THE AUSTRALASIAN Radio World

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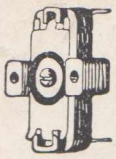
1/-

VOL. 13 ..... NO. 8 JANUARY 15, 1949

# DEMAND CROWN COMPONENTS



## P.12. STANDARD 5-PLATE PADDER CONDENSER

455 Kc. using Polystyrene base. For use in conjunction with H. gang condenser. Price 2/6.

## D.C. 2A TUNING UNIT

(13 to 42 metres), 1600 to 550 Kc/s, for use with H gang condenser. Suitable for compact chassis construction. Price, 36/-.

## CROWN PERMATUNE F.M. DISCRIMINATOR TRANSFORMER

PT45. Price, 17/6.

Freq. 10.7 meg.

Cap. 50 mmf.

Wound and tropic treated same as PT44.

## NEW COILS CROWN PERMATURE

PC63 Aerial, PC64 R.F., PC65 Oscillator. These are our latest production and are wound on trolitul formers and moisture proofed for tropical conditions with high impedance primary in the Aerial and R.F. Coils. Secondary wound with 7/41 litz for High Q.

PRICE, 7/6

## 455 K.C. NEW I.F. TRANSFORMERS

New PT141-42-43 Series I.F. transformers are of revoluntionary design, using silver mica condenser moulded in the trolitul base, making them absolutely moisture proof. I.F. PT42 is required for the 2nd Stage in A.C. sets, this I.F. having 100mmf. condenser, whilst the 1st I.F. has 70mmf.

PT41 1st stage
PT42 2nd stage } 13/- each
PT43 Low Gain

## IRON CORED SHORT WAVE COILS

I.C. 62 aerial,
I.C. 63 R.F.,
I.C. 64 oscillator,
13 to 42 metres, for use on standard H. gang. Price 4/9.

## M.E.B. TRIMMER CONDENSERS

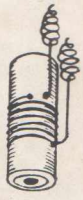
2 to 35 mmfd. on Polystyrene base. Price, 1/1.

## R.F. CHOKE

Standard general purpose honeycomb winding, will carry up to 50 M/a. Price, 1/10.

## AIR CORE S/W COILS

13 to 42 metres, Z.C.59 aerial, ZC.60 R.F. ZC61 oscillator, for use with H gang. Price, 2/10 Each.



D.P. 3A Tuning Unit: 3 Stage, range 13 to 42 metres, 1,600 to 550 Kc/s. Price, £4/17/-.

B.F.O. 455 Kc/s. Oscillator Coils. Price, 13/-.

R.F. Coil with reaction in aluminium can. Price, 9/10.

Reinartz Coil in aluminium can. Price, 7/6.

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Crown

RADIO PRODUCTS PTY. LTD.

51-53 MURRAY ST.
PYRMONT, SYDNEY. TELEPHONE: MW 2628

# THE AUSTRALASIAN
# RADIO WORLD

*Devoted entirely to Technical Radio*

and incorporating

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**Vol. 14** **JANUARY, 1949** **No. 8**


## CONTENTS



## EDITORIAL

You may wonder why the Women's Weekly can give you so much reading matter for 3d. when I only offer you a much smaller publication for four times the price. There are many strange things in the publishing business.

For example, when you pay your 1/- the actual amount received by the publisher will not nearly pay the printer's bill. The more copies the publisher sells the more money he loses, unless he can convince enough advertisers to support him.

If I sold an extra 5,000 copies of Radio World each month I would be running at a dead loss. Silly, isn't it?

Paper, printing and block costs are up about double what they were in 1939, so are the prices of books, shoes, suits, motor cars and many other things. Yet there seems to be an unwritten law that the price of magazines must remain at not more than 1/- per copy.

Getting back to the value offered by the Women's Weekly and other such publications; the explanation lies in the advertising revenue. With cosmetics, patent medicines and many household lines it becomes possible for the trades concerned to support general magazines with thousands of pounds' worth of advertising for each issue. But when it comes to technical radio only; well, the component manufacturers are having a pretty thin time of it and they cannot afford to spend big sums on advertising.

So the publisher of a magazine devoted exclusively to technical radio can only shrink his publication to conform with the shrinking of the purchasing power of the shilling, if he wants to remain in business.

Which makes it hard to explain why optomists should be wanting to start up in the publishing game. What is that they say about rushing in where angels fear to tread? Or is it that one is born every minute!

—A. G. HULL.

# R. C. S.

## First Again With The Latest Development!

### FILAMENT TRANSFORMERS

Type TP55. 6.3 volts, 3 amps, 15 watt .... .... .... .... .... .... at **14/6**

### AUDIO TRANSFORMERS

Long experience in the production of highly efficient transformers combined with extensive research into raw materials and design has resulted in the production of audio transformers of excellent performance and complete reliability.
Size 2¾ x 2⅜ x 1¾.

Type TB42. A class single, 3 to 1 ratio .... .... .... .... .... .... **21/-**

Type TB43. A class Push Pull, 3 to 1 ratio .... .... .... .... .... **22/6**

Type TB44. B class Push Pull, 1½ to 1 ratio .... .... .... .... .... **21/-**

### R.C.S. VOLTAGE DIVIDERS

Wound with oxidised nichrome wire on round bakelite formers 3¾ in. x ¾ in., complete with mounting legs.
VD25. 15,000 ohms, 2 variable clips .... .... .... .... .... .... .... 5/6
VD28. 25,000 ohms, 2 variable clips .... .... .... .... .... .... .... 5/6

### IF YOU ARE UNABLE TO OBTAIN

from your local dealer, write us and we will arrange for your retailer to receive supplies immediately, or advise you where supplies can be obtained.


### NEW POLYSTYRENE FROM OVERSEAS WITH EXTRA HIGH MELTING POINT

By airmail from overseas, R.C.S. has just received a consignment of new improved Polystyrene. As a result of exhaustive research, overseas scientists have developed a Polystyrene whose melting point is above water-boiling point.
This is another stride ahead for the famous R.C.S. Coils, which already possess the most up-to-date features in moisture-proofing, climate-proofing, and High Q.

## *Here's the Kit!*

Identical Coil Kit for the Universal Five consisting of aerial, oscillator, 2 I.F.'s and a padder (Kit type No. K121) .... .... .... .... .... Retail £2/3/6

### POTENTIOMETERS & RHEOSTATS

7/6 Retail

| | |
|---|---|
| PT40 .... .... .... .... .... .... | 6 ohm 25 amp |
| PT38 .... .... .... .... .... .... | 10 ohm 25 amp |
| PT39 .... .... .... .... .... .... | 20 ohm 25 amp |
| PT34 .... .... .... .... .... .... | 30 ohm 25 amp |
| PT46 .... .... .... .... .... .... | 400 ohm 50 M/A |
| PT47 .... .... .... .... .... .... | 1,000 ohm 35 M/A |
| PT49 .... .... .... .... .... .... | 2,500 ohm 30 M/A |
| PT51 .... .... .... .... .... .... | 5,000 ohm 30 M/A |
| PT52 .... .... .... .... .... .... | 10,000 ohm 30 M/A |

The R.C.S. volume control is constructed so as to cut off all volume; the main fittings are made from high-grade nickel silver, and they are so manufactured as to be completely noiseless.

LF20 27/-

### LINE FILTER
### Wound to P.M.G. Specifications

The R.C.S. Line Filter is specially designed and constructed to eliminate all noises which occur by reason of feedback from power mains—electric motors—refrigerators—elevators—sub-stations—high-tension wire—irons—and jugs. Easy to install—it connects between the radio and power point.

### COILS and I.F.'s

| | | |
|---|---|---|
| FM 10.7 Meg. Intermediate .... .... .... .... .... .... .... .... .... | each | 13/– |
| FM 10.7 Meg. Discriminator Transformer .... .... .... .... .... .... | each | 17/6 |
| FM 88-110 Aerial, Oscillator, Coupling Coil .... .... .... .... .... | each | 2/6 |
| E 356 Aerial .... .... .... .... .... .... .... .... .... .... .... .... .... | each | 7/6 |
| E 357 R.F. .... .... .... .... .... .... .... .... .... .... .... .... .... | each | 7/6 |
| E 358 Oscillator .... .... .... .... .... .... .... .... .... .... .... .... | each | 7/6 |
| 175 K.C. Intermediates .... .... .... .... .... .... .... .... .... .... .... | each | 13/9 |
| 455 K.C. Standard Intermediates .... .... .... .... .... .... .... .... | each | 13/– |

# R.C.S. RADIO PTY. LTD.

174 CANTERBURY ROAD, CANTERBURY

# AN ELECTRONIC ALARM

**The science of electronics is opening up a wide field for the radio engineer. Here are the details of a little electronic device which is a good start for the radioman who wants to dabble in electronics.**

By

**Wm. DARRAGH**

(Dip. Radio Eng.)

129 Empress Avenue

Footscray West, Vic.

THE device described was originally used as a "baby alarm," but no doubt may be adapted to a large number of different uses, such as an "open sesame" door-opener and within 5 feet of the microphone burglar alarm.

The sensitivity of this device is such that a snap of the finger will cause a relay to close, thus operating a remote indicating device.

The "heart" of the circuit is the rectified feedback stage. The 6J5 is biassed so that the relay just releases. When a signal is impressed on its grid, it is amplified and fed through a 1 mfd. condenser from its plate to a 6H6 reversed rectifier, a positive voltage is developed across its 50,000-ohm load and fed back to the 6J5's grid via a .25 meg. decoupling filter.

This bucks the negative voltage normally applied to its grid, resulting in a large increase in plate current.

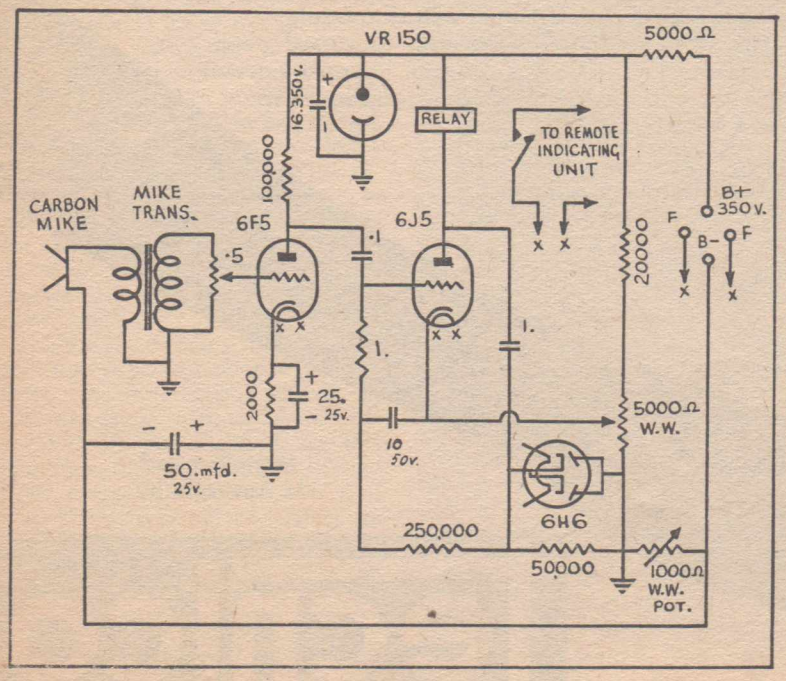
A refinement incorporated is the inclusion of a 1000-ohm potentiometer in the negative return to provide microphone energising current, using an ex-Disposals carbon mike. With this resistor adjusted to allow a current of 25 ma. to flow through the mike, excellent results were obtained. The 6.3v. heater supply was used in this case to operate a remote buzzer, thus making the unit completely self-contained.

The amplifying stages are quite normal, a VR150 holding the voltage constant with variable loads, and a 5000-ohm potentiometer across the power supply to adjust the negative bias on the control tube.

Adjustment is very simple, all that is necessary being to reduce the bias on the control tube till the relay just operates, then, ascertaining that the microphone is operating, and the input control potentiometer at maximum, increase the bias slowly till the relay just opens; after this, the input potentiometer can be set at any level.

The relay used was of 1000-ohm resistance, operating current 4 ma. and release current 1 ma. No doubt a more suitable relay would vastly improve sensitivity, and the addition of another preamplifier stage would boost sensitivity to a stage where a vast field of interesting experiments would be available.

In conclusion, this device is admirably suited to operate a tape recorder from a receiver. In such a set-up it would be advantageous to use a limiter between receiver and relay unit to smooth out any variations in signal strength.

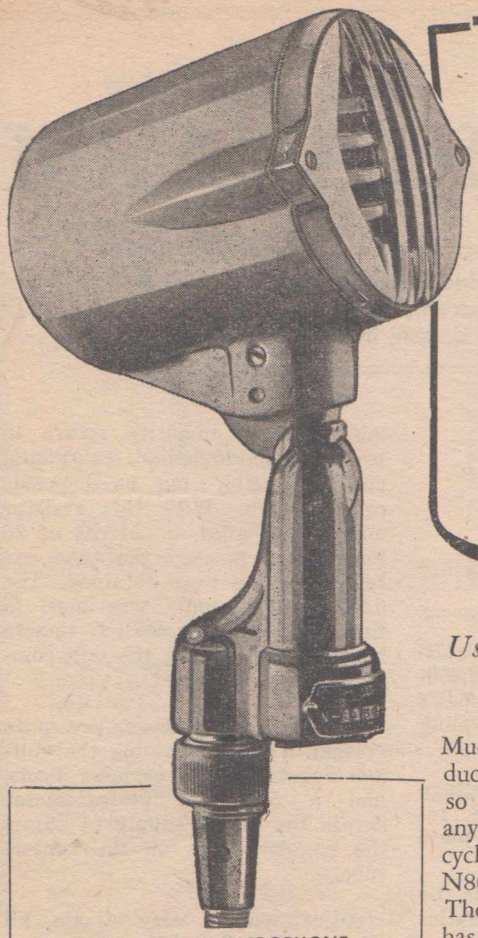


# THE FERGUSON AMPLIFIER

INCORPORATES THE

**tecnico**

- N80 CRYSTAL MICROPHONE &
- FL48 CRYSTAL PICK-UP



*Use these Tecnico products for superior results in the widely-used, restricted frequency range.*

Much attention has been focussed lately on high fidelity—on reproduction of high notes beyond 15,000 cycles. This is, in most cases, so unnecessary—for few broadcasting stations attempt to broadcast anything higher than 5,500 cycles. A range of from 75 to 7500 cycles is most commonly used—and for *this* range the Tecnico N80 Microphone and FL48 Pick-up are admirably suited.
The N80 Crystal Microphone features an Astatic element, has exceptionally smooth frequency response, adjustable head, and effective acoustic feedback control.
The FL48 Crystal Pick-up, with its curved offset arm, combines low tracking error with balanced sidewall pressures in the record groove—reducing wear and surface noise.

Available from better class radio retailers throughout Australia.

**N80 CRYSTAL MICROPHONE**

A voice range model with output level of —49db below one volt per bar; rising response from 1000 to 3500 cycles per second. These microphones are particularly suitable for public address systems.

**FL48 CRYSTAL PICK-UP**

A replaceable needle pick-up for general use. Improved performance due to lower needle pressure —1¼ oz. and higher needle point compliance. Frequency range 50—7500 c.p.s. Type L-40 Astatic Crystal Cartridge.

Manufactured in Australia by

**tecnico**

TECNICO LIMITED, CARRINGTON ROAD, MARRICKVILLE, N.S.W.

# HANDY P.A. AMPLIFIER

**Here is a splendid amplifier, designed especially to suit those fine crystal units, the Tecnico N80 microphone, and the Tecnico FL48 pick-up. The gain has been arranged to give full output with these two components, which carry our fullest recommendation for the job.**

HERE is a story about a nice little amlipfier which we can strongly recommend for the purpose for which it was designed, to give 12 watts of power from either crystal pick-up or microphone with absolute reliability, long life, certain satisfaction and pleasing tone.

Lately a lot of emphasis has been placed on higher fidelity and many people may get an impression that you aren't getting any quality in the reproduction if you don't go after the high notes beyond 15,000 cycles. This is all so wrong, as can be simply explained when you know that mighty few broadcast stations attempt to broadcast anything over 5,500 cycles per second, and few records carry any highs beyond a similar figure. With restricted range it becomes easy to get pleasing reproduction and only the hyper-critical will miss the extreme highs. Restricted frequency range has many attractions, especially for microphone work where too many highs always end up with high-pitched squeals when the microphone starts to pick-up some output from the speaker. No claim is made for this amplifier to handle highs beyond 8,000 cycles, but don't let it fool you. There is plenty of realism on gramophone reproduction and yet not too much nerve-wracking needle scratch.

This amplifier has been designed by the Ferguson transformer people to make the most of their fine range of equipment and uses transformer coupling to the push-pull output stage. By using a transformer in this position it is possible to get extra power without distortion, as quite an amount of grid current can be tolerated before the distortion is noticeable. The low resistance of the transformer windings in the grid circuit of the 6V6's means that they can be safely operated at their maximum voltage ratings with the utmost reliability.

Using a kit of transformers as supplied by Fergusons we recently built up this amplifier, making it in unit fashion so that is can be plugged into a standard a.c. power unit for operation from the mains,

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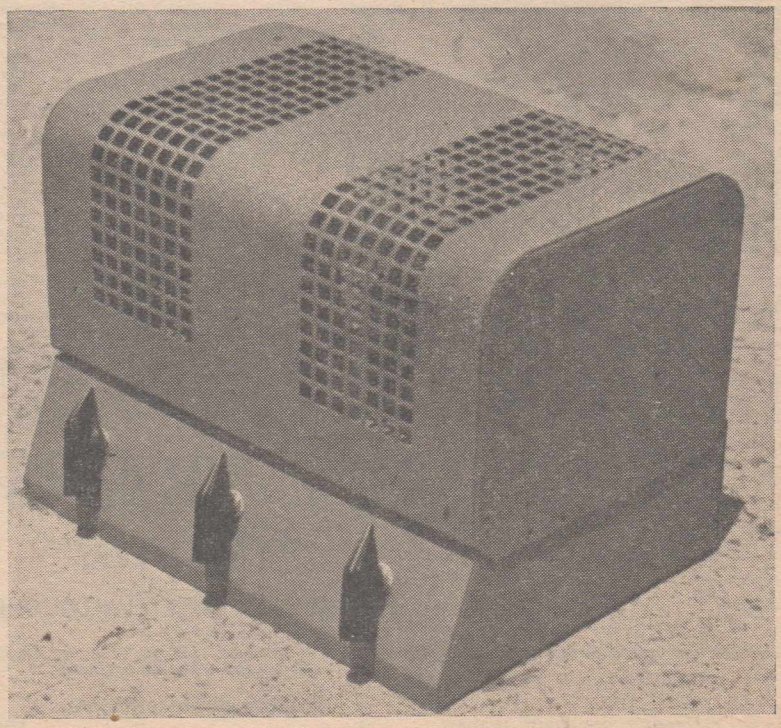


# FERGUSON TRANSFORMERS PTY. LTD.

**Transformer requirements for the Ferguson 12-Watt Public Address Amplifier described in this issue.**

## OUTPUT TRANSFORMER

**The choice of the correct type of output transformer depends on the desired speaker line impedance.**

**Four different unit types are available.**

| Type | Primary Impedance | Sec. Impedance | Rating |
|---|---|---|---|
| OP-5 | 10,000 ohms P-P | 12.5, 8.4, 2.3 ohms | 15W. |
| OP-5 | 5,000, 6.600 10,000 ohms P-P | 12.5, 8.4, 2.3 ohms | 15W. |
| OP-8 | 10,000 ohms P-P | 500, 250, 125 line | 15W. |
| OP-9 | 5,000, 6,600 10,000 ohms P-P | 500, 250, 125 line | 15W. |

### POWER TRANSFORMER TYPE P100/325

**SPECIFICATION—**

Prim. 230-240 Volts 50 c/s.
H.T. Sec. 325/325 Volts.
Max. Rectified Current using Full Wave and Condenser Input—100 M.A.

| | | |
|---|---|---|
| L.T. Sec. | 6.3V. | 2 amps. |
| L.T. Sec. | 6.3V. | 2 amps. |
| L.T. Sec. | 5.0V. | 2 amps. |

WEIGHT ..... 6 lbs. 5 ozs.
MOUNTING ..... VERTICAL

### FILTER CHOKE, TYPE C12/100

**SPECIFICATION—**

Inductance—12 Henries at 100 M.A. D.C. 50V. A.C. at 100 C/S.
Resistance—200 Ohms (Cold).
Max. Current—100 M.A. D.C.
Test Voltage—1500 V. A.C.

WEIGHT ..... 2 lbs. 6 ozs.
MOUNTING ..... VERTICAL

## NEW RELEASE

**DATING FROM JANUARY, 1949, A NEW RANGE OF FILTER INDUCTORS IS TO BE RELEASED.**

### STANDARD RANGE

| Type No. | Minimum Inductance at Normal D.C. | Normal D.C. | Normal D.C. Resistance | Normal D.C. Voltage Drop | RMS TEST | Total Weight |
|---|---|---|---|---|---|---|
| C50/10 | 50H | 10M/A | 1900 Ohm | 19V | 1000V | 1 lb. |
| C30/25 | 30H | 25M/A | 870 ,, | 22V | 1000V | 1 lb. |
| C15/60 | 15H | 50M/A | 300 ,, | 15V | 1000V | 1 lb. |
| C30/60 | 30H | 60M/A | 420 ,, | 25V | 1500V | 2 lb. 6 oz. |
| C30/75 | 30H | 75M/A | 580 ,, | 43V | 1500V | 3 lb. |
| C15/80 | 15H | 80M/A | 250 ,, | 20V | 1500V | 2 lb. 6 oz. |
| C12/100 | 12H | 100M/A | 200 ,, | 20V | 1500V | 2 lb. 6 oz. |
| C30/100 | 30H | 100M/A | 360 ,, | 36V | 2000V | 4 lb. 1 oz. |
| C12/150 | 12H | 150M/A | 135 ,, | 20V | 2000V | 4 lb. 1 oz. |
| C20/150 | 20H | 150M/A | 225 ,, | 34V | 2000V | 5 lb. 4 oz. |
| C12/200 | 12H | 200M/A | 100 ,, | 20V | 2000V | 6 lb. 12 oz. |
| C16/200 | 16H | 200M/A | 165 ,, | 33V | 2000V | 6 lb. 12 oz. |
| C10/250 | 10H | 250M/A | 70 ,, | 18V | 2000V | 6 lb. 12 oz. |
| C20–5/250 | 20/5H | –(50–250M/A) | 70 ,, | —— | 2000V | 6 lb. 12 oz. |

**NOTE.**

The inductance of an iron-cored choke designed to carry Direct Current varies with the value of direct current in the winding that is assuming a fixed value of A.C. Magnetising Current.

The inductance values of an iron-cored choke can therefore have two extremes—viz., 1, a "maximum inductance" value, i.e., when D.C. magnetising current is zero; 2, a "minimum inductance" value, i.e., when D.C. magnetising current is normal.

It is this "minimum inductance" value which is the important rating on any iron-cored inductor designed to operate with a superimposed direct current.

As an example, choke type C30/60 in the above column would have a "maximum inductance" value in the neighbourhood of 100 henries without D.C. magnetisation.

The "minimum inductance" value shown above for each type of choke has been measured under the normal or rated direct current load with 50 volts A.C. impressed across the choke.

# FERGUSON TRANSFORMERS
## PTY. LTD.

**12 McMAHON STREET, WILLOUGHBY**

**Procurable from any wholesale house in all States including Tasmania. If you have any trouble obtaining supplies, write to us direct and we will forward a list of suppliers.**

**Factory Representative:**

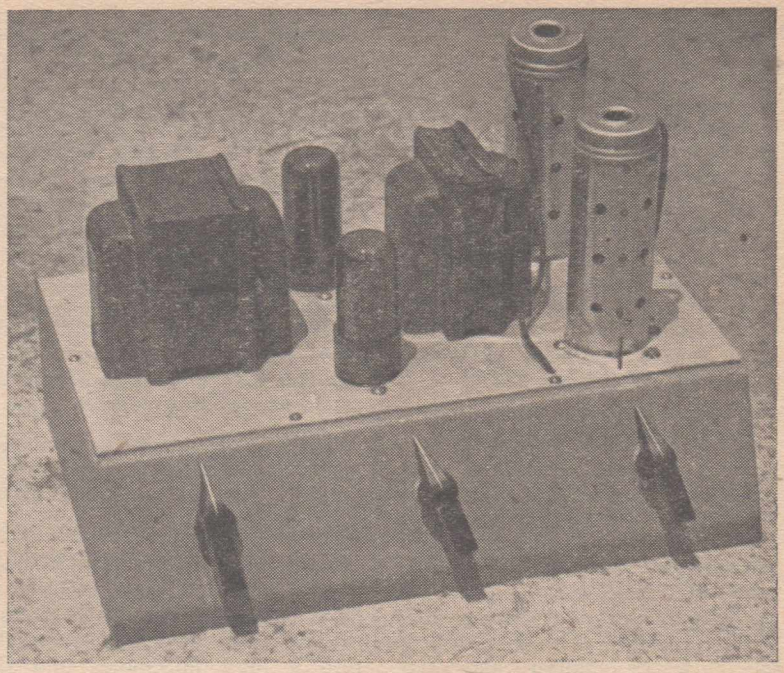
**N.S.W.: ELECTRONIC INDUSTRIES IMPORTS**
**VIC.: ELECTRONIC INDUSTRIES IMPORTS**
**STH. AUS.: APEX AGENCIES**
**QLD.: ELECTRONIC INDUSTRIES IMPORTS**

(Continued)

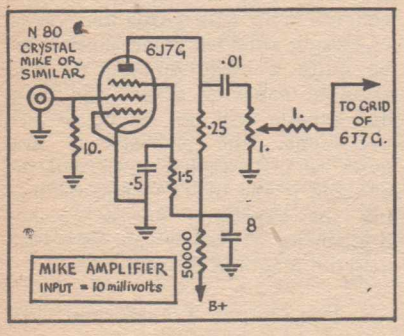
or plugged into a vibrator power unit if it is desired to operate it from an accumulator. The amplifier itself is built on to one of those nice little meat-safe type of amplifier chassis, which come complete with cover for both top and bottom and give the job the real professional touch. The particular chassis in the photographs was a "Ferrier" amplifier case, obtained from J. H. Magrath & Co.

The chassis comes in the form of a steel top, bottom and sides and a removable aluminium flat base which is easily cut and drilled to suit the valve sockets and transformer openings.

Three quarters of the wiring job can be done before this aluminium base is bolted into position on the top of the steel piece which forms the sides and ends.



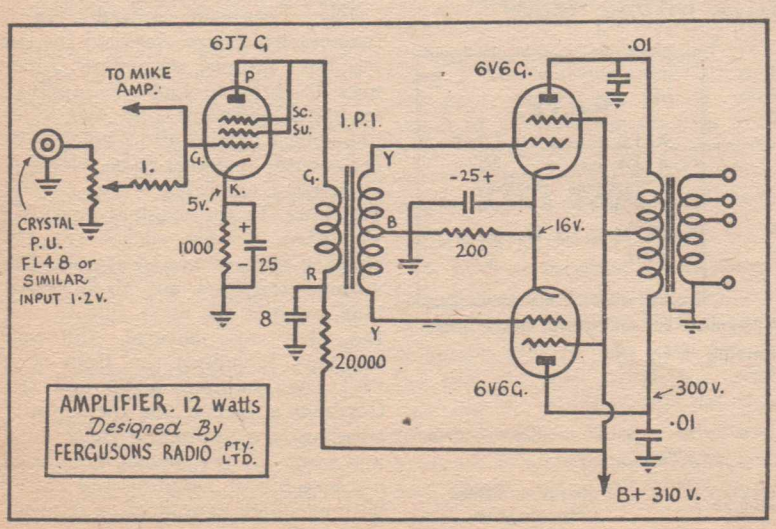
A view of the chassis with the cover removed.




## The Circuit

As will be seen from the schematic circuit, the amplifier is designed to have a microphone amplifier stage, which can be omitted if the amplifier is required for pick-up work only.

A neat fader arrangement makes it possible to feed both microphone and pick-up in together or one at a time with smooth switch over by means of the volume controls.




The pick-up feeds straight into the second stage of the amplifier, a 6J7G connected up as a triode and feeding into the push-pull audio transformer. Since the highest fidelity is not attempted the circuit has been kept as simple as possible. For example, no attempt has been made to improve the performance of the audio transformer by shunt-feeding the primary, as is sometimes noticed in high-fidelity amplifier designs. In fact there is little advantage to do so in this case, as the audio transformer has been designed to operate in the manner shown and the unbalanced primary current taken by the plate of the driver has been taken into consideration when the core specifications were calculated.

Points of interest in the circuit include the by-passing of the main bias resistor. Although not necessary with true "Class A" push-pull the by-pass is handy in case you want to run at overload level, when it helps to keep distortion at a reasonably low level. With the ten-

(Continued on next page)

(Continued)

megohm grid-leak in the grid circuit of the microphone amplifier stage it is hardly necessary to provide bias for this valve, and so we show the cathode directly earthed.

Those who are extra fussy can insert the usual 2,000 ohm bias resistor and 25 mfd. by-pass condenser here if they so desire, but it is most unlikely that any difference will be noticed.

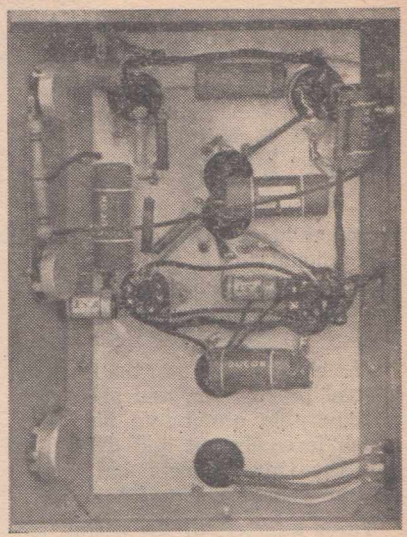
### Avoiding Hum

Mounting the amplifier on a separate chassis from the power supply is a big help to keep hum level to a minimum, but it is also necessary to take some precautions with the microphone input. The gain from the crystal pick-up stage is not so high, and we found no shielding was required when working with a pick-up, even with unshielded leads of quite a length.

But on the other hand the gain overall when the microphone stage is included is quite high and hum trouble may be encountered unless careful shielding is carried out. Following a practice which we found helpful many years ago, we did not fit a pair of terminals for the microphone input, but instead, we just mounted a terminal on a piece of strip inside, with an earthing lug handy. The idea is to solder the microphone lead right into position, or else fit an elaborate type of shielded plug to ensure full shielding for the input.

The lead to the grid of the 6J7G microphone amplifier valve should be well shielded in copper braiding, effectively earthed.

With crystal pick-ups and microphones is it not good practice to have more shielding than necessary, as these devices like to feed into a high impedance and the tonal quality is affected if the impedance is not up to specifications.



Under-side wiring is particularly simple.

This is especially important with the microphone, which should have a load of 5 to 10 megohms. If you connect it up with yards and yards of closely shielded cable there may be quite a large amount of distributed capacity across the load and results will not be up to expectations. The pick-ups is not quite so critical, but lows will be affected if the overall load, including the capacities across shielding, bring it below an effective quarter megohm or so.

### The Output Transformer

The Ferguson output transformers which are specified for the job have tapped secondary windings to provide various tappings to match different line and voice impedance and to allow voice coils for several speakers to be wired up in parallel or series to get correct matching. In the original amplifier we fitted a 5-pin socket for the speaker connection and brought the various tappings out to different pins, so that we were able to test the job on several different speakers including the Rola type "O", the Amplion AV39 and the Goodman's Axiom 12. Incidentally speakers are improving these days and any of the above-mentioned are capable of handling the power with excellent reproduction if properly baffled.

It will be noticed that two condensers are used to by-pass the plates of the output valves to earth, these condensers being of .01 mfd. capacity and 600 volt working rating. With the Ferguson output transformer these values give a nicely balanced degree of high-note response, but it should be remembered that these values of capacity will not necessarily suit the amplifier if some other brand or type of output transformer is used.

### Operating Voltages

It will be noticed on the circuit that we have shown the approximate working voltages for the amplifier when used with the standard a.c. power unit. These voltages are a very good check on the proper operation of the amplifier and should be measured with a meter having a 1,000 ohm-per-volt movement, with the power on and both volume controls fully retarted.

When used with a vibrator unit the voltages will depend largely on the unit used, but should be fairly well proportional to those shown. Lower high tension voltage may mean lower power output but not necessarily any effect on the quality. It is quite permissible to operate the amplifier with voltages down to 150 or 200 volts and still get quite good performance.

**Full details of the construction of a power unit to suit this amplifier are given on pages 29 and 30 of this issue.**

### Input Voltages

It will also be noted that the required input voltages are given, the design having been worked out by Ferguson to suit the Tecnico crystal units shown on the diagram. Our testing was done with these crystal units and we found that they gave good results. If magnetic pick-ups of low output are to be used it will be necessary to feed them into the microphone input terminals.

### Tone Control

It will be noticed that on our version of this amplifier we show three controls on the panel, the third being an extra tone control for use to lop off the highs under certain operating conditions, as, for example when operating the microphone and speaker together in a fairly small hall. Under such circumstances it is sometimes highly desirable to restrict the frequency range still further to avoid feedback whistles.

### Conclusion

As we said before this amplifier circuit can be recommended to all as a thoroughly reliable one. It is not so likely to give trouble with parasitics, or instability of any kind. It has well-designed high and low-gain inputs. It should give years of trouble-free service, even when operating under conditions where it gets almost continual use.

## MID-WAY PORTABLE

Portable receivers of the type operating from self-contained dry batteries come in a variety of sizes and styles. The old-fashioned ones were bulky and heavy. Then came a rush of baby-size ones, mainly designed to be as light and as small as possible. Most of these have proved unpopular on account of short battery life and heavy running cost.

As a feature article for next month's issue we hope to describe the Mid-way Portable, designed to take medium-size batteries, to operate at a much lower running cost than most modern portables, yet to be reasonably light and compact.

## LICENCE FIGURES

A further increase in the number of broadcast receiving licences in force in Great Britain and Northern Ireland was recorded at the end of April, when the total was 10,810,550 (approx.). Of this total 16,600 were television licences. The corresponding figures for March were 10,780,400 and 14,550.

# Mullard

## PIONEERS IN ELECTRONICS

THE science and practice of electronics doubtless commenced with the first application of the thermionic electron tube—familiarly known as the "valve." The name of Mullard was closely associated with the early developments of the valve and Mullard was one of the first in the world to manufacture valves commercially. During the first World War Mullard Valves were used extensively by the Services, particularly the Mullard Silica Transmitting valves supplied to the Admiralty. Then as now Mullard Silica Valves were famous for their long life and high efficiency.

Early radio experimenters remember affectionately their first valve—carefully nursed and wrapped in cotton-wool—which in a majority of cases was the famous Mullard "ORA." Those letters represented "Oscillates, Rectifies, Amplifies"—one valve type for all purposes. Today Mullard's range of valves includes a highly-developed specialised type for every conceivable application in science, industry, warfare and entertainment.

In the television field, too, Mullard was, and remains, right out in front. The late John L. Baird is recognised as the "father" of practical television and most of the special tubes and valves he required were developed and made by Mullard. From that beginning Mullard has become England's leading source of electronic tubes for television and special defence applications.

There is hardly a field of application for electronics with which the name of Mullard is not intimately associated. In all modesty, Mullard can truly claim the title "Pioneers in Electronics."

## SOME OF THE Mullard ELECTRONIC PRODUCTS

**Electronic Tubes:**

Radio Receiving Valves
Radio Transmitting Valves
Industrial Valves for Heating and Control
Hearing Aid Valves
Special Television Valves
Cathode Ray Oscillograph Tubes
Television Picture Tubes
Photographic and Stroboscopic Flash Tubes
Photoelectric Cells
Accelerometer Tubes
Voltage Stabilising Tubes
Voltage Reference Tubes

**Electronic Apparatus:**

Domestic Radio Receivers
Domestic Television Receivers
Communication Receivers
Fixed and Mobile Radio Transmitters
Mobile Transceiver Equipment
Intercommunication Equipment
Sound Amplifying Systems
Industrial Electronic Equipment
Cathode Ray Oscilloscopes
Moisture Meters
Potentiometric Titration Apparatus
Measuring and Testing Instruments
Scientific Apparatus

*"Where there's a new electronic device–there's Mullard!"*

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Mullard

FIRST OF A NEW SERIES

# WORLD STANDARD FOR 1949

**Here is the introduction to a new series of radio receiver designs, to be known as the World Standard series. The heart of the design is the use of the 6SN7GT twin triode as a direct-coupled phase-changer to provide push-pull operation in a most simple form. For improved tone and power it offers many advantages.**

By

**A. G. HULL**

SIXTEEN years ago I designed a receiver which was so successful that I have had a bad time of it ever since trying to improve upon it.

The old 1933 Standard had several features which made it extremely popular. It cost little more than ordinary sets of the time, yet gave considerably greater power, with good tone, was simple to build and the circuit was versatile enough to ensure that good results could be obtained with a wide variety of different types and styles of components.

Now after some months of experimenting I offer the 1949 World Standard, a receiver designed to give the same advantages as the original 1933 Standard. This set has as its heart the use of the direct-coupled phase-changer to drive a pair of output valves in push-pull. It provides scope for a dozen different designs to be evolved around it. For a start we have here the dual-wave version, which resembles the popular five-valve dual-wavers which abound at the moment, except that there is the extra output valve and a couple of extra resistors, probably a total cost of a pound to thirty shillings more for a kit of parts. For this extra cost you get twice the power, much less distortion than usual, a frequency range as wide as you want it, practically no phase displacement, which means more in resulting tone than you would expect from words written about the subject, and last but not least, a

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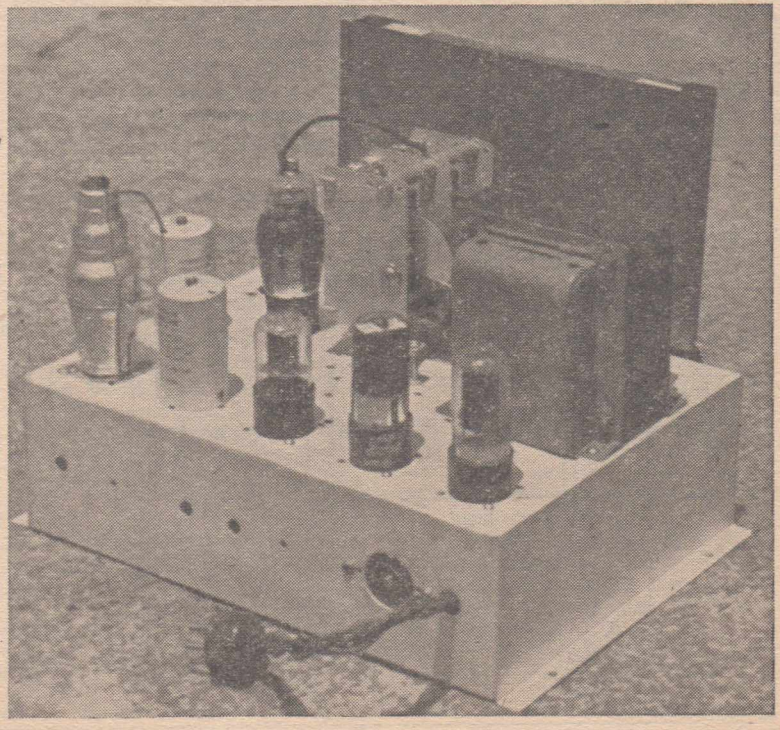


(Continued)

much lower hum level at no extra cost.

### Other Versions

The 1949 World Standard is here described as a dual-waver, but the audio arrangement can be used in a number of applications and it is hoped to give further articles from time to time on other versions, such as a straight broadcast version, a long-range broadcast version, a high-fidelity version, a radiogram version, and so on. The circuit is most versatile in this respect and suits different types of circuit whilst still retaining its inherent advantages.

Even in this first version there are a number of modifications which can be carried out to suit individual taste. For example, the circuit lends itself admirably to the application of inverse feedback which can be added by using just one extra resistor. But inverse feedback is by no means essential and many will prefer normal gain. Others will be able to experiment and judge by results as actually heard by ear. For the output valves there are many different types suitable, some may prefer to have higher voltages, with powerful output valves, others may use low-powered triodes and go after the sweetest possible tone at fairly low volume.

The circuit can be built with an ordinary speaker and an ordinary speaker transformer, in which case the frequency range will not be much wider than normal, or the set can be built with high-fidelity output transformers and speaker of the widest range and will then give fidelity of the highest degree. But in every case there will be less than usual distortion.

### The Phase-Changer

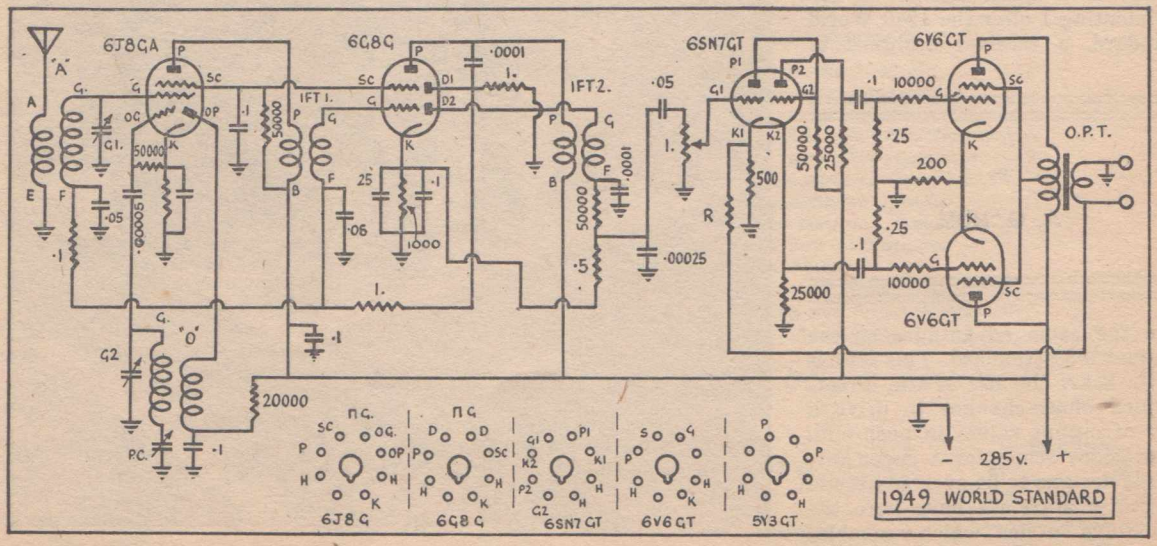
Heart of the circuit is the direct-coupled phase-changer which has been so popular amongst amplifier enthusiasts since the publication of the Williamson amplifier in our issue for August, 1947 and the Australian version of this amplifier in our February, 1948 issue. Actually the direct-coupled phase changers date back a long way before Williamson was heard of, having been featured in our issue of May, 1940 and several other issues about that period. The fact that it failed to gain proper recognition at that time does not detract from its merit. Technicians of that day thought mostly in terms of frequency range and the more gross forms of distortion. It was only when the finer points about inverse feedback were being investigated that the subject of phase displacement made itself felt. With feedback it becomes most important to have the feedback retain its proper phase relationship, and the ear now tells us that phase displacement is also important in normal reproduction of speech and music. It offers a fair sort of an explanation as to why direct-coupled amplifiers of all types sound so much better than other amplifiers which appear to have similar characteristics.

The advantages of push-pull are well known and appreciated. Especially with pentodes and beam power valves it is highly desirable to have the cancellation of the second harmonic distortion which push-pull provides. Even without inverse feedback the tone becomes completely satisfactory for ordinary listening.

### Construction

Taking this first version as probably the best proposition and the most likely to be popular with set-builders, we find that there is the usual dual-wave bracket, with a 6J8GA converter, then an i.f. stage at 455 Kc. using the 6G8G so that a.v.c. and detection can also be had from this single tube. That then leaves us with a clear audio end consisting of the twin-triode 6SN7GT as a direct-coupled phase changer, driving a pair of 6V6G beam power valves in push-pull.

There are several advantages in



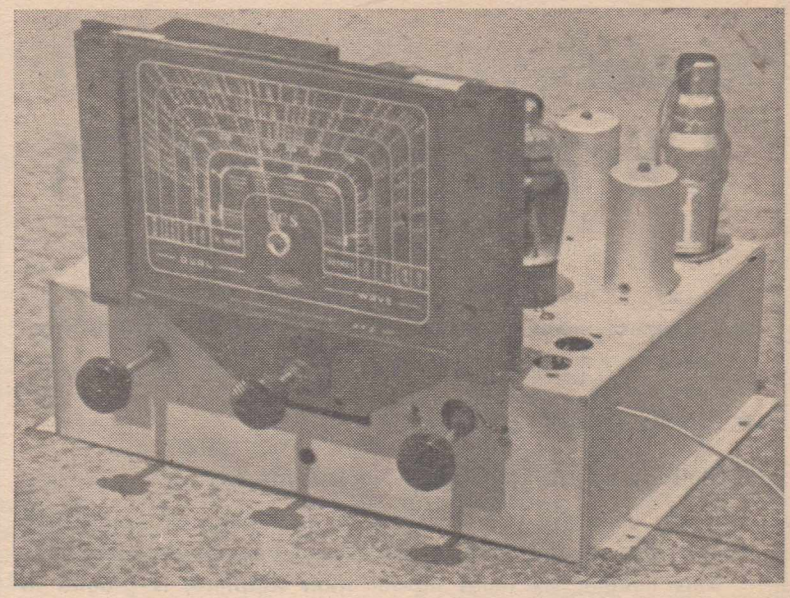
unit style of construction and this is used with this set, the power unit being a separate one from the main chassis. This allows the use of the standard types of 4/5 valve d.w. chassis which are available in a number of different types to suit the many different dual-wave brackets. In the normal rectifier sockets we place the extra output valve, and in place of the power transformer we mount the speaker transformer. A cable with six-pin plug couples up this unit to the separate power supply which consists of transformer, choke, rectifier and a couple of filter condensers mounted on a small base which can be folded up out of sheet metal with a couple of wooden ends.

### The Question of Cost

Before starting out on the construction of this set it is well to take off a few minutes to reckon up the banking account to see just how much is to be spent on the job. There is not much difference in prices as regards the chassis, power transformer, valves, coil brackets and so on, but when it comes to the speaker and the input transformer there is a big gap between the cheap and the good. It is possible to get quite good results with a cheap commercial type of speaker and input transformer of the type which you can buy for £2 or £3 complete, or you can go to the other extreme and pay £15/10/- for the speaker and £7 for an output-to-line and

**Full details of the construction of a power unit to suit this receiver are given on pages 29 and 30 of this issue.**

line-to-voice-coil transformer pair. The set is capable of giving fidelity worthy of thebest in speakers, especially if used with wide-band i.f. transformers, but it is doubtful whether the average, or even the critical, listeners will appreciate the value of such wide-range equipment.



**A front-view of this first version of the 1949 World Standard chassis.**

Probably the best bet is in the medium-priced range, such as the new series Rola 12" speakers known as type "O," and the Amplion AV39, both of these being capable of giving beautiful reproduction and handling the power, especially if adequately baffled.

In all cases the speaker transformer should be mounted up on the main chassis handy to the output valves and the voice coil leads kept to a reasonably short length of heavy gauge wire.

### Inverse Feedback

Inverse feedback is popular these days and has many attractions as well as a couple of snags. It can level out the frequency response of an audio end and it can cut down hum quite a bit when properly applied. But with certain types of cheap output transformers it can be a source of distortion. Even with the best of equipment it can be a possible cause of all sorts of troublesome parasitics. My recommendation is to get this set operating properly without feedback, then start to play around with the feedback and judge by results as you find them. It is quite a scheme, in fact, to fit a variable resistance in the feedback circuit and adjust it to note the various effects which are obtained. A 50.000 ohm potentiometer wired in as a rheostat will do the job nicely. After you have adjusted to taste you can either leave it set, or replace it with a resistor of similar value to that being used.

(Further details of this set, together with a picture diagram of the wiring and a full list of parts, are scheduled to appear in next month's issue.—Ed.)

# A CHALLENGE

**By**

**Wm. DARRAGH**

IN answer to the great deal of criticism directed at single ended direct coupled amplifiers, I desire to point out a few advantages of these systems, together with comparative results obtained on laboratory checking both a direct coupled 6J7-6A3, and a resistance-capacity coupled version utilising the exact same tubes and components.

Before pointing out advantages, I think it fit to confess a disadvantage of D.C. amplifiers, namely, their necessitating the use of high voltages. However, if careful thought is given to the voltage distribution network, one can quite successfully build a D.C. amplifier with a H.T. potential of 425v, which is obtainable with standard power supply components.

By omitting the coupling condenser, we eliminate two disadvantages common to resistance coupling circuits, and these are, phase rotation, and bass attenuation, at this juncture, I may mention that there are several other disadvantages of a slight academic flavour, but, nevertheless, play an important part in the faithful reproduction of recorded sound. These are caused by the poor properties of a condenser in passing a square wave. This obviously results in defective transient response, particularly at low frequencies, which means that even though a R.C. amplifier may have a flat response from 20 c.p.s. to 30 kC/s as per sine wave B.F.O. and associated measuring equipment, on actual reproduction of a complex band of frequencies of a transient nature, in other words, music, its response will be anything but flat . . .

While the use of a large coupling condenser minimises this effect, it cannot be eliminated.

This phenomenon was demon-

**(Continued on page 20)**

# DIFFERENTIAL CONDENSERS

By J. N. WALKER (G5JU), Technical Dept., Stratton & Co. Ltd., Birmingham, Eng.

MANY readers will remember, in pre-war days, a component known as a differential condenser. It consisted of two sets of opposing stators, with a single rotor section, arranged so that, as the capacity of one side decreased, that of the other side increased by an equal amount. The dielectric was usually of some solid material, the vanes thin and flexible, and the losses were probably by no means negligible. This latter did not matter much, as the condenser was generally used for reaction control on medium frequencies.

The modern differential condenser, as typified in the examples manufactured by **Stratton & Co. Ltd.** is a very different component. The capacity per section is quite small, the dielectric air and the insulation ceramic. The condenser can be used in any circuit without introducing additional losses. This obtains even at the very high frequencies (e.g. up to 150 Mc/s), and when high R.F. voltages are present, as in circuits associated with a transmitter.

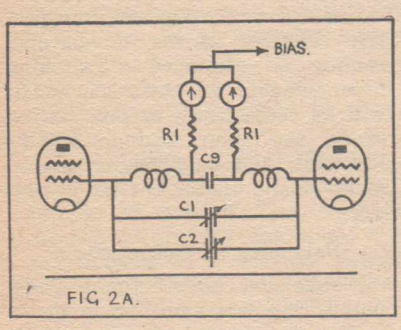


FIG 2A.

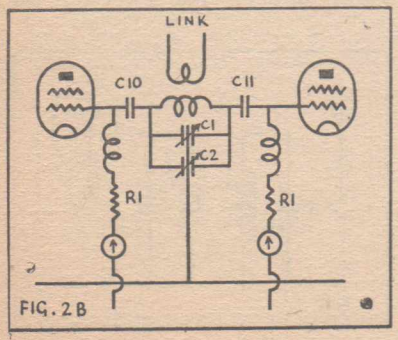


FIG. 2B

### Balancing Circuits

The chief application of a differential condenser is for balancing a circuit. Stray capacities can be equalised, each side of the circuit then becomes symmetrical (referred to zero potential) and the R.F. potentials are equal in amplitude but opposite in phase.

The capacity of a differential condenser has to be considered in a somewhat different way to that of a split-stator type. With the latter, if each section has a value of 25 pF, the effective capacity, assuming a balanced circuit with the rotor at earth potential, is 12.5 pF maximum and between 1 pF and 2 pF minimum, giving a total swing of say 11 pF.

A differential condenser is rated on the basis of the capacity, at full mesh, between the rotor and one stator. Previous to final adjustment, the rotor will be set at half mesh, each side then having

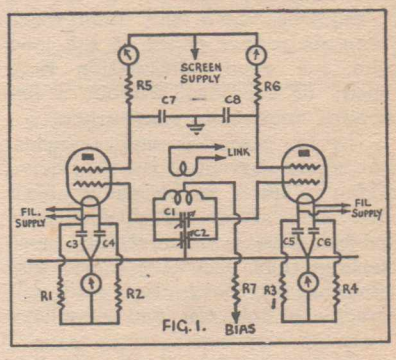


FIG. 1.

a value equivalent to half of one section, e.g. in the case of the Eddystone Cat. No. 719 25/25 pF. condenser, this would be 12.5 pF. The effective capacity placed across the whole circuit would be half again, say 6 pF. Rotation of the condenser results in capacity simultaneously being added to one side of the circuit and subtracted from the other. The effective capacity across the circuit as a whole will remain much the same at any adjustment, provided the rotor is grounded.

Similarly, in the case of a 100/100 pF differential condenser (e.g. the Eddystone Cat. No. 725), the effective additional capacity introduced is 25 pF.

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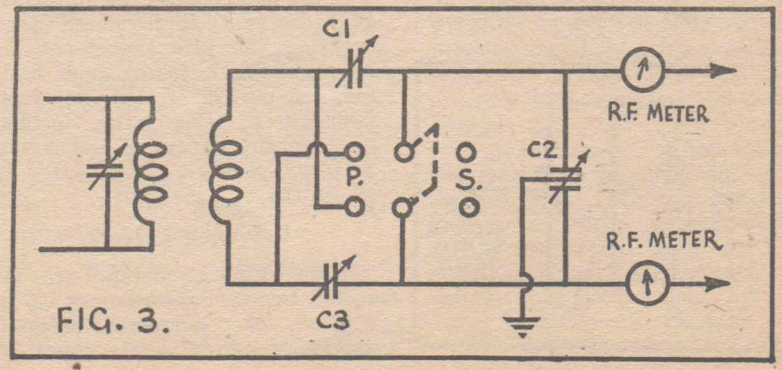

FIG. 3.

## DIFFERENTIAL

(Continued)

### Transmitter Applications

It is important to ensure correct balancing of the input circuit in a transmitter using valves in push-pull. Otherwise, one valve will be driven harder than the other, giving rise to the following disadvantages:—

(a) One valve will take more than its proper share of the load and the anode dissipation may easily be exceeded, without it becoming immediately apparent.

(b) In pentodes and tetrodes, the screen current of the over-drive valve is likely to be unduly high and the screen dissipation exceeded. This is, if anything, more serious than excessive anode dissipation, as the control grid will become unduly hot and secondary emission may occur.

(c) In triodes, and possible tetrodes also, neutralising adjustments will be more critical.

(d) Grid current will be unequal.

(e) The valve life will be shortened.

(f) Even harmonics will not be cancelled out to the degree possible in a well balanced circuit.

A small differential condenser placed across the grid circuit as shown in Fig 1. provides a simple enough means of effecting a balance but it is not quite so simple to determine the proper adjustment.

In the case of tetrodes, a convenient and also a very reliable method is to equalise the screen current of the two valves. In Fig 1. two separate meters are indicated, R5 and R6 being decoupling resistors of low value (e.g. 470 ohm or 1,000 ohm). This feature is a worth-while permanent refinement,

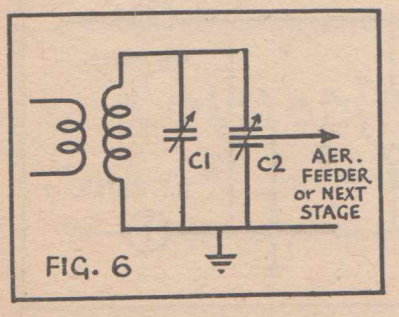

FIG. 6

particularly if the transmitter is employed on various bands and possibly with different couplings and aerials. But, in the majority of cases, it will be satisfactory to insert the meters as a temporary measure, tune up the transmitter for normal operation, rotate the differential condenser C2 for equal screen currents (adjusting the tuning condenser C1 as necessary) and thereafter leave C2 strictly alone.

A method, suitable for triodes, is to measure the individual cathode current. In valves with indirectly heated cathodes, this is a simple

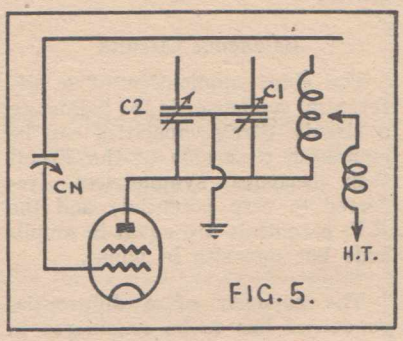

FIG. 5.

matter. Theonly precaution necessary is to ensure the meters are properly by-passed to R.F. currents. Where directly heated valves are used, heated from a common transformer winding, a temporary transfer of one filament to a separate winding is called for. If the windings are centre tapped, so much the better—the meters are inserted between C. T. and chassis. Otherwise, the centre tapped resistor network shown in Fig. 1 should be used.

A third method, but one difficult to apply in practice, is to measure and equalise the individual grid currents. It involves either splitting the grid inductance, as shown in Fig. 2, (a) or shunt feeding, as in Fig. 2, (b). In some transmitters, this latter method may already be in use and it will be good practice permanently to insert the two meters.

### Balancing Feeders

When R.F. ammeters are inserted in tuned feeder lines, as in Fig. 3, the currents indicated should be approximately equal. If

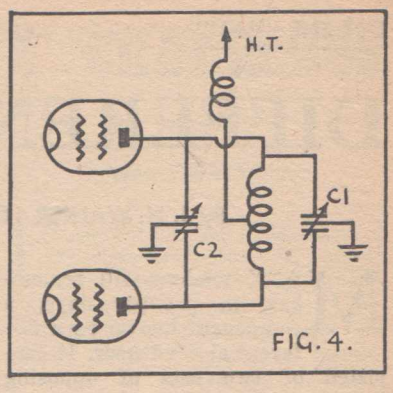

FIG. 4.

this is not so, it means that the feeder wires are not balanced with respect to ground, and the standing wave ratio is likely to be high. It follows that considerable radiation will occur off the feeder and the directional effects of the aerial system as a whole may be quite different from what one would expect.

The addition of a differential condenser (in this instance, of the transmitting type) enables the symmetry of the feeders to be restored. It should be noted that the differential condenser remains across the feeders, both with series and parallel tuning. Fig. 3 indicates the relative position of the differential condenser C2, which remains across the feeders, irrespective whether series or parallel tuning is employed. Switching arrangements are also shown. It will be found that, at one setting of C2, the meter readings will be identical, and only minor adjustment should thereafter be necessary.

### Balancing an Output Stage

A skeleton circuit for a push-pull R.F. power amplifier is shown in Fig. 4. The tank circuit finds its earth through the rotor of the

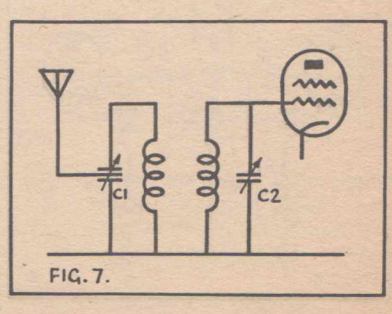

FIG. 7.

split-stator tuning condenser C1, and the balance will be satisfactory, provided C1 is not near the minimum capacity. If, however, C1 is near minimum, the valve and other stray capacities from the major proportion of the capacity in the circuit and the balance may not be so good. Incidentally, practically the whole of the circulating current will flow through the anode seals, which, in some valves, may not be advisable, particularly at high power and high frequencies.

The addition of a differential condenser C2, ensures that an adequate minimum capacity is in circuit, properly balanced to earth. C2 will normally be left set at the half way position—that is, with the rotor engaging the stators to an equal degree. A slight variation either way can be made to take up any unbalance, such as may arise if C1, the tuning condenser, is a single-ended type, the rotor and frame of which may have greater stray capacity to earth than the stator.

Now consider a single-ended stage, as in Fig. 5. Although a split-stator tuning condenser (C1) is employed, the circuit can hardly be called balanced, since that side of the tuned circuit connected to the valve anode has much more capacity across it (the capacity of CN can be ignored). For example, if the valve is an 813, the anode/earth capacity amounts to about 20 pF.

The addition of the differential condenser C2 enables a good balance to be secured. The vanes on the side away from the anode will be engaged to a greater degree than on the other side, dependent on the type of valve used.

### Impedance Matching

We now come to an application of a somewhat different kind—one of impedance matching or variation of coupling, as opposed to balancing.

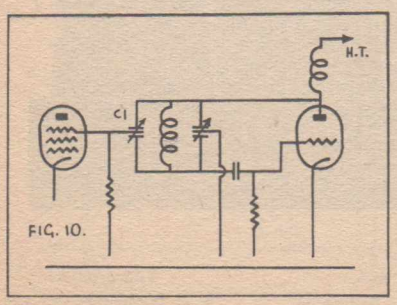

FIG. 10.

An energised single-ended tuned circuit, with one end held down to earth, (Fig. 6), such as is commonly used for aerial coupling, exhibits high voltage and high impedance at the free end and low voltage and low impedance at the earth end. Potential and impedance gradients exist across the circuit and a good match into any external impedance (e.g. and end-on aerial) can be made by tapping on to the coil. This latter operation is not always convenient and also is somewhat rough. A better way is to use a capacitative potentiometer, easily provided in the form of a differential condenser. In effect, the rotor is the variable arm. The impedance (and the voltage varies from maximum when the rotor is fully engaged with the stator connected to the "hot" end of the circuit, to practically zero when fully meshed with the earthed stator. The rotor spindle should be fitted with an insulated coupling. The usual tuning condenser is required to maintain exact resonance.

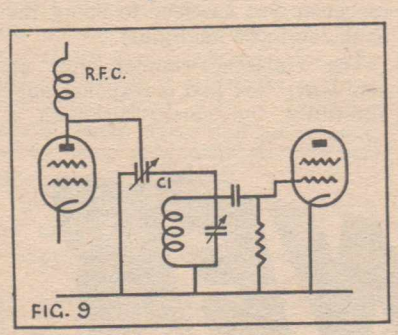

FIG. 9

This coupling system is applicable to almost any length of single wire aerial and also to other parts of a transmitter. For example, a good match into an 80 ohm coaxial cable can be secured, the outer screen being connected to the earthed stator and the inner conductor to the rotor of the condenser.

### Receiver Applications

The same principles outlined earlier apply also to receivers, although possibly the applications are not so obvious. A few examples will illustrate methods of improving receivers in minor ways.

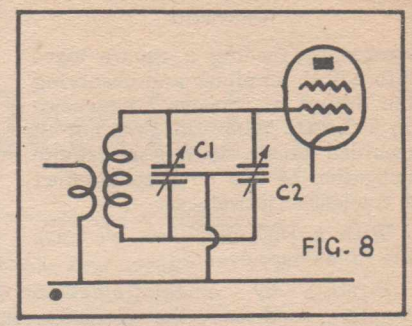

FIG. 8

Fig. 7 shows a differential condenser used for variable aerial coupling to the input circuit of a receiver. The two stators are connected across the coupling winding, the differential condenser may be connected directly across the tuned circuit.

This little refinement is of particular advantage in a T.R.F. type of receiver, and enables good results to be secured from any length of aerial. It is also suitable for use with co-axial cable, the centre conductor of which is connected to the condenser rotor.

Fig. 8 is the receiving version of Fig. 1. The differential condenser C2 allows compensation to be made for the input capacity of the valve and ensures a good overall balance.

The inter stage coupling between two R.F. stages can be varied smoothly by adopting the circuit in Fig. 9. It has the advantage that the capacities in the circuit change less when C1 is adjusted than if a single variable condenser is used for coupling purposes.

Smooth control of the oscillator injection voltage is possible in an HF or VHF converter with the circuit arranged as in Fig. 10. The rotor of the differential condenser is shown connected to the suppressor grid of the frequency changer valve but it may equally well be connected to any other electrode used for injection. With the differential condenser at half-mesh, practically no oscillator volts will be transferred. Rotating C1 in either direction will increase the voltage. An adjustment can be found which gives maximum conversion efficiency and maximum signal-to-noise ratio.

(Continued)

strated by feeding a square wave into a R.C. amplifier and observing the output at various frequencies on a C.R.O. While this was not an recorded music, it was a definite indication of this unwelcome effect a condenser introduces.

With a D.C. amplifier, we have the following advantages.

Firstly, by eliminating the coupling condenser, the aforementioned disadvantages are eradicated. By not having a following grid resistor, which is effectively in parallel with the plate load, a greater voltage output is obtainable from the voltage amplifier, together with a slight increase in voltage gain.

And last, but not least, the output tube is operating essentially as a fixed bias amplifier, by virtue of the large cathode-ground voltage on this tube, and the very small percentage of this voltage used as bias.

This results in slightly greater efficiency and a small reduction in distortion.

With a direct coupled 6J7-6A3, a maximum undistorted output (with negative feedback applied from voice coil to 6J7 cathode) of 2.7 watts, measured across the voice coil, was obtained. With the same tubes R.C. coupled, the max. undistorted output obtained was just over 2.2 watts; in this case, the same amount of neg. feedback was used, though great difficulty was experienced in preventing oscillations due to phase rotation in the coupling condenser, whose value, by the way, was—.25 mfd., with a .5-ohm grid resistor following on.

On sine wave tests, the D.C. version's response was flat plus or minus .5 D.B. from below 10 c.p.s. to 18 kC/s. On square wave, its response was as close to being the same, as to be negligible.

The resistance-coupled unit on sine wave test had a response substantially the same, although a drop of 300 was apparent at 10 c.p.s. On square wave test, the response was rather uneven, being down 6 D.B. at 30 c.p.s., and 3 D.B. at 15 kC/s, where the response fell off rapidly. Various peaks and troughs, of about plus or minus 2 D.B. variation, were observed.

Our final test was to cock the old ear to each amplifier separately, and I can honestly state that the difference in quality was definitely apparent. The pickup and speaker used were, respectively, an Audioscribe and a Goodmans 12-inch.

I hope this article will prove a satisfactory answer to a great number of readers torn between the desire or advisability of building a D.C. amp. in preference to a R.C. version.

(Another direct-coupled amplifier design from Mr. Darragh is due for release in next month's issue. It uses an 807 in the output stage, giving fairly solid power as well as exceptional quality.—Ed.)

# "New Look" Selectivity

**Extreme selectivity is not always desirable, but there are many listeners who want to be able to separate a large number of the stations now on the air. It is not possible, in many cases, to separate stations which share the same frequency, but it is possible to play a great many more stations than might be imagined after trying with a typical commercial receiver.**

By

**PAUL STEVENS**

21 Fletcher's Avenue

Bondi, N.S.W.

REVIEWING the Radio Exhibition at the Royal Easter Show in the May, 1948 issue of the Radio World, I was particularly critical of the poor selectivity characteristics of most receivers, pointing out, that this was o.k. for local reception, but that more expensive interstate receivers should do much better in this respect. The result of these unflattering remarks was a flood of letters, from correspondents sharing and applauding my view, others criticising me for always finding fault and not telling, how to make it better. To answer my challengers, I wrote this article and I extend my apologies to regular readers of the Radio World for repeating some of the things I have written in another article in the December, 1947 issue. I used the expression "New Look selectivity" because, similar to the latest fashion craze, I am going to dig up old and forgotten ideas and principles for a revival, the only difference being my claim to have achieved that way something really worth while and permanent, a definite improvement on our present day technique.

To achieve this we have to adopt an entirely new approach to the designing of radio. We have to free ourselves from the idea, that anything generally adopted or newly invented or developed must necessarily be good, or better than its forerunner.

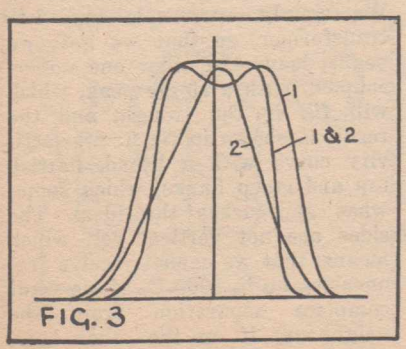

FIG. 3

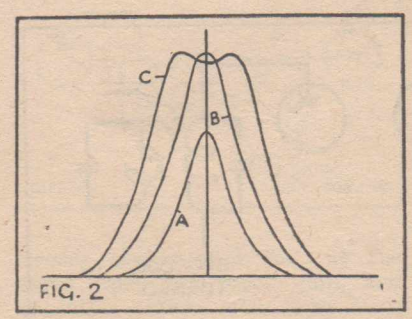

FIG. 2

It is necessary, to pick out the various methods and principles we want to use to get certain results, from an entirely logical and detached point of view, irrespective of when they have been invented or whether they are now in general use or not.

It is quite amazing, how far you can get, by tearing yourself away from the general trend and fashions and follow your own ideas.

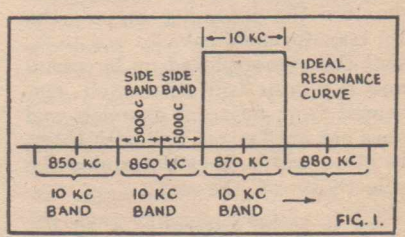

FIG. 1.

This article deals with the obtaining of sharp selectivity without sacrificing gain and, what is more important, fidelity; not high fidelity, of course, but "popular fidelity," the tone people like in their radio, with enough high notes to keep speech easily intelligible.

Although selectivity is generally attributed to coils and IF transformers, the valves play a very important part, as far as their plate resistance is concerned. Whenever a valve anode is connected to a tuned circuit, the plate resistance will appear as a shunt across it and cause considerable damping, which results in loss of gain and especially selectivity. The first rule for a selective receiver is therefore the use of valves with highest possible plate resistance. As a general rule no valve with less than .8 megohm plate resistance should be used as an IF amplifier or converter. While every converter and IF pentode of the continental "E", "A" and "C" series will fill the bill in this respect, only few of the American

(Continued on next page)

## SELECTIVITY

(Continued)

valves will make the grade, or rather they will just make it, if .8 meg is considered sufficient. The only real good American valve from plate resistance point of view is the 6J8G with 4 meg. E series valves average 1.3 meg, the EK32 leading available types with 2meg.

We therefore have to keep in mind, that valves, although they do not determine selectivity, can influence it in a detrimental way.

Apart from valves, the most important parts in the tuner section of a radio are the IF transformers. While the task of the valves is to amplify the incoming signal, the IF transformers have to see to it, that the signal picked up by aerial and oscillator coil stays well separated from adjacent channels and does not get "mixed up" with them, in other words, they determine the selectivity of the set.

As it is in Australia, a 10 Kc. channel is allotted to each broad casting station between 540 and 1560 Kc., which is commonly known as the Broadcast band. A receiver, which is strong enough to pick up a big proportion of the about one hundred stations available, is also faced with the task to get them one at the time, not two or three together. It therefore has to have an effective selectivity of 10 Kc., which means, that a station 10 Kc. away from any point the receiver is tuned to must be suppressed to a degree, where its strength is small compared with that of any station of programme strength, which may occupy the tuned in channel. I call "programme strength" the signal strength necesary to give clear and reasonably free-from-noise reception, so that the programme can be really enjoyed.

### Side-bands

Against this stands the fact, that not only the carrier frequency of a certain station, but also frequencies up to 5000 C. away from it, the so called "side bands," have to be received. These side bands represent the modulation and the highest audio frequency received depends on the width of the sidebands the receiver admits. A variation of 5000 C. up and down the carrier frequency thus represents a 5000 C. note, which will only become audible in the speaker, if the "band width" of the set is sufficiently broad to allow it to pass. And it is here, where the trouble starts:

To separate one station from the two adjacent ones, we need 10 Kc. selectivity; at the same time, if we want to get frequencies up to 5000 C. though, we have to admit the two 5000 C. sidebands of the station, which also adds up to 10,000 C. or 10 Kc. Therefore we have to achieve a selectivity curve as in fig.1, which allows the full sidebands to pass, but cuts off abruptly at 5000 C., to keep the neighbouring station out.

Unfortunately, the square selectivity characteristic depicted in fig 1 is an ideal, which has never been achieved, although it has been closely approached. It is one of the peculiarties of coupled tuned circuits, such as our I.F. transformers, which hepls us in this direction. If the coupling is very loose, we get a pointed curve, as in fig 2a. With increasing coupling, the height of the peak will increase too, indicating, that more energy is being transferred between the coils. It eventually reaches a maximum height, as shown in fig 2b, after which further tightening of the coupling will only cause broadening of the peak, which soon starts to divide itself in two, a "trough" appearing in the middle, which deepens and widens with further increases in the coupling (2c.)

### An Ideal

This peculiar characteristic can now be used, to create a curve, which comes pretty near the square selectivity we dream about. We simply overcouple one I.F. transformer, so that we get two peaks, leave the other one undercoupled, with a single peak, which will fill in the trough, and the result is shown in fig 3: a selectivity curve with a broad, flattish top and steep flanks, which somewhat approaches the ideal. The sides are not vertical yet, which means, that we cannot receive frequencies up to 5000 C., if we want complete separation from the neighbour; if on the other hand

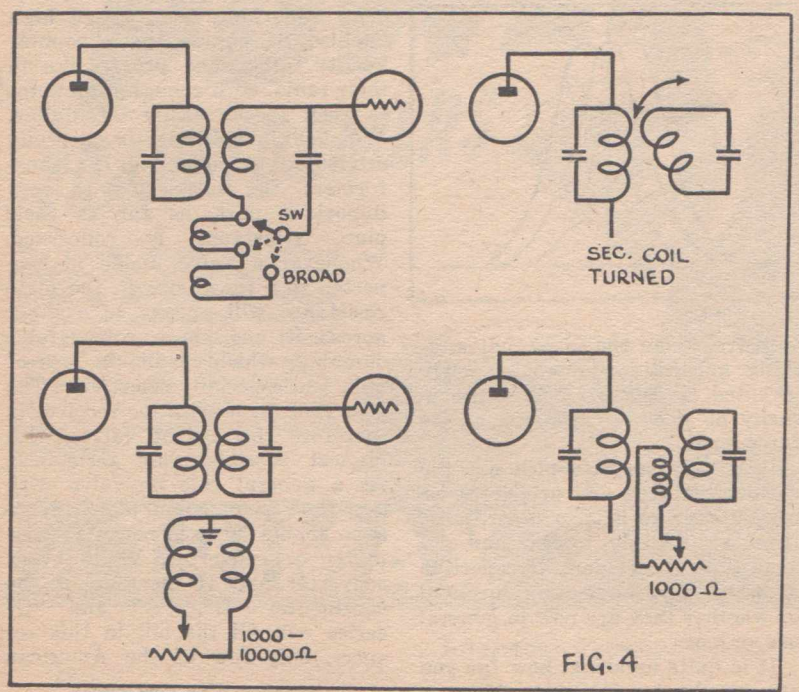


FIG. 4

we insist on our 5000 C., we have to put up with the possibility, that a strong adjacent station will cut in. When listening to locals, we can safely use a band width of up to 20 Kc., without running the risk of interference, as the power of the local station will simply blot out the neighbours. We thus get high fidelity, but cannot use our receiver for interference-free long-range reception, as we would in most cases get two stations together.

### Variable Selectivity

The logical thing to do is therefore to equip our receiver with variable selectivity, which is easily done by fitting an extra coupling winding, that can be controlled by a switch or rheostat, to the I.F. transformer. Fig 4 shows various methods to achieve variable selectivity. The coupling windings consist only of very few turns of wire, co that it is comparatively easy, to convert any good high selective I.F. transformer to this purpose. (to be described in future article).

### "Q" Factor

Our main problem is now, to get one of these highly selective types. Apart from the "Q" factor, the selectivity of the I.F. channel is largely dependant on the frequency used. These frequencies range from about 110 Kc. up to 1900 Kc., for special short wave sets even higher. Standard frequencies are in the region between 110 and 130, round 175, 460 Kc., and 1900 Kc. Selectivity decreases sharply with increasing frequency. It is easy to achieve 10 Kc. flat top on 110 Kc., even with coils of medium "Q," a little harder on 175 Kc. On 460 Kc. not even the highest quality I.F. transformers will do it on two stages and we have to resort to an additional one to get 10 Kc. selectivity. When using three I.F. transformers, they are of a special high-selectivity low-gain type, with large capacities and small inductances. These gives a very good curve and at the same time keep the gain over 3 stages down to that of the usual two, so that no instability is experienced. As for the 1900 Kc., we can practically forget it for our purposes, as both gain and selectivity are far too low.

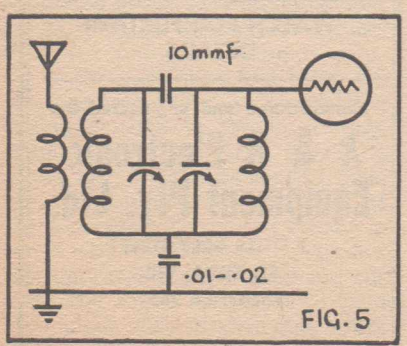

FIG. 5

### The I.F. Frequency

These considerations seem to have brought us to the conclusion, to settle for an I.F. between 110 and 130 Kc. But again we have to compromise. The image frequencies, which are 900 Kc. apart for a 450 Kc.I.F. , are only 220 to 260 Kc. apart in our case, which requires very high input selectivity, that cannot be achieved by a single tuned circuit. A twin circuit, or band pass, has to be used, which means an extra condenser section and coil, at the same time less input gain, and therefore higher valve noise from the converter. (fig 5). This sort of design, which was common in Europe, is therefore rather wasteful. Another way out would be the use of an R.F. stage, which would also put two tuned circuits ahead of the converter. Due to the gain of the R.F. valve, however, the relative increase of input selectivity is not quite sufficient, and we would still have some trouble with the "second spot." By the use of 175 Kc. I.F., this could be overcome, as the images are now 350 Kc. apart, for which frequency the preselection of an R.F. stage is sufficient. At the same time, an R.F. stage is almost a "must" for long-range reception, as it gives high-gain before the converter, thus reducing the relative strength of the converter noise as against signal strength, enabling clear reception of even weak and remote stations.

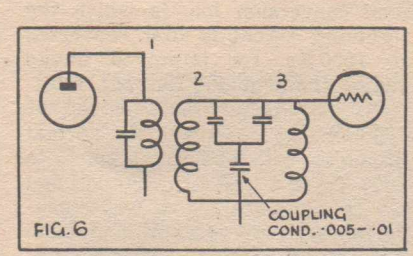

FIG. 6

### The Answer

The second possibility to get sufficient selectivity for telereception is the use of three I.F. transformers of 460 Kc. If used with another I.F. valve, it doesn't really mean extra gain, as low-gain types have to be used to keep the I.F. amplifier stable. If the third I.F. transformer, on the other hand, is fitted as an additional one between converter and I.F. valve (fig 6), it will increase selectivity but the gain will suffer considerably, which is just the contrary of what we want for a long range receiver. So whichever way we look at it, we come to the conlusion, that for long-range reception 175 Kc. I.F. in conjunction with an R.F. stage gives the best possible results for both selectivity and sensitivity, freedom from valve noise and also from the economical point of view. With amplification evenly spread over R.F., I.F. and audio frequencies, we get good stability in spite of high gain, while due to the extra controlled valve, A.V.C. action is also improved.

It is interesting to note, that this detached way of reasoning has already brought us a good way off the beaten track. Let us compare our telereceiver with the standard Australian and American long-range model. First of all we do not find such a thing as flat top selectivity here; instead there is a point curve with gently falling off flanks, which gives the equivalent of a 20 to 30 Kc. band width. I purposely say "equivalent," because there is no such thing as band width in an undercoupled I.F. circuit. Only the carrier frequency itself will theoretically be received at full power, while the side bands fall off rapidly with increasing frequency. In practice, there is still a band of a few hundred cycles

(Continued on next page)

## SELECTIVITY

(Continued)

around the centre, and the falling off of the higher notes does not become noticeable up to about 3000 cycles, provided the flanks are not too steep.

There is a fundamental difference in the functioning of an I.F. transformer, which derives its band width from careful adjusted coupling between the coils, and one, which admits a certain band only out of sheer lack of selectivity. The band-pass type will admit any frequency within its band width at nearly equal strength. If we, for instance design one with a 30 Kc. top, it will receive three stations of equal signal energy at the same volume, will therefore be totally unsuited for telereception. The pointed type however, will act in a quite different way. With the gentle sloping of the flanks, attenuation will increase gradually and if we again imagine three equally strong stations within the 30 Kc. limit, the centre one will become the "main station," while the two other ones at the flanks will just form a back ground of "monkey chatter," as this distorted form of modulation is called. With fading playing its tricks, one or the other side station will get the upper hand, while the middle one is weak and the resulting mix up will completely marr the enjoyment of the programme. These facts are only too well known to anybody, who ever tried to listen to interstate on one of our standard "long-range" receivers.

With a flat top selectivity curve, on the other hand, we have to be careful, that the band width is less than 10 Kc., as other wise the sidebands of neighbouring stations will often interfere at full strength. Variable selectivity is therefore adviseable.

Image frequencies on short waves are always a bit of a nuisance. Even on 460 Kc, I.F. they are still able to interfere with other stations. That is, why the 1900 Kc. I.F. was created. It is very unfortunate, that at this frequency selectivity is too poor for the broadcast band. To find a satisfactory solution of this problem, without compromising, is hard. Dual wave sets are generally a makeshift, because of the poor tuning facilities on S.W. Apart from this, the standard 460 Kc. I.F. still gives bad image ratio on short waves, unsatisfactory selectivity on the broadcast band.

We have now two ways open: We can build a long-range set, with R.F. stage and 175 Kc. I.F., as described before and include a short wave band merely as a sales feature, as most manufacturers do. For people, who are satisfied with the tricky tuning and impossible calibration on S.W., image frequencies won't be a bother; on the contrary, they may be happy to get about twice as many stations as there really are! But for those, who take the game seriously and listen to short waves for more than two weeks, after the set has been bought, we have to find a far better solution. Improved preselection by means of a band-pass input or R.F. stage does not get us very far on S.W., because of the poor quality of the coils. The only way out is an I.F. of 1900 Kc. or thereabouts. We can combine both the high and low I.F. in a dual conversion job, in which the incoming signal is first converted to 1900 Kc. for improved image **radio, than to 175 Kc. for** selectivity. By using 1600 instead of 1900 Kc., we can make the normal broadcast coils of our set, tuned to 1600 Kc., the first I.F. channel, and use a separate short wave converter with proper dial and band spread facilities.

There are two more ways to get improved selectivity on 460 Kc.

The first method is to use low-gain high selectivity I.F.'s in conjunctions with a high-gain valve, such as the E.F.50, which makes up the loss.

The second is the use of a "infinite impedance" detector circuit, which does not put any damping onto the second I.F. transformer, thus making it as efficient as the first, and improving both selectivity and gain.

### Conclusion

When judging the selectivity of a certain receiver, we have to be careful not to make serious mistakes, due to the action of AVC. Without AVC, the gain of the set does not alter with signal strength. When tuning off a station, amplification will not automatically increase, and the station will vanish quickly, giving the impression of high selectivity. Receivers equipped with AVC however will immediately increase their gain, as soon as the signal weakens and will tend to keep up the original volume to the limit of their power. The result is, that the tuning seems to be far broader than the band width of the receiver, especi-

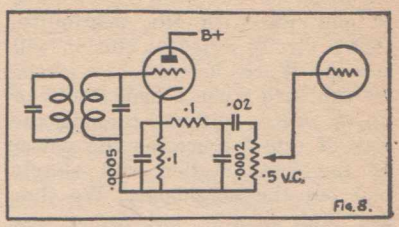

Fig. 8.

(Continued on page 34)

# 10/15 CONVERTER

**This converter is available from the Aegis Company as a complete unit, built-up, wired and tested. This is somewhat different from previous Aegis policy, which has been to supply complete kits of components. However, the Aegis Company has not forgotten the enthusiast, and anyone who feels confident enough to tackle the construction of this rather critical piece of gear will find that Aegis will be pleased to quote for the special components required, such as the case, coils, dial, etc.**

THE Aegis Manufacturing Co. have much pleasure in adding this unique converter to its extensive range of radio kits and components. There are many receivers both commercial and ex-disposals in use today which do not cover the higher "Amateur" bands. With the increasing popularity of both "Ham Radio" and the use of "Ten Metres" it was felt that a converter for this frequency would be a very desirable piece of apparatus. With this view in mind the design of a suitable converter was initiated and while on the job it was decided to include provision for the new "Fifteen Meter" band for when it becomes available. The unit is therefore a two-band type, with bandswitching. Band 1. covers from 27.0 Mcs. to 30.0 Mcs. and Band 2. from 20.85 Mcs. to 21.75 Mcs.

### Design Details

The unit consists of two tubes, an EF 50 as an R.F. amplifier and an ECH 35 as the converter tube. Only one tuning condenser is coupled to the main dial, this being for the oscillator tuning. Broad-band tuning is used in the inter-stage coupling and the aerial circuit is tuned with a separate control. This greatly simplifies the operation of the converter. The aerial circuit is tuned with a split-stator condenser, this improves the efficiency and enables the aerial condenser to tune both bands without switching while still maintaining satisfactory operation. The use of the EF 50 gives good signal-to-noise ratio. The interstage coupling is actually an I.F. transformer with primary and secondary resonant. On band 1 the tuning capacity is supplied by the tubes and strays, the tuning being accomplished by iron cores in each coil while on Band 2 additional trimmers are switched across each coil. The coupling of this transformer is adjusted to have a flat response across each band and this eliminates the necessity of having this stage variable tuned.

The oscillator uses a modified "Colpitts" circuit and special attention has been given to obtaining

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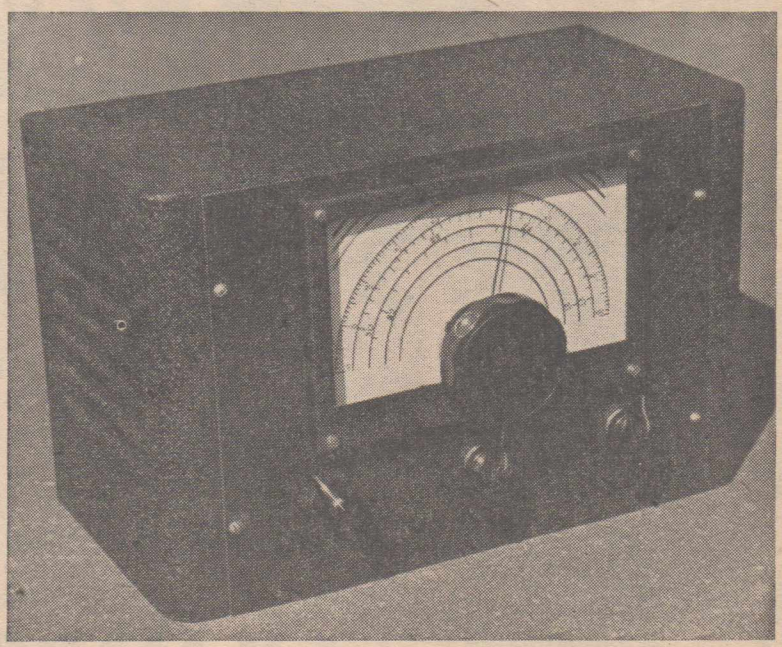
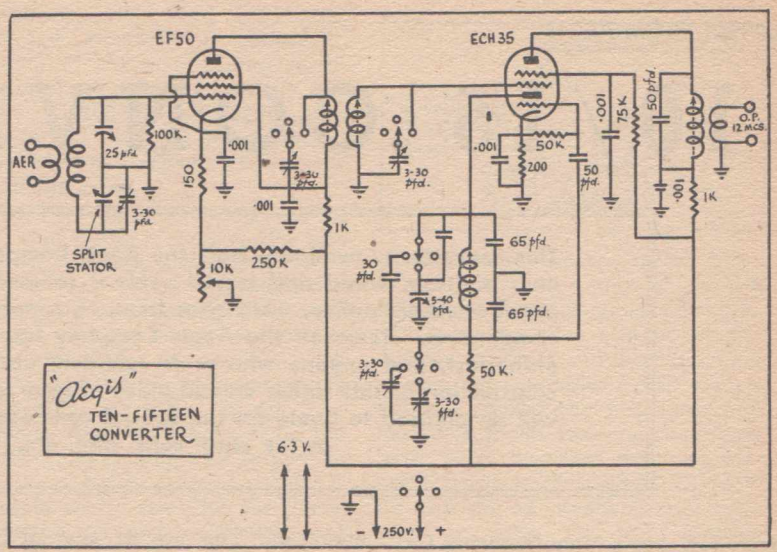


## CONVERTER

(Continued)

a satisfactory tuning characteristic. The converter is designed to operate at an I.F. frequency of 12 Mcs., the output being coupled to aerial and earth of any short-wave receiver capable of tuning to 12 Mcs. This frequency was adopted in preference to the usual 10.7 Mcs. in order to eliminate the possibility of spurious signals and heterodynes as the second harmonic of 10.7 Mcs. falls within Band 2.

Band 1 covers both the "Ten and "Eleven" metre bands while Band 2 covers the "Fifteen" metre band. The dial—an "Eddystone" full-vision vernier type—is calibrated 0-100, as well as being directly calibrated in frequency for both bands. The calibrations are every 100 Kcs. on Band 1 and every 50 Kcs. on Band 2. The amount of bandspread obtained is




50 divisions on "ten metres," 9 divisions on "eleven metres" and 45 divisions on "fifteen metres."

### Operational Details

Provision has been made for obtaining power from an existing power supply the requirements being 6.3 V. at .6 A. and 250 V. at 20 mA. The filaments have been wired so as to suit either a centre-

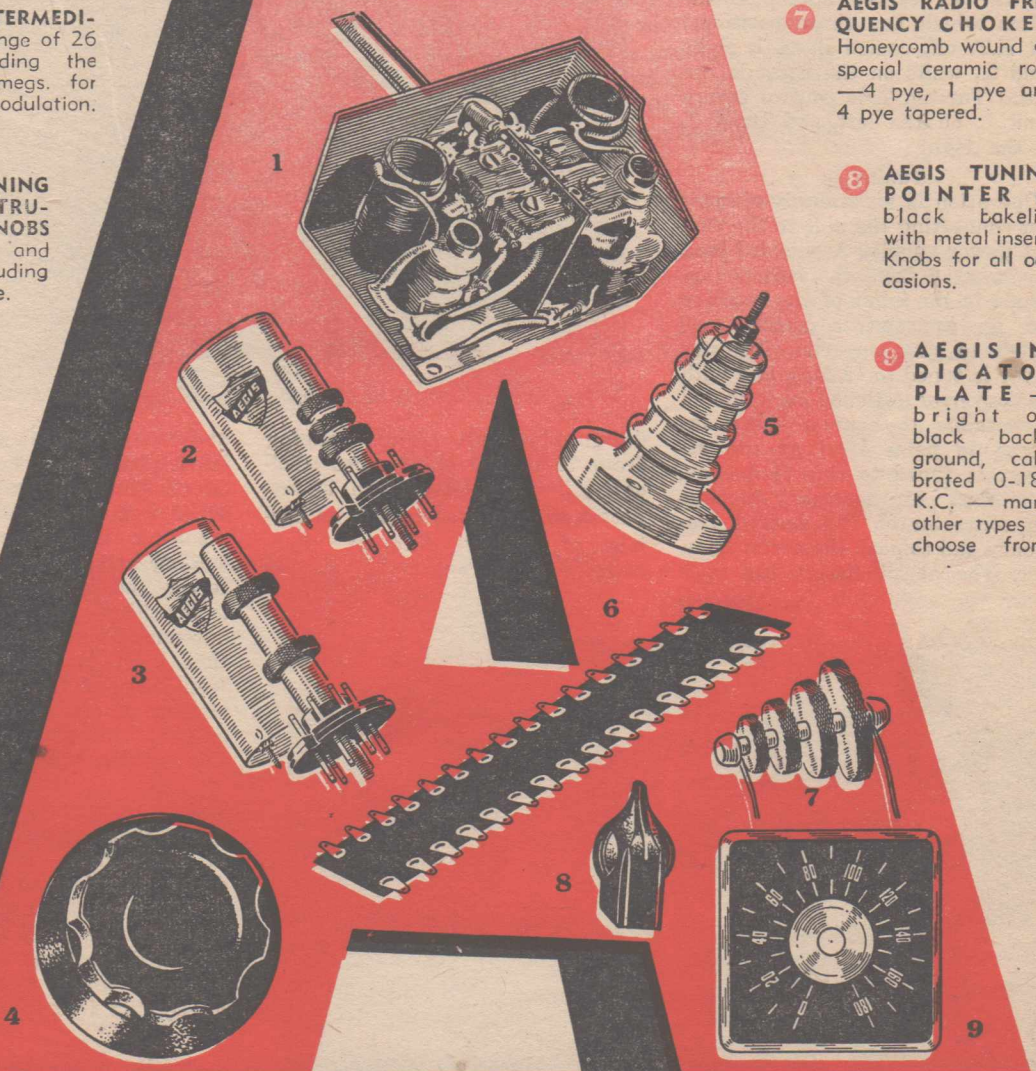
1. **AEGIS 2-STAGE D/W COIL ASSEMBLY** featuring Permeability iron-cored B/C and SW coils.

2. **AEGIS BROADCAST COILS** cover the full range of standard types, plus special windings as required.

3. **AEGIS INTERMEDIATES** — range of 26 types including the new 10.7 megs. for Frequency Modulation.

4. **AEGIS TUNING AND INSTRUMENT KNOBS** all sizes and types including Vernier drive.

**Capital "A" is appropriate for Aegis components—for their quality is second to none! Here are some typical examples from the comprehensive Aegis range, each one designed and made to exacting standards from first-grade materials.**

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8. **AEGIS TUNING POINTER** in black bakelite with metal insert. Knobs for all occasions.

9. **AEGIS INDICATOR PLATE** — bright on black background, calibrated 0-180 K.C. — many other types to choose from.

# AEGIS COMPONENTS

**AEGIS MANUFACTURING CO. PTY. LTD., 208 LT. LONSDALE ST., MELBOURNE, VIC.**

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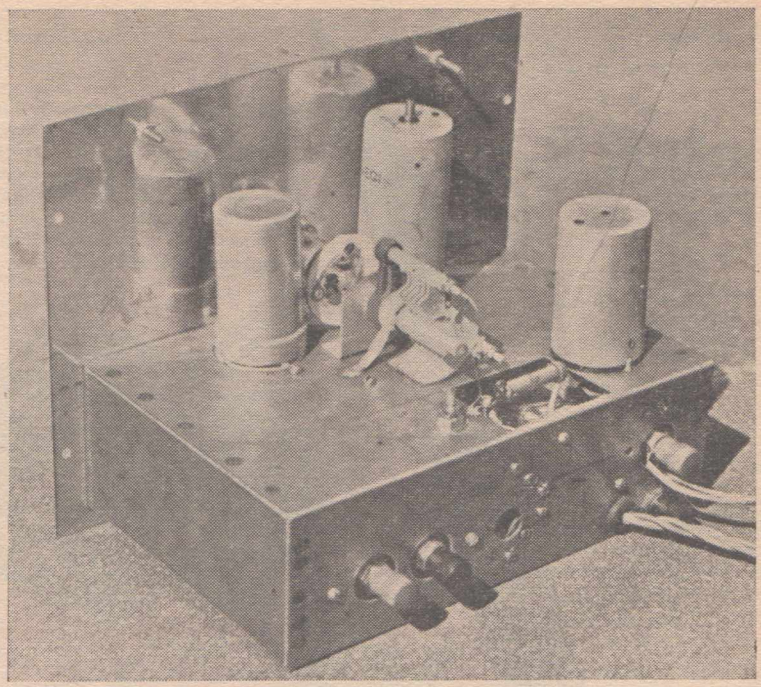
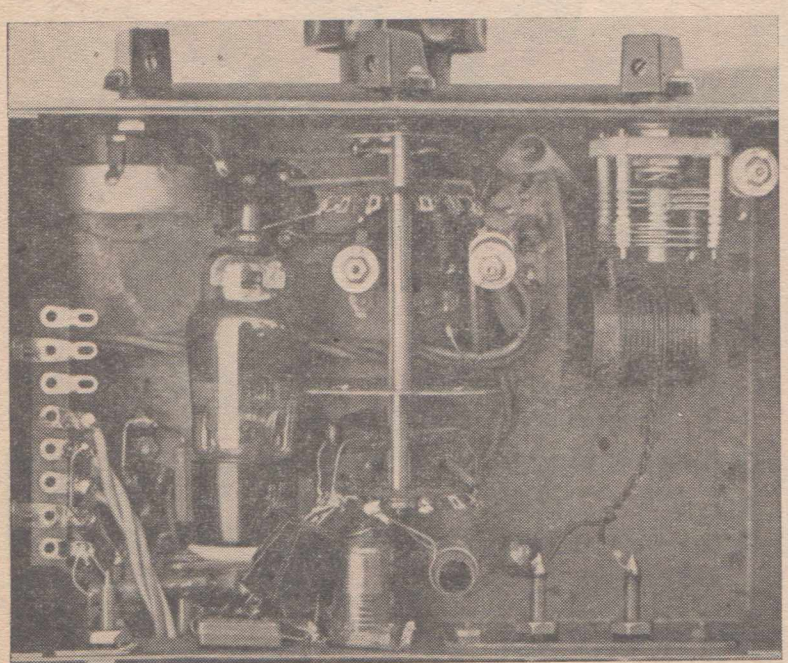
tapped or with one side earthed, and if necessary, can be easily rewired for series 12 volt operations. An R.F. gain control has been incorporated with the EF50 in case of overloading on powerful signals. The controls on the front panel are the main tuning dial with three controls underneath. The control on the left is the R.F. Gain Conrol, in the centre is the Bandswitch which has three positions, left H.T. off, centre Band 1, right Band 2., while on the right is the Aerial Tuning. This control covers Band 1. on the left and Band 2. on the right.



**Tuning-in**

Operation is exceedingly simple; first connecting the unit to the correct power supply. A shielded lead is connected from the output terminals to the input of the receiver and an appropriate aerial connected to the converter. The receiver is tuned to 12 Mcs, and with the converter switched on it should be possible to hear a sharp increase in noise level as the receiver is tuned to this frequency. It is then only necessary to tune the converter on the desired frequency and to peak the aerial trimmer. The aerial circuit has been designed to suit aerials ranging from 75 to 300 ohms most efficiently, but the circuit can be expected to give good results on aerials of widely different characteristics. It might be noticed under some conditions that the aerial trimmer does not have much effect. This will indicate that the aerial has considerable mismatch, resulting in severe reactive or loading being presented to the receiver and it would be advisable to investigate the properties of the antenna. When the unit is in operation if it is possible to get a frequency check by receiving a station of known frequency it is only necessary to set the dial at this frequency and adjust the dial of the main receiver until this station is received. This will indicate that the receiver is now set at the correct frequency for the dial calibrations to be correct and it might only be necessary now to readjust the receiver slightly should it be found to be receiving a signal which would heterodyne all signals from the converter.



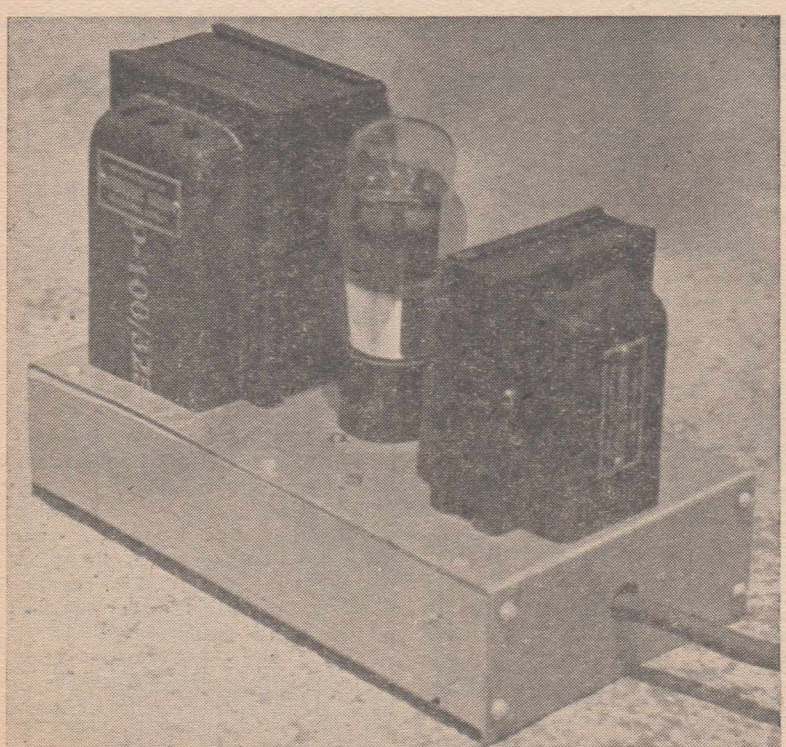
Finally it can be said that this converter is smooth in operation and can be relied on to extend the usefulness of existing receivers. It will always be found at peak performance as there are no sharply tuned circuits to get out of alignment and the direct dial calibrations will be found helpful in locating and logging stations.

# Standard Power Unit

**About twenty years ago nearly all radio receivers were operated from batteries. Then came the bright idea of rectifying the alternating current from the power mains. Today it is usual to find the power supply built into the all-electric receivers, but it is often quite handy to have a separate power supply unit. This is just such a unit and suitable for use with the amplifier and receiver described elsewhere in this issue.**

THERE are quite a few obvious advantages to using unit construction for both radio receivers and amplifiers, such as prevention of hum and mechanical rattle. It is also a handy way of arranging things. In fact we might even say that a standard power unit is one of the handiest things to have around any experimenter's bench. When you see some new circuit you would like to try it is so much easier to just build the amplifier itself and then plug it into your power supply.

This unit is simply the usual style of power transformer, rectifier, filter choke and filter condensers. Normally such components would be built into the main chassis of the amplifier and receiver described on other pages in this issue. So instead of building up two sets of rectifer and transformer equipment, we simply build up this single standard unit and then used it for both items when testing them.



There are all sorts of possibilities when making up a power unit; some experimenters might prefer a more complicated job like the one we have on our bench which can deliver almost any filament voltage from 1.4 volts to 35 volts, with wide tolerance on account of the primary of the filament transformer being tapped to suit 190, 200, 210, 220, 240 and 250 volts. In fact, together with two high tension voltages, ranging from 150 to 750 volts at currents up to a third of an ampere. But it is a big affair, using special transformers and costs a lot of money. A much simpler outfit is described here and can be built with standard components and yet serve a dozen different amplifier and receiver circuits.

### The Transformer

The transformer used in the power unit actually shown in the photographs was one which came down as a sample with the Ferguson components used in the amplifier described elsewhere. It provided about 325 volts a.c. for the plates of the rectifier, which gives about 340 volts d.c. at the entrance to the filter choke with a normal load of about 100 milliamps. The choke, which is also a Ferguson

(Continued on next page)

## POWER UNIT

(Continued)

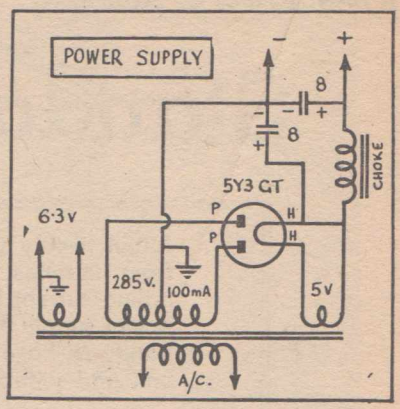
job, has a d.c. resistance of about 200 ohms, so at normal current drain there is a voltage drop in it of about 20 volts, leaving around 300 to 320 volts for the amplifier. With a larger drain, as taken by a set, the voltage will be slightly lower, but those who want to keep well within the maker's ratings of 250 or 275 volts for the plates of valves such as converters, will do well to fit a heavy-duty resistor of 400 or 500 ohms in series with the choke. This will give increased voltage drop here and, at the same time, extra smoothing of the rectified current, making the amplifier or set even better than ever as regards hum level.

### Heater Windings

For the heater power supply the Ferguson transformer has two separate 6.3 volt windings in addition to the 5 volt winding for the rectifier filament. In most cases, these days, it is normal practice to run all the valves in a set or amplifier from the same 6.3 volt winding. It is not a bad plan to use both windings, however, with the output valves operating from one winding and the rest of the valves from another. The output valves usually have a much heavier current drain, so that the current drain is fairly evenly split if there are four or five valves in the rest of the set. With the current drain divided there will be less voltage drop in the leads.

### The Outlet Socket

One of the neatest and most practical ways of coupling up a set to a power unit is by means of a six-wire cable and a six-pin plug fitting into a six-pin socket mounted in the power unit. Fitting the socket to the power unit means that if the set is disconnected but the power turned on there will not be any high voltages available to be touched accidentally, which could be the case if the plug came from the power unit and plugged into the set. With the six-pin socket there is a more or less standard arrangement of using the pins. The two fat pins are used for the heater supply of the output valves, the two diagonally opposite



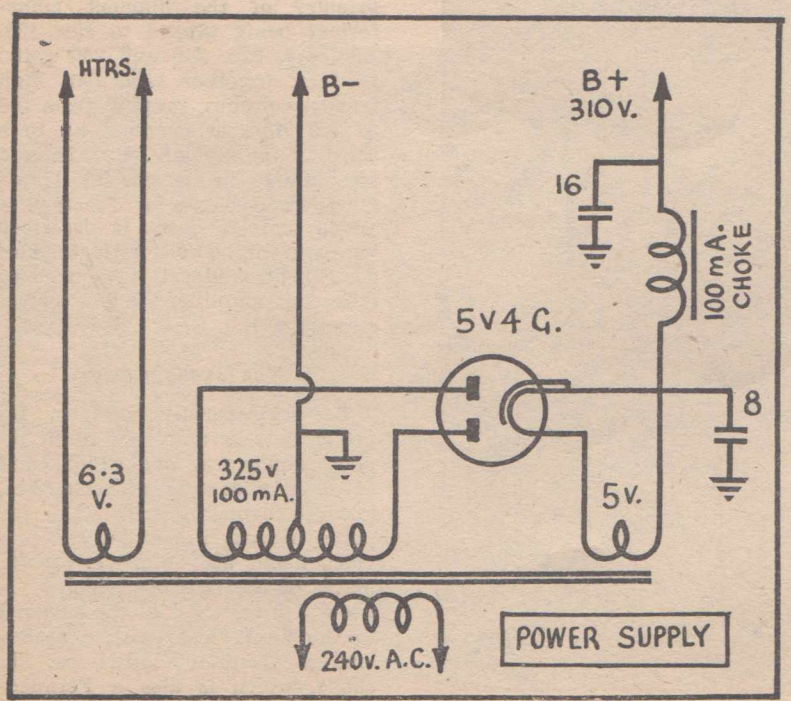

The circuit for use with the "1949 Standard."

pins are for the other heater winding, with the high tension positive going out through the pin which is normally the plate pin, and the negative being connected to the cathode pin, which is also earthed in most cases. There is no hard and fast rule about connections and those who prefer to use their own ideas can do so. Some may find it easier to get an octal plug and socket and wire it up to suit themselves.

### Filter Condensers

Two filter condensers are required and these can be 8 or 16 microfarads capacity with a working voltage rating of 525 or 600 volts. Many prefer to use an 8 mfd. condenser at the output of the rectifier and a 16 mfd. at the output of the choke. Highest peak voltages occur at the output of the rectifier so a condenser with a 600 volt rating is to be preferred at this position. If the power unit is switched on without the set connected there is always satisfaction in knowing that your filter condenser will stand up to the peak voltages which may rise far beyond the normal voltages marked on the power transformer. Sad to relate, in practice it is often found that 600volts electrolytics seem to break down just as readily as those

(Continued on page 34)



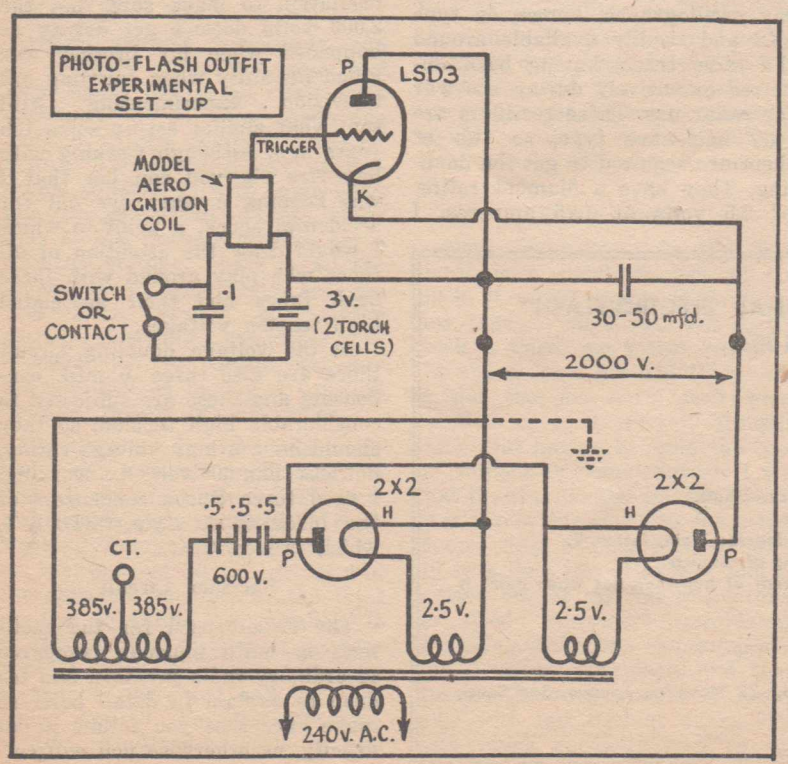

Circuit for use with the P.A. Amplifier.

# Photo-Flash Experiments

**Radio experimenting is a grand hobby because there are so many different directions in which it can be applied. Apart from set building there is amateur transmitting, long-distance reception, and so on. Even in the field of practical experiment there is no limit. Here is a suggestion for fresh experiments, the building up of a photographic flash outfit using mostly radio components.**

Most of our readers are hobbyists, interested not only in radio but in many of the other technical subjects which appeal to those souls who can be classified as "mechanically minded." I, personally, follow a rather wide range of hobbies, being keen on lathe work and mechanical engineering, model aeroplane design, construction and contest winning and last but not least, photography. In the photography line I have my own Graphlex and enlarger and I have done quite a bit of pinch-hitting for press and commercial photographers from time to time. For example the photographs of the converter in this issue were done by my old Graflex with the converter sitting in the spring sunlight on a Melbourne city footpath.

So you can understand that when the Mullard people advertised their LSD3 flash tube in our columns a few weeks ago I was greatly interested and soon got hold of a tube and carried out certain experiments with it. A number of other enquiries have come to hand from readers who also have photography as an additional hobby to radio. The whole set-up of the flash-tube outfit follows radio practice to a marked degree, too, but with some rather different angles, so I feel sure that this article will interest a number of our readers. I hope I need offer no further apology for contravening our policy of "technical radio only" by giving it to you.




### Flash Tubes

The first essential for photography is light, and the very essence of the game is to get proper exposure of the plate to the light reflected from the subject. Normally the sunlight provides illumination, but there comes the time when you want to take a photograph at night, or inside a comparatively dim room. Up till fairly recently the solution to this problem was to use a flash bulb, the modern equivalent of the old idea of lighting a flash of magnesium powder. The flash bulb had its points, not making the smoke and smell of the old flash powder, but had the drawback that it was good for only one exposure and cost quite a few shillings.

Now comes the flash-tube, such as the Mullard LSD3, which is a sort of small-sized neon light, which gives a very sharp and bril-

(Continued on next page)

## PHOTO-FLASH

(Continued)

liant flash of light when a charge from a condenser is released through it. The tube is not destroyed by the flash and can be used over and over again indefinitely, providing thousands of flashes at a running cost of practically nothing.

Requirements for the operation of the tube, however, are not so easy. For a start a high voltage is required to charge the condenser, about 2,000 volts. The condenser needs to have a capacity of about 30 microfarads and needs to be able to withstand the 2,000 volts applied. The flash is started (fired, I think, is the right term) by a spark from an ignition coil. However these problems are all overcome quite easily, as we will see in this story of the experiments I have carried out with these flash tubes.

### Types of Outfits

Outfits to use the flash tube naturally divide into two types of equipment, fixed and portable. For the pressman and outdoor photographer the portable outfit provided plenty of scope for brainy applications.

A typical commercial outfit uses an accumulator for power supply, feeding into a vibrator to supply the high voltage required to charge the condenser. However the accumulator is not exactly the neatest of things to lug about in addition to your photographic gear and so other ideas are being worked upon. A gentleman who has been most helpful to me with advice and guidance is Mr. J. H. Larkin of the National Instruments Company of Sans Souci, who tells me that he has a portable outfit well on the way which is about half the weight and size of anything seen so far, gives comparable light output, costs less and gives over 500 shots from four type 701 cycle lamp batteries. These batteries are fairly light and, being dry, do not have the drawbacks of re-chargeable accumulators which are acid-filled.

For my own experiments I selected a fixed installation to operate from the 240 volt power mains and to use radio and model aeroplane equipment which I had on hand. In order to get the required 2,000 volts of high tension I used an ordinary 385 volt radio-type transformer with a voltage doubling circuit suggested by Mr. Larkin. This takes two high voltage rectifiers of the type used with cathode ray oscillographs, known as type 2X2 and readily available around the radio trade, having been imported extensively during the war for radar use. These rectifiers are only half-wave type, so two of them are required to get the doubling. They have a filament rating of 2.5 volts at 1.75 amperes, I found suitable windings on an old 385 volt transformer which was lying around. There is considerable voltage stress between these windings and they should really have something special in the way of insulation to make sure that the 2,000 volts doesn't get astray as happened when my brother was killed instantly when carrying out television experimenting with somewhat similar set-up some ten years ago. Although working with hay-wire rig you can bet that I was keeping a wary eye out for accidental shock, a point to which I would draw the attention of all those who play around with these flash tubes and their associated high tension voltages.

In the voltage doubling circuit there are also three .5 mfd. condensers and these are subjected to considerable high tension, so they should have a high voltage rating, not less than 600 volts d.c. working. I used three Ducon condensers of the block type, style PST89A/1, which proved O.K.

### Rectifier Circuit

The circuit used for the rectifiers is quite unusual, compared to ordinary radio practice, and too deep to explain in detail here, so make sure that you follow it out exactly, as otherwise you will cer-

### SPECIFICATIONS OF NATIONAL "ELECTRO-FLASH" MODEL 100A

Energy storage—30 joules.
Time to charge—6 seconds.
Duration of flash—1/14,000 of sec.
Weight of outfit—8 lb. 7 oz.
Size—8¾ in. x 7½ in. x 2⅞ in.
Battery equipment—4 type 701 or 800 cycle batt.
Battery life—500 flashes with normal use.
Reflector—Diam, 7 in.; beam angle, 45 degrees; gain, factor, 8.
Synchronisation—Instantaneous on closing of contacts.
Charge indicator—Neon lamp fitted in rear of gun indicates when outfit is charged to 30 joules ready for use.
Case—Pressed aluminium.
Cord—4 ft. 6 in. cable from unit to flash lamp.
Price—£65, plus tax.
Made by—National Instruments Pty. Ltd., 22 McMillan Avenue, San Souci, Sydney.

### FLASH-TUBE DATA

### Mullard Type LSD3

Operating voltage—
Min. 1,000v.
Max. 2,700v.
Max. Energy Discharge—
100 joules.
Max. size of condenser—
2,700v.—27 mfds.
2,000v.—50 mfds.
1,500v.—85 mfds.
1,000v.—200 mfds.
Trigger voltage—
1,500 volts from spark coil.
Flash duration—
100 to 300 micro-seconds.
Base—
4-pin UX type socket.
Distributed in Australia by Mullard-Australia Pty. Ltd., of 35-43 Clarence Street, Sydney.

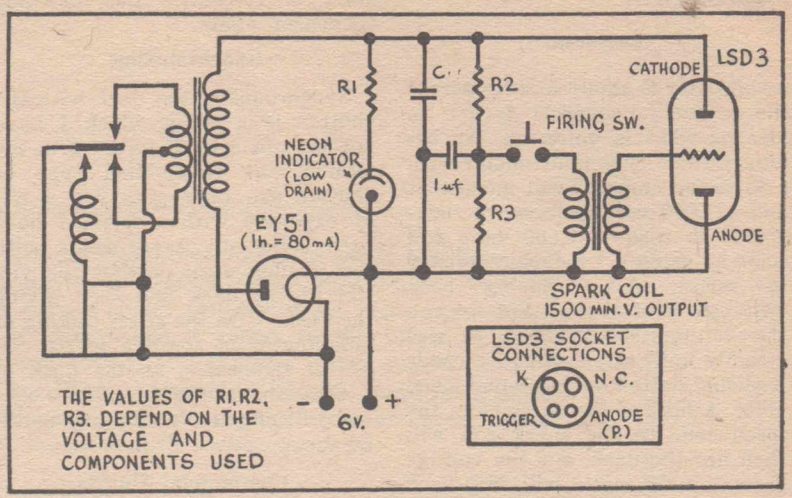
tainly get some funny effects, but not the 2,000 volts of d.c. which you require to charge the main reservoir condenser.

### The Reservoir

The main 30 mfd. condenser which holds the charge before it is released into the flash tube is subjected to the full strain of the 2,000 volts with which it is charged, so you would naturally expect to use a condenser with this voltage rating. But condensers are rated for radio use where in addition to the main working voltage there may be super-imposed audio or r.f. voltages with peaks far in excess of the figure expected. So condensers are made with plenty of safety factor and it is found in practice that the reservoir condenser for a flash outfit can be of the type rated to work at 1,000 volts, yet readily withstand the strain of the 2,000 volts with which it is charged. The condenser used by us in our experiments was the "Ducon" 30 mfd., 1,000 volt d.c. working, type 5N300A. These particular condensers appear to be more or less standard equipment for the commercial flash outfits.

Other suitable condensers can be obtained from disposals and junk shops, but in all cases it is necessary to be sure about the voltage rating being a working rating. There are plenty of disposals condensers with their English ratings marked on them, which may be test voltage ratings, not a working voltage. There is all the difference in the world between these two groups of voltage ratings. Normally a condenser with a 2,000 volt test rating can only be classified as having a working voltage rating of 600 volts.

To make up a reservoir condenser from several small units is quite a practical scheme. By putting condensers in parallel their working voltage remains the same as the weakest in the group and the capacity amounts to the total of the capacities in parallel. It is also possible to connect condensers in series, so that the working voltage is increased and the capacity lowered. For example, two 4 mfd. condensers, each of 600




**Circuit recommended by Mullard for use with vibrator and accumulator power supply.**

volt rating can be connected in series to give an effective capacity of 2 mfds. at 1,200 volts. Keep away from electrolytic condensers, such as radio filter condensers which are readily available in capacities of 8 and 16 mfds. with working voltage of 525 or 600 volts. I cannot recommend you to build up a bank of these condensers in series-parallel connection as they have quite heavy internal leakage, even when in the best of condition, and the leakage is so irregular that balancing resistors would be needed to keep voltages level across different sections.

### Firing Spark

Next requirement in the flash outfit is a spark to set off the flash, it would appear that almost any type of spark coil will do the trick. I tried one which had been discarded from my old Chev. and it did the job quite well when coupled up to a six-volt accumulator. But having in mind the type of contacts of some shutters I felt that the smaller the amount of current across the contacts the better chance they will have of standing up to a long life of service and so I tried one of my miniature coils, as used in model aeroplanes. Weighing only two ounces, these are light and compact, and they operate from a couple of torch cells with low current drain. The lead which normally goes to the spark plug is taken to the trigger of the LSD3 tube and the other side of the coil primary to the plate or cathode of the flash tube; it does not seem to make any difference to which, in practice.

Now all we need is the tube, the UX type socket for it and a reflector and we have all the doings for making heap big flash in mighty quick time.

The amount of light obtained from the flash tube is dependant on the input voltage, the capacity of the condenser and the efficiency of the reflector used. The reflector alone can account for a gain of up to eight. With 2,000 volts and 30 mfds. there should be 60 joules dissipated in the tube and this would give a light of 5,000 lumen-seconds, which is comparable with a Press 40 flash bulb. With this amount of light it should be possible to get a good negative when using Super XX film, with an aperture of f4.5, at distances of up to 32 feet. For closer shots the aperture can be cut down accordingly. Chalky effects instead of skin texture on the finished photograph will indicate overexposure, which can be cut down by closing up the aperture or by under-development of the negative, as recommended by a writer in the Sept.-Oct. number of "Contemporary Photography."

### Operation

On switching on the flash outfit

## PHOTO-FLASH

(Continued)

a voltmeter is handy to have across the reservoir condenser to get an idea of what is going on. An ordinary radio type multi-meter with a thousand-ohm-per-volt movement and a 1,000 volt scale can be converted to read to 2,000 volts full scale by using a 1 megohm resistor in series. After having been switched on for a second or two the voltage should start to rise steadily until after about 7 seconds it should flatten out ataround 2,000 volts. A flick of the wires from the torch cells to the spark coil will then fire the flash, and the voltage shown on the meter will drop back to a hundred volts or so, indicating that the condenser does not fully discharge and still has left in it enough juice to give you a kick. So it is a wise precaution to short out the condenser when you have finished your experiment. Once the outfit has been charged up from the a.c. to the full 2,000 volts it can be switched off, or if left switched on, as soon as one flash has been fired the rectifier will start to re-charge the reservoir condenser again.

### Synchronising

Synchronising the flash with the shutter is a thing which I have not yet got around to, as with the Graflex the roller-blind type of shutter can only give you a slit of exposure with a flash. I have been doing my experiments with the Graflex open, sitting the victim in the dark and then giving the flash. With the sitter talking or laughing it is possible to get excellent likenesses, as the flash of a three-thousandth part of a second will effectively stop any movement.

### Commercial Outfits

Several outfits are now being manufactured in Australian factories and are available to the public through photographic stores.

The Paton Electrical Company, well-known in the radio trade for their meters and test equipment offer one job at £59-10-0, plus tax. It weighs about 14 lb., delivers 300 flashes for each charge of the accumulator, requires 8 seconds between flashes for the charging of the reservoir condenser. Power output is given as 50 to 80 joules and the life of the flash tube is advertised by Paton as being from 10,000 to 50,000 flashes. Paton have also announced a Junior model for early release, operated from dry batteries, with output of from 25 to 50 joules, weight of 9 lb., and listing at £49-10-0 plus tax.

Most others are along similar lines to the above.

### Further Details

Work with the outfit is still being carried on and as soon as time permits it is hoped to build up the job in neat form with a special transformer being built to order by the makers of A & R components, and when this is ready for photographing it is hoped to publish the details together with wiring diagrams.

## POWER UNIT

(Continued)

rated 525 volts, but you can only hope for the best in this regard.

### Care Needed

As with all gear which is connected to the power mains it must be remembered that care must be taken to avoid accidental shock. Contact with the a.c. mains is far more dangerous than contact with the high tension voltages in the set. On this account some set builders prefer to cover a.c. input terminals and connections with insulation tape to prevent accidental contact. A dangerous shock can be had between one of the power mains and earth, so it is good practice to always work with one hand behind your back if you are fiddling around in a power unit with the power switched on; a thing which you should not do, of course.

## ONE GOOD TURN—

**If you would like bigger and better issues, make a point of supporting those firms who advertise with us.**

## AMPLIFIERS KILL SKEETERS

According to the Melbourne "Sun" American scientists have lured countless millions of mosquitoes to their deaths by broadcasting the mating call in Cuban swamps.

The broadcast was made from records of the mating call, which is inaudible to the human ear.

An electrified wire screen was placed in front of the amplifiers and it was this that killed the courting males coming in answer to the mechanical call.

In a few days the device cleared the swamps, which are among the worst known.

## AN OMEN ?

Noticed that in English technical journals some amplifier manufacturers are advertising that their products "contain no electrolytic condensers." Have often felt that the power factor conditions existing in electrolytics might not be the best for high-quality audio work.

What is claimed to be the world's smallest electric motor, the "Electrotor," has been invented by the Eurich brothers of England. Measuring $\frac{3}{16}$ inch in length and diameter and weighing less than one gram, the miniature device turns over at 7,000 r.p.m.

Glyptol, bane of those converting war surplus, can be softened temporarily by the application of heat—a heavy-duty soldering iron is a good source. However, fast work is necessary once a setscrew or coupling has been freed in this manner, because the stuff "sets up" rapidly—QST (U.S.A.).

## SELECTIVITY

(Continued from page 24)

ally on sets with an R.F. stage, which have a flat AVC characteristic.

I hope that with this article I have satisfied my critics, that something can be done about selectivity of long-range receivers at practically no extra cost. I intend to follow up with a description of a receiver built along these lines, with 175 Kc. I.F. and variable band width, which I built some time ago for myself.

# NEW SET DESIGNS

**From time to time we are fortunate indeed to get a few lines and a few circuits from one of our good friends, Ray Brown. Ray was the winner of one of our circuit contests some years ago, and is always way out in front when it comes to the latest in circuit designs. Here are two circuits for effective reflex circuits, one for a.c. and the other for vibrator operation, also a design for a three-unit radiogram. All have been thoroughly tested at Taree, one of the toughest radio testing grounds.**

IN the issue of April last I noticed a request from a reader for more reflex circuits.

Here are two such circuits which have given outstanding results over the last twelve months.

The vibrator version was submitted to a trade house for test and the report was that the performance was up to normal five-valve standard. A sensitivity of ten micro-volts can be expected from both models with reasonably good coils and intermediates.

Volume control, whilst not going to zero, reduces the signal to

By
**RAY BROWN**
C/- Harvey Ivers
Taree, N.S.W.

a barely audible level. In metropolitan use it is suggested that the plate loading in the A.C. version (second detector) shown as 50,000 ohms be changed to 15,000 ohms.

A few points regarding construction and chassis layout—in any receiver where maximum gain for stage is required it is advisable to arrange layout so that signal voltage from point of entry to chassis does not double back or cross over a preceding stage after amplification and, if the first stage is located at front of chassis, aerial lead should either be shielded or preferably brought through the chassis close to the aerial coil and taken around the outside of chassis to the rear of receiver. If a terminal is used the wire should be passed back through the chassis close to the terminal.

The greatest single cause of instability experienced by the writer is that of location of A.V.C. leads. A golden rule for this problem is to busbar these leads clear of all other wiring and, in the case of components around the second detector the .0001 mfd. condenser across the diodes, the one-meg. return to earth and the one-meg. to A.V.C. line, should be mounted

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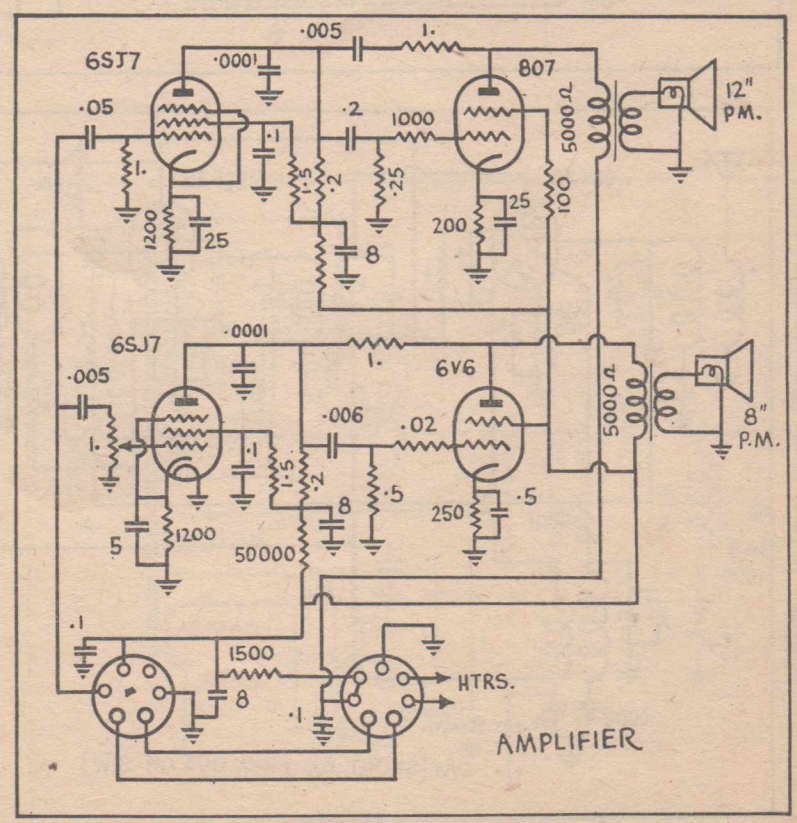
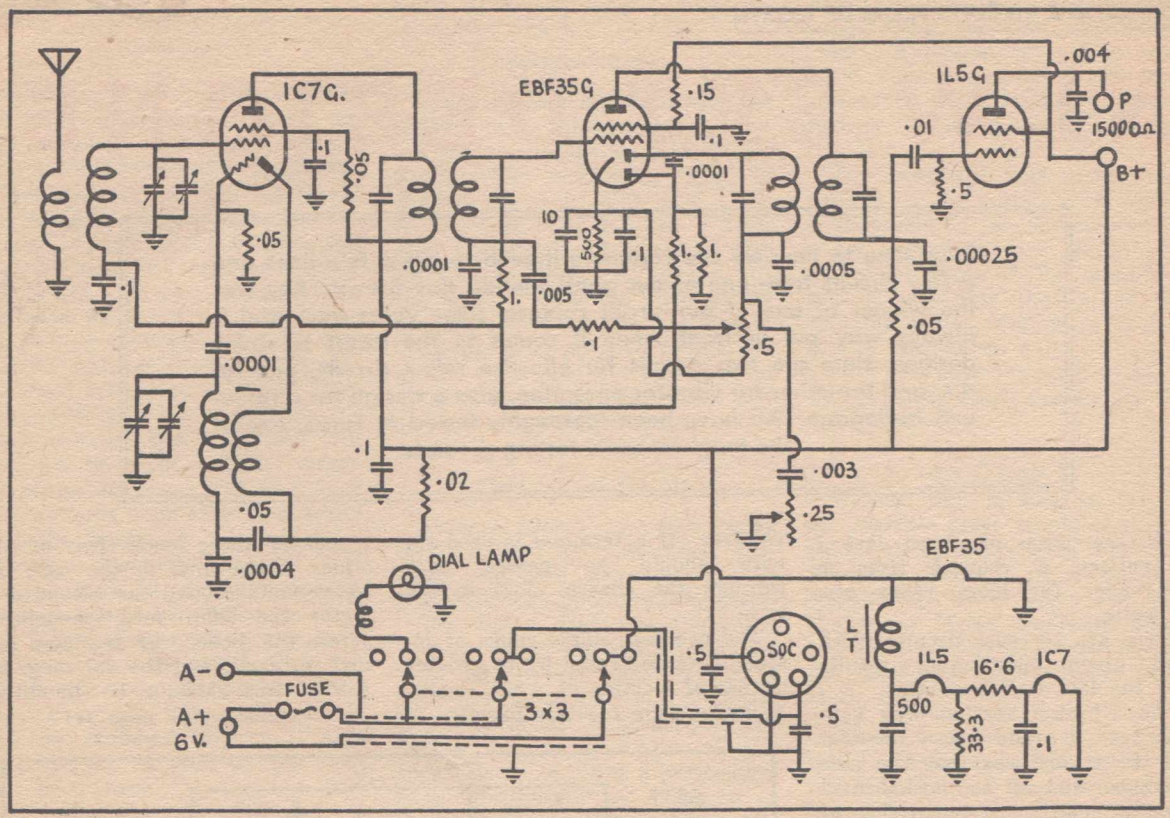



Twin-channel audio end of the radiogram.


1C7G.
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DIAL LAMP
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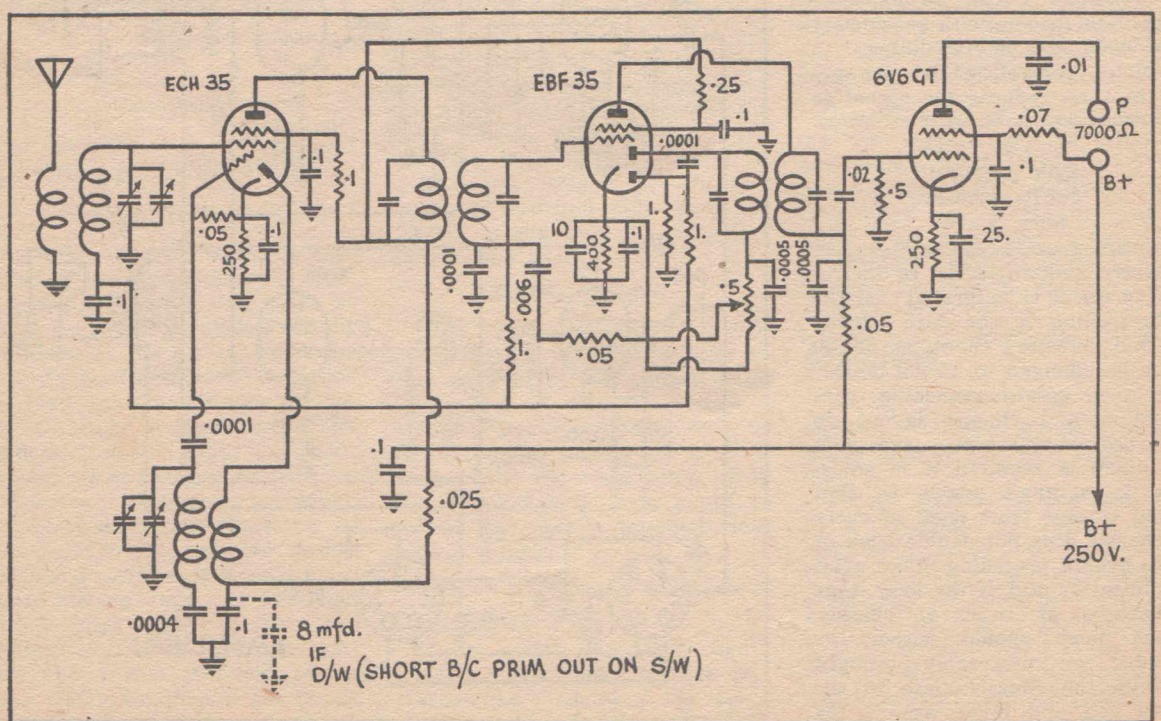
ECH 35
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8 mfd.
IF
D/W (SHORT B/C PRIM OUT ON S/W)
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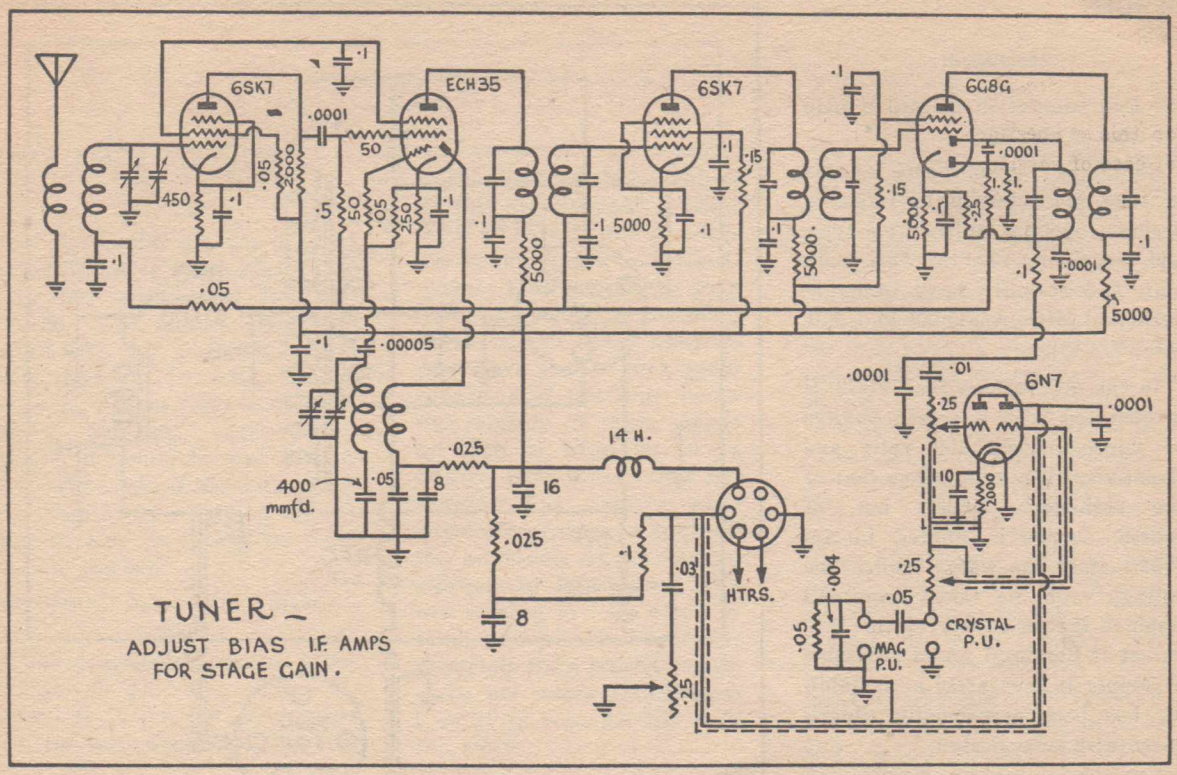
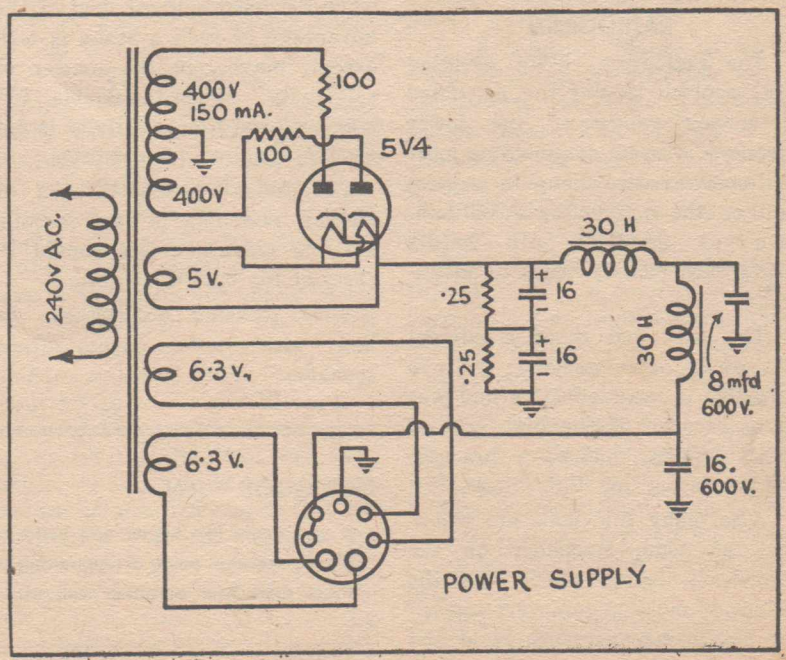
250V.




**At left—Top: Circuit for a vibrator-powered reflex set with exceptional range for three valves. Left—Lower: The a.c. version of the reflex circuit, also a splendid performance. This page—Top: the tuner of the radiogram. Lower: The power supply unit for the radiogram.**

## DESIGNS

(Continued)

right at the sockets, in other words no lead at all should emanate from the A.V.C. diode.

If the vibrator box is to be mounted on chassis it should be floated on gang-mounting grommets so that the only negative return passes through any filter system incorporated within the chassis proper—a socket and plug

(Continued on next page)

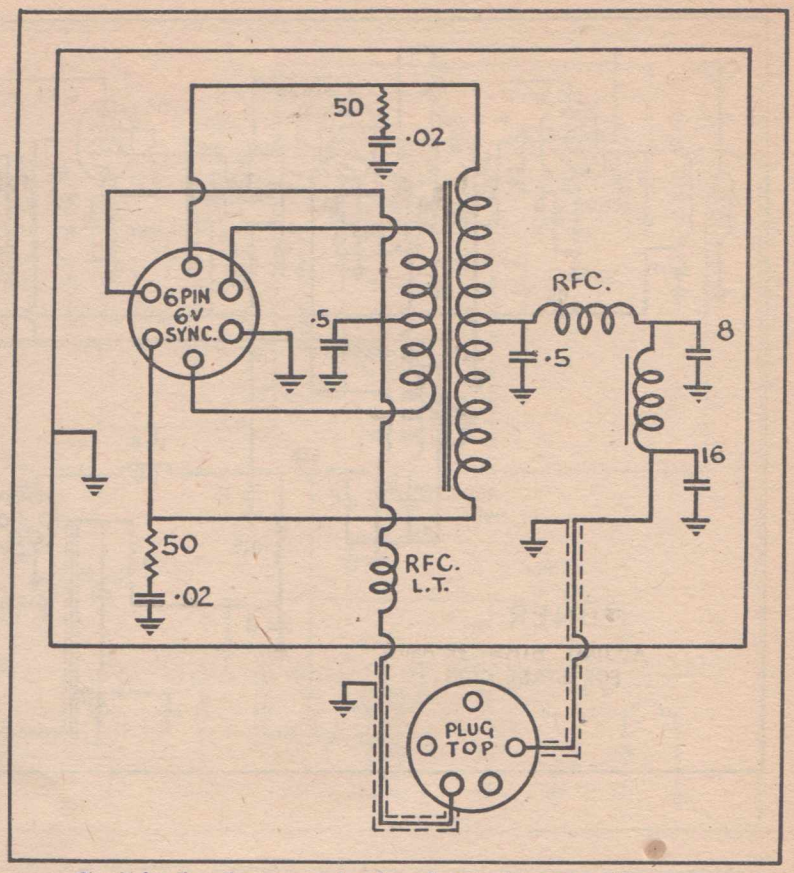
(Continued)

for this connection is also a help for ease of service.

Single-pie intermediates appear to take more kindly to reflexing designs than the multiple pie type, and excellent results with both gain and stability have been experienced with Aegis J9 and J10, 455 kC/s type.

In the A.C. version the 6V6GT/G is operated with a screen voltage of approximately 100 volts and sensitivity then approaches that of the high-slope EL33A but, of course, output is limited to approximately one watt. Whilst this voltage could be taken from the common screen supply of the R.F. valves it has been found advisable to supply it separately as instability has been occasionally experienced with some design.

I.F. gain in both models is high enough to ensure excellent performance if a short-wave band is added.




Circuit for the vibrator unit for the reflex circuit on a previous page.

## RADIOGRAM

The radiogram circuit enclosed was evolved to suit the restricted frequency range of the lower grade of pick-up available on most automatic record-changers at present on the market, as a Williamson-type amplifier will hardly show such pick-up heads to advantage.

The R.F. end is of a current American arrangement and in practice is most effective and was used because of the high cost of good quality dual-wave brackets incorporating an R.F. stage.

Also many R.F. coils are resonant at some frequency on the broadcast band, which has the effect of making gain very uneven or not linear over such band and when de-tuned a great deal of the advantage of such a stage is lost, except, maybe, in the matter of selectivity. When a double I.F. stage is used this selectivity is not always required or desirable.

The fader system in lieu of pick-up switching is very smooth, but the potentiometers should be checked for cut-off at zero.

Very pleasing quality can be had with quite medium-grade speakers.

## ONE GOOD TURN—

**If you would like bigger and better issues, make a point of supporting those firms who advertise with us.**

## DISC OR TAPE

The oft-repeated rumour that the gramophone record companies have attempted to restrain the development of new methods of recording, such as those on magnetic tape and wire, to protect their interests in disc manufacture, have been discredited by Sir Ernest Fisk. In his statement as vice-chairman and managing director of E.M.I., Sir Ernest announced at the annual general meeting that the company is energetically developing these new methods of sound recording and reproduction.

In defence of the disc he instanced the cheapness and the ease of mass production, adding that at present there is no practical method for the mass production of wire and tape records.

# Shortwave Review

CONDUCTED BY
L. J. KEAST

## NOTES FROM MY DIARY

### Say 99

One man who can say 99 and really enjoy it is Rex Gillett. Fact is, he has verifications from 99 countries. The century should be reached any day as, with reports out to Monaco, U.S.S.R., Greece, Roumania, French Cameroons, Biak Islands, Sumatra, Cyprus and Ethiopia, it would be bad luck if none acknowledged his letter. Russia is said to be verifying reports again, so may be it will be them that rings the bell.

### Something You Can't Shake Off

I was delighted to receive a letter from an old-timer, Allan W. Beattie. It is just on eight years since he last wrote me but his silence was not that he had lost interest in Dx-ing but he was going through the University and, as soon as he had completed his course, he purchased a receiver and began again to tune-in to the world.

Readers of these pages will remember how Allan provided me with many fine notes and, although he has decided to take up a few additional subjects at the Uni., he will send along a list of loggings and by the middle of '49 expects to be flat out on his old favourite hobby.

### Short Waves From Ocean Waves

Running over the dial as he is wont to do, Rex Gillett happened on the Royal Prince Alfred Yacht Club's classic race of 350 miles from Sydney to Montague Island and return. Reception of some of the participating yachts and duty boats stationed along the route was experienced on a number of occasions. Yachts heard were "Trade Winds," "Kyeema" and "Peer Gynt" and in addition the following duty boats VJPG on board the "Nameena," "Koonya," "Supercraft," "Marlene," "Roderick" and "Take It Easy." All were heard on 6.235mc, but on one occasion VJPG used 6.28mc. Contacts were also made at times with Sydney Radio VIS on 6.41mc.

**Whether we have FM or TV this coming year, I guess a lot of us will still be sticking to the good old Shortwaves, and I want to take this opportunity of thanking those many fine listeners who have sent in such great reports and not only given the readers of these pages an idea of what "is to be heard" from other lands but through this paper's wide circulation overseas enabled the engineers of the various stations to learn how they are coming in . . . often at times and places they never dreamed they would reach.**

**To my many contributors I want to say: All the best for 1949.**

### Verifications

Allan W. Beattie of Bondi writes: "As I am boarding for the present, I have not been able to put up anything in the way of an aerial but with a few feet of wire strung partly around the room—no earth—I have logged over 150 stations and reports are out to about 60. Verifications are back from half a dozen or so of the Australians and the three New Zealanders (ZL2, ZL3 and ZL4), so I am fairly happy." Mr. Beattie goes on to say that he finds the Australian stations a great help in calibrating his deal but regrets that the BBC do not as of old give the various call-signs and frequencies and consequently he finds it difficult to be certain if he is listening to GWE (15.435mc) or GRD (15.45mc), but he gets great comfort from several of the old-timers such HCJB (12.45mc), FZI (11.97 mc, KZRH (9.64mc), Saigon (11.78mc and several others who bring back happy memories.

Rex Gillett of Adelaide as usual has been keeping the postman busy and reports the following as having arrived:

WXFG (5.82, 12.255), CQM-4 (first from Australia), Paris (6.17, first from Australia), Baden Baden, KZCA, CS2WI, Johannesburg (4.80, 9.523), XGOA (9.73), YDC, Belgrade (6.10), ZRB (9.10), CBCX, HP5K, Macassar (9.55), Warsaw (6.215), HLKA, Malaya (6.135 and 4.89), VUD (15.35), VLT-5, VLT-7, OIX-7, HI2T (7.275 and 11.90), WNRX (9, 11.83), WNBI (17.78), SBP, SBT, SDB-2, Madrid and Tananarive (6.065, 9.69 and 10.615), Monte Carlo, VJPG (6.28 and 6.235), Denmark (15.165 and 9.52), YDD-2, Tangier, HCJB (5.96), HLKA, Supercraft (yacht), Falange (first from Australia) and XEBT.

A. E. (Ernie) Moore of New Farm, Brisbane, has also been hearing the postman. Here is his latest list of veries.: HH2S (5.945mc), "Radio Port au Prince," Haiti, sent a white card with call-sign in small black letters. Power is 300 watts. Address: P.O. Box B-81.

TG-2 (6.62), "Radio Morse, Palacio de Communicaciones, Guatemala City, sent a fairly long letter in Spanish plus a nice card with red and blue printing.

HP5A (11.695mc), "Radio Teatro," Apartado 954, Panama City, sent a fairly large white card with black printing.

Also the usual card from OTC, Leopoldville, for a report on Radio Congolia (9.21) sent last September.

Card from Radio Trinidad (9.625) and ZL-3, Wellington.

SAYS WHO?

All times Aust. East. Stan.

Mr. A. E. (Ernie) Moore of New Farm, Brisbane, sends a fine list of loggings:

CR6RF, Benguela, Angola (8090kc): Fair sig. from opening at 4.30 p.m.

CR6RG, Radio Diamang, Dundo, Angola (8250kc): Quite a nice signal, daily, from 4.30 to 5.30 a.m.

CR6RA, Nuanda, Angola (9470 kc): Good sig. at 5.30 p.m., but with QRM from TAP.

Radio Congolia, Leopoldville (9210): Good sig. from 4 to 4.30 a.m. in native prog.

Omdurman, Anglo-Egyptian Sudan (13,335kc): Fair from 5 to 5.30 a.m. in Arabic.

Damascus, Syria (12,000kc): Fair sig. at 5 a.m. in Arabic.

Radio SEU, Madrid, Spain (7147kc): Good sig. from opening at 5 a.m.

EAG9, Malaga, Spain (7022kc): Good sig. from opening at 5 a.m.

EAG3, Valencia, Spain (7037 kc): Good sig. at 5.30 a.m. (Radio Medeterraneode Valencia).

Radio Andorra, Andorra (5980 kc): Good level at 5.30 a.m. in Spanish and French.

Radio Munchen, Munich, Germany (6080kc): Fair sig. at 5 p.m.

Radio Monte Carlo, Monaco (6035kc): Good level at 5 p.m.

FBS, Cyprus (7220kc): Fair sig. at 4.30 a.m.

KZCA, Salzburg, Austria (7220 kc): Heard under Cyprus, at same time.

ZYK3, Pernambuco, Brazil (9656): Very nice level at 6 a.m., after Delhi closes.

HJCQ, Bogota, Colombia (11,680kc): Good sig. till close with march at 2.15 p.m., after news in Spanish, and heard from as early as 1.30 p.m.

HOLA, Colon, Panama (9505): Fair level, opening at 10 p.m.

HLKA, Seoul, Korea (7930): Good sig. around 8 p.m.

KZFM, Manila, P.I. (9620 and 11,840kc): Good sigs at 8 p.m. from both outlets.

From Adelaide another excellent report from Rex Gillett:

The Forces Broadcasting Service in Cyprus has been heard on 7220 kc, leaving the air at 6.20 a.m. with the playing of Ted Lewis' "Goodnight Melody." Signals here are of fair strength.

Vienna on 7240kc is fair strength at 6.30 a.m. Programmes are in German.

The British Far Eastern Broadcasting Service is being logged on 11850kc. English is used till 9.15 p.m., when Indonesian language programme commences.

ZLT-4, Wellington, on 10980kc, has been heard contacting Sydney at 7 a.m.

PRL-7, 11720kc, takes the air at 8 p.m. and is heard quite strongly.

ZOY, Accra, is now being logged on 7275kc, until closing at 4 a.m. with "God Save the King."

The Finnish B/C Co.'s new transmitter on 15190kc, which is testing to North America between the announced times of 6.45 p.m. and 9 p.m. and 10.15 p.m. to 10.30 p.m., is being heard here at splendid strength in the latter period. Heard it sign off one night at 11 p.m.

Radio Tananarive has been heard since Sept. 18 on a new frequency of 7375kc in relay with 6065kc, to sign off at 4.45 a.m.

La Voz de la Falange, Madrid, on 7380kc, opens with an interval signal of eight chimes at 8 a.m.

WTV, location unknown, has been heard contacting WVLO at 10 p.m. WVT used about 12285kc approx. WVLO's location also unknown.

The following information concerning transmissions from Spain has been received from Mr. K. Dobeson, English representative:

Radio Falange de Alicante, 7940 kc, 1.2kw: 10 p.m. to 12.30 a.m., and 6 a.m. to 9.30 a.m.

Radio Club de Tenerife, EAJ43/EA8AB: 0.5kw, 7267kc: 10 p.m. to M/N and 3.30 to 9 a.m. Some sources quote 8 to 9.30 a.m. as schedule; this is incorrect, however.

Radio SEU, Madrid, EDV10, 7117kc, 1kw: 10.30 p.m. to 2 a.m., 4 to 5.30 a.m. and 6.30 to 9.30 a.m.

Radio Nacional de Espana en Cuenca, 7100kc, 200 watts: Closed temporarily.

FET22, Radio Falange de Oviedo, 250 watts, is closed down. Future operation is not known.

Radio Mediterrana de Valencia, 7037kc, was 100 watts, reported to have increased to 3kw. However, this is doubted by Mr. Dobeson. Schedule is 10 p.m. to 1 a.m. and 5 to 9 a.m.

Radio Nacional de Espana en Malaga, EAJ9, 7025kc: 11.30 p.m. to 1 a.m. and 6 to 10 a.m.

Radio Falange de Valladolid, FET1, 7006kc: 10.30 p.m. to M/N and 6 to 8.30 a.m.

FZI has not been heard on its 19-metre channel for some time now, so it was interesting to hear it with a special Armistice Day programme on Nov. 11 at 10.30 p.m. FZI closed with "La Marseillaise" at 10.45 p.m. It has since been heard at the same time closing following an English session. Since WVTM is on 15600kc, FZI's frequency is nearer 15620kc rather than 15595 as listed.

Radio Congolia has been heard on 9210kc, signing off at 4.30 a.m. Languages used were French and Flemish. Signals here have been fairly good.

PZR has been tuned on 10970kc at 6.30 a.m. At this time PZR was announcing: "Hello, Amsterdam! Here is Paramaribo" in Dutch. Speech was "scrambled" after contact had been established.

ZNB, Mafeking, Bechuanaland, on 5900kc, is heard with recorded music until sign-off at 5.30 a.m. with "God Save the King."

N.S.W. contribution of loggings comes from Allan W. Beattie:

*Philippines*

KZFM (11.84mc): News 8 p.m., weak signal.

KZRH (9.64mc): Very good at night and at 7 a.m.

KZFM (6.17mc): Fair at 8 p.m. in news.

KZBU (6.10mc): News at midnight.

KZMB (6.0mc): Fair nightly.

*China*

XGOY (15.17mc): Good at night.

XGOA (15.105mc): Good from around 7 p.m.

XMPA (12.21mc): Strong, if noisy, signal at night.

ZBW3 (9.52mc): Poor signal as a rule.

# Speedy Query Service

**Conducted under the personal supervision of A. G. Hull**

**G.S. (Bendigo) seems to have had a bad-luck run with valves.**

A.—Yes, it seems that modern valves are not as reliable as they were a while back. Doubtless there are plenty of worries in present production and many reasons why they are not better. Can only suggest you approach valve manufacturers, through your dealer, for replacements under guarantee.

* * *

**S.C.A. (Goulburn) and many others have been surprised by our early publication of the October issue.**

A.—Yes, we are working on a quicker schedule for publication and, although we have not had sufficient experience with it yet to know whether it can be maintained for all times (such as over the Christmas holiday periods), we have every hope that future issues will be out before the date shown on the cover. Subscribers' copies should reach them up to a fortnight before the official publication date.

* * *

**L.M. (Launceston) asks about the Ham Section.**

A.—We have decided to drop this section until such time as we can obtain someone to operate it on rather different lines. We would like to make it more technical, dealing with details of building gear, adjusting transmitters and that sort of thing, rather than scandal and the sordid old battles of phone versus code. So far we have not been able to find a suitable person with sufficient spare time to handle the job.

**B.L. (Glenferrie) enquires whether the Q-Plus coil kit is suitable for the Carlectric set described in the December issue.**

A.—Yes, a feature of this set was the use of a layout which would accommodate any size or shape of coil on the market. With small coils, like the Q-plus, you will have ample room for them. The original circuit used an i.f. frequency of 175 kC/s, but will operate with a 465 kC/s i.f. For the installation and use of the hash coil you will need to be guided by the data supplied with the Q-Plus kit.

## HELP WANTED

**One of our readers lives 'way out in the bush and has no one to talk to about the operation of the "FS6" and the "A.Mk.111" sets which he is using for a private radio service between adjoining stations under call-sign VK4AJ. He would like hints about aerial lengths, modulating the MK.111, etc. If anyone can help in these matters would they care to write direct to Arthur W. Shepherd, Milray Station, Pentland, North Queensland?**



## BACK NUMBERS

**The following issues are available from our Back Dates Dept. at 6d. each or 5/- per dozen, post free:**

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**Please send your remittance in 1½d. stamps or postal notes. Address:**

**Australasian Radio World, Box 13, Mornington, Vic.**

# BARGAIN CORNER

Advertisements for insertion in this column are accepted free of charge from readers who are direct subscribers or who have a regular order placed with a newsagent. Only one advertisement per issue is allowed to any subscriber. Maximum 16 words. When sending in your advertisement be sure to mention the name of the agent with whom you have your order placed, or your receipt number if you are a direct subscriber.

**BACK NUMBERS WANTED: Will pay 15/- per volume for Volumes 7, 8, 9 and 10 of Radio & Hobbies, and Nos. 6, 8, 10 and 12 of Volume 10 of Radio World. A. J. Carmichael, "Warragoon," Thomas Avenue, Moorabbin, S20, Vic.**

**FOR SALE: Radio engineer's and serviceman's course; Modern Radio & Television (3 vols.), Coyne Electrical & Radio Trouble Shooting Manual. The lot for £15. J. Gambell, 13 Weigand Avenue, Bankstown, N.S.W.**

**FOR SALE: AR14 communications receiver, complete with all coils, headphones and valves (2—1P5 and 1D8), less batteries, price £8, or best offer. K. J. Jacobson, Gobarup, Wanalta, Vic.**

**FOR SALE: Cathode ray tube type 902 and 884. Both brand-new in original cartons. £3 the pair. Write No. 8491, C/- Radio World, Box 13, Mornington, Vic.**

**FOR SALE: A pair of 809 transmitting tubes, both brand-new in original cartons. £2 the pair. Write No. 8492, C/- Radio World, Box 13, Mornington, Vic.**

**FOR SALE: Set of 5 double-sided gramo records of Marconi morse code training course. £1 the lot, delivered Melbourne. Write No. 8493, C/- Radio World, Box 13, Mornington, Vic.**

**FOR SALE: 7 Valve D.W. receiver, little used. £12 or offer. Also I.F.'s, Valves, Condensers, etc. Write: R. Dovatt, Willyama Hotel, Broken Hill.**

**ADD BARGAIN CORNER**

RED LINE

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## HEAVY DUTY AMPLIFIER TYPE

**The transformers listed in this section comprise a wide range of types suitable for practically any circuit requirements. Careful attention has been given to their design and construction to produce robust, economical and reliable units of maximum dependability.**

**Temperature rise conforms to accepted practice for electrical apparatus of this nature, and will not exceed 35-40 degrees Centigrade for continuous operation under full rated load. Unless otherwise stated, current ratings are based on their use in choke input filter circuits, and while insulation is ample to cover the added peak voltages involved in condenser input systems, H.T. secondary current ratings should be reduced by approximately 20 per cent. to allow for the severe heating effect due to the poor form factor of rectified current. The approximate DC voltage available at the input to the filter system is given for rectifier valves normally used.**

**All Red Line units are baked and impregnated with super insulating varnish and are specifically made for use under adverse climatic conditions.**

**ITEM 12.** **TYPE No. 15353.**

Prim: 200-230-240v. ..... 110vA. ..... 50 cps
H.T.: 350 CT 350v. 150mA. Cond. Input.
Fils: ..... 5v-3A 2.5v-5A 6.3v-3A
Base: $4\frac{1}{2}$ x 4 x $4\frac{1}{4}$" H. ..... Wgt. 9lb. 4ozs.
Mntg: V11 ..... "S" is 2-1/8"

| D.C. Volts | Choke Input | Cond. Input |
|---|---|---|
| 5V4 | 285v | 350v |
| 83 | 290v | |
| 5Z3 | 260v | 350v |

**ITEM 13.** **TYPE No. 15403.**

Prim: 200-230-240v ..... 110vA. ..... 50 cps
H.T.: 400 CT 400v. 150mA. Cond. Input.
Fils: ..... 5v-3A 2.5v-5A 6.3v-3A
Base: 5 x $4\frac{1}{2}$ x $4\frac{3}{4}$" H. ..... Wgt. 10lb. 12ozs.
Mntg: V15 ..... "S" is $1\frac{3}{4}$"

| D.C. Volts | Choke Input | Cond. Input |
|---|---|---|
| 5V4 | 320v | 405v |
| 83 | 335v | |
| 5Z3 | 290v | 400v |

**ITEM 14.** **TYPE No. 20353.**

Prim: 200-230-240v. ..... 140vA. ..... 50 cps
H.T.: 350 CT 350v. 200mA. Cond. Input.
Fils: ..... 5v-3A 2.5v-10A CT 6.3v-3A.
Base: 5 x $4\frac{3}{4}$ x $4\frac{3}{4}$" H. ..... Wgt. 12lb. 8ozs.
Mntg: V15 ..... "S" is 2"

| D.C. Volts | Choke Input | Cond. Input |
|---|---|---|
| 5Z3 | 240v | 320v |
| 83 | 300v | |

**ITEM 15.** **TYPE No. 17503.**

Prim: 200-230-240v. ..... 145vA ..... 50 cps
H.T.: 500 CT 500v. 175mA. Cond. Input.
Fils: ..... 5v-3A 6.3v-3A 6.3v-2A.
Base: 5 x $4\frac{3}{4}$ x $4\frac{3}{4}$" H. ..... Wgt. 12lb. 8ozs.
Mntg: V15 ..... "S" is 2"

| D.C. Volts | Choke Input | Cond. Input |
|---|---|---|
| 5V4 | 410v | 470v |
| 83 | 425v | |
| 5Z3 | 375v | 480v |

**ITEM 16.** **TYPE No. 20453.**

Prim: 200-230-240v. ..... 150vA. ..... 50 cps
H.T.: 450 CT 450v. 200mA. Choke Input.
Fils: ..... 5v-3A 6.3v-3A CT 6.3-3A.
Base: 5 x $4\frac{3}{4}$ x $4\frac{3}{4}$" H. ..... Wgt. 12lb. 8ozs.
Mntg: V15 ..... "S" is 2"

| D.C. Volts | Choke Input | Cond. Input |
|---|---|---|
| 83 | 380v | |
| 5Z3 | 345v | 460v |
| 5V4 | 340v | 450v |

**ITEM 17.** **TYPE No. 25503.**

Prim: 200-230-240v. ..... 190vA. ..... 50 cps
H.T.: 500 CT 500v. 250mA. Choke Input.
Fils: ..... 5v-3A 6.3v-3A 6.3v-3A.
Base: 5-3/8 x 5 x $4\frac{3}{4}$" H ..... Wgt. 15lb. 8ozs.
Mntg: V15 ..... "S" is $2\frac{1}{2}$"

| D.C. Volts | Choke Input |
|---|---|
| 5Z3 | 355v |
| 83 | 400v |

**ITEM 18.** **TYPE No. 25563.**

Prim: 200-230-240v ..... 200 vA. ..... 50 cps
H.T.: 565 CT 565v. 250mA. Choke Input.
Fils: ..... 5v-4A 6.3v-3A 6.3v-3A.
Base: 5-5/8 x 5 x $4\frac{3}{4}$" H. ..... Wgt. 15lb. 8ozs.
Mntg: V15 ..... "S" is $2\frac{1}{2}$"

| D.C. Volts | Choke Input | Cond. Input |
|---|---|---|
| 83 | 475v | |
| 5Z3 | 430v | |
| 5R4GY | 430v | 600v |

**ITEM 19.** **TYPE No. 5176.**

Prim: 200-230-240v ..... 240vA. ..... 50 cps
H.T.: 730 CT 730. ..... 200mA
330 CT 330v. ..... 100mA
Fils: ..... 5v-3A 5v-2A 6.3v-3A 6.3v-4A
Base: 4 x $5\frac{1}{4}$ x $5\frac{3}{4}$" H. ..... Wgt. 16lb. 12ozs.
Mntg: V12 ..... "S" is 3"

# RED LINE EQUIPMENT PTY. LTD.

**TRANSFORMER ENGINEERS**

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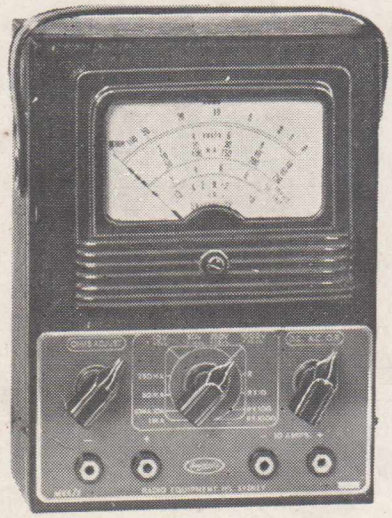
**A GUARANTEE OF DEPENDABILITY**

# University news:

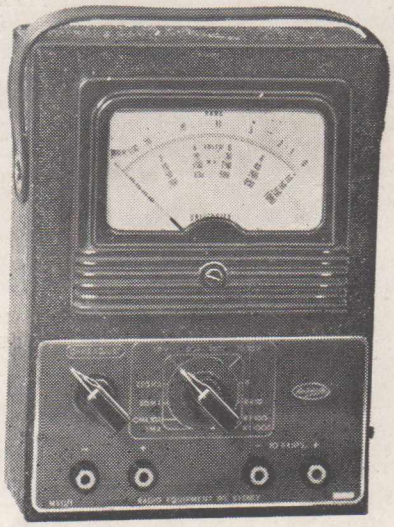
## Successful Twins In the Multimeter Field!



### Two New Multimeters With Many New Features: In Attractive Cases

### MODEL MVA/2 : AC/DC

Used extensively in trade circles, military organisations, and government departments, the new model MVA/2 now has a modern appearance—is for use on the bench or for portable use in the field. The latest "University" four-inch square type meter is a feature and its ranges in D.C. Volts, A.C. Volts, Output Volts—D.C. Current—Resistance—and Output are outstanding and may be extended with "University" plug-in shunts. Size: 8 in. x 6 in. x 3 in. Price: £11/5/- plus Sales Tax.



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Range is 10 Amperes (which can be extended with plug-in shunts). The various ranges of volts, ohms, and milliamperes are selected by means of fool-proof switching system and the meter is the well-known "University" Model R4 rectangular type. Price, complete: £8/17/6, plus Sales Tax.

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University

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16/FP2

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