

# Mullard

## Outlook

Australian Edition



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MULLARD-AUSTRALIA PTY. LTD.



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Our cover picture taken at the Mullard valve factory at Whyteleafe illustrates the scrupulous care taken to ensure that valves remain dust free during assembly. (Note the specially constructed glass screen).

### MULLARD-AUSTRALIA PTY. LTD.

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Associated with  
MULLARD LTD., LONDON  
MULLARD OVERSEAS LTD.

## NEW YEAR 1958

*Now man may say: the electronic age  
Has come upon us with its man-made brains,  
Infallible computers, unmanned planes,  
Electrons captured in a gas-filled cage.*

*Now nuclei and atoms hold the stage  
Of man's imagination, progress reigns.  
And yet, when Christmas comes, each man remains  
The same and reads an old and yellowed page.*

*That page describes how man was promised peace.  
And though the world that scientists designed  
Does differ, no invention could decrease  
The impact of that promise to mankind.  
May then, this coming year, all hatred cease,  
May we have peace, of nations and of mind.*

L. P. A. S.

Much has been written on this modern age; our electronic way of life and man's persistent and relentless search for knowledge. A better understanding of his world and the Universe is one of the highlights of the 20th century and the practical application to everyday living. The rapid advances—communication by wire, carrier and radio techniques, accurate and reliable navigational aids, electronic and nuclear aids to medicine, television and automation in industry—all to a degree complimentary and closely dependent on valves, electron tubes and semi-conductors—I believe, with all modesty, signify the consistent Mullard contribution through the years which has earned the respect of technicians and engineers in these fields.

The birth of a new journal highlights this development and the cover motive of the Australian edition of the Mullard Outlook is symbolical of communications in the broadest sense. The United Kingdom edition has for many years acquainted retailers and servicemen on diverse phases of valve sales and technical applications and it is our aim that this journal should provide a parallel service.

The Mullard Outlook is dedicated to those of our fellow men whose livelihood and interest is in the electronic field and its scope directed to the salesman, the retailer, the service mechanic, the development engineer, the research worker and the hobbyist and it is my earnest trust that through the years this journal will be the happy medium linking our efforts to all whom we have the privilege and pleasure of offering our services.

MAURICE A. BROWN.

# VIEWPOINT WITH MULLARD

"Mullard Film Audiences Pass The 30,000 Mark." This heading appeared recently in the U.K. edition of the "Outlook"; it indicates the popularity of such activities and is perhaps fitting as an introduction to these notes.

When "Viewpoint" comes to your district, you will be made more than welcome, so come along and meet the Mullard Team — a team with a vast amount of knowledge in all matters pertaining to valves, electronic tubes, and semi-conductors. Short technical and sales discussions, and demonstrations of equipment ensure a thought provoking evening of practical interest. A screening from one of the films listed on page 7 of this issue will provide something of technical interest and show you valve and picture tube production in one of the modern Mullard factories.

## INAUGURAL MEETING

Already 5 meetings have been held in Australia, the first in Sydney on the 25th July last year, followed shortly afterwards by a similar function in Melbourne. Since then it has been our pleasure to entertain the Sydney Eastern Suburbs Retailers on the 2nd October and in conjunction with the Mullard West Australian Distributors, Messrs. Harris Scarfe & Sandovers, 2 evenings were held in Perth on the 12th and 14th of November. Mr. M. A. Brown, Mullard

General Manager, Mr. J. R. Goldthorp, Valve Applications Engineer, and Mr. P. C. Bidence, Maintenance Valve Sales, addressed the meetings and covered the various aspects of valve sales and applications.

## EXTRA VALVE SALES

Wholesalers, retailers and servicemen were reminded of the rapidly expanding market for electronic equipment. Valves in television receivers, owing to the complexity of application, operate under quite stringent conditions and a valve slowly failing during its normal life, may require much earlier replacement than in a normal sound receiver.

It was suggested that with due regard to the sale of new AM receivers retailers and servicemen were perhaps neglecting the replacement of valves in existing sets for in most cases it was only when a receiver required service that valves were replaced. Mr. Brown went on to say that he considered some 20% to 30% of all valves in AM receivers throughout the Commonwealth could be replaced with a noticeable improvement in set performance. This extra valve sales potential was virtually untapped and it was suggested that as retailers and servicemen were in the front line the answer lay in their hands. He said: "It had been shown overseas that courteous service in this regard had built up tremendous consumer/retailer goodwill with ultimate benefits in sales of new receivers and other merchandise."

## FUTURE MEETINGS

Newcastle: The Princeton, 7th February.  
Hobart: Highfield Hotel, 25th February.  
Launceston: Cornwall Hotel, 27th February.  
Wollongong: Phillip House, 21st March.  
Tamworth: Central Hotel, 11th April.

## MULLARD DISPLAYS



One of the new Mullard portable display units which includes a wide variety of types to be found in our range in addition to several photographs depicting certain factory processes as well as illustrations of Mullard built equipment.

## VALVE DISPLAY

In order to generally stimulate the interest in Mullard valves we have arranged the construction of various portable displays which include samples taken from the wide range of Mullard types including battery portable and A.C. radio ranges, audio amplifier, television, imported English and European types as well as some of the more specialised industrial, transmitting, radar, X-Ray and hearing aid valves.

## 6BX6 COMPONENTS

In the unit illustrated above a section of the main centre panel shows the component parts and method of assembly of the popular television type 6BX6.

## IN PREPARATION

Further displays are in the course of preparation which would be more appropriate for use in small windows or as counter and show case displays.

## LEAFLETS

Mullard valve displays accompanied by a selection of leaflets, show cards, etc., are available on loan to Retailers. Please address your enquiries to the Maintenance Valve Sales Department.



GLIMPSES OF RECENT VIEWPOINT WITH MULLARD AUDIENCES IN SYDNEY, PERTH, MELBOURNE.

# "3-3" QUALITY AMPLIFIER CIRCUIT

This circuit has been designed by Mullard engineers for those constructors who wish to make a simple amplifier having a reasonably high quality. It can be used with all types of crystal pick-up and it gives an output of 3 watts at a total harmonic distortion of 1%.

## CIRCUIT DESCRIPTION

The amplifier, which is operated from a.c. mains, uses three Mullard valves: an EF86 as the voltage amplifier, a 6BQ5/EL84 in the output stage and a 6V4/EZ80 as the rectifier. The circuit (Fig. 1) includes three controls: volume (RV1), treble (RV2) and bass (RV14).

The comparatively high sensitivity of the amplifier (100mV for 3W output) permits the use of all types of crystal pick-up, and allows, if required, the use of equaliser networks between the pick-up and amplifier. The 3.75Ω and 15Ω output terminations are suitable for almost all kinds of loud-speaker, and, although the circuit is designed to make the most effective use of the single output valve, the best possible results will only be achieved if a suitably housed, high quality speaker is used.

The EF86 is used under 'starvation' conditions; the valve currents and voltages are very much smaller than they would be under normal working conditions because of the high resistance ( $R_4=1.0M\Omega$ ) in the anode circuit. Direct coupling from the anode of the EF86 to the control grid of the 6BQ5/EL84 is also used. These two factors together produce a very high stage gain, and, although feedback of approximately 20dB is used around the whole circuit, an input of only 100mV

is required to give an output of 3W.

The working points of the valves are stabilised by the d.c. negative feedback provided when the screen grid feed of the EF86 is taken from the cathode circuit of the output stage.

## PERFORMANCE

With the treble and bass controls in their minimum effective positions, the frequency response is essentially flat from 35c/s to 30kc/s (Fig. 2). With maximum application of the respective controls, a treble cut of 20dB is available at 10kc/s, and a bass boost of 15dB is available at 70c/s. The bass boost is obtained by reducing the main feedback at low frequencies by means of RV14 and C6 (Fig. 1).

## SUMMARY OF PERFORMANCE

### Output Power (at 400c/s)

3W at 1.0% total harmonic distortion.

### Power Response

Flat from 100c/s to 10kc/s.

### Frequency Response

Flat within  $\pm 1$ dB (relative to the response level at 1kc/s) from 35c/s to 30kc/s.

### Tone Control

Maximum Treble Cut: Approx. 20dB at 10kc/s.  
Maximum Bass Boost: Approx. 15dB at 70c/s.

### Sensitivity

100mV for 3W output.

### Hum and Noise Levels

At least 70dB below 3W.

The relationship between the total harmonic distortion and the output power is shown in Fig. 3. It will be seen

that, for a typical amplifier, for outputs above about 3.5W, the distortion increases rapidly. This indicates the point beyond which over-loading of the amplifier occurs.

## CONSTRUCTIONAL DETAILS

The photograph is of the prototype amplifier, and it gives a suitable layout for the main components. The dimensions of the chassis are 8in.  $\times$  6in.  $\times$  2in. The can of the electrolytic capacitors should be isolated from the chassis if the can is used as the negative side. The earth connection to the chassis is made at the input socket only. A bottom cover plate to the amplifier is not necessary.

The mains transformer should have an h.t. rating of 300-0-300V, 60mA, and it is preferable, though not essential, that a separate l.t. winding (6.3V) be used for the 6V4/EZ80 rectifier. This is indicated in the circuit diagram, and also in the list of components. A transformer recommended for the low loading operation of the 5-valve 10-watt amplifier is suitable for this equipment.

## D.C. CONDITIONS

### Line Voltage

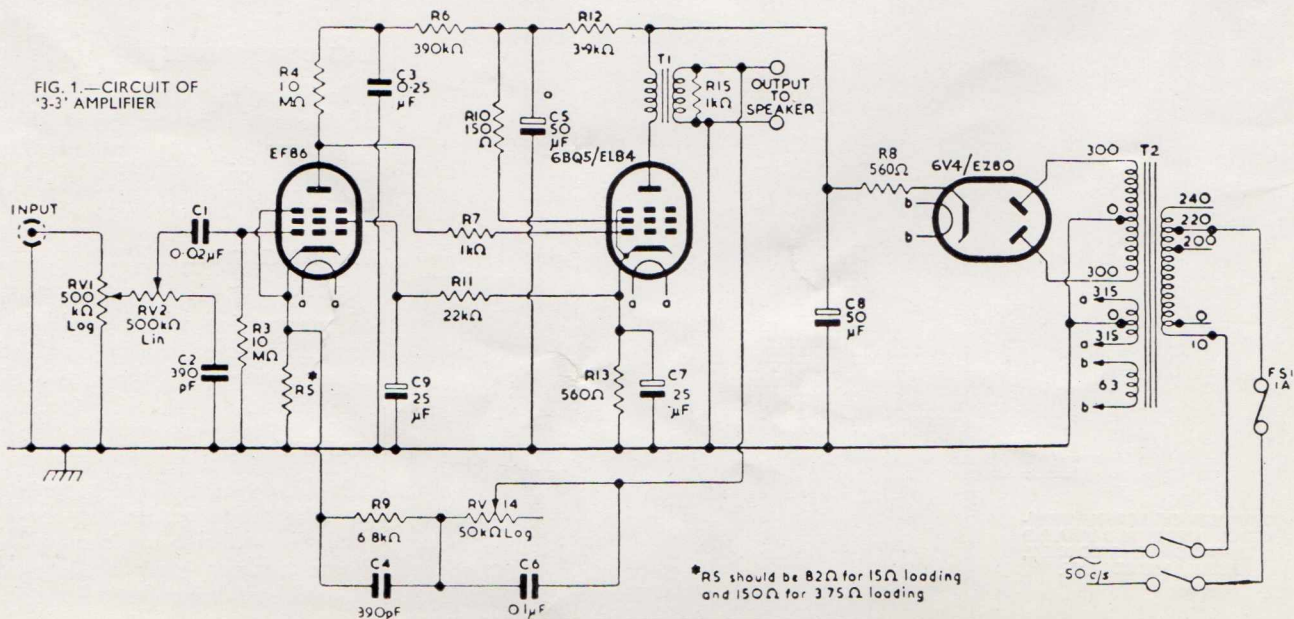
C8 at 48mA: 310V  
C5: 295V

### 6BQ5/EL84

Anode Voltage: 290V  
Cathode Voltage: 27V  
Cathode Current: 48mA  
Screen Grid Voltage: 295V

### EF86

Anode Voltage: 30V  
Anode Current: 190μA  
Screen Grid Voltage: 27V  
C3: 220V



**ERRATA**

Please insert this sticker in place of list of components for the 3/3 amplifier on page 5 of Mullard Outlook, Vol. 1, No. 1, 1958.

**LIST OF COMPONENTS**

**Valves:** Mullard EF86, 6BQ5/EL84, 6V4/EZ80.

**Resistors**

RV1	500kΩ <sup>1</sup>		
RV2	500kΩ <sup>2</sup>		
R3	10MΩ	±20%	¼W
R4	1.0MΩ	±10%	H.S.
R5	82Ω	±10%	for 15Ω load ¼W
	or 150Ω	±10%	for 3.75Ω load ¼W
R6	390kΩ	±10%	¼W
R7	1kΩ	±20%	¼W
R8	560Ω <sup>3</sup>	±20%	3W
R9	6.8kΩ	±10%	¼W
R10	150Ω	±20%	¼W
R11	22kΩ	±10%	¼W
R12	3.9kΩ	±10%	¼W
R13	560Ω <sup>3</sup>	±5%	3W
RV14	50kΩ <sup>1</sup>		
R15	1kΩ	±20%	¼W

<sup>1</sup> Logarithmic; carbon. <sup>2</sup> Linear; carbon. <sup>3</sup> Wire-wound.

**Output Transformer T1**

Primary: 5000Ω.  
Secondary: 3.75Ω or 15Ω.

Several local transformers have been approved by our Technical Service Department. We will be glad to discuss any problems which may arise during construction of this popular unit.

**Mains Transformer T2**

Primary: 10-0-200-220-240V.  
Secondaries: H.T. 300-0-300V, 60mA.  
L.T. 3.15-0-3.15V, 1A  
(For EF86, 6BQ5/EL84)  
0-6.3V, 1A (for 6V4/EZ80).

If only one 6.3V secondary winding is available, it should have a 2A rating to supply all three valves.

**Capacitors**

C1	0.02μF	Paper	150V min.
C2	390pF ± 10%	Silvered Mica or Ceramic	
C3	0.25μF	Paper	350V wkg.
C4	390pF ± 10%	Silvered Mica or Ceramic	
C5, C8	50-50μF	Double Electrolytic	350V wkg.
C6	0.1μF	Paper	150V min.
C7	25μF	Electrolytic	50V wkg.
C9	25μF	Electrolytic	50V wkg.

FIG. 2.—FREQUENCY RESPONSE OF AMPLIFIER, SHOWING RELATIVE GAIN WITH MINIMUM TONE CONTROLS, AND ALSO WITH MAXIMUM TREBLE CUT AND MAXIMUM BASS BOOST.

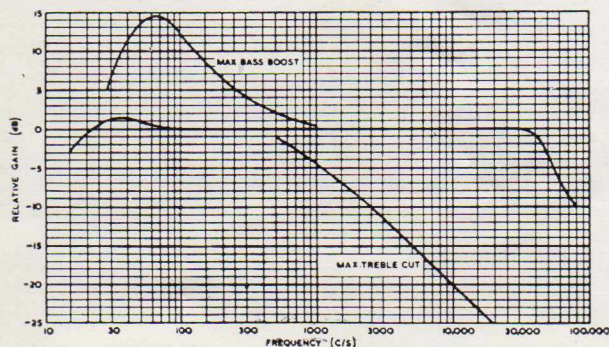


FIG. 3.—TOTAL HARMONIC DISTORTION PLOTTED AGAINST OUTPUT POWER.

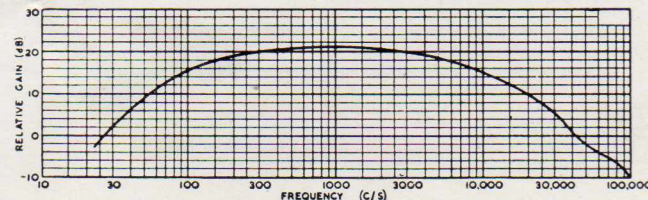
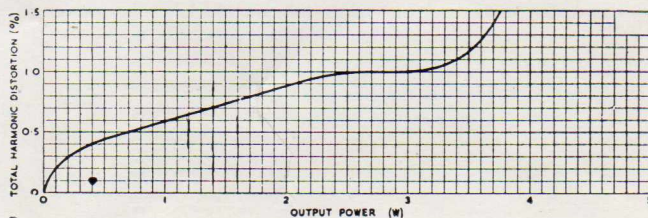
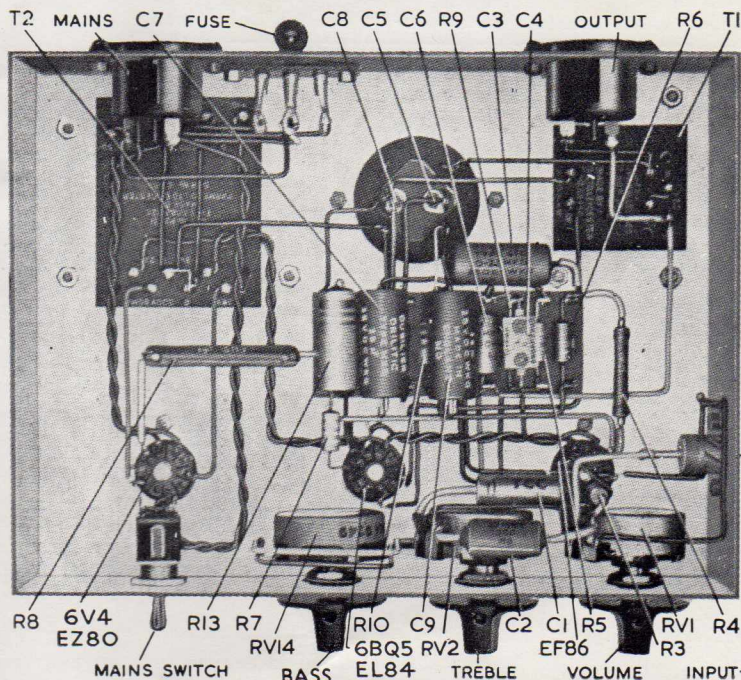


FIG. 4.—LOOP GAIN CHARACTERISTICS



The illustration shows power and speaker sockets, which are peculiar to the United Kingdom. It is suggested that the A.C. power lead be passed through the chassis via a rubber grommet in the usual way. The output socket illustrated may be replaced by a standard four pin miniature speaker socket.

**HARDWARE:**

- 1 Audio Input Socket
- 3 Knobs
- 1 Fuseholder (1A Fuse)
- 1 Mains switch 230V, 2A
- 1 Group Board 10 way
- 1 Miniature Speaker Socket
- 3 Valve holders B9A (EF86 skirted, P.T.F.E. or ceramic).

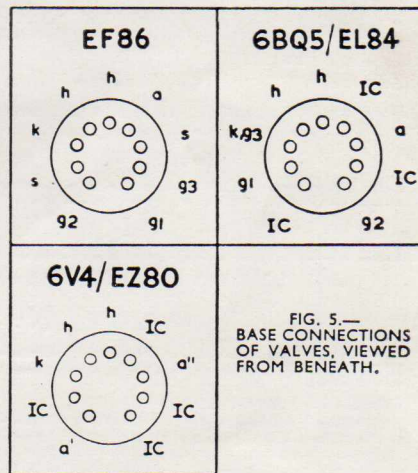


FIG. 5.—BASE CONNECTIONS OF VALVES, VIEWED FROM BENEATH.



# MULLARD RADIANT SCREEN PICTURE TUBE GUARANTEE

Any alteration makes this card unacceptable.

TUBE TYPE <b>MW43-69</b>	DO NOT LOSE THIS CARD AFTER REGISTRATION, as it must accompany the tube if returned under guarantee.
SERIAL No <b>AB15827</b>	<b>PART B</b> No 24991
MAKE OF RECEIVER <b>AJAX</b>	Dealer's Name and Address <b>JONES TELEVISION SERVICE</b>
TYPE <b>B46</b>	<b>15 MAIN ST NORTHTOWN N.S.W</b>
SERIAL No <b>AX4970</b>	DATE OF SUPPLY TO USER (to be completed by dealer) <b>4-8-56</b>
	USER'S NAME AND ADDRESS <b>MR. J. GREEN</b>
	<b>21 ANTHONY ST. NORTHTOWN N.S.W</b>

FOLD ALONG THIS LINE

<b>PART A</b>	
Dealer's Name and Address <b>JONES TELEVISION SERVICE</b>	No 24991
<b>15 MAIN ST NORTHTOWN N.S.W</b>	
TUBE TYPE <b>MW43-69</b>	SERIAL No <b>AB15827</b>
	DATE OF SUPPLY (to be completed by dealer) <b>4-8-56</b>
USER'S NAME AND ADDRESS <b>MR. J. GREEN</b>	
<b>21 ANTHONY ST. NORTHTOWN N.S.W</b>	

FOLD ALONG THIS LINE —

**DO NOT TEAR**

Fold Part B inwards, fold this flap over and tuck tongue into slot.

**DO NOT SEAL**

Please make sure that your name and address has been completed on the reverse side of Part B which will be returned to you after registration.

TONGUE

TEAR ALONG THIS LINE AND RETAIN PART C

**PART C** No 24991

**WARNING** If you do not receive Part B bearing date of registration within seven days, or you posting it to Mullard-Australia Pty. Ltd., inform the Technical Service Dept at the address below immediately.

### IMPORTANT NOTICE

This Guarantee becomes operative only under the following conditions:—

- That Parts A and B of the card are completed and returned to the Manufacturers of the tube within ten days from the date of receipt of tube by the user
- That the Guarantee covers operation only within the Manufacturer's published rating and does not cover misuse, consequential or accidental damage or loss or injury howsoever arising. The Manufacturer shall not be liable for any charges that the dealer is entitled to make for services involved in carrying out the terms of this Guarantee.
- That the Television picture tube is returned at the sender's own risk and expense, adequately packed in the Manufacturer's standard packing (complete with internal fittings) for the type returned, and the Manufacturer's accept no responsibility for loss or damage in transit or for the safe custody of any Television picture tubes returned to them. No claim will be entertained unless the tube is received with the glass bulb intact.
- That the acceptance of any Television picture tube for examination and test does not imply any obligation on the part of the Manufacturer to replace or return it.
- That if it is necessary to dismantle the tube for examination, the Manufacturer is at liberty to do so, without any obligation to replace or return it.
- That claims under the Guarantee will not be considered unless the tube is returned to the Manufacturers accompanied by a Form of Application for Examination, obtained from and properly completed in conjunction with a Radio Dealer, preferably the one from whom the tube was purchased, supported by proof, if required, of the date of its purchase or delivery as replacement under Guarantee.
- That the full List Price has been paid (except in the case of a replacement under Guarantee) and that the Manufacturer's identification or other marks have not been removed or defaced.
- That no claim for tube replacement under the terms of the Guarantee will be entertained unless the returned tube is accompanied by Part B of the Guarantee Card duly stamped by Mullard-Australia Pty. Ltd. with the Registration date.
- That Part B of the Guarantee Card has not been altered or defaced in any way.

N.B.—No person, firm or company has any authority to vary the conditions of this Guarantee.

Address all communications to:—  
Mullard-Australia Pty. Ltd., Technical Service Department,  
35-43 Clarence Street, Sydney, N.S.W.  
Telephone: BX2006  
Parts A and B of Card posted on 6TH AUGUST 1956  
(for user's convenience)

**IMPORTANT**—As this Guarantee becomes effective only if the Registration Card is duly received by Mullard-Australia Pty. Ltd., please ensure despatch immediately the tube is received. This Guarantee is not transferable.

Issued by  
Mullard-Australia Pty. Limited — 35-43 Clarence Street, Sydney  
592 Bourke Street, Melbourne  
Associated with Mullard Limited, London and Mullard Overseas Limited

A guarantee card accompanies each Mullard Radiant screen Picture Tube whether it has been supplied as initial equipment in a new television receiver or as a cartoned tube for replacement purposes. The picture tube type and serial number should be endorsed in ink on the front of the card which is made up of three sections—parts A, B and C.

In order that we can offer the most effective service and courtesy to Mullard Radiant Screen Picture Tube owners, and indirectly to television receiver distributors, wholesalers and service organisations, it is necessary that the following procedure be carried out. It will be helpful for the salesman to assist the customer in filling out the guarantee card at the time of sale, i.e., installation of a new receiver in a customer's home, the fitting of a replacement tube during service or the sale of a tube to a home constructor. It is then the purchaser's responsibility to—

Remove part C (which he permanently retains, this part carries the picture tube and serial number and also lists the conditions of guarantee).

Fold parts A and B together. Affix a 4d. postage stamp. Mail so as to reach Mullard-Australia Pty. Limited within 10 days of the date of purchase.

When received by our Technical Service Department, parts A and B are registered, part B is returned to the purchaser and part A is retained by us for record purposes.

In the event of a claim within the guarantee period, it is essential for the owner, with your assistance, to complete a "Form of Application for Examination" and return the picture tube, together with this form and part B of the guarantee card, to Mullard-Australia Pty. Limited, Sydney or Melbourne as applicable. (These forms are available through normal suppliers).

We take this opportunity to emphasise the importance of treating all picture tubes with the utmost care, as a damaged or scratched picture tube returned with a claim for replacement under guarantee may be rejected on this count alone. Remember that all picture tubes

returned under guarantee must be treated as fully serviceable pending the result of tests carried out in our Valve and Picture Tube Service Depot. An article on page 8 of this issue covers more fully the care and precautions to be taken in handling picture tubes and we shall be glad to answer any further queries you may have on this subject.

This procedure has been applied most successfully to the sale of millions of picture tubes by our parent company, Mullard Limited, London. In order that this may function as well in Australia it is necessary that we have your co-operation in assisting us to establish the system.

In the interest of cordial customer relationship it is imperative that the correct procedures be adhered to at all times, thus making for smooth and efficient handling of all picture tube claims under guarantee.

### HIGH SPEED VALVE TESTING

The Mullard High Speed Valve Tester has securely established itself in radio dealers' service departments in the United Kingdom. It is equally useful wherever valves are used in large numbers and a rapid evaluation of the condition of a particular valve is required.

When the appropriate control card for the valve type is inserted, the correct conditions for a sequence of tests are automatically provided. The tests are: heater or filament continuity, interelectrode insulation, cathode-to-heater insulation, insulation under working conditions, reverse grid current, anode current, and electrode continuity.

The tester and its range of cards are designed to cover all Mullard and competitive valve types which can be broadly classified as "receiving" valves, up to 35W anode dissipation. The answer which is provided to each of the tests is a value judgment: "good" — "indifferent" — "bad".

Full descriptive literature is available and demonstrations may be arranged by contacting the Communication and Industrial Valve Department in Sydney or Melbourne.

## 50AVP PHOTOMULTIPLIER

The 50AVP is a photoelectric multiplier tube consisting of a photocathode, a series of eleven electrodes with secondary emission factors considerably greater than unity, and a collector. The total current amplification from photocathode to collector is of the order of  $2.5 \times 10^6$  with a total supply voltage of 1800V. The 50AVP enables an amplification of this order to be obtained from a small device with a signal-to-noise ratio which is much better than that obtained with a simple photocell followed by a valve amplifier. The dark current is of the order of  $50 \times 10^{-9}$ A.

The average luminous sensitivity of the cathode is  $50 \mu\text{A}$  per lumen. The maximum spectral response is in the region  $4800\text{A} \pm 500\text{A}$ , with cut-off at about 3100 and 6500A.

The optically plane-parallel end window, with a useful diameter of 32mm, enables the distance of a light source to be determined accurately. The very constant electron transit time ensures high resolution of rapid trains of impulses.

The maximum continuous anode current is 0.1mA, and the maximum dissipation is 0.5W. The physical dimensions of the tube are: length  $121 \pm 6$ mm, and diameter  $38 \pm 1.5$  mm. A duodecal (B12A) base is used.

Applications of the 50AVP include scintillation counting, photometry, pyrometry, and a wide range of industrial counting, control, and measurement operations.

## DEFINITION OF DRIVE POWER

The value of grid current stated on the data sheets is intended only as a guide. In making adjustments to the circuit the important factor to note is the grid driving voltage. Both over-driving and under-driving will reduce efficiency.

$P_{\text{drive}}$

At low radio frequencies the drive power required for class C operation

## CURRENT MULLARD PUBLICATIONS

	PRICE	POST PAID IN AUSTRALIA
"Circuits for Tape Recorders"	2/6d.	3/0d.
"Transistors for the Experimenter"	2/6d.	3/0d.
"High Quality Sound Reproduction"	5/9d.	6/3d.
"Mullard Radio Valve Manual"	7/6d.	8/6d.
"Mullard Technical Handbook," Vol. 1, 1A, 2 and 3.	£6/6/0	£6/6/0* plus freight

\* The initial charge of £6/6/0 includes supply of the amendments for two years after which there is a nominal charge of 15/- p.a.

## MISCELLANEOUS LEAFLETS

In addition to the publications above a selection of leaflets listed below are available free of charge from the Technical Service Department, Mullard-Australia Pty. Ltd., Box 2118, G.P.O., Sydney.

Mullard World Series Valves for Audio.  
Mullard Transmitting Valve Data.  
Mullard Halogen Quenched Geiger-Muller Tube Guide.  
Mullard 6080 Series Regulator Valve.  
Mullard 75C1 Voltage Stabiliser.  
Thyratrons for the Control of Small Currents.  
QQV03-10 Application Notes.

## MULLARD SOUND FILM SERVICE

(16 m.m.)

	RUNNING TIME
"Discharge through Gases"	11 minutes
"Made for Life"	34 minutes
"Mirror in the Sky"	22 minutes
"Principles of Ultrasonics"	15 minutes
"Special Quality Valves"	25 minutes
"The Linear Accelerator"	12 minutes
"The Manufacture of Radio Valves"	22 minutes
"T.V." Part 1 and 2 (Film strip).	

These films are available on loan to educational groups, etc.

Applications should be made as follows:—

Title of Film .....

Date Required .....

Name of Organisation .....

Address .....

Signed .....

can be calculated from the expression.

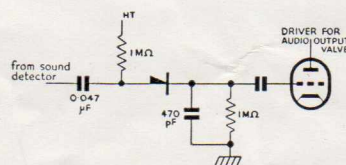
$$P_{\text{drive}} = 0.9 \times V_{\text{in(pk)}} \times I_{\text{gt(dc)}}$$

At higher frequencies more drive power is required because of input

damping. The value which is given in the data sheets for  $P_{\text{load(driver)}}$  is the power which must be available from the driver stage to provide for the input damping and fixed frequency intermediate circuit losses.

## HAM SHACK

In this month's edition we feature a simple, inexpensive noise limiter circuit which is shown in the accompanying figure. The circuit functions as follows: A small current flows between h.t. and earth through the two resistors and Germanium diode. The diode which may be a Mullard OA81 or OA85, is thus positively biased providing a



conductive path for normal audio frequency signals. Interference, however, drives the diode into its inverse current region and the high back resistance virtually open-circuits the signal path. This circuit can be most helpful when incorporated in the more basic types of communication receiver. With a simple circuit modification it may be switched in or out as desired.



# HANDLE WITH CARE

## SOME HINTS ON THE TREATMENT OF PICTURE TUBES

Visitors to the Mullard Picture Tube Plant are always impressed with the careful way in which the picture tubes are handled. At each stage from the moment when the bulbs are issued to the Production Department until the tubes are exhausted and sealed, they are transported from department to department by overhead runways; and after pumping, each tube is enclosed in a linen bag to protect it from damage. Although such elaborate precautions are neither practicable nor necessary in the dealer's service department, picture tubes should be handled with due care, and some practical hints on the subject are given below.

Television Picture Tubes are, to use the modern idiom, "functional" in form, but although this results in a product which is admirably suited for its particular duty, they are of somewhat awkward shape for easy handling. Of necessity, most of the weight is concentrated at the wide end of the tube—the cone and faceplate—with the result that the junction between neck and cone is the weakest part mechanically. Again, the faceplate being comparatively flat, the tube is usually placed face downward on the bench—a position in which the risk of scratching the surface is greatest. Yet, with a little care and forethought, the possibility of breakage and the risk of blemishing the surface of the faceplate can be almost entirely eliminated.

### REMOVAL FROM CARTON

Each tube is delivered from the factory carefully packed in a specially designed carton which safeguards the tube from mechanical damage during transit and storage. The tube is fitted in the carton faceplate downward, and this at once gives the clue to the correct way of lifting and carrying it. After removal of the various packing pieces, the tube should be removed by slipping both hands down and under the edge

of the faceplate at opposite sides of the tube and carefully withdrawing it from the carton. This obviates the possibility of subjecting the junction between the cone and neck to undue strain.

### CARRYING

This position, face downward, with both hands under the edge of the faceplate as shown in Fig. 1 is also the safest and most convenient way of carrying a picture tube. It goes without saying that a tube should never be carried by merely clutching the neck only.

### AVOIDING SCRATCHES

The faceplate of a picture tube can easily be scratched by contact with a hard or sharp surface, and such blemishes obviously mar the picture. A tube should therefore never be set down upon the surface of the work bench as dust, grit, screws or tools are often present and may cause irreparable damage. It is quite easy to fit up a rack or shelf or keep a clear space on the bench or table for setting down the picture tube. The surface should be covered with felt or thick cloth for additional protection.

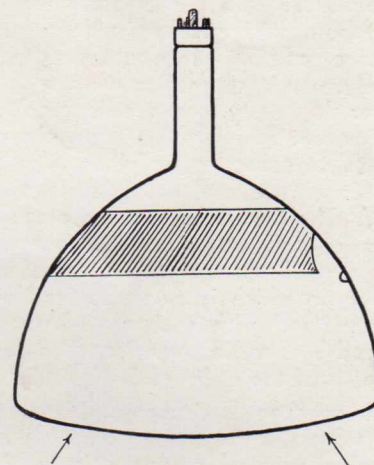
### CLEANING

The faceplate of a cathode ray tube will, in time, collect a film of dust by electrostatic attraction. It can be cleaned by wiping it over with a soft, slightly damp cloth, after which it should be thoroughly dried with a clean cloth. If desired, one of the proprietary anti-static preparations may be used, carefully following the maker's instructions.

### REPACKING FOR TRANSIT

Finally, if it is necessary to return a tube for examination, it should be properly packed. If possible the original carton should be used, but if this is not available a suitable carton will be issued by the Mullard Service Department on receipt of an application stating the type of tube. When re-packing, the tube should be inserted in the carton face

Fig. 1.



LIFT BY PLACING HANDS HERE

downward, and a soft tissue pad placed in the bottom of the carton to prevent the faceplate becoming scratched.

## THYRATRONS FOR INDUSTRIAL CONTROL

The increasing use in industry of electronic methods of measurement and control has led to the development of many thyratrons and thyatron circuits. The thyatron is capable of controlling currents up to about 20 amperes at normal supply voltages. It is particularly suitable where precise control, rapid response, and a low loss of power in the control operation are necessary. Its many applications include motor and welder control, power regulation, the inversion of d.c. to a.c., relay operation, the control of a variety of industrial processes, and the regulation of lighting. Mullard produce suitable gas-filled or mercury vapour thyratrons for all these purposes.

- EN32 Inert gas-filled triode
- EN70 " " " tetrode
- EN91 " " " "
- EN92 " " " "
- EN93 Argon filled triode
- MT5545 Inert gas-filled triode
- XG1-2500 Mercury-vapour triode
- XG2-12 " " "
- XG2-25 " " "
- XG2-6400 " " "
- XG5-500 " " "
- XG15-12 " " "
- XR1-1600 Inert gas-filled triode
- XR1-3200 " " " "
- XR1-6400 " " " "

### CIRCULATION

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Return copy to office for filing.