THE RAPID MULLARD VALVE GUIDE

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REPAIRS A SPECIALTY

Mullard

THE · MASTER · VALVE

Introduction

THIS booklet is issued in order to provide a rapid guide to answer technical queries, such as "what Mullard P.M. valve am I to use in the first stage of an audio frequency amplifier, and what H.T. current does it require?"

As the popularity of Mullard valves continues to increase by leaps and bounds, such information is sure to be in greater demand than ever.

Be sure that you keep this little book always handy. It will save you many wasted minutes.

RAPID GUIDE

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Special Valves

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High Frequency Amplification

The essential portions of a radio receiver are first, an aerial-earth system which collects energy radiated from the transmitting station; second, a tuning device which may be considered as selecting the signals it is desired to receive; third, a detector (usually a three-electrode thermionic valve) which separates the audio-frequency component of the signal from the radio-frequency component, and fourth, a sound reproducer which may be either a telephone or a speaker.

The power output of a single valve detector is determined by many factors, chief among which are the power of the transmitting station and its distance from the receiver, and the efficiency of the receiving aerial. In the most favourable circumstances, however, a single valve set can only operate headphones, and if it be desired to use a speaker, further valves must be employed to amplify the signals. If the incoming signals are fairly strong, it will be sufficient to amplify the audio-frequency portion after it has left the detector valve, but very weak signals must be amplified before reaching the detector. An amplifier used for this purpose is termed a high-frequency or radio-frequency amplifier, and may be said to increase the *range* rather than the *power* of the receiver.

The main principle of high-frequency amplification is that incoming radio-frequency impulses are applied to the grid of the high-frequency valve, and give rise to much stronger but precisely similar impulses in the anode circuit of that valve. In the anode circuit is included apparatus of high impedance, and the oscillating voltage drop across this "loaded" portion of the circuit is applied to the grid of the following valve, which is usually the detector but may be a second- high-frequency amplifier. The "load" in the anode circuit of the H.F. valve may take several forms—a resistance, a choke, a high-frequency transformer, or a tuned circuit. For the sake of simplicity, we will discuss the tuned anode circuit which consists of a coil shunted by a variable condenser.

In the original "straight" high-frequency amplifier, the aerial tuning circuit, brought into resonance with the incoming signal, supplies impulses of maximum strength to the grid of the H.F. valve, and the tuned anode circuit, also adjusted to resonance, provides maximum voltage swings to be applied to the grid of the following valve. At first sight, this appears to be a most efficient arrangement, but in practice a difficulty occurs, because, in an ordinary three-electrode valve, the inter-electrode capacity is sufficient to permit energy to be fed back from the anode to the grid circuit. The feed-back is cumulative, and the valve is thrown into oscillation, made manifest by a continuous howl in the 'phones or speaker. Further feed-back may also occur due to magnetic coupling between the anode and grid circuits of the valve. Instability of the receiver cannot, of course, be permitted. Feed-back due to the coupling of coils and other parts of the circuit can be eliminated by screening and suitably spacing the components, but feed-back in the valves themselves is a more difficult proposition. It may be solved in three principal ways.

1. Damping, either by applying sufficient positive bias to the grid of the valve to cause it to cease oscillating, or by introducing intentional losses into the tuned circuits by the insertion of resistances. This method depends for its success upon working the valve inefficiently, and is therefore not to be recommended.

2. Neutralising the feed-back in the valve by an intentional feed-back of exactly opposite phase. This is done by using a centre-tapped coil in the anode circuit, one half of the coil forming the

normal anode coil, while the other half is connected back to the grid circuit through a small variable condenser. Neutralised circuits are quite efficient and permit a reasonable percentage of the amplification factor of the valve to be utilised. A difficulty sometimes arises, however, owing to the fact that the setting of the neutralising condenser is not constant over the whole tuning range of the receiver.

3. The third, and most modern method of overcoming high-frequency instability is the use of the four-electrode valve or screened-grid valve in place of the ordinary triode in the H.F. stages. This valve has, in addition to the normal electrodes—filament, grid and anode—a fourth electrode in the form of an extra grid which is located between the control grid and the anode. The anode and control grid are fairly widely separated in order to reduce inter-electrode capacity and the screen grid, which is maintained at a fairly high positive potential, is at earth potential with respect to the radio-frequency signal, and therefore acts as an earthed screen between the control grid and anode, effectively preventing feed-back.

When using screened grid valves, therefore, the anode circuit may be accurately tuned to the frequency of the incoming signals, thus ensuring the maximum transference of energy, without risk of instability, and an effective amplification of 50 per stage is frequently obtained, comparing favourably with the gain of 20 per stage, which represents the best possible achievement with a neutralised receiver of average efficiency.

The Mullard range of screened-grid valves consists of four types—P.M.12, P.M.14, and P.M.16, which are battery operated valves for use with 2-volt, 4-volt, and 6-volt accumulators respectively, and S.4V, which is an indirectly heated valve for operating on a 4-volt A.C. low tension supply. Full details of their working characteristics are given on pages 18, 26 and 34.

Audio or Low Frequency Amplification

The process of audio frequency amplification consists in magnifying the signals passed by the detector valve to such a degree that they are powerful enough to operate a speaker. In general principle, low frequency amplification is precisely similar to high frequency amplification, but it should be remembered that an audio frequency amplifier handles only audio-frequency current, and therefore the difficulties due to unwanted capacity effects are not so serious.

The low frequency amplifier in an ordinary broadcast receiver usually consists of two, and never more than three stages. The early stages are intended to give merely voltage amplification, but the last valve must be capable of delivering a comparatively large amount of power to the speaker circuit. For this reason, although all the valves following the detector are low frequency amplifiers, the last, or output stage, is always referred to as the power amplifier, and must be equipped with a specially designed power valve.

Low Frequency Couplings.

Coupling between the detector and the first low frequency valve, and between stages, is arranged on a similar system to that adopted in a high frequency amplifier, namely, by including in the anode circuit of the preceding valve a component having a fairly high impedance, the alternating voltage drop across this impedance being applied to the grid of the following valve. Owing, however, to the fact that the amplifier is dealing with audio-frequencies instead of radio-frequencies, the nature of the coupling units in an L.F. amplifier differs considerably from that in high frequency amplifiers. In the first place, a high impedance cannot be obtained by using a tuned circuit, and, owing to the comparatively low frequency, chokes and transformers must be provided with iron cores.

The types of A.F. coupling employed are three in number:—

1. *A.F. Transformer.*—This is an iron-cored transformer, the primary winding being included in the anode circuit of the preceding valve and the secondary in the grid circuit of the following valve.

2. *Resistance-Capacity Coupling.* In this form of coupling a high resistance is included in the anode circuit of the preceding valve, connection to the grid of the following valve being through a fixed condenser which isolates the grid from the positive charge on the preceding anode. A high resistance leak is included in the grid circuit to discharge the negative charge which accumulates on the grid due to the incoming signals. The stage gain with this form of coupling is limited to that obtained from the valve, and the advantage lies only in the perfectly uniform response to all musical frequencies.

3. *Choke-Capacity Coupling.* Because of the high resistance included in the anode circuit of a resistance capacity amplifier, it is necessary to use a somewhat large value of H.T. voltage. This disadvantage is avoided in the choke-capacity amplifier, in which the place of the resistance is taken by an iron-cored choke.

CHOICE OF VALVES.

It is obvious that the greater the impedance in the external anode circuit of a valve, the greater will be the voltage available to be transferred to the grid of the following valve. In practice, the best results are obtained when the external impedance bears a definite relation to the internal impedance of the valve, the optimum condition for a transformer coupled amplifier being when the external impedance is about twice that of the internal impedance, and in a resistance-capacity or choke coupled amplifier when the ratio is about 5 to 1. In choosing valves for an A.F. amplifier therefore, it is necessary to select those having appropriate anode impedance.

Another point of great importance is the amplification factor of the valve, which is defined as the amount of change in anode voltage which would have the same effect upon the anode current as a 1-volt change in grid potential. It is, in other words, a measure of the maximum theoretical voltage amplification obtainable from the valve. In practice, this maximum can never be attained because only a portion of the alternating energy in the anode circuit can be passed to the following valve. Other things being equal, therefore, a high amplification factor is preferable to a low amplification factor, and is particularly desirable in a resistance-capacity coupled amplifier because, as has already been pointed out, the stage gain is limited to that obtainable from the valve itself.

The efficiency of a valve can be judged by the value of its "mutual conductance." This is a factor which represents the change in anode current (in milliamps) due to a 1-volt change in grid voltage, measured under some standard conditions, usually at 100 volts anode potential and zero grid volts. In other words, it expresses the mutual effect of the anode impedance and the amplification factor upon the performance of a valve, and the higher the mutual conductance the better the valve.

POWER VALVES.

Because the speaker is a power-operated mechanism, the final valve in an L.F. amplifier must be capable of delivering a comparatively large power output, that is to say the audio-frequency A.C. component of the anode current must be large. This means that the internal impedance must be small. In multi-stage amplifiers, high amplification factor in the power valve is not of great consequence, as sufficient voltage amplification is obtained in the early stages.

One of the most recent developments in the design of output valves is the five-electrode valve or pentode, of which the Mullard P.M. Pentone is a typical example. These valves are a development from the screened-grid valve, and contain, in addition to filament, control grid, auxiliary grid and anode, a fifth electrode in the form of a further grid, which is situated between the auxiliary grid and anode, and is connected internally to the filament. By means of this construction a valve is produced having an output comparable with that of a normal super-power valve, and with a very high amplification factor. It therefore gives results equivalent to a two-stage amplifier employing three-electrode valves, the last stage being a super-power valve. In other words, if a Mullard P.M. Pentone be employed in the output stage it should, in most cases, directly follow the detector valve, no intermediate L.F. stage being necessary. Full information on Mullard P.M. Pentones is given on pages 25, 32, 33 and 40.

GRID BIAS.

The properties of a valve can be conveniently recorded by a graph in which the anode current at some definite anode voltage is plotted against grid volts. Characteristic curves of various Mullard valves are given in the following pages. It will be noticed that the general form of all these curves is like an elongated letter S, with a central straight portion and a bend at the top and bottom. It is important that, except when used as an "anode-bend detector," a valve should operate under conditions corresponding to the straight portion of its characteristic curve, that is to say that equal changes in grid volts should produce equal changes in anode current.

To ensure these conditions, it is necessary to apply a steady negative voltage to the grid. This negative grid bias can conveniently be obtained from a small dry battery. The calculation of appropriate grid bias for any valve is a simple matter if the characteristic curve is available, the method being as follows:—

The straight part of the characteristic of most valves commences at a point corresponding to a small positive grid potential and extends to a point corresponding to a comparatively large negative grid potential. The limits of grid potential covered by the straight portion is known as the "grid base" of the valve, and the correct negative bias is approximately the voltage represented by the mid-point of the grid base. Actually slightly greater negative bias is desirable.

Apropriate values of grid bias for all Mullard valves at various anode voltages are given on the tables on pages 16 and 17.

Mullard A.C. Valves

Present-day receiving valves represent a very high pinnacle of efficiency as regards both performance and power consumption, while types are available for practically every purpose to which a valve can be put. Great as have been the technical advances during the past few years. however, one unsatisfactory feature has persisted—the necessity for using some form of battery for filament heating.

The disadvantages attaching to the use of "A" batteries are too well-known to need repetition. and it will suffice to point out that the accumulator, although reasonably efficient, is inconvenient, expensive and liable to cause considerable damage either through the leakage of acid or the emission of corrosive fumes.

For a considerable time it has been recognised that the ideal radio receiver would obtain all its power supply from the electric light mains. High Tension supply was the first problem to be tackled on these lines, chiefly because the dry high tension batteries were even more unsatisfactory than low tension accumulators and because the superpower valves then being introduced demanded anode currents which could not be economically obtained from primary batteries. Mullards are now removing once and for all the bugbear of the low tension accumulator by the introduction of a complete range of receiving valves, the filaments of which may be operated from an alternating current supply.

There are two main methods of distributing electric current for heating and power, one in the form of a direct current supply and the other alternating current supply at frequencies ranging from 25 to 100 cycles per second. Although there are still a number of direct current installations in this country, they are greatly outnumbered by the districts enjoying an alternating current supply and although A.C. frequencies employed include standard values of 25, 40, 50, 60 and 100 cycles per second, the most commonly adopted is 50 cycles per second and this figure will within a few years be standardised for all installations. It is because A.C. supply will ultimately become universal throughout the country that the time is opportune for the introduction of A.C. valves.

INDIRECTLY HEATED CATHODE.

The function of the low tension supply to a valve is to heat the cathode so that it will emit electrons. The electrons are attracted through the vacuum to the anode by virtue of the positive charge supplied by the high tension battery. The stream of electrons travelling from the filament to the anode is known as the anode current and it is the function of the grid to exercise control of this current by virtue of the varying charges applied to the grid.

The foregoing are the common features of all radio valves, and the difference between the Mullard A.C. valves and the regular battery heated valves lies in the method of heating the cathode.

Mullard A.C. valves are of the indirectly heated type, that is to say, they are fitted with heating elements which raise the temperature of the cathode by radiation. The heaters are standardised and consume 1 ampere at 4 volts, which may be conveniently supplied by a Mullard P.M. Filament Transformer.

By using a separate heater, hum can be entirely eliminated without employing additional electrical apparatus in the circuit. A further advantage is that the indirectly heated valves have better characteristics than the directly heated valves. because the cathode is of large area, and the grid can be arranged to be nearer the cathode than in the directly heated valve.

Four types of Mullard A.C. valves are available, and include a screened grid valve for use as a highly efficient H.F. amplifier, two general purpose valves, and a power amplifier. If a large amount of power is required for the output stage. a P.M.254 super-power valve, a P.M.24 Pentone, or a P.M.24A. Pentone may be employed, the filaments of these valves being connected to the 4-volt A.C. supply. Details of the Mullard range of A.C. Valves will be found on pages 46 to 52.

RAPID MULLARD VALVE GUIDE

Purpose	Remarks	For use with battery low tension supply			For use with A.C. Low tension supply.
		2-volt accum'tor	4-volt accum'tor	6-volt accum'tor	
H.F. amplifier ..	Screened grid	P.M. 12	P.M. 14	P.M. 16	S 4V. (Indirectly heated valves with heaters rated at 4 volts 1 amp.)
	Neutralised and circuits * other than screened grid	P.M. 1 H.F	P.M. 3	P.M. 5X	354V
Detector	Followed by resistance-capacity coupling	P.M. 1A	P.M. 3A	P.M. 5B	354V
	Followed by transformer coupling	P.M. 1L.F. P.M. 2DX	P.M. 3 P.M. 4DX	P.M. 5X P.M. 6D	164V
L.F. amplifier (except output stage)	Followed by resistance-capacity coupling	P.M. 1H.F.	P.M. 3	P.M. 5X	354V
	Followed by transformer coupling	P.M. 1L.F. P.M. 2DX	P.M. 3 P.M. 4DX	P.M. 5X P.M. 6D	164V
Power amplifier (output valve)	Moderate power for small speakers	P.M. 2	P.M. 4	P.M. 6	104V
1. Following a stage of low frequency amplification	"Super power" type for large speakers	P.M. 252	P.M. 254	P.M. 256	P.M. 254. directly heated valve may be used on 4-volt A.C. circuit
Power amplifier (output valve) 2. Pentone, specially suitable for sets having no other L.F. stage.	A single stage amplifier incorporating this type of valve will give an output equivalent to that of a 2-stage amplifier having a super-power valve in the last stage	P.M. 22	P.M. 24	P.M. 26	P.M. 24 or P.M. 24A, directly heated "Pentone" may be used on 4-volt A.C. circuit.

* Except in certain American sets employing H.F. transformer having low impedance primaries.

GRID BIAS TABLE FOR MULLARD VALVES

D.C. VALVES.

Type of Valve.	ANODE VOLTAGE				
	50 Volts.	75 Volts.	100 Volts	125 Volts	150 Volts.
P.M.12	0	0	0 to 1.5	0 to 1.5	1.5
P.M.1A	0	0 to 1.5	0 to 1.5	0 to 1.5	1.5
P.M.1 H.F.	0	1.5	1.5 to 3.0	3.0	3.0 to 4.5
P.M.1 L.F.	1.5	3.0	4.5	6.0	7.5
P.M.2 DX	0 to 1.5	1.5	3.0	4.5	6.0
P.M.2	3.0	4.5	7.5	10.5	13.5
P.M.252	3.0	6.0	9.0	12.0	15.0
*P.M.22	1.5 to 3.0	3.0	6.0	7.5	10.5
P.M.14	0	0	0 to 1.5	0 to 1.5	1.5
P.M.3A	0	0	0 to 1.5	0 to 1.5	1.5
P.M.3	0 to 1.5	1.5	3.0	4.5	6.0
P.M.4 DX	0 to 1.5	0 to 1.5	1.5 to 3.0	3.0 to 4.5	4.5 to 6.0
P.M.	3.0	4.5	6.0 to 7.5	9.0	10.5 to 12.0
P.M.254	4.5	7.5	12.0 to 13.5	16.5 to 18.0	22.5
*P.M.24	1.5 to 3.0	3.0	6.0	9.0	12.0
P.M.16	0	0	0 to 1.5	0 to 1.5	1.5
P.M.5B	0	0 to 1.5	0 to 1.5	0 to 1.5	1.5
P.M.5X	0 to 1.5	1.5	1.5 to 3.0	3.0	3.0 to 4.5
P.M.6D	0 to 1.5	0 to 1.5	1.5 to 3.0	3.0 to 4.5	4.5
P.M.6	3.0	4.5	6.0	7.5	9.0
P.M.256	4.5	9.0	12.0	15.0	18.0
*P.M.26	3.0	6.0	9.0	12.0	15.0

* The voltage used on the auxiliary grids of these valves should have the same value as that used on the anodes.

GRID BIAS—*continued*

POWER VALVES.

Type of Valve.	ANODE VOLTAGE				
	75 Volts	100 Volts	125 Volts	150 Volts.	180 Volts
S4V (Screened Grid)	0	0 to 1.5	0 to 1.5	1.5	—
354 V.	1.5 to 3.0	1.5 to 3.0	1.5 to 3.0	3.0 to 4.5	3.0 to 4.5
164 V.	3 0	4.5	6.0	7.5	9.0 to 10.5
104V	3.0 to 4.5	4.5 to 6.0	6.0 to 7.5	7.5 to 9.0	10.5
A.C.3 (U.X. 226) ..	4.5	6.0	7.5	9.0	—
102T. (U.Y. 227) ..	—	4.5 to 6.0	7.5	9.0	10.5 to 12.0
A.C.4 (U.X. 171A.) ..	—	10.5	15.0	19.5	25.5

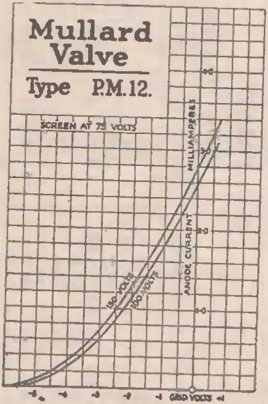
A.C. VALVES.

Type of Valve.	ANODE VOLTAGE					
	200 Volts.	250 Volts.	300 Volts.	400 Volts.	500 Volts.	1000 Volts.
*P.M.24 A	21.0	27.0	33.0	—	—	—
DFA. 6	15.0	18.0 to 19.5	24.0	36.0	—	—
DFA. 7	60.0	80.0	100.0	150.0	—	—
DFA. 8	3.0 to 4.5	4.5 to 6.0	6.0 to 7.5	7.5 to 9.0	—	—
DFA. 9	21.0	30.0	—	—	—	—
DO/20 ..	21.0	30.0	33.0	45.0 to 48.0	—	—
DO/40 ..	—	—	—	—	30.0	80.0
DO/60 ..	24.0	36.0	45 to 48	69.0 to 72.0	93.0	—

* Maximum auxiliary grid voltage on this "Pentone" is 200 volts.

Mullard
Valves
for use with
2 - VOLT
accumulator

Type P.M. 12
SCREENED GRID VALVE.



A four - electrode screened grid valve for use as a high frequency amplifier employing a high impedance anode coupling such as the tuned-anode circuit.

In order to obtain full benefit of the low inter-electrode capacity and high amplification factor of this valve, a metal screen should be fitted to separate the anode and grid circuits and thus prevent feed-back between their components.

Max. Filament Voltage	..	.. 2.0 volts.
Filament Current ..	..	.. 0.15 amp.
Max. Anode Voltage	..	.. 150 volts.
Positive Screen Voltage	..	.. 75 volts.
*Anode Impedance ..	..	.. 230,000 ohms.
*Amplification Factor	..	.. 200.
*Mutual Conductance	..	.. 0.87 mA/volt.

* At Anode Volts 100; Screen Volts 75; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
2 - VOLT
accumulator

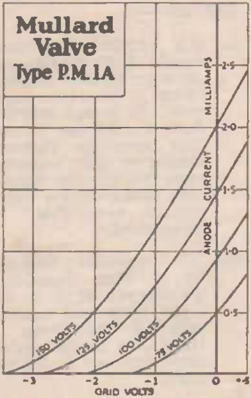
Type P.M. 1A

A valve having high impedance and high amplification factor, suitable for use as:—

(a) H.F. amplifier, using resistance capacity coupling. The anode resist. should have a value of about 100,000 ohms.

(b) Detector, when coupled to the following L.F. amplifier by a resistance-capacity coupling unit. The anode resistance should be up to ½ megohm (500,000 ohms) unless reaction be incorporated, in which case the resistance should not exceed 200,000 ohms.

(c) L.F. amplifier, first stage only when the input signals are very weak, and when coupled by R.C. coupling to the next stage



Max. Filament Voltage	.. 2.0 volts.
Filament Current	.. 0.1 amp.
Max. Anode Voltage ..	.. 150 volts
*Anode Impedance	.. 51,000 ohms.
*Amplification Factor ..	.. 36.0.
*Mutual Conductance ..	.. 0.7 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

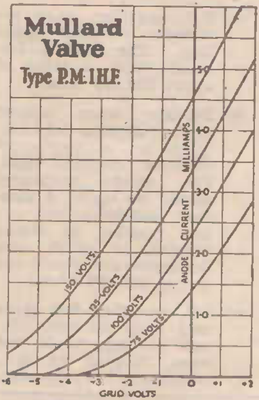
Mullard
Valves
for use with
2 - VOLT
accumulator

Type P.M. 1H.F.

A valve having medium impedance and medium amplification factor, and suitable for use as:—

(*a*) H.F. amplifier with tuned anode, H.F. transformer or other form of coupling except resistance-capacity. It is not suitable, however, for use in certain American receivers employing H.F. transformers having low impedance primaries, for which circuits type P.M.2 is recommended.

(*b*) L.F. amplifier followed by a high impedance transformer or a second stage resistance-capacity coupling, employing a fairly low anode resistance, say, up to 100,000 ohms.



Max. Filament Voltage	..	.. 2.0 volts.
Filament Current ..	..	.. 0.1 amp.
Max. Anode Voltage	..	.. 150 volts.
*Anode Impedance ..	..	.. 22,500 ohms.
*Amplification Factor	..	.. 18.0.
*Mutual Conductance	..	.. 0.8 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

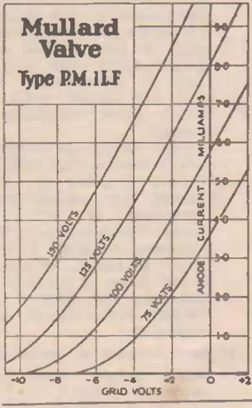
Mullard
Valves
for use with
2 - VOLT
accumulator

Type P.M. 1 L.F.

A valve with a medium impedance and medium amplification factor suitable for use as:—

(*a*) Detector when coupled to the following valve by a medium impedance coupling such as transformer or choke.

(*b*) L.F. amplifier for all stages except the last or "power" position.



Max. Filament Voltage	.. ..	2.0 volts.
Filament Current ..	.. ..	0.1 amp.
Max. Anode Voltage	.. ..	150 volts.
*Anode Impedance ..	.. ..	12,000 ohms.
*Amplification Factor	.. ..	11.0.
*Mutual Conductance	.. ..	0.9 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
2 - VOLT
accumulator

Type P.M. 2DX

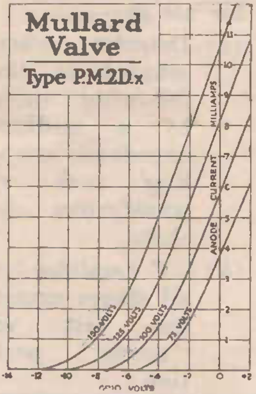
A valve having a very steep slope, specially suitable for use as:—

(*a*) Highly sensitive detector using either leaky-grid or anode-bend rectification. It is possible to employ comparatively low anode voltages with these valves, and in the interest of both quality and economy, it is advisable to use the lowest voltage which gives satisfactory results.

Full advantage of these valves results when transformer coupling is employed, but satisfactory operation is obtained using choke-capacity or resistance-capacity coupling. In the latter case, a low value of anode resistance, i.e., 20,000 to 50,000 ohms should be employed.

(*b*) Low frequency amplifier.

(*c*) Small power valve for moderate volume.



Max. Filament Voltage	.. ..	2.0 volts.
Filament Current ..	.. ..	0.25 amp.
Max. Anode Voltage	.. ..	150 volts.
*Anode Impedance ..	.. ..	10,700 ohms.
*Amplification Factor	.. ..	13.5.
*Mutual Conductance	.. ..	1.25 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

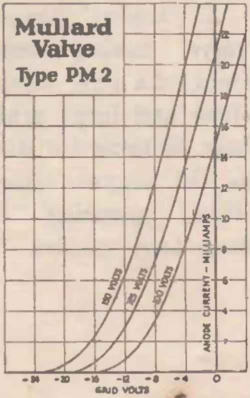
Mullard
Valves
for use with
2 - VOLT
accumulator

Type P.M. 2

A valve with low impedance suitable for use as:—

(*a*) Power valve for moderate output.

(*b*) Low frequency amplifier in the stage before the power stage using transformer coupling, between them.



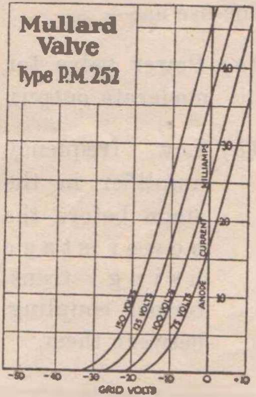
Max. Filament Voltage	.. ..	2.0 volts.
Filament Current ..	.. ..	0.2 amp.
Max. Anode Voltage	.. ..	150 volts.
*Anode Impedance ..	.. ..	4,400 ohms.
*Amplification Factor	.. ..	7.5.
*Mutual Conductance	.. ..	1.7 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
2 - VOLT
accumulator

Type P.M. 252



A "super" power valve having low impedance, steep slope and large grid base, suitable for use as the output valve when operating a large loud speaker.

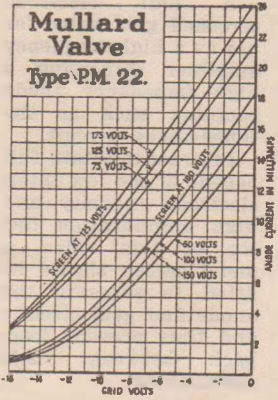
Max. Filament Voltage	.. 2.0 volts.
Filament Current	.. 0.3 amp.
Max. Anode Voltage ..	.. 150 volts.
*Anode Impedance	.. 2,600 ohms.
*Amplification Factor ..	.. 5.4.
*Mutual Conductance ..	.. 2.1 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
2 - VOLT
accumulator

Type P.M. 22
"PENTONE."



A five-electrode valve for use in the last or output stage of a low-frequncy amplifier. The only extra connection required when using this valve in a receiver is a wire between the auxiliary grid terminal on the side of the base and the H.T. supply. The auxiliary grid voltage should be approximately the same as the anode voltage. In order to prevent L.F. interaction when supplying this valve from an H.T. unit, the auxiliary grid connection should be taken through a Mullard wire-wound resistance of 5,000 ohms and a condenser of 2 m.fd. capacity connected between the auxiliary grid and H.T.—

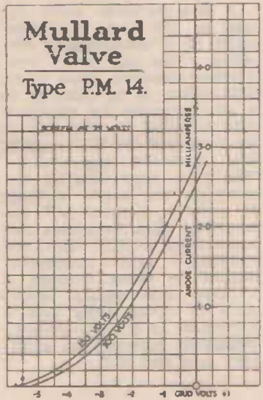
Max. Filament Voltage	.. 2.0 volts.
Filament Current	.. 0.3 amp.
Max. Anode Voltage ..	.. 150 volts.
Auxiliary Grid Voltage ..	.. As H.T.+
*Anode Impedance	.. 62,500 ohms.
*Amplification Factor ..	.. 82.
*Mutual Conductance ..	.. 1.3 mA/volt.

* At Anode Volts 100; Grid Volts Zero; Aux. Grid Volts 100.

For Price, see page 63.

Mullard
Valves
for use with
4 - VOLT
accumulator

Type P.M. 14
SCREENED GRID VALVE.



A four - electrode screened grid valve for use as a high frequency amplifier employing a high impedance anode coupling such as the tuned-anode circuit.

In order to obtain full benefit of the low inter-electrode capacity and high amplification factor of this valve, a metal screen should be fitted to separate the anode and grid circuits and thus prevent feed-back between their components.

Max. Filament Voltage	4.0 volts.
Filament Current	0.075 amp.
Max. Anode Voltage	150 volts.
Positive Screen Voltage	75 volts.
*Anode Impedance	230,000 ohms.
*Amplification Factor	200.
*Mutual Conductance	0.87 mA/volt.

* At Anode Volts 100; Screen Volts 75; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
4 - VOLT
accumulator

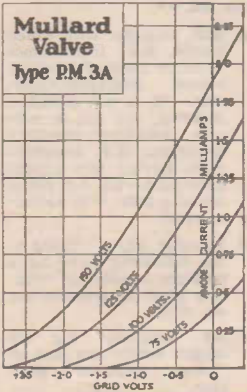
Type P.M. 3A

A valve having high impedance and high amplification factor, suitable for use as:—

(*a*) H.F. amplifier, using resistance capacity coupling. The anode resistance should have a value of about 100,000 ohms.

(*b*) Detector, when coupled to the following L.F. amplifier by a resistance capacity coupling unit. The anode resistance should be up to ½ megohm (500,000 ohms) unless reaction be incorporated, in which case the resistance should not exceed 200,000 ohms.

(*c*) L.F. amplifier, first stage only when the input signals are very weak, and when coupled by R.C. coupling to the next stage.



Max. Filament Voltage	.. ..	4.0 volts.
Filament Current ..	.. ..	0.075 amp.
Max. Anode Voltage	.. ..	150 volts.
*Anode Impedance ..	.. ..	55,000 ohms.
*Amplification Factor	.. ..	38.
*Mutual Conductance	.. ..	0.66 mA/volt.

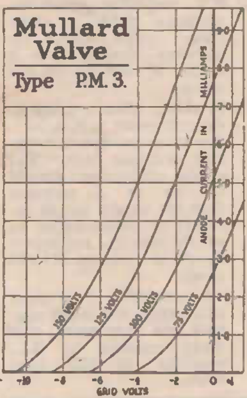
* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
4 - VOLT
accumulator

Type P.M. 3

A valve having medium impedance and medium amplification factor, and suitable for use as:—



(*a*) H.F. amplifier with tuned anode, H.F. transformer or other form of coupling except resistance-capacity. It is not suitable, however, for use in certain American receivers employing H.F. transformers having low impedance primaries, for which circuits P.M. 4 is recommended.

(*b*) Detector when coupled to the following valve by a medium impedance coupling such as transformer or choke.

(*c*) L.F. amplifier for all stages except the last or "power amplifier" position.

Max. Filament Voltage	4.0 volts.
Filament Current	0.075 amp.
Max. Anode Voltage	150 volts.
*Anode Impedance	13,000 ohms.
*Amplification Factor	14.0.
*Mutual Conductance	1.05 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
4 - VOLT
accumulator

Type P.M. 4DX

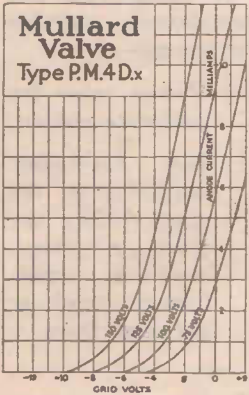
A valve having very steep slope, specially suitable for use as:—

(*a*) Highly sensitive detector, using either leaky-grid or anode-bend rectification. It is possible to employ comparatively low anode voltages with these valves and in the interest of both quality and economy, it is advisable to use the lowest voltage which gives satisfactory results.

Full advantage of these valves results when transformer coupling is employed, but satisfactory operation is obtained using choke-capacity or resistance - capacity coupling. In the latter case, a low value of anode resistance, i.e., 20.000 to 50,000 ohms should be employed.

(*b*) Low frequency amplifier.

(*c*) Small power valve for moderate volume.



Max. Filament Voltage	.. ..	4.0 volts.
Filament Current ..	.. ..	0.1 amp.
Max. Anode Voltage	.. ..	150 volts.
*Anode Impedance ..	.. ..	7,500 ohms.
*Amplification Factor	.. ..	15.0.
*Mutual Conductance	.. ..	2.0 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

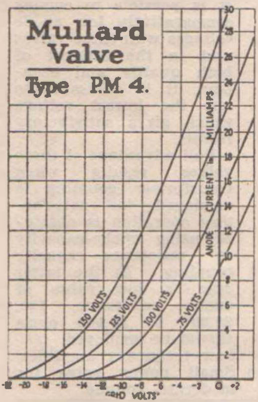
Mullard
Valves
for use with
4 - VOLT
accumulator

Type P.M. 4

A valve with low impedance suitable for use as:—

(*a*) Power valve for moderate output.

(*b*) Low frequency amplifier in the stage before the power stage, using transformer coupling, between them.



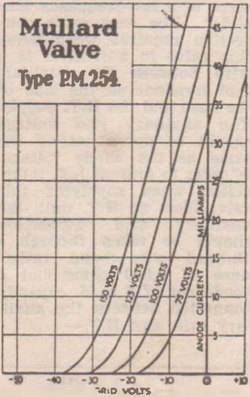
Max. Filament Voltage	.. ..	4.0 volts.
Filament Current ..	.. ..	0.1 amp.
Max. Anode Voltage	.. ..	150 volts.
*Anode Impedance ..	.. ..	4,450 ohms.
*Amplification Factor	.. ..	8.0.
*Mutual Conductance	.. ..	1.8 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
4 - VOLT
accumulator

Type P.M. 254



A " super " power valve having low impedance, steep slope and large grid base, suitable for use as the output valve when operating a large loud speaker.

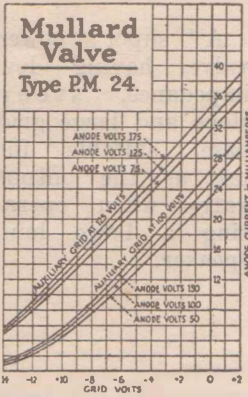
Max. Filament Voltage	.. ..	**4.0 volts.**
Filament Current	.. .. ..	**0.18 amp.**
Max. Anode Voltage	.. ..	**150 volts.**
***Anode Impedance**	.. .. ..	**2,000 ohms.**
***Amplification Factor**	.. ..	**4.2.**
***Mutual Conductance**	.. ..	**2.1 mA/volt.**

*** At Anode Volts 100; Grid Volts Zero.**

For Price, see page 63.

Mullard
Valves
for use with
4 - VOLT
accumulator

Type P.M. 24
"PENTONE."



A five-electrode valve for use in the last or output stage of a low-frequency amplifier The only extra connection required when using this valve in a receiver is a wire between the auxiliary grid terminal on the side of the base and the H.T. supply. The auxiliary grid voltage should be approximately the same as the anode voltage. In order to prevent L.F. interaction when supplying this valve from an H.T. unit, the auxiliary grid connection should be taken through a Mullard wire-wound resistance of 5,000 ohms and a condenser of 2 m.fd. capacity connected between the auxiliary grid and H.T.—

Max. Filament Voltage	4.0 volts.
Filament Current	0.15 amp.
Max. Anode Voltage	150 volts.
Auxiliary Grid Voltage	As H.T.+
*Anode Impedance	28,000 ohms.
*Amplification Factor	62.
*Mutual Conductance	2.3 mA/volt.

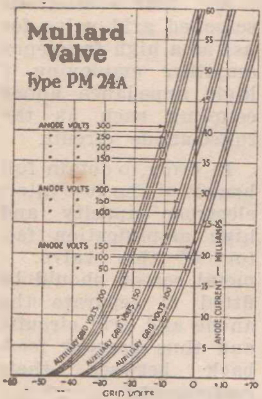
* At Anode Volts 100; Grid Volts Zero; Aux. Grid Volts 100.

For Price, see page 63.

Mullard Valves
for use with 4 - VOLT accumulator

Type P.M. 24a
" PENTONE."

A five-electrode valve for use in the last or output stage of a low-frequency amplifier. The only extra connection required when using this valve in a receiver is a wire between the auxiliary grid terminal on the side of the base and the H.T. supply. The auxiliary grid voltage should be approximately the same as the anode voltage. In order to prevent L.F. interaction when supplying this valve from an H.T. unit, the auxiliary grid connection should be taken through a Mullard wire-wound resistance of 5,000 ohms and a condenser of 2 m.fd. capacity connected between the auxiliary grid and H.T.—



Max. Filament Voltage	.. ..	4.0 volts.
Filament Current ..	.. ..	0.275 amp.
Max. Anode Voltage	.. ..	300 volts.
Auxiliary Grid Voltage	.. ..	200 volts.
*Anode Impedance ..	.. ..	53,000 ohms.
*Amplification Factor	.. ..	83.
*Mutual Conductance	.. ..	1.55.

* At Anode Volts 100; Grid Volts Zero; Aux. Grid Volts 100.

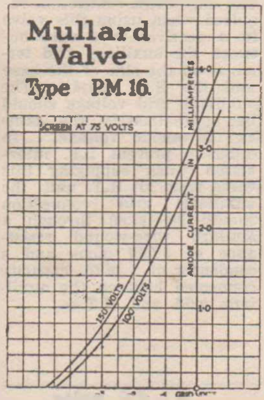
For Price, see page 63.

Mullard
Valves
for use with
6 - VOLT
accumulator

Type P.M. 16
SCREENED GRID VALVE.

A four - electrode screened grid valve for use as a high frequency amplifier employing a high impedance anode coupling such as the tuned-anode circuit.

In order to obtain full benefit of the low inter-electrode capacity and high amplification factor of this valve, a metal screen should be fitted to separate the anode and grid circuits and thus prevent feed-back between their components.



Max. Filament Voltage	.. ..	6.0 volts.
Filament Current ..	.. ..	0.075 amp.
Max. Anode Voltage	.. ..	150 volts.
Positive Screen Voltage	.. ..	75 volts.
*Anode Impedance ..	.. ..	200,000 ohms.
*Amplification Factor	.. ..	200.
*Mutual Conductance	.. ..	1.0 mA/volt.

* At Anode Volts 100; Screen Volts 75; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
6 - VOLT
accumulator

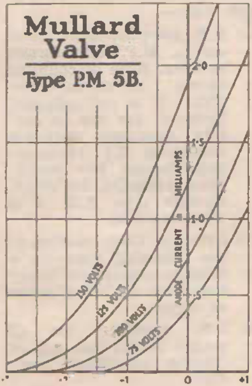
Type P.M. 5B

A valve having high impedance and high amplification factor, suitable for use as:—

(*a*) H.F. amplifier, using resistance capacity coupling. The anode resistance should have a value of about 100,000 ohms.

(*b*) Detector, when coupled to the following L.F. amplifier by a resistance capacity coupling unit. The anode resistance should be up to ½ megohm (500,000 ohms) unless reaction be incorporated, in which case the resistance should not exceed 200,000 ohms.

(*c*) L.F. amplifier, first stage only when the input signals are very weak, and when coupled with R.C. coupling to the next stage.



Max. Filament Voltage	.. ..	6.0 volts.
Filament Current ..	.. ..	0.075 amp.
Max. Anode Voltage	.. ..	150 volts.
*Anode Impedance ..	.. ..	53,000 ohms.
*Amplification Factor	.. ..	40.
*Mutual Conductance	.. ..	0.75 mA/volt

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
6 - VOLT
accumulator

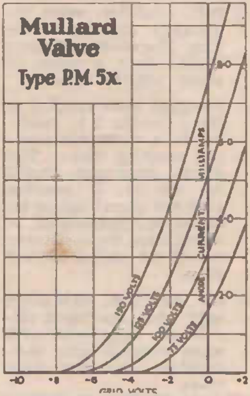
Type P.M. 5X

A valve having medium impedance and medium amplification factor, and suitable for use as:—

(*a*) H.F. amplifier with tuned anode, H.F. transformer or other form of coupling except resistance-capacity. It is not suitable, however, for use in certain American receivers employing H.F. transformers having low impedance primaries, for which circuits type P.M. 6 is recommended.

(*b*) Detector, when coupled to the following valve by a medium impedance coupling such as transformer or choke.

(*c*) L.F. amplifier for all stages except the last or "power amplifier" position.



Max. Filament Voltage	..	.. 6.0 volts.
Filament Current ..	..	.. 0.075 amp.
Max. Anode Voltage	..	.. 150 volts.
*Anode Impedance ..	..	.. 14,700 ohms.
*Amplification Factor	..	.. 17.5.
*Mutual Conductance	..	.. 1.2 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
6 - VOLT
accumulator

Type P.M. 6D

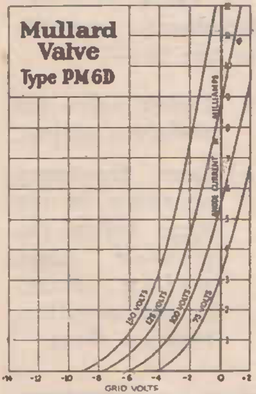
A valve having very steep slope, specially suitable for use as:—

(a) Highly sensitive detector, using either leaky-grid or anode-bend rectification. It is possible to employ comparatively low anode voltages with these valves and in the interest of both quality and economy, it is advisable to use the lowest voltage which gives satisfactory results.

Full advantage of these valves results when transformer coupling is employed, but satisfactory operation is obtained using choke-capacity or resistance - capacity coupling. In the latter case a low value of anode resistance, i.e., 20,000 to 50,000 ohms should be employed.

(b) Low frequency amplifier.

(c) Small power valve for moderate volume.



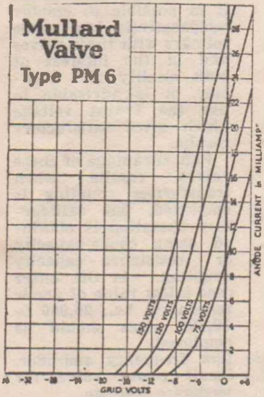
Max. Filament Voltage	.. ..	6.0 volts.
Filament Current ..	.. ..	0.1 amp.
Max. Anode Voltage	.. ..	150 volts.
*Anode Impedance ..	.. ..	9,000 ohms.
*Amplification Factor	.. ..	18.
*Mutual Conductance	.. ..	2.0 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard Valves for use with 6 - VOLT accumulator

Type P.M. 6



A valve with low impedance suitable for use as:—

(*a*) Power valve for moderate output.

(*b*) Low frequency amplifier in the stage before the power stage, using transformer coupling, between them.

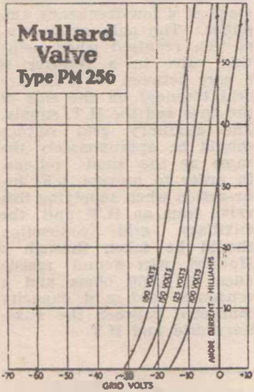
Max. Filament Voltage	6.0 volts.
Filament Current	0.1 amp.
Max. Anode Voltage	150 volts.
*Anode Impedance	3,550 ohms.
*Amplification Factor	8.0.
*Mutual Conductance	2.25 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
6 - VOLT
accumulator

Type P.M. 256



A " Super " power valve having low impedance, steep slope and large grid base, suitable for use as the output valve when operating a large loud speaker.

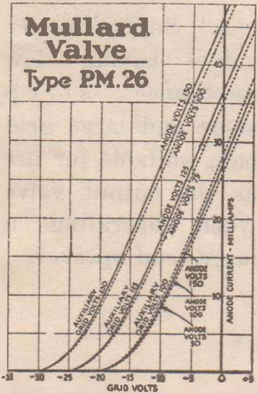
Max. Filament Voltage	.. 6.0 volts.
Filament Current	.. 0.25 amp.
Max. Anode Voltage ..	.. 180 volts.
*Anode Impedance	.. 1,850 ohms.
*Amplification Factor ..	.. 6.0.
*Mutual Conductance ..	.. 3.25 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
for use with
6 - VOLT
accumulator

Type P.M. 26
"PENTONE."



A five-electrode valve for use in the last or output stage of a low-frequency amplifier. The only extra connection required when using this valve in a receiver is a wire between the auxiliary grid terminal on the side of the base and the H.T. supply. The auxiliary grid voltage should be approximately the same as the anode voltage. In order to prevent L.F. inter-action when supplying this valve from an H.T. unit, the auxiliary grid connection should be taken through a Mullard wire-wound resistance of 5,000 ohms and a condenser of 2 m.fd. capacity connected between the auxiliary grid and H T.—

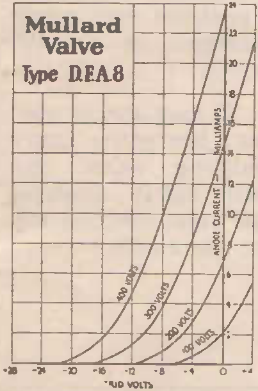
Max. Filament Voltage	.. ..	6.0 volts.
Filament Current ..	.. ..	0.17 amp.
Max. Anode Voltage	.. ..	150 volts.
Auxiliary Grid Voltage	.. ..	As H.T.+
*Anode Impedance ..	.. ..	25,000 ohms.
*Amplification Factor	.. ..	50.
*Mutual Conductance	.. ..	2.0 mA/volt.

* At Anode Volts 100; Grid Volts Zero; Aux. Grid Volts 100.

For Price, see page 63.

Mullard
Valves
SPECIAL TYPES

Type D.F.A. 8



A valve similar to type D.F.A. 6, but having a higher amplification factor. It is most suitable for use in resistance-capacity coupled amplifiers using high anode voltages, and may also be employed as a low power transmitter, dissipating not more than 10 watts at the anode.

Filament Voltage	4.5 volts.
Filament Current	0.85 amp.
Anode Voltage	400 volts.
*Anode Impedance	15,000 ohms.
*Amplification Factor	19.5.
*Mutual Conductance	1.28 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

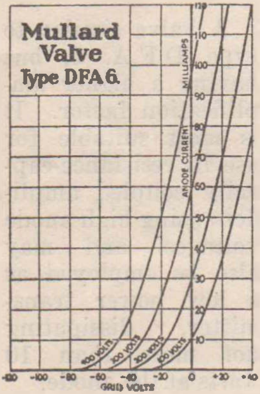
For Price, see page 63.

Mullard
Valves
SPECIAL TYPES

Type D.F.A. 6

A power amplifying valve with large emission, suitable for operation with anode voltages up to 400 volts.

It may also be used as a low power transmitting valve, and will safely dissipate 10 watts continuously at the anode.



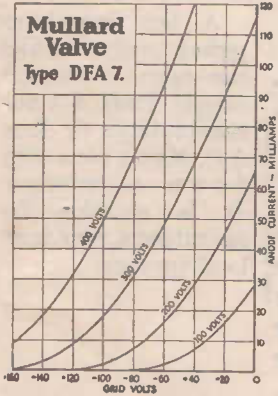
Filament Voltage	.. 4.5 volts.
Filament Current	.. 0.85 amp.
Anode Voltage	.. 400 volts.
*Anode Impedance	..4,500 ohms.
*Amplification Factor ..	.. 6.4
*Mutual Conductance ..	.. 1.45 in A/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
SPECIAL TYPES

Type D.F.A. 7



A power amplifying valve with large emission suitable for use with anode voltages up to 400 volts and capable of operating a large loud speaker.

It may also be used as a transmitter or modulator in telephony transmitters, with voltages up to 400 and dissipating not more than 10 watts at the anode.

Filament Voltage	4.5 volts.
Filament Current (max.)	0.85. amp.
Anode Voltage	400 volts.
*Anode Impedance	2,850 ohms.
*Amplification Factor .. .,	2.4.
*Mutual Conductance	0.85 mA/volt.

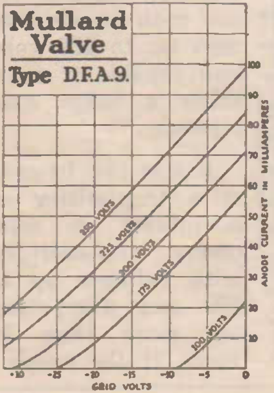
* At Anode Volts 100; Grid Volts Zero.

For Price, see page 63.

Mullard
Valves
SPECIAL TYPES

Type D.F.A. 9

A low impedance power valve which can take its filament supply from a 6-volt accumulator or from A.C. Mains *via* a step-down transformer. It is suitable for operating a very large loud speaker.



Filament Voltage	6.0 volts.
Filament Current	0.6 amp.
Anode Voltage	250 volts.
*Anode Impedance	2,000 ohms.
*Amplification Factor	5.0.
*Mutual Conductance	2.5 mA/volt.

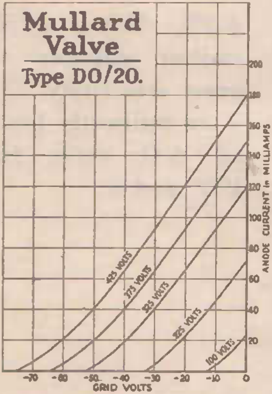
* At Anode Volts 100; Grid Volts Zero.

For Price List, see page 64.

Mullard
Valves
SPECIAL TYPES

Type D.O. 20

A low impedance power valve suitable for use as the output valve in an amplifier operating the largest types of loud speakers. Filament supply at 7.5 volts can be taken from A.C. Mains *via* a step-down transformer and anode voltages up to 425 may be used. The anode dissipation must be limited to 20 watts, which may on no account be exceeded.



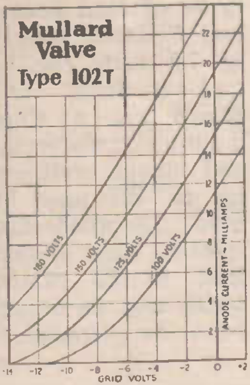
Filament Voltage	7.5 volts.
Filament Current	1.3 amp.
Max. Anode Voltage	425 volts.
*Anode Impedance	2,000 ohms.
*Amplification Factor	5.0.
*Mutual Conductance	2.5 mA/volt.

* At Anode Volts 100; Grid Volts Zero.

For Price List, see page 64.

Mullard
Valves
for use with
ALTERNATING CURRENT

Type 102T.
(UY 227)



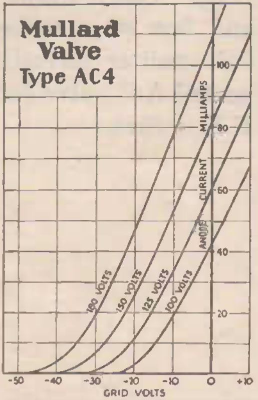
102T. This is a dull emitter detector of great sensitivity. It is an indirectly heated A.C. valve for U.Y. socket.

Max. Heater Voltage	2.5 volts.
Heater Current	1.5 amp.
Max. Anode Voltage	180 volts.
Anode Impedance	6,650 ohms
Amplification Factor	10.

For Price List, see page 64.

Mullard
Valves
for use with ALTERNATING CURRENT

Type A.C.4
(U.X. 171A.)



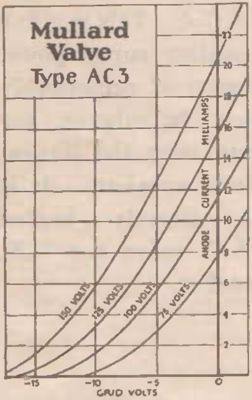
A.C.4. This is a dull emitter super power valve of remarkably low impedance, for use with the largest loud speakers. It is a directly heated A.C. valve for U.X. socket.

Max. Filament Voltage	5.0 volts.
Filament Current	0.25 amp.
Max. Anode Voltage	180 volts.
Anode Impedance	1,450 ohms.
Amplification Factor	3.8.

For Price List, see page 64.

Mullard
Valves
for use with
ALTERNATING CURRENT

Type A.C.3
(U.X. 226)



A.C.3. This is a radio and first stage audio dull emitter directly heated A.C. valve for U.X. socket.

Filament Voltage	1.5 volts.
Filament Current	1.1 amp.
Max. Anode Voltage	180 volts.
Anode Impedance	7,800 ohms.
Amplification Factor	10.

For Price List, see page 64.

Mullard
Valves
for use with
ALTERNATING CURRENT
Type S. 4V.

A screened-grid four-electrode valve with indirectly heated cathode, suitable for use as a high-frequency amplifier for circuits employing a high impedance anode coupling such as a tuned-anode circuit.

The valve is fitted with a five-pin base, the connections being as follows:—

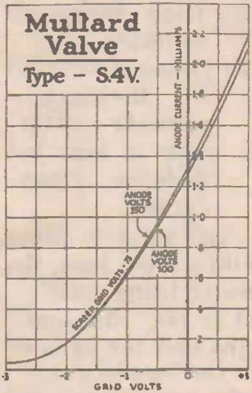
Heater connected to filament pins.

Cathode connected to centre pin.

Screen connected to "anode" pin.

Grid connected to "Grid" pin.

Anode connected to the top cap.



Max. Heater Voltage	.. ..	4.0 volts.
Heater Current ..	.. ..	1.0 amp.
Max. Anode Voltage	.. ..	150 volts.
*Positive Screen Volts	.. ..	75 volts.
*Impedance	.. ..	1.33 megohms
*Amplification Factor	.. ..	1,000.
*Mutual Conductance	.. ..	0.75 mA/volt.

* At Anode Volts 100; Screen Volts 75; Grid Volts Zero.

For Price List, see page 64.

Mullard
Valves
for use with
ALTERNATING CURRENT

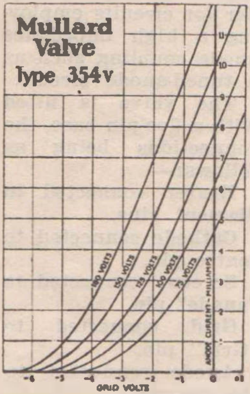
Type 354V

A three electrode valve with indirectly heated cathode, and suitable for use as:—

(*a*) High frequency amplifier.

(*b*) Detector followed by Resistance - capacity coupling or high impedance transformer.

The valve is fitted with a 5-pin base, the heater being connected to the "filament" pins and the cathode to the centre pin.



Max. Heater Voltage	4.0 volts.
Heater Current	1.0 amp.
Max. Anode Voltage	180 volts.
*Impedance	14,000 ohms.
*Amplification Factor	35.
*Mutual Conductance	2.5 mA/volt.

* At Anode Volts 100: Grid Volts Zero.

For Price List, see page 64.

Mullard
Valves
for use with
ALTERNATING CURRENT

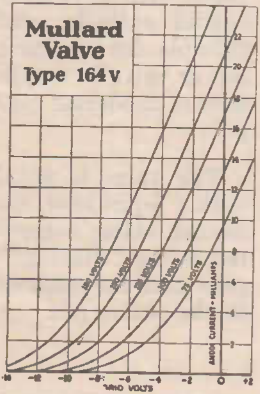
Type 164V

A three - electrode valve with indirectly heated cathode, and suitable for use as:—

(*a*) Detector followed by transformer coupling.

(*b*) Low frequency amplifier followed by transformer coupling.

The valve is fitted with a 5-pin base, the heater being connected to the "filament" pins and the cathode to the centre pin.



Max. Heater Voltage	.. ..	4.0 volts.
Heater Current ..	.. ..	1.0 amp.
Max. Anode Voltage	.. ..	180 volts.
*Impedance	.. ..	6,650 ohms.
*Amplification Factor	.. ..	16.
*Mutual Conductance	.. ..	2.4 mA/V.

* At Anode Volts 100; Grid Volts Zero.

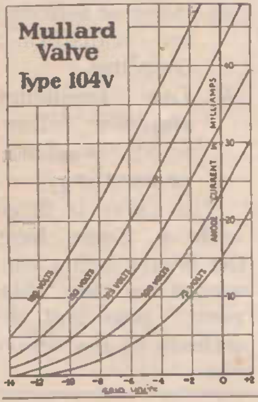
For Price List, see page 64.

Mullard
Valves
for use with
ALTERNATING CURRENT

Type 104V

A three - electrode valve with indirectly heated cathode, and suitable for use as a power valve in amplifiers of moderate output.

The valve is fitted with a 5-pin base, the heated being connected to the "filament" pins and the cathode to the centre pin.



Max. Heater Voltage	4.0 volts.
Heater Current	1.0 amp.
Max. Anode Voltage	180 volts.
*Impedance	2,850 ohms.
*Amplification Factor	10.
*Mutual Conductance	3.5 mA/volt.

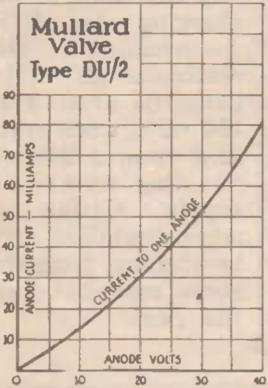
* At Anode Volts 100; Grid Volts Zero.

For Price List, see page 64.

Mullard RECTIFYING VALVES

Type D.U. 2

A full wave rectifying valve suitable for use in a H.T. battery eliminator or for charging H.T. Accumulators. The maximum safe D.C. output is 40 m. A at 150 volts when operating from a 240 volt A.C. supply. Output for other conditions may be obtained from the accompanying curve.



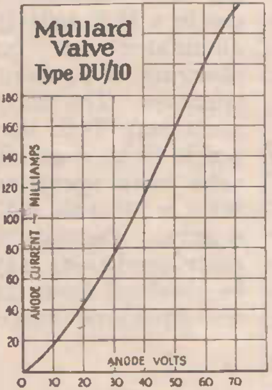
Filament Voltage	..	..	.. 4.0 volts.
Filament Current	..	..	.. 1.1 amp.
Approx. Impedance		..	.. 500-500 ohms.

For Price List, see page 64.

Mullard RECTIFYING VALVES

Type D.U. 10

A half-wave rectifying valve suitable for use in a H.T. battery eliminator or for charging an H.T. Accumulator. The maximum safe D.C. output is 40 m. A at 150 volts, when operated from a 240 alternating current supply. Output for other conditions may be obtained from the curve reproduced on this page.

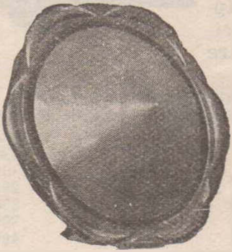


Filament Voltage	4.0 volts.
Filament Current	300 ohms.
	1.1 amp.
Anode Impedance	(approx.)
Max. Anode Voltage	240v. R.M.S.

For Price List, see page 64.

MULLARD
PURE MUSIC
SPEAKER
Model C

for Standing or Hanging



The Loud Speaker with a Tone Control

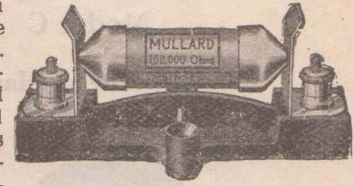
This Pure Music Speaker will delight you in every way. The name "Mullard" behind this British Speaker is your guarantee of its quality.

For Price List, see page 64.

Mullard

Wire-wound Anode Resistances

These resistances are made of metal wire and retain their resistance value indefinitely. They can withstand an applied voltage of several hundred volts with safety. Capacity and inductance effects are negligible.

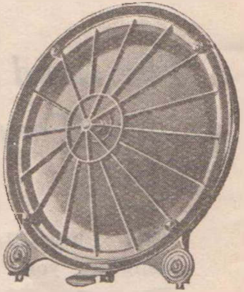


Max. Overall Length, 65 mm. or $2\frac{1}{2}$ inches.
Max. Diameter, 17 mm. or $\frac{11}{16}$ inches.

Resistance Values. ohms.	Resistance Values. ohms.
20,000	200.000
50,000	250,000
80,000	300,000
100,000	400,000

Mullard

Model H Speaker



There is no field current to provide for, either from batteries or mains.

Special power valves are not required. The Speaker works satisfactorily from ordinary valves.

For Price List, see page 64.

Mullard

Grid Leaks and Carbon Resistances

Supplied in All Sizes (without Holder) and Holders only (with Clips)

Sizes Stocked—

Grid Leaks: 1.0, 1.5, 2, 3, 4 and 5 megohms.
Carbon Resistances 50,000, 100,000, 150,000, 200,000, 250,000, 300,000, 400,000 and 500,000 ohms.

Mullard

P.M. POTENTIAL DIVIDER

Overall Height: 105 mm., or 4⅛ ins.
Overall Diameter: 75 mm. or 3 ins.

The Potential Divider is designed to enable many different values of High Tension to be obtained from a supply of Direct Current at one voltage. The variations obtainable from this Potential Divider ensure that the most suitable adjustment can be made for any set of conditions in the receiver.

Very low voltages are sometimes desirable; such values as 5, 10, 20 volts can readily be obtained from the Mullard Potential Divider for Grid Bias or H.T. supply to detector valves, etc. It should be noted that the voltage steps between successive tappings are arranged to give the maximum possible range of adjustment for the nine tappings provided.

Five wander plugs are provided: two red, for H.T. positive connections; one black, for H.T. negative; and two green, for grid bias negative connections.

ASK FOR TECHNICAL DETAILS.

For Price List, see page 64.

NEW SOUTH WALES

Station	Wave Length	Dial Settings.			Remarks.
		1	2	3	
2 H.D.—Newcastle ..	221				
2 M.K.—Bathurst	260				
2 U.W.—Sydney	267				
2 K.Y.—Sydney	280				
2 U.E.—Sydney	293				
2 G.B.—Sydney	316				
2 B.L.—Sydney	353				
2 F.C.—Sydney	451				

VICTORIA

Station	Wave Length	Dial Settings.			Remarks.
		1	2	3	
3 D.B.—Melbourne	255				
3 U.Z.—Melbourne	319				
3 L.O.—Melbourne	371				
3 A.R.—Melbourne	484				

QUEENSLAND

4 G.R.—Toowoomba ..	294				
4 Q.G.—Brisbane	385				

SOUTH AUSTRALIA

Station	Wave Length	Dial Settings.			Remarks.
		1	2	3	
5 K.A.—Adelaide	250				
5 D.N.—Adelaide	313				
5 C.L.—Adelaide	409				

WEST AUSTRALIA

6 W.F.—Perth	435				

TASMANIA

Station	Wave Length	Dial Settings.			Remarks.
		1	2	3	
7 Z.L.—Tasmania	516				

NEW ZEALAND

1 Y.A.	333				
2 Y.A.	420				
3 Y.A.	316				
4 Y.A.	463				

Name of Station	Wavelength	Dial Reading

Price List of Mullard Valves and Accessories

April 1, 1930. Subject to alteration without notice.

Page	Type	Price, each
18	P.M. 12	25/-
19	P.M. 1A.	13/6
20	P.M. 1H.F.	13/6
21	P.M. 1L.F.	13/6
22	P.M. 2D.X.	13/6
23	P.M. 2	13/6
24	P.M. 252	15/-
25	P.M. 22	25/-
26	P.M. 14	25/-
27	P.M. 3A.	13/6
28	P.M. 3	13/6
29	P.M. 4D.X.	13/6
30	P.M. 4	13/6
31	P.M. 254	15/-
32	P.M. 24	25/-
33	P.M. 24A	30/-
34	P.M. 16	25/-
35	P.M. 5B.	13/6
36	P.M. 5X.	13/6
37	P.M. 6D.	13/6
38	P.M. 6	13/6
39	PM. 256	15/-
40	P.M. 26	30/-
41	D.F.A. 8	38/6
42	D.F.A. 6	30/-
43	D.F.A. 7	38/6

Price List of Mullard Valves and Accessories.

Page.	Type.	Price, each
44	D.F.A. 9	30/-
45	D.O. 20	50/-
	D.O. 60	£12
46	102T.	22/-
47	A.C.4	18/-
48	A.C. 3	14/-
49	S. 4V.	32/6
50	354V.	30/-
51	164V.	27/6
52	104V.	30/-
53	D.U./2	25/-
54	D.U./10	17/6
55	"C" Speaker	£3/15/-
56	"H" Speaker	£7/7/-
56	Mullard Wire Wound Anode Resistances, 20,000—100,000 ..	10/9
	With Holder—	
	200,000 With Holders	14/6
	250,000 With Holders	17/-
	300,000 With Holders	19/6
	400,000 With Holders	23/-
	Holders only	2/9
57	Mullard Grid - Leaks and Carbon Resistance. All sizes, without Holders ..	3/-
	Holders, with Clips ..	2/-
57	P.M. Potential Divider	£1/16/-

RCA

[illegible]

UX112A	18/-
UX171A	18/-
UX222	35/6
UY224	29/6
UX226	14/-
UY227	22/-
UX245	28/6
UX280	25/-
UX UV199	12/-
UX201A	8/-
UX112A	18/-
UX120	13/-
UX245	28/6
RCR221	13/6

VR. 46a

O'BRIEN'S RADIO ELECTRICAL SERVICE
W K O'BRIEN
60 Irvine Street
Sth Kensington
REPAIRS A SPECIALTY

LEVENSONS RADIO
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Pennington & Somerville Printers
31 Cunningham Street - Sydney