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.

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."

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.
"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 6BQS/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 (R4 = 1.0MΩ) in the anode circuit. Direct coupling from the anode of the EF86 to the control grid of the 6BQS/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 ±1dB (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 × 6in × 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
- 6BQS/EL84
  - Anode Voltage: 290V
  - Cathode Voltage: 27V
  - Cathode Current: 48mA
  - Screen Grid Voltage: 295V
- EF86
  - Anode Voltage: 30V
  - Anode Current: 190mA
  - Screen Grid Voltage: 220V

FIG. 1.—CIRCUIT OF '3-3' AMPLIFIER

![Circuit Diagram](image-url)

*Rs should be R2 for 15Ω loading and 150Ω for 3.75Ω loading.
LIST OF COMPONENTS

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

Resistors
RV1 500kΩ
RV2 500kΩ
R3 10MΩ ±20%
R4 1.0MΩ ±10%
R5 82Ω ±10% for 15Ω load W
or 150Ω ±10% for 3.75Ω load W
R6 390kΩ ±10%
R7 1kΩ ±20%
R8 560Ω ±20%
R9 6.8kΩ ±10%
R10 150Ω ±20%
R11 22kΩ ±10%
R12 3.9kΩ ±10%
R13 560Ω ±5%
RV14 50kΩ
R15 1kΩ ±20%

1 Logarithmic: carbon. 2 Linear: carbon. 3 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 Silvered Mica or Ceramic
C1 390pF ±10%
C2 0.25µF
C3 390pF ±10%
C4 50-500µF Paper
C5, C8 0.1µF Double Electrolytic
C6 25µF Electrolytic
C7 25µF Electrolytic

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).

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.

Capacitors
C1 0.02µF
C2 390pF ±10%
C3 0.25µF
C4 390pF ±10%
C5, C8 50-500µF
C6 0.1µF
C7 25µF
C9 25µF

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
MULLARD RADIAN TUBE GUARANTEE

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 cartonned 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 customier 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.

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, Sydney or Melbourne as applicable. (These forms are available through normal suppliers).

We take this opportunity to emphasize 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 type valve 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 2.5×10⁶ 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 50×10⁻⁶A.

The average luminous sensitivity of the cathode is 50μA per lumen. The maximum spectral response is in the region 4800±500A, 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±6mm, and diameter 38±1.5mm. 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 overdamping and under-driving will reduce efficiency.

\[ P_{\text{drive}} = 0.9 \times V_{\text{in(pk)}} \times I_{\text{grid}} \]

At low radio frequencies the drive power required for class C operation can be calculated from the expression.

At higher frequencies more drive power is required because of input conductive path for normal audio frequency signals. Interference, however, drives the diode into its inverse current region and the high back resistance virtually opens-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.

Did we address your magazine correctly? If not, please notify the editor of any change. Thank you.
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 possibility of breakage and the risk of blemishing the surface is greatest. Yet, with a little care and forethought, the risk of breakage and the possibility of subjecting the junction between the cone and neck to undue strain 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. I 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