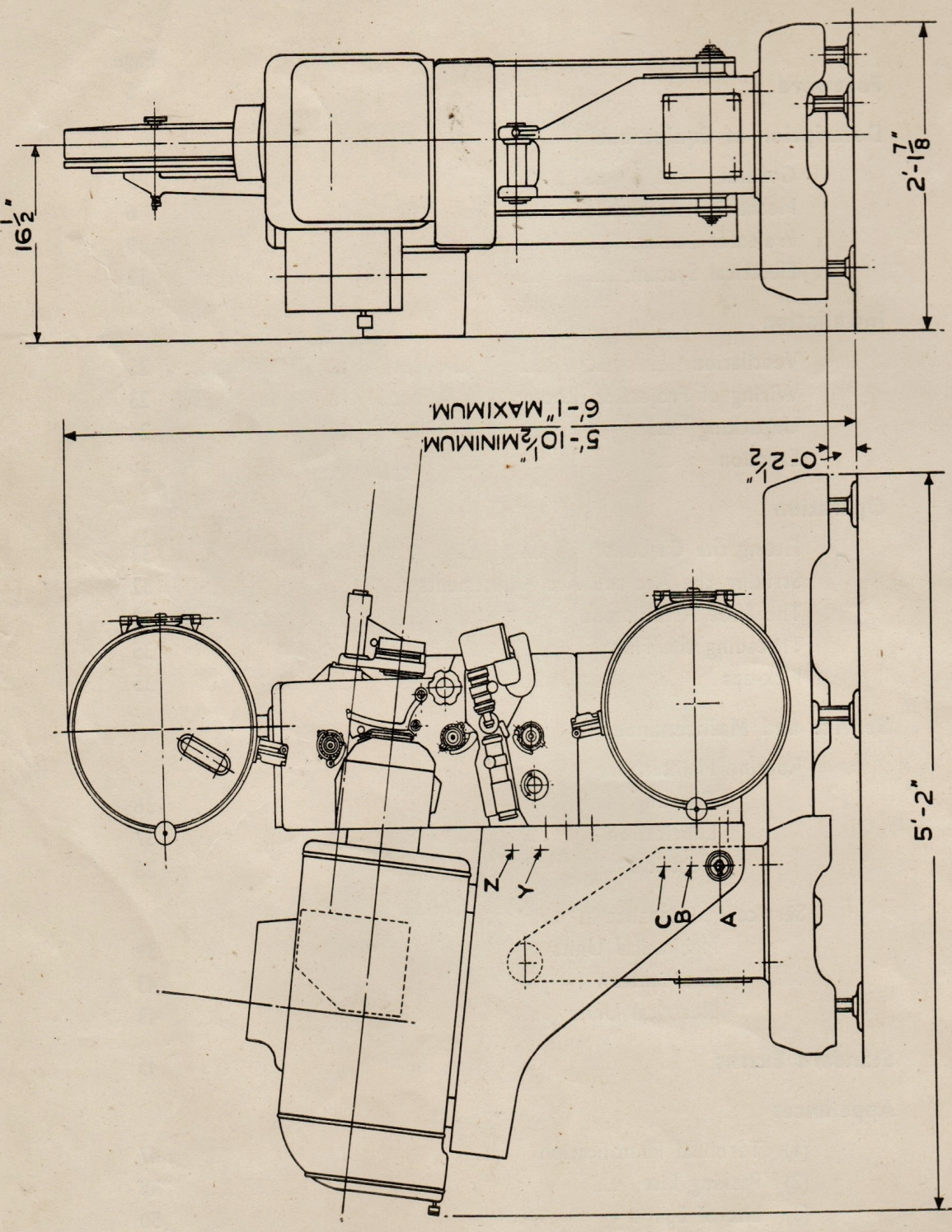


Fig. 1. Supa—Mark 2. Outline Diagram of Projector, showing base used for steep angles of rake. The base for normal rakes is shorter (at the front) by $7\frac{5}{8}$".

NOTE: The choice of pivot-holes A, B, and C, and anchor-bolt holes Y and Z is determined by projection conditions. See Fig. 35.

Supa—Mark 2

"MARK 2" is a simplified version of S/U/P/A, intended for use in the smaller cinema. It has been designed to provide, in its simplest form, an equipment, complete in every detail, that is capable of being accommodated in small projection rooms. With this object in view the amplifier and projector units have been separated to enable them to be installed in the most convenient manner.

A complete installation consists of two identical stands each mounting a S/U/P/A-pattern mechanism with conventional round spoolboxes and a high-efficiency arc lantern ; an input switch box for each, wall-mounted adjacent to its stand, to give convenient control of sound changeover and volume ; an amplifier and an exciter lamp supply unit mounted in a steel cubicle ; and a single or twin non-synchronous turntable unit fitted with lightweight magnetic pick-ups.

An attachment for projecting lantern slides is available.

Adjustments can be made to the stand to suit different porthole heights and angles of projection, the range covering extreme dimensions as ascertained during a detailed survey of cinema projection rooms.

The high light-efficiency is due to a combination of improvements in design :—

(a) The arc lantern is fitted with a 12″ mirror and gives a larger aperture (f2) than previously obtained.

(b) The new range of Taylor, Taylor & Hobson "Aperful" lenses was designed to take full advantage of the large aperture.

(c) A high ratio is obtained between the diameter of the flicker shutter and the diameter of the light-beam at the point of cut-off.

For convenient operation an automatic feed device is provided for the carbons and this has an additional refinement which enables the feed rate of both positive and negative carbons to be individually matched.

Increased picture steadiness and freedom from buckling and distortion have been obtained by using an improved type of curved gate, and flicker is reduced to a minimum by the dish-type shutter.

An audio output of thirty watts enables signal input "peaks" to be handled without overloading, and frequency and harmonic distortion are reduced to negligible proportions by the use of negative feed-back. The signal-to-noise ratio is improved as a result of the specially-designed sound optical system and input circuit.

The ability to tilt the amplifier and amplifier-rectifier units when they are withdrawn on their runners, without disconnection of the leads, greatly facilitates inspection and service. The units are shown in the tilted position in Fig. 21. Varying degrees of H.F. and/or L.F. boost can be applied in the pre-amplifier circuit to suit local acoustic conditions, thus obviating all possibility of misuse of a manually-operated tone control.

GENERAL

The overall dimensions of each equipment when in the normal position (rake 7½° down) are :—

Projector Unit

Length from back of lantern to forward end of the base	4 ft. 6¼ in. (138 cm.)*
Maximum width	2 ft. 0⅞ in. (63 cm.)*
Height from the floor to the top of the top spoolbox	5 ft. 10½ in. (179 cm.)
Weight	694 lb. (315 kg.)
Maximum upward rake	10°
Maximum downward rake	25°

Amplifier Unit

Maximum height (floor mounted)	4 ft. 0$\frac{13}{16}$ in. (124 cm.)
Width	1 ft. 11⅝ in. (60 cm.)
Depth	1 ft. 2⅛ in. (36 cm.)
Weight	190 lb. (86 kg.)

* For steep rakes, these dimensions are : Length—5 ft. 1⅞ in. (157 cm.), width 2 ft. 1⅞ in. (66 cm).

MECHANICAL ASSEMBLIES

The conventional mutehead and soundhead have been replaced by one mechanism, a feature of which is the use of ball-bearings throughout. Fig. 2 shows the interior of the mechanism box with the drive motor removed, and Fig. 4 the mechanism box interior without the sound drum or drive motor. The mechanism box is primarily a casing containing various sub-assemblies, described in detail below, each of which is removable as a unit.

The Gear Drive Assembly, 12, Fig. 4, is spigoted to the main casting and contains all the gears necessary for the drive transmission, including bevel drive gears and a differential gear for compensating framing displacement in relation to the flicker shutter.

The Drive Motor Assembly comprises :—

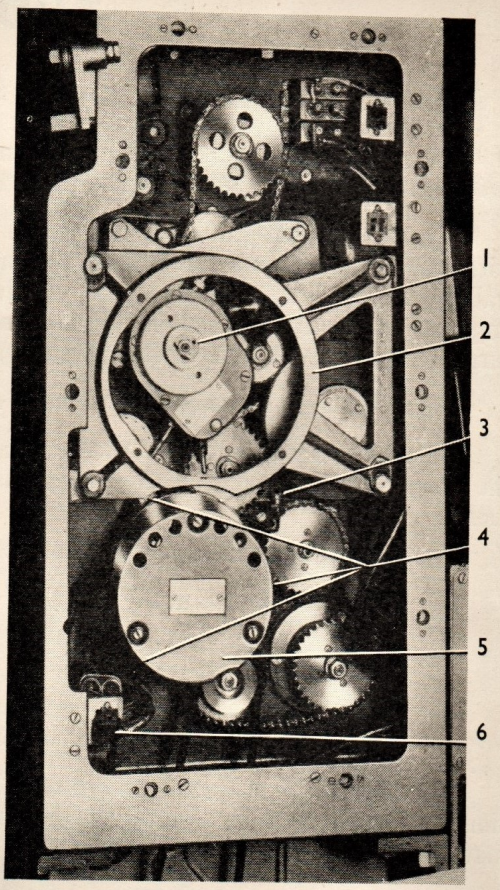
(a) A support assembly made up of two cylindrical brackets resiliently coupled, the inner bracket being fixed in the motor support plate, 2, Fig. 2.

(b) A 240 volt, 1440 r.p.m. capacitor motor, Type BC 2406, fitted to the outer resilient mounting bracket.

(c) A flexible-drive coupling.

The Sound Drum Assembly, 5, Fig. 2 consists of the sound drum, flywheel, and motor disc mounted in ball-bearings on a single spindle. The special-type motor incorporates an induction disc about which the driving units are symmetrically disposed.

Drum-speed control is by the injection of D.C. into the driving unit, and the resultant eddy currents provide braking and a second-order damping effect. The D.C. potential is obtained from a rectifier and potentiometer.



1. Intermittent Mechanism Driving Pinion.
2. Driving Motor Support Plate.
3. Sound Drum Motor Lubricator.
4. Sound Drum Assembly Fixing Bolts.
5. Sound Drum Assembly.
6. Input Plug for Sound Drum Assembly.

Fig. 2. Mechanism Box, driving motor removed.

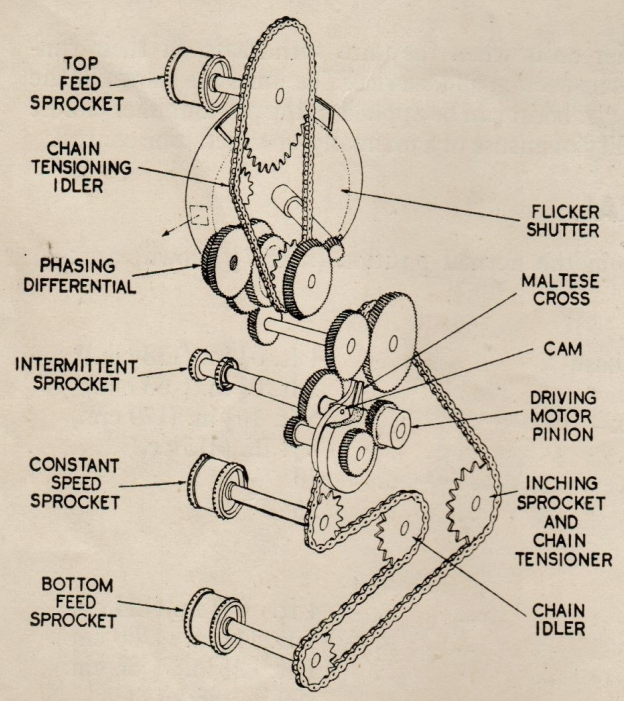


Fig. 3. Arrangement of Driving Chains.

The fact that the sound drum is motor-driven avoids wear on the film, prolongs its life, and enables a large flywheel to be used ; the flywheel, in conjunction with the resilience of the film, forms a very efficient filter system.

Electrical connection is by plug and 3-core cable 6, Fig. 2, from a socket mounted at the bottom of the mechanism box.

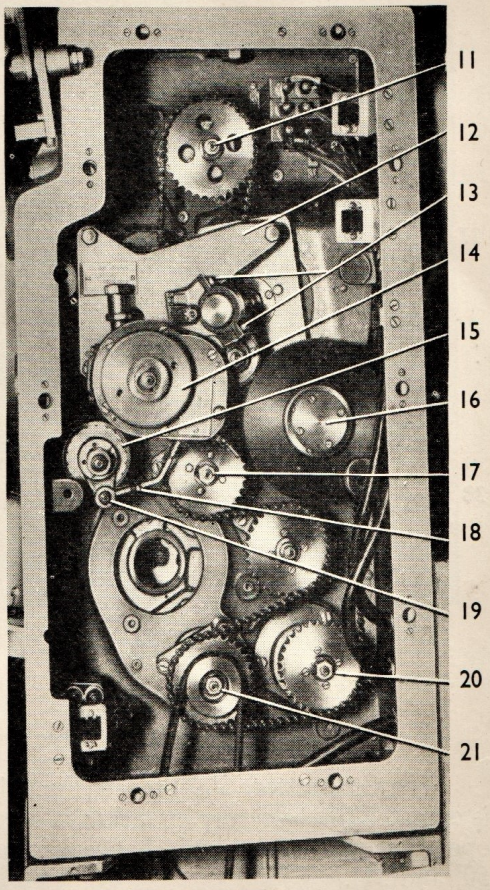
The Intermittent Mechanism, 14, Fig. 4, is a sealed unit. It is completely self-contained and its essential components, the Maltese Cross and Geneva Cam, run in oil. The mechanism is driven directly by the motor through a flexible coupling. The motor-shaft is mounted co-axially with the maltese cross spindle and engages the cam and flywheel spindle through a one-to-one gear, the object of this arrangement being to couple the two high-speed units (i.e. the motor and the intermittent mechanism) directly together, avoiding the use of a long gear train.

The Framing Assembly, 15, Fig. 4 has a control shaft carried between two thrust bearings in a flanged support casting. To the end of this shaft is fitted a clutch-boss assembly, inner clutch, and compression spring. A projection on the clutch-boss assembly forms the actuating arm to which the framing link, 18, Fig. 4, is resiliently coupled.

The Inching Assembly, 20, Fig. 4, performs a dual function. Its shaft is eccentrically carried in a 2-bearing housing, and, with a chain sprocket, provides tension adjustment for the sound feed and bottom sprocket drive chain in addition to its function as an inching device.

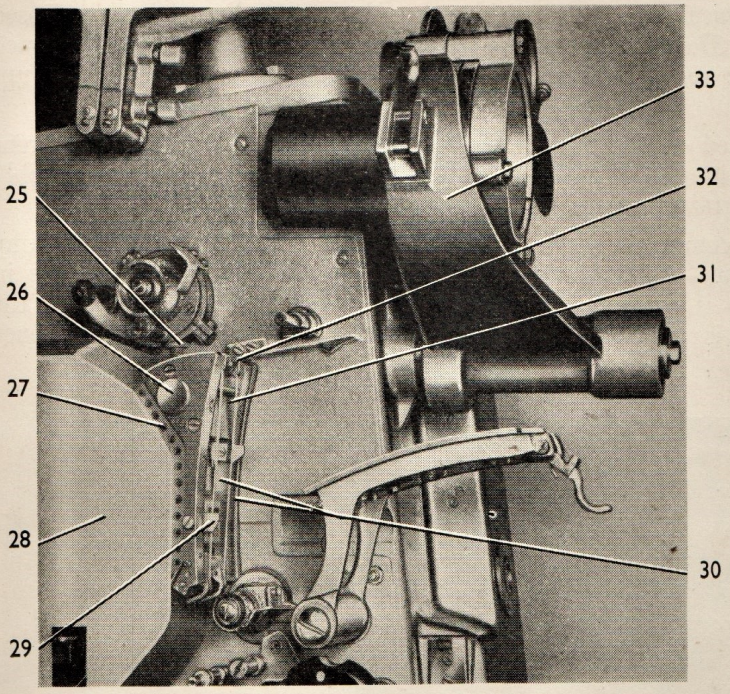
The Film Sprocket Drive Assemblies, 16, Fig. 4, consist of a two-ball-bearing housing and a drive shaft to which chain sprockets are fitted. Two chains are used, one to drive the top sprocket assembly, 11, and the other the sound-feed sprocket, 17 ; bottom sprocket, 21 ; and inching assembly, 20.

The Picture Gate Assembly, Fig. 5, is in two sections and is curved to ensure more even distribution of light over the entire picture area. The resultant film path prevents buckling in the gate. Flexible spring skids, 30, are used in the fixed part of the gate. Tension of these skids is adjusted by a small screw, 25, at the top of the gate. Three heat reflectors, 27, of conventional type are fitted behind the gate. The framing aperture, 31, is situated at the top of the gate and is illuminated by a standard 6 volt lamp of the miniature-screw type, connected in parallel with the intermittent-mechanism inspection lamp.



11. Top Sprocket.
12. Gear Drive Assembly.
13. Bolts for Flicker Shutter Bearing.
14. Intermittent Mechanism.
15. Framing Assembly.
16. Lower Sprocket Drive.
17. Sound Feed Sprocket.
18. Framing Link.
19. Pivot for 18.
20. Inching Assembly.
21. Bottom Sprocket.

Fig. 4. Mechanism Box, without Sound Drum.

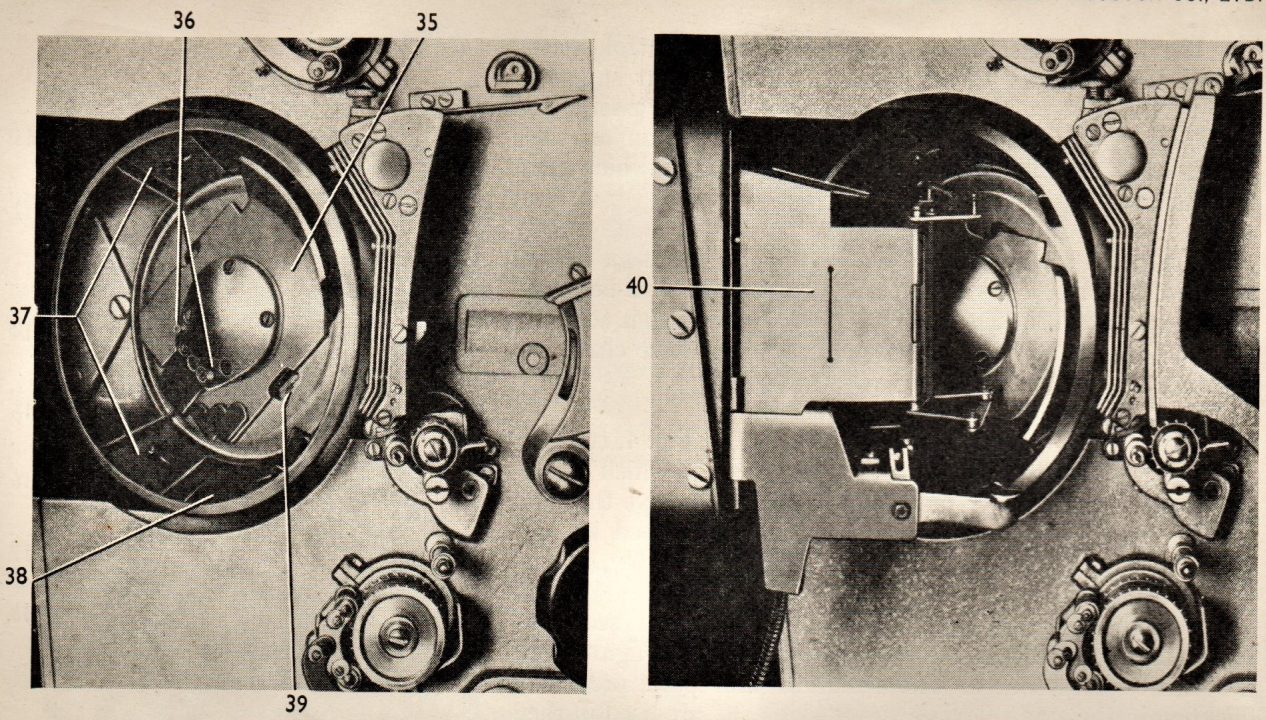


25. Tension Adjuster for Spring Skids.
26. Framing Lamp.
27. Heat Shields.
28. Light Tunnel.
29. Lower Guide Pellet.
30. Flexible Spring Skids.
31. Framing Aperture.
32. Spring Skid Pivot.
33. Lens Holder Assembly.

Fig. 5. Picture Gate and Lens Holder Assembly.

The Lens Holder Assembly, 33, Fig. 5, is designed for use with "Aperful" lenses developed by Messrs Taylor, Taylor & Hobson Ltd., but other lenses may be fitted by use of a standard range of adaptors. The lens carrier is mounted in a casting which can be hinged upwards and retained in the raised position by a spring catch. (It is shown in this position in Fig. 5). Focusing is by axial movement of the lens, coarse and fine adjustment being provided.

The Light Tunnel, 28, Fig. 5 is simply a metal shield enclosing the flicker and changeover shutters for protective purposes.



35. Fire Shutter.
36. Fire Shutter Stops.
37. Flicker Shutter Adjustable Extension-pieces.
38. Flicker Shutter.
39. Flicker Shutter Adjusting-screws.
40. Changeover Shutter.

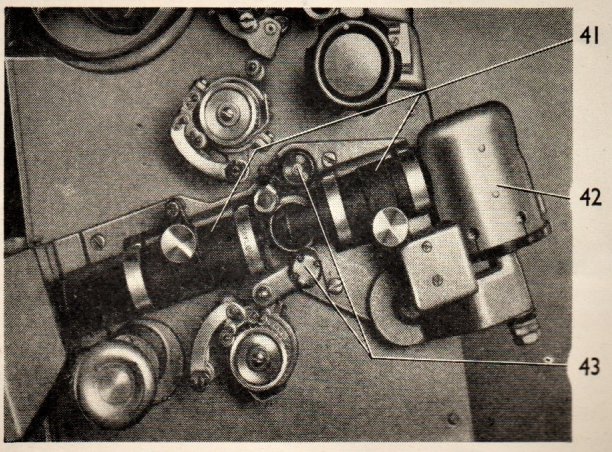
Fig. 6. (*Left*). Flicker Shutter and Fire Shutter. (*Right*). Changeover Shutter.

The Changeover Shutter, 40, Fig. 6 is mounted on a bracket fixed to the mechanism box. Normally it is operated mechanically by means of a tension cable, but it can also be arranged for simultaneous electrical operation with the sound changeover relay if specified when ordering (Circuit Diagrams Figs. 16, 19, 50, and 51).

The Flicker Shutter, 38, Fig. 6, consists of a sheet-metal dish which projects from the mechanism box at an angle. Apertures are cut in the conical side of this dish so as to leave two diametrically-opposed shutter blades. Adjustable extension pieces, 37, are fitted at the edge of each blade and a vane is formed at the outer edge of each extension piece to render the transmission of " light " to " dark " less abrupt and so to reduce flicker.

The Fire Shutter, 35, Fig. 6, is mounted on the boss of the flicker shutter shaft. An eddy current disc fixed to the flicker shutter rotates in the gap of a permanent magnet on the fire shutter assembly and so opens the fire shutter ; it closes by gravity.

The Sound Optical Assembly, Fig. 7, comprises the sound optical system, 41, a twin exciter lamp turret, 42, the P.E. cell mounting, and guide and take-up rollers, 43. The sound optical system is in two sections. Light from the exciter lamp is projected, in the form of a rectangular spot, on to the sound track ; an image of the sound track is then magnified, focused on a mechanical slit and thence transferred to the P.E. Cell cathode.



41. Sound optical system.
42. Exciter lamp housing.
43. Sound drum Rollers.

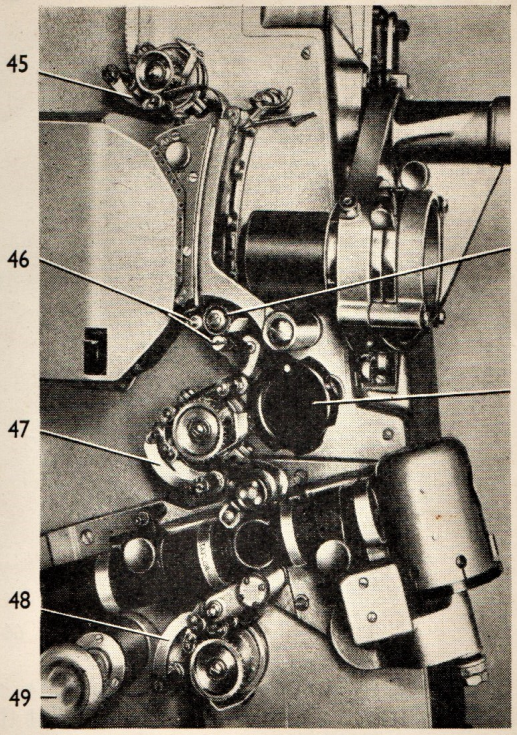
Fig. 7. Sound Optical Assembly.

The Film Sprockets and Stripper Plates are of conventional design and function. The top sprocket is of the 6-picture type and the sound-feed and bottom sprockets of the 8-picture type.

The Pad Roller Assemblies, Fig. 8, have provision for tension adjustment. The top pad roller assembly, 45, contains a single roller, whilst the sound-feed and bottom assemblies, 47 and 48, each contain two rollers. At the intermittent sprocket, 51, film guide pads, 46, are used.

The Spoolboxes are of the conventional round type with a deep lid so that, on opening, the film spool is completely exposed for ease of handling. On leaving the top spoolbox and on entering the bottom spoolbox the film passes through efficient fire traps, fitted in each case to the fixed portion of the spoolbox.

The Stand forms a rigid mounting for the projector and is suitable for a wide range of porthole heights and projection angles, as indicated in the chart, Fig. 34. The base is provided with screw jacks, the ball ends of which fit into cupped feet, spaced to ensure stability over the complete range of projection angles. These screw jacks also provide a means of levelling the base and a fine adjustment for projection height.



45. Top Pad Roller Assembly.
46. Film Guide Pads.
47. Sound-Feed Pad Roller Assembly.
48. Bottom Pad Roller Assembly.
49. Inching Handle.
50. Framing Handle.
51. Intermittent Sprocket.

Fig. 8. Film Sprockets, etc.

PROJECTOR LANTERN

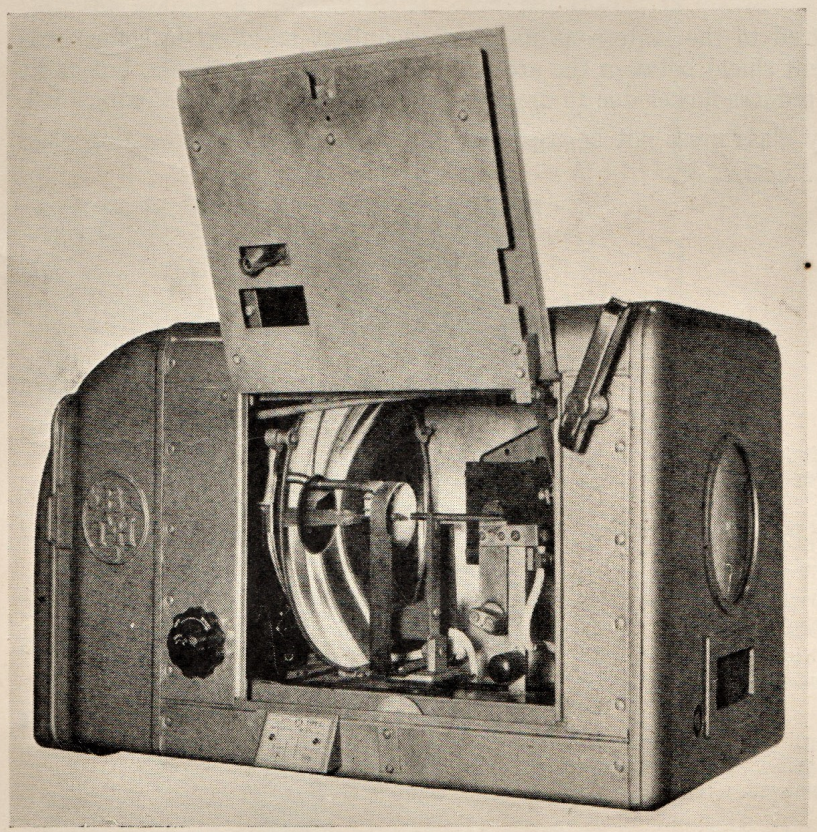
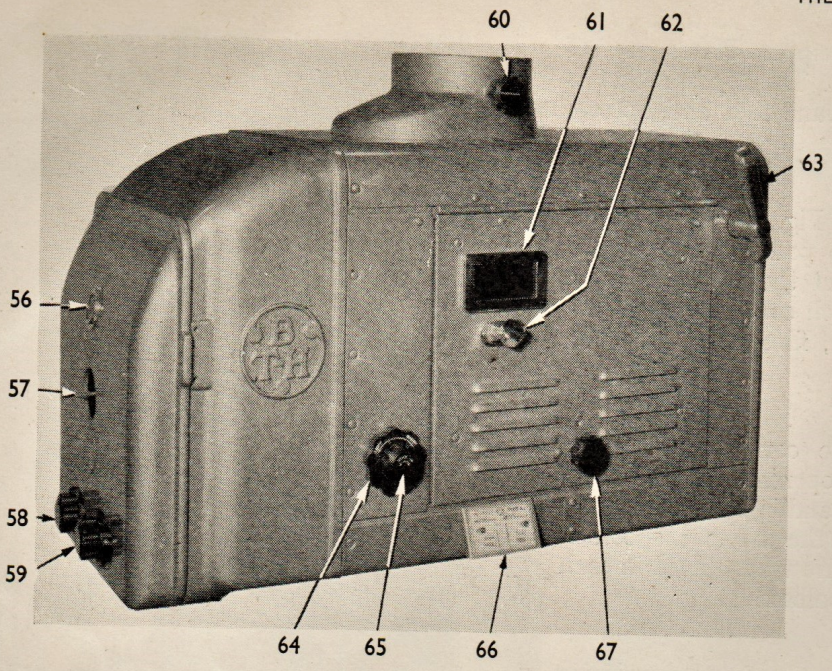


Fig. 9. Operating Side of Lantern.

The Projector Lantern is designed to operate with high-intensity carbons but conversion parts can be supplied to enable either high- or low-intensity carbons to be used. The lantern is of the mirror-arc pattern, i.e. the light system includes a mirror having two fixed focal points, the arc crater and the picture gate. The best results therefore are obtainable only when the mirror, arc-crater, and gate occupy their correct relative positions. The mirror is 12″ (30·5 cm.) diameter, and is designed to operate with a projection lens of f2 or better.

For low-intensity operation, the arc supply voltage should not be less than 80, and for high-intensity operation it should not be less than 60 volts, ballast resistances being selected to suit. Higher voltages can of course be used, but will result in reduced efficiency, due to the additional losses in the external resistance.



56. Crater Inspection Window.
57. Negative Carbon Adjusting Knob.
58. Negative Feed Knob.
59. Positive Feed Knob.
60. Flue Damper Knob.
61. Side Inspection Window.
62. Arc Image Periscope.
63. Front Shutter Handle.
64. Mirror Slewing Knob.
65. Mirror Tilting Knob.
66. Arc Image Plate.
67. Door Knob.

Fig. 10. External view, showing main controls.

The lantern is simple to erect, operate, and maintain. All the main components can be clearly and quickly separated and re-assembled without the use of special tools. By removing the mirror and its adjusting knobs, the complete chassis can be withdrawn from the body, exposing all the working parts for inspection and cleaning.

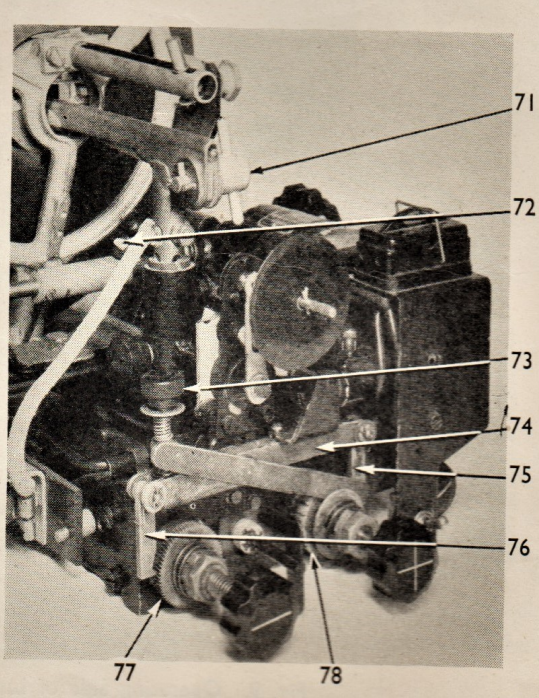
The negative carbon is provided with an external adjusting knob, 57, Fig. 10 to enable the tip to be raised, lowered, or slewed sideways so that correct burning of the crater can be obtained. Quick-release devices are fitted to both carbon carriages.

Provision is made for tilting the mirror so that the light beam can be correctly lined up on the gate. An image of the positive and negative carbons is projected on to a plate, 66, Fig. 10, mounted at a convenient point on the lantern body, so that the correct position of both carbons can easily be checked and maintained.

A Heat-resisting Nose Glass is fitted to the lantern as its use is definitely specified in some areas by local regulations, to form a permanent shield between the arc and the film. It is removable, but as its insertion conduces to a cooler gate and reduces flicker due to draughts, its permanent use is recommended.

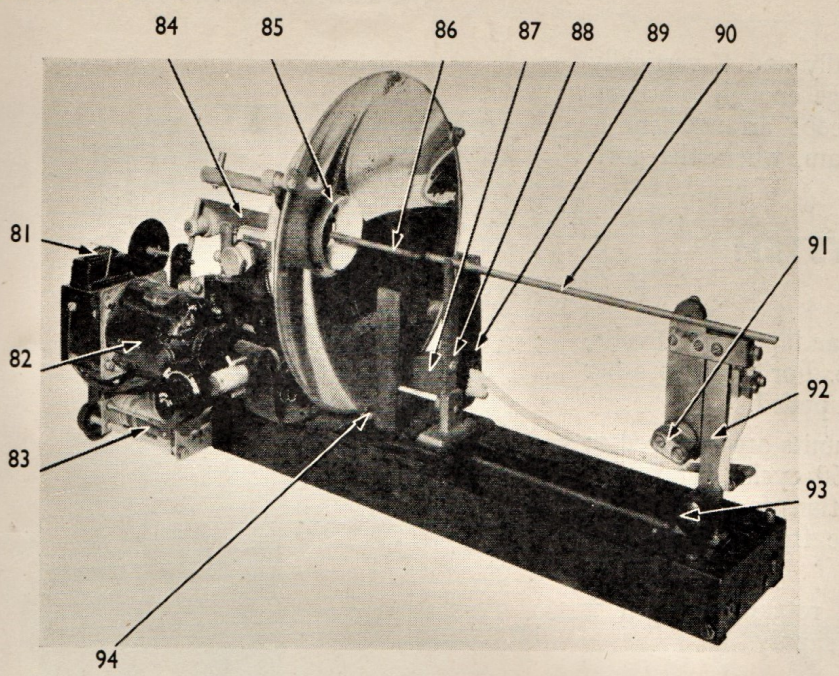
In the event of breakage, ordinary glass must not be used but only the special heat-resisting glass supplied for the purpose.

The Automatic Feed Mechanism, Fig. 11, is driven by a Type BB 314 40 v. D.C. motor, 82, Fig. 12, through a worm and worm-wheel. The worm-wheel shaft carries an eccentric, which, as it rotates, causes a rocker arm, 74, to oscillate about a pivot, placed above and between the positive and negative carbon feed shafts. To one end of this arm is attached a pawl, 75, which engages in a ratchet, 78, on the positive carbon-feed shaft. The other end of the rocker arm acts on a secondary rocker pivoted about the same pivot point ; held by a spring against the main rocker arm is another pawl, 76, which engages with a ratchet, 77, on the negative carbon-feed shaft. The rate of negative-carbon feed can be altered by means of an adjusting



71. Negative Carbon Clamp.
72. Mirror-knob Spindle Clamp Screw.
73. Negative Feed Adjusting Knob.
74. Rocker Arm.
75. Positive Pawl.
76. Negative Pawl.
77. Negative Ratchet and Clutch.
78. Positive Ratchet and Clutch.

Fig. 11. Rear view of Chassis, with gear-cover removed.



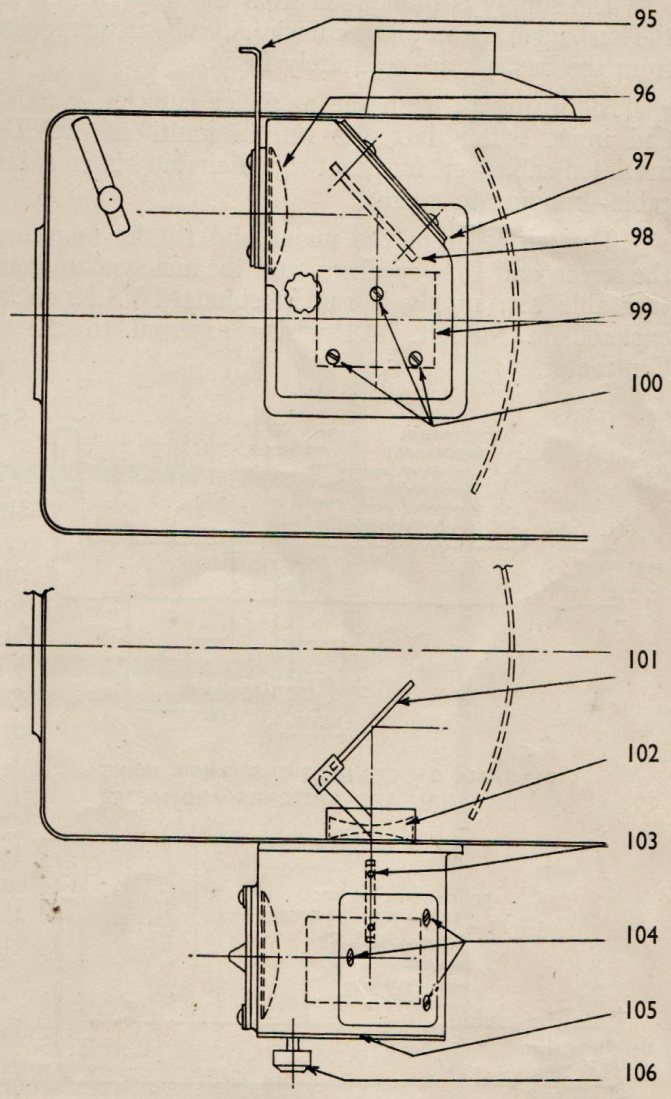
81. Motor Fuses.
82. Feed Motor.
83. Speed-control Rheostat.
84. Negative Carriage.
85. Mirror Shield.
86. Negative Carbon.
87. Slag Tray.
88. Positive Guide.
89. Arc Control Magnet.
90. Positive Carbon.
91. Positive Clamp Knob.
92. Positive Carriage.
93. Resetting Knob for 92.
94. Bottom Location for Mirror.

Fig. 12. Chassis, Motor, and Control Unit.

knob 73, which controls the number of negative ratchet teeth engaged by the negative pawl for each complete revolution of the positive lead screw. This device enables the feed rate of the negative carbon to be varied with relation to that of the positive. Motor speed control is effected by a potentiometer in the field circuit. Fig. 17 shows the circuit diagram. To enable adjustment to either carbon to be made by hand, the feed shafts are brought out to conveniently-placed knobs, 58 and 59, Fig. 10, and the automatic mechanism is connected to the feed shaft, in each case, through a friction clutch.

The Slide Attachment, Fig. 13, can be supplied, where required, for projecting lantern slides ; it uses the lantern arc as the source of illumination. This device is attached to the left-hand side of the lantern (viewed from the rear) and is internally-coupled to the front shutter lever. The shutter handle, 63, Fig. 10, is spring-biased to suit normal film projection ; operation of the handle opens and closes the shutter and operates the mirror shield. For slide projection, the handle is pushed inwards (from operating side) before rotation ; this couples it to the swinging mirror, 101, Fig. 13, and disengages it from the lantern shutter. Rotation of the handle then swings the slide mirror into position and retracts the mirror shield 85, Fig. 12, but leaves the shutter closed to prevent light entering the picture gate. The lantern is now ready for slide projection.

The optical system comprises a swinging mirror, 101, a negative lens, 102, and two preset mirrors, 98 and 99, in the slide attachment, the beam finally passing through a condenser lens, 96, immediately behind the slide carrier. The beam from the slide lantern is parallel to the line of the main projector beam,



95. Slide Carrier.
96. Condenser Lens.
97. Top Cover.
98. Upper Mirror.
99. Lower Mirror.
100. Lower Mirror Adjusting Screws.
101. Swinging Mirror.
102. Negative Lens.
103. Stop for 101.
104. Upper Mirror Adjusting Screws.
105. Side Cover.
106. Shutter Knob.

Fig. 13. Arrangement of Slide Attachment.

and at distances of 11¼″ horizontally and 4″ vertically from it. The porthole must be large enough to accommodate both beams, or a periscope arrangement is available to transpose the slide beam, where the porthole cannot be enlarged.

ELECTRICAL SYSTEM

Supply

The equipment is designed for an input of 240 volts, 50 cycles per second, single phase. For voltages other than 240, an auto-transformer is supplied.

The amplifier and associated units are designed to operate on frequencies of 40 to 60 cycles per second without modification, but modifications to the projector mechanism are required when the frequency is other than 50 cycles.

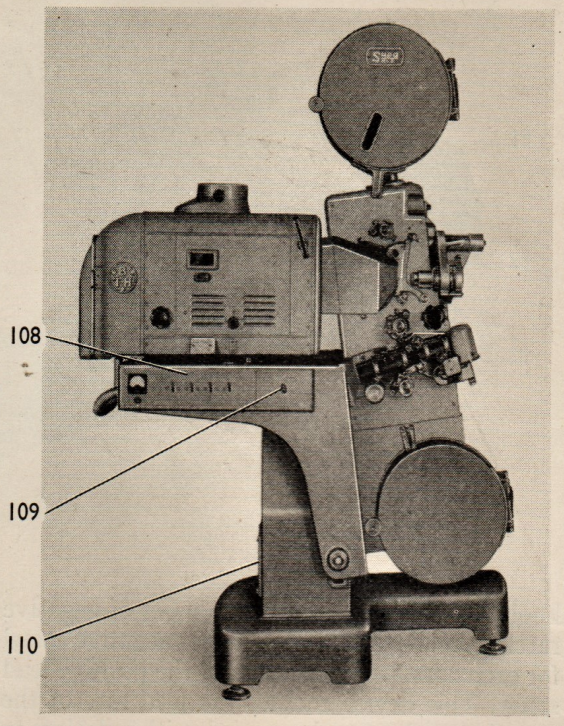
A special governor-controlled rotary converter is supplied for operation from a D.C. supply.

Inter-unit Wiring

The supply is brought in from the main switch to the busbars in the amplifier cubicle. All sub-circuits taken from the busbars are separately fused.

All wiring between the amplifier cubicles, stands, and input switch boxes is run in multi-core P.V.C. insulated cable—or, for input signal circuits, in co-axial cable—running in conduit.

The wiring from the mains and to the monitor, the screen and P.A. speakers, and the non-synchronous turntable A.C. supply is run in standard V.I.R. cable enclosed in conduit. All wiring external to the reproducer units is installed by the Electrical Contractor.



108. Arc Resistance Switch Panel. 110. Stand Cover Plate.
109. Drive Motor Switch.

Fig. 14. Supa—Mark 2 Projector, operating side.

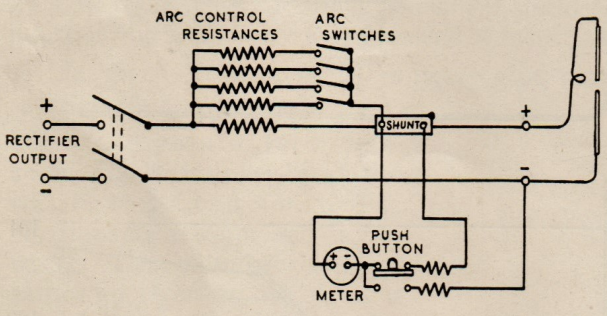


DIAGRAM OF CONNECTIONS WHEN USING INTERNAL ARC SWITCHES AND METER

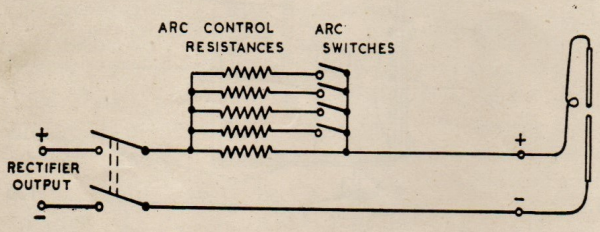


DIAGRAM OF CONNECTIONS WHEN USING INTERNAL ARC SWITCHES BUT NO METER

Fig. 15. Alternative Arc-current Control-switch Diagrams.

Stand

The cables coming into the stand are brought up through the centre column. The A.C. and control cables terminate on a terminal board, 121, Fig. 36, on the non-operating side of the lantern table. The four-core cable to the P.E. Cell and cathode follower housing terminates in a 4-way socket which mates with a corresponding plug in the housing. The P.E. Cell signal co-axial cable also terminates in a plug and socket at the P.E.C. housing.

Leads from the lantern-table terminal board are carried through into the mechanism box to supply the driving motor, sound drum motor, and framing and exciter lamps. The switch, 109, Fig. 14, controlling the driving and sound drum motors, is mounted on the operating side of the lantern table.

Switches 108, Fig. 14, controlling the arc current, can be fitted in the lantern table, if desired. When this is done an arc volt/ammeter may also be provided in a position adjacent to the arc switches. Fig. 15 shows the connections for these alternative arrangements. Both these items are extras to the standard equipment.

The internal stand wiring is shown in Fig. 16.

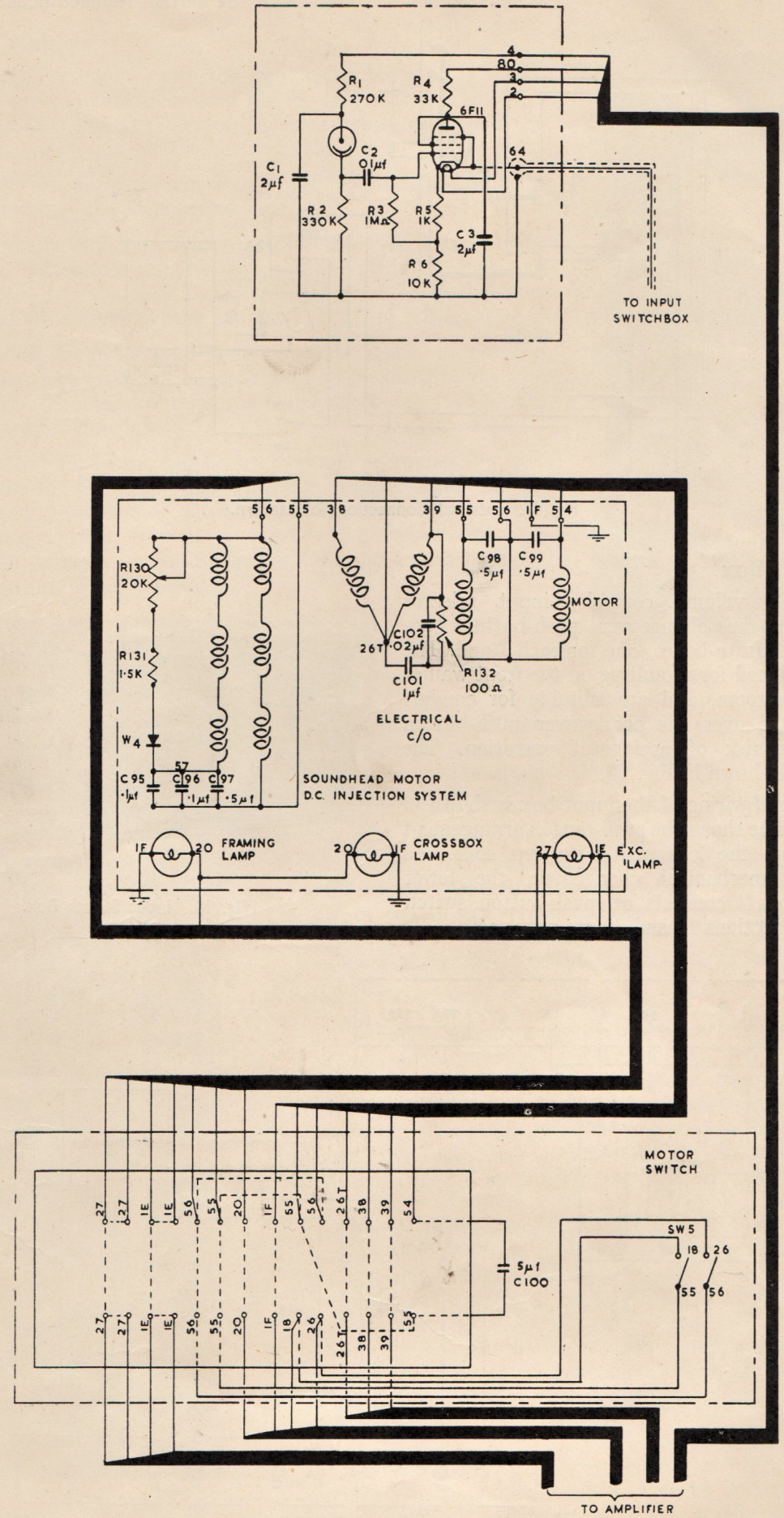


Fig. 16. Internal Stand Connections.

NOTE : Wiring is shown as arranged for Electrical Changeover. Connections 38, 39, and 26T do not exist in Mechanical Changeover equipments.

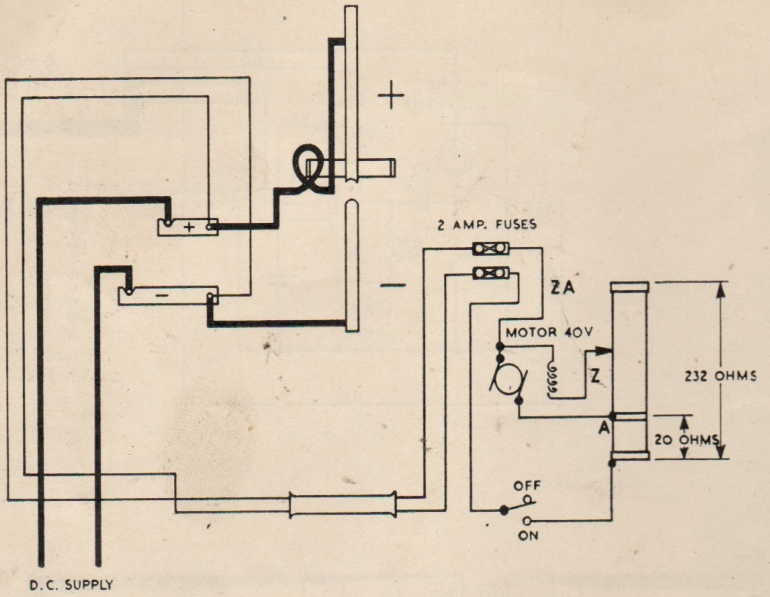


Fig. 17. Internal Connections of Lantern.

Input Switch Box

The main volume controls, input selector switches, and the changeover push-buttons are mounted in separate boxes, one for each stand. The boxes are designed for mounting on the front wall of the projection room, and are suitable for conduit entry. A guard over the changeover push-button minimizes the risk of accidental operation. The arrangement is shown in Fig. 18.

The internal wiring of the input box is shown in Fig. 19 which also shows the push-button arrangement for controlling the changeover-shutter coils. As arranged for mechanical changeover, the lower "normally open" contacts on push-button switch SW 3 and connections 18 and 39 are not used.

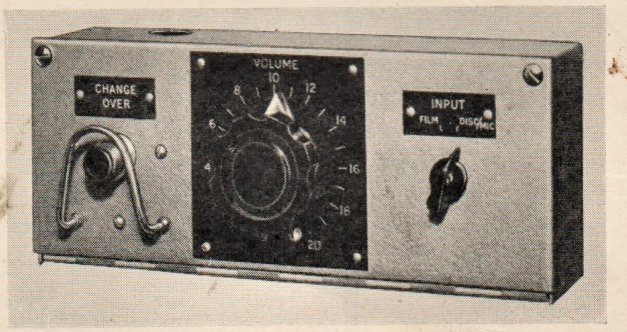


Fig. 18. Input Switch Box.

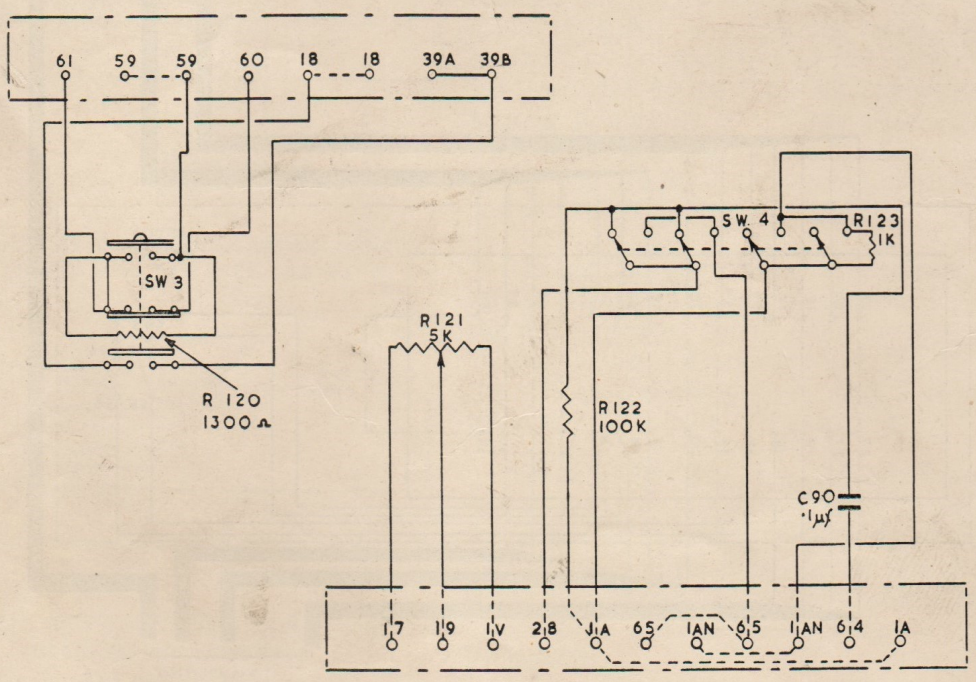


Fig. 19. Input Switch Box internal connections. The lower "normally open" contacts on SW 3 and connections 18 and 39 are used only in Electrical Changeover equipments.

Amplifier Cubicle

The amplifier cubicle with the front cover removed is shown in Fig. 20 ; the main amplifier is on the top tray, 111, the amplifier rectifier and deaf aid amplifier on the centre tray, 112, and the exciter lamp supply unit at the bottom, 113.

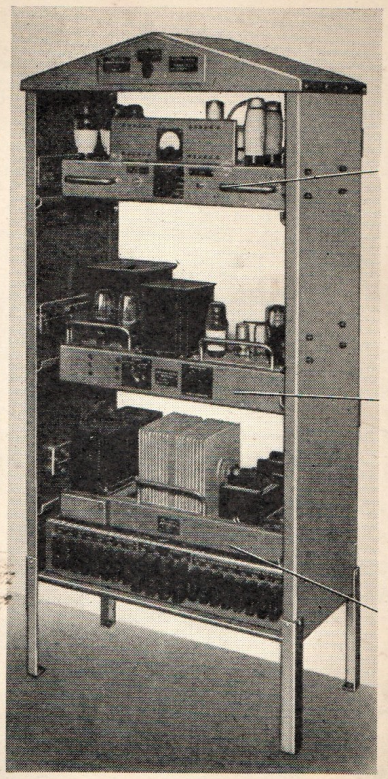
The cubicle is normally arranged for wall mounting but supports for floor mounting can be supplied.

All incoming and outgoing wiring in the cubicle is brought through the bottom. Terminal boards are provided at the bottom of the cubicle, and the sub-circuit fuses are mounted in the same position and are accessible from the front, 119, Fig. 21.

The signal from the non-synchronous turntable unit is fed through a co-axial cable into a screening box mounted in the roof of the cubicle. This box contains the non-synchronous transformer and its associated network.

The three units in the cubicle are mounted on runners for easy removal, and the amplifier and amplifier rectifier units can be tilted so that the underside wiring and components are accessible by the service engineer, after the bottom covers have been removed. Connections are made to the removable units by means of spade terminals on the wiring bunches.

The internal wiring in the standard cubicle is shown in Fig. 49, and that for the standby cubicle in Fig. 52.

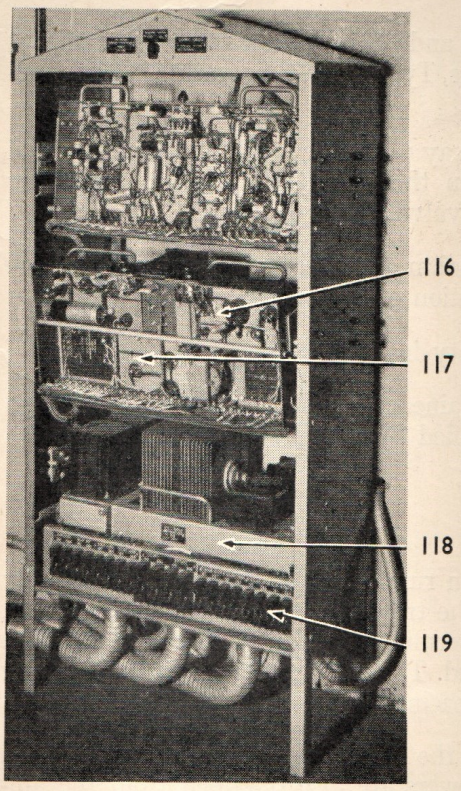


111. Main Amplifier.
112. Amplifier Rectifier and Deaf Aid Amplifier.
113. Exciter Lamp Supply Unit.

Fig. 20. Amplifier Cubicle, cover removed.

Sound System

The signal from the photo-electric cell is fed into a cathode follower mounted in the P.E.C. housing. The output from the cathode follower is taken through co-axial cable to the input switch, which gives a choice of film or non-synchronous sound.



116. Deaf Aid Amplifier.
117. Amplifier Rectifier Unit.
118. Supply Unit.
119. Sub-circuit Fuses.

Fig. 21. Amplifier Cubicle, trays inverted.

The sound output from the non-synchronous turntable unit is fed into a separate first stage valve, Type 6 F11, in the amplifier, thereby enabling the non-synchronous sound level to be adjusted to match that from the film channel. The amplified non-synchronous signal is taken through a co-axial cable to the input switches.

The signals from each of the input selector switches are taken, through separate first stage valves, Type V 455, and the contacts of a small relay, to a common second stage valve, Type 6 F11. When the relay is de-energized, the " A " channel is earthed, so that sound on the " B " channel is passed to the power amplifier stages. When the relay is energized, the " A " channel is connected to the second stage while the " B " channel is earthed.

Sound changeover is effected to the " A " reproducer by pressing the " A " C/O push-button which is connected so as to energize the C/O relay. If the " B " C/O push-button is pressed the relay is de-energized, because the " B " button is connected to open the C/O relay coil circuit, thereby bringing in " B " channel sound. The normally open contacts on the C/O push-buttons are shunted by resistances which are of such a value as to hold the relay closed when the " A " push-button is released.

An adjustable bass-boost network is included in the grid circuit of the second stage valve. A preset volume control is also included at this point in order to set the average volume level.

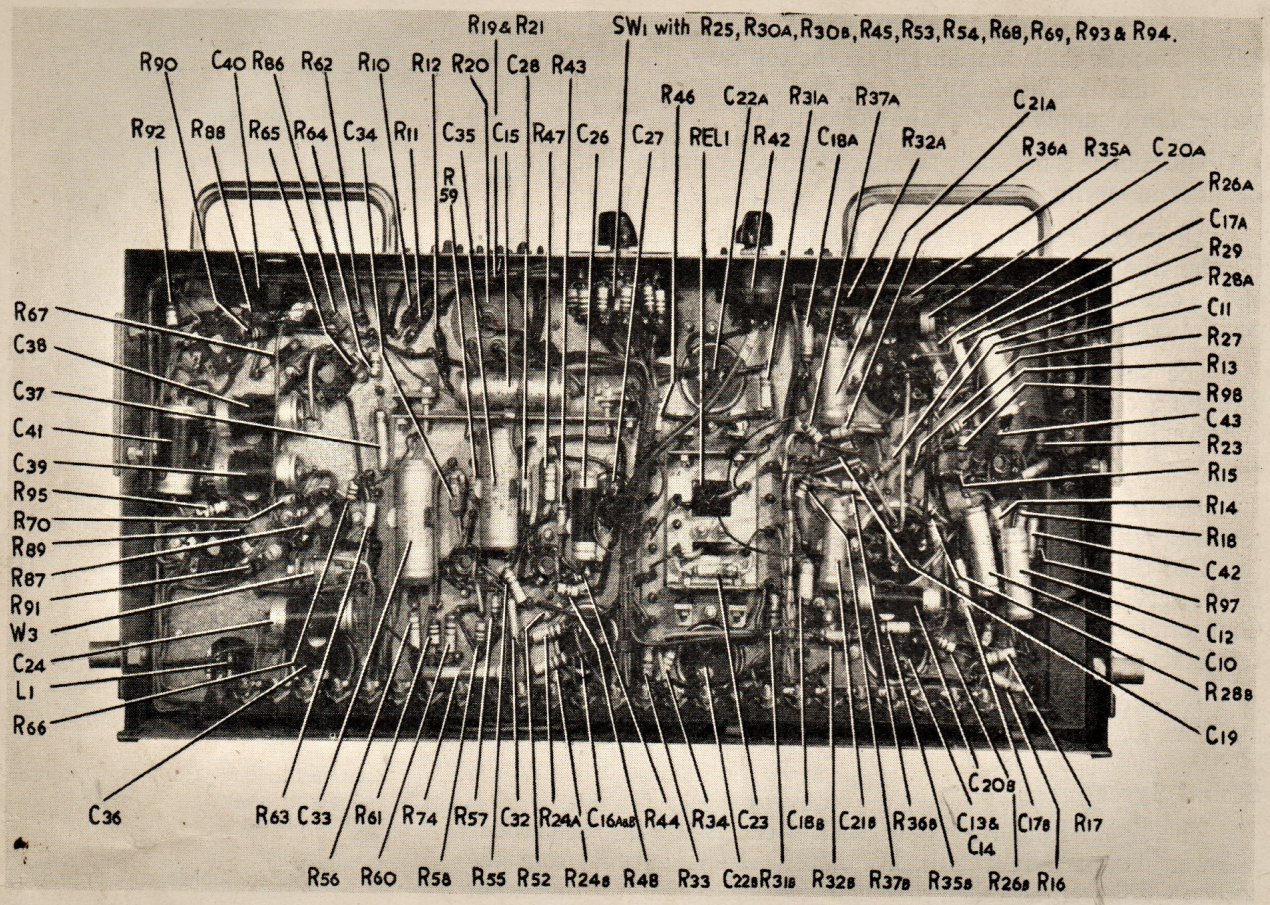


Fig. 22. Underside of Amplifier Tray.

An adjustable H.F. boost network is provided between the second and phase-splitter stages ; the output from the latter is fed into the power output stage. There are four valves, Type Pen 44, operating in push-pull parallel (Class AB 1) in this stage.

The output transformer is mounted on the amplifier rectifier tray with the monitor attenuator and output switch. Negative feed-back is obtained by connection from the output transformer secondary through a potential divider into the cathode of the phase-splitter valve, Type 6 L19.

The output is designed to feed into a 500-ohm load, and a 500-ohm artificial load is provided on the amplifier rectifier tray, and brought into circuit in the " test " position of the output switch.

The amplifier rectifier is a normal full-wave type, with capacity input filter.

The 10·5 volt supply for operating the changeover relay is obtained by connecting the 6·3 volt and the 4 volt 8·4 amp. filament windings in series. The supply is rectified by a half-wave rectifier mounted in the amplifier.

Amplifier Unit, III, Fig. 20.

The amplifier is built on a conventional type of tray mounted on runners. The underside is normally protected by a detachable cover. As it is not necessary to remove the tray from the cubicle for servicing, connections are made to the tray by flexible leads terminating on a terminal board at the back of the tray. Components likely to be affected by vibration are resiliently mounted. The small panel carrying the meter and boost components is hinged to facilitate adjustment and servicing.

The balanced potentiometer network components required for the P.E. Cell excitation are mounted on the amplifier tray. The H.T. supplies for the P.E.C. cathode followers are also obtained from the amplifier tray.

Fig. 22 is an underside view of the amplifier and Fig. 23 shows the wiring.

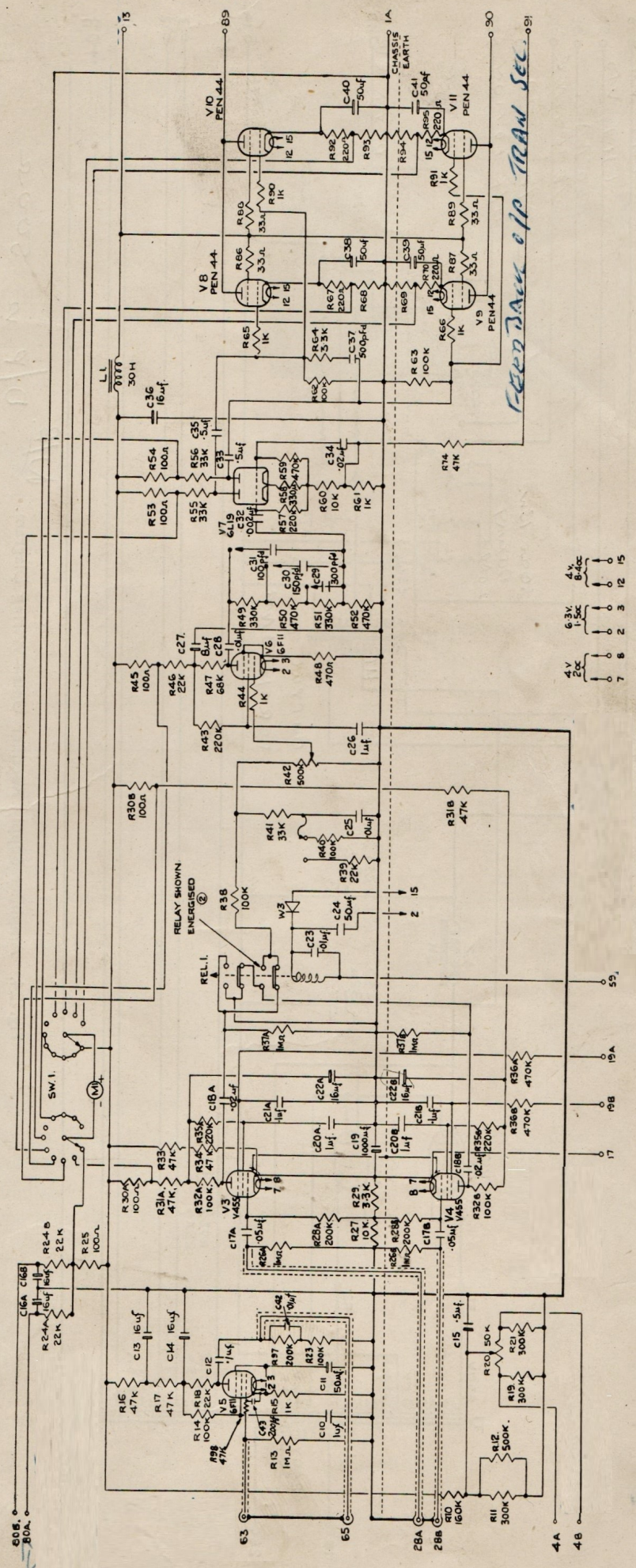


Fig. 23. Amplifier Wiring Diagram

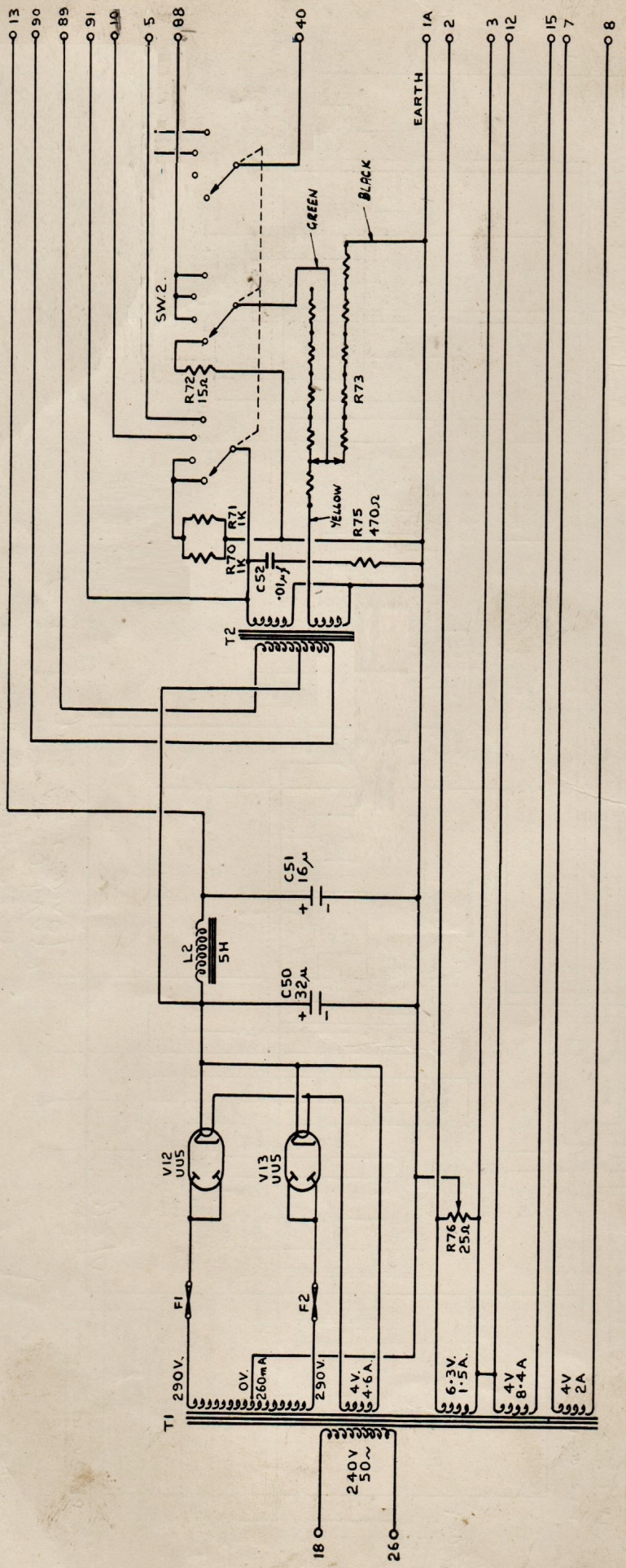


Fig. 24. Amplifier Supply Rectifier Unit—Wiring Diagram.

Amplifier Rectifier Unit, 112, Fig. 20

The rectifier is built on a tray similar to that of the amplifier. The rectangular opening on the right hand side, normally covered by a plate, takes the deaf aid amplifier when the latter is required.

The 6·3 volt, 1·5 amp., and 4 volt, 8·4 amp., filament windings, which are connected in series in order to provide a 10·5 volt supply source for the changeover relay, are earthed through a small 25-ohm potentiometer ; this is set to obtain minimum hum.

Fig. 25 is an underside view of the rectifier and Fig. 24 shows the wiring.

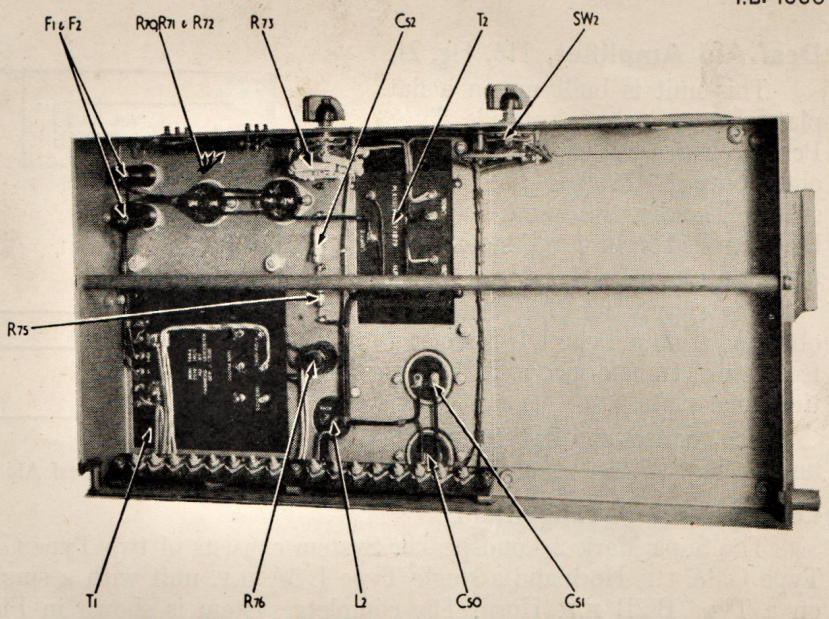


Fig. 25. Amplifier Supply Rectifier Unit (Underside).

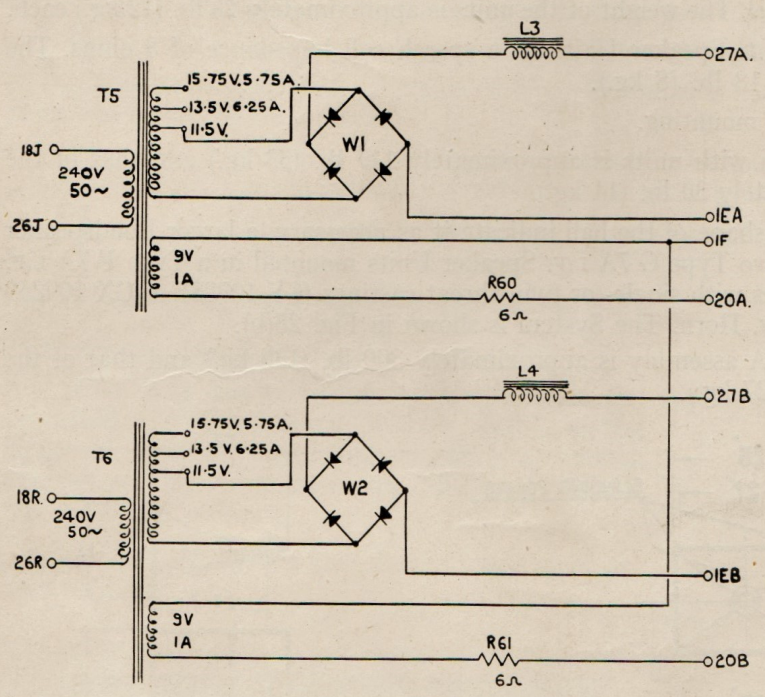


Fig. 26. Exciter Lamp Supply Unit—Wiring Diagram.

Exciter Lamp Supply Unit, 113, Fig. 20.

This unit supplies two 10 volt, 5 amp. exciter lamps and also the framing and intermittent inspection lamps. It has two bridge-connected rectifiers fed from independent transformers mounted on a conventional tray. This tray does not tilt as the servicing required on this unit is very small.

The connection diagram for this unit is shown in Fig. 26.

Standby Amplifier Arrangement

When standby facilities are required a second amplifier cubicle is supplied. This houses an amplifier and amplifier rectifier (also deaf aid amplifier if required) identical with those in the main cubicle.

In the position normally occupied by the exciter lamp supply unit a changeover switch panel is fitted. This incorporates three changeover switches ; one for the input circuits ; the second for control circuits ; and the third for the output circuits.

The following external wiring circuits are brought in to the standby cubicle instead of being taken to the main cubicle :—

(1)	Changeover push-buttons	59 and 60.
(2)	Volume controls (A & B)	17, 19 and 1v.
(3)	P.E.C. excitation & C.F. supplies	2, 3, 80, & 4.
(4)	N/S post-amplifier, A & B amplifier input co-axials	28A, 28B, & 65.

The above-numbered leads are then interconnected between the standby cubicle and the main cubicle.

The connections for this unit are shown in Fig. 52.

Deaf Aid Amplifier, 116, Fig. 21.

This unit is built up on a flat plate. It uses a single pentode, Type Pen 45, which is fed from the 500-ohm output through the output switch. The deaf aid sound level can be controlled from a volume control mounted on the plate.

The supply for the pentode is obtained from a Type UU 5 rectifier fed from a transformer mounted on the same plate.

The connection diagram for this unit is Fig. 27.

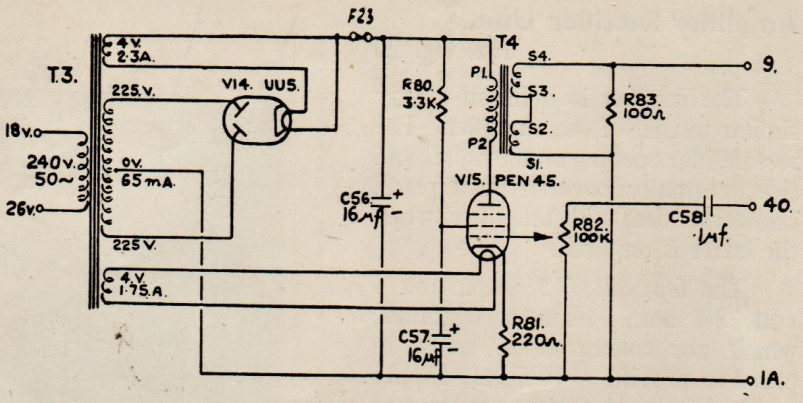


Fig. 27. Deaf Aid Amplifier—Connections.

Loudspeaker Arrangement

The Supa Mark 2 Loudspeaker System consists of two Type G 7A L.F. Speaker Units mounted on a Type G 8A L.F. Horn and a single Type E 5A H.F. unit with a single throat casting CY 109887 mounted on a Type B 2B H.F. Horn. The complete system is shown in Fig. 28(a).

The Type G 7A Permanent Magnet L.F. Speaker Units have a speech coil impedance of 10 ohms, and the two speech coils are connected in parallel. The weight of the units is approximately 26 lb. (12 kg.) each.

The Type E 5A Permanent Magnet H.F. Speaker Unit has a speech coil impedance of 8 ohms. The weight of the unit with throat casting is 18 lb. (8 kg.).

Both the horns are designed for sling mounting.

The weight of the complete L.F. Horn with units is approximately 117 lb. (53 kg.) and that of the complete H.F. horn with unit is approximately 30 lb. (14 kg.).

If acoustic conditions or the size and shape of the hall indicate it as necessary, a larger Loudspeaker System can be installed. This consists of two Type G 7A L.F. Speaker Units mounted in a Type F 7A L.F. Horn, and one or two Type E 5A H.F. Units with single- or twin-throat castings (CY 109887 or CX 109259 respectively) mounted on a Type B 2B H.F. Horn. The System is shown in Fig. 28(b).

The weight of the complete Type F 7A assembly is approximately 300 lb. (136 kg.) and that of the H.F. Horn with two speaker units 60 lb. (27 kg.).

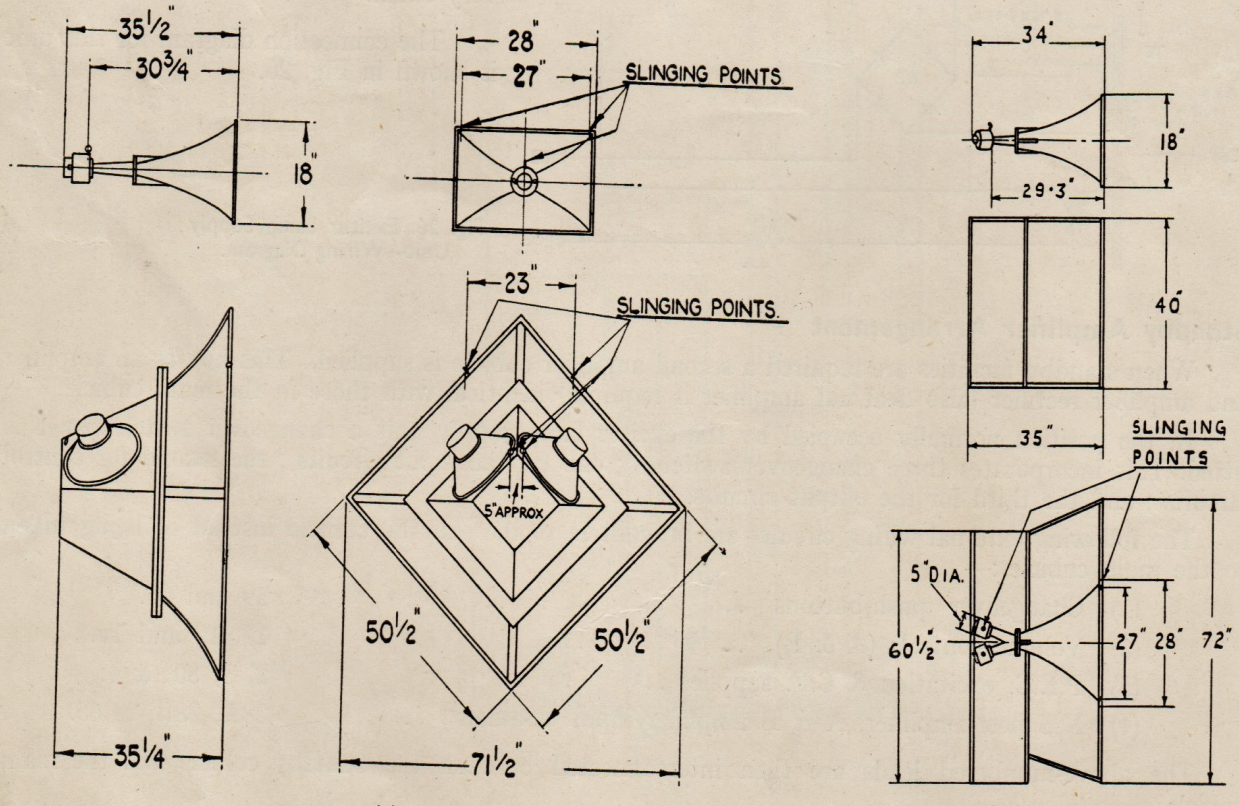


Fig. 28. Alternative Loudspeaker Systems.

Loudspeaker Filter Unit

Full frequency range is fed from the amplifier, via the speaker selector switch on the amplifier rectifier unit. Dual-channel output is obtained from the filter circuits which are arranged to have a cross-over frequency of 500 c.p.s. The type reference for the unit is D 1A.

A selector switch is provided so that the full frequency range can be applied to the L.F. speakers in an emergency.

The connections are shown in Fig. 29.

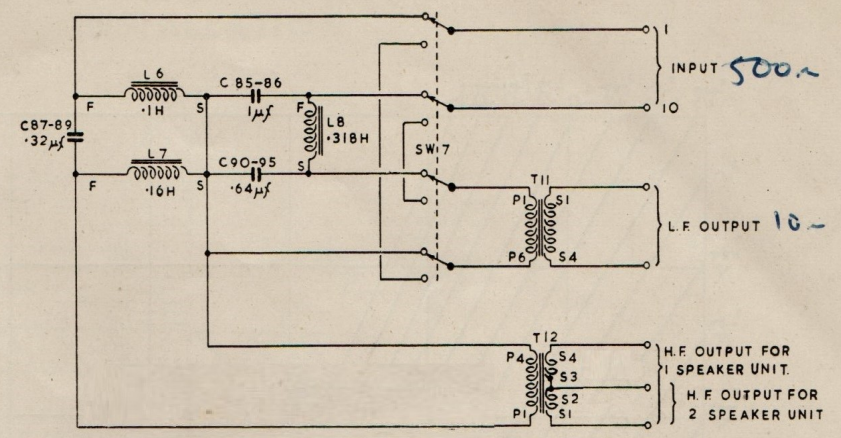


Fig. 29. Loudspeaker Filter Unit—Connections.

Non-synchronous Turntable Unit

This unit incorporates two turntable units and lightweight pick-ups mounted in a sheet steel cabinet; a continuous programme from gramophone records can be given.

The standard motors are suitable for operation on 100/130 or 200/250 volt 50/60 cycles supplies.

A fader having a resistance value of 400/0/400 ohms is fitted. This enables a smooth fade to be made from one record to the other.

A separate scratch-filter is not required because the combination of the pick-up circuit and the special non-synchronous transformer and its network has, intentionally, a sharp H.F. cut off.

The turntable unit is illustrated in Fig. 30, and another view, showing the motor plate raised for servicing, is given in Fig. 44.

A diagram of connections is shown in Fig. 31.

Microphone Input

When it is desired to use a microphone on the system, a special switch-plate assembly can easily be fitted. This includes a selector switch giving choice of non-sync. or microphone, using a common transformer but coupling-in at different points in the correcting network.

The connections for the above arrangement are shown in Fig. 49.

Fig. 30. Non-synchronous Turntable Unit.

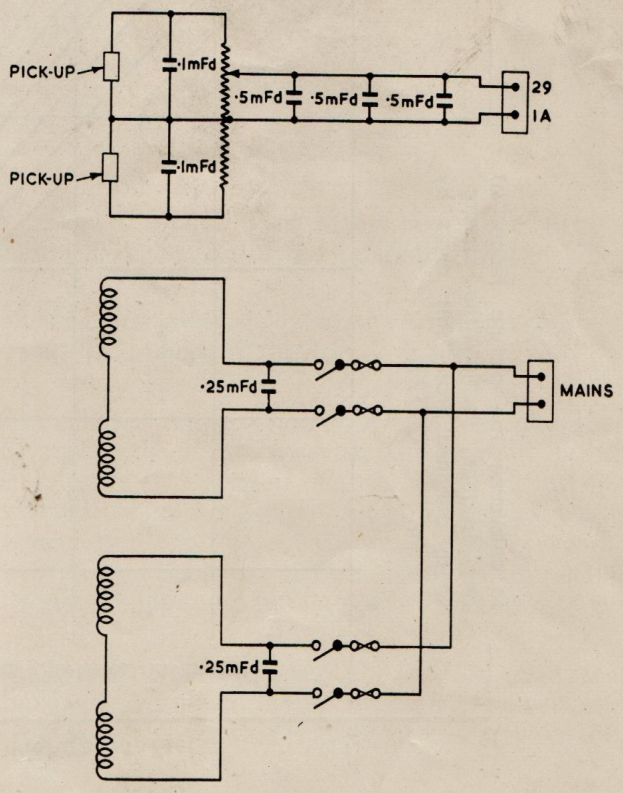


Fig. 31. Non-sync. Turntable—Connections.

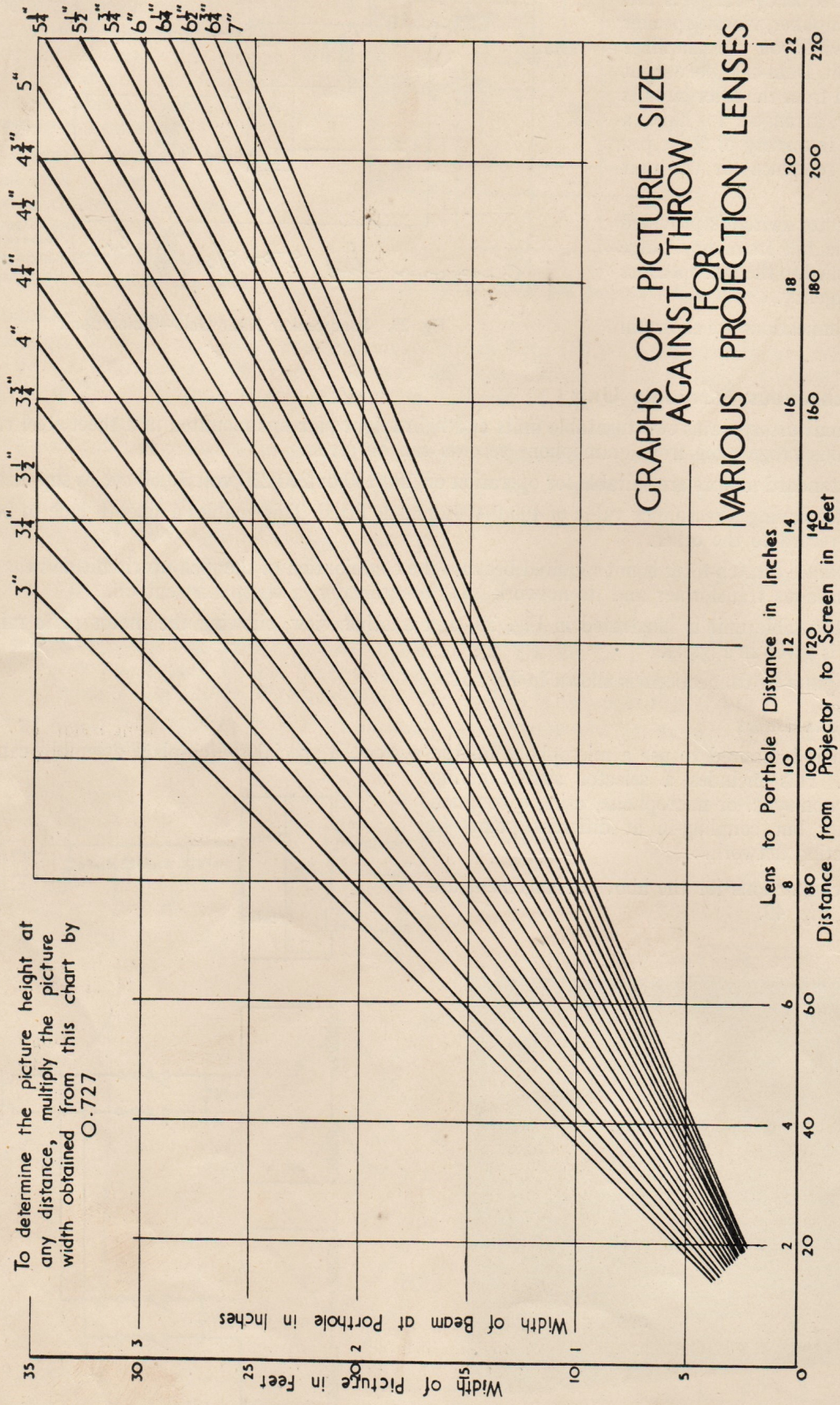


Fig. 32. Picture width/length of throw for lenses of various focal lengths.

INSTALLATION

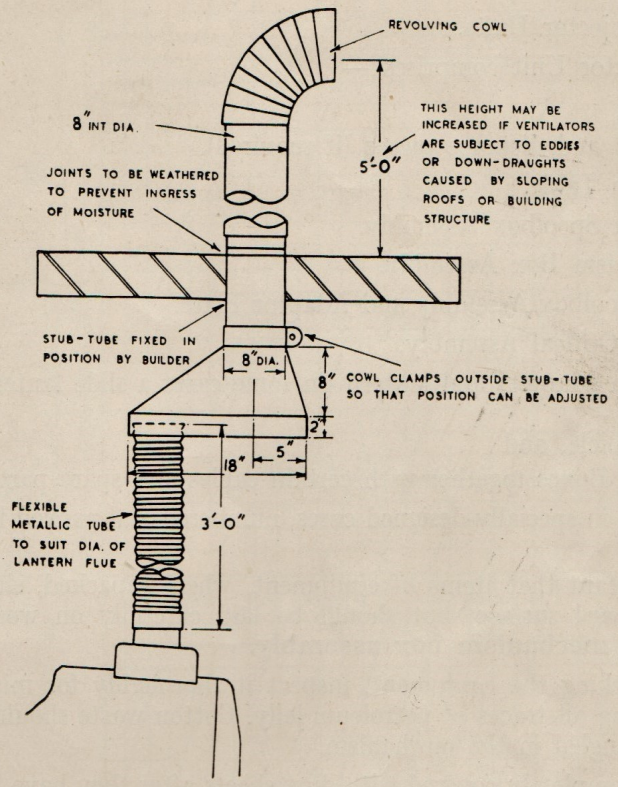


Fig. 33. Recommended Ventilation Arrangement.

Ventilation

A ventilating system must be provided to carry exhaust gases out of the operating room. This exhaust system should be designed so that it is free from downdraught and will extract the fumes under all weather conditions. A suitable arrangement is shown in Fig. 33.

The carbon consumption rate will vary with the amount of air drawn through the lantern, and a cowl over the lantern is preferable to the alternative method of solidly connecting the ventilating duct. The use of the cowl ensures that the carbon consumption will not be accelerated by extra air drawn through the lantern due to the exhaust draught.

Wiring of Projection Room

The wiring should be run throughout in solid-drawn screwed conduit using square boxes at tee-joints. All cutting-away of floors should be completed and as much as possible of the external wiring installed before commencing to assemble the equipment.

Where "Supa—Mark 2" is superseding older equipment in the projection room, the existing mains, arc, deaf aid, loudspeaker, and non-synchronous conduits may be utilized if they are in a satisfactory condition for further service.

Conduit coming into the stands terminates in boxes under the centre column. Flexible conduit is then carried from these boxes to the stand terminal boards and to the P.E.C. housing. The conduits should be all bonded together at the amplifier cubicle between clips on each conduit, and the bonding must not depend on the possible contact between the conduit nuts and the cubicle bottom, since the latter is paint-finished. The main earth should be connected to the conduit bond. The cubicle should also be solidly earthed to the conduit bond point; a cable thimble is provided on the inside of the cubicle bottom for this earth lead. The stands should be solidly earthed to the mains supply conduits at each stand—*not* to the audio signal conduits.

Arc current-control resistances may have been supplied with the equipment, or existing resistances can be used provided their values and rating are suitable. The wiring to the arc resistances will depend on these circumstances and on the location of the arc control switches, which can be fitted on the Stand, 108, Fig. 14, or on a separate arc control panel.

The external wiring in general must be carried out in accordance with the BTH " Specification of Electrical Contractor's Work for the Installation of ' Supa—Mark 2 ' Equipment."

Unpacking

A two-projector equipment consists of the following items :—

2—Complete Projector Units.

Each Projector Unit comprises :—

(1) Base.
(2) Column and distance pieces (if required).
(3) Lantern Table.
(4) Bottom Spoolbox Assembly.
(5) Mechanism Box Assembly.
(6) Top Spoolbox Assembly and Adaptor Plate.
(7) Sound Optical Assembly.
(8) Lantern adaptors and lantern (in some cases a slide lantern is also included).

Also

1—Amplifier Cubicle, and
2—Input Switch Boxes together with certain cables and spare parts.

These are despatched in specially-designed cases, numbered and packed in accordance with the Table in APPENDIX 2.

Note :—It is most important that items of equipment, when unpacked, should not be placed on the floor or any other hard surface, but should be laid carefully on wooden bearers. **This applies particularly to the mechanism box assembly.**

After carefully unpacking the equipment, inspect it thoroughly for missing parts or damage, then clean it with rag, removing all traces of petroleum jelly. Cotton waste should not be used as the threads are liable to become entangled in the mechanism.

All items should be completely covered with dust sheets after they have been cleaned and the utmost care must be taken to ensure that they are kept scrupulously clean. This applies particularly to the machined faces of parts that are to be bolted together.

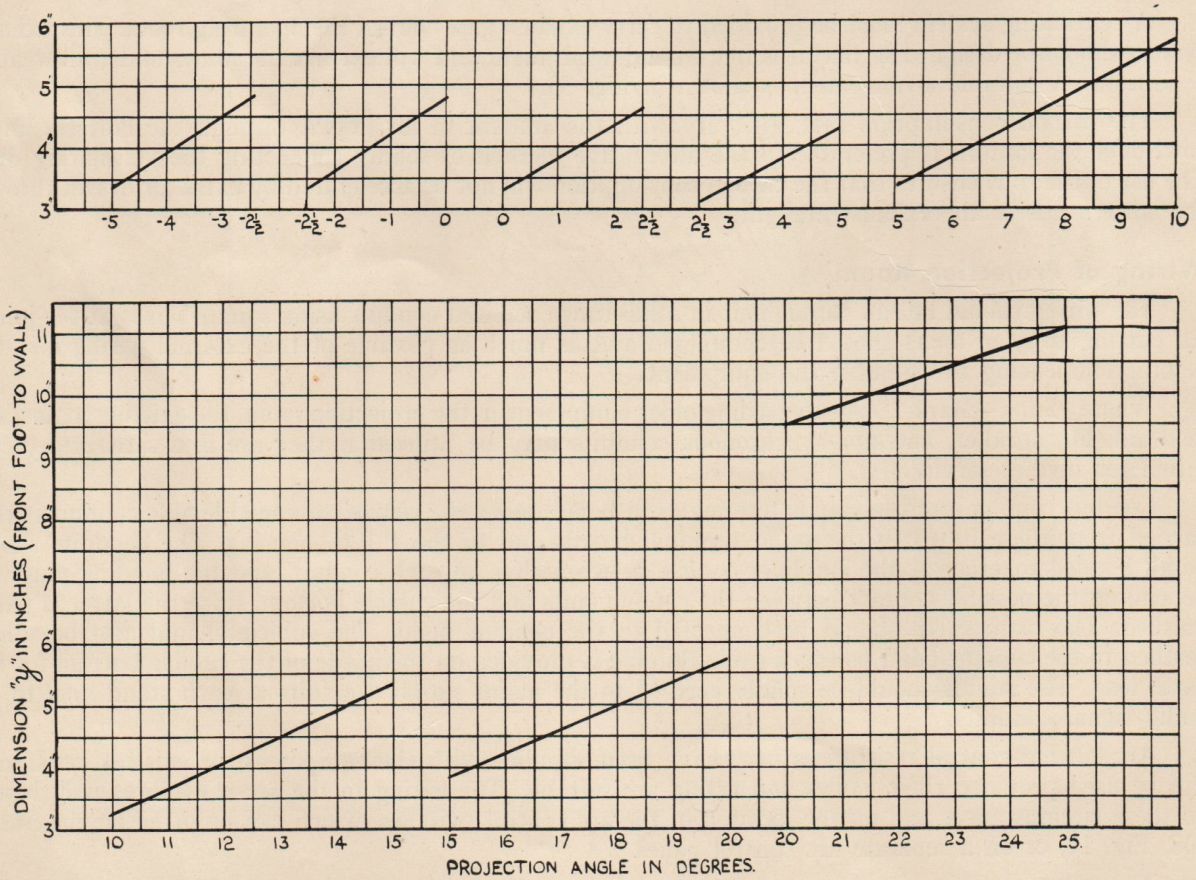


Fig. 34. Position of Projector for given Projection Angles (Dimension " y " represents the distance of the front foot of stand from the front wall of the projection room. See Fig. 35).

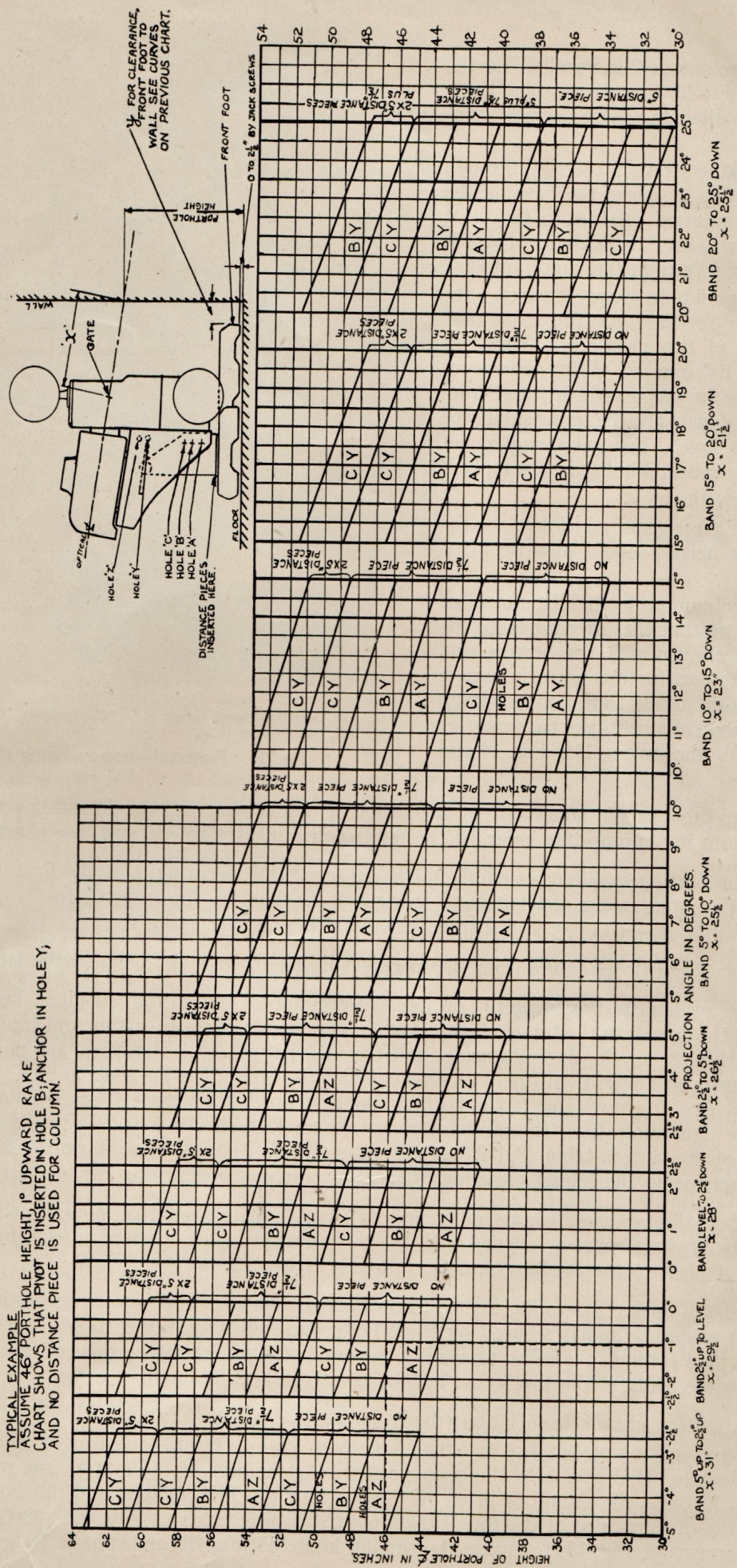


Fig. 35. Erection Chart for Supa—Mark 2. See also Fig. 34 and Outline Diagram, Fig. 1.

Erection

Assemble the two stands " in parallel " in the order indicated in the following paragraphs. Parts of the frame are dowelled to ensure correct alignment.

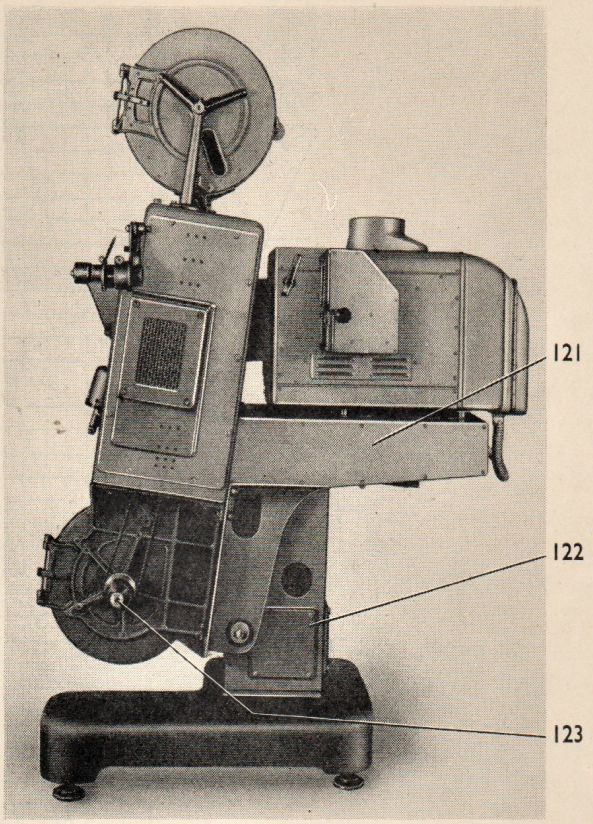
(1) With all jacking screws projecting through the base approximately 2″, place the base on the floor in the correct position relative to the front wall of the projection room as indicated in Fig. 34, and seat the jacking screws in the cups provided.

When the long 5-hole base is used, the rear jacking screw on the operating side may be placed in either of two positions. Thus, for a rake angle from 10° upward to 5° downward, this screw should be in the rear hole ; and from 5° downward to 25° downward the screw should be placed in the front hole. For rake angles not exceeding 15° down, a short 3-hole base is supplied.

(2) Roughly level the base.

(3) The distance piece required (if any) for the particular port hole height should now be fitted (see chart, Fig. 35).

(4) Mount the column on to the distance piece or base and make sure that the three holes for the lantern-table pivot are towards the screen, and that the hole at the top for the adjusting-screw trunnion is to the rear. Access to the screws fixing the distance piece and column to the base may be obtained by removing the covers, 110, Fig. 14 and 122, Fig. 36.



121. Terminal Board Cover. 123. Spoolbox Clutch.
122. Stand Cover Plate.

Fig. 36. Projector—non-operating side.

(5) The lantern-table should now be fitted in position. The pivot bar and the adjusting-screw anchor pin must be fitted into the appropriate holes for the rake angle and port hole height. See chart, Fig. 35.

(6) Now fit the bottom spoolbox assembly to the lantern-table, securing it in the first instance by the $\frac{3}{4}$″ diameter fitting stud in the top left-hand fixing hole (looking at the front of the lantern-table). After alignment with the lantern table fit the three remaining $\frac{1}{2}$″ diameter fixing screws.

(7) Thread the 2 multi-core cables from the mechanism box through the holes in the lantern-table.

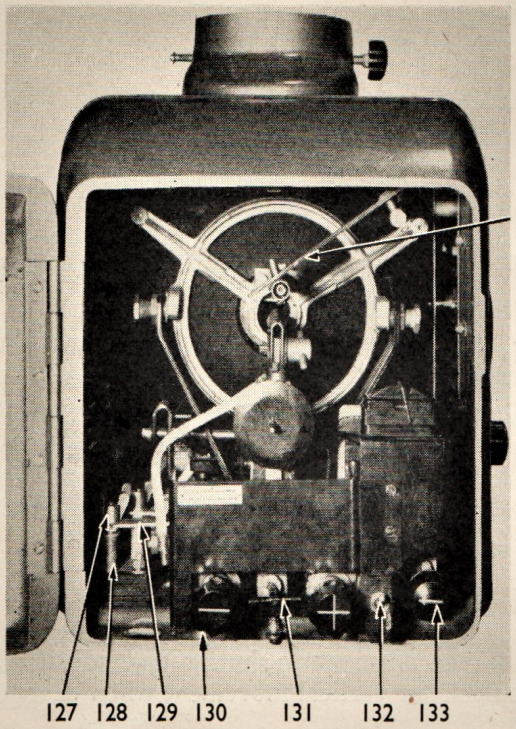
(8) Mount the mechanism box assembly on the platform top of the bottom spoolbox bracket, with its slots locating on the dowels in the top of the bracket. Lift by inching-handle casting and framing-handle casting, 49 and 50, Fig. 8, on the operating side, and the motor bracket, 2, Fig. 2, on the non-operating side. (Do not risk trapped fingers by lifting with fingers under the base.) The mechanism box is secured to the lantern-table by two $\frac{1}{2}$″ screws and to the bottom spoolbox bracket by three $\frac{1}{2}$″ screws. Care must be taken before finally tightening down the mechanism box to see that the back face is pulled close up to the machined face of the lantern-table. Put 25 cc. of " Asteroil AA " oil into the intermittent mechanism through the breather, using the funnel provided, then fit the drive-motor.

(9) At this stage the top spoolbox assembly and its adaptor plate should be mounted on top of the mechanism box. The fire trap must be aligned with the top sprocket before the screws securing the spoolbox and the adaptor plate to the mechanism box are finally tightened.

(10) Fit the sound optical assembly, Fig. 7, to the mechanism box. This locates on the bearing-boss of the sound-motor assembly and is secured by three bolts. Care must be taken to see that the exciter lamp leads are threaded through the hole provided in the bracket. Connect these leads to the exciter lamp sockets, blue and white leads at the top, green and black at the bottom.

(11) Remove lantern chassis from lantern body for ease of handling, thus :—

First remove any packing material or ties that have been used to ensure safe transit, and rotate the front-shutter handle, 63, Fig. 10, to the open position. At the rear of the lantern the mirror shield operating link, 126, Fig. 37, should be lifted off the pin with which it engages, and this link should be "parked" in the clip provided at the top of the lantern. Remove mirror knobs and spindles by, first, loosening the screw, 72, Fig. 11, to enable the smaller knob, 65, Fig. 10 and spindle to be pulled out.



126. Mirror-shield operating link.
127. Wing-Nuts.
128. Terminal Studs.
129. Connection Strips.
130. Chassis Locating Pins.
131. Chassis Locking Handle.
132. Feed-motor Switch.
133. Speed-control Knob.

Fig. 37. Rear view of Lantern.

This in turn will release the larger knob, 64, Fig. 10 (When subsequently re-assembling remember to insert the small knob so that the flat on its spindle is in line with the clamping screw, 72). Loosen the two wing nuts, 127, Fig. 37, on the chassis connecting strips and rotate the chassis locking handle, 131, Fig. 37, 90° anti-clockwise. The chassis may now be withdrawn. On future occasions when the chassis is removed, it will first be necessary to remove the mirror, in addition to the instructions already given.

The lead screws under the lantern chassis are coated with grease before despatch, and this grease **must** be removed during installation. **Before moving the carriages,** wipe off as much as possible with a dry cloth, then use a brush moistened in paraffin or carbon tetrachloride to clean the surfaces thoroughly. Wipe dry and apply a coating of graphite powder.

(12) Mount the lantern body on the projector stand by means of the adaptation gear provided, and lightly clamp it in its approximate working position. The nose of the lantern should be 10″ (25·4 cm.) from the gate, which gives a distance of 29″ (73·6 cm.) from the centre of the mirror to the film. The vertical height should be set approximately by fitting the nominal shim ($\frac{1}{16}$″ thick), bearing in mind that the optical centre from the base of the lantern is $8\frac{9}{16}$″ (21·7 cm.).

(13) Connect the flexible tubing, of $1\frac{1}{4}$″ (32 mm.) outside diameter, between the lantern and the table. Pass the arc cables through the tubing into the lantern body and solder them to the sockets which are clamped to the terminal board at the left-hand side. For wiring diagram refer to Fig. 17.

(14) Connect remaining cables in accordance with wiring diagram, Fig. 16. To facilitate this it will be necessary to remove the terminal board cover, 121, Fig. 36, on the non-operating side, and the switch panel, 108, Fig. 14, on the operating side of the lantern table.

(15) Replace the lantern chassis, first making sure that the contact wing nuts, 127, Fig. 37, are slackened back and that the locking handle, 131, at the rear of the chassis is vertical. When replacing the chassis, take care to avoid damaging the contact strips, 129. The front of the chassis will be guided into position by the pins in the body, and the chassis should be pushed right home, the correct location being indicated by the fact that dimples on the underside of the chassis rear casting seat correctly on two stationary rounded pins, 130, in the body rear casting. Care should be taken to ensure that the contact strips pass correctly on to the terminal studs, 128, in the body, without fouling the wing nuts.

When the chassis is home, rotate the locking handle, 131, in a clockwise direction until horizontal, and this will clamp the chassis in position. Finally, tighten wing nuts 127.

(16) Fit the mirror, taking care that the negative carriage, 84, Fig. 12, is retracted as far back as possible, also that the mirror shield, 85, is pulled backwards. Rest the bottom of the mirror on the locating ledge of the mirror frame, noting that the diamond cut (if any) should be at the top. Gently press the mirror backwards to enable the upper clips to be rotated.

(17) Re-connect the mirror shield operating-link over its pin by reversing the procedure detailed in (11), and check that the mirror shield operates with the front shutter.

(18) At this stage the projection height and angle should be set as accurately as possible by means of the jacking screws in the base and the rake-angle adjusting screw under the lantern-table.

(19) Fit the lens holder to the front of the mechanism box by means of the internal expanding collet on the end of the pivot spindle. Make sure that the tension spring is positioned to compensate the weight of the lens holder.

(20) Fit the bottom take-up belt, adjusting the length to give the required tension.

(21) The lantern should now be carefully lined up, using the following method, so that its optical centre-line is correctly placed in regard to the gate and projector lens.

First remove the glass in the lantern nose, open the front shutter, and traverse the moving positive head, 92, Fig. 12, to the front end of the lantern.

Obtain a straight metal tube or rod $\frac{1}{4}$" (7 mm.) outside diameter and about 36" (91·5 cm.) long and clamp it in the position normally occupied by the positive carbon 90, Fig. 12, when it will be on the optical centre-line of the lantern. The lantern should then be adjusted using shims as required, and finally tightened down in such a position that the rod passes through the centre of the gate and through the exact centre of the lens holder.

(22) Fit the glare shield to the light-tunnel bracket.

(23) Connect the Bowden cable assembly to the changeover shutter and adjust. Cleat the cable to the lantern support casting, allowing sufficient slack for vertical movement when changeover is pushed in reverse.

(24) Fit the light tunnel.

(25) After setting the projector to the required angle of rake, rack the cross-box round until the oil is just level with the centre-line of the oil sight. So that this position can be repeated when checking for loss of oil, make a centre-punch mark on the top of the framing-handle bearing and a corresponding mark on the boss of the framing handle.

(26) Connect the ventilation system.

(27) The amplifier and the two rectifier trays are removed from the amplifier cubicle for transit, and should be fitted into the cubicle and connected to the wiring after the cubicle has been fixed to the wall or mounted on the floor stands.

The input box is fitted with 0 BA cleat nuts acting as spacers. It should be fixed to the wall with No. 8 or No. 9 woodscrews.

(28) Connect the amplifier cubicle and input switch boxes in accordance with wiring diagrams Figs. 19, 49, and 52. Figs. 50 and 51 show alternative wiring arrangements.

(29) A check on the lantern alignment operation in (21) above may now be carried out on each machine, using a spot lantern or the other machine to obtain screen illumination.

Remove the light tunnel from the " A " machine and prop open the fire shutter and flicker shutter. Place a positive carbon in the " A " lantern with its end nearest to the mirror in the correct crater position, i.e. projecting 1" beyond the positive guide. If everything is in perfect alignment, including the mirror, an image of the illuminated theatre screen will be visible on the end of the carbon. This little image can be brought in-and-out of focus by adjusting the hand feed of the positive carbon, and is in best focus when the crater is moved towards the mirror approximately $\frac{3}{16}$" from its working position.

If the small image is slightly displaced, it can be brought into the correct position by manipulation of the mirror-adjusting knobs, 64 and 65, Fig. 10.

If *considerable* displacement is apparent, serious lantern misalignment is indicated and operation (21) should be repeated. Finally, if it should be found that—with the lantern correctly set and the beam central with the film gate and screen—the mirror adjusting knobs are themselves not in the mean or central position of their adjustment range, these knobs may be reset as follows :—

First check that the beam is in the optimum position and switch off. Then note the settings of the mirror knobs and proceed thus :—

Mirror Tilt Knob (" Raise "—" Lower ")

Remove mirror, and slacken locknut of the screw located immediately under the centre of the mirror frame. Rotate this screw as required, one half-turn being roughly equivalent to 45° movement of the knob. If the knob requires clockwise rotation to bring it to the mean position, turn the screw clockwise (from slotted end) and vice versa. Finally, re-tighten the locknut.

Mirror Slew Knob (" Left "—" Right ")

It is not essential to remove the mirror. Slacken the locknut of the screw on the operating side of the mirror frame with a 2 BA spanner. Adjust the screw, one half-turn corresponding to 45° movement of the knob. If the knob requires clockwise movement to bring it to the mean position, the screw must be turned away from the cam, and vice versa. Finally, re-tighten the locknut.

(30) Where provided, mount the slide lens and its fittings on to the side of the projector. With the shutter in the closed position, push the shutter handle, 63, Fig. 10, inwards from the operating side. This decouples it from the shutter and couples it to the internal swinging mirror. Anti-clockwise rotation of the handle then swings the slide mirror into position and retracts the mirror shield, but leaves the shutter closed to prevent light passing into the projector picture gate. Operate the slide cut-off shutter by knob 106, Fig. 13, to project the arc beam, which should be aligned so that it passes centrally through the lens and fills the screen.

With the crater in its correct position for film projection, operation of the slide attachment should give an evenly-illuminated slide picture on the screen, but when the equipment is first installed, the following adjustments are recommended :—

Referring to Fig. 13, remove knob 106, and its locking nut, and take off the side cover 105. The beam from the swinging mirror will now project through the opening. Adjust the internal mirror so that the beam is at right angles to the axis of the lantern. This adjustment is made by resetting the stop, 103, nearest the lantern, in the slot under the slide attachment. Having correctly set the swinging mirror, replace the side cover and knob, and remove the top cover and upper mirror 98. Adjust the lower mirror, by means of the 3 countersunk screws, 100, in the side cover 105, so that the light beam projects upwards squarely with the lantern, in both planes. Replace the top cover and upper mirror and adjust the latter by means of the 3 screws 104, so that the beam passes through the centre of the projection lens. Focus the lens and adjust it to bring the beam central on the screen, making any slight adjustments to the upper mirror which may be necessary.

Reverse the operation of the shutter handle to reset the mechanism for film projection.

(31) After the mechanical erection and wiring is completed, check that the H.F. and L.F. boost networks on the amplifier are set to the " Mid bass—mid top " condition (see Fig. 38). Fit all valves, lamps and P.E. Cells.

(32) Having confirmed that the volume controls are set to zero, switch on the supply and check that the exciter, framing, and intermittent inspection lamps are energized. Set output switch to " Monitor " position and both input switches to " Film." Set monitor volume control to zero attenuation position, main volume controls to "8" and preset volume control half-in. By flicking an opaque object in the light-beam in the " B " machine sound-optical system confirm that the " B " film channel is functioning. Operate the " A " machine changeover push-button, flick the " A " machine sound-optical system light-beam to confirm that its film channel is also operating.

(33) Set the " A " machine input switch to " Disc " position. Put records on the non-synchronous turntables and switch them on. Increase volume control on left-hand turntable to check that non-synchronous sound is coming through. Press " B " changeover push-button, noting that the non-synchronous sound goes off. Set " B " machine input switch to " Disc " position thereby bringing in non-synchronous sound on the " B " channel. Swing non-synchronous volume control from left hand to right hand turntable and check fade into second record.

Check satisfactory operation of monitor volume control.

(34) Thread up film in both machines as described under " OPERATION," Page 35, and switch both input switches to " Film." Start up " B " machine and with main volume control set at " 8," and preset volume control at zero, switch output switch to " Screen " speakers. Increase *preset* volume control only until a satisfactory sound level is obtained in the auditorium—allowing for the fact that there is no audience.

Start up " A " machine and operate " A " sound changeover push-button, with " A " volume control at " 8." A difference in sound level will probably be noticed on changeover ; if so alter setting of P.E. Cell excitation-balancing potentiometer until no difference in sound level is observable on changeover.

Having listened critically in the auditorium to film sound from both machines decide how the sound characteristic requires to be adjusted and make the necessary alterations to the amplifier boost networks. See Fig. 38.

(35) Take frequency characteristic checks on both film channels, using a signal generator and the series 4·7 meg. adaptor in place of the P.E. cell. Fig. 39 shows the average characteristics obtained under these circumstances. Actual characteristics may vary by ± 2 db. from these curves, due to manufacturing tolerances and to the effect of boost change at one end of the characteristic affecting that at the other end.

(36) Finally take a frequency characteristic check on the non-synchronous channel. Optimum characteristics are indicated by the curves in Fig. 40. See also the notes on page 44.

It will be noticed that the H.T. supply to the cathode followers is taken through 80A and 80B lines but the negative return is through the co-axial screen to the input switch in the input box, and from there to 1A earth. If either P.E. Cell co-axial plug on the P.E.C. housing or *both* the 28 co-axial plugs in the amplifier are withdrawn a potential will exist between the plug outer and earth. The supply should therefore be switched off the amplifier before removing these plugs.

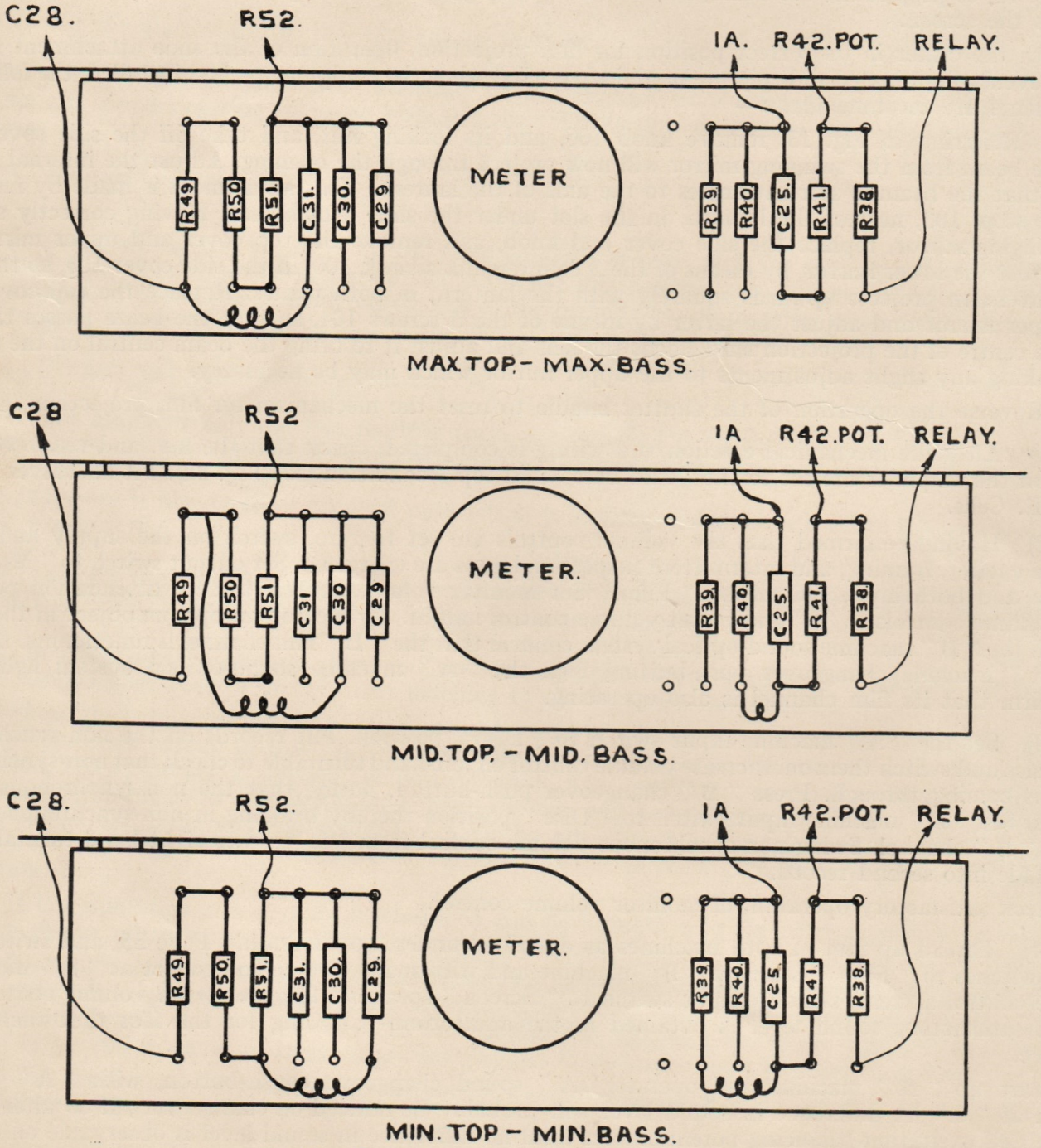
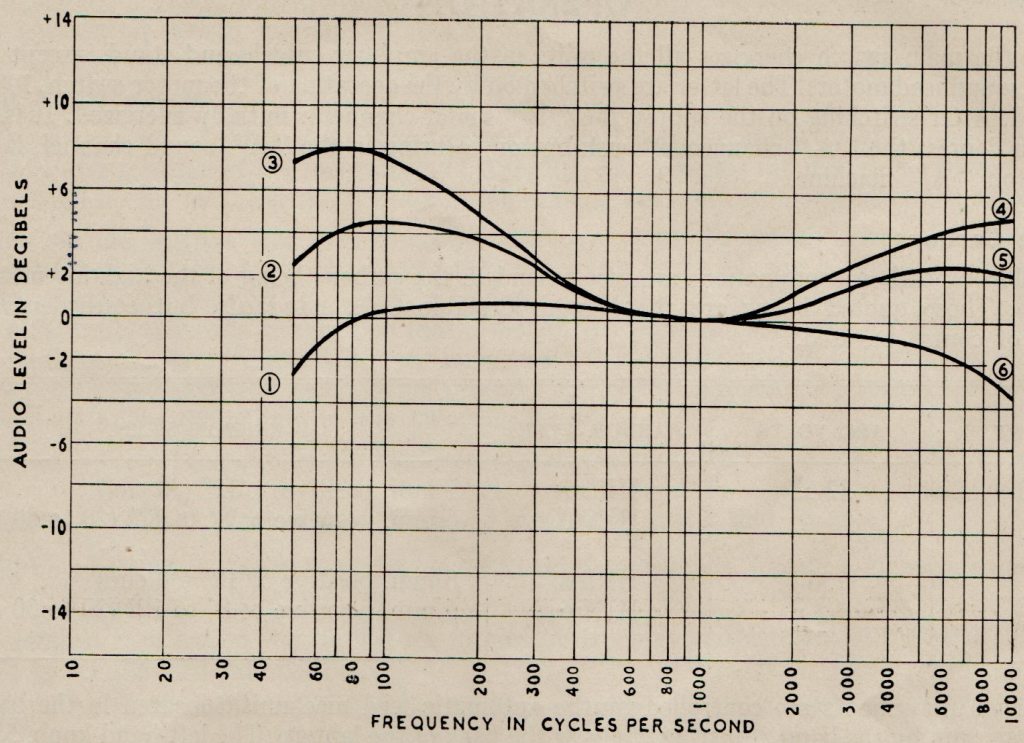


Fig. 38. Connections of Amplifier Boost Networks.



Curve 3. **Max. Bass.** Mid. Top. C 25 only in use.

Curve 2. **Mid. Bass.** Mid. Top. R 40 in parallel with C 25.

Curve 1. **Min. Bass.** Mid. Top. R 39 in parallel with C 25.

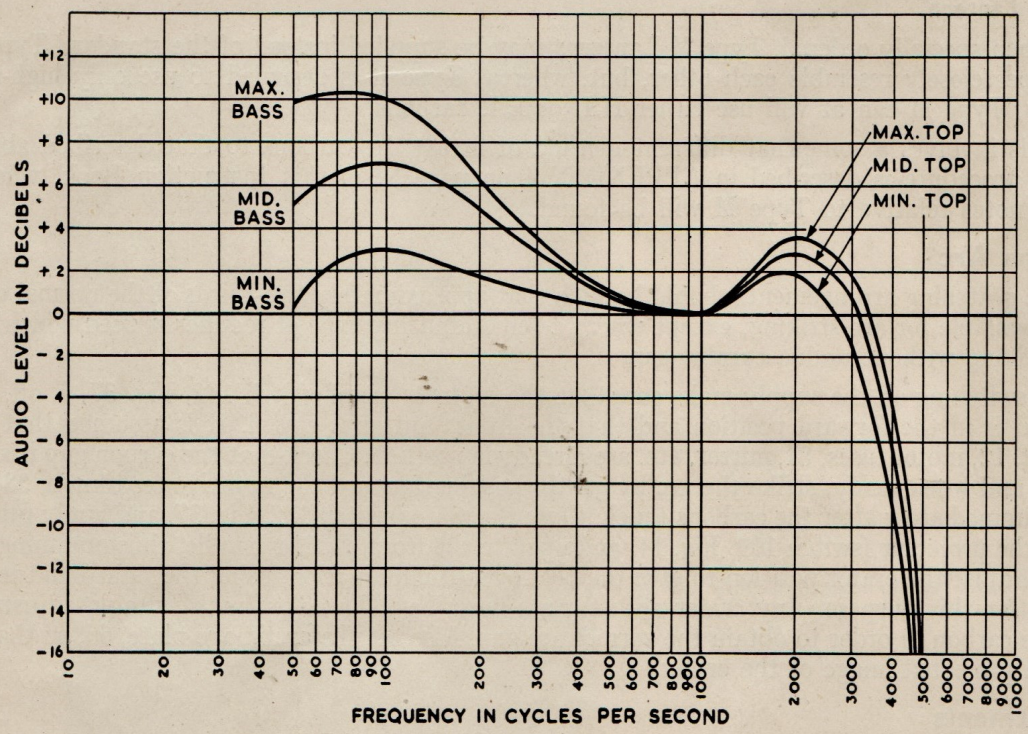
Curve 4. **Max. Top.** Mid. Bass. C 31 in parallel with R 49, R 50, and R 51.

Curve 5. **Mid. Top.** Mid. Bass. C 30 in parallel with R 50 and R 51.

Curve 6. **Min. Top.** Mid. Bass. C 29 in parallel with R 51.

(Test with input fed through 4·7 megohm resistor to cathode of P.E. Cellholder, using a BSR Oscillator set to give 1 volt at 1000 c.p.s., main volume control at 10, and preset volume control set to give output of 20 volts through either film channel.)

Fig. 39. Film Channel Frequency Characteristics.



The effects on the non-sync. channel response of varying bass boost and top boost in the amplifier are shown respectively by the curves below and above 1000 cycles per second.

Fig. 40. Non-synchronous Channel Frequency Characteristics.

OPERATION

Closing the main switch energizes all the units in the amplifier cubicle and stand, except the main driving and soundhead motors. The latter are switched on by the operation of the motor switch, 109, Fig. 14, on the stand. After switching on the supply the " B " sound channel is initially energized. It is therefore necessary to depress the " A " changeover push-button to bring in the " A " sound channel, if the show commences on " A " machine.

Fitting the Carbons

The following carbon combinations are recommended, the carbons being of the high-intensity copper-coated type. Those quoted below are the Morgan Crucible Co.'s standards, but equivalents in other makes can of course be used.

CURRENT	ARC VOLTS	CARBON TYPE	CARBON SIZES
40-45	32-35	HRS 7 HIN 6	7 mm. positive × 12″ (30 cm.) 6 mm. negative × 8″ to 12″ (20 to 30 cm.)
50	36	HRS 8 HIN 6	8 mm. positive × 12″ (30 cm.) 6 mm. negative × 8″ to 12″ (20 to 30 cm.)

The carbon movements are controlled by the automatic feed mechanism located in the back of the lantern chassis, and by the hand adjusting knobs at the back of the lantern. The left-hand knob, 58, Fig. 10, controls the negative and the right-hand knob, 59, the positive.

To insert a positive carbon, the door on the right-hand side should be opened, and the positive carriage, 92, Fig. 12, tilted and moved forward to the nose of the lantern. Rotate the knob 91, on this carriage to open the carbon clamp and put the positive carbon in the vee with the crater end extending about 1″ (25 mm.) beyond the positive guide, 88, then clamp the carbon in the moving head.

To insert a negative carbon, open the rear door, and, using the left hand, tilt the negative carriage, 84, and pull it backwards ; rotate the carbon clamp handle, 71, Fig. 11, anti-clockwise, and push the carbon through the clamp, re-tightening the latter when the arc gap is about $\frac{1}{4}$″ (6 mm.).

Type M Lantern

When specially ordered, Type M Lanterns may be supplied instead of the standard Type L. The two types closely resemble each other, but, whereas Type L is designed to use only high-intensity carbons, Type M can at will use either H.I. or L.I. carbons.

This involves a somewhat different method of fitting the carbons to that described above. The correct procedure is described in APPENDIX 4 on page 52 of this Instruction Book, where other special notes relative to Type M will be found.

Striking the Arc

The arc switching arrangements should be such that approximately two-thirds of the normal operating current is available for arc striking, except where a self-stabilizing type of rectifier is used which provides full load striking without undue current surges.

Before switching on the supply make sure that the motor control switch 132, Fig. 37, is off, that the mirror shield is in the forward position and that the front shutter is closed. It is assumed that the slag tray, 87, Fig. 12, motor fuses, 81, mirror, etc. are already in position. Check that the carbon gap is a nominal $\frac{1}{4}$″ (6 mm.), and when ready, strike the arc by gently pushing forward the negative feed knob, 58, Fig. 10, releasing it immediately after the carbons touch. Close the motor switch 132, Fig. 37, and apply full arc current. Start the projector (switch 109, Fig. 14) and operate the front shutter handle, thus obtaining light on the screen. Adjust the crater position to give the best overall illumination, using the right-hand feed knob, 59, Fig. 10, for this purpose. Any crater adjustments must be followed up with suitable adjustments to the negative carbon in order to obtain the correct arc gap. Also set the arc image plate, 66, so that it lines up with the projected image of the crater.

Arc Adjustments

To obtain the best possible light on the screen, the crater of the positive carbon should burn so that it is always square with the mirror. This condition can be definitely maintained by correct setting of the negative carbon.

The knob, 57, Fig. 10, provides universal adjustment of the negative carbon tip allowing it to be raised, or lowered, or moved sideways.

Arc Feed Adjustments

Set the speed control rheostat so that the *positive* carbon feeds correctly at the selected operating current. Clockwise rotation of the rheostat knob, 133, Fig. 37, increases the feed rate ; correct adjustment will be indicated by the fact that the crater position remains constant as indicated on the arc image plate.

Having set the positive feed rate correctly, attend next to the negative feed. Immediately above the feed rocker-arm 74, Fig. 11, at the rear of the chassis is a knob, 73, and a small anti-clockwise movement of this knob will increase the negative feed-rate and vice versa. It should be explained that this patented differential device is designed so that although the positive feed pawl, 75, (right-hand) operates 1 ratchet-tooth per stroke of the rocker arm, the negative (left-hand) pawl, 76, follows a rhythmic *change* of stroke, comprising several strokes each moving 1 tooth, followed by a sequence of strokes each moving 2 teeth. Typical settings might therefore give the following results :—

18 strokes—1 tooth, 4 strokes—2 teeth, 18 strokes—1 tooth, etc.
or
10 strokes—1 tooth, 12 strokes—2 teeth, 10 strokes—1 tooth, and so on.

It will be seen that the second example gives the higher feed-rate, having a higher content of 2-tooth strokes.

This detailed information is given for the interest of the user ; adjustment of the knob, 73, is all that is required to set the feed rate correctly.

It should be particularly noted that the settings so made are for one current-rating only. Should it be desired to run subsequently at, for instance, a higher current-rating, a small increase in the positive feed, by means of the rheostat, and adjustments of the negative feed will be required. Remember, however, that the positive setting should always be obtained first.

The Slide Attachment

Close the lantern shutter by means of the handle, 63, Fig. 10, then push this handle in and turn it anti-clockwise. This swings the slide mirror into position and retracts the mirror shield but leaves the shutter closed to prevent light passing into the projector. If the slide attachment has been correctly set up and aligned as detailed in an earlier section of this book, it is now ready for slide projection.

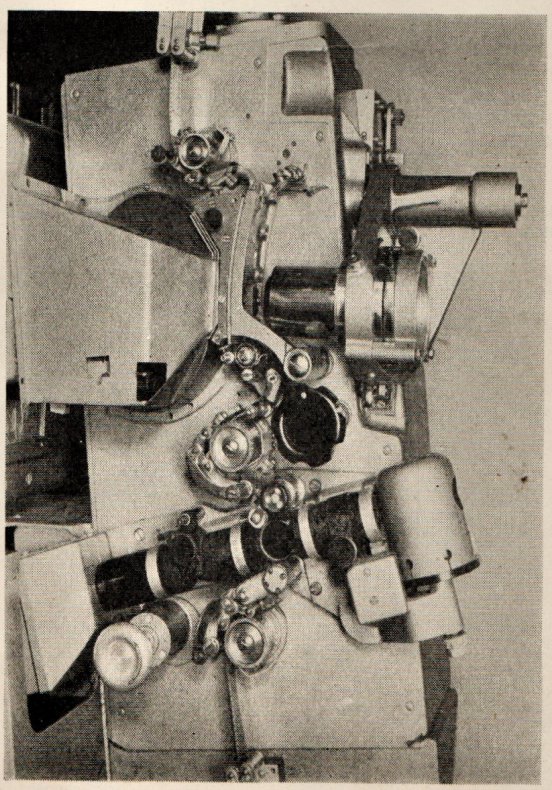


Fig. 41. Appearance of film after threading. See "Threading the Film" and Fig. 42 overleaf.

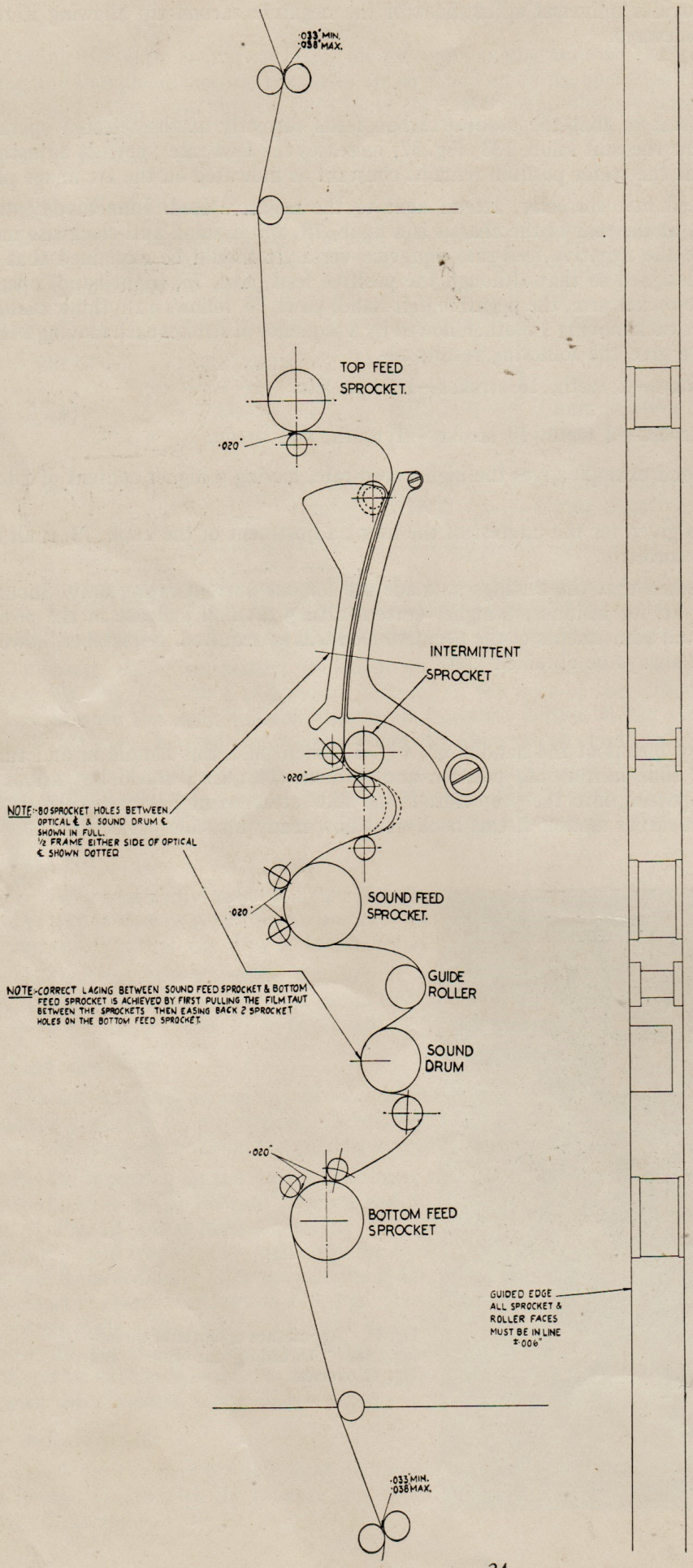


Fig. 42. Film-threading Diagram.

Threading the Film

Fig. 42 illustrates the film path through the mechanism, and the appearence of the film when correctly threaded may be seen in Fig. 41. Put the loaded spool on the top spoolbox spindle. Draw off about 6 feet of film and thread through the fire-trap on to the top feed sprocket. Leaving a 4-frame loop from the top feed pad-roller, thread the film through the gate on to the intermittent sprocket which must be in the locked position. Close the gate and frame the film. Close the intermittent film-pad assembly. Leave a 6-frame loop between the intermittent and sound-feed sprockets ; lead the film over the guide roller, insert it between the drum pressure roller and the sound drum and over the drum take-up roller. The correct appearance of the film when threaded through the sound-optical system is shown in Fig. 43. Thread the film over the bottom sprocket and through the bottom fire trap, pull taut and then release two sprocket holes from the bottom sprocket and distribute the loop above and below the sound drum. Feed the film on to the bottom spool in an anti-clockwise direction.

WARNING : The inching handle must not be turned backwards when the film is threaded in the gate. The correct rotation is indicated by the arrow on the knob.

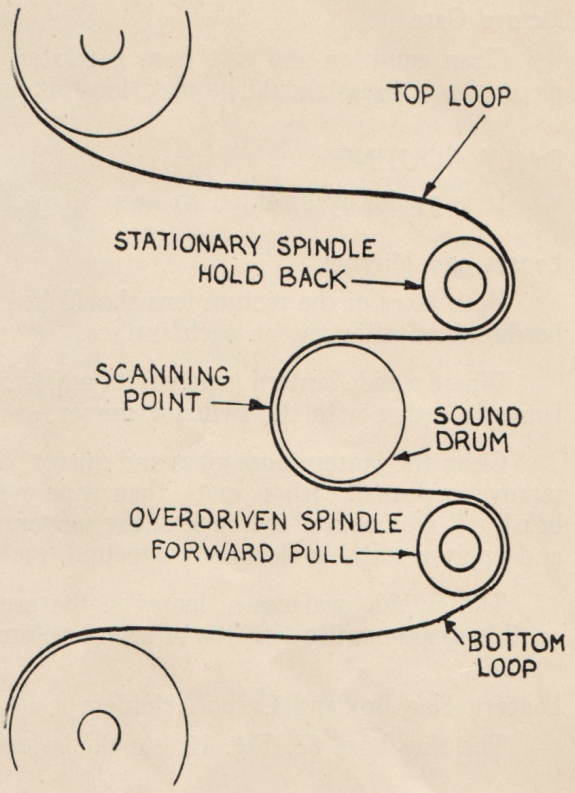


Fig. 43. Film-path through Sound Optical System.

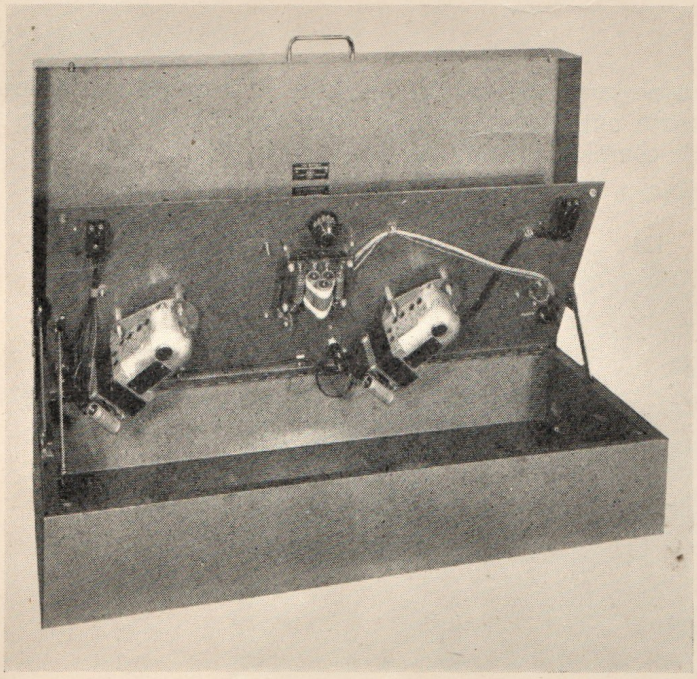


Fig. 44. Non-sync. twin-turntable unit— motor-plate raised for servicing.

Pick-ups

The pick-ups are of a new lightweight type with semi-permanent needles. Careful handling of the pick-up is essential and the following precautions should be taken :—

(1) When not "playing", pick-ups should be placed carefully on their rests.

(2) Needle points should not be allowed to come into contact with anything but record grooves, and should be lowered gently on to the records.

(3) Needles should not be moved in their holders or excessive wear may result.

(4) Needles should be changed when appreciable wear is observed at the point. The needle will be suitable for approximately 2000 playings of 10" commercial records.

ROUTINE MAINTENANCE

CLEANING

Picture Gate

Clean emulsion and dirt from gate regularly, after each reel if necessary. A small brush or a thin piece of soft brass should be used for this purpose. This is particularly necessary when using new film.

DAILY ROUTINE

It is obviously essential to keep all parts of the mechanism as clean as possible.

Lenses and Mirrors

Both faces of the picture lens should be cleaned, preferably using a piece of lens tissue, which should be discarded after use on each surface.

Where a slide lantern is fitted, its projector lens and the accessible faces of the condenser and negative lenses, together with the swinging mirror, should be cleaned.

Clean the lantern nose-glass and mirror. Remove the mirror and, if of the glass type, using a soft cloth remove any small carbon spots, then wipe over with a mirror-cleaning compound. Allow to dry and then brush off. Do not wet the back of the mirror. If the mirror is of the metal type, carefully remove all dust and apply a suitable cleaning compound, such as the finer types of polish used for cleaning silver.

The outside surfaces of lenses in the sound optical system should be carefully polished as any dirt on this system will cause loss of sound volume.

Lantern Slag Box and Carbon Holders

The slag box, 87, Fig. 12, should be emptied and the carbon holders cleaned.

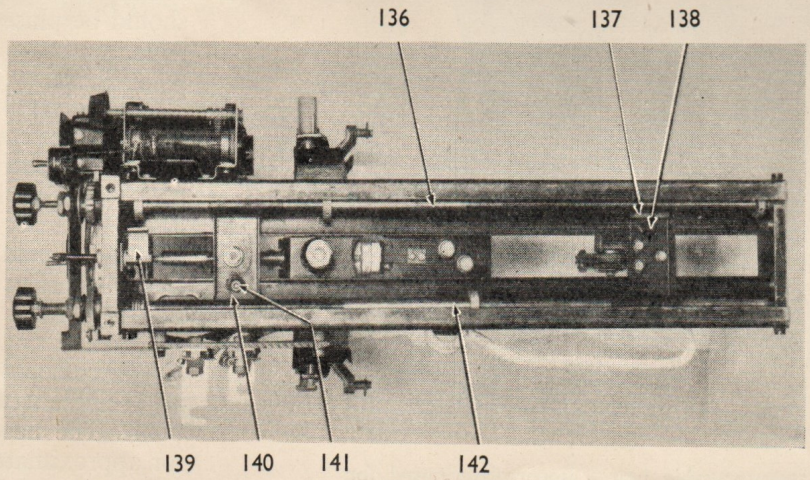
WEEKLY ROUTINE

Sound Drum

The periphery of the sound drum should be carefully wiped with a cloth moistened with methylated spirit.

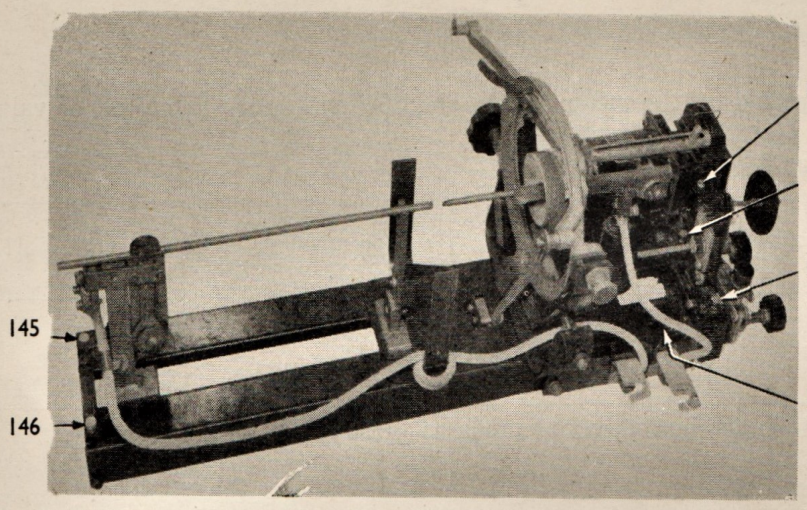
Lantern Chassis

Clean all working parts of the chassis and wipe surplus oil off the bearings. Remove dust from lead screws 136 and 142, Fig. 45, and clean the smooth unthreaded surfaces. Then apply a light coating of graphite powder. Give the inside of the lantern a complete dusting out.



136. Positive lead screw.
137. Positive lead screw nut.
138. Spring plunger for 137.
139. Chassis locking plate.
140. Negative lead screw nut.
141. Spring plunger for 140.
142. Negative lead screw.

Fig. 45. Underside of Lantern Chassis.



145. Front bearing of positive lead screw.
146. Front bearing of negative lead screw.
147. Gearbox bearing.
148. Rear bearing of positive lead screw.
149. Rear bearing of negative lead screw.
150. Access cover—negative lead screw nut.

Fig. 46. Lantern Chassis Lubrication points, etc.

LUBRICATION

WARNING : Changeover shutter must NOT be oiled.

DAILY ROUTINE

Oil the bearings only of the lantern gearbox and lead screws. Oil cups are located as follows :—

2 in front end of chassis casting, 145 and 146, Fig. 46,
2 in rear end of chassis casting, 148 and 149, Fig. 46,
and 1 in gearbox bearing, 147, Fig. 46.

WEEKLY ROUTINE

(1) The top and bottom spoolbox spindles should be lubricated with one or two drops of "Asteroil AA."

(2) The ball race on the lantern gearbox spindle should be lightly oiled with " Asteroil AA."

MONTHLY ROUTINE

(1) Check the oil level in the intermittent mechanism and, if necessary, top up with " Asteroil AA," having first adjusted the rack to bring the marks on the framing handle hub and bearing into line. The oil level should be brought up to correspond with the mark on the sight glass.

(2) Add two spots of " Asteroil AA " to the soundhead coil-end bearing through the lubricator, 3, Fig. 2, inside the mechanism box.

(3) Examine the fire-shutter bearing (as detailed on page 42) and if the grease is lacking in oil content repack with " Crimsangere No. 8." Note : The bearing holds approximately 4 cc.

(4) Chains should be lubricated with a few spots of " Asteroil AA."

THREE-MONTHLY ROUTINE

(1) Drain the intermittent mechanism box, swill out with a full box of clean oil, then replace the oil with 25 cc. of clean " Asteroil AA."

(2) Wash out the fire-shutter bearing and re-pack with " Crimsangere No. 8."

(3) Lightly smear the teeth of all gears with " Crimsangere No. 1 " grease.

(4) Dismantle the sound-optical take-up roller from its spindle and re-pack with " BTH 285 " grease.

(5) Lightly oil the joints of the moving parts in the lantern body mechanism, including the door hinges, also spoolbox door hinges and catches, moving gate, and take-up roller pivots, lens holder and moving gate catches, framing spindle, exciter lamp turret pivot, and lens-focusing adjustment, if necessary.

(6) Dismantle the cam in the moving positive head and dust the surfaces with graphite powder or graphite grease.

All other parts of the mechanism have been lubricated for life before leaving the Factory and should not be oiled.

ELECTRICAL

DAILY ROUTINE

The valve currents should be checked on the meter on the amplifier unit. Any falling off of valve currents should be watched and the faulty valves replaced.

The nominal valve currents are as follows :—

Valve	P.E.C. Cathode Followers	V 3	V 4	V 6	V 7 (per anode)	V 8, V 9, V 10, V 11
Current in mA.	4·8	1	1	2·8	2·5	60 each valve

The above currents will vary with individual valves as much as ± 20%.

MONTHLY ROUTINE

(1) Check that all valves are firmly fixed in their sockets, not forgetting those in the P.E.C. housings. Also check that valve top caps are making good contact.

(2) Check connections to the amplifier, amplifier rectifier, and exciter-lamp rectifier units ; make sure they are secure and making good contact.

(3) Check valve currents.

(4) Check operation of non-synchronous sound channel.

(5) Check operation of microphone and P.A. speakers—where these are fitted.

(6) Examine connections on speakers and speaker filter unit.

(7) Check operation of speaker filter switch in emergency position.

(8) Check operation of standby amplifier and its associated changeover switches—where standby is fitted.

(9) Check balance of sound level between " A " and " B " stands, and if necessary rebalance on P.E.C. voltage control.

(10) Check operation of deaf aid, where this is fitted.

(11) Check freedom from noise when operating volume controls.

THREE MONTHLY ROUTINE

(1) Calibrate arc ammeters and check arc voltage readings—where arc volt/ammeters are provided on the stands.

(2) Examine changeover push-button contacts.

(3) Check exciter lamp voltage on load. (Lamp terminal voltage approximately 8 v.)

SIX MONTHLY ROUTINE

(1) Examine control cubicle connections, and see that they are secure and making good contact.

(2) Check all voltages given on the Voltage Tables in the " SERVICE MAINTENANCE " section.

TWELVE MONTHLY ROUTINE

(1) Measure insulation resistance of arc lamp circuit.

(2) Check condition of all wafer-type switches.

(3) Check accuracy of amplifier meter against a known meter.

SERVICE MAINTENANCE

No repairs must be attempted on Intermittent Mechanisms, Geared Drive Assemblies, or Sprocket Drive Assemblies. The Intermittent Mechanisms are sealed on dispatch and any interference nullifies the guarantee. A list of components and assemblies, which are not supplied with the equipment unless specially ordered but which the user is recommended to hold as service spares, is given in APPENDIX 3.

Defective units should be returned with full details to The British Thomson-Houston Co., Ltd., E. & S. R. Sales Dept., Rugby, England, where they will receive prompt attention. When ordering spares or replacements, it is essential that the fullest possible information, including *all* particulars on the apparatus nameplate, should be given.

MECHANICAL UNITS

The Drive Motor Assembly is spigoted to the motor support plate and held by four screws. Electrical connection is by plug and socket. Care must be taken when removing or replacing this assembly to avoid damaging the bonded-fabric pinion (on the end of the coupling shaft) which engages with the steel pinion, 1, Fig. 2, on the flywheel of the intermittent mechanism. To remove the motor from its mountings, first slacken off the two support screws under the outboard end of the support bracket (which extends from the inner mounting-bracket), remove springs, cradle and rubber strip. Remove the four screws fixing the motor flange to the outer member of the resilient mounting, and withdraw the motor from its spigot. Note : The motor half of the flexible-drive coupling should slide off the motor shaft extension.

The flexible coupling-insert is fixed to the inner half-coupling by screws and to the outer half-coupling by screws and nuts.

To dismantle the mounting, undo the locking ring securing the outer to the inner bracket. Note carefully the arrangement of the rubber insulation, and in re-assembly replace it exactly as it was originally. The drive-shaft is ball-bearing mounted in the inner bracket, and the half-coupling and fabric pinion are keyed to this shaft.

The Intermittent Mechanism, 14, Fig. 4, may be removed as follows :—

(1) Remove projector mechanism box cover.

(2) Remove intermittent film-pad assembly, 46, Fig. 8, stripper plate, intermittent sprocket, and nose-cap 51, Fig. 8, exposing locknut.

(3) It is most important to slacken the screw in the locknut and remove the nut with the special spanner provided. Remove all four washers, (one flat, two dished back-to-back and one flat) from the stem of the intermittent mechanism.

(4) Remove the drive-motor assembly from the motor support plate by first removing the four fixing screws on the circular flange.

(5) Rack into the horizontal position and remove the 2 BA nut and washer from differential gear intermittent mechanism connecting link, 18, Fig. 4.

(6) Remove the 4 BA nut and washer fixing the connecting link to the framing handle.

(7) Withdraw the intermittent mechanism.

If a replacement mechanism is to be fitted, unscrew the pillar holding the phasing link, taking care not to alter the position of the locknut. Undo the framing link nut and remove the link and stud.

Replacing the unit :—

(1) Fit the phasing and framing links to the intermittent mechanism ; make sure that the bend in the connecting link to the framing-handle is downwards.
Allow the differential to fall to the bottom of its travel.

(2) Set the shutter in the mean position of adjustment, i.e. with the fixing screws in the centre of the slots. Rotate the shutter backwards, setting the timing mark to register with the lines on the edge of the heat shield. Hold it in this position.

(3) Well grease the outside of the intermittent-mechanism cross-spindle bearing casing with " Crimsangere No. 1," and feed the mechanism into the framing sleeve until the phase-link rests on the outer diameter of this sleeve. Then holding the mechanism with the timing mark on the flywheel about $1\frac{1}{2}$" clockwise from the mark on the body, slide it in until the gears *just* engage. Release the flicker shutter and guide phasing link on to its stud as the mechanism is pressed right home.

(4) **Check that the timing marks on the flicker shutter and heat reflectors, flywheel and intermittent mechanism line up** as nearly as possible. If they are more than half a tooth out, correction **must** be made by remeshing the gears. The timing may be half a tooth out, either way, causing " ghosting " which **must** be rectified by adjustment of the flicker shutter.

(5) Secure the phasing link by assembling, first the plain washer, then the shakeproof washer, and finally the nut, which must be fastened tightly by means of a **long** 2 BA box spanner. Assemble the framing link on its stud, with the bend downwards, and then secure it with a washer and a new 4 BA Simmonds nut.

(6) Replace the four washers on the sprocket-end of the stem of the intermittent mechanism, fitting first a flat washer, then two dished washers (back-to-back), and finally another flat washer. Tighten the lock-nut carefully, as if it is too tight the mechanism will stick on dead centre, and if too loose, vibration will cause picture unsteadiness. Tighten the screw in the lock-nut.

(7) Replace the nose cap, sprocket, stripper plate, and motor.

(8) Test the picture steadiness and freedom from ghosting.

The Gear Drive Assembly, 12, Fig. 4, can, if a replacement is necessary, be withdrawn as follows :—

(1) Remove the mechanism box cover.

(2) Unplug and remove the driving motor assembly.

(3) Remove motor support bracket, 2, Fig. 2.

(4) Remove intermittent mechanism, 14, Fig. 4. (see page 39).

(5) Remove light tunnel, 28, Fig. 5.

(6) Remove changeover shutter assembly, 40, Fig. 6, (see page 42).

(7) Remove the three hexagon-headed screws securing the flicker shutter bearing housing, from the inside of the gear drive bracket.

(8) Slacken the two hexagon-headed screws holding the saddle which clamps the end bearing-housing of the flicker shutter spindle, 13, Fig. 4.

(9) Withdraw the flicker shutter assembly complete with shutter, from the operating side of the machine, taking care not to lose the shims which are fitted between the bearing housing and the gear drive bracket.

(10) Remove top and bottom chains.

(11) Remove the three hexagon-headed screws securing the gear drive bracket to the mechanism box.

(12) Withdraw the gear drive assembly from the mechanism box. When re-assembling, follow the same procedure in reverse. Particular care must be taken to see that the same shims are replaced on the flicker shutter bearing housing. This will ensure the correct meshing of the bevel pinion and bevel gear.

The Sound Drum Motor, 5, Fig. 2, should be removed as follows if it is essential that a replacement motor should be fitted :—

(1) Remove drum pressure roller and drum take-up roller and fit the protective cover over the sound drum. Disconnect and remove the sound-optical system, Fig. 7, and withdraw the motor connection plug 6, Fig. 2.

(2) Remove the three fixing screws, 4, Fig. 2, and ease the motor out until its spigot is clear of the mechanism box. Move the motor over to the left as far as possible and carefully withdraw it, taking care to clear the chain sprockets with the back portion of the casting. Keep the cover on the motor to protect the windings.

(3) When fitting the new motor use only the shims supplied with it. Make sure that the spigot fits properly and is not burred. Bolt the motor in position and check that the joint between it and the mechanism box is feeler-tight, ensuring correct alignment. Re-fit motor plug and reconnect cables at rear of P.E. Cell housing. Re-fit the sound optical system and reconnect exciter lamp leads, (the blue and white leads are at the top and the green and black at the bottom). Re-assemble pressure and take-up rollers and test for sound quality.

Should the grease in the drum end bearing lose its oil content, causing loss of speed, a few drops of " Asteroil AA " should be added. A lubrication hole is provided for this purpose ; it is sealed by a cheese-headed screw, which will be visible after the sound optical assembly is removed.

The Film Sprocket Assemblies have similar driving shafts and bearings for the top, sound feed, and bottom film sprockets. The chain sprockets, however, are not similar and care must be taken not to interchange them. When fitting new sprockets make sure that they have the correct number of teeth. In each case the pad-roller spindles are fitted to a clamp on the front boss and must be removed before withdrawing the assembly. The chain sprocket is keyed to the shaft and located by an inner distance piece and an outer screw, but it is not necessary to remove the sprocket to withdraw the drive assembly, as the screws fixing the bearing housing to the mechanism box are accessible through holes in the sprocket. The chains can be removed by easing the tension.

Tension in the top chain is eased by pivoting the sprocket drive assembly on its fixing screw, and in the bottom chain by adjusting the eccentric housing which carries the inching handle.

The Inching Assembly, 20, Fig. 4, is composed of a 2-bearing housing, a driving shaft, a distance piece between the bearings, a chain sprocket, and an operating handle. The handle is screwed on to the shaft and secured by a taper pin.

The bearings are mounted eccentrically in the housing, and the sprocket acts as a tension-adjuster for the sound feed-sprocket drive-chain.

The Picture Gate Assembly, Fig. 5, has been carefully fitted and adjusted at the Factory and it is inadvisable for anyone other than a BTH Service Engineer to remove it. If, however, its removal is considered absolutely essential, the following method should be adopted :—

(1) Remove framing lamp, 26, Fig. 5, take out the three 2 BA fixing screws, (two on the front surface at the top and one at the bottom of the gate near the intermittent boss), and lift the gate off its dowels. Disconnect the framing lamp lead. Take care of the shims, as they must be replaced when re-assembling.

(2) Remove pressure springs and adjusting screws, etc. First remove the springs, 30, by releasing the tension and unhooking from the pivot device, 32, at the top of the gate, and then from the bottom of the gate. Remove the three heat reflectors and their distance pieces.

Re-assembly is a reversal of these operations.

The heat reflectors are not dowelled and will have to be re-aligned with the aperture plate on the moving part of the gate. The film surface of the lower guide pellet, 29, should be in line with the outer edge of the top sprocket.

The moving part of the gate may be taken off its pivot by removing the retaining screw, thrust washer, key washer, and compression spring. This part of the gate is shimmed to line up with the fixed gate, and here again the same shims must be replaced.

The film guides are registered in position and the aperture plate is fixed by two screws and nuts.

The Changeover Shutter, 40, Fig. 6. To take off the changeover shutter assembly, uncleat the Bowden cable and remove the two screws which fix the bracket holding the operating lever. Unscrew the remaining two screws securing the changeover shutter to the main frame.

In replacing the shutter, take care that the stop on the back is located between the stop pins, 36, Fig. 6, on the fire-shutter bearing-plate.

The Flicker Shutter Assembly, Fig. 6. The flicker shutter and fire shutter form a complete assembly, the fire shutter blade being screwed to the housing of its ball-bearing on the flicker-shutter boss.

To remove the assembly, first take off the changeover shutter. Take out the four equally-spaced 4 BA screws on the fire-shutter bearing-cap. Three 6 BA screws will then be seen on the magnet. Remove the two **outer** screws, not disturbing the centre screw. Care must be taken that the magnet shims are not displaced. Remove the split pin and special retaining nut from the flicker shutter shaft. This is **left-hand thread.**

Replacement is a reversal of the above procedure. When re-fitting the bearing cap, first enter the 6 BA screws on the magnet, but do **not** tighten. Fit and tighten the four 4 BA bearing-cap screws. Then insert magnet shims **exactly as removed,** and tighten the two 6 BA screws.

The Fire Shutter Bearing should be inspected at monthly intervals. Remove the bearing cap as described in the preceding section, exposing the bearing. If the grease has lost its oil content, remove the fire shutter assembly, and by using four long 4 BA screws as jack-screws in the bearing-cap fixing holes, draw off the fire shutter hub and bearing.

Thoroughly clean the bearing in carbon-tetrachloride or petrol until all trace of the old lubricant has been removed, then re-pack the bearing with " Crimsangere No. 8 " grease. Note :—"Crimsangere No. 8 " must not be used for lubricating any other part of the equipment.

After re-packing, enter the magnet on the eddy-current disc of the fire shutter and refit the fire shutter and its bearing on the boss of the flicker shutter, with the usual caution to be employed when handling ball-bearings. Replace the fire shutter assembly as described above.

The Bottom Spoolbox Clutch, 123, Fig. 36, should be adjusted so that it will operate with minimum pressure, i.e., it should just keep the film taut between the hold-back sprocket and the spool, using a full spool of film.

A lubricator is provided on the spoolbox spindle for oiling, and care must be taken to keep the clutch leather clean and free from oil.

Picture Steadiness

If the picture is unsteady, check that the gate-catch spring is sufficiently strong to hold the moving part of the gate in close contact with the fixed part. Check that the surfaces of the skids on the moving part are in close contact with the stop screws on the fixed part and that the gap between the moving and fixed gate is uniform over the whole length of both skids. Check that the surfaces of the guides on the moving gate are in line within 0·0015″. By means of a special gauge, check that the film face of the lower pellet is 0·010″ clear of the edge of the intermittent sprocket.

With the film in the gate and the intermittent film-pad open, check, by use of the inching handle, that the film is being guided on to the intermittent sprocket correctly, that is, with the teeth in the centre of the sprocket holes. If not the position of the lower pellet must be altered to suit.

Close the intermittent film-pad and repeat. By opening the film pad after inching and examining with a mirror, check that the film is still being guided correctly on to the sprocket. Check that the film surface of the intermittent film pad is parallel with the sprocket and that the sprocket, film guides, and pressure springs are clean and free from emulsion. No alignment of the picture relative to the screen must be attempted by adjustment of the mechanism, but the machine must be moved bodily until the optimum position is obtained.

Ghosting

" Ghosting " is corrected by adjustment to the flicker shutter. To clear a top " ghost," which is caused by a " slow " shutter, slacken the screws fixing the flicker shutter dish, rotate the dish clockwise the required amount and re-tighten the screws. These screws, 39, Fig. 6. are accessible through slots in the eddy-current disc.

For a bottom " ghost," move the flicker shutter anti-clockwise.

THE LANTERN

To take up wear on the lead screw nuts 137 and 140, Fig. 45, of the carbon carriages, run the carriages back to the end of the chassis where the nuts will be directly under access holes in the chassis. Loosen the screws in the access covers and move the latter to one side. Then loosen the screws holding the nuts, and insert shims from the underside, immediately on top of the nuts. Use shims as required to compensate for wear. In the case of the positive carriage, apply the shims to bring the column upright and central with the " V " in the positive guide and then re-tighten the screws.

ELECTRICAL UNITS

A table of terminal identification is given in " APPENDIX 1."

Fuses

The two types of rewirable fuse are rated as follows :—

7 amp., using 0·009″ tinned copper—18A/26A, 18B/26B.

2 amp., using 0·0164″, 63/37% lead/tin alloy—18J/26J, 18M/26M, 18R/26R, 18V/26V, 18Y/26Y, also those in the lantern feed-motor and the non-synchronous turntable unit.

1¼″ Tubular fuses are used as follows :—

Amplifier Rectifier Unit (F 1 and F 2)	500 mA. (Mag-nickel)
Deaf Aid Amplifier (F 23)	250 mA. (Mag-nickel)

Valve Voltages

The following table gives nominal voltages which may be used as a guide in cases of fault finding. The values obtained on any individual unit will naturally vary from the nominal figures due to normal manufacturing tolerances. The meter used in each case is an " AVO-7," using the meter range specified.

Valve No.	Heater		Cathode to Earth		Anode to Earth	
	Meter Range	Volts	Meter Range	Volts	Meter Range	Volts
V 1	10 v.	6·3	—	—	—	—
V 2	10 v.	6·3	—	—	—	—
V 3	10 v.	4·0	—	—	1000 v.	180
V 4	10 v.	4·0	—	—	1000 v.	180
V 5	10 v.	6·3	—	—	1000 v.	70
V 6	10 v.	6·3	—	—	1000 v.	60
V 7	10 v.	6·3	—	—	1000 v.	170*
V 8	10 v.	4·0	100 v.	12·0	—	—
V 9	10 v.	4·0	100 v.	12·0	—	—
V 10	10 v.	4·0	100 v.	12·0	—	—
V 11	10 v.	4·0	100 v.	12·0	—	—
V 12	10 v.	4·0	—	—	—	—
V 13	10 v.	4·0	—	—	—	—
V 14	10 v.	4·0	—	—	—	—
V 15	10 v.	4·0	—	—	—	—

* Per anode.

Other Voltages — all to terminal 1 A.

Terminal No.	17	13	80A	80B	4A	4B
Meter	AVO-7	AVO-7	AVO-7	AVO-7	Electrostatic	Electrostatic
Meter Range	100 v.	400 v.	1000 v.	1000 v.	—	—
Voltage ..	9·0	285	200	200	78 (min.) to 90 (max.)	78 (min.) to 90 (max.)

Relay Voltages

The following nominal voltages are obtained across the relay coil when measured with an AVO-7 on the 10-volt range.

Condition	Voltage
Neither Push-button depressed	5·0
With " B " Push-button depressed	0
With " A " Push-button depressed	10·0

Switches

All switches of the wafer type are fitted with self-cleaning contacts and should require no attention. If, however, the condition of the switch is suspect it should be replaced without delay.

Loudspeakers

A periodic check should be made to see that the fixing bolts are screwed up very tightly.

A fault which can occur on the loudspeakers is an open-circuited speech coil. The effect of this trouble is very soon apparent on listening to the sound. Care should be taken when replacing units to see that they are correctly phased.

The D.C. resistance of the speech coil in the Type G 7A L.F. unit is 7·5 ohms $\pm$ 7½% and that for the Type E 5A H.F. unit is 5·8 ohms $\pm$ 7½%.

Periodical checks should be made to ensure that no shorts exist between the speech coils and earth.

Filter Unit

When the emergency switch is not operated for a long period there is a danger of faulty-contact trouble developing when it has to be used. As a precaution, therefore, the switch should be operated a number of times each month.

Non-synchronous Turntable Unit

The Gramophone Motor top plate is provided with oil-holes, and a few drops of oil should be put in these holes once every six months. Do not over-fill.

The frequency response of the non-sync. channel is illustrated by the curves in Fig. 40. These curves represent the optimum performance on non-sync., **assuming that the best possible performance on film has first been obtained by correct adjustment of the boost networks.**

When checking the non-sync. channel response, the curves should be regarded only as a guide, as the curves actually obtained in service may vary by as much as $\pm$ 2½ db. between equipments by reason of variations in manufacturing tolerances.

STANDARD EXTRAS

The following are standard extras to the equipment :—

(1) Single or twin turntable non-synchronous gramophone unit.

(2) Quick-action slide attachment.

(3) Standby amplifier.

(4) Deaf-aid amplifier and lorgnette type earphones.

(5) Microphone.

(6) Arc switches and/or meter mounted in stand.

(7) Twin L.F. baffle, Type F 7A, for use in larger halls, up to 1250 seats.

(8) Rotary Converter for operation on D.C. supplies.

(9) Floor-mounting supports for Amplifier Cubicle.

NOTICE

REPLACEMENTS ARE OBTAINABLE FROM ANY SERVICE DEPOT OR FROM THE BRITISH THOMSON-HOUSTON CO., LTD., SOUND REPRODUCER SALES DEPT., RUGBY, WHICH WILL ALSO SUPPLY INSTRUCTIONS SHOULD IT BE NECESSARY TO RETURN APPARATUS TO THE WORKS FOR REPAIR OR OTHER REASON.

COMPLIANCE WITH THIS PROCEDURE WILL AVOID DELAY AND INCONVENIENCE.

APPENDICES

Wiring Diagrams

APPENDIX I

TERMINAL IDENTIFICATION

Terminal No.	Circuit
1	Earth
2	6 F11 Heaters (V1, V2, V5, V6, and V7)
3	6 F11 Heaters (V1, V2, V5, V6, and V7)
4	P.E. Cell H.T.
5	Output line to P.A. Speakers
6	Not used
7	V 455 Heaters (V3 and V4)
8	V 455 Heaters (V3 and V4)
9	Deaf Aid output
10	Output line to screen speakers
11	Not used
12	Pen 44 Heaters (V8, V9, V10, and V11)
13	280 volts H.T.
14	Not used
15	Pen 44 Heaters (V8, V9, V10, and V11)
16	Not used
17	Volume Control—line end
18	A.C. Supply (live side)
19	Volume Control —slider
20	Framing and Intermittent Lamps
21	Not used
22	Not used
23	Not used
24	Not used
25	Not used
26	A.C. Supply (neutral)
27	Exciter Lamp supply
28	Signal line (Input Switch to Amplifier)
29	Signal line from Non-synchronous Unit
30	Not used
31	Signal line from Microphone
32	Not used
33	Not used
34	Not used
35	Not used
36	Not used
37	Not used
38	Not used
39	Not used
40	Deaf Aid input
41	Not used
42	Not used
43	Not used
44	Not used
45	Not used
46	Not used
47	Not used
48	Not used

Terminal No.	Circuit
49	Not used
50	Not used
51	Not used
52	Not used
53	Not used
54	Drive Motor Condenser
55	Drive Motor and Sound Drum Motor
56	Drive Motor and Sound Drum Motor
57	Not used
58	Not used
59	Sound relay coil
60	Sound relay push-button (connected to 2)
61	Sound relay push-button (interconnection)
62	Not used
63	Signal line (Non-synchronous transformer to pre-amplifier V 5)
64	Signal line—P.E. cell cathode follower to input switch
65	Output from non-synchronous pre-amplifier V5
66	Not used
67	Not used
68	Not used
69	Not used
70	Not used
71	Not used
72	Not used
73	Not used
74	Not used
75	Not used
76	Not used
77	Not used
78	Not used
79	Not used
80	H.T. Supply to cathode followers
81	Not used
82	Not used
83	Not used
84	Not used
85	Not used
86	Not used
87	Not used
88	Monitor speaker
89	Output Transformer primary
90	Output Transformer primary
91	Feed-back line

APPENDIX 2

PACKING LIST

Care should be taken, during the unpacking, to ensure that no parts remain hidden in the packing material and are thus overlooked. Indicator and exciter lamps, valves and photocells are packed separately.

In each of two Cases, Nos. 1 and 11

1 Base, W 1858253-1
4 Adjusting Screws, SK 1856445-1

or

1 Base, W 1924497-1
3 Adjusting Screws, SK 1856445-1

In each of two Cases, Nos. 2 and 12

1 Column, W 1858254-1, with its Distance Piece(s).

In each of two Cases, Nos. 3 and 13

1 Lantern Table Assembly, W 1858257-1.
1 Mirror (sometimes supplied direct from BTH, Willesden).
1 Set of Adaptation Gear for Lantern.

In each of two Cases, Nos. 4 and 14

1 Bottom Spoolbox Assembly, DW 1889836-G1.

In each of two Cases, Nos. 5 and 15

1 Mechanism Box Assembly, DW 1889876-1, complete with :—

1 Changeover Shutter, X 1758166-21 (Complete with M 1901179-1).
1 Heat Baffle and Light Shield Assembly, M 1909304.
1 Lens Holder Assembly, X 1749663-G1.
1 Leather Belt, SK 1150902-1.
1 Sound Head.
1 Gear Bracket.
1 Cross Box.

Less Main Drive Motor and support.

In each of two Cases, Nos. 6 and 16

1 Top Spoolbox Assembly, W 1869366-G1

In each of two Cases, Nos. 7 and 17

1 Lantern Assembly, Type L (may be supplied direct from BTH, Willesden).

Case No. 8

1 Standby Cubicle (if required).

Case No. 9

1 Amplifier Cubicle (less trays).

Case No. 10

1 Anchor Pin, SK 1856448-1.
1 Pivot Pin, SK 1856447-1.
1 Trunnion, M 1858265-1.
1 Rake Adjusting Screw and Nut, M 1858264-2.
1 Top Spoolbox Adaptor Plate, X 1889850.
4 Base Cups, SKC 16245-2 (3 with Base W 1924497-1).

Case No. 10 (*continued*)

1 Main Drive Motor and Support.
1 Loud Speaker Filter Unit.
1 Nose Glass and Clip. (May be supplied with Lantern.)
1 Twicklip Extractor.
1 Oil Measure.
1 Oil Funnel.
1 Oil Drain Tube.
4 Cable Glands, SK 1360079-5.
1 Lens Adaptor (when required).
1 Sound Optical System, W 1776661-95.

Case No. 18

1 Power Amplifier.
1 Amplifier Supply Rectifier. } For Standby (if required)

Case No. 19

1 Bowden Assembly, Y 1890144 (when required—mechanical changeovers only).

Case No. 20

1 Anchor Pin, SK 1856448-1.
1 Pivot Pin, SK 1856447-1.
1 Trunnion, M 1858265-1.
1 Rake Adjusting Screw and Nut, M 1858264-2.
1 Top Spoolbox Adaptor Plate, X 1889850.
4 Base Cups SKC 16245-2. (3 with Base W 1924497-1.)
1 Main Drive Motor and Support.
1 Nose Glass and Clip. (May be supplied with Lantern.)
2 Input Switch Boxes, X 1869443-1.
2 Flexible Conduits for Lanterns.
70 Yards (approximately) of cable, Z 1890144.
1 Allen Key.
1 Lens Adaptor (when required).
10 yards of Cable T 3020 (Large Size).
1 Set of Marker Sleeves.
1 Sound Optical System, W 1776661-95.

Case No. 21

1 H.F. 9-cell metal horn, CW 110478-G2.

Case No. 22

2 Low Frequency Speaker Units, Type G 7A, DLC 3896.

Case No. 23

2 High Frequency Speaker Units, Type E 5A, DLC 3847.
1 Twin Throat Casting, DLC 3851.
1 Monitor Speaker Complete, DLC 3899.

or

1 High Frequency Speaker Unit, Type E5A, DLC 3847.
1 Single Throat Casting, DLC 3809.
1 Monitor Speaker complete, DLC 3899.

Case No. 24

1 Twin Turntable Non-synchronous Gramophone Equipment, with Turntables and Lightweight Pick-ups.

Case No. 25

3 Amplifier Cubicle Trays.

Case No. 26

1 Low Frequency Horn, Type G 8A, DLC 3903.

APPENDIX 3

LIST OF SPARES

(Note : Items marked with an asterisk (*) are consumable and spares of these should be kept at the theatre.)

Mechanical

Item No.	Description	Drawing No.
* 1	Film Guide-runner (L.H.)	Y 1909270-1
* 2	Film Guide-runner (R.H.)	Y 1909270-2
* 3	Spring Skids	SK 1904167-1
4	Spring Gate for Top Tensioner	SK 1904183-1
* 5	Drive Motor Pinion (Bonded Fabric)	SK 1747478-1
6	Driving Chain Spring Connecting Link, for 8 mm. Roller Chain No. 110500, (ex Renolds & Coventry Chain Co.)	—
* 7	Motor Coupling Insert	SK 1784673-1
8	Fire Shutter Vane Assembly with brass weights	M 1858549-1
9	Fire Shutter Magnet Assembly with keeper	SK 1716766-8
10	Shim for above (0·008″)	SK 1716770-1
11	Shim for above (0·010″)	SK 1716770-2
12	Shim for above (0·016″)	SK 1716770-3
13	Fire Shutter Ball-race	SKC 31891-19
14	Split Pin for Flicker-shutter Shaft 0·048″ × $\frac{5}{8}$″ long	—
15	Moving Gate Catch-spring	SK 1753712-1
16	Moving Gate Pivot Compression Spring	SK 1735023-1
*17	Intermittent Mechanism Lead Washer	Z 1755804
18	Rubber-bonded Bush for Framing Link	SK 1775642-1
19	Spring for Lens-holder Focusing Control	SK 1716957-1
20	Lens Holder Counterbalance Torsion Spring	SK 1747028-1
21	Lens Holder Trigger Catch	SK 1747481-1
22	Spring for 21	SK 1716955-1
23	Latch for 21	SK 1784683-1
24	Sound Optical Take-up Roller Assembly	W 1776661-77
25	Pivot Shaft for Take-up Roller Assembly	Z 1756146
26	Guide Roller Assembly (Sound op.)	M 1786340-G 1
27	Torsion Spring for Take-up Roller	SK 1775940-1
28	Film Pressure-roller Assembly	SK 1784664-1
29	Film Pressure-roller Assembly Locating Spring	Z 1756213
30	Film Pressure-roller Assembly Pressure Spring	SK 1784567-1
31	Top Feed Pad-roller Twicklip	Z 1736741
32	Top Feed Pad-roller	SK 1716788-1
33	Top Feed Pad-roller Spindle	Z 1710813
34	Sound and Bottom Feed Pad-rollers	SK 1716788-1
35	Sound and Bottom Feed Pad-roller Spindle	Z 1710680
36	Spring for Top Feed Pad-roller Assembly	Z 1710813
37	Spring for Sound and Bottom Pad-roller Assembly	Z 1736739
38	Intermittent Guide-pin (Bottom)	SK 1871387-1
39	Intermittent Guide-pin (Top)	SK 1871388-1
40	Intermittent Guide-pin Spring (Short)	SK 1871623-1
41	Intermittent Guide-pin Spring (Long)	SK 1891905-1
42	Intermittent Guide-pin Locating Ball $\frac{1}{4}$″ dia. steel	—
43	Intermittent Guide-pin Pivot	SK 1871622-1
44	Top Spoolbox Hold-back Spring	CR 17737-1
*45	Bottom Spoolbox Clutch Washer	CR 17742
46	Bottom Spoolbox Clutch Spring	CR 17683
47	Spoolbox Door Catch Assembly	CZ 62741-14
48	Fire Trap Spring	SK 1871368-1
49	Fire Trap Roller	SK 1871370-1
50	Fire Trap Roller Spindles	Z 1855674
51	Top Sprocket	M 1749764-1
*52	Intermittent Sprocket	SK 1775824-1
53	Sound or Bottom Feed Sprocket	M 1713615-1
54	Lockwashers for Fixing Sprocket	Z 1736592
55	Intermittent Mechanism Assembly	X 1749767-44
56	Changeover Shutter Assembly	X 1758166-21
57	Mech. Adaptation for Changeover Shutter	M 1901179-1
58	Sound Motor Assembly	X 1758345-1
*59	Bottom Spoolbox Drive Belt	SK 1150902-1

Electrical

Item No.	Description	Drawing No.
1	Changeover Relay	SK 2016764-1
2	1 mfd. Electrolytic Condenser	M 1703035-14
3	50 mfd. Electrolytic Condenser	M 1703035-6
4	16-16 mfd. Electrolytic Condenser	SK 1891917-1
5	1000 mfd. Electrolytic Condenser	M 1889995-5
6	16 mfd. Electrolytic Condenser	M 1889995-3
7	50 mfd. Electrolytic Condenser	M 1889995-1
8	8 mfd. Electrolytic Condenser	M 1703035-15
9	32 mfd. Electrolytic Condenser	M 1889995-4
10	16 mfd. Electrolytic Condenser	M 1703035-5
11	Meter (0 — 10)	SK 1716843-1
12	Spring return Switch (Mech. c/o)	SK 1891854-1
13	Spring return Switch (Elec. c/o)	M 1942525-1
14	Input Switch	SK 1891794-1
15	Volume Control	M 1722813-1
*16	Fuse (500 mA)	SK 1753664-2
*17	Fuse (250 mA)	SK 1753664-1
18	Output Switch	SK 1871297-1
19	Output c/o Switch (standby)	SK 1904007-1
20	Control c/o Switch (standby)	X 2019008-1
21	Input c/o Switch (standby)	SK 1904007-1
*22	Ardoloy Needle	SKC 89453-G1
*23	Sapphire Needle (substitute for Item 22)	SKC 89453-G2

Lantern

Item No.	Description	Drawing No.
*1	Mirror (where glass mirrors are used)	SK 1683258-1
*2	Mirror (cutaway, alternative to above)	SK 1683258-2
*3	Side Window	Z 980902
*4	Nose Glass	SK 1379528-1
*5	Fuse (2)	SK 980907-2
*6	Periscope Lens	Z 1683224

Spare Valves and Lamps

A complete set of valves and lamps comprises :—

4—6 F11 Valves.

2—V 455 Valves.

1—6 L19 Valve.

4—Pen 44 Valves.

2—UU 5 Valves.

2—PE 50 Photo-electric Cells.

4—5 amp., 10 volt Supa 2 Exciter Lamps.

4—M.E.S. 3 watt 6 volt lamps.

When a deaf aid amplifier is used the following extra valves are required:—

1—UU 5 Valve.

1—Pen 45 Valve.

APPENDIX 4

TYPE M LANTERN

Type M Lantern, supplied when specifically ordered, differs from Type L, fitted as standard, in that in Type M provision is made for the use of either High Intensity or Low Intensity carbons, whichever is desired. It must be noted that, to avoid instability, Low Intensity carbons require a **line** voltage of not less than 80 volts, used in conjunction with a suitable ballast resistance.

Carbons

Before despatch, the negative carbon-holder is set to accommodate 6·5 mm. carbons, the diameter being the same for either High or Low Intensity.

H.I. Trim

Negative Carbon	6·5 mm. × 8″ HI, CC.
Positive Carbon	7·0 mm. × 12″ HI, CC.
Arc Current	45 amp.
Arc Voltage	35 volts.

L.I. Trim

Negative Carbon (Morganite Type LCN is recommended)	6·5 mm. × 8″.
Positive Carbon	13·0 mm. × 12″ LI.
Arc Current	35 amp.
Arc Voltage	50 volts.

H.I. Operation

Referring to the diagram of the positive head, Fig. 47, loosen screw 2, raise it as far as possible, and re-tighten it. Rotate clamp jaw 1 anti-clockwise. This will set the positive head to clamp 7 mm. carbons correctly. Fit the 7 mm. positive guide to the fixed head.

Turn the negative clamp handle anti-clockwise to enable the 6·5 mm. carbon to be inserted.

The special short-circuiting switch mounted *above* the gearbox should be " ON," i.e. the switch knob should be towards the front of the lantern. The connections of this switch are shown in Fig. 48. Instructions regarding the setting of the carbon feed-rate are given on page 33.

L.I. Operation

Loosen screw 2, Fig. 47, lower it as far as possible, and re-tighten it. Turn clamp jaw 1 clockwise. Fit the 13 mm. guide to the positive head.

The switch above the gearbox must be " OFF " (knob to rear of lantern). After fitting the carbons and striking the arc, adjust the arc-gap, focus-up, and then set the carbon feed-rate as follows :—

Adjust the feed-rate by means of the speed-control rheostat to suit the positive carbon burning-rate, and unscrew knob 73, Fig. 11, far enough for it not to cause rocker arm 74 to " hinge " at its left side on each oscillating stroke.

Under these conditions, the negative carbon is feeding as fast as possible, and only occasional adjustments to the negative feed knob 58, Fig. 10, will be necessary to maintain the correct arc-gap.

In all other respects, the instructions given in this Book for the installation, operation, and maintenance of the Type L Lantern apply equally to Type M.

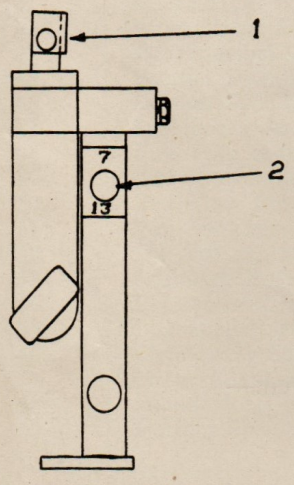


Fig. 47. Type M Lantern—Positive Head.

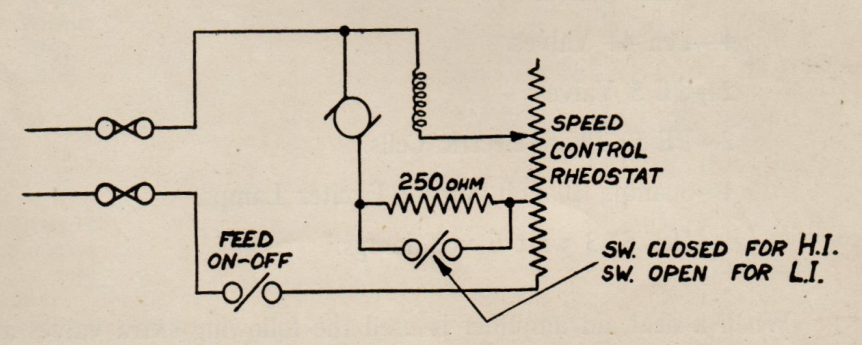


Fig. 48. Type M Lantern—Feed-motor Connections.

(Overleaf)

Fig. 49. Internal Wiring of Amplifier Cubicle.

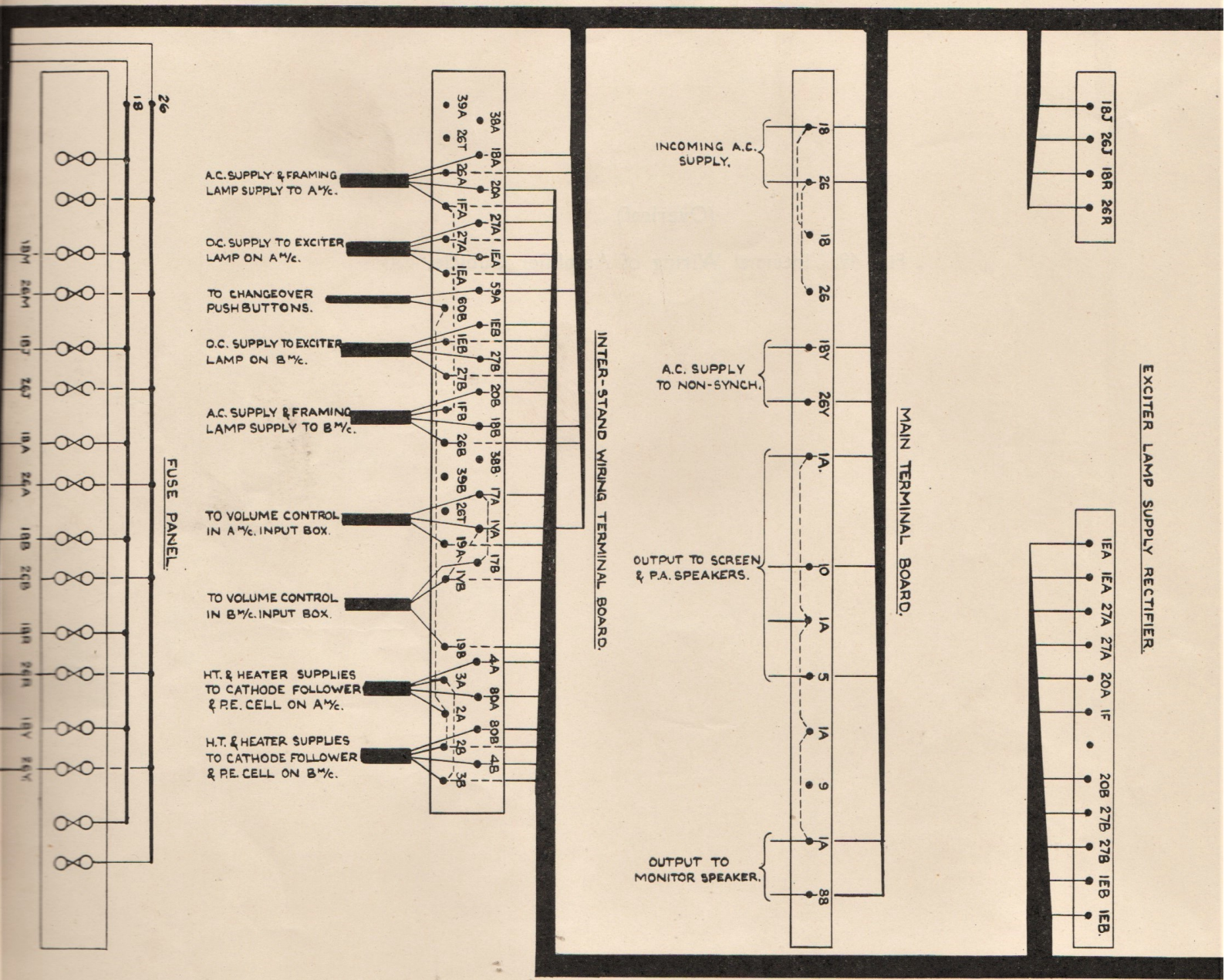
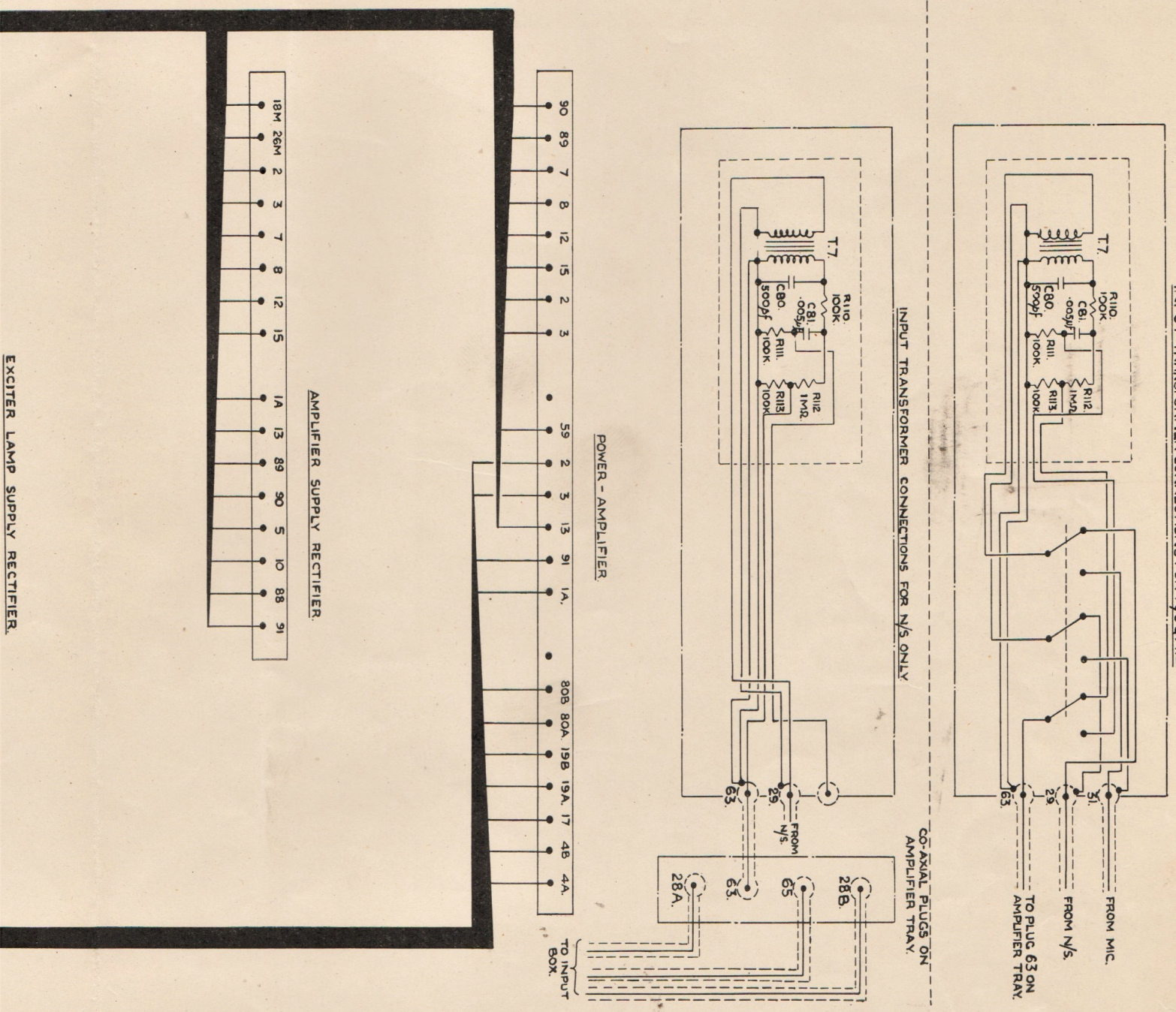


Fig. 49. Internal Wiring

Supa—Mark 2



rnal Wiring of Amplifier Cubicle.

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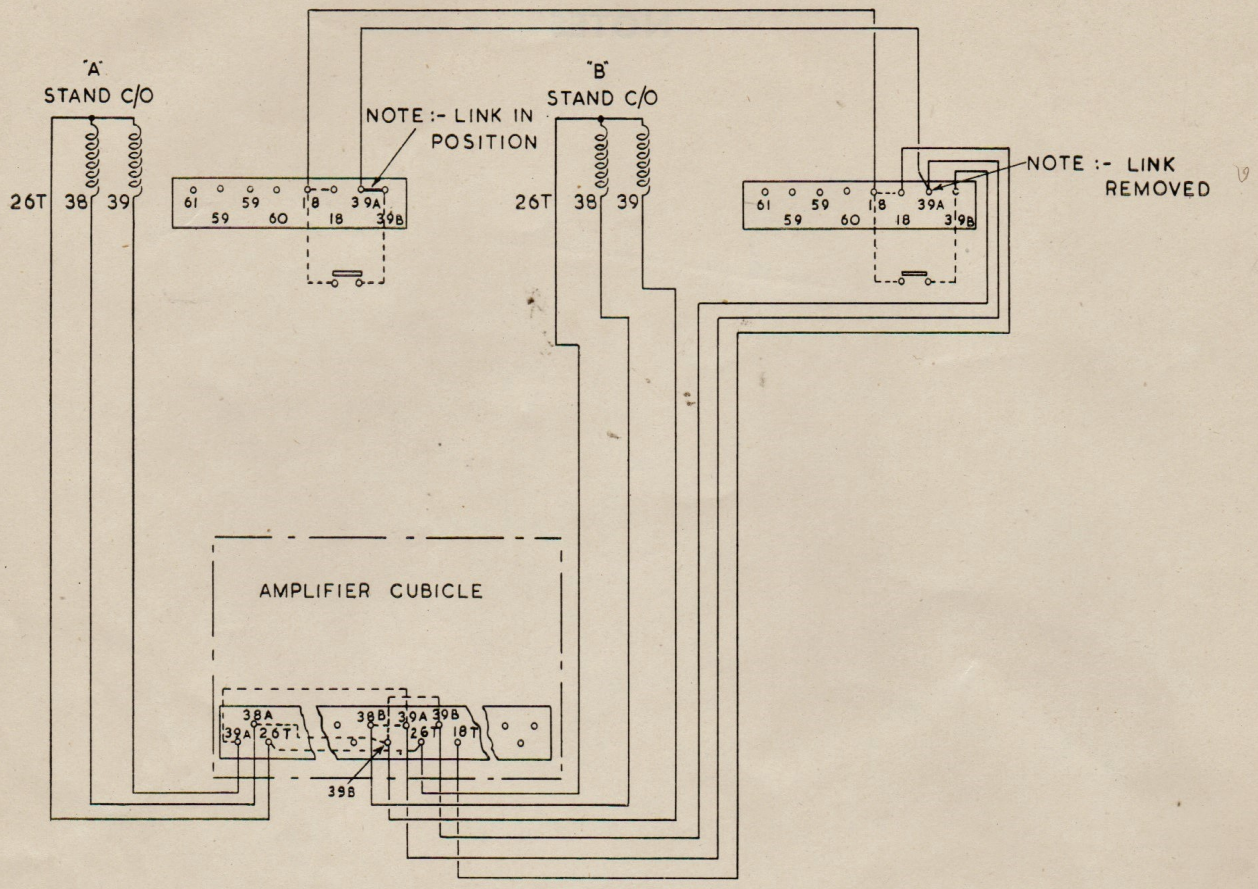

Fig. 50. Electrical Changeover—Schematic Diagram for cables entering c/o conduit system from right-hand side.

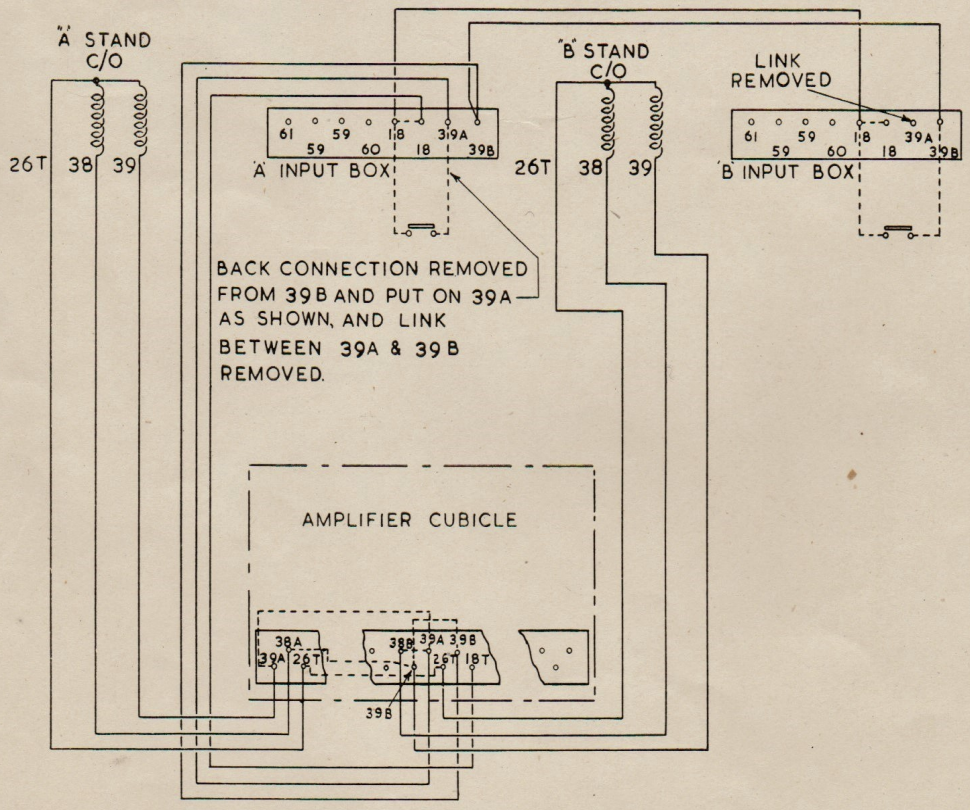

Fig. 51. Electrical Changeover—Schematic Diagram for cables entering c/o conduit system from left-hand side.

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(Overleaf)

Fig. 52. Internal Wiring of Standby Amplifier Cubicle.

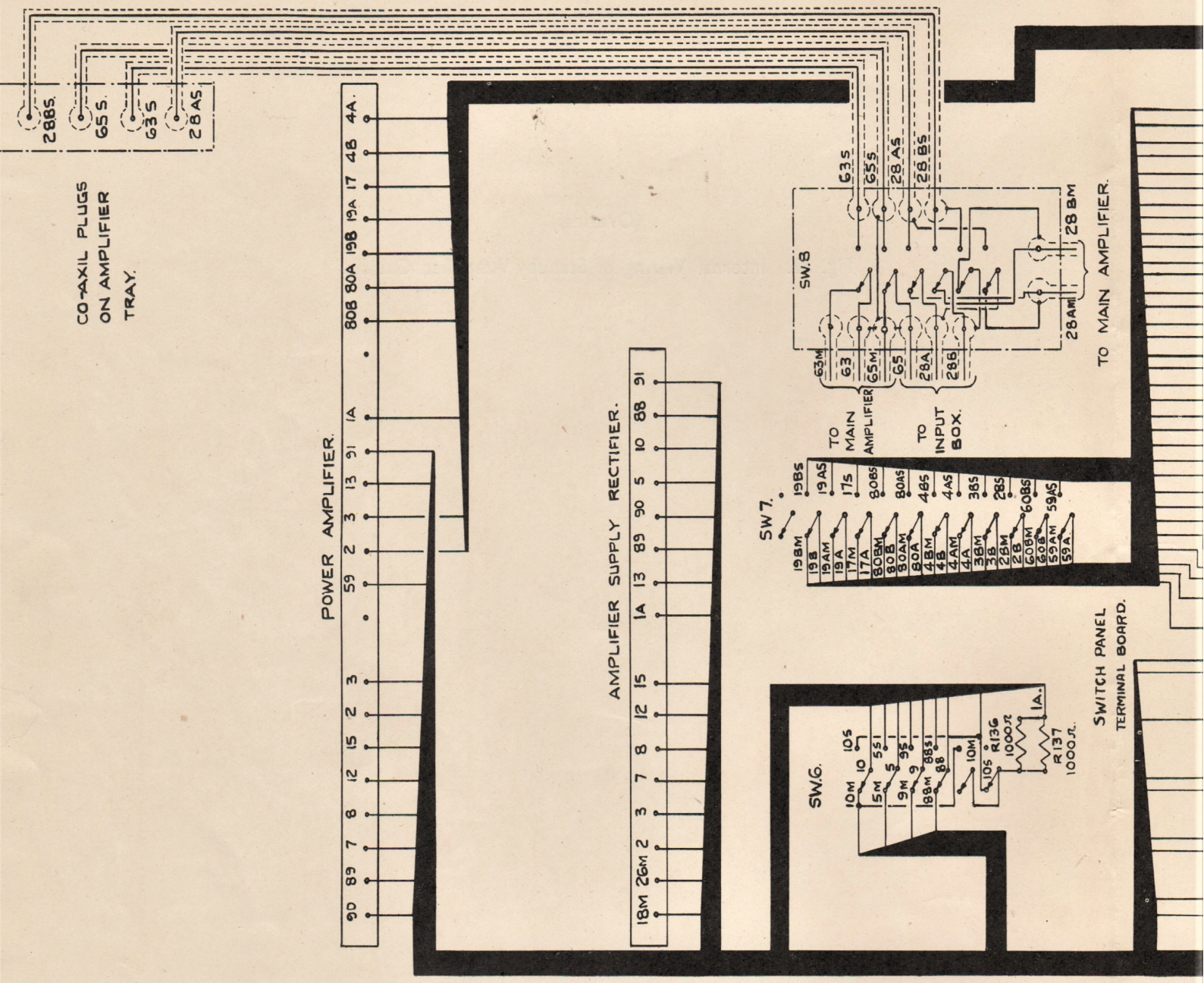
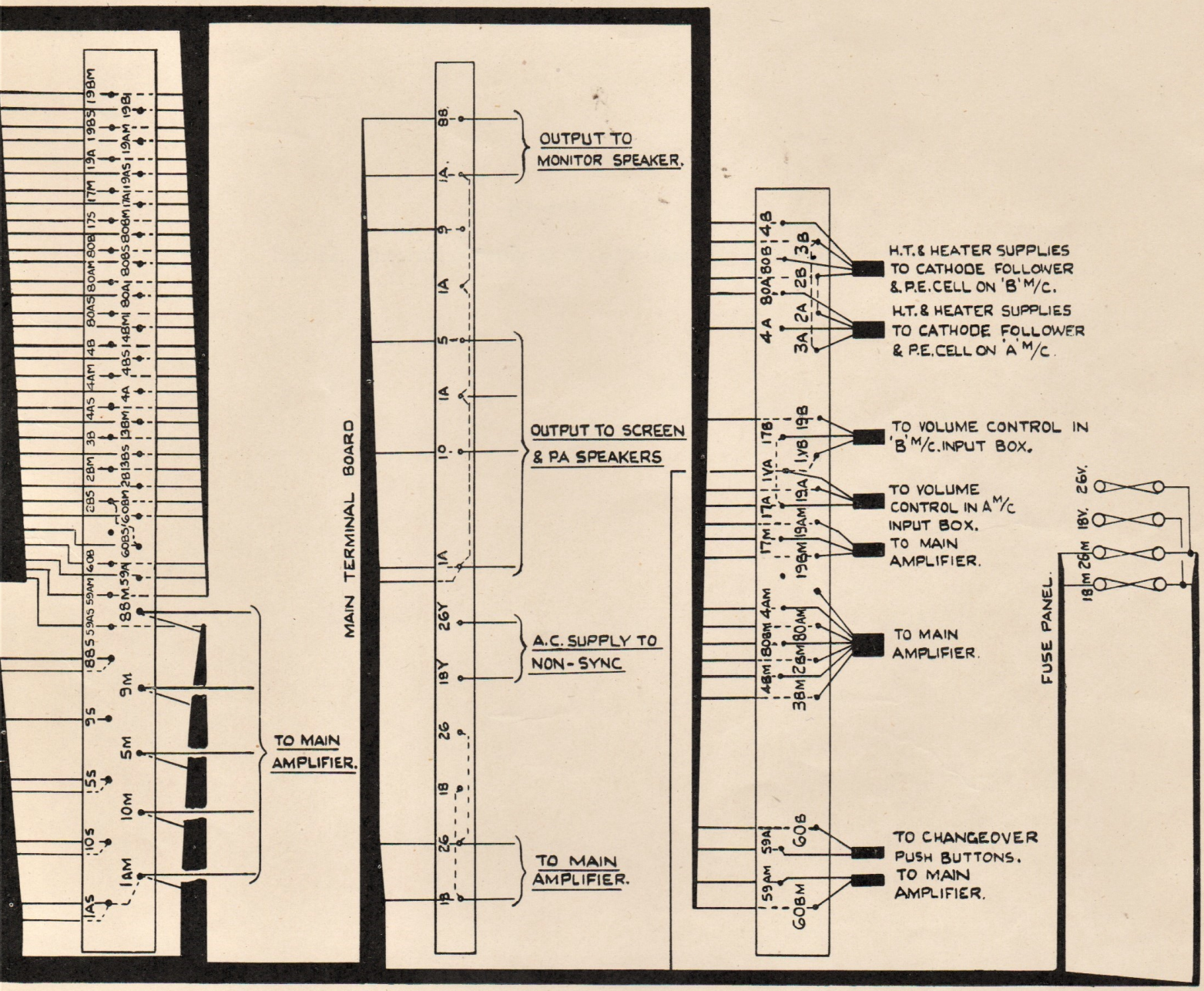


Fig. 52. Internal Wiring of Standby A

ark 2



andby Amplifier Cubicle.

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