

# RADIO *for the* MILLION

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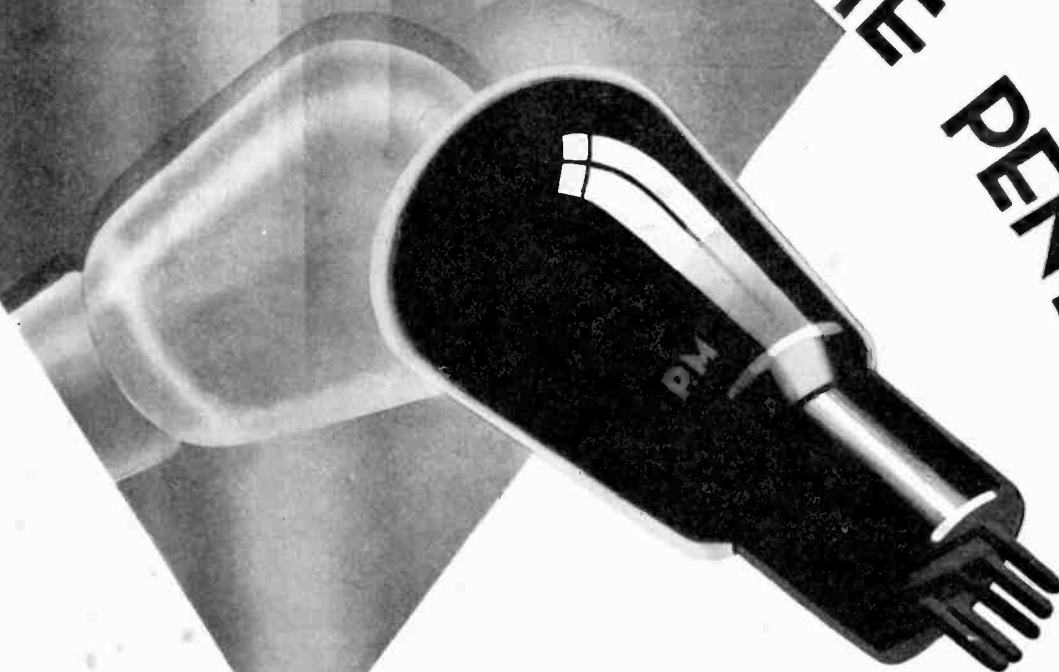
VOL 4 N° 3

APRIL 1930



THE RADIO OWNER'S MAGAZINE

# PLAIN FACTS ABOUT THE PENTODE



Here is the valve that does the work of two—an amplifying valve and a super power valve. The pentode gives great magnification to a small signal and then supplies super power energy to drive the speaker. The ultimate result as you hear it in your speaker is big volume without distortion. There is no single alternative valve to the pentode. But there is a choice among pentode radio valves and Mullard have made the alternative. They have designed a pentode to utilise the P.M. Filament—a filament with the greatest emission yet discovered. They have distinguished it by calling it the P.M. Pentone.

Ask your dealer for the following type numbers:

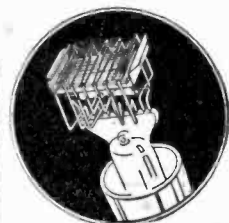
P.M.22.

P.M.24.

P.M.26.

## Mullard

### THE MASTER-VALVE



Above: The P.M. Pentone Filament—strong—durable and marvellously efficient. The complex and intricate structure is almost unrecognisable as a development of the first simple P.M. Filament constructed five years ago.

# RADIO *for the* MILLION

## THE RADIO OWNER'S MAGAZINE

VOLUME 4 — No. 3.

SPRING ISSUE 1930

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IN every issue of "Radio for the Million" new designs for highly efficient radio sets have appeared, and each issue has called forth eulogies on the clarity of the instructions and the simplicity of the design.

The issue now prepared for your delectation may be said to surpass its preceding issues for the simplicity of the receivers described in it, and for the rigid economy which has been exercised in the choice of components. Yet the value of this achievement is increased by the fact that no iota of efficiency has been sacrificed, for each and every set will more than live up to the high standard of quality which the discerning public associates with sets from the "Radio for the Million" laboratories.

Perhaps the most important part of the issue is that devoted to a description of the turning of the "Master Three" or "Master Three Star" Receiver into a highly efficient set incorporating the Mullard Screened Grid Valve.

There is no doubt that this set, whether converted from a "Master Three" or built entirely from new components, will prove one of the most popular receivers ever described in this Journal.

There are, in addition, such important items as an H.F. Unit incorporating a screened grid valve, and a new and highly efficient "Master 2" Receiver which will make a wide appeal to those readers who desire to possess a highly efficient Regional Broadcasting Receiver for the very minimum outlay.

These are but a few of the items of great interest we have prepared for our thousands of readers, but each and every item has been prepared with that painstaking accuracy and conscientious testing which has ensured the production of such famous receivers as the "Master Three," "The Orgola," and many more.

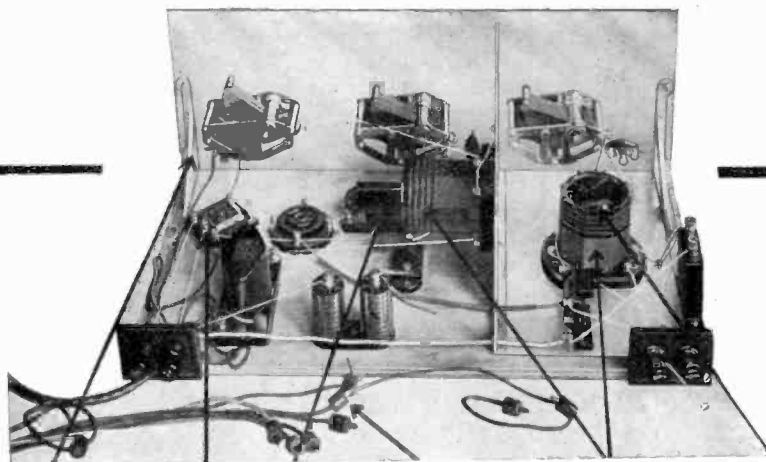
*The Editor*



# ORGOLA Master 3

BUILD IT FOR £5 16 4  
VALVES - - - 2 5 6

OR WITH "PENTONE" 12/6 EXTRA



Durable metal panel with lasting finish.

Provision for "Pentone" Valve.

Adjustable reaction coil.

Battery cord for safety.

Dual range coils operated from panel.

Variable selectivity, fits the set to your own aerial.

## Our Engineers Report on the "Orgola Master Three."

*24th March, 1930.*

Tested 12 miles from Brookmans Park.

Commencing at 7.15 p.m. the receiver was tested on an aerial 27 feet above the ground and consisting of 58 feet of 7/22 copper wire. After adjusting the aerial and reaction rotors, the separation between the two Brookmans Park transmitters was adequate; six foreign stations were received clear of interference between the Regional and National programmes.

In all, 34 stations were received at loud speaker strength.

Reaction control was particularly smooth and

enabled the more distant stations to be brought up to full strength, without trouble from "threshold growl" or floppy reaction becoming evident.

Selectivity Control enabled selectivity to be adjusted to a very high degree without noticeable loss of signal strength.

Quality was of a very high order, particularly so when a "Pentone" valve was in use, this latter adding considerably to the crispness and brightness of the output.

A commendable feature was the fact that the two tuning dials matched very closely over the major part of the tuning scale.

# A New High Power Receiver—

*Build it from your “Master Three”  
for £3 : 4 : 6 including valve.*

**Makes the “Master Three” a wonder set.**

Constructors may think our solution to the problem of fitting a screened grid valve to the “Master 3” belated, but every Mullard set is the result of prolonged research, and this is the case with the “Orgola Master 3.” Every conceivable avenue has been explored, every alternative has been tested in order that no fraction of the possible signal strength shall be lost, and in order that the cost of the conversion might be as low as was consistent with high efficiency.

**Performance equal to the  
“Orgola.”**

The “Orgola” receiver is, of course, a one-dial tuning set, and has many refinements not incorporated in the “Orgola Master 3”; yet station for station the new set will prove the equal of its more elaborate stable mate.

If proof is wanted of its capabilities, none better than the one printed next to this column could be found, for it is the opinion of seasoned radio fans working in a district notoriously difficult for reception.

*Read what a prominent Radio Society  
says of the “Orgola Master Three.”*

## HODDESDON & DISTRICT RADIO SOCIETY.

*Gen. Sec. and Treasurer:*  
O. G. KNAPP,  
156, Rye Road,  
HODDESDON.

*(All communications to be addressed  
to Hon. Secretary).*

*Headquarters:*

THE CLOCK HOUSE,  
HODDESDON,  
HERTS.

27th March, 1930.

The Editor,  
‘Radio for the Million’.

Dear Sir,

### THE ORGOLA MASTER THREE.

On behalf of my Society, I have to thank you for the opportunity you so kindly afforded of trying out the ‘Original’ of the new three valve receiver, particulars of which you propose publishing in the next issue of your magazine.

The receiver was thoroughly tested at the meeting of my Society on the 26th instant and the unanimous opinion of all present was “IT”.

With only a few yards of wire for an aerial and a rather poor earth, eight stations were received with no interference from the “Twin Transmitters” at Brookman’s Park, and these latter only eight or so miles away.

It is almost unnecessary to state that the National and Regional transmitters could easily be separated.

A feature, commending itself to my members, is the ease of construction and the consequent simple matter it becomes to convert the ‘Master Three’ to an up-to-date set, suitable for broadcast reception under the new B.B.C. Regional Scheme.

Yours faithfully,

*O. G. Knapp.*  
(Hon. Secretary).

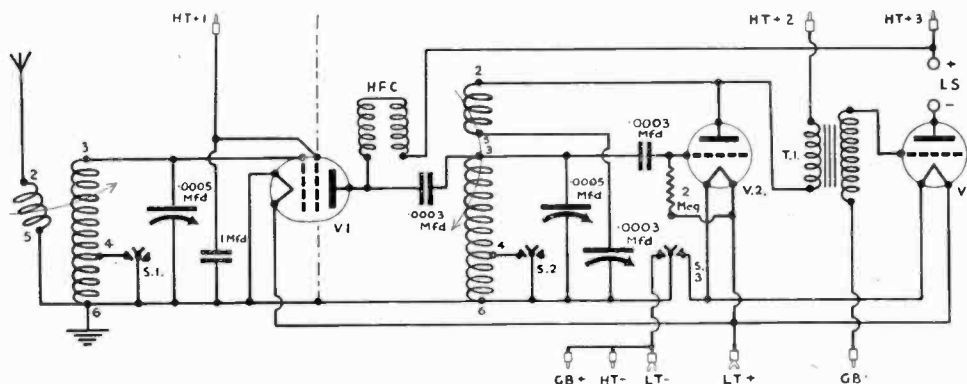
**R<sub>FOR</sub>M**

For modern conditions, experience shows that no type of receiver can approach for performance the Screened Grid, Detector and one L.F. Receiver. Its H.F. Stage if suitably designed, gives a degree of selectivity quite unobtainable with the older type of detector and two L.F. sets; and moreover, the enormous amplification which can be obtained from a Mullard Screened Grid Valve enables the listener to secure a greater and more reliable choice of programme from foreign stations. At the same time the reduction of the

tuning will take a fraction of time longer than would the same operation on the "Orgola."

### Can be made from a "Master 3."

A further advantage of this arrangement is that the possessor of a "Master 3" or "Master 3 Star" receiver may convert it into an "Orgola Master 3" for the sum of £2 2s. od., plus the cost of screened grid valve which amounts to £1 2s. 6d., a total of £3 4s. 6d. This is not an exorbitant



Circuit diagram of "Orgola Master Three." If this is compared with the diagram of the "Orgola" receiver, it will be seen that the only difference is in the connections of the reaction rotor. This difference enables the reaction condenser to be arranged with one side at earth potential.

L.F. Stages renders elaborate decoupling devices, etc., unnecessary when working the set from an eliminator.

There is only one objection which can be made to this type of circuit, and that is that in most cases the initial cost is higher than the straight detector and two L.F. arrangement. The fact that the improved performance more than outweighs any question of increased cost does not greatly influence the man who has not the money to invest. So for those whose purses are light we have evolved the "Orgola Master 3." This receiver is capable of a performance identical in every detail with that of the now famous "Orgola."

### "Orgola" coils used.

The special coils which were designed for the "Orgola" receiver itself are employed; the screen also is identical. The features which made the "Orgola" receiver such a deservedly popular set are here, with the one exception of the single dial control. In order to reduce the cost, and in deference to the wishes of a large section of our readers, separate tuning for Aerial and H.F. Coils is incorporated. This variation only means that

charge for converting a set to the most modern design—and at the same time increasing selectivity and power to an enormous degree.

The rebuilding can be accomplished in a very short space of time. The first step should be to remove all the components from the baseboard of the "Master 3" or "Master 3 Star" Receiver, and the condensers, etc., from the panel.

Clean the parts, for they have most probably become covered with a layer of partially conductive dust which may mar the performance of the finished receiver.

The next step is to drill the additional holes in the panel according to the blue print. If the builder has no facilities for drilling, a new panel can be obtained from the dealer for the sum of 5s. 6d. This is made by Colvern, Ltd., and has all the necessary holes for the components required in the "Orgola Master 3."

### How to start building.

Having obtained the necessary new components, or all components if the set is being newly built, a start can be made with the construction of

the receiver. It is best to commence by fixing the components to the base-board. A good way of ensuring that their position shall be exactly as in the original is to place the blue print over the base-board, accurately align the edges, and pierce through the fixing hole positions with a bradawl. It is then a simple matter to screw the components into their exact positions.

#### Assembly on panel.

When the three Junit black switches are fixed the wiring may be commenced. Do not fix the variable condensers, for the wiring is much simpler if these parts are fitted when the set is partly wired.

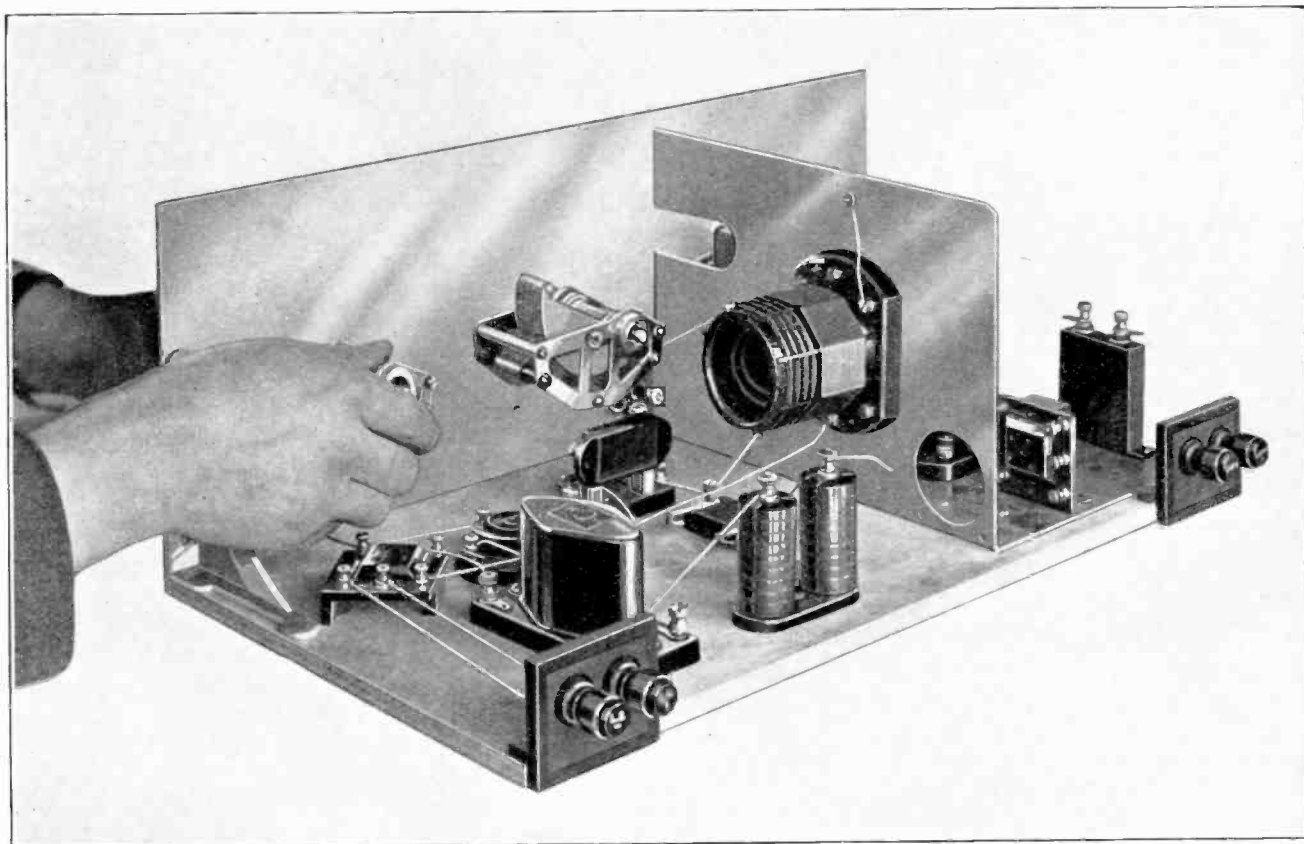
The point to point wiring instructions which are printed by the side of the blue print, together with the blue print itself, constitute the simplest

#### Stop at wire No. 17.

The wiring should proceed progressively until wire No. 17 has been fixed, when a halt is called and the variable condensers fixed in place. Their positions are as follows, the two .0005 mfd. condensers in the two right-hand positions and the .0003 mfd. reaction condenser in the left-hand position, viewed from behind the panel.

The remainder of the wiring is just as simple, and again the point to point wiring instructions together with blue print make the easiest guide which it is possible to devise.

Just a word about the battery cord. This is of course a refinement, but a refinement well worth the fitting, for its appearance is neat, and each wander plug is clearly engraved with its function. The distinctive colours which are



Showing the fitting of the variable condensers, after completion of the wiring up to wire No. 17. The wiring of this set is even more simple than that of the "Orgola" itself.

method of wiring the receiver. If these instructions are followed, and a tick made against each number as the wire corresponding to it is fixed in place absolutely no difficulty can be experienced.

used in its assembly virtually eliminate any possibility of wrong connection and consequent damage to the valves.

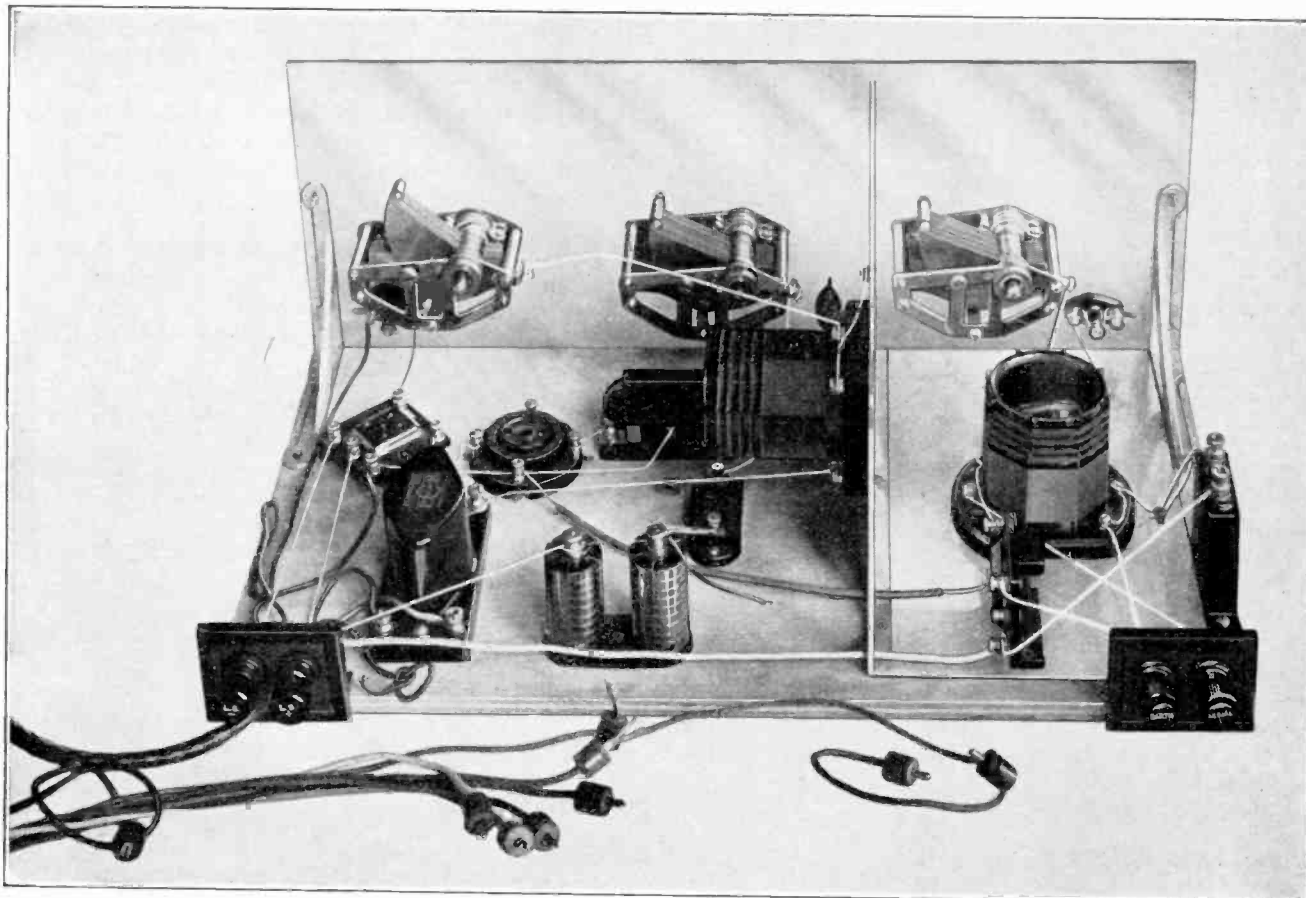
When the wiring is completed each and every

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connection should be checked, for all humans are fallible, and an apparently trifling error may cost the unfortunate perpetrator of the mistake the price of a set of valves. This is no light charge, and moreover one that may

short wave reception and then the receiver can be switched on by pulling S.3.

The rotor in coil H.2 should first receive attention, for this controls reaction. Start with



The receiver completed. Note the battery cord, which, while not essential, is a refinement strongly recommended.

easily be avoided if ordinary care is taken in the checking of the wiring.

Assured that all is in order, a screened-grid valve, of the same voltage as those already in use, should be inserted in the valve holder V.1. If it is a new set insert a screened-grid valve into holder V.1, detector valve into holder V.2 and an output valve into holder V.3.

The batteries should be connected up according to the table of connections on page 9.

#### Testing the receiver.

A test should first be made on short waves in order to adjust the rotors within the coils. Pull switches S.1 and S.2, which set the coils for

this coil set at an angle of 45 deg. to the panel.

If the reaction condenser, that is the condenser on the extreme right as we face the panel, is turned towards maximum, we should hear the familiar scream as the set goes into oscillation. It will now be found that slight adjustment of this rotor increases or decreases the violence of oscillation. The best position will be found when the receiver working on short waves commences to oscillate at about the centre of the reaction dial, that is about 50 deg. on a 100 deg. dial and about 90 deg. on a 180 deg. dial.

#### Adjusting Selectivity.

The next point to receive attention should be the rotor in coil H.1 for this controls the



selectivity of the receiver. When the rotor coil in H.1 is nearly vertical the highest degree of selectivity is available, but when the rotor is horizontal the tuning is flattened as much as is possible. The right position can be only found by trial and error, but when making the adjustment move the rotor very slightly at each trial, as the smallest movement makes an appreciable difference. Having made a good preliminary adjustment, a tour of the stations available should be made. After dark a multitude of distant transmissions should be received, if a reasonably efficient aerial and earth system is employed.

After this some small adjustment of selectivity may be made with advantage, bearing in mind that if the receiver is made too selective a definite loss of signal strength will be inevitable.

### Getting a further big increase.

Increasing volume is easily accomplished by fitting a Mullard Pentone in the output stage, that is Valve Holder V.3.

The "Pentone" is possibly the greatest advance which has been made in output valves. It gives

a magnification approximately equal to two stages of low frequency amplification, and a large undistorted output for the same consumption of anode current as the ordinary super-power valve would need.

As an additional improvement there is no doubt that the Mullard Pentone valve will give a remarkable increase of magnification for a very small cost and is one that can be strongly recommended.

### Using the Mullard P.M. H.T. Unit.

The most effective way of obtaining H.T. supply from A.C. mains is by means of the P.M. H.T. Unit, for this accessory is capable of supplying generous smoothed output such as is required if the best results are to be obtained from this set.

The leads should be connected as below.

Blue	(H.T. —)	to Socket —
Maroon	(H.T. +3)	to Socket +4.
Yellow	(H.T. +2)	} to Socket +2.
White	(H.T. +1)	

These connections will be found the most suitable; the correct resistances are incorporated in the unit, and the correct voltage is obtained without critical adjustment of variable resistances—no small advantage. Of course, the original wander plugs must be removed from the leads and the special safety plugs provided with the unit substituted.

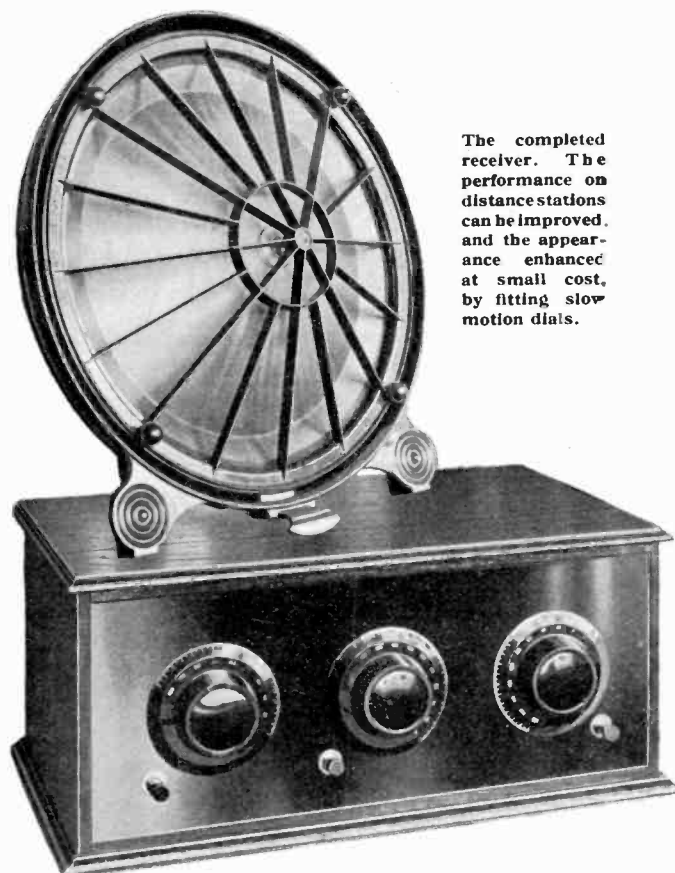
### Using D.C. Eliminators.

If the constructor wishes to obtain a supply of H.T. from a D.C. eliminator, several precautions should be taken to minimise the possibility of shock, since certain parts of the receiver are connected directly to the mains.

The first precaution is to cover the panel with a sheet of ebonite or other insulating substance. Do not omit the metal panel since this forms part of the wiring of the circuit. A good way of dealing with this is to obtain a panel of ebonite 18 ins. × 7 ins. ×  $\frac{3}{16}$  in. and use the metal panel as a guide for drilling, so that the holes in the ebonite are an exact duplicate of those in the aluminium. The set is then assembled with the mask of ebonite outside and the metal behind it.

### Fixing Switches.

It is necessary to make sure that the fixing bushes of the Junit switches make positive contact with the metal panel, and to make certain that



The completed receiver. The performance on distant stations can be improved, and the appearance enhanced at small cost, by fitting slow motion dials.

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this is the case, it is best to fix the three switches to the metal panel, and drill the switch holes in the ebonite mask  $\frac{1}{2}$  in. diameter so that these holes clear the fixing nuts when the assembly is made.

Another point to watch is the aerial and earth leads. If no provision is made on the eliminator, a 2 mfd. condenser should be included in the earth lead and a .01 mfd. condenser in the aerial lead. This will prevent earthing the mains and consequent damage to the lighting installation.

### Power, Super Power, or "Pentone"?

This is a question the builder himself must decide for he must choose the valve suitable to his requirements. The most that we can do is to point out the advantages and disadvantages of each type.

### Power valve.

The power valve gives a moderate undistorted output, and seems to give sufficient volume for

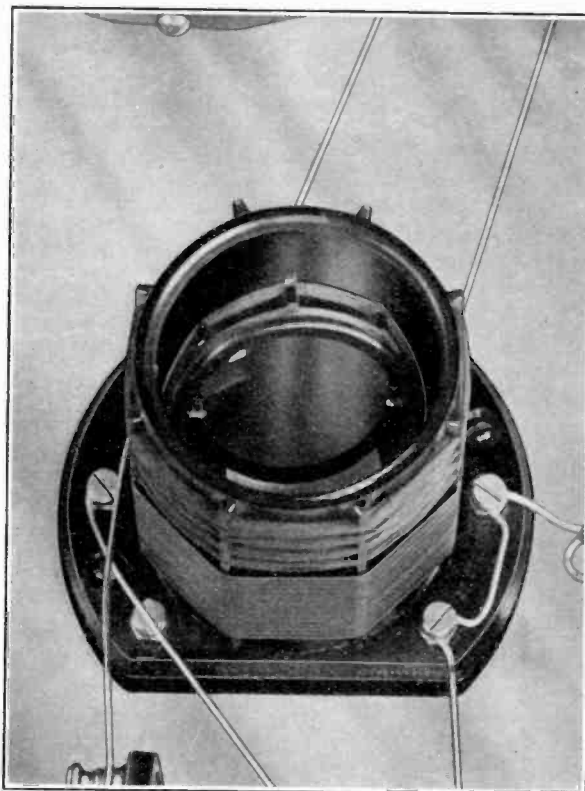
a great many listeners. At the same time the consumption of H.T. current is very low, and this valve is recommended when battery economy is of primary importance.

### Super power valve.

The super power valve is suitable for use where full loudspeaker reproduction is required with faultless quality. The H.T. battery consumption is a little more than is the case with the power valve but not excessively so.

### "Pentone."

The "Pentone" valve gives a slightly greater undistorted output than the super power valve, and consumes approximately the same amount of H.T. current as the super power type; it has the advantage that the amplification is about twelve times as great; approximately the same results as would be obtained if an additional stage of amplification was added.



The aerial rotor as seen in the picture, is correct for the first test. The receiver becomes more selective when the far edge is raised, thus bringing the rotor more nearly at right angles to the coil itself.

## Essential components for the Mullard "Orgola Master Three."

Complete Kit.					
	£	s. d.		£	s. d.
1 Cabinet (Oak) (W.T. Lock)	1	6 6	1 "Permacore" transformer (Mullard)	19	6
1 Baseboard 18" x 10" (included with Cabinet)		—	1 '0003 mfd. fixed condenser (Mullard)	1	9✓
1 Panel "Orgola Master Three" (Colvern)	5	6	1 1 mfd. paper condenser (Mullard)	2	6✓
1 Pair "Orgola" coils (Colvern or Gent)	17	0 ✓	2 '0005 mfd. Universal log variable condenser (Jackson Bros.)	19	0 9 9 6
1 Set "Orgola" screens (Colvern)	2	9 ✓	1 '0003 mfd. Universal log variable condenser (Jackson Bros.)	9	0
1 Pair panel brackets (Burne-Jones)	2	6	3 4" dials (Jackson Bros.)	4	6
2 5-pin valve holders (Junit)	3	6 ✓	1 H.F. choke (Climax)	7	6
1 Valve Holder, anti-microphonic (Garnett Whiteley)	1	3	4 Terminals, Aerial, Earth, L.S. + L.S.— (Belling Lee)	2	0
3 switches (Black knob) (Junit)	4	6	1 "Orgola" Battery Cord (Belling Lee)	5	9
2 terminal mounts (Junit)	1	4	1 Safety anode connector (Belling Lee)	6	
1 Combined grid leak and condenser holder with 2 meg grid leak and '0003 mfd. condenser (Mullard)	6	0			

# Essential Components for converting Master 3 and Master 3\* to "Orgola Master Three":

	s.	d.		s.	d.
1 pair "Orgola" coils (Colvern or Gent)	17	0	1 4 inch dial (Jackson Bros.)	1	6
1 set "Orgola" screens (Colvern)	2	9	1 Condenser '0003 mfd. fixed (Mullard)	1	9
2 five pin valve holders (Junit)	3	6	1 1mfd. paper condenser (Mullard)	2	6
2 switches (Black knob). (Junit)	3	0	1 safety anode connector (Belling Lee)		6
1 Condenser '0005 mfd. Variable (Universal Log) (Jackson Bros.)	9	6			
				£2	2 0

## Specified Mullard Valves:

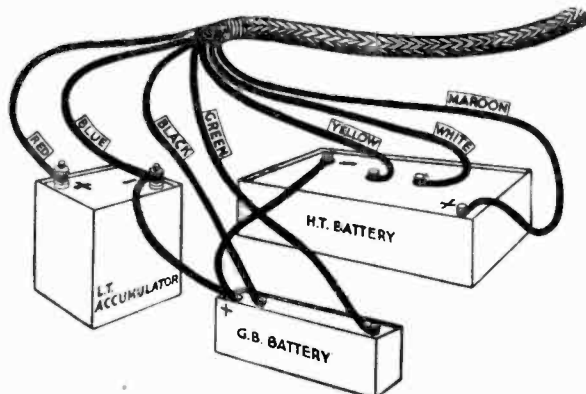
V.1.	2 Volt. P.M. 12	4 Volt. P.M. 14	6 Volt. P.M. 16	£	s.	d.
V.2.	P.M. 2D.X. P.M. 1L.F.	P.M. 4D.X. P.M. 3.	P.M.6. D. P.M. 5X.	£	10	6
V.3.	P.M. 2 Power Valve P.M. 252 Super Power Valve P.M. 22 Pentone	P.M. 4 Power Valve P.M. 254 Super Power Valve P.M. 24 Pentone	P.M. 6 Power Valve P.M. 256 Super Power Valve P.M. 26 Pentone	£	12	6
					15	0
					1	5 0

## CALIBRATION CHART—"ORGOLA MASTER THREE."

Wave Length.	Aerial condenser (C.1).	Anode condenser (C.2).	Wave Length.	Aerial condenser (C.1).	Anode condenser (C.2).	Wave Length.	Aerial condenser (C.1).	Anode condenser (C.2).
Medium Waves.			Medium Waves.			Medium Waves.		
200 M	43	27	290	94	84	460	153	149
205	47	31	295	96	86.5	470	156	152
210	51	35	300	98	89	480	159	155
215	55	38.5	310	102	93.5	490	162	158
220	58.5	42	320	106	98	500	164.5	161
225	62	45.5	330	110	102.5	510	167	164
230	65.5	49	340	114	107	520	169.5	167
235	68.5	52	350	118	111	530	172	170
240	71.5	55	360	121.5	115	540	174.5	173
245	74	58	370	125	118.5	550	177	176
250	76.5	61	380	128.5	122			
255	79	64	390	132	125.5	Long Waves.		
260	81.5	67	400	135	129	Hilversum	60	45
265	84	70	410	138	132.5	Kalundborg	72	60
270	86	73	420	141	136	Motala	95	88
275	88	76	430	144	139.5	5XX Daventry	122	115
280	90	79	440	147	143	Radio Paris	135	131
285	92	81.5	450	151	146	Huizen	141	138

## Battery Connections — "ORGOLA MASTER THREE."

<b>BLUE</b>	LT-. HT-. GB+.
<b>RED</b>	LT+.
<b>MAROON</b>	HT + 100 TO 150
<b>WHITE</b>	HT + 75
<b>YELLOW</b>	HT + 60
<b>BLACK</b>	Not used unless Gramophone pick-up is used. GB - 1 1/2
<b>GREEN</b>	GB - 6 TO 22 1/2



NOTE.—Obtain correct value for green from the instruction slip which accompanies your valve.

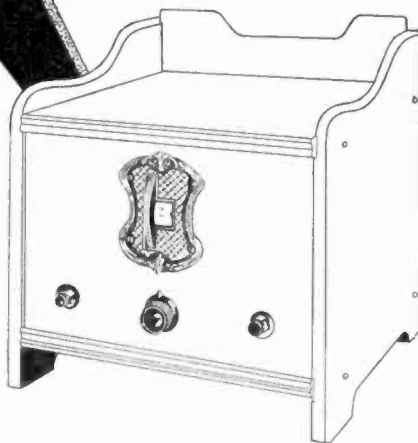
Paste this page into the lid of your receiver. All data regarding it are then to hand.

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# MULLARD MASTER

# 2

## NEW REGIONAL BROADCASTING RECEIVER



Regional Broadcasting has rung the death knell of the majority of the older type of receivers, for it is as hopeless to attempt to separate the new transmissions with these obsolete sets as it is to carry water in a sieve.

At the same time many designs quite suitable for use are beyond the means, or cost more than the user cares to spend on entertainment. So it was felt that a new design of spartan simplicity, yet employing components which would ensure a higher degree of selectivity, under widely varying conditions, would fill the bill for a host of enthusiastic listeners.

### Economy without sacrifice.

Economy has, however, not been effected at the expense of quality or signal strength. For example, the L.F. Transformer, which is one of the principal factors governing quality, is the famous "Permacore" transformer, the even response curve of which has secured its inclusion in many sets famous for purity of reproduction.

Every other detail has received the same attention. In order to secure the exact degree of aerial coupling, a coil with moveable aerial coil has been fitted, similar to the coils which are employed in the now famous "Orgola" Receivers,

and so on. A book could be filled with the proceedings which governed the choice of every component. But to be brief, let us state definitely that no more powerful—or selective—2-valve design is available to the public. The building is simplicity itself; only 17 wires have to be fixed, and it can be built to operate from A.C. Mains, or, if built to operate from batteries, it can be cheaply and

easily converted to operate from A.C. Mains at any time.

### Pleasing Appearance.

In appearance this receiver strikes an entirely new note, both as regards internal layout and cabinet work. The period-design cabinet is collapsible and is built round the receiver after its completion. Another point which will draw favourable comments from the new constructor is the panel assembly. This enables the builder to avoid the assembling of drum dial variable condensers on the panel—possibly the only part of the construction which might be approached with misgiving.

### £5 13s. 2d. to build.

With all this it will come as a revelation when we say that the receiver can be built complete for the sum mentioned above, and moreover this includes the Period oak cabinet and the valves, one of which is a Mullard Pentone.



When the building is commenced, it is best to mark the position of the components on the baseboard by laying the blue print over it, and piercing through the fixing holes with a bradawl, or other sharp instrument. By the way, the baseboard can be distinguished from the top of the cabinet by the fact that it is unpolished. Another point is that the fluted edge is the front, and the panel is, of course, fixed at the front.

The front edge should be exactly  $\frac{1}{4}$  of an inch back from the front edge of the baseboard. This point should be watched, otherwise the finished receiver will not possess the shapely proportions of the original.

#### A point about switches.

The switches specified for use on the panel are possible sources of error, for in the case of those specified the bush of the switch makes definite contact with the panel, and the spindle of the switch has a special contact to maintain connection between it and the bush. At the same time when the knob is pushed, both terminals of the switch are disconnected from the panel.

Only the switch specified falls in this class, and if a substitution is made trouble will result, either from the set not working, or one wave band being unobtainable.

#### The L.F. transformer.

At the same time it is as well to point out that, as no H.F. choke is fitted in this receiver, the primary of the L.F. transformer assumes a double task, performing the function of H.F. choke in addition to its usual duties. If another

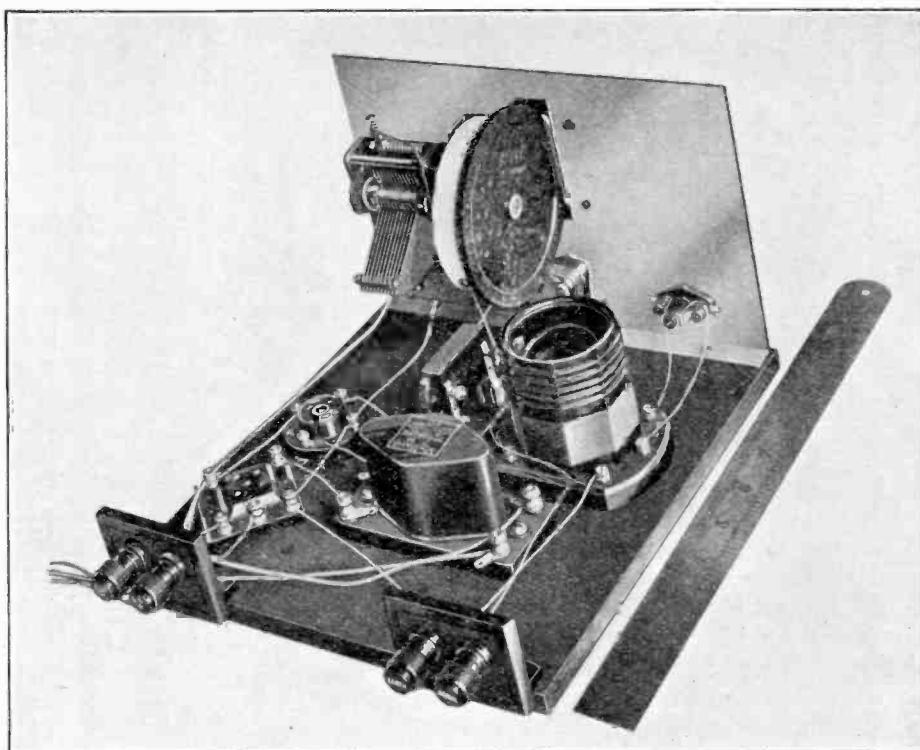
The "Master Two" receiver was tested  $7\frac{1}{2}$  miles east of the Brookmans Park transmitters, on an aerial 60 feet long and easily separated the two transmissions, a feat which many receivers costing three times as much were unable to perform. Tested at 15 miles from Brookmans Park in a South-Easterly direction, the regional and National transmitters were easily separated, and several foreign stations received at loud speaker strength.

make of transformer is substituted for that specified it may be found that no reaction is obtainable, or the control of reaction is very rough, and smooth reaction control is of the first importance with a 2-valve receiver.

Proceeding with the building, the wiring is the simplest that has ever been presented to the public, and the 17 wires which complete the operation are easily fixed in position, none being inaccessible or difficult to secure.

The point to point instructions make the best guide to the wiring, and if these instructions are carefully followed, and ticked as the wires are in position, no mistake can be made. When the wiring is completed, a check should be made, again ticking the wires as they are checked.

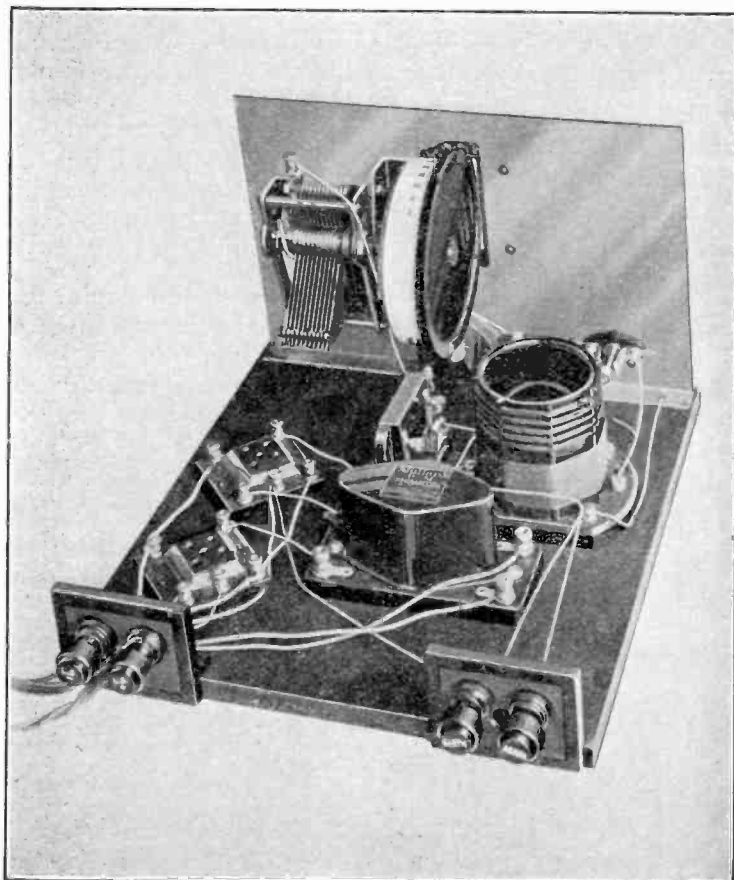
If all is in order, the valves should be fitted, the position being given in the data on suitable valves.



The complete receiver. The 12" rule gives a good idea of the size.

**R<sub>FOR</sub>M**

and the batteries connected up. A point to note is that the grid bias battery should be connected before the H.T. Battery, and if at any time it is wished to alter the plugs in the grid bias battery the set must be switched off. Never neglect this point, for the valves may be irreparably damaged if this advice is not followed.



The A.C. Model which does not materially differ from the battery type.

### Adjusting Selectivity.

The testing of the receiver can now be taken in hand. The rotor within the coil should be set at an angle of 45 degrees to the axis of the coil, and the Local Station tuned in. If the receiver is to be used within the service area of the Brookmans Park transmitters, the first check should be made by tuning in the two transmissions to see if adequate separation is possible. If the receiver is not sufficiently selective, the rotor should be moved nearer the vertical, thus increasing the selectivity. Remember that adjustment of the reaction control, situated just below the tuning dial, will considerably enhance the selectivity.

The receiver should next be tested on long-waves; this is effected by pushing in the left-hand switch (S.2).

### Adjusting for long waves.

Now, there is an important point to note about the selectivity control on the Colvern coil; it is possible to vary the degree of selectivity on this wave band without altering the setting for short waves. The reason for this is that on long waves, a section of the long wave winding is switched in series with the 30 turn rotor.

It is easy to see from this, that if after the short wave setting has been found it is wished to vary the selectivity on long waves, it can be accomplished by turning the rotor 180 degrees round, that is exactly half a turn.

The best position will obviously be found by experiment.

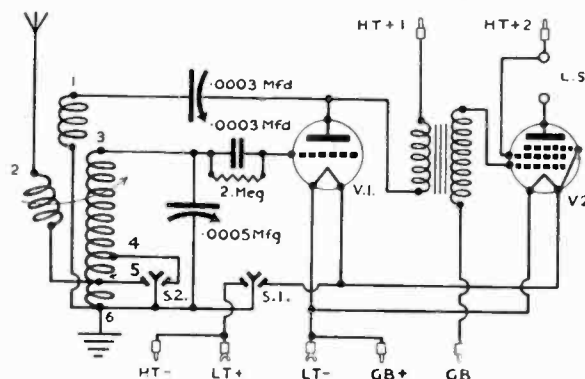
### For the A.C. Model.

When the A.C. Model has been tested, instead of connecting batteries it is only necessary to connect the leads according to the table given, and proceed exactly as in the case with the battery model.

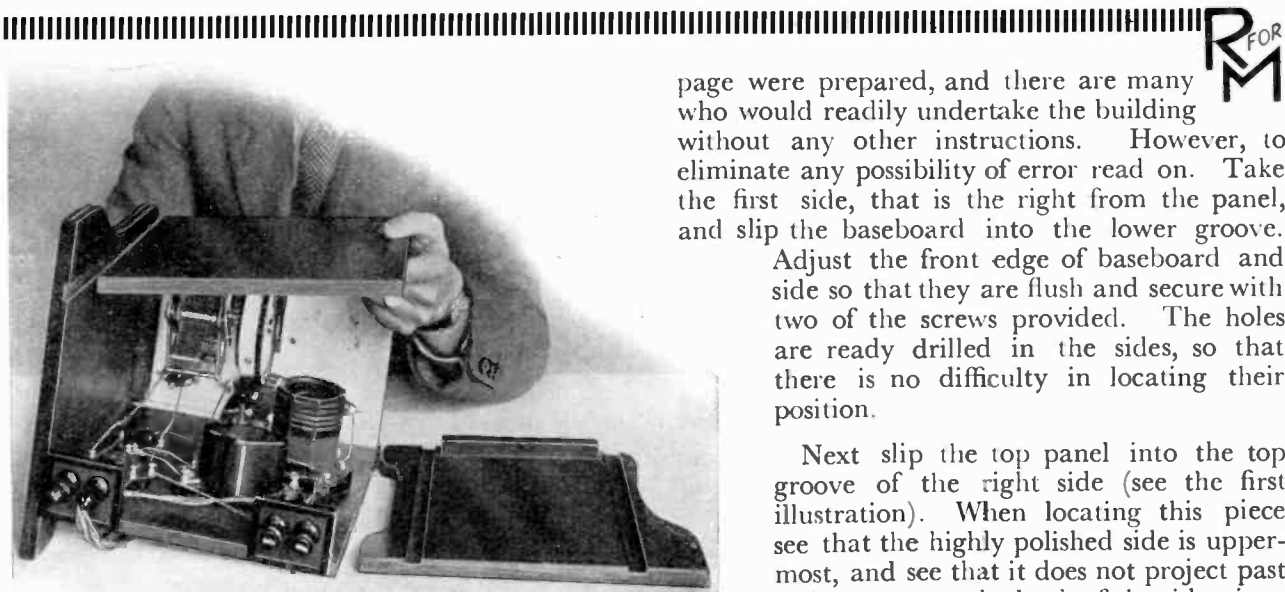
While the set is primarily intended to be a local station receiver, if a reasonably efficient aerial is used a number of Foreign Stations will be heard, if care is exercised in the tuning and adjustment of reaction.

### Use of Reaction.

The important thing to understand, if distant stations are to be received, is the use of the reaction control, for in place of the H.F. stage which amplifies the



Circuit diagram of Master Two. Simplicity is the keynote, yet an exceptionally high degree of efficiency may be expected.



1. The first step. Screw one side to the baseboard, and put the top panel in position, making sure that the polished side is uppermost.

incoming signal we must depend entirely upon the reaction control to increase the sensitivity of the receiver.

Of course the receiver is in the most sensitive condition when the reaction control is as near to the oscillating position as possible; yet if the receiver oscillates no signals can be received, besides which our near neighbours will also suffer if they happen to be listening to the station we are endeavouring to tune in.

Having at length adjusted the receiver for a correct degree of selectivity and sensitivity, the valves should be removed and the batteries disconnected while the cabinet is assembled.

### Assembling the Cabinet.

The knowledge that every part has been assembled by one's own hands appeals to every man, for the desire to build and—between ourselves, show off our handiwork to our admiring family—is strong in our breasts.

So for the "Master Two" receiver a cabinet for home assembly has been designed, and this component, while handsome in appearance and easy to construct, satisfies yet another desirable proviso. It costs no more than half of the sum which would be necessary for a completely cabinet built container.

To make the operations of assembly as easy as possible the series of photographs on this

page were prepared, and there are many who would readily undertake the building without any other instructions. However, to eliminate any possibility of error read on. Take the first side, that is the right from the panel, and slip the baseboard into the lower groove.

Adjust the front edge of baseboard and side so that they are flush and secure with two of the screws provided. The holes are ready drilled in the sides, so that there is no difficulty in locating their position.

Next slip the top panel into the top groove of the right side (see the first illustration). When locating this piece see that the highly polished side is uppermost, and see that it does not project past the groove at the back of the side piece, if it should do so it will be impossible to fit the back panel later.

Now put the remaining side in position, lining up at the front before screwing up, fit the four remaining screws, and the cabinet is complete; possibly the simplest piece of cabinet work you have ever undertaken.

The valves can now be inserted, the back put into position, the



2. The second step, screwing the second side in position. The screw holes are ready drilled in all parts to simplify this operation.

batteries reconnected, and you have completed the simplest and cheapest regional broadcasting receiver it is possible to construct.



3. The last step, sliding the back panel into position after the valves have been inserted.



## Specified Components for the Mullard "Master Two."

	£	s.	d.		£	s.	d.
1 Collapsible Cabinet "Master Two" (W.T. Lock)	12	0		1 "Permacore" transformer (Mullard)	19	6	
1 "Master Two" panel assembly (Garnett Whiteley)	1	1	0	1 Combined grid leak and condenser holder with	6	0	
1 "Master Two" coil (Colvern or Gent)	8	6		2 meg. leak and .0003 mfd. condenser (Mullard)			
2 Switches, Black Knob (Junit)	3	0		4 Terminals, Aerial, Earth, L.S.—, L.S.+ (Belling			
1 5-pin Valve Holder (for A.C. Model 2 Valve Holders				Lee)	2	0	
are required) (Junit)	1	9		3 Red and 2 black wander plugs (Lissenin)	10		
1 Valve Holder, Anti-microphonic (Not required for				1 Red and 1 black spade tags (Lissenin)	6		
A.C. Model) (Garnett Whiteley)	1	3					
2 Terminal mounts (Junit)	1	4					
					3	17	8

### For A.C. Model.

1 P.M. H.T. Supply unit (Mullard)	£	s.	d.	1 P.M. Filament transformer (Mullard)	£	s.	d.
	5	5	0		1	12	6

*When ordering H.T. units or Filament Heating Transformers always give voltage and periodicity of mains.*

### Recommended Accessories.

1 P.M. Speaker (Model K) (Mullard)	£	s.	d.	1 P.M. Speaker (Model C) (Mullard)	£	s.	d.
or	6	16	0		2	10	0
1 P.M. Speaker (Model H) (Mullard)	6	6	0	1 Grid bias battery 16v. type C3. (Siemens)	3	6	
or							

### Additional Accessories for Battery Model.

1 P.M. H.T. Supply unit (Mullard)	£	s.	d.	1 H.T. Dry battery 100v. type 1202 (Siemens)	s.	d.
	5	5	0		13	6
1 H.T. Dry battery 100v. type 1206 (Siemens)	1	2	6	1 Accumulator say 30 amp. hr. capacity (Exide) per		
or				2v. cell	11	6

### Specified Mullard P.M. Valves for Battery Model.

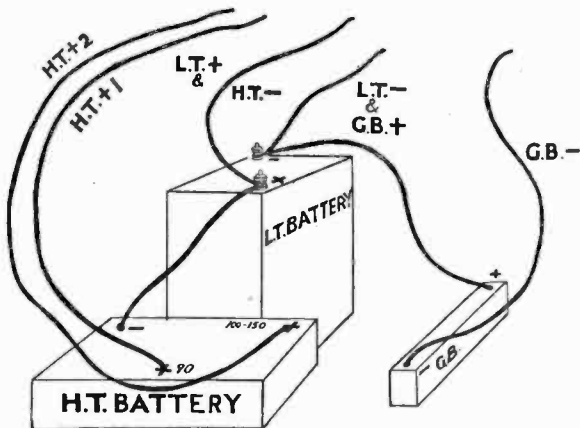
V.1.	2v.	4v.	6v.	s.	d.	V.2.	2v.	4v.	6v.	£	s.	d.
P.M.2D.X.	P.M.4D.X.	P.M.6D.	..	10	6	P.M. 22	P.M. 24.	P.M. 26.		1	5	0

### For A.C. Model.

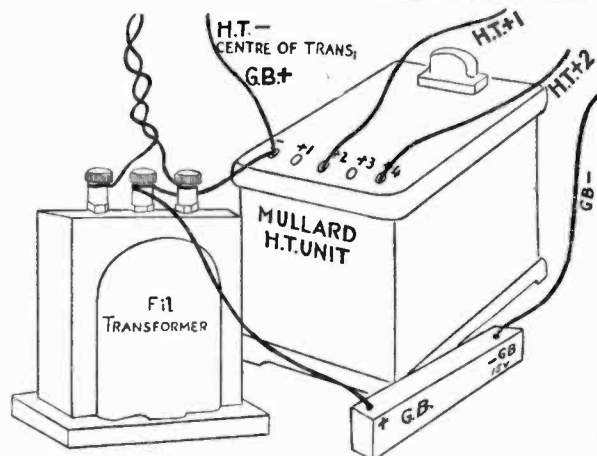
V.1.	Mullard 354v.	s.	d.	V.2.	P.M. 24	£	s.	d.
		15	0			1	5	0

### Calibration Chart for the Mullard "Master Two."

Wave Length.	Station.	Dial Reading.	Wave Length.	Station.	Dial Reading.	
MEDIUM WAVES.			MEDIUM WAVES.			
200m	Leeds (2LS)	0	301	Aberdeen (2BD)	74.5	
224.4	Cork (6CK)	19	310	Cardiff (5WA)	79.5	
242	Belfast (2BE)	36.5	356.3	London Regional	104	
261.3	London National	50	377	Manchester (2ZY)	114.5	
288.5	Bournemouth (6BM)	67	399	Glasgow (5SC)	124	
	Newcastle (5NO)		413	Dublin (2RN)	129	
	Bradford (2LS)		479	Midland Regional (5GB)	152	
	Plymouth (5PY)					
	Dundee (2DE)					
	Edinburgh (2EH)					
	Stoke-on-Trent (6ST)					
	Hull (6KH)					
	Swansea (5SX)					
	Liverpool (6LV)					
			LONG WAVES.			
			1554	Daventry (5XX)	115	



Battery cord connections. "Master Two."



Power lead connections for A.C. Model. "Master Two."



# MULLARD "ORGOLA" H.T. SUPPLY UNIT.



## Point to Point Wiring, "Orgola" H.T. Supply Unit.

NOTE.—Every wire must be fully covered with insulating sleeving.

### WIRE NO.

- 1 Connect left hand bottom terminal of transformer T.1 to terminal 2 of valve holder V.1.
- 2 Connect right hand bottom terminal of transformer T.1 to terminal 1 of valve holder V.1.
- 3 Connect top right hand terminal of transformer T.1 to terminal 3 of valve holder V.1.
- 4 Connect top left hand terminal of transformer T.1 to terminal 4 of Valve holder V.1.
- 5 Connect top centre terminal of transformer T.1 to nearer terminal of condenser C.6.
- 6 Connect bottom centre terminal of transformer T.1 to left hand terminal of choke C.H.1.
- 7 Connect left hand terminal of choke C.H.1 to nearer terminal of condenser C.1.
- 8 Connect right hand terminal of choke C.H.1 to left hand terminal of choke C.H.2.

NOTE.—Connect choke C.H.2 in series according to instructions above the terminals.

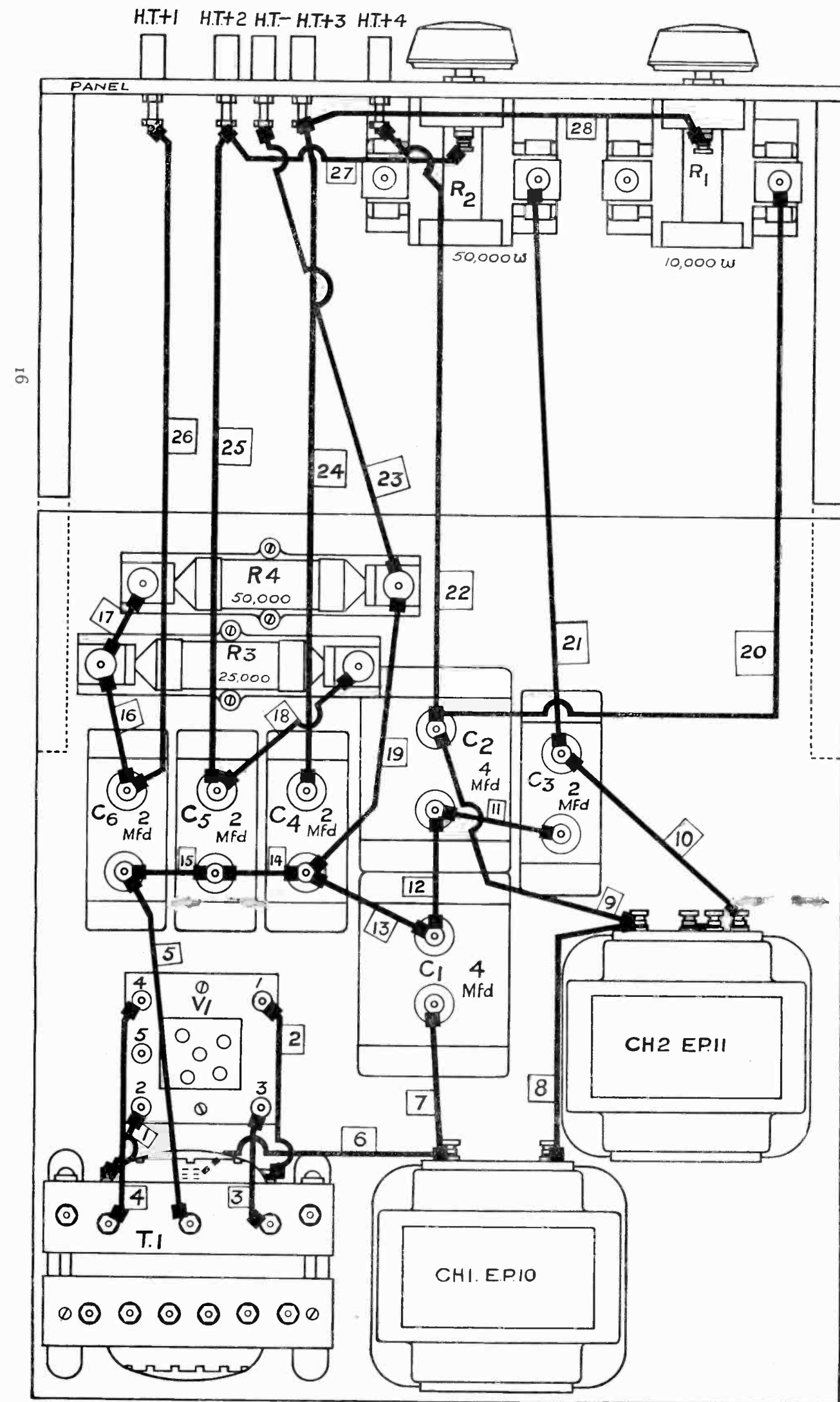
- 9 Connect left hand terminal of choke C.H.2 to further terminal of condenser C.2.
- 10 Connect right hand terminal of choke C.H.2 to further terminal of condenser C.3.
- 11 Connect nearer terminal of condenser C.3 to nearer terminal of condenser C.2.
- 12 Connect nearer terminal of condenser C.2 to further terminal of condenser C.1.
- 13 Connect further terminal of condenser C.1 to nearer terminal of condenser C.4.
- 14 Connect nearer terminal of condenser C.4 to nearer terminal of condenser C.5.
- 15 Connect nearer terminal of condenser C.5 to nearer terminal of condenser C.6.
- 16 Connect further terminal of condenser C.6 to left hand terminal of resistance holder R.3.
- 17 Connect left hand terminal of resistance holder R.3 to left hand terminal of resistance holder R.4.
- 18 Connect further terminal of condenser C.5 to right hand terminal of resistance holder R.3.
- 19 Connect nearer terminal of condenser C.4 to right hand terminal of resistance R.4.

NOTE.—The panel with its components should now be fitted.

- 20 Connect right hand terminal of variable resistance R.1 to further terminal of condenser C.2.
- 21 Connect right hand terminal of variable resistance R.2 to further terminal of condenser C.3.
- 22 Connect red socket H.T.+4 to further terminal of condenser C.2.
- 23 Connect right hand terminal of resistance R.4 to black socket H.T.—.
- 24 Connect red socket H.T.+3 to further terminal of condenser C.4.
- 25 Connect red socket H.T.+2 to further terminal of condenser C.5.
- 26 Connect red socket H.T.+1 to further terminal of condenser C.6.
- 27 Connect red socket H.T.+2 to centre terminal of variable resistance R.2.
- 28 Connect red socket H.T.+3 to centre terminal of variable resistance R.1.

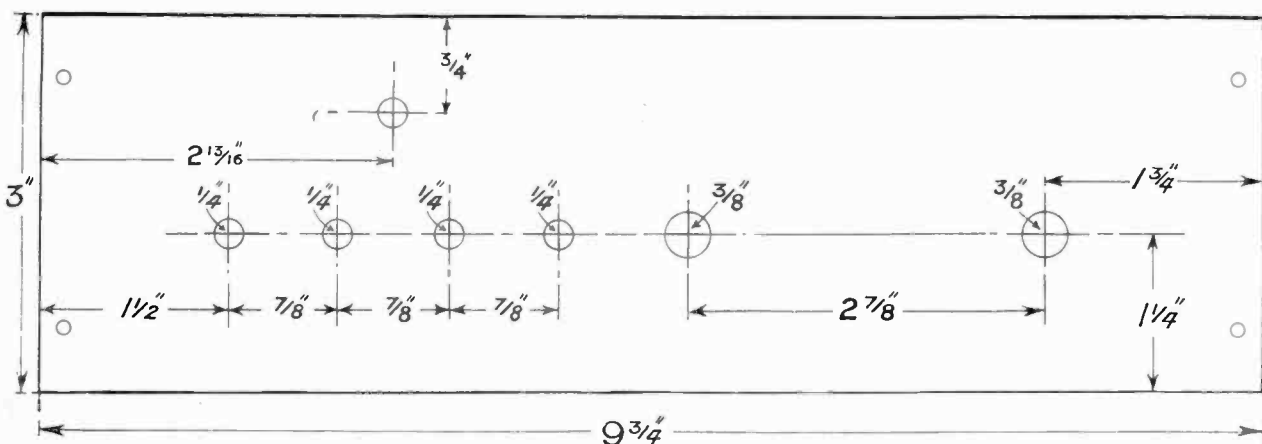
## Warning.

This apparatus is capable of giving shocks dangerous to life, and should not be connected to the mains unless in the safety box specified.



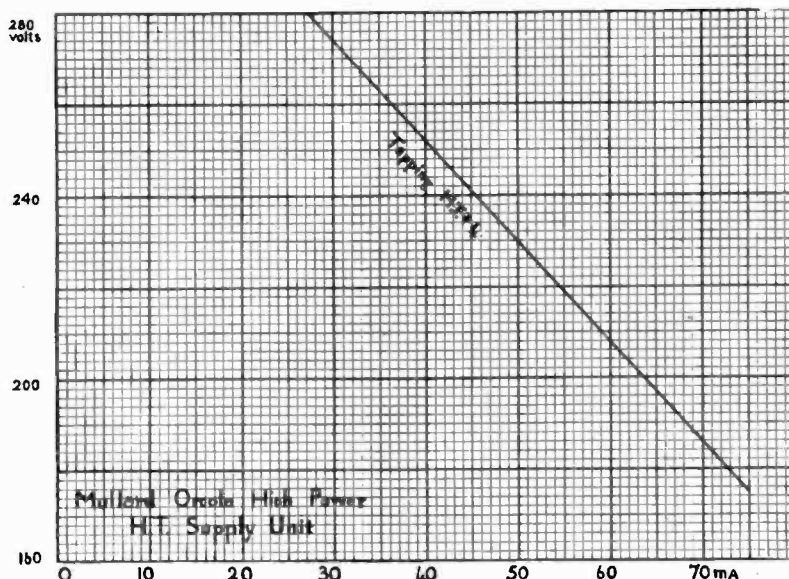
Reduced plan of eliminator drawn to scale. Great care should be exercised in building, as an error can cause considerable damage.

### EBONITE PANEL



Reduced plan of panel. This part can be obtained ready made if the constructor is unable to drill the necessary holes.

The output curve for this unit only holds good when the specified components are used. Any deviation from the listed components is strongly to be discouraged as not only will the output be altered, but also a possibility of unsatisfactory working introduced.



To use this graph, find the total anode current of the valves to be used, either from published information or the valve characteristic curve, and follow the line corresponding to the total up to the curve.

The horizontal line which meets both our load line and the curve, shows the maximum available voltage at this load.

### SPECIFIED COMPONENTS.

#### The "Orgola" High Power H.T. Supply Unit.

	£	s.	d.		£	s.	d.
1 "Orgola Power Unit" transformer * (Wearite)	1	10	0	1 50,000 ohms wire-wound resistance with holder (Mullard)		6	6
1 Choke E.P. 10 (Varley)	1	0	0	1 25,000 ohms do. (Mullard)		6	6
1 Choke E.P. 11 (Varley)	1	1	0	1 5 pin valve holder (Junit)		1	9
1 Power potentiometer, 50,000 ohms (Varley)		10	6	5 Safety plugs and sockets (1 black, 4 red) (Belling Lee)		3	9
1 Power potentiometer, 10,000 ohms (Varley)		10	0	1 Eliminator Safety box (Ferranti)		1	10
2 4 mfd. Paper condensers (Mullard)		10	6	1 B.C. adaptor, or plug for connection to mains, say			6
4 2 mfd. Paper condensers (Mullard)		14	0				

#### Specified Valve Mullard D.W.2. Price 17/6.

Always state voltage and periodicity of mains when ordering transformers.

\* If the periodicity of the mains is lower than 40 cycles a special transformer is necessary.

8.7/6  
176  
9.46

N.W.2,

15th January, 1930.

Dear Sirs,

I obtained a volume of the "Radio for the Million" and after studying this and the Blue Print, I decided to construct the "Mullard Orgola Receiver."

Although I am a novice having not made a Wireless Receiver before, I saw no reason why I could not construct this one.

Having procured the necessary parts according to the specification I proceeded to build the set, and saw how easy it was at once.

It took me a very short time to build, and in fact it would have taken less if I had not been held up for some of the parts. The necessary hints as you proceed shows the consideration given to the amateur.

Having finished the construction and fitted the battery

lead, I fitted the valves in the proper places. Then I connected up the Aerial, Earth, Loud Speaker, and Battery Leads, and by the way, the printing of a chart showing the correct way to connect up the batteries struck me as another typical consideration shown to amateurs.

As soon as I switched on the set and had tuned in to London, I got a magnificent performance, afterwards I got Daventry 5 G.B., 5 XX., and Radio Paris and Eiffel Tower, all in one evening, and on an indoor aerial round the picture rail. The volume and reproduction of this set is marvellous. I heartily recommend the Orgola to anyone who wants to get the best out of wireless.

You are at liberty to use this letter in any way that you may think desirable.

Yours sincerely,  
Satisfaction.

# People say about "Radio for the Million" Sets—

EXTRACT REPRINTED FROM "DAILY EXPRESS" MARCH 3, 1930

## REGIONAL SCHEME TESTS

### DIAL READINGS FOR 30 STATIONS

According to present arrangements, the regional broadcasting system, so far as the twin transmitters at Brookman's Park are concerned, will be in full operation next week.

Experimental transmissions on the second aerial (261.3 metres), which have been in progress for some time past do not seem to have proved entirely satisfactory.

Some listeners complain that several stations, hitherto clear, come through with a strong background, and others that they are wholly blotted out, 2LO "booming through," as one correspondent puts it, to the complete elimination of everything in its path.

Others have been more fortunate and have no cause of complaint against the new order of things. It all depends on the character and capability of the set.

Meanwhile, in order to help the set-owner who finds difficulty in receiving certain stations, the "Daily Express" Wireless Department is able to give the detailed results of a series of experiments which have been made with the most popular of the "constructor's sets."

Trials made at a distance of between eight and nine miles south-west of Brookman's Park have brought in thirty stations on the Mullard "Orgola" three-valve screened grid set.

The following table shows the wavelength, power in kilowatts, and dial readings for the first ten stations logged at full loud-speaker strength:—

Metres.	Kilowatts.	Station.	Dial.
225	1.5	Cork	15
227	2	Cologne	23
201	20	Regional	24
291	7	Turin	44
356	30	2LO	63
381	8	Toulouse	68
300	4	Frankfort	70
399	1	Glasgow	72
408	10	Katowice	74
413	1.5	Dublin	75

Between Regional 261 and Turin comes the British relay wave-length of 288.5, which is common to ten stations.

Tuning, it will be observed, is somewhat critical between Cork and Cologne, both low power stations, and only separated by two metres, but it can be achieved with care and patience.

Following are the stations on the higher medium wave-band:—

Metres.	Kilowatts.	Station.	Dial.
431	2.5	Belgrade	78
441	30	Rome	80
473	13	Langenberg	85
479	25	Daventry 5GB	86
493	60	Oslo	89
501	7	Milan	90
509	1	Brussels	91
517	15	Vienna	93
533	1.5	Munich	95
550	20	Budapest	98

In this group the chief difficulties have been in separating Langenberg from Birmingham, between which the difference is only six metres, and Milan from Brussels with a difference of eight metres.

The following stations were tuned in on the long wave-band:—

Metres.	Kilowatts.	Station.	Dial.
1071	6.5	Hilversum	18
1154	7.5	Kalundborg	27
1304	5	Kharkov	41
1348	30	Motala	45
1411	8	Warsaw	49
1554	25	Daventry 5XX	59
1635	20	Berlin (Koenigswusterhausen)	64
1725	12	Radio Paris	69
1875	6.5	Huizen	78

These readings do not exhaust the possibilities of the set, nor, on the other hand, is it claimed that all the stations tabulated can be received without careful tuning.

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Dear Sir,

Just a word in praise of your 1930 Mullard Orgola S.G.3 receiver. On a very poor and badly screened aerial I have logged 30 stations, mostly at good strength. This is not counting many fairly weak ones which I did not trouble with. In brief, I have heard loud sets at the cost of purity, selective sets at cost of volume, and pure sets at the cost of range, but the Mullard is one of those rare sets which combined all three points. Congratulations.

Yours truly,

E. G. S.

Leeds.

Dear Sir,

Two years ago I built your Blake circuit which did yeoman service and which I remained faithful to (although trying scores of hook ups) until I built the S.G.P. Master Three, the Blake now being on short waves only.

The S.G.P. Master Three I sum up as follows:

Fans, Roaming Countrymen, lend your ears to the Mullard S.G.P. Master Three; stay at home and roam to other towns, cities and countries; your passport is universal and a connoisseur withall; what more must I say, it speaks for itself and needs not my praise.

Carmarthen.

Scores of sets I have made, but I must at last settle down to be just an "Ordinary listener" until such time as you publish something again extraordinary in sets, when I shall try out the new before letting it supersede my companion of rambles and travels.

I am, Sirs,  
Yours faithfully,  
J. S.

Thornton Heath, Surrey.  
15th January, 1930.

Dear Sirs,

I busied myself over last week-end by constructing an Orgola receiver for A.C. mains operation, and am now celebrating Radio Week by listening on it.

I want to let you know how pleased I am with the set's performance, and to congratulate your engineers on designing what the ordinary non-technical man like myself wants—a good, easily assembled "all-mains" set. I also would like to express my appreciation of the help so courteously and ably given by your technical expert whom I consulted upon several difficulties.

I have not yet "logged" many foreign stations; that side of radio does not greatly interest me, but my ideal is purity of tone, and the Orgola gives amazingly faithful reproduction. The reserve of power when listening to 2LO and 5GB no doubt helps this.

I adhered throughout to specified components. I am using your filament heating transformer and high tension unit. There is not the slightest trace of hum, although I am a few yards only away from tramways. In fact, the set is more silent than my old battery run receiver (detector and 2 L.F. with R.C. coupling but NOT Mullard).

Yours faithfully,  
C. A. A.

Enfield Highway,  
Middx.

Dear Sir,

I have been the proud possessor of a Mullard Master Three Star for this past twelve months, and have spent hours of pleasure with it listening to the local programme, and making a tour of foreign stations, which I received in plenty until Brookmans Park came so near to me. I tried several wave traps but without much success, so I decided to build the Orgola set which I have successfully done, thanks to Mullard's simplified plan supplied with the RADIO FOR THE MILLION.

The results I have obtained have been beyond any expectations for I can cut out both Brookmans Park stations, and I am only about six to seven miles away. This was done with an outdoor aerial, and without wave traps; a fine performance for such a simple set. I can obtain many more foreign stations and at a greater strength than with my old set, and the quality of the reception is as fine as I have heard, again thanks to Mullard valves.

There is one point I would like to ask of you, that is, I am using my Mullard Permacore transformer, Climax H.F. choke, and P.M. combined grid leak and condenser holder, out of my old set, are these parts quite in order to use.

I wish you every success with the Orgola and to anyone who builds it; this must come providing they use essential components stipulated in the RADIO FOR THE MILLION.

Yours faithfully,  
F. W. P.

Bradford, Yorks.

Dear Sirs,

Many thanks for your letter of the 2nd instant and for testing and replacing faulty valves.

I connected up the set on Saturday last and got 28 stations that day. The volume from all being excellent. In fact, so many stations came in at great strength that I had not and have not yet had time to search for the weaker stations. Local experts (?) are astounded at the volume and purity from 5XX, 5GB and the local stations; it must be heard to be believed.

Thanking you once again for your prompt service and attention and wishing Mullard products and especially the Orgola A.C. model every success in the future,

I am,  
Yours sincerely,  
H. T.

Syston.

Dear Sir,

I am in receipt of your letter of the 16th inst., for which I thank you.

Acting upon your advice I have replaced the last valve, P.M.2, with a P.M.252 super power valve, and am delighted to find that the distortion has now completely disappeared.

It is now a real pleasure to listen to the programmes, and now the set more than justifies all that you claim for it.

Many thanks for your kind attention to my enquiry and for your excellent advice.

Yours faithfully,  
G. F. H. A.

There is still a limited number of copies of Vol. 4 No. 1 of "Radio for the Million" containing instructions for building the "Orgola," "Orgola Senior" and the "Orgola" Radio Gramophone.

Price 3d. or Post Free 4½d.

"Radio for the Million."  
63, Lincoln's Inn Fields, London, W.C. 2.





# MULLARD MASTER

## H.F. UNIT

A new Unit incorporating a screened grid valve. The efficiency of this unit is of the highest order, and the builder is assured that the results, when used in conjunction with a "Master 3" set, will be equal to those of any well-designed 4-valve set.

WHAT should one do with a cherished set which gives adequate volume and pure tone from the local station, yet wants just a little power to make those more distant stations audible on the loud speaker?

This is a question which many owners of "Master 3" and "Master 3 Star" sets ask themselves.

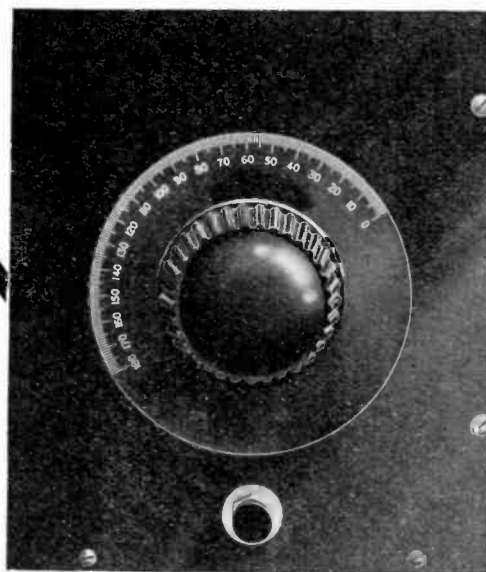
Loth to scrap such an eminently satisfactory set, the unfortunate listener is in a quandary. Up to the present, H.F. units have generally been considered unsatisfactory, and in fact when the three electrode valve was the only type available, and neutralising arrangements had to be incorporated, it was indeed a difficult task to devise a simple and efficient H.F. Unit.

The advent of the screened grid valve, however, has entirely changed the situation, and the H.F. Unit becomes a more simple and more efficient piece of apparatus.

### Makes the "Master 3" a 4-valve Set.

The "Master S.G.H.F. Unit" used in conjunction with the "Master 3" or "Master 3 Star" receivers makes a combination which is definitely as efficient as a four-valve set, and we state without fear of contradiction that it is impossible to increase the efficiency of the complete assembly however the components might be arranged. As to the building, the H.F. Unit is possibly the simplest piece of apparatus ever devised for popular construction.

There are a few wires only, 12 to be precise, and the L.T. Battery leads are so arranged that



the H.F. Unit can be switched off automatically with the set. There is no fear of the set being switched off and the Unit left running.

### Do not substitute.

When building this unit one important point should be noted. The components should not be substituted by a different make, nor should the position of the components be changed. In the high frequency stage of a radio receiver the disposition of the components can make or mar the performance, as also can the substitution of components of different electrical characteristics.

If this warning is taken to heart, no difficulty will be experienced, and when the Unit has been built from the point to point wiring and blue print it is ready for test.

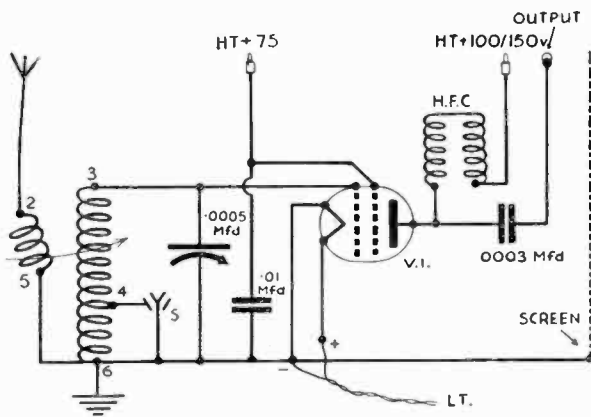
Before making any attempt to receive stations, however, read the following notes which explain some points about the sets it can be used with.

Follow these instructions carefully, for failure to do so may cause poor results.

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LT +, the filament wire farther from the panel.

Connect the batteries as before, remembering that the black spade is still L.T.— and the red still L.T.+, although they are fixed to different wires.



## Connecting the Unit.

Connect L.T.—lead of the H.F. Unit to F.—terminal (nearer panel) of the detector valve holder (V.1).

Connect L.T. + lead of the H.F. Unit to F. + terminal (further from panel) of the detector valve holder.

Connect H.T. +1 to +75 volts H.T.

Connect H.T. +2 to +100 to 150 volts H.T.

Leave the earth wire connected to the earth terminal of the receiver.

Connect the aerial to aerial terminal of the H.F. Unit.

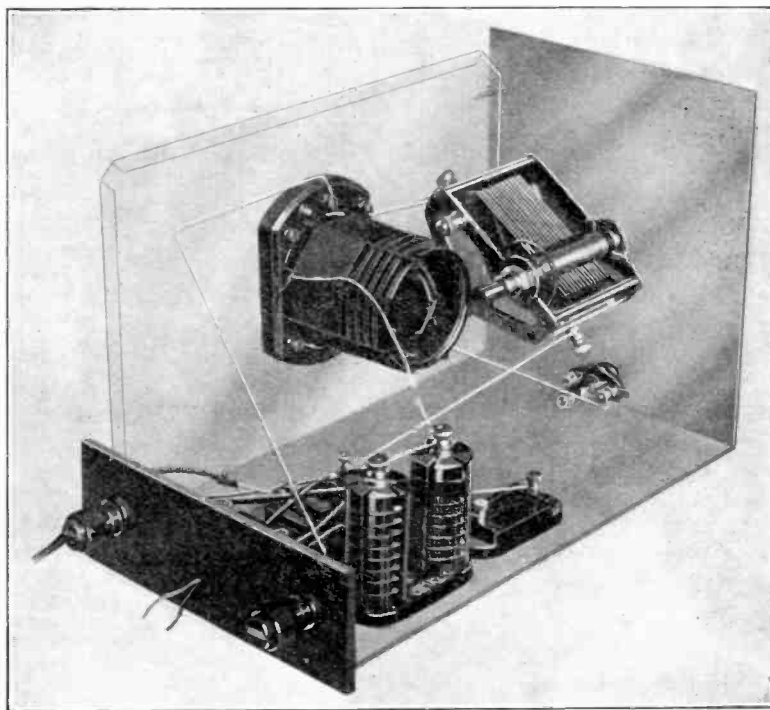
Connect a wire from terminal "Output" to terminal 1 of coil base in set.

Remove the red spade from battery lead No. 1 (previously L.T.+), that is the lead which is connected to the push-pull switch on the panel. Replace on this lead the black spade, retaining the short length of wire which connects to H.T. — (this lead now becomes L.T.—). Fix the red spade to the L.T. Battery lead which is connected to the Fil. terminal of V.3 (previously L.T. — now L.T.+). Remove G.B.+ from the Fil. terminal further from the panel and connect it to the Fil. terminal nearer the panel.

In order to retain positive bias on the detector valve it is necessary to make a slight alteration in the position of the grid leak.

In the original receiver the grid leak connects across the grid condenser. To ensure positive bias on the detector, one must now obtain a grid leak holder and fix this to the baseboard near to the grid condenser.

One terminal of this grid leak holder must be connected to the grid terminal of the detector valve holder V.1, and the remaining terminal connected to



The finished unit ready for connecting to the receiver. Note the simplicity of the assembly and wiring.



The receiver and unit can now be switched on. The tuning is carried out by adjusting the H.F. Unit control and the tuning control of the set in unison. The reaction behaves exactly as before. It will be found that the readings of the tuning condenser and H.F. condenser will be alike over the greater part of the tuning range.

The push-pull switch on the panel of the H.F. Unit sets the coil for broadcast band reception when pulled, and for long wave reception when pushed, exactly as is the case with the "Master 3 Star" Coil.

#### Note on "Master 3 Star" Coil.

If the set is inclined to oscillate when tuned to the lower end of the dial, 15 turns should be removed from the reaction winding. This is wound in a slot at the base end of the coil. Cut the wire about two inches from the outer end of the winding, remove the turns and twist the bared ends together; this will effectively prevent any reaction troubles.

#### Note on "Master 3" 6-pin Coil.

If the receiver is inclined to oscillate on long waves, take a short length of wire, bared at each end, and make one turn in the fourth slot from the bottom of the coil. Twist the bare ends securely together.

#### Adjusting Selectivity.

The next point to receive attention should be the rotor in the coil, for this controls the selectivity of the receiver. When the rotor coil in H.1 is nearly at right angles to the coil the highest degree of selectivity is available, but when the rotor is in the same plane as the coil the tuning is flattened as much as is possible. The right position can only be found by trial and error, but when making the adjustment move the rotor very slightly at each trial, as the smallest movement makes an appreciable difference. Having made a good preliminary adjustment, a tour of the stations available should be made. After dark a multitude of distant transmissions should be received if a reasonably efficient aerial and earth system is employed.

After this some small adjustment of selectivity may be made with advantage, bearing in mind that if the receiver is made too selective a definite loss of signal strength will be inevitable.

#### A Volume Control.

If a volume control is desired this can be arranged by fitting to the panel of the set itself a 50-ohm rheostat in the case of 6 or 4 volt valves or a 15-ohm rheostat for 2 volt valves. Then instead of connecting L.T.—from the H.F. unit to the L.T.—wire of the set, connect the L.T.—wire of the unit to the fixed terminal of the rheostat, and connect the slider terminal of the rheostat to the panel bracket screw on the set.

#### Specified Components for the Mullard "Master H.F. Unit."

	s.	d.		s.	d.
1 Cabinet, oak (W. T. Lock)	—	—	1 black knob switch (Junit)	1	6
1 Baseboard, 6 × 10 in. (supplied with cabinet)	—	—	1 H.F. choke (Climax)	7	6
1 "Master S.G. H.F. Unit" panel and screen (Colvern)	4	6	1 Fixed condenser .01 mfd. (Mullard)	1	9
1 .0005 mfd. log condenser (R/210) with dial (Ormond)	13	0	1 Fixed condenser .0003 mfd. (Mullard)	1	9
1 R2R coil with 100 turn rotor (Colvern)	8	6	2 Terminals "Aerial" and "Output" (Belling Lee)	1	0
1 5 pin valve holder (Junit)	1	9	1 Terminal strip 6 × 2 ins. (Becol), say		6
				£2	1 9

#### Recommended Valves for the Mullard "Master H.F. Unit."

2V	4V	6V
P.M. 12 .. .. . £1 2s. 6d.	P.M. 14 .. .. . £1 2s. 6d.	P.M. 16 .. .. . £1 2s. 6d.

#### Calibration Chart Mullard "Master H.F. Unit."

Wave Length.	Condenser.	Wave Length.	Condenser.	Wave Length.	Condenser.	Wave Length.	Condenser.
200 M	43	310	102	420	141	530	172
210	51	320	106	430	144	540	174.5
220	58.5	330	110	440	147	550	177
230	65.5	340	114	450	151	Long Waves.	
240	71.5	350	118	460	153	Hilversum	60
250	76.5	360	121.5	470	156	Kalundborg	72
260	81.5	370	125	480	159	Motala	95
270	86	380	128.5	490	162	5XX Daventry	122
280	90	390	132	500	164.5	Radio Paris	135
290	94	400	135	510	167	Huizen	141
300	98	410	138	520	169.5		

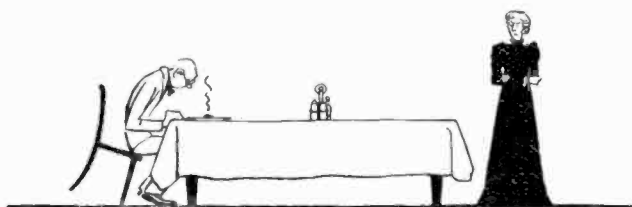
# Things to know about radio

A talk about things which may have puzzled you,  
and the solution to one or two radio problems.

## Tuning.

Tuning is a function one usually assumes to be the prerogative of the coil and the familiar variable condenser, but it is in fact not confined to these components alone. The aerial-earth system, in conjunction with the portion of coil included in it, being possessed of inductance and also capacity, must tune to some frequency, and, as is always the case, the greater the capacity and inductance the higher the wavelength to which the system tunes.

Now this useful piece of knowledge enables us to see why certain types of aerial are apparently more selective than others, for it is obvious that if the natural wavelength of the aerial is approximately the same as a station we wish to eliminate, our task will be almost impossible to accomplish. The moral is, of course, keep the aerial short so that its inductance may be as low as possible. Keep its capacity low, too, by using a single wire, and let that one-wire aerial consist of as much vertical length as possible, and as little flat top as is consistent with a reasonable total length. A good figure to work on is 60 feet; 30 feet of lead in and 30 feet of flat top wire.



Keep its capacity low.

Of course the earth wire must be taken into consideration, for this is part of the aerial-earth system and, while a long earth wire adds nothing to the intensity of the signal picked up, it does, as its length increases, adversely affect selectivity.

Here we have very sound reasons for moderating the length of the aerial and keeping the earth

to the very shortest dimensions possible. There is also another important aspect of this matter. When the aerial-earth system is unduly long, the load imposed on the aerial tuning coil may prevent it tuning down to the lower wavelengths or, in the case of receivers such as the "Orgola," the two tuned stages may be thrown out of step, so making it impossible to receive stations at full strength at the lower end of the dial.

This, of course, is the reason why some sets appear to collect a greater signal from a small aerial than they do from the larger and apparently more efficient system.



100 times the amplification.

Quite apart from this consideration, however, modern sets, such as those published in this journal, and employing Mullard valves, give such enormous amplification that there is no advantage to be gained by erecting a large aerial, while a much greater degree of selectivity is enjoyed if the shorter aerial is used.

## Why use a Super Power Valve?

The name "super power valve" can be at times misleading, for one can easily associate power with amplification, while it is in fact quite a different thing. Each stage in the receiver must amplify, and in modern, well-designed sets the overall amplification is often 100 times as great as it was from the same number of valves in a set designed four or five years ago.

Mullards made the modern set possible when they introduced the P.M. range of valves, but at the same time they did something more. For

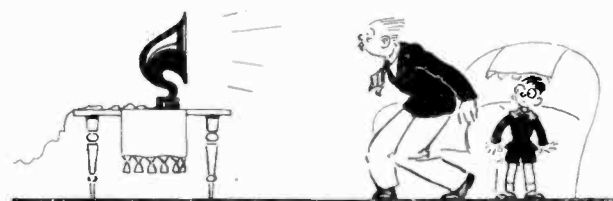


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with the increased amplification these valves give, a greater signal is passed to the last stage, necessitating the use of a valve capable of handling the increased signal without distorting it, and Mullards have produced output valves easily able to handle these big signals.

In order to handle this greater signal one must increase the power in the anode circuit of the last stage of the receiver. This is done by using a super power or pentode valve in the socket of the last stage. One often hears the remark, "I use a hundred-volt battery and the results are fine." Yet if this same listener were to increase the voltage to 150 volts, thus increasing the power in the output stage, he would be astonished to hear almost twice the volume without distortion, for with wireless, as with other things, not excepting banks, one cannot extract more than one puts in. Of course there is the disadvantage that more power is consumed, and power costs money. This is true, but even so the extraordinary increase in volume and the amazing improvement in quality, more than repay the user for the money expended.

Next time you buy a valve let it be a Mullard super power valve; it will improve the quality of reproduction beyond belief. It costs a little more to run, but not more than you will gladly pay, having once heard it. Of course if electric light is fitted in your house you can fit super power valves and still run radio for a trifling cost. For with a Mullard P.M. H.T. Unit the set can be run from the mains for about 10 watts consumption, which is approximately a sixth of the current consumed by your dining-room light.



Astonished to hear double the volume.

### A Reaction Point.

Reaction is, to most listeners, a mysterious happening which conveniently enables them to increase the volume of signals from distant stations. Yet most have noticed that a smooth control of reaction enables the signals to be increased to a much greater degree than is the case when at the last moment reaction takes charge

itself and spills over into oscillation, or gives a dismal growl as the control approaches the most sensitive position.

As a reason can be found for most things, so can one be found for this not unusual trouble.

In "Radio for the Million" sets, the capacity controlled reaction arrangement is used, and for this arrangement to be completely successful it is important to see that there is an efficient H.F. stopper in the anode circuit of the detector valve.



Gives a dismal growl.

In the "Orgola," "Orgola Master 3," and "Master 2" receivers the only apparatus included in the detector anode supply lead is the primary winding of the L.F. transformer. For efficient reaction the primary of this transformer must have a high inductance and low capacity. Both conditions are fulfilled in the Mullard "Permacore" Transformer, so that unless this component is substituted for another, no trouble will result. If, however, you really must use the transformer out of your old set, connect an efficient H.F. choke between the anode terminal of the detector valve and the anode terminal on the low frequency transformer, for some method must be found of preventing an undue leak of H.F. current across the primary of the L.F. transformer.

### Acquiring Skill at Tuning.

A number of newcomers to radio often suppose that, because the radio is so simple to operate, it is unnecessary to acquire any skill in tuning.

Now this is a fallacy. Let us assure you that with the simplest apparatus, a degree of skill and familiarity with the controls will enable you to double your "bag" of stations.

Don't be disappointed if your first essay at tuning your receiver does not come up to expectations, practice a little, for the art of tuning a receiver cannot be taught, it must be acquired by practice, and it is best to practice on the set one means to use.

# Using a Pick-up with your set!

How to fit radio gramophone facilities to any "Radio for the Million" Receiver.

Modern radio has acquired such a reputation for clarity and pleasing quality, that most possessors of good radio receivers wish at some time that they could use a gramophone pick-up in conjunction with the radio equipment. Such an arrangement, if properly devised, does give a marked improvement in quality compared with the older type of gramophone—there is a richness and delicacy of light and shade not expected of a gramophone record. There is also a much better response to the lower notes; and it is these bass frequencies which can make or mar any piece of music, for if they are suppressed the music seems without foundation, without the power to stir the listener, and lacks the thrilling richness which is the chief feature of a full orchestra or a grand organ.

## Some difficulties.

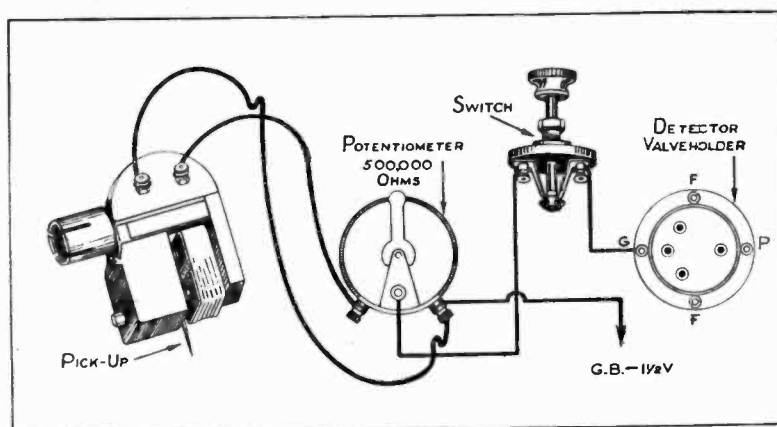
Many have been deterred from going over to electric reproduction on the score of cost. Their present sets have no attachment for connecting the pick-up, and the valve base adaptations often advocated necessitate pulling the set almost to pieces each time the change from gramophone to radio, or vice versa, is desired.

However, for those who wish to arrange their sets for gramophone reproduction, here is information which will enable almost any type of set to be so adjusted.

It is as well to say, before any expense is incurred, that great volume will not be obtained with quality unless a super power or "Pentone" valve is used in the output stage of the receiver. Gramophone

pick-ups will give very pleasing results when an ordinary power valve is used, but it will be impossible to increase volume to any great extent without distortion occurring.

Having clearly outlined the results which can be expected with valves commonly in use, we will proceed to the business of connecting the apparatus to the set.



Pictorial circuit of pick-up connections to any "Radio for the Million" set.

## The Components you need.

The components to acquire are a pick-up, a volume control, terminals, and, if switch operation is desired, a push-pull switch which, if fitted to a metal panel, must

have its spindle and both contacts insulated from the panel. The "Junit" blue knob switch is suitable—this component was specified for this purpose in the "Orgola" receiver, but if another make is used, be certain that the contacts cannot be brought into connection with the panel, for if this occurs no signals will be heard on radio or gramophone.

As to the actual disposition of the switch; this should be fitted as near as possible to the detector valve holder, for one contact of it is connected by a wire to the grid of the detector, and if this wire is unduly long and runs near to the H.F. end of the set, trouble may result.

Looking at the sketch of pick-up connections, it will be seen that it is necessary to connect one side of the input to the grid of the detector valve and the other to the grid bias battery.

The purpose of this is to feed the impulses from the pick-up on to the grid of the valve, and, by making the remaining connection to G.B.—

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maintain the grid of the valve at its correct negative potential for amplifying ; for the valve is a detector when used on radio, and an amplifying valve when used on gramophone.

### Fitting to the Set.

When fitting the connections to the set, one may ignore any H.F. stages, for these are not in use when the gramophone operates. All that we are concerned with is the detector and amplifying valves, and if there is a rheostat controlling the H.F. valve or valves, this should be turned off while the gramophone is working. Again, if reaction is used, as it is in most sets, this control should always be set at zero when the gramophone is operating, as it will only distort the signals if increased.

The volume control is another very important part of the complete outfit, for this is not a refinement but an essential. Most pick-ups develop a signal vastly in excess of the valve's capabilities, and if the volume control is not adjusted correctly, overloading and the most horrible distortion will result.

For the volume control use a potentiometer of about 0.5 megohms resistance. This component can be bought for about 6s. 6d., a very modest sum, and it will enable any pick-up to be used, and in addition control the volume to proportions suitable to different occasions.

### Fitting the Volume Control.

The volume control may be fitted to the set or to the gramophone which ever is more convenient. We would suggest that you fix it on the motor board of the gramophone, for when it is fitted to

the panel of the radio receiver, the uninitiated members of the family may confuse it with the controls for radio reception.

### Choosing a Pick-up.

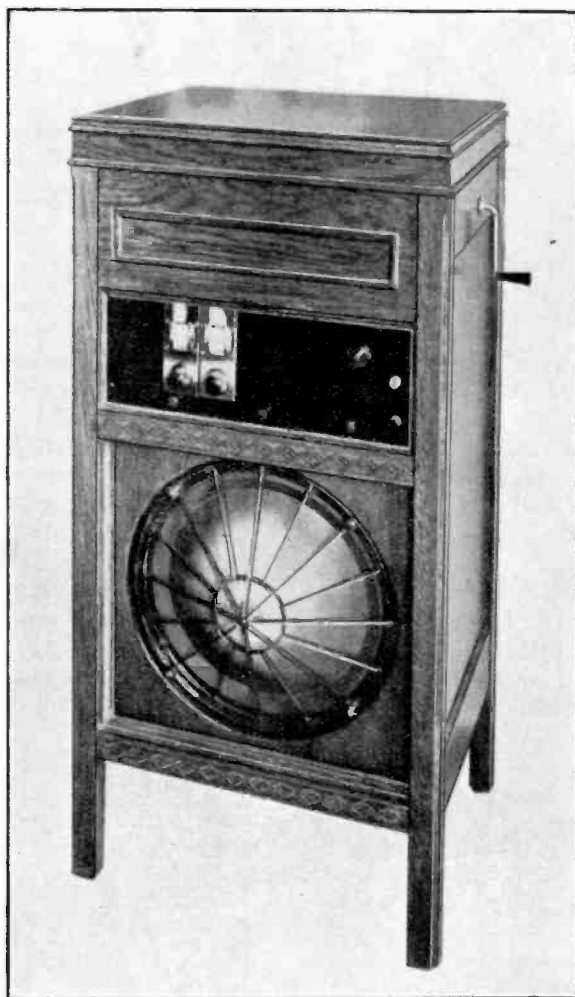
Pick-up devices vary enormously both as regard output and response curve. It is no easy matter to advise how to choose, but one pick-up which was specified for the "Orgola" radio gramophone—illustrated below—was the Igranix Super Phonovox, an eminently satisfactory instrument. Of course, there are many other satisfactory types but this is, to our knowledge, good when used in conjunction with such sets as the "Orgola," "Orgola Master Three," etc.

### Tracking the Pick-up.

With the Super Phonovox type of pick-up, tracking is accomplished very simply, by arranging for the needle to fall directly in the centre of the turntable spindle.

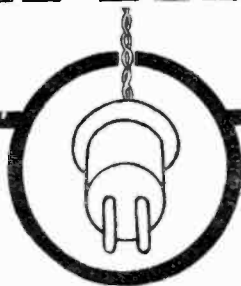
Certain types with cranked arms have to be adjusted by other methods, but since no standard angle is observed it is best to adjust each make according to the maker's instructions.

Just one final word. Any set possessing a good low frequency stage can be made into a radio gramophone amplifier. The "Master 2," for instance, will behave as well as the "Orgola" itself, or the "Orgola Master 3," for here are all the requisites for a good gramophone amplifier—provision for a "Pentone" output valve and an inter-stage transformer with an even response curve.



The Mullard "Orgola Radio Gramophone." The "Orgola Master Three" will fit this cabinet, and work admirably as the radio-amplifier for the general scheme.

# CONVERT YOUR MASTER 3 TO AN ALL-ELECTRIC SET



Many requests for instruction on converting the "Master 3" and "Master 3 Star" Receivers to A.C. sets have been received in the editorial office—hence this article, which will deal with the difficulties likely to crop up if this is attempted, and at the same time will give instructions for converting these Sets into quiet, stable, A.C. receivers.

A few amateurs have attempted to convert the receivers by fitting five-pin valve-holders, making the necessary cathode connections and inserting 3 A.C. valves; the result has been in most cases good, but with a distinctly audible hum.

Some have condemned A.C. valves, others have decided that there was some factor involved which they had not previously experienced.

The causes of the hum are many, but chiefly it can be described as pick-up on the grid of the detector, the 2 megohm grid leak accentuating the trouble.

When this fact is exposed one asks why this trouble has not been experienced when running the original receiver from a battery eliminator? The reason is that the overall magnification is enormously increased when A.C. valves are used, and any hum picked up in the detector is magnified to a much greater degree, while the signal is cut down by reducing reaction or by a volume control.

The result is a greater ratio of hum to signal.

Apart from this fact too great a degree of L.F. amplification is undesirable as it may make the set appear unselective.

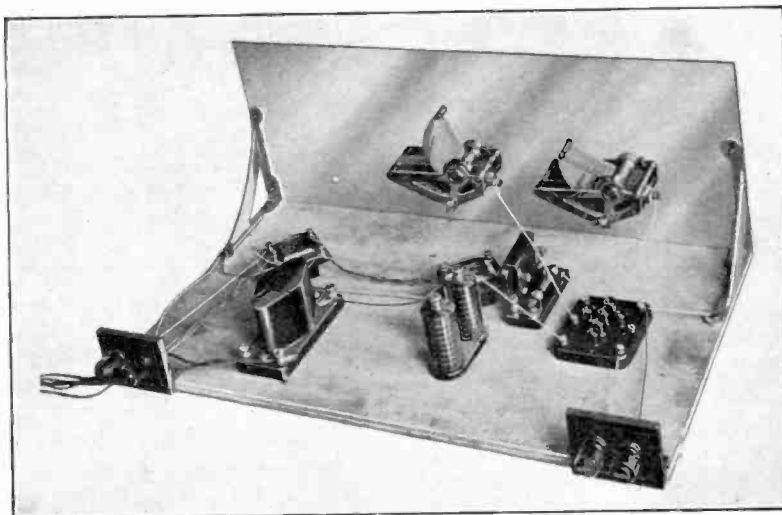
How, you ask, can this difficulty be overcome? Quite simply—for whilst the removal of one stage of amplification will lower the signal strength too much, the replacement of the output valve with a "Pentone" valve will restore the magnification to something of the same order as in the original receiver.

## HOW TO MAKE THE CONVERSION.

The new components required are :—

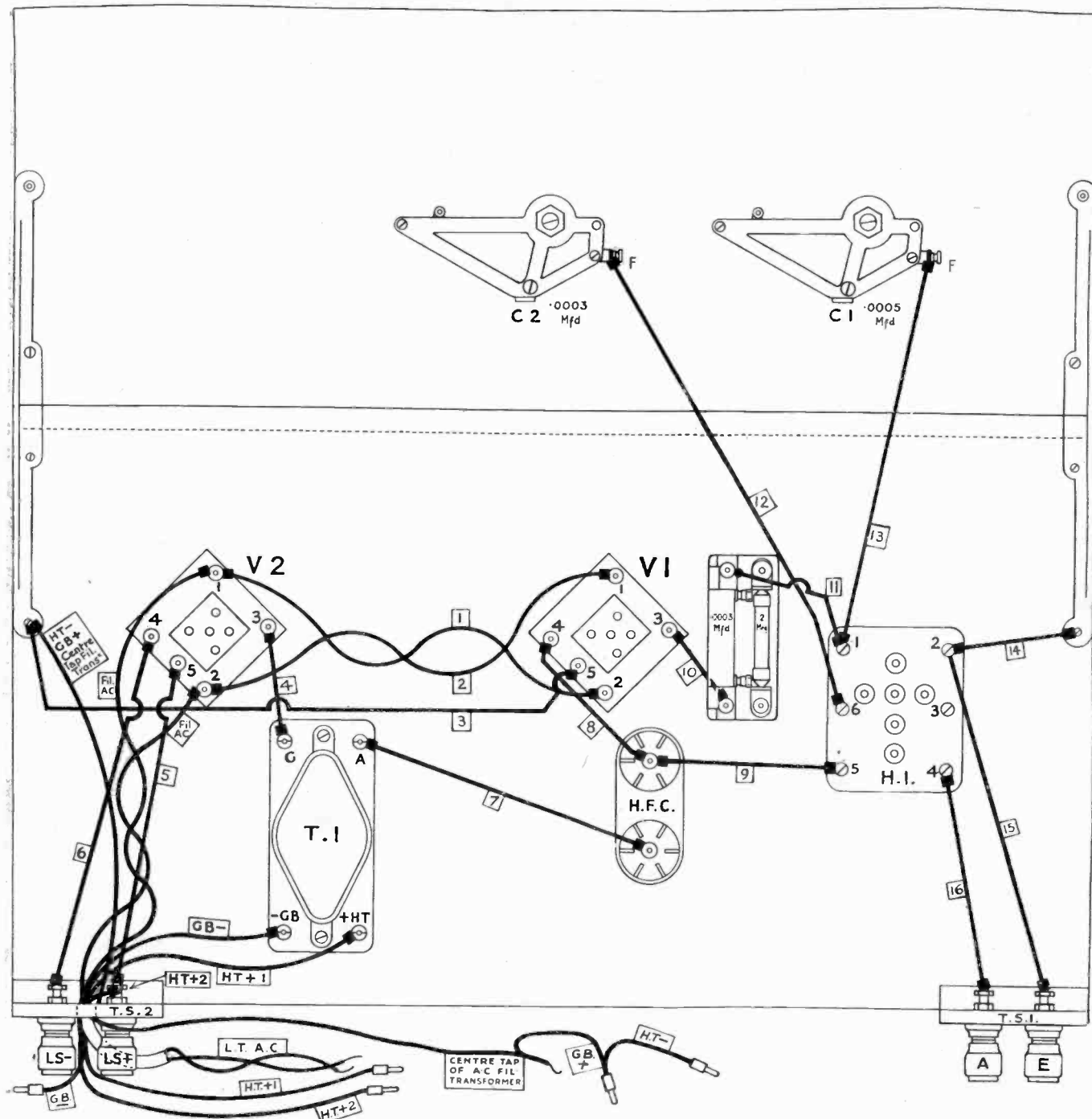
- 2 Junit 5-pin valve holders.
- 1 P.M. Filament transformer. (Mullard.)
- 1 P.M.H.T. Unit. (Mullard.)
- 1 354 V Valve. (Mullard.)
- 1 P.M. 24 Valve. (Mullard.)

As can be seen from the drawing, the original valve holders must be removed and replaced by the two Junit 5-pin models—the R.C.C. Unit, or in the case of the "Master 3 Star" one transformer, is also removed, as one stage only is required and this should be coupled by the Mullard transformer. The wiring can be completed in less than the hour originally scheduled for the building of the set.



The receiver after the conversion. The main components are exactly as before and in the identical positions.

# “Mullard Master Three” Receiver converted to Electric Two.



The reduced print above will enable most constructors to convert their sets without removing more components than the valve holders, and a few wires. It is advisable however, if the set has been constructed some time and there is an accumulation of dust, to remove all the components and clean them before commencing the new wiring.

## “Master 3 Star” Receiver.

The numbering of the coil base of the “Master 3 Star” is identical with that of the “Master 3.” The only difference will be the fixed condenser in wire No. 16.

Before operating the set remember to make a careful check on the wiring.



# Point to Point Wiring.



## WIRE NO.

- 1 & 2 Take a length of twisted flex and bare the four ends. Connect the leads at one end to terminals 1 and 2 on valve holder V.2., and at the other end to terminals 1 and 2 on valve holder V.1.
- 3 Connect terminal 5 of valve holder V.1 to the left-hand panel bracket fixing screw.
- 4 Connect terminal G of transformer T.1 to terminal 3 of valve holder V.2.
- 5 Connect terminal 5 of valve holder V.2 to terminal L.S.+ on terminal strip T.S.2.
- 6 Connect terminal 4 of valve holder V.2 to terminal L.S.— on terminal strip T.S.2.
- 7 Connect terminal A of transformer T.1 to nearer terminal of H.F. choke H.F.C.
- 8 Connect terminal 4 of valve holder V.1 to further terminal of H.F. choke H.F.C.
- 9 Connect further terminal of H.F. choke H.F.C. to terminal 5 of coil base H.1.
- 10 Connect terminal 3 of valve holder V.1 to nearer terminal of combined condenser and grid leak holder.
- 11 Connect further terminal of combined condenser and grid leak holder to terminal 1 of coil base H.1.

NOTE.—Do NOT remove loose link from grid leak and condenser holder.

- 12 Connect terminal 6 on coil base H.1 to terminal F (fixed vanes) of condenser C.2.
- 13 Connect terminal 1 of coil base H.1 to terminal F (fixed vanes) of condenser C.1.
- 14 Connect terminal 2 of coil base H.1 to fixing screw of right-hand panel bracket.
- 15 Connect terminal 2 of coil base H.1 to terminal E on terminal strip T.S.1.

## WIRE NO.

- 16 Connect terminal 4 of coil base H.1 to terminal A on terminal strip T.S.1.

NOTE.—If a Master Three Star coil is used, wire 16 should be taken to one terminal of a .0001 mfd. fixed condenser, and the other terminal of the fixed condenser connected to terminal A.

## Power Supply Leads.

### L.T.A.C.

Take a length of twisted flex and bare the four ends; fix the two leads at one end to terminals 1 and 2 respectively of valve holder V.2. Connect the other ends to the outer terminals of the Mullard filament transformer.

H.T.—.

G.B.+.

Centre tap. Connect one end of a length of insulated flex to fixing screw of left-hand panel bracket, and bare the other end at three places, 6 inches apart. Connect the first to the centre terminal of the filament transformer, the second to G.B.+ wander plug, and the last to H.T.— plug of the P.M. H.T. Unit.

G.B.—. Connect a length of insulated flex to terminal —G.B. on transformer T.1 and the other end to the —15 v. socket in the G.B. battery.

H.T.+1. Connect a length of insulated flex wire from +H.T. on transformer T.1 to plug +2 on the P.M. H.T. Unit (90 v. approx.).

H.T.+2. Connect a length of insulated flex from terminal L.S.+ on terminal strip T.S.2 to plug +4 on the P.M. H.T. Unit (150 v. approx.).

The Editor,  
"Radio for the Million."

Nottingham.  
5/5/29.

Dear Sir,

I have had a Mullard Master 3 set working since last October (The original Master 3) and have had excellent results from it, and many of my friends consider it to be one of the sweetest toned sets they have heard and considering the number of Stations I have received I consider it still to be one of the best sets placed before the radio enthusiast. I have received on the Loud Speaker the following at different times, viz., Budapest, Munich, Vienna, Oslo, Brussels, 5 G.B., Langenberg, Rome, Madrid, Stockholm, Frankfurt, Dublin, Glasgow, Hamburg, Toulouse, Manchester, Stuttgart, Leipzig, London. Barcelona, Göteborg, Prague,

Copenhagen, Huizen, Cardiff, Breslau, Aberdeen, Belfast, Königsberg, Turin, Sheffield, Cologne, Horby, Nurnburg and the English relays, a truly remarkable list, and reflects great credit on the designer of the set, on the long wave I have not been quite so successful as I can only get 5XX, Kalundborg and Hilversum, when the first named is working, but when silent have had Radio Paris, Berlin, Eiffel Tower, Motala, Warsaw and Leningrad, besides the other 3.

I am feverishly awaiting the particulars of the new set, as knowing what the name Mullard means to radio, I know that the new set will be a distinct advance on any other set published.

I am Sir, Yours sincerely,  
S. R.



## European Broadcasting

according to the latest information available at the time of going to press.

M.	Station.	M.	Station.
1935	Kaunas (Lithuania), 7 kW.	352	Graz (Austria) (usually relays Vienna), 7 kW.
1875	Huizen (Holland), 6.5 kW.	349	Barcelona (Radio Barcelona) (EAJ1) (Spain), 8 kW.
1796	Lahti (Finland) (relays Helsinki), 40 kW.	342	Brno (Czechoslovakia), 2.4 kW.
1725	Radio Paris (CFR), 12 kW.	338-2	Brussels, No. 2 (Belgium), 3 kW. Flemish programme.
1635	Königswusterhausen (Zeesen) (Germany), 26 kW. Relays Berlin.	325	Breslau (Germany), 2 kW.
1554	Daventry (5XX) National Stn. (Gt. Britain), 25 kW.	322	Göteborg (Sweden) (relays Stockholm), 10 kW.
1481	Moscow (Old Komintern) (RA1) (Russia), 40 kW.	316	Marseilles (PTT) (France), 0.5 kW.
1445-7	Eiffel Tower (FI.), 12 kW.	311	Agen (France), 0.5 kW.
1411	Warsaw (Poland), 8 kW.	310	Cardiff (5WA) (Gt. Britain), 1 kW.
1348	Motala (Sweden) (relays Stockholm), 30 kW.	304	Bordeaux-Lafayette (PTT) (France), 1 kW.
1304	Kharkov (Russia), 25 kW.	301	Aberdeen (2BD) (Gt. Britain), 1 kW.
1153	Kalundborg (Denmark) (relays Copenhagen), 7.5 kW.	298-8	Hilversum (Holland), 6.5 kW. Daily until 5.40 p.m.
1103	Moscow, Popov (Russia), 40 kW.	291-1	Turin (Italy), 7 kW.
1071	Hilversum (Holland), 6.5 kW. Daily after 5.40 p.m.		Bournemouth (6BM), 1 kW.
1000	Leningrad (Russia), 20 kW.		Bradford (2LS), 0.13 kW.
938	Moscow (Trades Unions), 50 kW.		Dundee (2 DE), 0.13 kW.
550	Budapest (Hungary), 20 kW.		Edinburgh (2EH), 0.35 kW.
533	Munich (Germany), 1.5 kW.		Hull (6KH), 0.13 kW.
517	Vienna (Rosenhügel) (Austria), 15 kW.	288-5	Liverpool (6 LV), 0.13 kW.
509	Brussels No. 1 (Belgium), 1 kW.		Newcastle (5NO), 1 kW.
501	Milan (Italy), 7 kW.		Plymouth (5PY), 0.13 kW.
493	Oslo (Norway), 60 kW.		Sheffield (6FL), 0.13 kW.
487	Prague (Czechoslovakia), 5 kW.		Stoke-on-Trent, (6ST), 0.13 kW.
479	Midland Regional Station (Gt. Britain), 25 kW.		Swansea (5SX), 0.13 kW.
473	Langenberg (Germany), 13 kW.	281	Copenhagen (Denmark), 0.75 kW.
466	Lyons (La Doua), France (relays Ecole Supérieure), 5 kW.	280	Radio-Liège (Belgium).
459	San Sebastian (EAJ8) (Spain), 0.3 kW.	279	Bratislava (Czechoslovakia), 12.5 kW.
447	Paris (PTT) (Ecole Supérieure), France 0.8 kW.	276	Königsberg (Germany), 2.5 kW.
441	Rome (1RO) (Italy), 50 kW. Stockholm (Sweden), 1.5 kW.	272	Rennes (France), 0.5 kW.
430	Belgrade (Yugoslavia), 2.5 kW.	268	Barcelona (EAJ13) Radio Catalana (Spain), 10 kW.
424	Madrid (Union Radio) (EAJ7), (Spain), 2 kW.	265-4	Lille (PTT) (France), 0.7 kW.
418	Berlin (Witzleben) (Germany), 1.5 kW.	263	Moravská-Ostrava (Czechoslovakia), 10 kW.
413	Dublin (2RN) (Ireland), 1 kW.	261-3	London, National Stn, 30 kW.
408	Katowice (Poland), 10 kW.	259	Leipzig (Germany), 1.5 kW.
403	Berne (Switzerland), 1 kW.	257	Hörby (Sweden) (relays Stockholm), 10 kW.
399	Glasgow (5SC) (Gt. Britain), 1 kW.	255	Toulouse (PTT) (France), 1.5 kW.
394	Bucharest (Roumania), 12 kW.	253	Gleiwitz (Germany) (relays Breslau), 5 kW.
390	Frankfurt (Germany), 1.5 kW.	251	Almeria (Spain) (EAJ18), 1 kW.
381	Toulouse (Radio) (France), 8 kW.	248	Juan-les-Pins (Nice) (France).
377	Manchester (2ZY) (Gt. Britain), 1 kW.	242	Belfast (2BE) (Ireland), 1 kW.
372	Hamburg (Germany), 1.5 kW.	238	Bordeaux-Sud-Ouest (France), 1 kW.
364-5	Algiers (Algeria), 13 kW.	228-4	Biarritz (Côte d'Argent, France) 1.5 kW.
360	Stuttgart (Germany), 1.5 kW.	227	Cologne (Germany), 2 kW.
356-3	London Regional Stn., 30 kW.	224-4	Cork (6CK) (Ireland), 1 kW.
		223	Radio Luxembourg, 4 kW. 8—1.0 p.m., daily.
		200	Leeds (2LS) (Gt. Britain), 0.13 kW.

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