THE AUSTRALASIAN

Radio World

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1/6

VOL. 14 . . . No. 1.

JUNE 21, 1949

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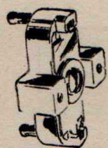

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THE AUSTRALASIAN

RADIO WORLD

DEVOTED ENTIRELY TO TECHNICAL RADIO

and incorporating

ALL-WAVE ALL-WORLD DX NEWS

Vol. 14 JUNE, 1949 No. 1

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EDITORIAL

MY recent remarks about television have not been apciated by all, which is, in itself, not remarkable. But television is one thing which I feel competent to deal with, so I intend to persevere with my policy of "soft-pedal" for this imminent colossus.

Television will come, there being no doubt left about this after Cabinet's recent statements, but its coming will not necessarily be similar to the coming of broadcasting as it was twenty-five years ago. To explain: I recently heard someone remark that when television first comes we will all have to make our own television receivers in the same way as we had to build our own crystal sets when broadcasting began. That is all rot.

When television comes it will be big business, and mighty little in it for the amateur. In fact, it may be bigger than big business; it may be government business.

Not wanting to get into political arguments at the moment, I am not saying whether I think socialism is good or bad, but I feel sure that the next election may have far-reaching effects on the future of television. If the present government is returned to power with a further mandate for government control, it is quite on the cards that the manufacture of television receivers will be an exclusive privilege of a government department or government-controlled factory.

No matter who controls it, television will never be as big or as lasting as radio broadcasting. Television is an interesting novelty, but will come, and go.

The latest American definition of television: "Television is radio with eye-strain." My own idea is that television gives you a pain in the neck. — A. G. HULL

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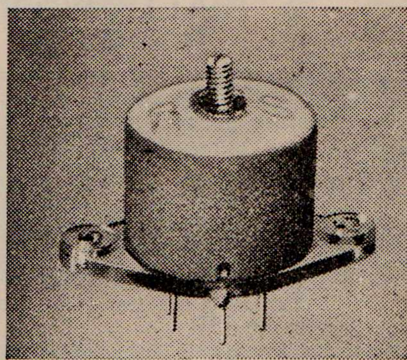
FOR BETTER COMPONENTS
IS RCS

1. MAGNASONIC COIL KIT

This newest coil offers radio technicians both miniature and midget coils which fulfil all standards of performance, consisting of the following coils:—

E352	Iron Core Aerial	6/6
E353	Iron Core R.F.	6/6
E354	Iron Core Osc.	6/6
E355	Iron Core Osc. 6SA7 Valve	6/6



Midget Magnasonic Coil (actual size)

2. R.F. DUAL WAVE COIL KIT

Standard Broadcast Coil, 6/6

These coils are moisture proof and climate proof, as are all R.C.S. components. The Kit consists of three broadcast coils, aerial RF and oscillator, three s/w coils, aerial RF and oscillator, three IF's, type No. 174, low gain, also BC Padder type P21 and s/w Padder type .004.

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An Electronic Stroboscope

Lots of interesting gadgets can be built from radio components. Here is a stroboscope which contacts or measure the revolutions of a motor will allow you to "stop" the motion of vibrator without taking any power from it.

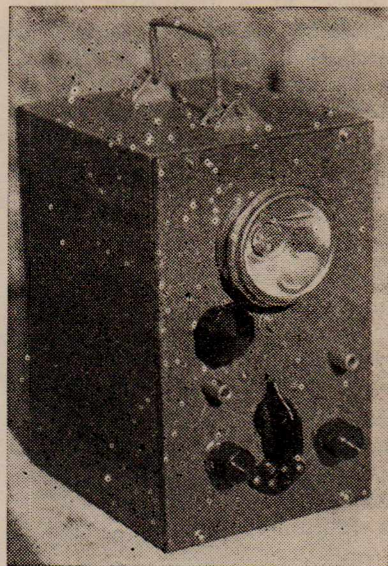
HOW often have you wished that you knew the exact speed of some motor or other moving machine; or wanted to see exactly what is causing some vibration or irregularity when it is in operation?

Designed and Built by
Alan G. Duncan
Callignee North
via Traraigon, Vic.

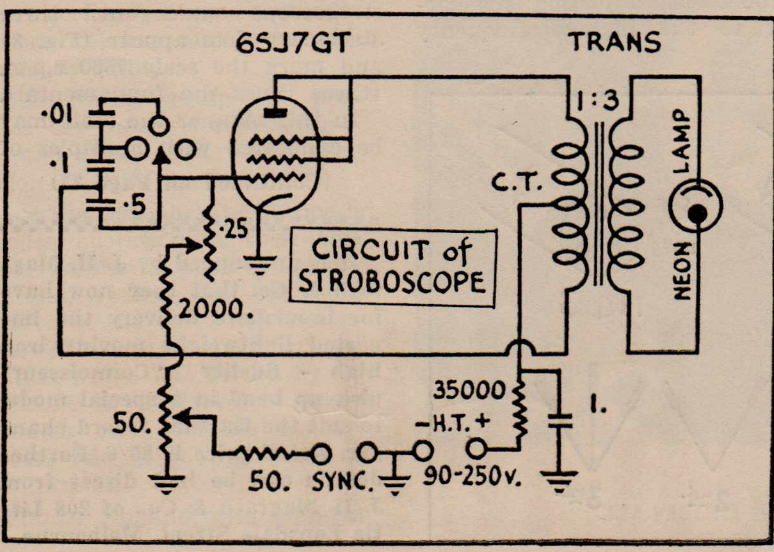
With the aid of this simple instrument it is not only possible to count revs-per-second of moving parts, you can also make them appear to slow down to any desired speed so that their exact movements can be readily discerned.

For example, suppose that you have an ordinary 100 cycle radio vibrator in operation. By viewing it in a semi-darkened room, under the light from the stroboscope, and suitably adjusting the frequency of the latter, the vibrating reed can be made to appear to open and close its contacts so slowly that you may clearly observe which contacts open first, etc.

These remarks will give you some small idea of the wonderful utility and versatility of this instrument, which is certain to be useful around any experimenter's workshop, and which will amply repay the short time and modest expense spent in its construction.



The exact layout of the various components shall be left to the discretion of the individual constructor, who will most likely make use of oddment parts from the faithful old junk-box.



Almost any valve type should do, if connected as a triode, but it must be realised that the circuit values shown are purely arbitrary, and may require some alteration for other valve types.

The transformer may have any suitable ratio around the 3:1 mark, and may easily be home-wound, if so desired. It should have as high a natural frequency as possible, and must be sufficiently well insulated to withstand the induced secondary voltage.

The light used is an ordinary

AN ELECTRONIC STROBOSCOPE (Cont.)

240 volt neon lamp fitted with a reflector from a discarded cycle lamp, although the use of a photo-flash tube offers possibilities to those who care to experiment a bit.

The circuit, as can be readily seen, is fundamentally a Hartley oscillator, but what is not so evident at first glance is the fact that it is arranged to block or "squeg" at a frequency determined by the values of the grid resistance and grid condenser. It is this squegging which actuates the neon lamp, and not, as may be surmised, the actual oscillator frequency.

By varying the resistance of the grid leak, the rate of squegging may be altered, and as the light flashes every time the oscillator blocks, its frequency is dependant on the setting of the grid leak potentiometer.

Calibration of the frequency scale is best achieved by comparison with known machine speeds. For purposes of accuracy a wire-wound potentiometer is desirable.

By having more than one value of grid condenser, several scales may be provided for frequency, giving quite a wide range.

When checking the speed of rotating machines, etc., the correct frequency is the highest which will show a single stationary image of the object.

A synchronising voltage of one or two volts may be fed in via the sync. terminals. By suitably adjusting the potentiometers the stroboscope frequency may be locked in step with the synchronising frequency. This is especially useful when it is desired to examine a machine moving at an irregular speed.

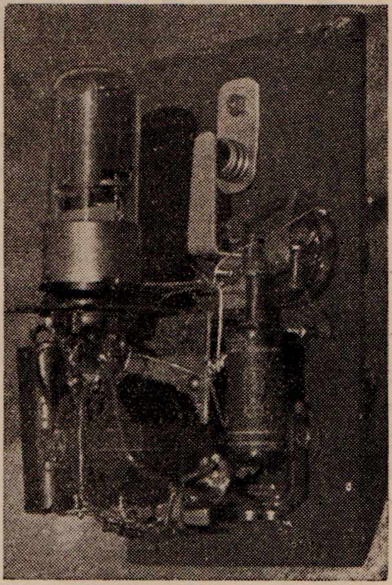
This voltage is easily obtained by rotating a coil in a magnetic field, by the machine under observation.

Probably the simplest way to calibrate the stroboscope is by comparison with a known frequency, and then by using multiples and sub-multiples of this frequency.

For example, let us suppose that an ordinary pulley shaft or machine spindle is rotating at a known speed—say 250 r.p.m.

Paint a single white dot on the end of the shaft near the edge, as in Fig. 1.

Now examine it with the stroboscope, adjusting the latter to the highest frequency



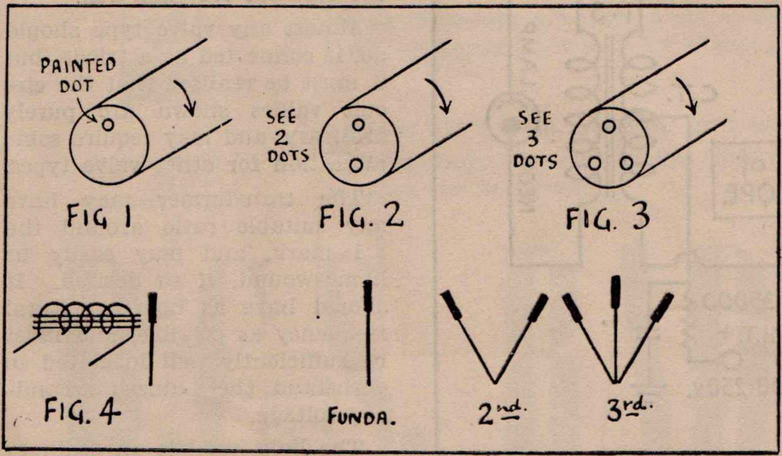
which will show a single stationary dot. The speed of the two are now identical — i.e., 2500 c.p.m.

Mark this spot on the scale, and now carefully increase the frequency of the stroboscope until two dots appear, as in Fig. 2. Mark the scale 5000 c.p.m. (twice the fundamental frequency).

Increase the speed of the stroboscope again until three stationary dots appear (Fig. 3) and mark the scale 7500 c.p.m. (three times the fundamental).

In this manner the scale may be calibrated with multiples of

(Continued on Page 37)



It is announced by J. H. Magrath & Co. that they now have for immediate delivery the imported lightweight moving iron high - fidelity "Connoisseur" pick-up head in a special model to suit the Garrard record changer. Retail price is 85/6. Further details can be had direct from J. H. Magrath & Co., of 208 Little Lonsdale Street, Melbourne.

Television In Europe

Television transmitting and monitoring equipment has recently been supplied to the Danish Postal Authorities by Philips, Holland.

The equipment in use in Denmark is generally available and is rapidly gaining in popularity on the Continent. It has been developed by Philips to provide facilities for the training of technicians and programme personnel. This television demonstation equipment comprises a studio camera, film projection camera, television signal generator, monitoring arrangements, low power transmitter, etc., together with an advisory service.

This equipment, which Philips have called "Teledem 1," can be supplied to comply with any specified standards and, without the transmitter, may be used to operate television reproducers by cable.

A similar but more elaborate television demonstrator with additional cameras and greatly extended studio facilities, etc., to which the user may change after having gathered sufficient experience, has also been produced by Philips.

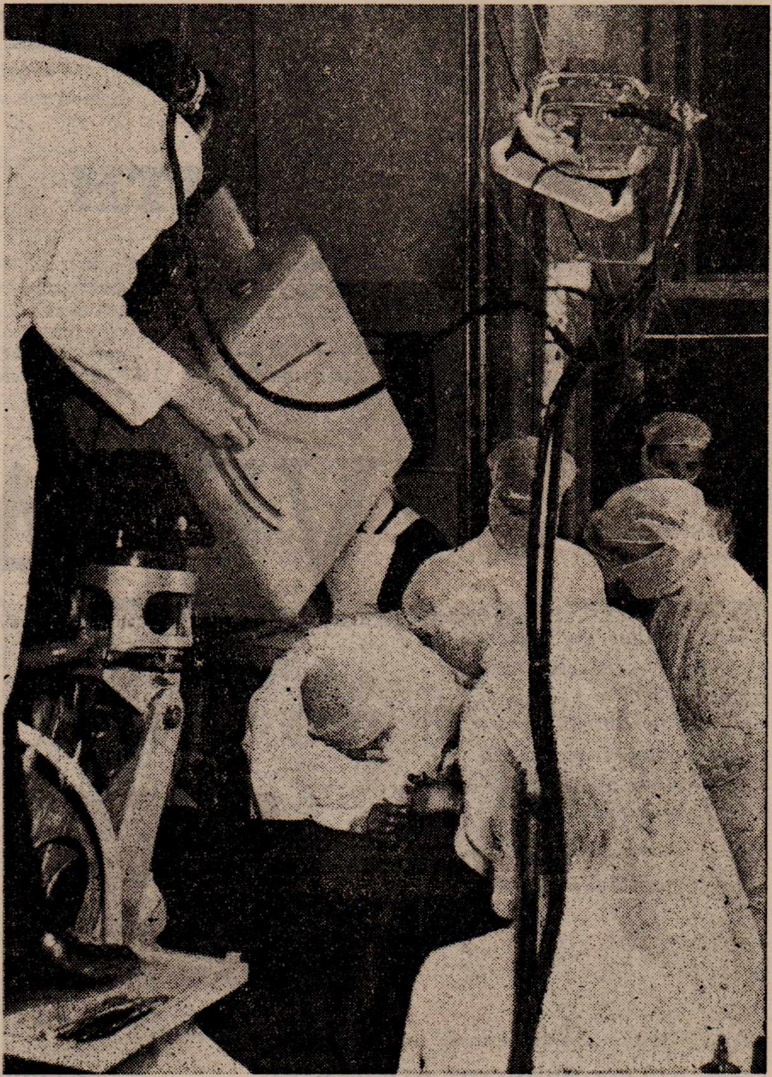
This Philips equipment provides the means for broadcasters and others to "try out" television at little expense.

For the first time in Europe a surgical operation has been televised. At the hospital at Leiden, Holland, recently, a television camera in the operating theatre followed a complete surgical operation which was viewed by an audience of 200 medical practitioners and students in the lecture hall in another wing of the hospital.

Philips, Holland, who supplied the equipment and undertook the technical arrangements for this demonstration, used two viewing screens each 4ft. 10in. x 3ft. 3in., and produced for the benefit of the audience a wonderful picture which showed beyond all doubt the enormous possibilities of television as an aid to medical training.

Newspaper and university rep-

(Continued on Page 36)



TELEVISING AN OPERATION

The VEGA Dual-Wave Five

The usual way of making a dual-wave receiver is to employ a dual-wave bracket, but it is also possible for the set builder to buy separate broadcast and short-wave coils and wire them up to the necessary switch, as shown in this article on the construction of a modern receiver.

THE receiver which is the subject of this article was designed and built by the technical staff of the factory which makes the "Vega" range of coil units which were mentioned in our columns for the first time in last month's issue.

Although primarily designed for use with the new "Vega" coils the circuit is a thoroughly well engineered one which is equally suitable for use with all types of modern coils. It contains several features of great interest to the technical enthusiast, including a novel tone control arrangement which operates as a combination of the usual plate by-passing, as well as selective inverse feed-back.

As will be seen from the photographs of the original chassis, there is a new component used in this set, at least, one which is new to our readers. We don't think we have ever shown photographs of a chassis using the new-style speaker plugs which have recently come on the market. Up till now it has been usual to fit an ordinary four or five-pin valve socket for the speaker plug to fit into. Now there are these miniature sockets and plugs to do the same job, but they are much smaller and neater. It will be noticed that they are used for the main speaker, also for an extension speaker fitting, and for the pick-up input terminals.

THE CIRCUIT

As will be seen from an examination of the circuit schematic, tht first valve is a converter using the X61M type valve which is becoming increasingly popular on account of its low noise level and low wattage heater. Most of the Australian-made Radiotrons have been based on American types and the most popular converters over the past few years have been types 6A8G and 6J8G, both American types. Not far behind and meeting with considerable popularity with some technical men have been the special Philips type of converters such as the EK2, EK32 and the ECH35. To cut a long story short, along comes the X61M, based on a war-time converter of the English Osram range.

The rest of the valves used in the Vega are normal types. Bias for the converter and i.f. valves is taken from the negative high tension, applied via the a.v.c. circuit. This arrangement allows the cathodes of both valves to be earthed directly. Sometimes this gives greater stability, as even the best of paper condensers have some reactance to r.f., which causes enough coup-

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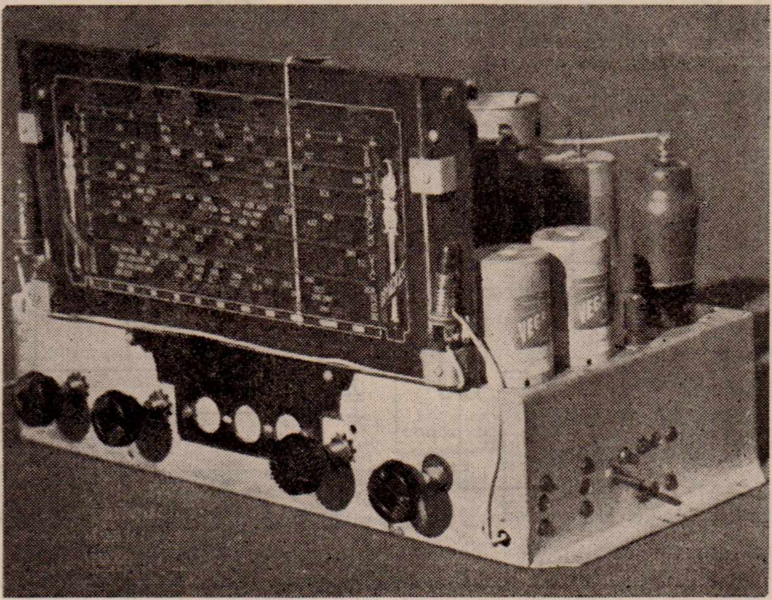


THE VEGA DUAL-WAVE FIVE (Cont.)

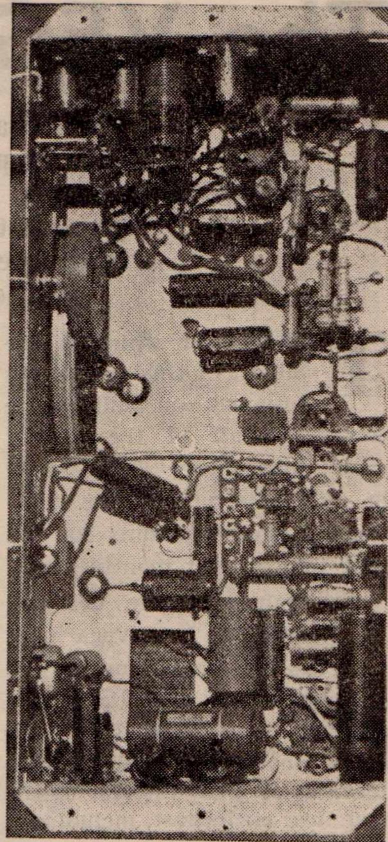
ling to create instability when really high gain is attempted. The bias is derived from the full high tension current flow through a 50 ohm resistor in the negative high tension lead. If the total current drain of the set is normal this voltage (by Ohm's Law; 60 milliamps through 50 ohms) will be about 3 volts. It is a handy checking point for servicing, too, as any variations in plate currents, such as caused by broken down coupling condensers, or faulty valves, wll be revealed by abnormal or subnormal voltage drop across this resistor. If the resistor burns out it will indicate that there is a short circuit of the high tension to earth.

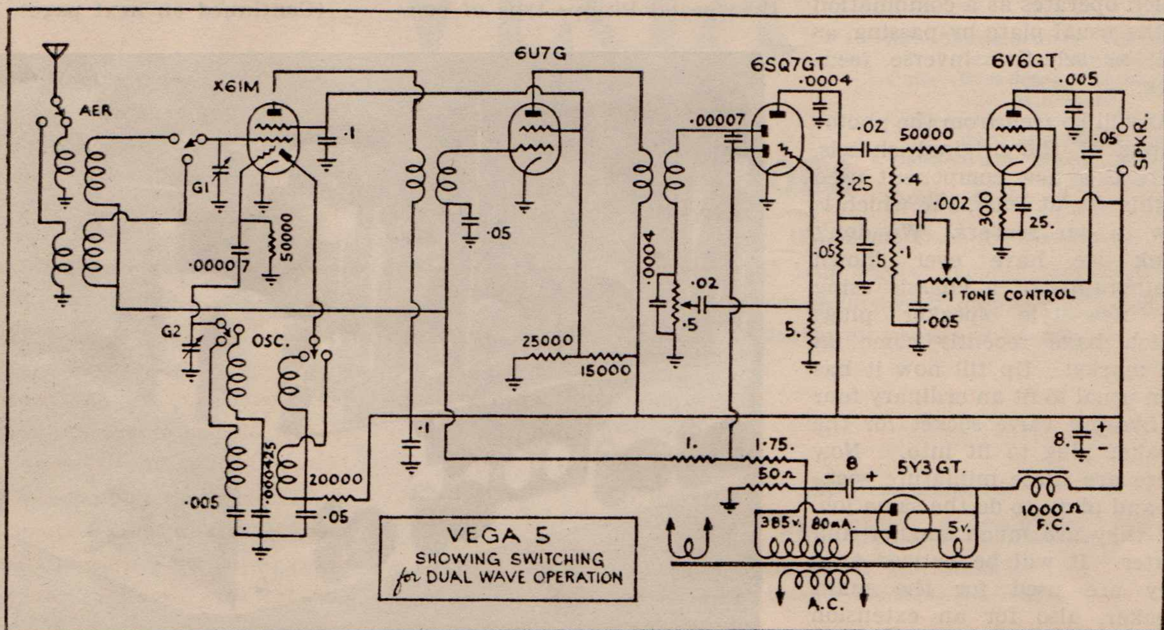
There is a point to watch when the centre-tap of the power transformer is not earthed, as in this case. The negative side of the first filter condenser must be returned to the centre-tap, not to earth. Otherwise hum trouble may be encountered. With the filter condensers fitted properly the bias resistor can actually help in reducing hum, acting in much the same way as a choke. ,

OSCILLATOR TRACKING

As will also be noted from the circuit, the latest type of oscillator tracking is employed. Instead of the adjustable padder of the old days, the padding condensers are both fixed capacity items, one of 425 micro-microfarads for the broadcast band and .005 mfd. for the short-waves. With fixed padders of this type it is essential to use the right type of alignment procedure. For this a signal generator or modulated oscillator is of the greatest assistance but it is surprising just how good results can be with the alignment done on station signals.

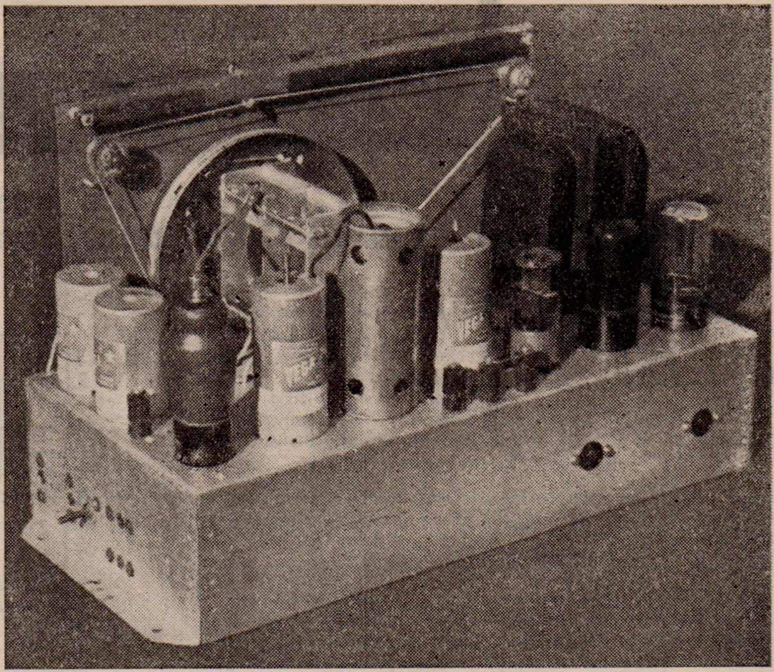
The essence of the scheme is to adjust the iron core in the





VEGA 5
SHOWING SWITCHING
for DUAL WAVE OPERATION

oscillator coil at the low frequency (2FC, 3AR) end of the band, to bring the stations in at approximately the right dial settings, then swing down to the other end and adjust the oscillator gang trimmer to bring things right at that end. If a modulated oscillator is available is can be used to go through this procedure at, say, 540 kc. with the gang fully meshed, then at 1600 kc. with the gang full open. This will ensure that the proper coverage will be obtained. Finer alignment is then carried out later at 600 kc. and 1,400 kc. which are points fairly well into the band. It won't matter much, then, if the tracking goes out slightly at the extremities.



Rear view of the "Vega 5" dual-wave receiver.

CONSTRUCTION

The general idea of the layout can be obtained from the photographs. The aerial and oscillator coils are mounted on top of the base, with the switch directly below. The short-wave coils are then mounted as close to the switch contacts as possible, but with their axis at right angles, to avoid inter-action of the fields. Trimmers are mounted on the end of the base, close in to the coils. The fixed padders are mounted directly to the coils.

Leads to and from the volume control are shielded to avoid hum.

THE FILTER

In the original set an electrodynamic speaker with a field coil of 1000 ohms was used. Due allowance was made to have a power transformer with a voltage rating of about 325 volts, so that, with 60 volts drop in the field, there was still adequate h.t. for the plate of the output valve. Only about 4 watts of power was thus dissapated in the field, only enough for a fairly small speaker. If a bigger speaker is to be used, it would be advisable to use a field of 1,500 or 2,000 ohms, with a power transformer rated 385 volts.

Those who desire to use a permagnetic speaker may do so by fitting a choke in place of the field coil shown in the circuit, with a power transformer secondary rated at 285 volts at 80 ma.

FURTHER DATA

Further information about this set can be obtained direct from Mr. Lay Cranch of Cranch Products and Trading Co., 17 Bond Street, Sydney.

TELEVISION (Continued from Page 7)

resentatives who witnessed the screening acclaimed the quality and value of this television demonstration which made European history and again evidenced the place held by Philips in the forefront of the technical field.

First in America, now in Europe, a surgical operation has been televised. In one of Holland's oldest university towns, Leiden, Philips have televised an operation to an audience of 200 medical practitioners and students, who were able to follow closely every detail of the operation.

Valves and their applications

THE EF42 IN THE OUTPUT STAGE OF A WIDE-BAND OSCILLOGRAPH AMPLIFIER

In the design of a high-gain amplifier for a C.R. oscillograph it is usually necessary to consider the output stages first, as the major frequency limitations usually occur at this point.

A C.R. tube presents a largely capacitative load to the preceding stage, which must therefore have a low anode load resistance, while the voltage swing required for full deflection of the beam entails a high maximum current.

When an ECR35 tube operating at 1.2 kV is used, a total signal of 180 V (peak to peak) must be provided on the most sensitive plates (allowing, say, 25% over-deflection), and if this is derived from two EF42's in push-pull, each must give 90V.

With a 250V H.T. line, the EF42 will give this signal swing across a 5K Ω anode load resistance provided that a little non-linearity can be tolerated at the lower limit of current. This is quite permissible, as over-deflection has been allowed for. The bias resistor necessary for this condition is 180 Ω.

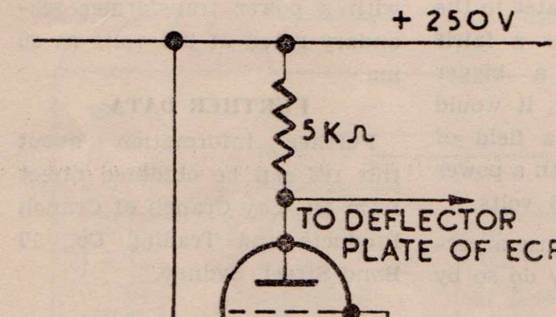
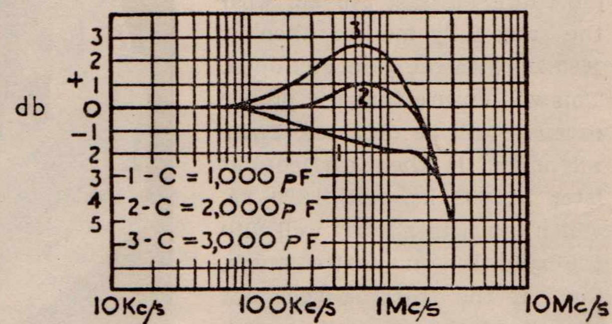


FIG: 1

FIG: 2



This amplifier-C.R. tube combination has a frequency response falling by rather more than 3db at 1 Mc/s., but this may be improved by compensation. One of the most convenient methods of doing this is to arrange that negative feedback shall appear in the amplifier at low frequencies, while at high frequencies the full amplification shall be used. This can be carried out in a variety of ways, but the most convenient and economical in components is that in which the existing cathode resistor is partially by-passed by a small capacitor. The circuit of the amplifier then becomes that shown in Fig. 1, while Fig. 2 indicates the frequency responses that can be obtained when three different values of cathode by-pass capacitors (C) are used. It must be remarked, however, that at high frequencies the full sweep available at low frequencies will not be obtained from the valve owing to the current swing limitation.

The transient response of the amplifier—usually a more important feature where oscillographs are concerned—is such that a square wave with a rise-time of 0.2 μs is reproduced with an "overshoot" of 0%, 10% or 20% when the cathode capacitor is 1,000 pF, 2,000 pF or 3,000pF respectively.

On this basis, a capacitor of 1,500 pF would probably be satisfactory in most cases, but if the preceding amplifier stages were found to limit the response severely, up to 2,000pF could be used, as such rapidly rising transients would never reach the output stages. The amplifier gives a voltage gain of 15 times when used under these conditions. *Reprints of this report for Schools and Technical Colleges can be obtained free of charge from the address below.*

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M8-49

Latest English Developments

Those who have wondered if the iron-core technique of i.f. practice could be applied to power transformers will be interested to hear that just such a scheme is being worked out in England at present.

AMONG the many examples of English scientific research shown at the recent Physical Society exhibition in London, is a soft magnetic core material, to be known as Caslam. This now reaching an advanced stage of development, has a finely laminated structure, and will be satisfactory for use at frequencies from 50 c/s, up to at least 10 Kc/s. It has a ring permeability of the order of 1,000 and is composed of flake iron particles pressed into a compact of the desired shape in such a way as to produce innumerable thin magnetic layers aligned in the plane of the flux. By virtue of its dense compacted structure, many of the assembly and fixing problems associated with the older stacking method, will be eliminated. Three grades of Caslam are at present under development. Grade I is a low density material with a maximum permeability of 860; Grade II, is a denser material with a higher maximum permeability of 1,000, and Grade III has magnetic properties similar to Grade I, but also has machining qualities and high strength.

Other examples of metallurgical research being shown at the exhibition are the materials known as Caslite and Caslox.

CASLITE

An iron powder made under carefully controlled conditions giving high chemical purity and consistency of physical characteristics. One of the chief applications of "Caslite" is for the manufacture of dust cores to operate at radio frequencies. A relatively high effective permeability is obtained in cores made from this high-purity iron, while the small particle size of the iron controls the eddy-current losses.

CASLOX

A complex metallic oxide powder with the following magnetic properties:—

B rem—1,500 gauss. Hc (B=0) —870 oersteds.

As a result of its high coercivity and almost straight demagnetisation curve, Caslox is magnetically stable under open circuit and generally unfavourable conditions. Caslox can be pressed into complex shapes by tabletting processes, the density of resulting components being 3.2 gm/c.c.

F.P. CAPACITATORS

The FP (fabricated plate) electrolytic capacitator has an aluminium - sprayed cotton - gauze anode. A large surface area is thus obtained giving a capacity ratio of about 12 : 1 over an equivalent area of plain foil anode. An important feature of manufacture is the impregnation and "ageing" of the condenser units in hot electrolyte.

CONDUCTIVE CERAMIC

Resistors made from this material are suitable for high wattage applications due to the high temperature at which they can operate. The temperature coefficient of the material can be modified by varying the manufacturing technique. A feature of this material is that it can be manufactured in a form which has an appreciable temperature coefficient of resistance.

HIGH TEMPERATURE CAMERA

This design of high temperature X-ray camera enables specimens to be examined at temperatures up to 1,500 deg. C. A high degree of vacuum or any desired atmosphere can surround the specimen. The film ring is entirely separate from the vacuum chamber and can be removed without any interruption of electrical, vacuum or water connections.

Of similar basic design to the high temperature camera is one for the examination of plastics. This has been specially modified to record low angle diffraction lines from plastic materials at temperatures up to 450 deg. C.

ELECTRON MICROSCOPE

A two-stage electromagnetic instrument is the electron microscope, giving a range of direct visual magnification from 600 to 20,000 diameters, with a resolution better than 100 A.U.

The H.T. system is an R.F.-operated voltage doubler circuit, delivering 50 kV., plus/minus 1 volt, to a biassed electron gun; the gun current, whilst giving

(Continued on next page)

adequate screen brightness for daylight viewing, has been reduced to a value which requires only a small H.T. supply unit.

A predictable motion with negligible backlash is given to the specimen by a novel form of mechanical stage incorporating an indexing mechanism which enables the position of any part of the specimen to be fixed within 0.00005 in.

The main vacuum valve, which offers no restriction to gas flow when open, allows the diffusion pump to be isolated when necessary and also serves to keep the microscope under vacuum when not in use.

The photographic unit enables five 2in. x 2in. or ten 2in. x 1in. photographs to be taken at one loading, plates being changed by means of an airlock similar to that on the specimen chamber.

ELECTRON PRECISION REVOLUTION COUNTER

The method employed to determine engine speed is an integral count of the number of revolutions ccurring in a standard time interval. This time interval is derived from a 1,000 c/s valve-maintained tuning fork, which controls a chain of frequency dividers to produce a one-second time interval.

The instrument is supplied with a 3-phase input signal whose frequency is proportional to engine speed, and the frequency is converted so that a full scale accuracy of at least 0.1% is achieved. A gate circuit permits the total number of pulses occurring in one second to be registered on a counter which consists of four identical electronic decades.

TEST OSCILLATOR

A wide-range velocity-modulated oscillator giving a frequency ratio of 1.5:1 with a calibrated output using a piston attenuator. 100 Mc/s checking points from a 20 Mc/s model crystal and an optical scale give good reading accuracy.

IMPEDANCE METER

The instrument is designed to give direct reading of impedance in ohms, phase angle in degrees and sine of the phase angle. These results are obtained by balancing the equipment for impedance only. It incorporates a 40 c/s. oscillator capable of supplying 30 volts into 700 ohms or to a series of termination resistances for use when transformers are to be measured.

STABLE BALANCED OSCILLATOR

This oscillator utilises a butterfly type capacitator with a plate shape designed to give a linear frequency change with a 2 to 1 ratio.

MICROWAVE COMPONENTS

S.H.F. Connectors: A range of connectors in two series: Major and Minor, having low reflection loss up to 7,000 Mc/s and 15,000 Mc/s respectively for use with low-loss cables in the impedence range 70-80 ohms.

Piston Attenuator: An "E" type waveguide evanescent mode version attenuator suitable for use down to wavelengths of 2 cms. Attenuation calibrated directly in decibels over the linear range 18-200 dB.

Coaxial Matching Stub: A graduated drive stub for the matching of concentric lines and cables.

Various Probes: Adjustable coaxial and loop type probes for coupling to waveguides and concentric lines.

Coaxial Wavemeters: Coaxial centrimetric and decimetric types covering wavelength measurements from 2 to 44 ohms. having vernier drive and incorporating a pick-up probe and crystal detector.

Crystal Detector: Series and shunt type crystal detectors suitable for direct and loop type coupling to waveguides and concentric lines.

Attenuators: Single and multiway coaxial attenuators for insertion in R.F. and power supply lines.

Coaxial Bolometer: A power measuring device for the range 100 microwatts to 100 milliwatts down to 3 cm. wavelengths. The bolometer includes a built-in matching stub and, in common with the other concentric components, is used with the major series of connectors.

Circular Waveguide Components: Examples of crystal and carrier frequency receivers, a sector attenuator waveguide bolometer and an adjustable launch for use at 5,000 megacycles.

All the above developments were exhibited by the English firm of Plessey Ltd., of Ilford.

THEORY

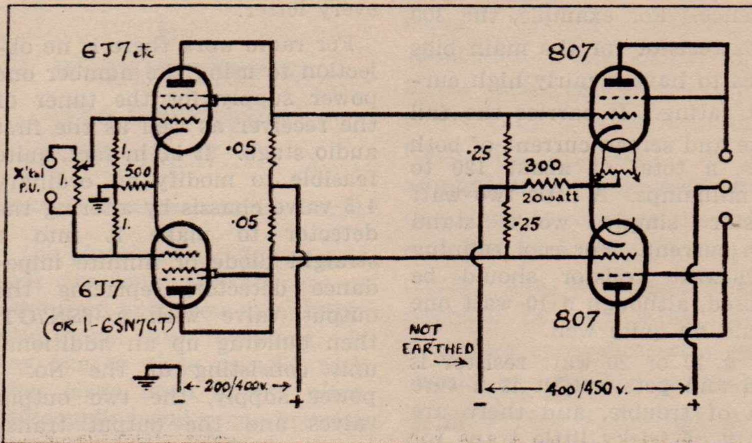
Owing to production difficulties, the second part of the new course in radio fundamentals has been held over to next month's issue.

MORE ABOUT LATEST DIRECT-COUPLERS

THE direct-coupled amplifier with twin power supplies, which was described in our April issue, has certainly created a lot of interest. In fact, one of the reasons for the lateness of the May issue was the rush of queries about this amplifier.

One or two readers have run into trouble with the amplifier, but most reports are wildly enthusiastic. With a good crystal pick-up and a well-baffled speaker, it can give a resounding whack to the lows. Highs need to be lopped to suit your taste. The reproduction of transients gives the amplifier a chance to show the advantage of avoiding coupling condensers.

By
A. G. HULL



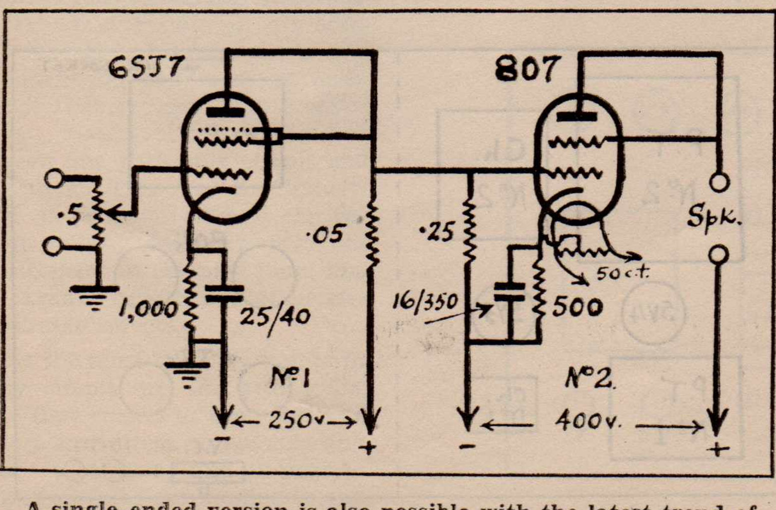
Suggested low-gain version for use with crystal pick-ups having fairly high signal output. This amplifier is capable of the highest fidelity and widest range.

The actual circuit shown in the April issue was only one of many alternative arrangements, and actually had two minor drawbacks. (1), There is too much gain for use with most crystal pick-ups; (2) The values of the grid resistors for the 807's and should be changed to quarter megs, instead of one megs. This change makes no difference in performance.

Lowering the gain a little can best be done by connecting the 6SJ7's as triodes. The three-quarter meg resistor is then omitted, but otherwise values can be left as shown in the original circuit. Those who want the utmost brilliance will need to lower the value of the plate feed re istors to 100,000 ohms for fairly strong high note response, or two 50,000 ohms if you want to cover the entire music (and scratch) frequencies.

A single 6SN7GT can be used to replace the two 6SJ7's, without any circuit or resistor changes.

Of the troubles reported and found in amplifiers inspected,



A single-ended version is also possible with the latest trend of twin power supply designs. Here is a basic design which is also suitable for use with almost any types of valves.

(Continued on next page)

so far, the main difficulty has been with routine errors which would have been avoided by radiomen with a little more experience. For example, the 300 ohms resistor for the main bias needs to have a fairly high current rating. It carries the full plate and screen current of both 807's, a total of about 120 to 150 milliamps. A little two-watt resistor simply won't stand such current. For cool running a 20-watt resistor should be be used, although a 10-watt one should do quite well.

If a 10 or 20 watt resistor is used and gets hot, it is a sure sign of trouble, and there are plenty of tricky little traps for those who don't watch out. The power supply arrangement is quite unconventional, and pitfalls abound. The whole of the 400-volt power supply (No. 2) has to be insulated from earth. Its negative side is NOT earthed, nor are the negative sides of its filter condensers. Layout seems to have provided problems, and in a couple of examples we have inspected, the most elementary rules of layout seem to have been completely ignored. Easiest of all is to have the power supply units on a separate base. Then on the actual amplifier chassis you can have the ideal lay-out, input at one end, with volume control handy, then the two 6SJ7's next, with the shortest possible plate to grid leads, the output valves, then the output aransformer. In other words, the layout should take the same style as the drawing of the circuit with the balanced arrangement of plate and grid leads. Keep the output plate leads short. Don't set the four valves in a line, as it will mean that grid leads from one of the output valves will run down alongside the plate of the other, and so on. Faulty layout can give plenty of trouble.

To answer some of the queries which have popped up in nearly every letter.

For radio work there is no objection to using the number one power supply for the tuner of the receiver as well as the first audio stage. It is, in fact, quite feasible to modify an ordinary 4/5 valve chassis by altering the detector to make it into a straight diode or infinite impedance detector, replacing the output valve with a 6SN7GT, then building up an additional unit consisting of the No. 2 power supply, the two output valves and the output transformer. Actual voltage supply for the first audio stage will need to be about 250 to 300 volts, as the converter valve may not stand more than 300. But if the amplifier is built up as an amplifier only, then the voltage applied to the end of the plate feed resistors can be anything from 200 volts to 500 volts, without exceeding the actual plate voltage ratings, or the plate wattage rating, which is really the point to watch.

The plate loading of the output valves can be varied within considerable limits without affecting results to a noticeable degree. From 5000 to 10,000 ohms plate-to-plate load should be about the limits, 6000 ohms our own preference. Bulky output transformers of the high fidelity type are recommended, of course, but quite good results can be obtained with the smaller types supplied with speakers. We advise that the speaker transformer should be mounted on the amplifier chassis, close to the output valves, with short, direct plate leads. Parasitics and other forms of instability can be encountered with long plate leads running right away to a speaker transformer, when it is mounted on the framework of the speaker.

The input circuit arrangements will affect the loading of the crystal pick-up. Actual load for the pick-up will amount to the two grid resistors in series, in parallel with the resistance of the volume control. Higher loading of a crystal pick-up

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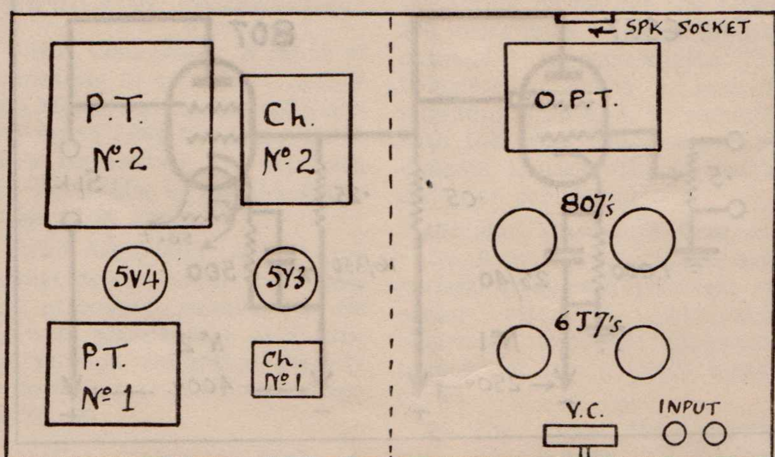

Suggested layout plan for direct-coupled amplifier, divided at the dotted line for a two-unit assembly.

FOR THE BEGINNER

Efficient Chassis Layout

By
G. W. BUTTERFIELD
"The Broadcaster"
Perth, W.A.

THOSE who followed the article for radio beginners —"Reading Circuit Diagrams"— published last month, may recall that emphasis was given to the fact that the arrangement of circuit symbols and lines did not necessarily indicate the actual practical layout of the components represented, although, naturally, the arrangement should be followed as near as possible. However, there are certain rules which must be followed in any practical layout.

These rules are concentrated mainly on "intercoupling" or feedback, because, if extreme care is not observed regarding this factor the whole performance of any set can be ruined. "Feedback," as the name implies, means that a certain amount of the amplified power is fed back to the previous stages and amplified over again. This same cycle continuing over and over again results in all sorts of squeals and other effects, dependent on the form of feedback taking place. "Intercoupling" means the coupling between one part of a circuit and another. This may be "inductive" or "capacitive" and can result in the feedback just described or an excesive hum, loss of signal strength and other undesirable effects.

As the most sensitive points in any circuit are the grid leads, the first rule is to keep these as short and direct as possible and also as far away and as near to right angle as permissible to any other leads, particularly those in the plate circuit. If the grid leads are long, the chances of picking up hum from stray magnetic fields, are increased. If they run in close parallel with other leads, such as the plate, intercoupling will occur between them, resulting in feedback as previously mentioned. The second rule is to keep each stage of the circuit and its associated components as close together as possible. This will result in short leads which is always to be preferred in any connection apart from grid leads. However, the grid leads are the most important for reasons already explained. The plate leads come next in order of preference where a compromise has to be made. However, as the grid connection to most of the valves is the metal cap on the top, it is generally easy to keep these leads well separated. As the amplification progresses from one stage to another the tendency for back coupling will increase, due to the increased strength of any stray fields. Therefore each successive stage should be arranged so that it is progressively further away from the input because any feedback here will receive the full amplification of all stages between this point and the point where the intercoupling occurs. As the earlier stages are usually working at a higher point of sensitivity than the latter, they are more sensitive to the greatly amplified stray fields from stages that follow.

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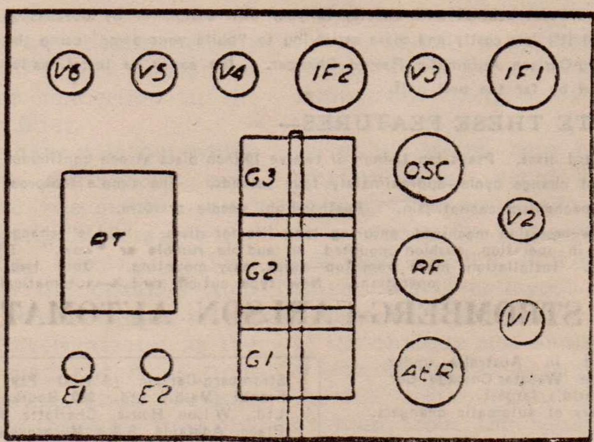


Suggested Layout for a Powerful Superhet

SHIELDING

Intercoupling and feedback can be avoided by proper shielding. Hence the reason for the metal cans or shields covering the various coils which are surrounded by a powerful concentrated magnetic field. These fields would result in a terrific feedback if they were not isolated by their protective metal coverings. Shielding can also be applied to leads for the same purpose, although this should be avoided as much as possible due to the "capacitive" losses which may take place between the small space existing between the copper braid used for this purpose and the lead. However, where long grid leads cannot be avoided it is preferable to shield these in this manner using a loos-fitting copper braid sheath to increase the space as much as possible. This will reduce the capacitive effect. All shields should be well earthed to be effective.

CHASSIS LAYOUT

I have chosen the layout of fig 1 as a good example. This represents a 6-valve super-heterodyne, but once you understand the principle, you will be able to modify the arrangement to suit any smaller set.

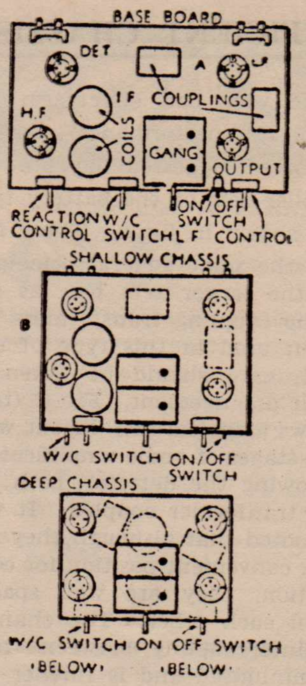
We will start with the first component which comes into action and this is the aerial coil marked AER. The aerial lead should be brought through the chassis as close to this coil as possible. This coil, with the valve VI and the section of the ganged condenser G1, represents the first tuned radio-frequency stage and it will be seen that the arrangement is such that direct short leads can be taken from the grid coil (aerial coil secondary winding) to the tuning condenser G1 and also to the grid of the associated valve VI, simply by connecting a short lead from the coil direct to the grid cap of the valve. Any associated components, such as small fixed condensers, cathode resistors, etc., can be made directly, or as near as possible, to the socket of V1 beneath the chassis. The plate lead will be located here and it will be seen that the socket is ideally placed to carry this lead direct to the primary (plate coil) which is coupled to the grid coil inside the can belonging to the second R.F. stage. Thus the first stage is compact with short leads and already inductively coupled via the plate coil to the grid coil of V2. The grid coil to this valve is also in a convenient position for short direct connections to the associated tuning condenser G2 and there is also a similar short connection to the grid-cap of this valve in the same manner as the first stage. However, as the V2 in this case is the superheterodyne converter, one section has to provide the tuned oscillator. It will be seen, however, that the coil (osc.) and tuning condenser G3 for this section is in just as convenient a position for short direct connections to the socket of the V2 as the R.F. section. The frequency created in the oscillator section and that of the incoming signal, which is mixed in the same V2 valve, results in a separate frequency (intermediate frequency or I.F.). This frequency is the difference of the two and is passed on via the V2 plate lead to the primary of the first I.F. transformer. This coil unit again is not so far removed from the V2 that the plate lead from the latter need be excessively long. The grid lead from the secondary of the I.F. transformer, as with the other R.F. coils, is in a convenient position for a short direct connection to the I.F. amplifier valve V3. The plate of the latter goes to the primary of IF2 and the secondary to V4, which represents the detector stage.

LOW FREQUENCY SECTION

After the V4 comes the power output V5 which, in itself, is comparatively insensitive to stray magnetic fields. However, this stage can be responsible for creating powerful fields of an audio frequency order which can be fed back to the previous L.F. stage (or stages in some receivers or amplifiers). Such fields are closely confined to the output transformer (or transformers where this form of coupling is used in other L.F. stages, as will be explained later). The output transformer in this case, as with most receiver power output valves, is connected (mechanically) to the speaker, thus being out of the way and usually covered by a shield. No appreciable radiation takes place from A.F. leads, therefore there is no necessity for these to be particularly short. Nevertheless all such leads together with other low frequency leads and components should be kept well away from the R.F. section of the chassis.

The final valve, shown as V6, is the rectifier and is in an ideal position for connection to the power transformer PT. At the same time is also well situated to dissipate the rather high amount of heat generated by this valve, being close to the outside edge of the chassis. The same applies to the power valve in this regard. If either of these valves were placed where the electrolytic condensers are shown, E1 E2, their combined heat would be confined right inside the cabinet, causing the chassis and components to overheat after the set has been in operation for some time. The effect of this heat can be responsible for melting wax out of components, such as condensers, and can quickly ruin the electrolytic type. However, by mounting the latter in the position shown, they are well away from any heating effects and still in a very convenient position for connection in the H.T. power filter.

Thus we have a layout which is compact and allows each stage to be reasonably spaced from the preceding stage without having excessively long leads. Also the distance from the highly sensitive input stages get progressively greater as the associated magnetic fields from each following stage become stronger. At the same time, the audio and low frequency power supply are all located on the



same side of the chassis and well away from the R.F. and I.F. sections, as they should be.

SMALLER SETS

The same layout sequence could, of course, be used for a 5-valve superhet, in which case, the first R.F. stage, as shown, is usually eliminated. The aerial being taken direct to the following R.F. coil. This would mean no alteration of layout but simply a narrower chassis, if preferred, as only a two-gang condenser would be required. The same arrangement could also be used for a smaller t.r.f., receiver, in which case either a smaller chassis could be used, or a greater space allowed between the audio and power section and the R.F. and detector stage. Whatever layout is used, always keep the power supply at the opposite side of the chassis, or as far as possible from the R.F. section. Any feedback or hum from this section can

(Continued on next page)

have very bad effects on the receiver's performance.

Some suggested layouts for smaller sets of the battery type are shown in fig. 2. These follow the same general principles of the larger sets but, as the audio coupling transformers are often used in this type of circuit, care should be taken in their arrangement. Fig. 2 (top) shows a typical t.r.f. layout with two stages of audio amplification following the detector, both being tranformer coupled. It will be noted that although they are in a convenient position for connection, they are well spaced from each other. The chances of intercoupling between them is minimised and is further reduced by placing them so that their windings are at right angles to each other. These points should be observed when dealing with any inductance of course, but extra care is required with power chokes, L.F. transformers, etc. Although such L.F. fields are confined closely to the coil itself, they are very powerful and can result in excessive hum, squeals and all sorts of effects if any intercoupling take place.

Fig. 2 (centre) shows the same arrangement in a more compact form, but it will be noted that there is very little difference in the spacing between th transformers, most of the reduced space being due to the more compact arrangement of the R.F. section which is all to the good as this means shorter leads.

Fig. 2 (bottom) is interesting as it shows how intercoupling can be minimised when the dimensions of the chassis must be kept exceptionally small. In this case, the R.F. coils are mounted beneath the chassis directly under their respective sections of the two-gang condenser. This leaves room on the top of the chassis for mounting the coupling transformer and yet keeping them well apart. However, in such a compact arrangement, just placing them at right angles may not be sufficient. In such cases, it is a good plan to twist them slightly at different angles before finally bolting them down. This must be done after the set is finished. You will then be able to judge audibly when the best angle is obtained. Often it will be found that only a very slight alteration one way or the other can make a tremendous difference. This method must often be adopted when dealing with A.C. sets using coupling chokes, or transformers to get rid of hum which may be induced from some stray magnetic field associated with the power supply, in spite of the care which has been taken.

WIRING

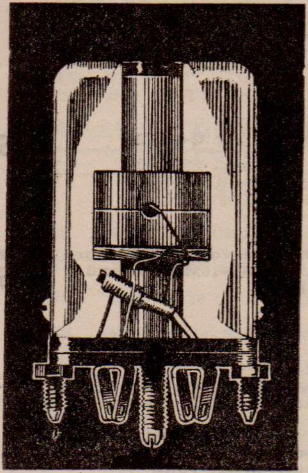
This article would not be complete without some reference to the wiring procedure. Only the main points will be touched upon, but bearing in mind the remarks already given regarding short grid leads, etc., they should be sufficient to enable you to avoid the common errors.

After you have the components fastened in position, you should commence connecting all the filaments. The two leads for this purpose should be twisted together as this reduces any chance of A.C. radiation from this source—that is, when dealing with A.C. ets. The leads can be any length—and should be tucked away around the inside edge of the chassis well out of the way. The next part is the H.T. supply which again should be connected up with the leads tucked well away. Any length can be used here. The main thing is to leave the main part of the chassis clear for the more important wiring. If you use a smoothing choke, instead of the field coil of the speaker, for filtering the H.T. supply, see that this is kept well away from the other receiver components and wiring. At the same time it must not be too close to the power transformer and preferably with the winding at right angles to the latter. The speaker socket should be mounted near the output valve end of the chassis as this will be a convenient position for the plate and H.T. leads to the latter. The volume control, which is usually in the grid circuit of the first I.F. stage, should be shielded with copper braid, the latter being well "earthed" to the chassis. Very little, if any capacity effect as mentioned earlier, will be noticed in this stage. Although neatness of wiring is to be recommended, this often results in too many parallel leads. Therefore, to be on the safe side, it is best for those with little experience to make direct connections where possible particularly in the R.F. or I.F. sections, always keeping in mind what I have already told you about plate and grid leads. Resistors and condensers look nice and neat when mounted in rows on terminal strips but it is safer to leave yourself enough room to mount these as close as possible to their point of connection no matter what they look like. This in most cases is the contact on the valve sockets.

Most sets of the dual-wave type usually have the S.W. coils mounted on the wave-change switching unit which is generally mounted directly under the ganged condenser or nearby. However, the method of layout and wiring will be found to conform with the general principles described.

"Q PLUS" 1949 COILS

KEEP FOR REFERENCE



Type Q+
AC4S Aerial or R.F. Coil

CATALOGUE

OF AUSTRALIA'S MOST COMPREHENSIVE RANGE

"Q.Plus" coils have now been established in Australia for many years, during which time they have pioneered the MIDGET coil field.

Now in 1949 the same precision methods and production techniques have been employed to offer you a complete range of STANDARD SIZE coils and I.F.'s.

Features included in these new products are: — non-softening bases, double lug soldering terminals, polystyrene tropic proofing, impact-drawn aluminium cans, high "Q" FERRO-MAGNETIC tuning cores and surrounds, litz wound secondaries, full impedance primaries and a host of "Know-how" improvements too numerous to mention.

STANDARD SIZE COILS AND I.F.'s, Etc. FOR REPLACEMENTS INITIAL EQUIPMENT

AERIAL COILS

Type No.		RETAIL PRICES, each
Q+AC4S	A progressively wound litz secondary, with hi-impedance primary, permeability tuned, inbuilt top coupling condenser, 1⅜" sq. can x 2¼" high. The whole polystyrene impregnated — an excellent GENERAL PURPOSE COIL AS USED BY MANY MANUFACTURERS	8/9
Q+AC5S	A ferro-magnetic cupped secondary unit using 7/41 litz wire. A coil of outstanding performance, other features as for type AC4S above	8/9

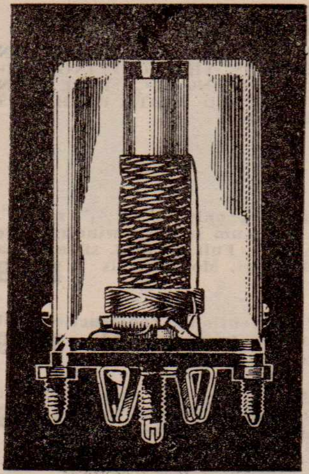
R.F. COILS

Q+RC4S	The same as for type AC4S Aerial coil above	8/9
Q+RC5S	The same as for type AC5S Aerial coil above	8/9

OSCILLATOR COILS

N.B.—Only one type of physical construction is available in the "Q.Plus" range of oscillator coils—pi wound—No advantage is obtained by the use of progressive windings or ferro-magnetic enclosure.

Q+07S	A pi wound coil suitable for use with either of the above type aerial and RF coils, permeability tuned, and designed specifically to give correct grid-current operaton with the type 6J8G converter valve	8/9
Q+08S	As above but designed for use with 6SA7 converter	8/9
Q+09S	As above but designed for use with ECH35 or 33 converter	8/9



Type Q+
AC58, Aerial or R.F. Coil

R.F. CHOKES

Q+RFC1	A single pi. ceramic mounted full 2.5MH choke, pigtail leads	1/9
Q+RFC2	A 4 pi low capacity unit, ceramic mounted, with pigtail leads —will take up to 100 ma.s. As for type RFC1, is fully tropic proofed	4/6

UNLESS OTHERWISE SPECIFIED, "Q.PLUS" COILS, ETC., ARE DESIGNED FOR USE IN CONJUNCTION WITH "H" TYPE GANGS AND DIALS—SPECIAL TYPES MAY BE SPECIALLY ORDERED FROM THE FACTORY.

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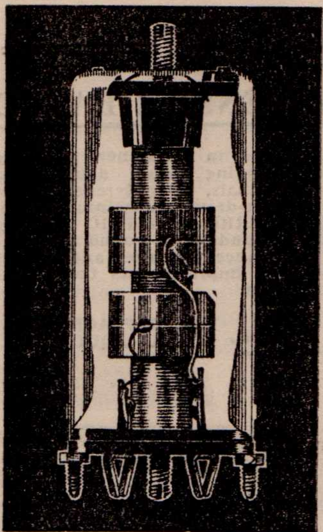
"Q PLUS" 1949 COILS



Q+IF8 or 9 I.F. Transformers
2/3rds size

Q+ Midget IF.'s
Q—IF1+2

Phantom Drawing showing 2/3rds size Midget Coil Construction

Midget Oscillator, Coil type Q+01 For IR5

STANDARD SIZE COILS (Continued)

REINARTZ COILS

Q+RC8S — A standard size coil built on the same lines as the Q—AC5S Aerial coils **9/6**

UNTUNED R.F. COIL

Q+RC9S — Designed mainly for replacement purposes, this coil may be used where a tuning condenser is undesired. Inductance—16MH. wound on ceramic former with pigtail connections **4/6**

SHORT-WAVE COILS

Q+SWA13
Q+SWA16 — An exceptionally high gain series, permeability tuned with special low-loss polystyrene impregnation. Unshielded, mounting by means of 1/8" Whitmore screw.
Type SWA13 covers 13-42 meters; SWA16 covers 16-50 meters.

Q+SW013 — The oscillator coil belonging to the above aerial coils.
Q+SW016 — The oscillator coil belonging to the above aerial coils.
Q+SWR13 — The R.F. coil belonging to the series. .. .. All coils **5/9**
Q+SWR16 — The R.F. coil belonging to the series.

I.F. TRANSFORMERS, STANDARD AND MIDGET SIZE

N.B.—ALL TYPES OF "Q.PLUS" I.F. TRANSFORMERS ARE MADE FOR OPERATION IN No. 1 AND No. 2 POSITIONS. UNLIKE OTHER BRANDS, THE COUPLING FACTOR OF THE No. 2 I.F. IS DEFINITELY GREATER, PRODUCING 10% MORE GAIN WHEN USED AHEAD OF THE DIODE STAGE. BROADER BAND WIDTH WITH LESS SENSITIVITY IS OBTAINED IF TWO No. 2 I.F.'s ARE USED.

I.F. TRANSFORMERS — 455 KC.

Q+IF1
Q+IF2 — Australia's smallest commercial I.F., measuring only 3/4" x 3/4" x 1 7/8". High "Q" Ferro-magnetic surrounds with optimum size litz windngs give performance equal to many standard size I.F.s. Full 100uufd. silver-mica condensers with special space-saving solder lugs. Mounting is by means of a 3/16" nut **13/9**

Q+IF3
Q+IF4 — A single pi 7/41 litz wound winding of conventional construction but with the exclusive "Q.PLUS" constructional features outlined before. 100 uufd. silver-mica condensers **13/9**

Q+IF8
Q+IF9 — The windings of these units are enclosed with high "Q" Ferro-magnetic surrounds, giving exceptional "Q" factors and corresponding performance. 100 uufd silver-mica condensers. 7/41 litz wire .. **14/9**

Q+IF10
Q+IF11 — A special high gain but broad bandwidth unit, each unit being composed of 3 pis of 7/41 litz wire. 80uufd condensers. Specially suitable for portable type radios. **14/9**

LOOP AERIALS

Q+LA1 — A midget type loop aerial with special loading coil and recommended circuit **7/6**

R-W-STEANE & CO. Pty. Ltd.

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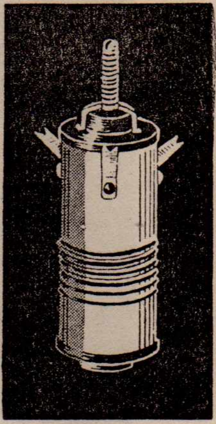
FACTORY: EASTERN PLACE AUBURN, VICTORIA

"Q PLUS" 1949 COILS

"Q.PLUS" MIDGET SERIES

NOW AN EXCLUSIVE LINE IN AUSTRALIA. "Q.PLUS" IS PROUD OF THE AMAZING PERFORMANCE BEING REPORTED. SIMILARLY TO THE STANDARD SIZE RANGE, ALL COILS AND I.F.'s ARE FULLY TROPIC PROOFED. THE OLDER IMPREGNATION SYSTEM OF OBTAINING HIGH "Q" FACTORS HAS NOW BEEN REPLACED WITH HIGH "Q" FERRO-MAGNETIC SURROUNDS. WITH THE EXCEPTION OF THE Q-01 UNIT, ALL COILS ARE NOW SHIELDED.



Q Plus Short Wave Coil, 2/3rd size

OSCILLATOR COILS — MIDGET

Q+01 For 1R5 type converter only, wound on a 100,000 ihm ½ watt I.R.C Resistor which is used in circuit. Pigtail connections. Spesial design gives good performance at low "A" battery voltages. Supplied complete with recommended circuit. **4/9**

Q+02S A permeability tuned coil for type IR5 converters, measures ¾" x ¾" x 1⅜" **8/9**

Q+03S Similar to above but for type 6J8G converters **8/9**

Q+04S Similar to above but for type ECH35/33 converters **8/9**

Q+05S Similar to above but for type 6SA7 converters **8/9**

AERIAL COILS — MIDGET　　R.F. COILS — MIDGET

Q+AC1S
Q+RC1S ACIS—Aerial coil, RC1s—RF coil:—Litz wound, with ferro-magnetic surrounds as for IF 1 and 2. Hi-impedance primary permeability tuned, measure measure ¾" x ¾" x 1⅜" Special space-saving terminals .. .. " **8/9**

CAR RADIO TYPE COILS

Q+AC2S
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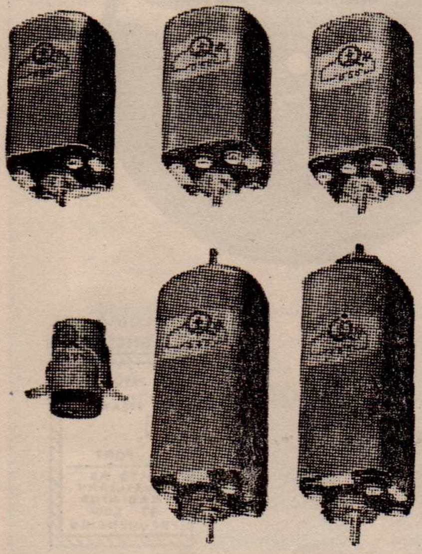

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(Illustrated at right')

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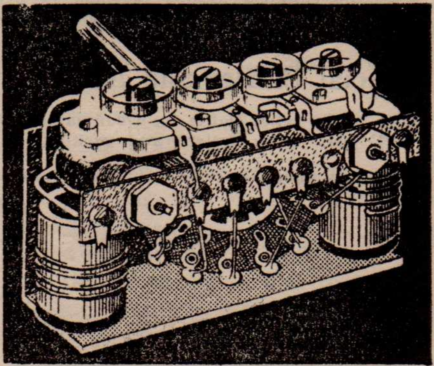

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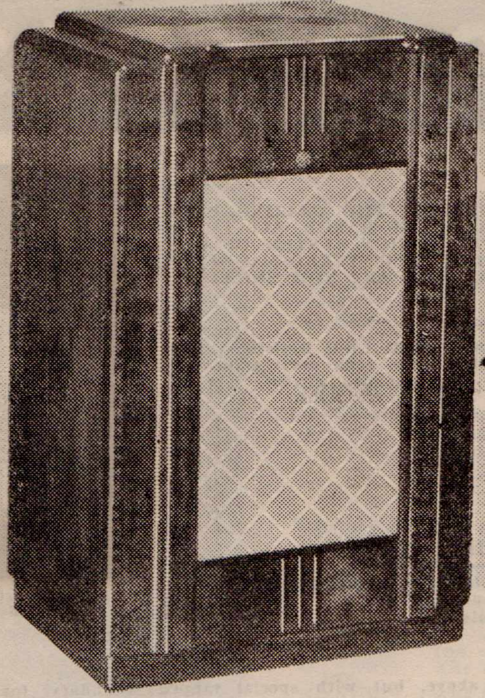

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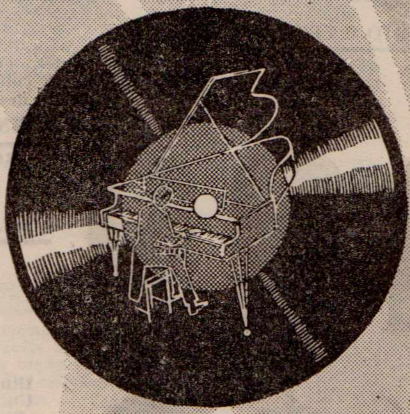

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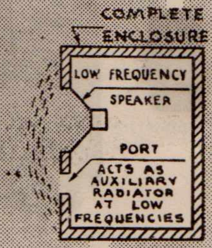

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RADIO SERVICE

THE 'UP and DOWN' RECEIVER

By

A. G. HULL

ONE of the most difficult problems facing the radio repairman is the set which goes up and down.

I have often heard of sets which will play normally for a short time, then fade to a whisper. Full volume level is regained by switching the set off and then on again, or by flicking any switch in the house. Years ago I investigated such a case and found that the steel conduit of the house wiring system was not effectively earthed. Cleaning and tightening the joints of the conduit and earthing it brought a complete cure of the trouble.

Recently I came across another case of an "up and down" set, but an example of trouble which was definitely in the set itself and not in house wiring, for the set behaved in similar manner in two different locations. So I brought it home and, sure enough, it gave a most perfect exhibition of fading every three or four minutes, going back to full volume as soon as any switch in the house was put on or off. It seemed most mysterious, but just as I was about to suspect the supernatural I discovered the faulty component.

Operating the set on its back and tapping each component in turn showed that the effect could be obtained by knocking the coupling condenser endways. This component, the condenser coupling the detector plate to the grid of the output valve, had been mounted, for convenience sake, with one pigtail tied to a vacant pin on the rectifier socket and the other pigtail on the grid pin of the output valve socket. Whether some effect happened when the rectifier warmed up, or why the light switching made the condenser misbehave I could not discover. A replacement of the condenser with a new one made a sure cure of the trouble. I opened up the old condenser and examined the connections between pigtail and foil, but they seemed to be quite in order. So, although a cure was made, the mystery was not explained.

Strangely enough, a few days later, another example of an up and down set was encountered. This time the tapping of the components failed to reveal the trouble, and quite a few hours of exasperation passed by before the trouble was located by the substitution method. The cause was a defective valve, type 6G8G, used as i.f. and detector.

This particular case was aggravated by the fact that the set would do its up and down stuff only when in its cabinet, but not when standing up on end on the bench. Later we discovered that it would play up when out of the cabinet if left sitting on the bench in its normal position. The valve gave an O.K. check when in the valve tester, as it was then in a horizontal position. When the tester was laid on its back, just to see, the indicator would jump when the valve was tapped. In this

(Continued on page 38)

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Here is a handy guide to the main articles which appeared in the past 12 issues. All these issues are available at 1/- each, post free, or 10/- for the complete set of 12 issues. Please remit by postal note or 1½d. stamps. Address: Australasian Radio World, Box 13, Mornington, Vic.

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Analysis Of Receiver Noise

By
Wm. DARRAGH
129 Empress Avenue
West Footscray, Vic.

SINCE sensitivity is of major importance in most applications, considerable effort has been expended in improving received techniques. The ultimate sensitivity of a receiver is limited by "noise" arising from thermal agitation in conductors, and by the irregular nature of electronic emission in vacuum tubes. The fluctuation in the anode current of pentodes is far greater than that of triodes due to "screen partition noise" arising from the random division of the cathode current between the screen and the anode. These noise currents cause fluctuating voltages to be set up across grid-cathode impedance, and after amplification, may assume serious proportions. For all practical purposes, the overall noise factor of a receiver is determined by the noise generated in the input stages, because the gain of the following stages raises the noise to a level where subsequent noise contributions are insignaficant.

The noise generated by a tube when used as an RF amplifier is considerably less than that of the same valve used as a mixer. The noise factor of a receiver may be reduced by using one or more stages of RF amplification, providing the gain of each stage is large, which should be so if the signal frequency is low enough. As the signal frequency is increased, then ultimately the gain of the RF stages are reduced to a level where, despite the lower noise content of the valve, a better receiver noise factor is possible by immediate conversion.

If the mixer in a receiver is replaced by a resistor of equal resistance to the output impedance of the mixer at intermediate frequency, the receiver noise output will be due to shot effect and partition noise in the tubes, and to thermal agitation in the equivalent resistor. However, it is found in practice that mixers generate more noise than the equivalent resistor. The noise factor of a receiver is defined as follows:—If an ideal receiver assumed to be noise free, and having an infinite input impedance, is connected to a signal generator in series with a resistance RA, which is to represent the radiation resistance of the aerial, the output noise is caused solely by thermal agitation voltages set up in RA. If the output of the signal generator is adjusted to give a signal to noise ratio of unity, and the level of the signal generator is X, then when the same procedure is applied to a practical receiver, it will be found that X must be increased to attain a signal to noise ratio of unity, by the factor N. This is defined as the noise factor of the receiver. It has been proven that the radiation resistance of an aerial on a practical receiver is in effect a source of thermal agitation noise. When the latter is in radiative equilibrium with its surroundings, the noise power at the receiver input is the noise in a resistor at ambient temperature whose resistance is equal to the radiation resistance; the noise factor of such, with an ideal receiver, is unity

One very satisfactory method of substantially reducing the noise factor of a receiver, particularly in VHF applications, is to employ grounded grid RF amplifiers, and, if the occasion warrants it, a triode mixer. Unfortunately, very little advantage would be gained by employing these applications at other than V.H.F.

The noise factor of a VHF receiver using triodes is roughly 50 per cent. of the same receiver utilising conventional pentode preliminary stages.

Poor quality resistors are also a source of noise in a receiver, particularly so if they are run in excess of their rated wattage. This also applies to high quality resistors, an increase in temperature producing increased thermal agitation, coupled with an increase in noise level.

So far, this article has dealt with sources of internal noise in receivers, the problem of induced noise will not be discussed, due to the latter being of a more practical nature. A great deal more could be propounded on the subject of internal noise, involving a great deal of mathematical formulae, however, as this article was written with the intention of providing a simple explanation of the subject, mathematical calculus was omitted. At a later date a full analysis of the pros and cons of V.H.F. receiver design will be dealt with.

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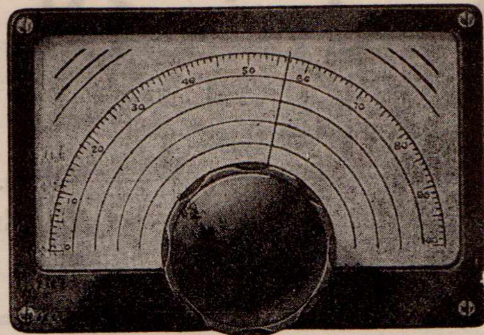

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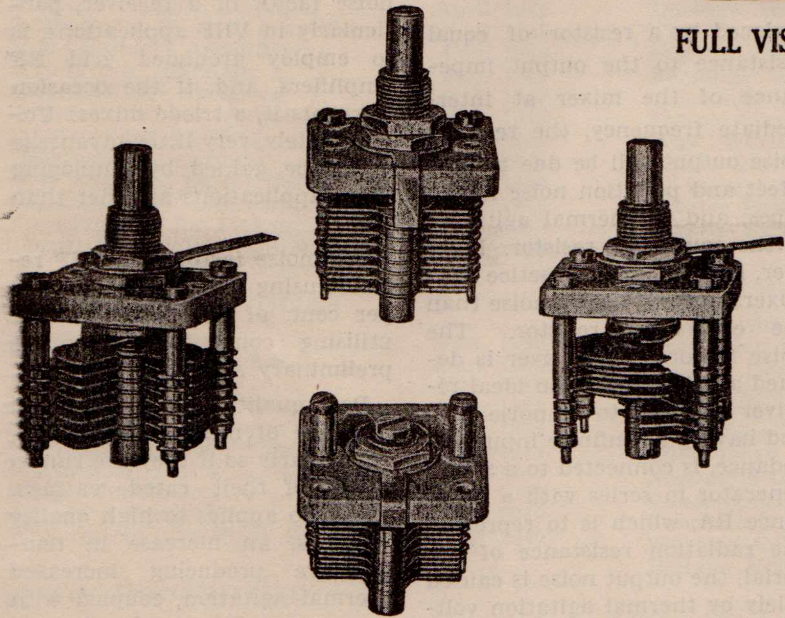

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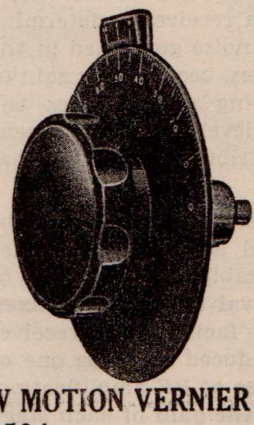

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FOR THE AMATEUR

Voltage Regulation

By J. N. Walker (G5JU)

PART TWO

(Continued From Last Issue)

SERIES CONNECTION

With one exception, all previous information has referred to the shunt method of connecting a stabiliser valve. The series connection mentioned under "Modulator Service" has other applications also. It may be used in a receiver, to ensure that the potential of screen grids is always so much less (according to the type of stabiliser) than the H.T. line voltage. Similarly, in a transmitter, the series connection is a simple means of obtaining the correct potential on the screen of 807, 815, 829 and similar valves. Being of inherently low resistance, little power is lost, compared to a series resistance, whilst modulation is maintained at, of anything, a higher level than with a series resistance. A typical circuit for use with 815, 829 and similar valves is shown in Fig. 7. A resistance shown connected from the cathode of the stabiliser to earth is necessary to ensure that ionisation of the stabiliser is independent of the valve operating conditions.

THE STABILVOLT

The Marconi Stabilovolt is of more than ordinary interest because it permits simultaneous stabilisation at different levels. It can be used to provide positive voltages of 280, 210, 140 and 70 volts or alternatively positive voltages of 210, 140 and 70 and a stabililsed negative voltage of 70. The maximum permissible current through the stabilovolt varies between 30 and 100 mA—the higher current at the lower voltages and vice versa.

The number of possible applications are too numerous to give in detail—in almost any circuit—receiver, transmitter, modulator, etc.— there are points, in the stabilisation of which will

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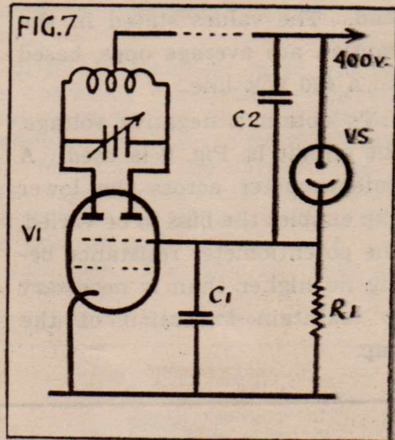

Fig. 7.—Series connection of stabiliser for good regulation of screen grid voltage with twin tetrode R.F. valve. Also applicable to single valves (807, etc.).

C1.—Normal bypass. R1, 100,000 ohms w1 watt.

C2.—.01 mF. Mica. V1, 815, 829, 832, etc.

VS, VR150/30 or equivalent.

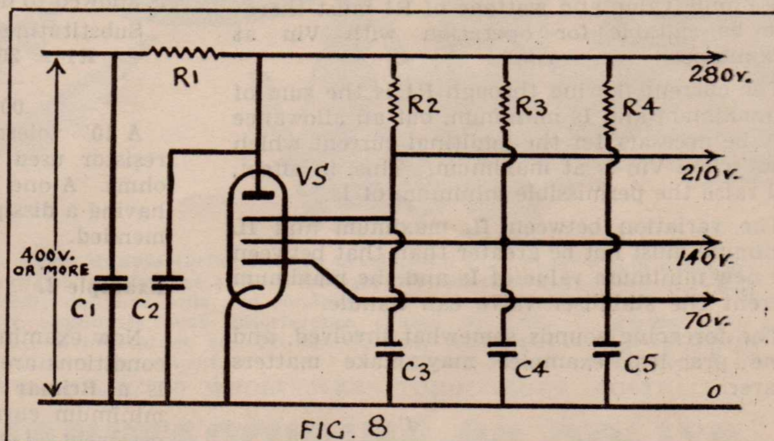

Fig. 8.—Connections of Stabilvolt to give four regulated positive voltages.

C1	**in power pack.**	**R1**	**See appendix.**
C2, 3, 4, 5, 6	**.1 to 1 mF.**	**R2, 3, 4**	**.25 or .47 megohm.**
		Vs	**Marconi Stabilvolt.**

tend to improve the performance.

The basic circuit used with a Stabilovolt is given in Fig. 8. The various resistors from each electrode to the main H.T. line ensure that each gap strikes, irrespective of that nature of the load. The values stated in the caption are average ones, based on a 400 volt line.

To obtain a negative voltage, the circuit in Fig. 9 is used. A potentiometer across the lower gap enables the bias to be varied, the potentiometer resistance being no higher than is necessary to maintain ionisation of the gap.

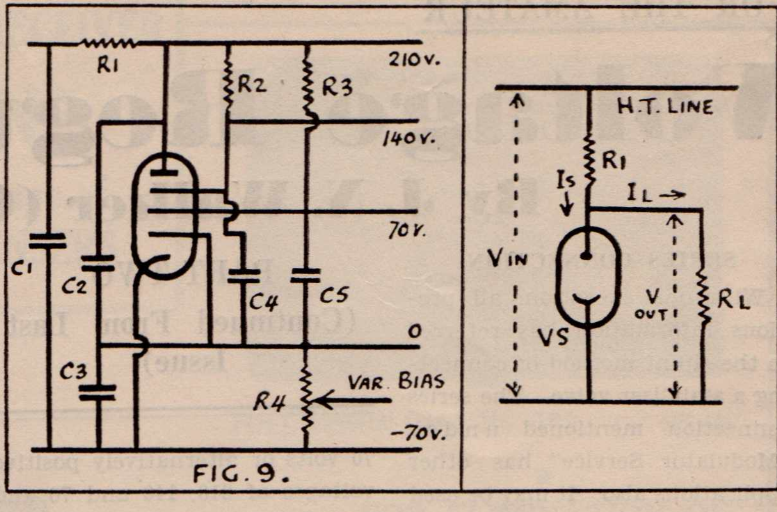

Fig. 9.—Connections of a Stabilvolt, to provide a number of regulated positive voltages PLUS one fixed and one variable negative bias voltages.

C1	**in power pack.**	**R4**	**10,0000 ohms or more.**
C2, 3, 4, 5	**.1 to 1 mF.**	**R1**	**See appendix.**
R2, 3	**.25 or .47 megohm.**	**Vs**	**Marconi Stabilvolt.**

DERIVATION OF VALUE OF SERIES RESISTOR

THREE conditions have to be borne in mind. They are (a) maximum and minimum values of input (H.T. line) voltage (Vin).; (b) maximum and minimum values of the current (IL) through the load; (c) maximum variation of current (Is) permissible in stabiliser valve.

Vout will, for practical purposes, be constant and any variation of Vin will appear across R1. The ohmic value and wattage of R1 must therefore be suitable for operation with Vin at maximum.

The current flowing through R1 is the sum of IL maximum and Is minimum, but an allowance may be necesary for the additinal current which flows when Vin is at maximum. This, in effect, will raise the permissible minimum of Is.

The variation between IL maximum and IL minimum must not be greater than that between the new minimum value of Is and the maximum current the stabiliser valve can handle.

The foregoing sounds somewhat involved, and some practical examples may make matters clearer.

Example 1.

In cases where the input voltage and load current variations are small — as with the oscillator in a receiver — the calculation is a straightforward one, based on average values. The formula to use is

$$R1 = \frac{Vin—Vout}{Is+IL} \text{ ohms}$$

Assume the average oscillator current is 6mA and the screen current of an associated valve is 1 mA. The stabiliser valve is a **Mullard 7475**, controlling at approximately 100 volts. The 7475 is allowed to draw 4 mA. Line voltage is 200 volts.

Substituting figures in the above formula:—

$$R1 = \frac{200—100}{.004+.007} = \frac{100}{.011} = 9091 \text{ ohms}$$

A 10% tolerance is permissible, and the actual resistor used may be between 8000 and 10,000 ohms. A one watt resistor will run hot, and one having a dissipation of 2 watts or more is recommended.

Example 2.

Now examine an example where the operating conditions are more severe. The stabiliser valve is a **Brimar** VR150/30, having maximum and minimum current ratings of 5 and 40 mA respectively. Let the load current be 30 mA max. and 10 mA minimum. The line H.T. voltage is nominally 250 volts, but is liable to vary over limits of 250 and 270 volts.

(Continued on next page)

Normal H.T. Voltage.

$$R1 = \frac{Vin - Vout}{IS + IL} \quad \left. \begin{matrix} Is\ (Min) + IL\ (Max) \\ (5) \quad (30) \\ Is\ (Max) + IL\ (Min) \\ (25) \quad (10) \end{matrix} \right\} = 35mA.$$

$$R1 = \frac{250 - 150}{.035} = 2860 \text{ ohms } (3.5 \text{ watts})$$

H.T. Volts 270

Volts dropped across R1 .... = 120 volts
Current through R1 (2860 ohms) = 42 mA.
Wattages rises to .... — 5 watts
Additional current through valve = 7 mA.
Is min becomes 12, Is max 32, which is permissible.

H.T. Volts 230.

Volts dropped across R1 .... = 800 volts
Current through R1 (2860 ohms) = 28 mA.
which is insufficient to provide maximum current through load and valve is liable to extinguish.

Consider 230 volts as normal.

$$R1 = \frac{230 - 150}{.035} = 2280 \text{ ohms}$$

Voltages rise to 270.
Volts dropped across R1 .... = 120 volts
Current through R1 (2280 ohms) = 53 mA.
(wattage over 6 watts)
Additional current through valve = 18 mA.
Is min becomes 23, max 48mA, which latter exceeds the limit.

On the face of it, the stabiliser valve will not cope with the operating conditions. However, intermediate values of R1 can be tried. If calculations are made on the basis of R1 being 2500 ohms, it will be found that the current flow is 32, 40 and 48mA respectively at 230, 250 and 270 line volts. Although, at the minimum value, the stabiliser valve will be passing only 2mA, the conditions are just met. Had this not been so,

(Continued on next page)

steps would have to be taken (a) to improve the line voltage regulation, possibly to the extent of using a circuit such as Figure 1, or (b) to alter the operating conditions to give less variation of load current, or (c) to employ a valve capable of passing a higher maximum current.

Example 3.

The calculation for the value of R1 with a Stabilvolt is carried out in the same way as with single gap valves. The load current in this case will be the sum of the currents drawn from each electrode, and there will be the standing ionisation current.

Assume the following conditions:—

Valve Stabilvolt .... = 280/40

H.T. voltage .... = 450

Current from A3 electrode at 210v. = 10 mA.

Current from A4 electrode at 280v. = 20 mA.

Current from A2 electrode at 140v. = 5 mA.

Current from A1 electrode at 70v. = negligible

Total load current IL is 35mA. Current Is is, say, 10 mA.

Vout is the max. stabilising voltage available—280 volts.

$$R1 = \frac{Vin—Vout}{IS+IL} = \frac{450—280}{.010+.035} = \frac{170}{.045} = 3777 \text{ ohms}$$

Wattage = 170 x .045 = 7.56—a 10 watt resistor is necessary.

Popular Pentode or Tetrode Transmitter Valves.

	Screen Volts	Av. Screen Current	Av. Grid Current	Bias (Class C)
PT15	300	25	6/7	—90
KT8	250	4—10	2	—40
807	250	9	3	—50
QQV04/20(815)	150	16	4	—45
QQV07/40(829)	200	30	12	—50
QV04/7	150	6	2.5	—45
813	300—400	15	10	—90
832	200—250	12/20	3	—60
Modulators, Per Pair				
KT66	250/300	5—12		—25
807	300	2—20		—30
815	125	5—32		—15
EL37	400	10—72		—32
EL38	400	5—56		—25

Obtaining Correct Resistor Values.

It will be found that the value of resistor required is nearly always some odd value. The nearest possible standard value may usually be used, erring on the low side if anything. Often, a near approximation is possible by making up a series-parallel combination of standard values.

Attention should always be given to the wattage dissipated and resistors used, having a total wattage adequate for the purpose.

BRITISH GAS-FILLED STABILISER VALVES

Min. Current	Max. Current	Current as voltage Reference	Base	Impedance	Type No.	Make	Regulating Voltage	Striking Voltage
7475	Mullard	90—110	140	1	8	4	B4	300
4687	Mullard	90—110	130	10	40	20	SC8	250
13201A	Mullard	90—110	135	15	200	—	B4	80
85A1	Mullard	83—87	125	1	8	4.5	B8G	290
VR150/30	Brimar	150	180	5	40	10	Octal	—
S130	Cossor	120	160/180	5	75	10	B4	—
	Osram							
ST11	Osram	100	140	1	8	4	B4	—
G120/1B	S.T.C.	55	100	2	30	—	B4	—
G180/2M*	S.T.C.	150	180	5	40	10	B8B	—
STV280/40	Marconi	280: 210: 140: 70:	400	5	35/60	—	B5	60 per gap
STV280/80	Marconi	as 280/40	400	10	35/100	—	B5	40 per gap
S70/20	Marconi	70	95	2	20	—	B7G	—
S95/10*	Marconi	95	110	2	10	—	B7G	—
S150/15*	Marconi	150	180	2	15	—	B7G	—

Notes:—All values of current are given in amperes.

*Fitted with auxiliary starting electrode—to be connected to HT through a high resistance (e.g., .25 megohm).

Permissible maximum current varies from gap to gap. Maximum figure applies to lowest voltage electrode and vice-versa.

Last three types are miniatures and therefore useful where space is restricted.

Type 85A1 is intended mainly for voltage reference purposes.

Search For Elusive HI-FI

A Letter From Mr. A. W. HOLLAND Surrey Hills, Vic.

Dear Mr. Hull: I am writing this letter to you for two reasons. Firstly, my experience in search of "Hi-Fr" may be of interest to readers of the *Radio World,* and, secondly, hoping for some help. In fact, the letter might well be headed "Where do I go from here?"

I have been interested in quality reproduction for about fifteen years, and started my activities in England with a detector, L.F. stage, transformer coupled to a pair of P x 4's in push pull, using D.C. mains for H.T., with the speaker in a service hatch between dining room and kitchen. The first two stages were battery valves and an accumulator looked after the P x 4 heaters, as well. With Brookman's Park station turning out 100 kilowatts 10 miles away, selectivity was no problem, as I had no hope of receiving anything else. The result was, however, quite good.

Twelve years ago I came to Australia and found conditions very different. I decided to build up as good a quality set as I could afford, and read through the local radio papers to find something suitable, and finally decided to build the Quality First rdeceiver designed by yourself and described in the now defunct *Wireless Weekly.*

It worked splendidly from the moment I first switched on and did sterling service for the next ten years. The speaker I was using was a Rola K 12. The line up, as you doubtless remember, was two stages R.F. (6D6's), a diode detector with a 6C6 driving a 2A3.

About two years ago I decided to try and improve on the set up without rendering myself bankrupt in the process. I perused the various articles on Hi-Fi assiduously, and, for a long time, did not know where to begin. I finally decided that, as the speaker is reputed to be the weakest link in the chain, I would start at the back end, as it were, and work forward.

I therefore ordered a Goodman's Axiom 12-inch speaker, and, while awaiting its arrival, decided to build a vented baffle. I managed to get hold of some heavy ply and after two week-ends of hard work installed my veteran K 12 and received a very pleasant surprise. The improvement in results was almost unbelievable. (I should mention that the K 12 had previously been in an ordinary Console cabinet, on a heavy ply baffle about 3 feet by 2 feet.) I expected an improvement in bass response, but was not prepared for the greatly improved treble responses. The whole reproduction was clearer, and the bass well and truly there, without any of the offensive boom so common and beloved of commercial sets. I sat back and happily awaited the arrival of my Goodman's, which duly arrived. Iut came the veteran and in went the Goodman's. I switched on and nearly wept. The results were terrible, or so it seemed, but prospective purchasers of Goodman's need not panic, yet !

I must have picked the worst evening in twelve months for poor recordings for my opening ceremony, and the Goodman's, as you well know, showed up every fault. After a day or two I realized that on live broadcasts I had something, but otherwise I had progressed backwards. The next and obvious step was that horror of horrors, a tone control,, which certainly helped on crook recordings.

As a result of changing from dynamic to permag I had an odd 100 volts to play with, ,and decided to direct-couple the 2A3. I was a bit annoyed with the residual hum and decided to put the power pack on a separate chassis, and did this

(Continued on next page)

SEARCH FOR ELUSIVE HI-FI (Cont.)

before changing over. With two good chokes and plenty of mfd. on a separate chassis, all trace of hum disappeared, in fact, it was impossible to tell if the set was on or not, when not tuned to a station.

DIRECT COUPLING

I then altered to the direct-coupled circuit, as described by Mr. Darragh, and achieved a worthwhile improvement. The results on direct broadcasts were definitely worth while. The realism is quite uncanny, compared with resistance coupling,, although it is very hard to decide where the real difference occurs.

Having really got worked up by this stage, I then altered the front end of the old "Quality First" and installed the A.V.C. circuit described in *Radio World* by Mr. Daley, which uses a 6SN7GT as an infinite impedance detector and A.V.C. supplier.

There was not a big difference here, from my point of view, but it made the set very easy and pleasurable to handle. Under the old circuit I had both bias and volume controls, which made it a bit puzzling for the rest of the family. They, at any rate, prefer the A.V.C. set up.

Up to this stage all is plain sailing, and if there are any other "Quality First" owners who get the urge to modernise, I would suggest that they instal a permag speaker such as a Rola 12/42 in a vented baffle and direct-couple the 2A3. The alteration to the front end is mainly a refinement for ease of handling, and, in my opinion, the Goodman's is an expensive luxury with the standard of broadcasting in its present state. It is certainly a fine job, but the price is the trouble, when one considers how few programmes are up to the necessary standard to display its quality.

TRIODE VALVES

I mentioned in the beginning that I was seeking some help. The reason for this is that 2A3's (and 6A3's) are now unobtainable, and my 2A3 is showing signs of wear and tear. Williamson amplifiers sound nice and dandy, BUT—I would need a new power transformer and output ditto—quite an expensive item without valves. An obvious alternative is the p.p. 45 circuit in February's *Radio World*. What I should like advice on is whether it would be possible to modify this to balance the 45's. Or, alternatively, how would p.p. 45's be, used in place of the 6V6's in the new standard circuit omitting the second 6SN7 of the 45 job. Further alternatives are a direct-coupled 45 in place of the 2A3, or even direct-coupling a pair of 45's in parallel.

Your correspondent who describes the p.p. 45 circuit rather apologises for it, as a poor relation of the 807 job, but is there any reason why it should not be the absolute equal of it apart from the output (who wants umpteen watts, anyway?), provided that the same care is taken to balance

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the circuit. If this is so, how should it be done?

I seem to be getting a little mixed up, but I think you will understand what I am trying to decide—whether it is better to use direct-coupled 45's, push pull 45's, or scrap the lot and start again. The last alternative is too expensive to bear contemplating.

I am also enclosing a cheque for subscription to the *Radio World*, as the monthly worry as to whether I have missed its appearance (I haven't, so far) is somewhat trying to the nervous system.

Trusting this letter may be of some interest, and hoping you may be able to give some good advice, Yours sincerely, A. W. Holland, 23 Warrigal Road, Surrey Hills, Vic.

In Reply

Your story about the experiences with the speakers, baffles and direct-coupled circuits makes interesting reading, and I am sure that a great many of our readers will be interested in it. It is only a pity that we don't get more letters like yours.

So far as we know there is no real shortage of the 2A3 and 6A3 triodes, and surely you will be able to buy a few if you shop around a bit. If you can't obtain them, then we suggest the parallel 45's as being practically the same. In fact, at one time, there was a valve manufacturer turning out type 2A3's that consisted of two sets of 45 type elements mounted in a single glass bulb. With regard to the output transformer, we would not think that it would be necessary to change this if it is designed for 2A3's and you use it with 45 triodes or type 807's in triode connection. For a circuit—well, at the moment all our enthusiasm goes out to the latest direct-coupled jobs using twin power supplies. They are easy to get into proper operating condition and can really perform when given half a chance by the associated equipment.—A.G.H.

EDDYSTONE DIALS

Owing to an error, the price of the Eddystone Vernier Dial was shown incorrectly in last month's issue. Correct price is 29/9

tends to emphasise lows. Strong low note response is not a bid idea if you want brilliance at low volume levels. Normal load is half a megohm, so if you have two 1 megohm resistors for the grids, and a 1 megohm pot, you will have this emphasis. If you use a pair of half-meg grid resistors and a 1 meg. pot you will have normal loading. If you have two 1 meg, grid leaks and a half-meg pot, you will have slightly less than normal loading, tending to cut the lows a bit. These points are handy to know, as they give you quite a lot of control over the balance of the reproduction.

When connecting 6SJ7's for triode operation, the suppressor will be connected to the plate.

Any type of output valve can be used if so desired, and already we have reports of success from readers who have used 2A3 and 6A3 type triodes. It is also quite in order to use the output valves as pentodes if you want greater power output, but beware of feeding a pair of 807's into a single speaker. Few 12in. speakers will stand more than 15 or 20 watts of sustained low notes, especially if they are not effectively loaded by proper baffling. By proper baffling we mean a yard square (or larger) of solid flat baffle, a properly designed and built box baffle or a baffling effect obtained by mounting a speaker in a wall between two rooms.

SINGLE-ENDERS

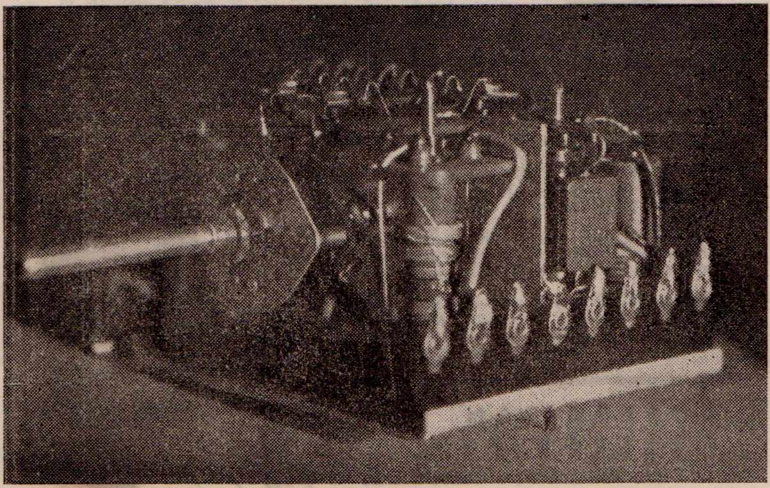
The idea of obtaining direct coupling by means of independent power supplies can be used with single-ended amplifiers just as well as with push-pull. Working on the original amplifier in haywire fashion, we found that most of the attractive features of the push-pull job can be obtained with a single-ender, with the added convenience of having one side of the input unearthed. Theorists may point out that the by-pass condensers will have reactance effects in much the same way as coupling condensers, so that single-ended direct-coupled amplifiers do not have so many advantages over resistance-capacity ones as can be claimed for the push-pull versions which have no condensers.

Circuit for the singl-ender which we give requires little further explanation. Any types of audio and output valves can be used, if correct bias and load resistors are used. With an 807 in the output stage, the main bias resistor will need a by-pass condenser with a voltage rating of at least 100 volts. Those rated 25 or 40 volts will not do. A 16mfd. 350 volt condenser is O.K. There are also some 24mfd. 300 volt disposals condensers about which will serve.

In response to several requests and enquiries. Yes, we hope to build up a complete set using one of these amplifiers, and hope to be able to give photographs and full diagrams in an early issue. At the moment, however, printing and production troubles are giving us very little spare time for set-building.

With regard to the amplifier by Outhred in the May issue, we have not yet actually built up or operated one of these in our own laboratory, but we have the highest reports about Mr. Outhred, personally, and from an examination of the circuit we would certainly expect it to be good. We hope to build one for our own use in the course of the next few weeks.

NEWEST R.C.S. DUAL-WAVE BRACKET



The above coil unit is the latest release from the famous R.C.S. Coil Factory. It is the improved version of the type DW29 dual-wave bracket, but with r.f. stage ahead of the converter, completely wired and tested. An accessible terminal strip makes for easy wiring. All trimmers and padders are built into the unit. Exceptional sensitivity and selectivity can be obtained in a receiver using this coil unit.

FOR DISPOSALS RECEIVERS

List Of Instruction Manuals

From our good friend, Geoff Masters, of the Papuan Theatre, Port Moresby, comes the following list of instruction manuals which are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D.C., U.S.A.

Biggest problem in connection with the procurement of these instruction booklets is to obtain the necessary dollars, which are controlled at the moment. Friends or relatives in the United States are very handy, as they can send them out as "gifts" without falling foul of restrictions.

Catalogue No.	Name	Cost Cents
W.1.33-24-18	Radio Communication	10
W.1.35- 1-470	Aircraft Radio Shop Practice	20
W.1.35-11-235	Radio Sets Scr. 536	35
11-237	,, ,, ,, 131 & 161	10
11-238	,, ,, ,, 194 & 195	15
11-239	,, ,, ,, 203	10
11-245	,, ,, ,, 511	35
11-250	,, ,, ,, 288	15
11-272	,, ,, ,, 210 & 245	30
11-280	,, ,, ,, 299	40
11-281	,, ,, ,, 399 & 499	100
11-300	Frequency Meter Sets Scr. 211	50
11-308	Remote Control Unit RM29	15
11-620	Radio Sets Scr. 608 & 628	60
11-805	,, ,, ,, 197	75
11-820	,, ,, T-4/FRC	75
11-822	,, ,, 149A	20
11-859	,, ,, Scr. 593A	15
11-862	,, ,, ,, 504A (D.F.)	35
11-873	,, ,, ,, 614 & BC 969	03
11-879	,, ,, BC 1335	50
11-1062	,, ,, BC 968	50
11-317	,, ,, R.C. 150-151	45
11-1324	,, ,, Scr. 584	45
11-1340	,, ,, AN/TPS-3	30
11-1341	,, ,, Scr. 615	35
11-1343	,, ,, AN/MPN-1	40
11-1362	,, ,, RC 384	20
11-1417	Maintenance Manual for RC-150-151	25
11-1424	Radio Sets Scr. 584	35
11-1431	Maintenance Manual RC 145A	25
11-1541	Radio Sets Scr. 615	150
11-1554	,, ,, ,, 784	400
11-1561	Service Manual Scr. 682	100
11-2601	Radio Sets AN/TRC 1-2 & 4 M to T	75
11-4001	Repair Instructions BC 312A-C-D-E-F-G-J-M-N-HX-NX-BC 342 A to N	35
11-4018	Radio Sets B.C. 745	20
11-4019	,, ,, B.C. 611	25
11-4022	,, ,, B.C. 630	25
11-4024	,, ,, B.C. 1000	20

STROBOSCOPE—

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the fundamental frequency until the frequency gets too high for bringing the image of the dots to a non-moving state. When this happens, a higher fundamental frequency must be employed.

Return the pointer to the 2500 c.p.m. point on the scale. Now slowly — very slowly — turn the stroboscope speed slower until you see a single dot again, as at 2500 cycles. This new frequency is just half the fundamental frequency — 1250 c.p.m. Repeat this last procedure as often as practicable, obtaining respectively 625 c.p.m., 312½ c.p.m., etc.

Instead of a rotating shaft as a frequency standard, you may prefer to wind a small solenoid and vibrator to work from the A.C. mains, and use this as a standard of reference (Fig. 4).

Incidentally, if the audio transformer for the 'scope's plate circuit is to be home made. I have tried out the following type with good results.

Primary — 50 turns 18 B. & S. enam., centre tapped.

Secondary—200 turns 22 SW.G. enam.

Wind the primary on to a laminated iron core — an old speaker "tranny" core will do—wrap around at least eight turns of shellaced brown paper, and soak the whole in liquid paraffin wax before adding the secondary. Wrap on more paper, and again immerse the completed transformer in paraffin, and stand aside to drain.

Odd Resistor Valves

THERE appears to be some confusion as to why odd values of capacity and resistance are appearing in circuit diagrams. However, there is a good reason for this when it is understood why.

There is a new system of numbering being used now, and this is based on the idea that permissable tolerances in values are what counts. Starting with 1 (10, 100 or any decimal multiple) values increase logarithmically so that each higher value represents a constant percentage increase over the value immediately below it. In practice, the values are rounded off to two significant figures, this order of accuracy being enough to give a complete range of the smallest tolerance (5%) ordinarily required.

A summary of values from 10 to 100 is given in Table 1. Larger values are found by multiplying by 10 or any multiple of 10, smaller values by dividing by 10 and its multiples.

Many of the old numbers such as 25, 50 and other "even" values do not appear. However, such values in themselves usually have no particular significance; they are simply convenient numbers to remember. Where no tolerance is specified it is to be understood that the largest tolerance available in that value is to be used; where two or three tolerances are available and a small tolerance is required, it will be specified. For example, if a 47,000 ohm resistor is called for, the tolerance is understood to be 20% unless otherwise specified. On the other hand, the 36 value appears only in the 5% column, so it would be understood that a 3,600 ohm unit would have 5% tolerance.

Values for the capacitances of small mica condensers follow a similar table, although in this case values listed under 5% tolerance can also be obtained with 2% tolerance.

20% Tolerance	10% Tolerance	5% Tolerance
10	10	10
		11
	12	12
		13
15	15	15
		16
	18	18
		20
22	22	22
		24
	27	27
		30
33	33	33
		36
	39	39
		43
47	47	47
		51
	56	56
		62
68	68	68
		75
	82	82
		91
100	100	100

VALVE RATINGS

IT is interesting to note that now give special high-voltage the American manufacturers ratings for receiver-type valves when used in amateur transmitting equipment. Values are for intermittent use only, in Class C r.f. The 6F6 can be used with 400 on the plate, 275 on the screen and a plate current of 50 milliamps, to give 14 watts of output power. The 6L6 will take 400 on the plate, 300 on the screen, and a plate current of 100 milliamps, delivering 28 watts. The 6V6 is rated at 350 on the plate, 250 on the screen, with 47 milliamps plate current, delivering 11 watts.

These ratings do not apply to audio use.

NOTE TO SUBSCRIBERS

The recent increase in price does not apply to current subscriptions.

Having supported us through thick and thin, we do not expect you to make any extra payment until your present subscription expires.

UP AND DOWN

(Continued from page 25)

case, too, the faulty component was opened up for examination, but failed to show any reason for its strange behaviour. All element connections were examined with a powerful glass, but appeared to be firm.

It would have been a most difficult service problem to solve if it had not been for the fact that another set of the same type, but performing to perfection, was available for the substitution test. As soon as it was found that the trouble switched from one set to the other when 6G8's were exchanged gave the unmistakable clue.

Shortwave Review

Conducted By L. J. Keast

YOUR PROGRAMME GUIDE

Have just received from the B.B.C. the General Overseas Service Programme Guide for April 3rd to July 2nd. It is impossible to print here the full programme but I think DX-ers will be interested in two good shows, viz., "Take It From Here" which features our own Dick Bentley and Joy Nicholls, and "Hi, Gang! 1949." "Hi, Gang!" will be remembered when it first came on the air in 1940. The three stars who made the show such a success were Vic Oliver, Bebe Daniels and Ben Lyon, and they appear again.

"Take It From Here" is scheduled for 6.30 p.m. on Saturdays and 10.15 on Sundays, or if you are doing a bit of early morning listening, 3.30 a.m. on Saturdays. Comes through splendidly on Sunday nights, particularly on the 16 metre band.

"Hi, Gang!" is listed for 6.15 and 11.30 a.m. and 2.30 p.m. on Fridays.

YOUR WAVEBANDS

The BBC expects to be serving Australia, New Zealand and Oceania during May and June on one or more of the wavebands shown in the table below:

May	M	19: 25: 31
	A	19: 25
	E	16: 19: 25: 31
June	M	16: 19
	A	13: 16: 19
	E	13: 16: 19

At time of writing these notes the wavelengths in use from 4-5.45 p.m. in the special programme for the Pacific are: Australia, 30.96, 25.38 and 16.93 met.; New Zealand and South-West Pacific, 31.22, 25.42 and 19.44 met.

CORRECT WAY TO TRY FOR A VERIE

Mr. Max Krumbeck writes: "Some time when you have space in your section, what about setting out an example of the correct way to set-up and write for a report. I find I am experiencing a great deal of difficulty in getting back veries." In our Special Data Handbook Issue, September 18th, 1948, on page 55 under the heading "How to Get an Extra Thrill from DX-ing," I gave a few hints on how the report should be prepared.—L.J.K.

VICTORY THROUGH AIR POWER

Allied planes have flown into Berlin for the last eleven months to break the Russian Blockade and it looks as though a different kind of air power will carry on for some time. In their natural desire to tell the world that the blockade has been lifted, the BBC considered the news should be given to Russia also and in their three daily sessions, 2.45 a.m., 5.45 a.m., and 2.30 p.m. (I am of course quoting Sydney time) they gave it. But apparently this was not wanted in Russia and the regular sessions were badly jammed. A hurried conference with the "Voice of America" authorities and a "reply" was staged resulting in the use of 61 frequencies to counteract the jamming. So maybe that terrible screeching sound you find at the above quoted times may be part of the cold war that is going on.

The last schedule list I have from the BBC gave their wavelengths for the early morning sessions as 49.500, 42.13, 31.01 and 25.68 met. while in the afternoon 49.500, 48.78, 52.13 and 31.01 met. are used.

I read in the papers the other day where a London newspaper said "One wave-length which the BBC is taking over for the increased transmissions is 42.3 met. which is reserved by International Convention for amateurs. A BBC spokesman said: "Amateurs will have to give way." Unless my records are a little bit out of date, I think the Cairo Conference regulations which came into force on September 1st, 1939, made the band from 7.200 m.c. to 7.300 m.c. to be shared between amateurs and broadcasting. In A.R.W. of December, 1946, I quoted in full a cutting from "London Calling" on the 41 metre band. Portion of it said, "Whilst the BBC is justified in using these frequencies for its broadcasting services, it naturally does not wish to interfere with the activities of amateurs, and will always seek to avoid such interference by choosing frequencies in other broadcasting bands when these are suitable and available."

(Continued on next page)

STOP PRESS

B.B.C. PACIFIC SERVICE

For Australia and New Zealand 4-5.45 p.m.

Transmitters brought into operation as from May 14 are:—

GS1	15.26 m.c.	19.66 metres
GSN	11.82 m.c.	25.39 "
GWH	11.80 m.c.	25.42 "
GRH	9.825m.c.	30.53 "
GRX	9.69 m.c.	30.96 "

At my listening post I find the new transmitter (for this service) GRH, excellent and absolutely in the clear.

NEW STATIONS

. . ., Benghazi, Libya, 4.79 m.c. 62.63 met.:

"Radio News" reports a new station on the air from 5-6.300 a.m. Just before closing they play Ted Lewis' "Good-night Melody.' I doubt if we would hear it at the hours shown, but you can add it to your register.

CHANGE OF FREQUENCY

VLC-11, Shepparton, is now using 15.22 m.c. 19.71 met. and latest advice from "Radio Australia" lists it on the air as follows: To Europe from 6-7.55 a.m. news is given at 7.45; 3.300-4.15 a.m. (German). Southern Asia from M/N-12.45 a.m.

VLC-11 is still listed as being allotted 15.21 m.c. 19.72 met. so they most likely moved to 15.22 to avoid interference to or from WBOS Boston who is broadcasting on 15.21 m.c. to Europe from 5-8.45 a.m.

VERIFICATIONS

Rex Gillett, of Prospect, South Australia, writes: "A verie from Radio Mediterraneo, Valencia, Spain, gives the schedule as 10 p.m.-1 a.m. and 5-9 a.m. on 7.0372 m.c. 42.63 met. Opens with march "Hacia Valencia" and closes with "Marcha de la Cuidal. ((Call-sign is EAJ-3 and interval signal is a xylophone.—L.J.K.).

Radio Club de Angola via a nice card advises that CR6RL and CR6RN on 9.477 and 8.09 m.c. respectively operate from 4.30-7 a.m., whilst CR6RA on 10.795 m.c. is from 4-6 p.m.

According to a letter verie from Radio Palemburg, the station is on the air daily from 7.30 p.m. till 1 a.m. on 4.855 m.c. 61.41 e.mt with programmes in Dutch and Indonesian. Address: Kantooren Studio, Talang Djawa 7, Palemburg, Sumatra.

Veries from Cypress and Sumatra mean that I have now 105 countries verified whilst reports are out to 10 others.

Mr. C. R. Woolsey, Terrigal, has received a verification from Radio Saigon in which they advise they operate on 6.163 m.c. and 11.78 m.c. English sessions are: 9.30-9.45 a.m.; 10.38-11 a.m.; 7.15-8.30 p.m., and 11.300 p.m.-12.30 a.m. Reports should be addressed to Mr. Jean Pipon, English Dept. Radio Saigon, Saigon, French Indo-China.

Another verie received is from CHLS, 9.61 m.c. Sackville, Canada.

According to a letter sent to New Zealand DX-TRA "Tune In" KZRH and KZMB (now DZH-2 and DZH-4 respectively) do verify. They say both send out QSL cards. . . We have had in the past few months a number of DX reports from New Zealand and as far as I have checked these they have been verified, but please assure DX-ers that we will be glad to verify any reception report received by us." The letter was signed by the General Manager, Mr. W. H. Wallace.

SAYS WHO?

Mr. Rex Gillett, of South Australia, say: "Dear Les. It's been some time since I last wrote you and even now I don't think that I have much news for you." But just look at what follows and I am sure there are many listeners who would like to have been able to present such a fine list.

Radio Donala, Fr. Cameroons, heard on 9160 k.c. with a musical programme 4.30 a.m. Signals were reasonably fair despite power tone buzz.

OTH (call from Swedish DX Bulletin No. 50) on 9210 k.c., heard with fairly good signals in native programme and some announcements in French before signing off at 4.30 a.m. with an anthem. Reference made to Radio Congo Belge in the French announcement prior to sign off.

Radio Indonesia in Djokyakarta about 5095 k.c. closes with the Dutch National anthem at M/n. Signs. are only fair here.

Am hearing Athens opening on 15330 k.c. at 8.28 a.m. with a horn-like interval signal, followed by a march and an announcement in Greek. At 8.300 a.m. a lady said in English "This is Radio Athens, you are listening to the Voice of Greece . . . this broadcast is beamed to the U.S.A. . . ." News in English follows.

Radio Algiers states in verie: "We b/c every day fom 4 a.m. to 6 a.m. in Arabic and from 6-9 a.m. in French." Frequency 9570. DZH-5 is heard on 9690 k.c. at 7.30 a.m. but is never very good here.

"Radio Hongkong" 9525 k.c. has been heard in French to 9 p.m., when BBC news presented. This does not seem to be a daily feature as to-night (March 30) programme is of recorded music compered in English.

HEU-3 on 9665 k.c. heard closing after English programme 4.30 a.m. Suffers interference from neighbouring stations on the dial.

Who's the station opening on 6230 k.c. at 9.30 p.m.? Is this CE622 moved to avoid Chow on 6220 k.c.? No English heard on opening if it was CE622.

LRM, Radio Aconcagua heard opening with march on 6180 k.c. 1000.

Mr. Max Krumbeck writes: "Just received April 'Radio World,' and realise I haven't sent in any reports lately—not that there is much to tell as I'm still and will be for a few years yet poring over my studies. Isn't it a pity we can't make a living being a DX reporter?"

Airletter card from Algiers gives details of apparently their only present S.W. transmitter on 9.57 m.c. from 4.30-6 a.m. in Arabic and 6 a.m.-9 a.m. in the French language.

From Macassar comes details of YDQ (9.55 m.c.), YDQ-3 (11.084 m.c.3 and YDQ-2 (5.03 m.c.) with daily programmes giving news in:

Dutch: 9.30 a.m. (YDQ); 3.15 p.m. (YDQ and YDQ-2); 4.15 p.m. (YDQ and YDQ-2); 10.30 p.m. (YDQ-3).

Indonesian: 8.30 a.m. (YDQ and YDQ-2); 9.03 a.m. (YDQ-2); 2.03 p.m. (YDQ and YDQ-2) M/N (YDQ and YDQ-2).

Makassar: 7.30 pm.. (YDQ and YDQ-2).

Bukinese: 7.40 p.m. (YDQ and YDQ-2).

OZF, Denmark, on 9.52 m.c. was heard on a Saturday at 3.05 p.m. with fair signal and quite a good readability.

LKQ, 11.735 m.c. Oslo, Norway, with a daily programme 9-10 a.m. is coming in well on a good strong signal. Announcements in English are made at 9.01, 37 and 57, when frequences were announced as 15.17, 11.735 and 9.36 m.c. Reception reports were asked for. Programme consisted of 40 minute talks in presumably Norwegian, whilst the balance was made up of traditional music."

HELP WANTED

Rex Gillett wants to know if anyone else has heard a Chinee on about 11.68 m.c. at 10.30 p.m. They seemed to announce call as BEAF (maybe the F was 7). Call not heard in English.

Latest air mail report from "Sweden Calling'" says call sign sounds like BCAF and is probably the former XGAF Chinese Air Force Station moved from Nanking to Taiwan, Formosa). L.J.K.

SHORTS

HER-6, 15.305 m.c. 19.60 met.; HER-5, 11.865 m.c., 25.28 met.; HEI-5, 11.715 m.c., 25.61 met., are all heard at terrific strength opening on Fridays at 5.15 p.m. calling Australia, New Zealand and Far East. The delightful chimes of the Swiss stations are heard for 5 or 10 minutes before opening. The announcement "This is Switzerland Short Wave Service in Berne, Switzerland," is followed by news.

"National Greek Army Broadcasting Station," B Army Corps, 453 Signals Battalion, Larissa, Greece, operates on 6.745 m.c. 44.52 met. daily from 11.15 a.m.-5 p.m.; 8 p.m.-M/N.; 2-6 a.m. English session is on Mondays, Wednesdays and Saturdays from 5.30-6 a.m. This is probably the only time they would be heard.

ZYK-2, Recife (Brazil) 15.145 m.c. 19.82 met. is reported as being heard in New Zealand with excellent signals till closing at 5 a.m. Programme is in Portuguese and they will verify correct reports. Slogan is "Radio Journal de Comercio."

"Kol Yisrael," Tel Aviv, Israel, 6.82 m.c., 43.96 met. in parallel with Haifa on 8.17 m.c., 36.72 met. operates: 2.45-4 p.m. (Sat. 2.30-4.30, Sunday, 2.45-4.30); and 7.300 p.m.-10-15 p.m.; 1-6.03 a.m. (Sun. 1-7 a.m.).

NEW STATIONS

VLX, Perth, 6.13 m.c., 48.95 met.:

This is a new station operated by The Australian Broadcasting Commission, and, after several tests, is now on the air daily as follows: 8 a.m.-1.15 p.m.

VLX, Perth, 9.61 m.c., 31.22 met.:

This frequency is used from 1.30 p.m. till 8 p.m. daily.

Speedy Query Service

Conducted under the personal supervision of A. G. Hull

J.A.R. (Kelvin Grove, Q.) is in doubt about amplifier gain.

A. The amount of gain required will depend entirely on the input. You must work back from the grid of the output valve. If the valve has a bias of 16 volts it will accept a signal of not more than this voltage. With resistance-coupling or direct-coupling the gain is unity, and you take a step back to consider the gain in the audio stage, about 10 to 20 for low and medium gain triodes, 40 for high-gain triodes and 100 for pentodes, roughly. Crystal pick-ups will give you from 1 to 3 volts peak, so only a triode audio stage is needed with a sensitive beam power valve in the output stage. If you have a 2A3 triode in the output biassed about 40 volts you might manage with a high-gain triode, or have plenty of gain in hand by using a pentode. Why not build up the job with a 6J7G first audio, and experiment with both triode and pentode connections? To make it a triode you simply connect screen and suppressor to plate.

B.S. (Benalla) finds it difficult to remove the insulation from nylex-covered hook-up wire.

A. A sharp knife is what we use Cut the wire to the required length, then roll it on the bench under the pocket knife blade, about three-eighths of an inch from each end. A slight pull and the little tube of insulation slips off the end of the wire. At first you may press too hard on the knife and cut right through the strands of wire as well as the insulation, but a little practice, and you will know the feel of the metal against metal.

E.S.G. (Richmond) and others who missed the run-ovar of the article on the "Simple Mantel Model" in the April issue.

A. Yes, there were plenty of minor tragedies in that issue. It is a tough job to get the printing done well. The run-over was only a matter of an inch or two of unimportant details. Main tragedy in this particular article was the omission of filter condensers from the circuit diagram!

N.R. (Bellevue Hill) points out an error in the circuit of the "Factory Designed Circuit" in the May issue.

A. Yes, there was a slight slip of the pen when the line down from the aerial coil didn't stop at the a.v.c. line as it should have done, but skidded on to the oscillator tuned circuit. It just shows how speed becomes a habit. Our circuit draughtsman recently bought a "Speed Twin" motor bike.

G.K.J. (Adelaide) complains of late delivery of the May issue.

A. Yes, we are having plenty of production troubles, but, now that the job is being done under our own wing, here in Mornington, we hope to catch up on our schedule again gradually. Rest assured that we are doing our best under difficult circumstances. A big increase in sales over the past couple of years has made the print run a long job, especially with the printing machinery at our disposal. Being only a little independent publication we lack the backing of a big newspaper organisation with its fast rotary presses.

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. Minimum 16 words. When sending in your advertisement be sure to mention the name of the agent with whom yoo have your order placed, or your receipt number if you are a direct subscriber.

FOR SALE—English "Goodman's" 18in. cinema speaker, brand new. £20 cash. Write "No. 8507," c/o. Radio World, Box 13, Mornington, V.

FOR EXCHANGE—Radio, electrical gear, including complete "Hammarlund" Super Pro tuning unit with instruction book, for two 16 m.m. projector mechanisms, less amplifiers. L. Harrison, c/o. Dept. of Education, Pt. Moresby, Papua.

FOR SALE—English "Hambander" receiver, ideal for ham radio. Brand new sample. If interested in making an offer for this fine set, write to arrange a home demonstration. No. 8503, c/o. "Radio World," Box 13, Mornington, Vic.

FOR SALE—English 19 receiver, with a.c. power supply, 6V6 output, bandswitched 3 to 8 megs. 7 tubes, £10. Further particulars from R. V. Francis, Box 250 Naracoorte, South Australia.

WANTED—Talkie or silent 35 mm. films; dramas, shorts or cartoons. Particulars to C. Ryan, 143 Talford street, Rockhampton, Q.

FOR SALE—Model aero engine, "E.D.," Mark II, brand new, never fuelled. Cost £7/17/6, will sell for £6. Apply No. 8508, c/o. Radio World, Box 13, Mornington. V.

"The Radio Enthusiasts' Supply Store"

MAGRATHS HAVE THEM..

Resistors

I.R.S. and Chanex. Wire wound and carbons from .. .. **5d.**
Plus tax, 10%

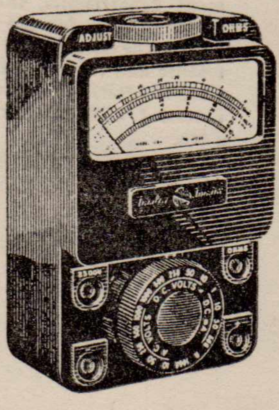
Coil Units

AEGIS TYPE K3 2 short wave band 13-42 meters, 40-80 meters and B/C band, complete assembly with switch and condensers **126/9**
Plus tax, 10%

Condensers

Paper tubulars, Mica and block type from **4d.**
Plus tax, 10%

TAYLOR JUNIOR AC/DC MULTIMETER

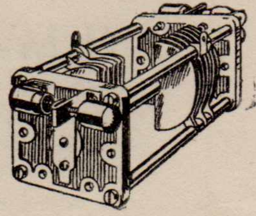


Model 120A 21 Ranges—Sensitivity 1000 ohms per volt. Weight with battery 14 ozs. High-grade shockproof moulded case measures 4⅞" x 3⅛" x 1 15/16" deep. Provided with three plug-in test leads, two with crocodile clips and one insulated test prod. A special device connected across the meter gives instantaneous overload protecton on all ranges. Internal battery easily accessible and cc adjust ohms control compensates battery voltage variations. Extremely accurate on all ranges.

DC Volts	DC mA	AC Volts	Resistance
0-0.25	0-1	0-10	0.5-20-2000 ohms
0-10	0-10	0-50	50-2000-200,000 ohms
0-50	0-50	0-250	*500-20,000-2 megohms
0-250	0-500	0-500	*5000-200,000-20 megohms
0-500		0-1000	
0-1000		0-2500	
0-2500			

Price - - - £9/17/6

EDDYSTONE TRANSMITTING CONDENSER



Identical in construction—length only varying according to capacity value—the condensers listed have ceramic end plates 2½" square—Single point rotor earthing connection prevents circulating RF currents. Lugs on the stators permit either the direct fixing of the associated coil or for connections to stand-off insulators, etc. Alternative contact points available. Vane spacing 8"—adequate for high voltages, provided DC is removed by insertion of blocking condenser between rotor and earth. Metal parts, including spacing pillars, supplied for three point chassis fixing. Standard ¼" spindle. Each condenser of the split stator type, directly applicable to balanced circuits. For aerial tuning and single-ended circuits, one section may be used singly or both can be connected in parallel. A wide range of working capacities thus becomes available.

No. 611 - - - - - - - - - 57/- **Plus Tax**
No. 612 - - - - - - - - - 50/6 **Plus Tax**
No. 614 - - - - - - - - - 58/3 **Plus Tax**

Germanium Crystals

Crystal type C.G.I. **20/-**
Plus Tax, 10%. Each.

R.F. Chokes

AEGIS, obtainable in 1 to 4 Pye, including tapered 2.5 inductance.

Note.—R.F. Chokes are available to any inductance of specificaton supplied.

Crystal Filter Coils

AEGIS type M22 input 455KC
M22A, OUTPUT 455KC **8/3**
Plus tax 10%

Terminals

Phillip Type Heavy duty. **1/6**
Plus Tax, 10%.

Solder

English Ersin, multi-cored. Plus Tax, 10%. **8/3**

Tag Strips

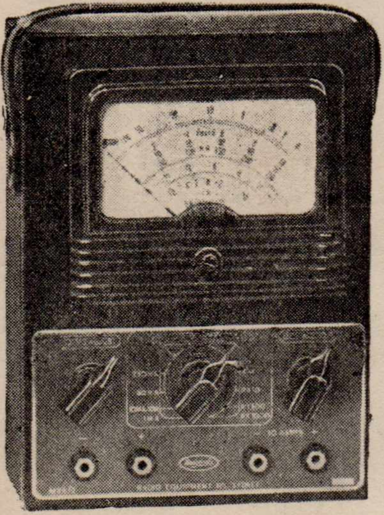
2" wide, 12 lugs a side. **2/-**
Plus Tax, 10%. Each.

J.H.MAGRATH & Co.

208 LT. LONSDALE ST., MELBOURNE *Phones:* **CENT. 3688 4414**

University news:

Successful Twins In The Multimeter Field!

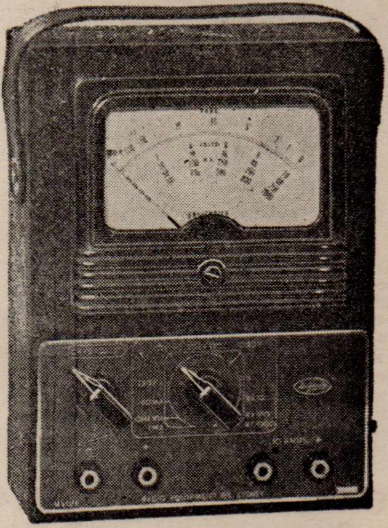


Two New Multimeters With
Many New Features:
In Attractive Cases

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 3in.

Write For
Details
and Prices



MODEL MVD : DC

Popular with radio men and electrical men alike—the model MVD Multimeter is built into a sturdy brocade finished metal box—has built-in batteries—yet measures only 8 in. x 6 in. x 3 in.
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.

RADIO & ELECTRONIC TEST EQUIPMENT

University

MANUFACTURED BY RADIO EQUIPMENT PTY. LTD., 5 NTH. YORK ST., SYDNEY, BU3169 (2 LINES).

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