THE AUSTRALASIAN

Radio World

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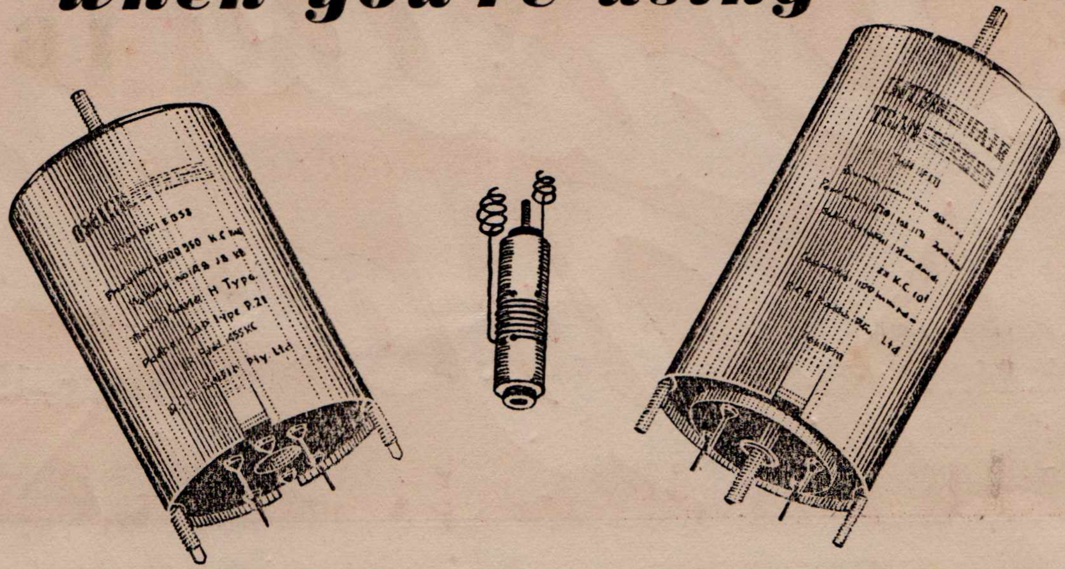
1/6

VOL. 14. . . Nos. 2-3

July-Aug., 1949

You're on the BEAM when you're using



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RADIO WORLD

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and incorporating

ALL - WAVE ALL - WORLD DX NEWS

PUBLISHED BY THE PROPRIETOR—
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CONTENTS

EDITORIAL.

BIG moves are on foot for the future improvement of our little publication, but the first steps have further increased our production difficulties so that it has been found necessary to "skip" an issue by making this a combined one to cover both months of July and August. The next issue will be the September issue and will be out in about four weeks time, well ahead of its publication date. Expiry dates on our subscription lists will be extended by one month accordingly.

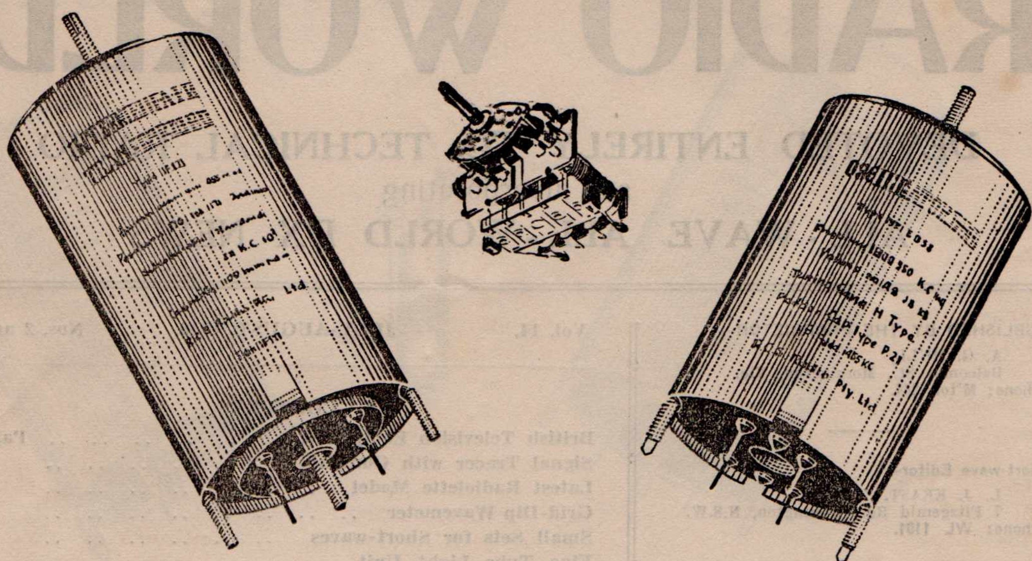
Main reason for the production delay has been the digging of an excavation in the floor of our local printing works, into which is being installed one of the finest and fastest automatic printing machines in the world. Just landed from Sweden, at a cost of about £9,000, this machine will turn out a much better Radio World at a cheaper cost and in much quicker time. It may take a month or two to get everything in place and running sweetly. In the meantime there may be a certain amount of tripping over cement bags and the like, but the prospects for the future are mighty bright

For many months past our big problem has been on the actual production side, so that we have not been in a position to go into ideas for improvements to the editorial side. Now that the production problems are in hand, our thoughts again turn to executive and editorial matters. Suggestions from readers as to what they would like to see in our columns are again invited.

—A. G. HULL.

Printed by "Post" Newspapers Pty. Ltd., Mornington, for the Proprietor of the Australasian Radio World, A. G. Hull, Balcombe Street, Mornington, Victoria.

Behind good reception . . .



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British Television Equipment

HIGH STANDARDS MAINTAINED

By

SIR ERNEST FISK

Deputy Chairman and Managing Director of Electric and Musical Industries Limited, Hayes, Middlesex, England.

THE scientific and engineering development of television in Britain is being pushed ahead today at a greater rate than ever before. Being the first country in the world to operate a regular public television service imposes on us an obligation to keep in the forefront of this vital modern development and, without hesitation, I say we are dong that.

It is widely recognised that the continuous transmission from the stadium and other places of the 1948 Olympic Games by the British Broadcasting Corporation, with modern television equipment wholly produced in Britain, was one of the most outstanding achievements in the history of applied science.

This very efficient equipment was not merely engineered and fabricated in Britain, but it was also entirely the result of British scientific research. Many hundreds of thousands of people witnessed those epoch making scenes in their homes within range of the television station in London.

Perhaps the most remarkable technical development of recent years is the new British television camera, known as the C.P.S. Emitron. In the world of engineering there is no such thing as a perfect machine, but the C.P.S. Emitron camera is as near perfect for its purpose as present day scientific knowledge can make it. This great British invention, which, during the next few years, promises to revolutionise our television service is a post-war product of the famous Electric and Musical Industries Research Laboratories at Hayes, Middlesex, in England. Many of the scientists in those laboratories have, with the exception of the war years, concentrated on television research for periods up to 20 years and they consequently have a knowledge and understanding of this complex subject which is unexcelled in any part of the world.

Television Cameras.

Television cameras are not to be confused in the mind with cinema or other photographic cameras. They work on entirely different principles, utilizing the science of electronics in some of its most advanced forms, instead of the science of chemistry which is the major factor in ordinary photographic apparatus. The elec-

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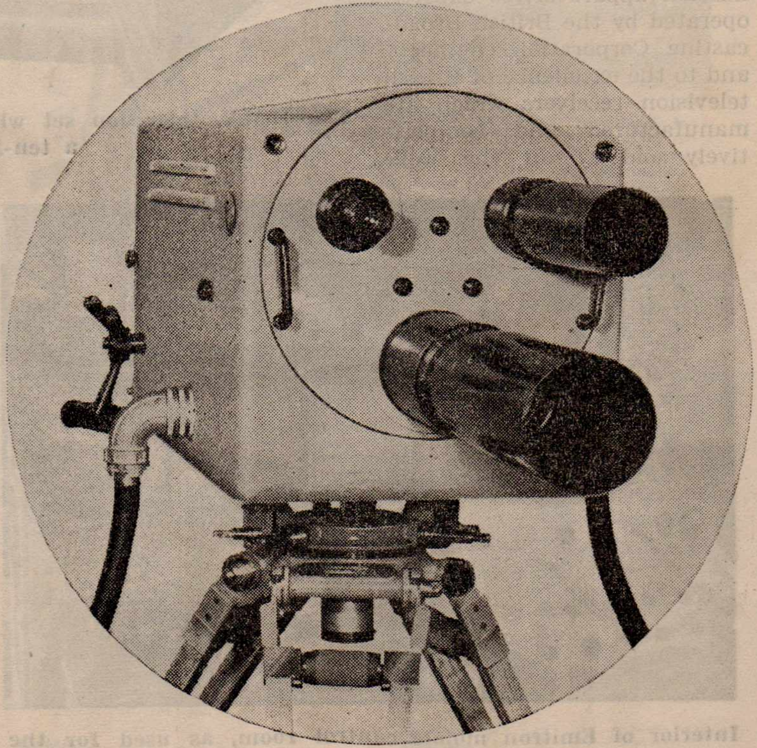
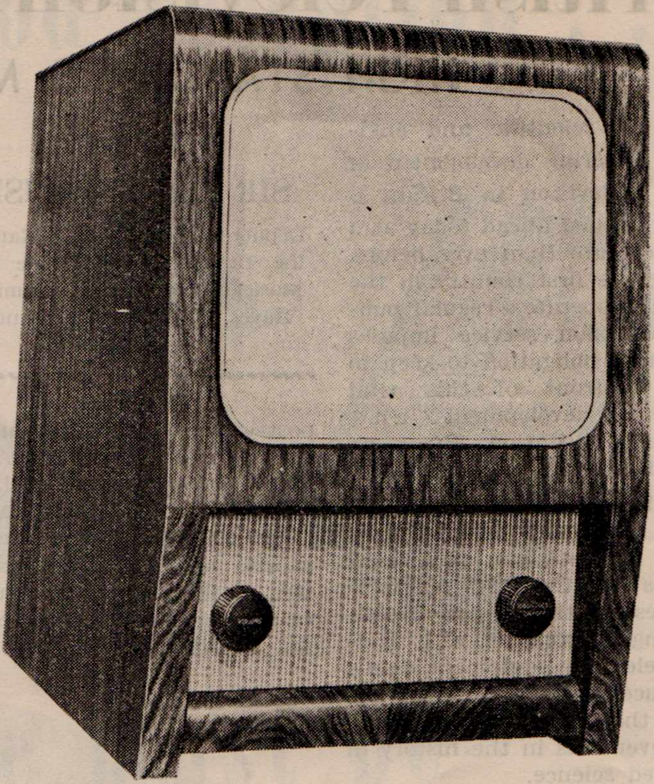


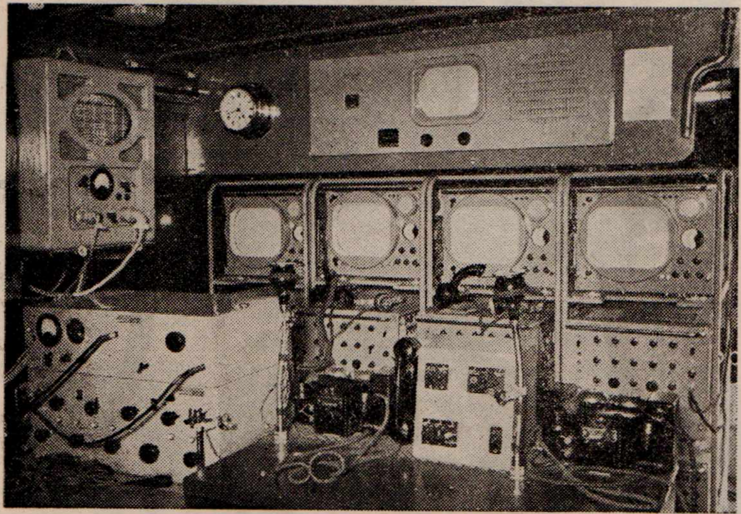
A close-up of the latest Emitron C.P.S. television camera.

tronic camera for television, and its elaborate associated apparatus, is by far the most important mechanism in any television station. After the camera and the vision modulator, the remaining apparatus in a television station is rather similar in its engineering principles to the equipment in an ordinary broadcasting station and particularly to those using very short waves, such as are employed for frequency modulation broadcasting.

,Britain's efficiency on the transmission side of television is equalled by its efficiency and ingenuity on the receiving side The admitted high standard of technical service from the London television station is due both to the quality of transmission apparatus, so expertly operated by the British Broadcasting Corporation engineers and to the excellence of British television receivers which are manufactured and competitively sold by all the well-known radio engineering firms



The H.M.V. television set which sells at 36 guineas. It has a ten-inch screen.



Interior of Emitron mobile control room, as used for the Olympic Games.

At the present time, it is possible to purchase in England a television receiver with a ten-inch diameter screen which produces a brilliant full definition picture capable of being viewed comfortably in broad daylight, housed in a handsome walnut cabinet .This is the greatest value in the world for a high quality television receiver for it costs only £37/16/-.

All parts for television receivers, including the cathode ray tubes which reproduce the picture, are manufactured in Britain from British designs and every month the output is increasing to meet a large unsaturated public demand.

Excellent Programme Service.

It is true that in the United States there are more television stations and more television receiving sets than in Britain, and we know that both the services and apparatus in the United States are of the highest quality but we are convinced that in programme service, as much as in scientific achievement and manufacturing excellence, British television stands well in the front rank with its respected American temporaries. Manufacturers of television apparatus in Britain, either for transmission or reception, can produce equipment to the highest scientific standards and the best engineering design and workmanship for any type of television service required, whether it be in the range of 400, 500, 600 or 700 or more lines definition with postitive or negative modulation and with accompanying sound on amplitude modulation or frequency modulation, according to the requirements of Governments or other television operators in any part of the world.

Another television problem which has been uniquely solved in Britain is transmission from motion picture film. This new British invention permits the use of standard motion picture film at television stations and gives reproduction in home receivers equal in definition and clarity to that of direct television camera studio work. Film will be used increasingly for television programmes, and we are satisfied that the new British method of film scanning provides the perfect answer to the problem of film scanning for television stations.

Scientists, engieners, technicians and manufacturers in the United Kingdom are working enthusiastically in this great field of enterprise with confidence that they can supply the knowledge, experience and high quality equipence and high quality equipment to establish and maintain television transmission and receiving apparatus to meet the requirements of all Government and commercial television operators in any part of the world.

Signal Tracer with Oomph!

The signal tracer is one of the most effective instruments for tracking down troubles in radio receivers. There is considerable difference of opinion about which types of signal tracers are best.

By
M. ELLIOTT
2 Havlin tSreet
Bendigo, Vic.

LAST Week I was talking to Dale Collins, who told me he makes a living out of this writing business. The editor, having accepted the opportunity to publish an article on a super-four valver some months ago, can please himself if he takes the risk with this signal tracer to end all signal tracers. You know radio cranks are all either lazy or just cranks. For either reason they sooner or later succumb to the lure of the signal tracer. I'm not quite sure to which category I, personally belong, but what I do know is that I built up one of these contraptions with the express purpose of cutting down on service time and headaches.

The lure of making all radio service problems just too easy was more than flesh and blood, etc., could stand. It was one of those tuned affairs with a built-in V.T.V.M. that in less time than it takes to tell could put a reversed double wrist lock on any wayward electron and return it to the company of its forefathers. Unfortunately,

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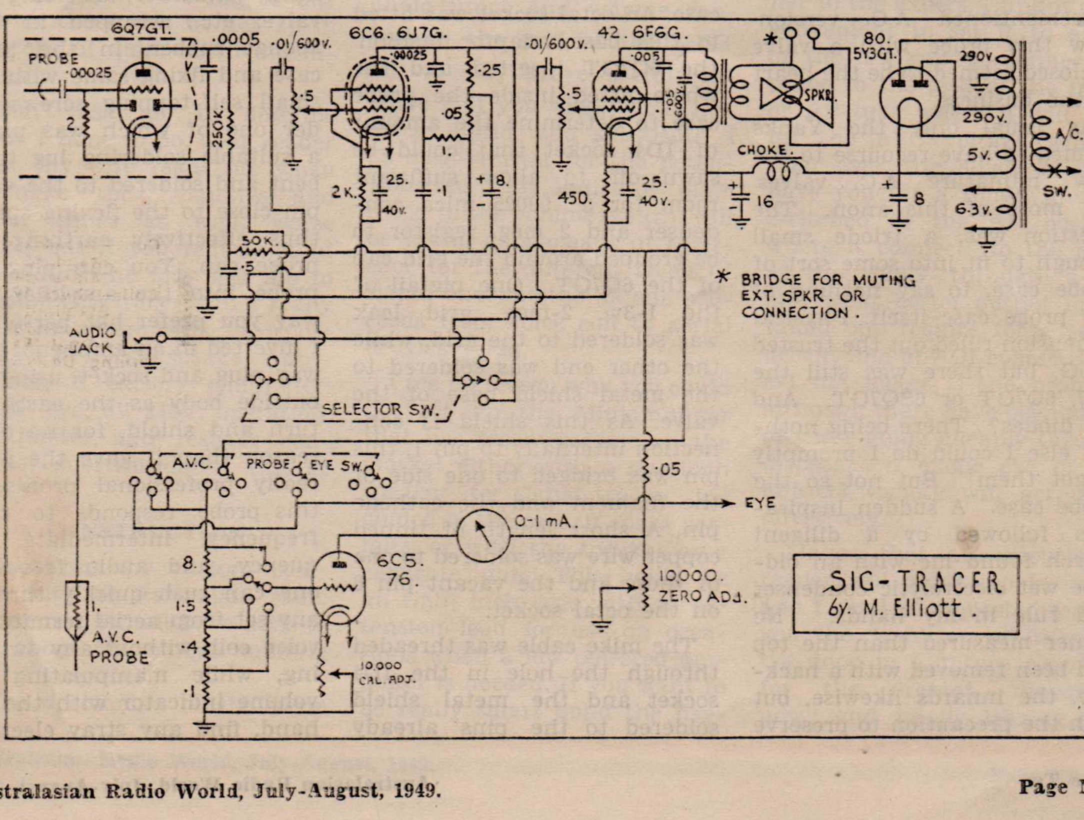
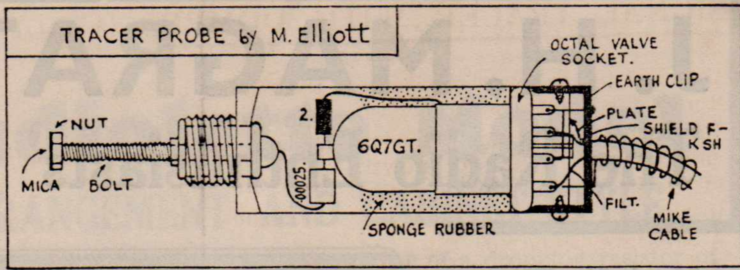


this having to tune the radio under test and the tracer to the same frequency was soon covered with a liberal growth of the proverbial whiskers. Add to this the fact that there was a separate probe for R.F. and A.F., and a switch to change from I.F. to R.F. to S.W., etc. and you can see one's time was mostly occupied in trying to fathom out just how one's two hands should be occupied at any precise moment.

Now several commercial firms produced a nice little set-up with a quaint little probe of rather elaborate dimensions These immediately took my fancy. How much more impressive was this new fangled probe instead of just a plain piece of hook-up? But these were battery operated, using the new miniature tubes, and I had invested a considerable amount of hard cash on the aforementioned A.C. version Now this probe with a valve enclosed seemed to be the heart of the business.

As usual only the Yanks seemed to have recourse to the new miniature A.C. valves but more of this anon. The question was, a triode small enough to fit into some sort of probe case, to say nothing of the probe case itself. Physical dimension ruled out the trusted 6B6G. but there was still the 6Q7, 6Q7GT or 6SQ7GT. And the diodes? There being nothing else I could do I promptly forgot them! But not so the probe case. A sudden inspiration followed by a diligent search found me with an old-type wet electrolytic condenser and rule in my hands. No sooner measured than the top had been removed with a hack-saw, the innards likewise, but with the precaution to preserve the rubber bush in the screwed end. After drying out, a hurried visit to the local electroplaters and she was buffed up to a loustrous finish 'at no extra charge to the consumer." And now to the assembly! The original rubber bush was refitted to the screwed end. Through this was fixed a brass bolt with fibre washer fore and aft, after a short length of hook-up had been soldered to the head. The base of an old 1D4 valve now had the pins sawn off close to the bottom and a hole of sufficient diameter to take a piece of twin microphone cable drilled in the centre. With a bolt through this hole, the plug was held in the chuck of a dirll and sufficient removed from the sides with a file to within a quarter-inch of the bottom, to ensure a tight fit in the open end of the probe case. An octal socket was fitted to this base, adaptor fashion the 6Q7GT inserted and the whole fitted inside the probe case to determine the amount of 1D4 socket that could be sawn off to allow sufficient room for a .00025 mica condenser and 2 meg. registor to be grouped around the grid cap of the 6Q7GT. One pigtail of the 1-3w. 2-meg. grid leak was soldered to the grid, while the other end was soldered to the metal shield base of the valve. As this shield is connection internally to pin 1, this pin was bridged to one side of the filament and the cathode pin. A short length of tinned copper wire was soldered to one of these and the vacant pin 6 on the octal socket.

The mike cable was threaded through the hole in the 1D4 socket and the metal shield soldered to the pins already shorted together to provide an earth return. One wire was soldered to the plate pin, the other to the hot filament pin. The two lengths of tinned copper wire were then passed through the two most convenient pin holes in the end of the 1D4 socket, the octal socket pushed firmly into the 1D4 and the tinned wire soldered to the pin holes to hold the assembly to a tight fit. A flexing spring from a discarded plugall was then slipped over the mike cable and run down to the socket. Here it was soldered to the same pin and the excess of tinned wire removed with the side-cutters. The assembly was completed by soldering the hook-up wire already fixed to the head of the probe bolt to the free end of the .00025 mica condenser, inserting the valve, etc., wrapped in thin sponge rubber, in the probe case and fixing same with two small self-tapping screws under one of which was placed a suitable soldering lug to be bent and soldered to the earth pin close to the flexing spring, thus effectively earthing the probe can. You can plug the probe into the amplifier any way you prefer but personally I invested in an amphenol two-way plug and socket, using the outside body as the earth return and shield, for no other reason than it gave the job a really professional profile. As this probe responds to radio frequency, intermediate frequency, and audio frequency one can rush quickly through any set from aerial terminal to voice coil, without any switching, while manipulating the volume indicator with the left hand, find any stray electrons



that have taken the wrong turning or picked up with bad company to produce distortion and the answer is not a lemon!

There is little I need say further regarding the probe, except to detail the tip required to prevent the "resumption of play" consequent upon contact surge due to the bare tip. Of course this is likely to happen at the moment of switching on the tracer so it is a wise plan to switch both set and tracer simultaneously. And here's the tip, but not from the horse's mouth! Solder a 3-8th brass washer to a nut that will screw on to the probe point. On the face of the washer fix a circle of mica with plastic cement S'easy, just like that, but quite effective!

Of course, just when I had her all finished and working like a charm what should these flaming valve manufacturers do but bring out a miniature type 6AV6 twin diode triode. And now I'll have me to buy one of these and fit her up in a probe of quite small dimensions.

Don't ask me to describe what I hope to do, dear reader (yes, my wife reads me when I make the headlines—and other times as well, worse luck), but if you request it of the Editor, he may ask me to develop this tracer into a really versatile instrument incorporating a universal speaker transformer, B battery eliminator magic eye, 6V 240V. operation multimeter, and resistor condenser substitution—it can be done!

CONSTRUCTION

Following the custom common with all Australian radio magazines, I shall have little to say about the actual building of the amplifier.

The decoupling of the plate feed to both the 6J7G and the 6Q7GT is a definite must; 8mfd for the 6J7G and .5mfd for the 6Q7GT being quite sufficient.

The audio jack is a worth while feature serving the dual purpose of providing an audio input for the testing of tuners pick-ups and microphones as well as a means of testing the audio sections of radios and amplifiers should the super probe meet with misfortune My own version has no low audio input and volume control to the grid of the 6F6G but it may prove useful; include it if you wish, but if not do as I did, and substitute a .5 meg. resistor for the potentiometer. An indicator plate fitted to the volume control will be useful as a means of reference for the different levels of signal encountered as one proceeds from voice coil to aerial or visa-versa.

I see no reason why you could not set up the Miniamplifier that has recently come on the market either with a five-inch speaker, for signal tracing, included in the case, if space permits, or with the speaker as a separate unit. This could be an eight inch type with an extension lead for use on occasions when a low powered amplifier is needed. If you want to be really smart build the five-inch type in the amp. case with a couple of banana sockets and DPDT switch across the voice coil and extend the eight-inch speaker that-a-way.

Now I've almost "been and gone" and forgotten the VTVM. It's the same as you've seen in many manuals from Ryder down. It was in the original version so why scrap it Adjustment is rather a ticklish business but not difficult, and since it reads voltage both positive and negative it has its moments for all, from the beginner to the expert. I find it quite convenient to set it to either of the low ranges, connect its probe to the grid of the mixer or RF tube where it will read off the AVC voltage while I rush over the slugs or what have you for a rough line up. Switched to the AF position where it connects to the plate of the 6F6G through a .05 mfd what better output meter would one require for a really decent line up? Of course if the 0-1 ma meter is the problem, although there have been many of these going cheaply through disposals, a magic eye of the 6U5/G5 variety will act quite effectively.

Maybe that aforementioned reader will prove too insistent and I shall be requested to give you the "gen" on all this extra dope in a future copy, so for the present, "goodbye-now" and happy tracing.

J. H. MAGRATH & Co
The Radio Enthusiasts' Supply Store

Hook-Up Wire

Plastic Hook-up wire, per yard, 2d. Plus 10% Tax. Cotton push back Hook-up wire. Per yard, 5d., plus 10% Tax. Available in assorted colors.

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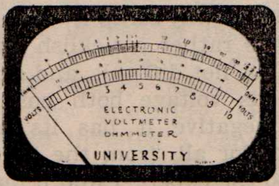
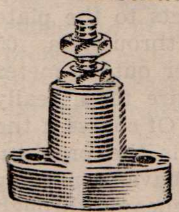
AEGIS ceramic Acorn sockets. Price, 4/-.

University Meters



The full range of University Meters includes 2in. round, 3in. Square, and 4ft. Round. Available for PROMPT DELIVERY. Prices range from 55/-, plus 10% Tax.

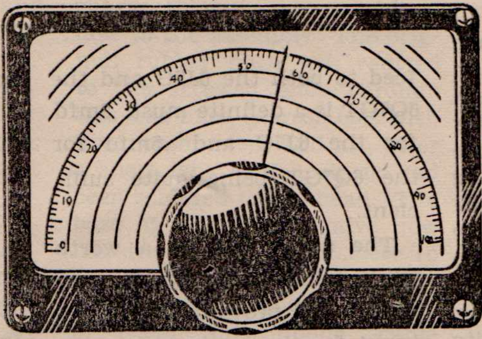
Miniature Stand-off Insulators



A midget insulator made from Frequentite with N. P. brass parts. A useful accessory in the design of ultra short wave receivers and transmitters. The new quality Frequentite closely approaches quartz in its characteristics as a low loss dielectric at high frequencies.

Bezels

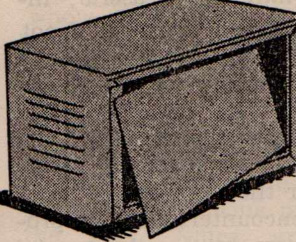
Reds and Green complete with lamp holder. Priced at 2/6 each. Plus 10% Tax.



Full Vision Dial

A most useful dial for all types of receivers, test oscillators and similar equipment. The dial escutcheon measures 6in. long x 4⅛in. wide. The scale is 5in. across. The outer scale is measured 0-100 degrees and three other scale lines are provided for the user to mark in his own calibrations as desired. Two spare printed scales are supplied with each dial. A large fluted instrument knob is fitted. The drive mechanism has a reduction ratio of 10-1, is free from backlash and has a beautifully smooth movement.

METAL CABINETS

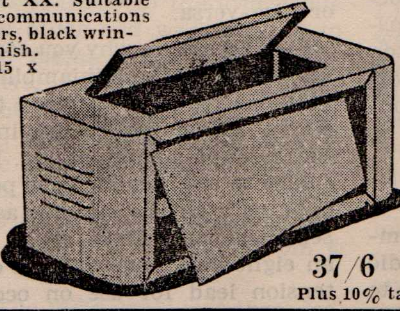


Cabinet 11in. x 7in. x 5½ x 7in. x 5½in. with panel . . black or grey wrinkle finish

25/-

Plus 10% Tax

We specialise in all types of sheet metal and aluminium chassis, boxes, cabinets, etc.



Cabinet XX. Suitable for communications receivers, black wrinkle finish. Sizes 15 x 7 x 8.

37/6

Plus 10% tax

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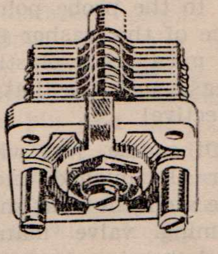
300 ohm 100 yd. length 8d. yd.
150 ohm 100 yd. length 6d. yd.
75 ohm 100 yd. lengths 6d. yd.
Plus 10% Tax. Additional cost of 1d. per yard is charged for cut lengths.

Micro Condensers



60 PF single section with provision for screwdriver adjustment instead of extended spindle. Mounting pillars supplied. Air gap .020ft.

Flexible Driving Shafts

This flexible shaft enables components which are awkwardly situated on the chassis to be controlled from the front panel. The length is adjustable between 4¾in. and 6in., and the drive is satisfactory through 45 degrees. The insulating portion is of Frequentite, giving ¼in. clearance between metal parts.

New Octal Socket

Standard Moulding 6d. each, mica filled, 9d. each, plus 10% Tax

208 Lt. Lonsdale Street, Melbourne. Phones--Cent. 3688-4414

FACTORY SET DESIGN

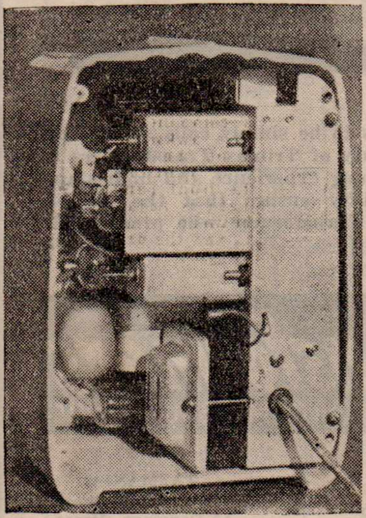
Latest Radiolette Model

NOVEL CHASSIS ARRANGEMENT AND CABINET STYLE

THERE has not been much change in factory designed sets for the past ten years. One of the many reasons why sets are so hard to sell these days is that the latest sets are little different to those of the past decade, either in appearance or performance.

Now and again something a little out of the ordinary turns up, and just such a set caught our notice recently.

The point that first drew attention to this set was the style of the cabinet, which was a small mantel type, yet standing up on end after the manner of a console. Often enough in the past there have been sets of this style, but they have always been a bit top-heavy, inclined to topple over when bumped. With brittle moulded cabinets such a characteristic is not a desirable one. Moulded cabinets do not bounce very well!



Rear view, showing the secret of its stability.

On inspection, however, it was found that this upright mantel model was not top-heavy; in fact it had quite a bit of inherent stability. A glance inside the cabinet revealed the reason why. The chassis, according to previous ideas, is mounted on its side in this new model. The valves are operating in a horizontal position.

A few years ago the valve manufacturers and some theorists would have claimed that the heaters would sag, or something like that. Modern thought on the subject is simply that it is quite in order to mount modern indirectly-heated valves in almost any position.

The name of the set, incidentally, is the Radiolette model 520M, with a list price of £17/8/-; not that this is intended as a publicity splurge for the Radiolette.

NO CHOKE

An examination of this set revealed that it has one or two other features of interest to students of radio design. For example, there is no filter choke in the set at all. High tension from the rectifier goes straight to the plate of the output valve, but there are two minor filters, the bias resistors in the negative high tension return act as a filter, and there is a certain amount of filtering for the screen supply by virtue of a dropping resistor of 10,000 ohms to a sort of second high tension line.

The Circuit

Glance at the circuit we have reproduced here in our simplified form and you will notice the following points.

In the aerial circuit there is a wave-trap arrangement at the intermediate frequency, to trap morse and other interference which may get through at that frequency.

Across from top of primary to top of secondary of the aerial coil is a small fixed condenser to afford some degree of capacitive coupling, in addition to the normal inductive coupling between primary and secondary. This is intended to

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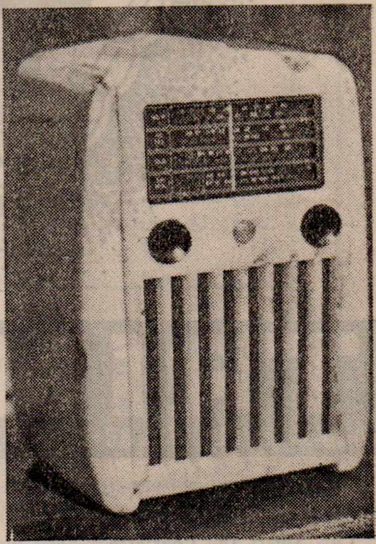


Front view of the "upright" mantel model.

LATEST RADIOLETTE MODEL (Cont.)

level out the gain over the whole band.

In the oscillator circuit there are two points to note, first the shunting of the oscillator section of the tuning gang with a small mica condenser. Just why this method of getting the frequency difference is used, instead of the normal difference in oscillator coil inductance, we have not been able to find out. Second feature in the oscillator circuit is the use of a fixed padder with the by-pass from the plate supply coupled in to the bottom of the grid winding, so as to get a certain amount of additional coupling. It would seem that this has been done in an attempt to cure a trouble which is sometimes noticed in earlier Radiola models, a tendency for the oscillator to go out of operation, or being hard to start, noticed especially when the oscillator coil is damp. As was the case with many of the old autodyne type of superhets, the cure is to dry out the oscillator coil in front of a radiator, or by heating the coil up by holding the soldering iron close to it for a minute or two.

Bias arrangement is simple and effective. Two small resistors in the negative high

TELEVISION IN U.S.A

More than 975,000 television receivers were produced during 1948, according to the Radio Manufacturers' Association. An additional 25,000 to 30,000 unassembled television kits were reported to have been assembled, according to "Universal Commerce" (U.S.A.).

tension return provide suitable negative voltages of 3 and 5 volts for bias for the converter and i.f. valves, and for the output valve.

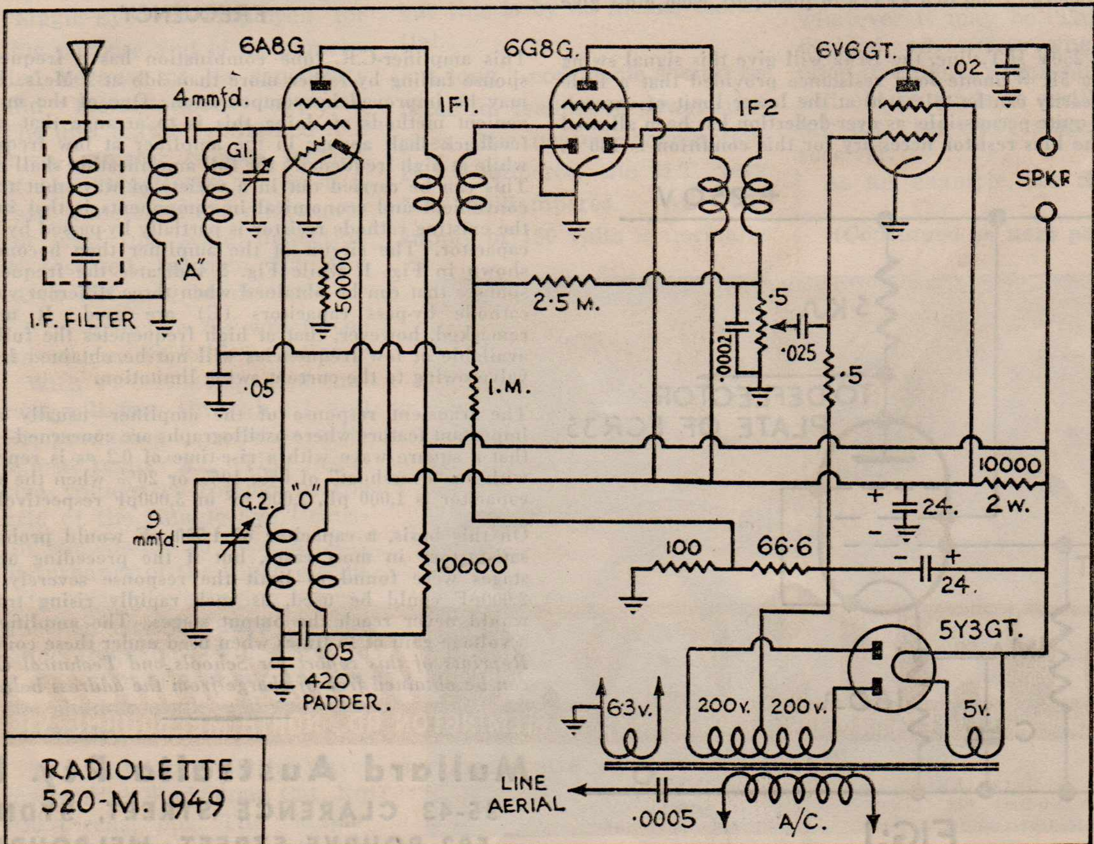
Notice that the high tension arrangement provides for a plate voltage of 200 volts for the 6V6G output valve, with 100 on the screens of all three valves, and also for the plate of the 6G8. Yes, the 6G8 is operated with 100 volts on both plate and screen.

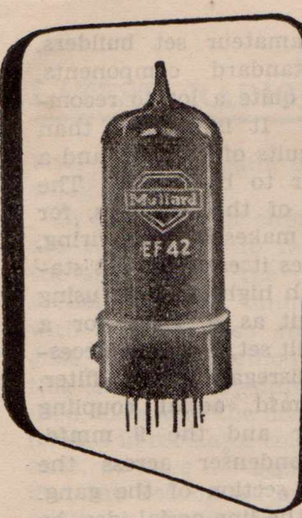
NO AERIAL NEEDED

The line aerial arrangement is interesting. A lead is taken away from one side of the line, through a series condenser of .0005, and brought out through the back of the chassis with a tip soldered to it. Instructions which go with the set say that under favourable conditions, the set can be operated without an external aerial if this tip is inserted in the aerial terminal. It is suggested that an ordinary aerial should be used if the line aerial gives weak or noisy reception.

Tested on the air, this little set gave exceptional performance for a set of its type. Checking the i.f. gain we found this to be much higher than would be obtained by ordinary commercial i.f. transformers. Stock transformers for replacements and amateur set building do not attempt the highest gain, as instability is such a problem when encountered under such circumstances.

The circuit used in the Radiolette should be quite O.K. for use by amateur set builders, using standard components, and has quite a lot to recommend it. It is simpler than most circuits of its kind, and a bit easier to build, too. The earthing of the cathodes, for example, makes for easy wiring, and makes it easier to get stability with high gain. If using the circuit as a basis for a home-built set, it will be necessary to disregard the i.f. filter, the 4 mmfd. aerial coupling condenser and the 9 mmfd. shunt condenser across the oscillator section of the gang. If using the line aerial idea, be sure to use a condenser with a high voltage rating, 2,000 volt test at least, as a break down would be a sad tragedy for the aerial coil.





Valves and their applications

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

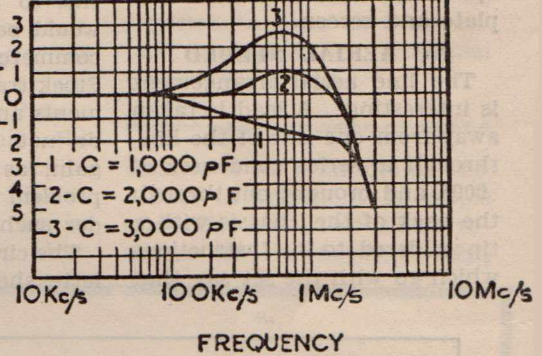
In the design of a high-gain amplifier for a C.R. oscillograph it is usually necessary to consider the output stages first, as the major frequency limitations usually occur at this point.

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: 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.*

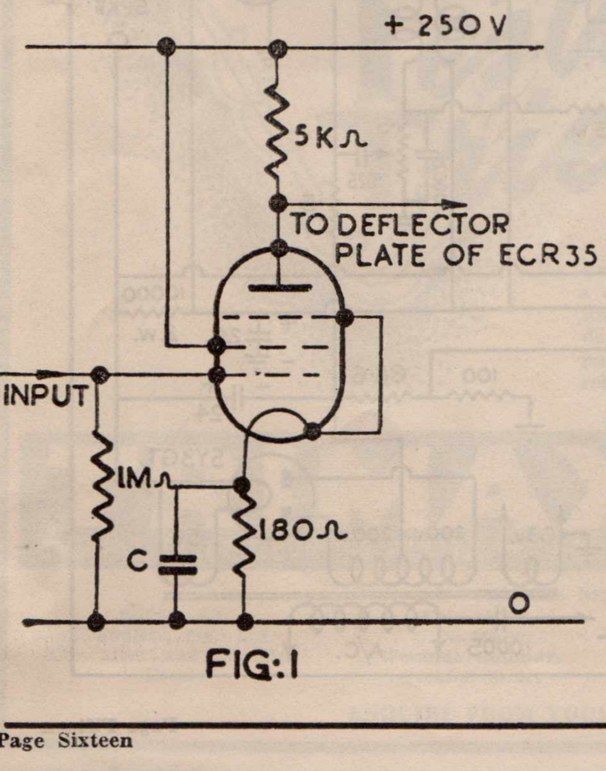


FIG:1

Mullard Australia Pty. Ltd.
35-43 CLARENCE STREET, SYDNEY
592 BOURKE STREET, MELBOURNE

M8-4v

GRID-DIP WAVEMETER

By
J. N. WALKER (G5JU)
and published by special arrangement with Short Wave Magazine (Eng.).

THIS handy little gadget will be found most useful to any amateur, experimenter or serviceman. With its aid, much time can be saved, particularly when the frequency coverage of tuned circuits under test is an unknown quantity.

The circuit is given herewith. It is simple enough, consisting of a straightforward triode oscillator, with provision for indicating changes in grid current. As described, a "Magic-Eye" is employed for this purpose and is recommended because of its sensitivity and instantaneous response The unit may be simplified if a mico-ammeter is used instead of the "Magic-Eye." In this case, a meter of 500 microamps (or less) full scale deflection is inserted between R2 and earth (R1 may be deleted).

The principle on which the wavemeter works is as follows:

With V1 oscillating, grid current will flow through R1 and R2, producing a negative voltage at point "X." This negative voltage is applied to the grid of the "Magic-Eye," causing the shadow to close up. Any disturbance of the tuned circuit —for example, bringing it near another circuit tuned to the same frequency—will result in a reduction of grid current and the shadow angle will vary accordingly.

The foundation of the wavemeter is an Eddystone Cat. No. 650 diecast box. The "Magic-Eye" should be sunk into the box, to improve readability, if necessary fitting a small external shroud to screen off direct light. If a miniature type of valve is used for V1, it can also be enclosed in the box by the exercise of some ingenuity but this is by no means essential.

A long 3-core cable should be fitted for feeding in power supplies. The heater consumption is 0.6 amperes, the H.T. very few milliamperes. An H.T supply of 150 volts is normally adequate, although up to 250 volts may be used, if more convenient.

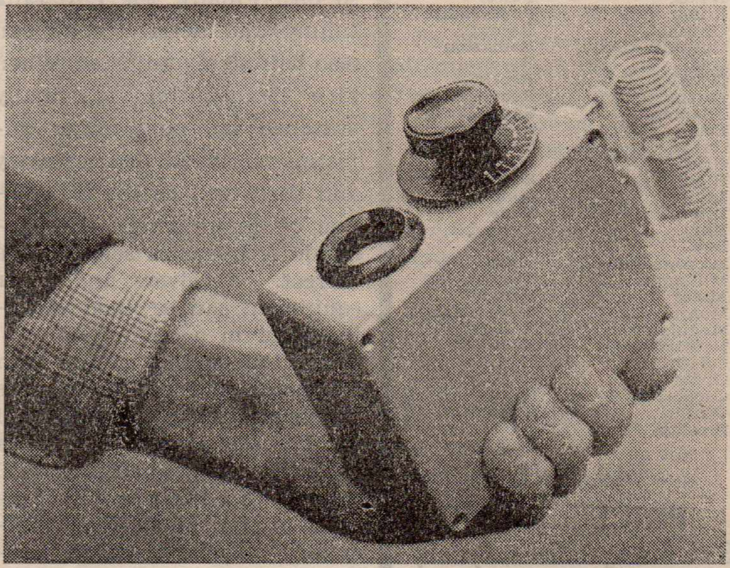
Using the Wavemeter.

With no H.T. or L.T. applied, the unit can be used as a simple Absorption Wavemeter, indications of resonance being obtained by variation of anode current in the valve associated with the circuit under test.

The real benefit is obtained when the wavemeter is energised. Circuits may then be tested for frequency coverage without power being applied to the receiver, transmitter or whatever it may be. This is a decided advantage when applied to circuits which normally will not be made to oscillate at all, e.g., the R.F. stage of a receiver.

As an example, let us take

(Continued on next page)

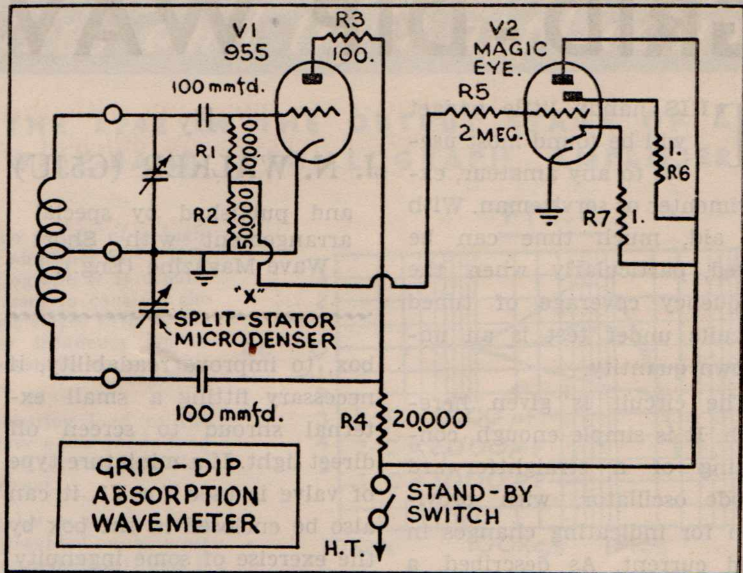


WAVEMETER (Cont.)

a multi-stage transmitter. The wavemeter is set to oscillate at (say) 7 Mc/s and brought near the crystal oscillator coil. Rotation of the C.O. tuning condenser should result in a flicker of the "Magic-Eye," indicating the resonance point. If no flicker is obtained, reverse the procedure. Set the C.O. condenser first at minimum, then at maximum, and vary the wavemeter tuning to secure indications of the frequency coverage of the circuit. The discrepancy will then be obvious and adjustments can be made accordingly.

The following stage can be tuned up on (say) 14 Mc/s and so on. Finally, the P.A. tank tuning and aerial tuning can also be roughly adjusted. When the transmitter is finally switched on, only minor adjustments should be necessary and there will be the satisfaction of knowing that the harmonic frequencies selected are correct. Receivers and other equipment can be lined up beforehand in a similar way.

The ten degrees at the high frequency end of the various ranges on the wavemeter should not be used, as grid current is lable to vary when the L/C ratio is very high and fluctuations in the "Magic-Eye" indications may be observed, irrespective of normal operation.



GRID DIP ABSORPTION WAVEMETER.

COMPONENTS LIST.

1. Diecast Box. Cat. No. 650 — Eddystone
1. Ceramic Microdenser (C1) Cat. No. 476. — „
1. Direct Drive Dial. Cat. No. 595. — „
1. Coil Base (Cat. 606). Coils as required. Cat. No. 601-605. — „

2. Valveholders.

C2, 3. 100 pF Silvered Mica.
R1 10,000 ohms. ½ watt.
R2 47,000 ohms. ½ watt.
R3 100 ohms. 1 watt.
R4 20,000-33,000 ohms. ½ watt.
R5 2 megohms. ½ watt.
R6, 7 1 megohm. ½ watt.
V1 6J5, L63, EC52, 955, etc.
V2 EM34 or equivalent.

Small Sets For Short-Waves

Successful short-wave operation with the small t.r.f. type of receiver depends on efficient, smooth and consistent regeneration.

THE ordinary two or three valve regenerative type of circuit is still the most popular receiver with the keen constructor who has a limited purse and unlimited enthusiasm. probably the main reason for this, apart from the simplicity and low cost of construction, is the fact that such circuits can be easily modified to incorporate any changes the constructor may like to experiment with to improve the sensitivity and overall performance.

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

One of the most troublesome snags in this type of circuit is in obtaining smooth and efficient regeneration on the lower wavelengths. Therefore, those who contemplate building a receiver of this type, or, who have already built one along orthodox lines and have had trouble in this regard, may like to try out the arrangement which is known as the electron coupled, or cathode form of feedback. There is nothing new in the idea—as a matter of fact, it has been used for years by experienced short-wave enthusiasts but, strange to say, most regenerative circuits published, still stick to the more orthodox plate-feedback methods. These methods, although quite efficient in many ways, often leave much to be desired in regard to smoothness of operation, etc., which proves more troublesome as the wavelength is decreased. With the cathode feedback arrangement, most of these troubles disappear once the correct setting has been obtained and smooth, consistent regeneration is obtainable right through the bands down to the lowest wave-lengths, without any trouble.

The basic circuit is shown in fig. 1, and it will be seen that it is similar to the well-known "Hartley" form of oscillator. When considering the circuit as an oscillator, the normal control grid, Gc, acts as the grid of the oscillator, and the screen-grid becomes its anode. Thus, by controlling the D.C. potential of that electrode, the operating conditions can be regulated. As it is necessary for this anode to be kept at earth potential as regards H.F. currents, the condenser Cs must be of a value which will offer negligible reactance to such currents and it is essential that the connections be as short and direct as possible.

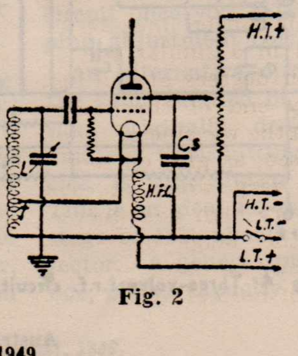


Fig. 2

The output is taken from the actual anode, to which a positive potential is applied in the usual manner, and it will receive the flow of electrons from the cathode through the screen-grid (i.e., the oscillator anode). This electron stream will be controlled by the oscillation produced in, what may be termed, the Hartley section of the valve, namely, the control-grid, screen-grid and cathode. It can be seen that the oscillator anode is tied down to earth as regards H.F. In other words, it cannot vary, but the cathode (C) which is returned through coil L and kept at H.F. potential above that of the earth line, will vary and it will be found that the tapping point "t" has a direct effect on the degree of regeneration obtained

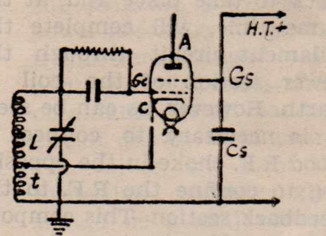


Fig. 1

At first, it may be imagined

SMALL SETS (Cont.)

that this form of feedback can only be applied to the indirectly heated type of valve as shown. The separate cathode certainly is very convenient for the purpose. Nevertheless, the same method can be just as well applied to the directly heated type, which means that the system can be used with battery receivers as well as the mains supplied type. The method of accomplishing this is shown in fig. 2. It will be seen that a cathode tap is obtained by connecting one leg of the filament to the tapping point. This will allow the R.F. feedback to take place and, at the same time, will complete the filament circuit through the lower section of the coil to earth. However, as can be seen, it is necessary to connect a good R.F. choke in the opposite leg to confine the R.F. to the feedback section. This component, should, of course, have a low D.C. resistance so as not to drop the filament voltage. However, the inductance need not be very high as it only has to provide a harder path to earth for the H.F. currents than the small section of the tapped coil.

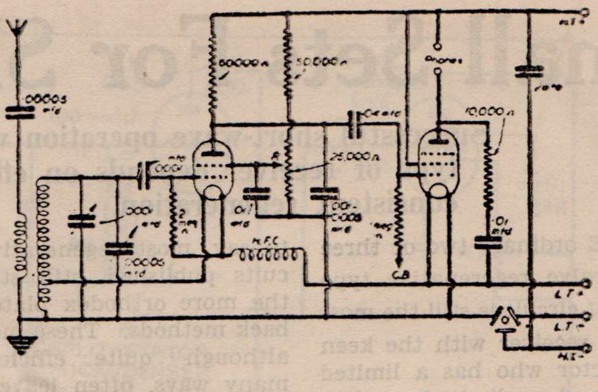


Fig. 3: An efficient S.W. two-valve circuit using the electron-coupled reaction system.

Therefore, a piece of ½in. diameter rod with suitable insulation properties such as glass, well dried wooden dowel, etc., will serve the purpose for a coil former. On this can be wound 35 turns of enamelled wire which will be adequate for the purpose. The thickness of the wire will depend on the filament current drawn by the valve. For the low current battery type, 24 gauge should be ample, but with the heavier current I.H. type, 18 or 20 gauge may be necessary to keep down the D.C. resistance. A choke, such as this, should be satisfactory over most of the ordinary S.W. bands, although one with more turns (increased inductance) may be necessary for satisfactory operation above 150 metres. However, this is a simple point on which you can experiment for yourself by connecting the choke so that it is interchangeable.

Coils

One of the things which may surprise you in this type of circuit is the amazingly small amount of turns required for feedback. In fact, so little is required that one quarter of a

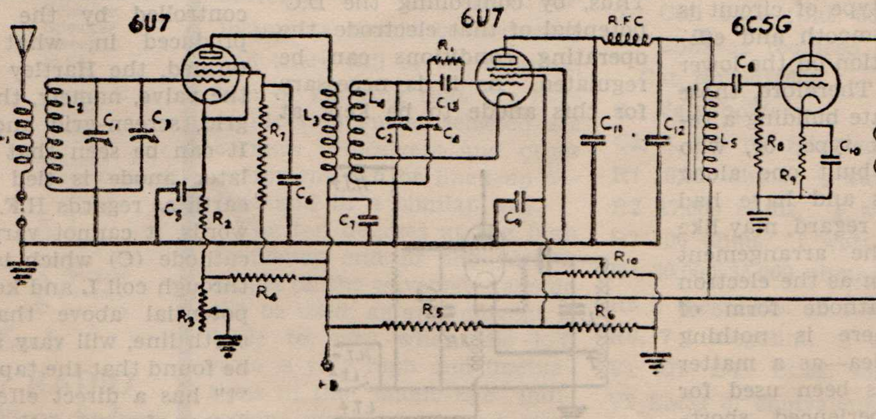


Fig 4: Three-valve t.r.f. circuit.

turn can mean the difference between overmuch and insufficient regeneration, so you will have to experiment until the correct amount is obtained for each group of bands. The writer has used commercialy-made S.W. coils and the normal reaction coil for the aerial coupling. In this case it was found that a tapping of only three-quarters of a turn up from the earth end of the grid coil was all that was required for the 9-14 metre coil in the receiver circuit shown in fig. 3. For the 12 to 26 metre coil, a 1 1-8 turn tap was necessary and the 22

COIL DATA FOR 3-VALVE T.R.F. SET

Band	L1	L2	L3	L4
1750	10	55	30	55 tapped at 3rd turn
3500	6	28	20	28 tapped at 1st turn
7000	5	11	9	11 tapped at $\frac{1}{2}$ turn
1400	3	5	5	5 tapped at $\frac{1}{4}$ turn

(L1/L2 on same form; L3 L4 ditto):

All primaries (L1 and L3) are wound with No. 36 d.s.c. wire. The 3,500 kc. grid coils are wound with No. 20 d.c.c.; 1,750kc. grid coils with No. 28 d.c.c.; both close-wound. The 7,000 and 14,000kc. grid coils are wound with No. 18 enamelled wire spaced to occupy a length of 1¼in. Tap turns are from the ground end of detector coils. Five-prong coil forms (diameter 1½in.) are used. Spacing between coils on each form is approximately 1-8in.

PARTS FOR 3-VALVE T.R.F.:

C1 and 2—35 mmfd. (midget).
C3 and 4—100 mmfd. (midget).
C5, 6, 7 and 8—0.01 mfd. (mica).
C9 and 10—1 mfd. (non-inductive).
C11 and 12 — 100 mmfd. (mica).
C13—250 mmfd. (mica).
R1—5 meg.
R2—250 ohm, 2 watt.
R3 — 10,000 ohm potentiometer (tapered).
R4—50,000 ohms. 2 watt.
R5—14,000 ohms., 5 watt.
R6—5,000 ohms., 5 watt.
R7—100,000 ohms., 1 watt.
R8—1 meg.
R9—1,000 ohms., 1 watt.
R10—50,000 ohm potentiometer.

to 47 metre coil 2¾ turns. Above this wavelength, say 41 to 94 metres, it may be necessary to add 3½ additional turns to the grid coil instead of making the tap at this number. However, you can try tapping first. You can now realise why it will be necessary to find the exact point yourself for the different coils by experiment.

The circuit of a two-valve set suitable for phones is shown in fig. 3 and it will be seen how the regeneration is controlled by a 25,000 ohm potentiometer R. The amplifier is quite orthodox being simply a resistance coupled pentode. Any R.F. type of valve can be used for the detector and any type of amplifier you like for the output. Actually, with a power pentode as shown, you could use a speaker on strong signals. Therefore, it would be a good plan to use a jack for phones so that either could be used as desired. Operation is the same as with any other regenerative circuit once you have the tapping adjustment correct.

An alternative circuit using the same method of regeneration, originally designed for amateur transmitting frequencies, is that shown in fig. 4. This is an ideal set-up having a stage of R.F. ahead of the detector. A general purpose triode, choke capacity coupled to the detector, provides all the power necessary for phones, but if this were changed to a power pentode, L.S. results should be obtainable on all bands. The circuit shown is, of course, for I.H. valves, but from the information already given it should be a simple matter to substitute the D.H. type if required. The following are the values of the parts shown in the circuit together with the coil winding details if you wish to try it out.

FLUO TUBE LIGHT UNIT

Here is a handy piece of equipment which you can assemble in your spare time. It is a fluorescent light unit which uses little current, yet gives effective illumination.

RADIO repair jobs are greatly facilitated if are doing. A careful examination will often reveal shorts, loose connections and errors which will be most baffling if you don't have proper lighting over the service bench.

Down amongst the bits in a radio chassis there are many dark corners, even with the brightest of lights. In fact, the brighter the light the worse are the shadows, as well as the eye strain.

Probably the best solution of the problem is to arrange a fluorescent tube light fairly close down over the bench. If it is installed just a foot or so higher than your head, and directly above it, you will get about the ideal lighting. The length of the tube means that there is no direct shadow, as the illumination comes from a long strip of light. You can hold your fingers up to test for shadow and you will find that it is quite impossible to make shadow rabbits!

The fluorescent light also has a big advantage in the economy direction. In fact, a fluorescent light will pay for itself. Even with a 300-watt lamp you can't get proper lighting of the bench, a couple of 100-watt lamps will give you little but glare; the fluorescent tubes are much more economical. A pair of 20-watt tubes will give you effective lighting without glare or shadow. The way they accentuate colours is also helpful down awong the wiring of a radio chassis.

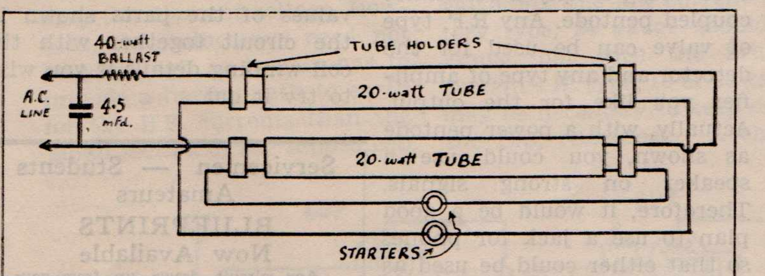
For those with plenty of money there are ready-built fluorescent units which can be installed quite easily. But if you want to economise, here is a short article on how to make your own tube light, guaranteed to perform like the best, yet at about half the cost, or less. The required components are readily available at most radio stores.

For the unit we built up for our own laboratory we used

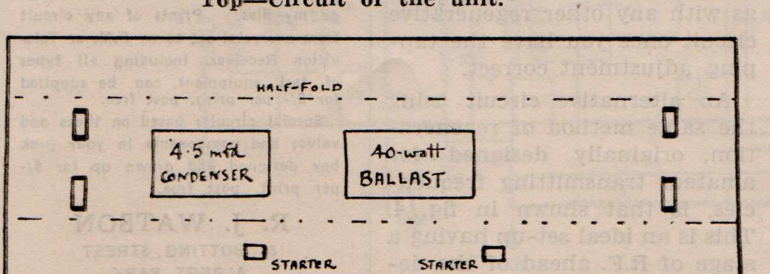
(Continued on page 40)

PARTS LIST

- 2 20-watt fluorescent tubes.
- 1 40-watt single ballast unit.
- 1 4.5 mfd. condenser.
- 2 Starter sockets.
- 2 FS2 starters.
- 4 Tube holders.
- 1 Sheet of 16 ga. aluminium, 30in. x 10in.
- Sundry screws, nuts, hook-up wire, hanging wire, connecting flex, etc.



Top—Circuit of the unit.



Below—Layout of components.

POST-WAR ORGANS

In years gone by we have given several articles on the subject of electronic music, and these appear to have interested a great many readers. Here is the latest report from an euthusiast who has made a close study of the subject.

By
J. E. JUNG,
1 Terry Road, Eastwood, N.S.W.

At the outset I feel that we should define the use of "Electric" and "Electronic" as used in reference to the organ!

A little over half a century ago electricity came into use in organ construction for driving the blowers, and for operating the action, i.e., the mechanism which connects the playing keys to the pipes. As may be expected, some of these early electric actions were very crude and unreliable, but they were improved over the intervening years, until the modern cinema and concert hall organ, with its amazing array of thousands of electric contacts, relays and magnets, and miles of wiring came to be known as the "Electric Organ," a term applied to these instruments long before the advent of the Hammonds, Everetts and Electrones but unfortunately the wide publicity to the Hammond "Electric" organ and others has clouded the original usage of the term.

In order to clear the air, therefore, I will define an electric organ as one in which electricity is used for wind production, action, etc., but in which the actual tones are produced by pipes; by the same reasoning, electronic organ will be the name given to any organ in which the tones are actually generated by the use of electricity (not merely amplified), besides which it may, or may not, use electric action.

Up till the early war years three such instruments had made their appearance commercially — the Hammond Organ and the Everett Orgatron, which are now familiar to most of us, were produced in large numbers in U.S.A. whilst the Compton Organ Co in England, manufactured the Compton Electrone in small numbers. These instruments had a mixed reception, and whilst they generally proved very reliable, and possessed the advantages of small space requirements and relatively low first cost, these advantages were largely offset by their lack of certain musical qualities as compared with the conventional pipe organ, mainly in their tonal make up. It is not proposed here to discuss any further these shortcomings of the pre-war electronic organs

In any type of electronic organ, it is first of all necessary to generate a series of musical sounds, the frequencies of which are tuned to the tempered musical scale, universally used in keyboard instruments; the actual number of these notes may range from 61 to 97 according to the compass of the instrument, i.e., 5 to 8 octaves.

MAKING TONES

Having produced the required scale of notes, it is next necessary to be able to play them in different timbres, i.e., diapasons, flutes, strings and reeds, in all their tonal shadings, and in various combinations of them. Finally, all these tones, or the electrical analogies, have to be amplified and projected as sound from loud speakers. As substantially the same amplifying and sound projection apparatus is used in all the electronic organs, it will be passed over in this discussion. The production of the tones of the tempered scale has been accomplished by a wide variety of means, many of which have never reached the stage of commercial production. The instruments on to-day's markets rely on three main types of tone generators—firstly the rotating generator, which may

(Continued on next page)

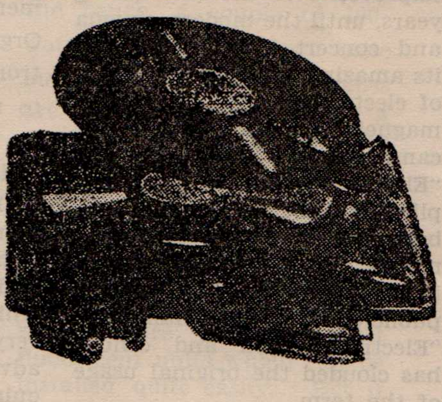
be further subdivided into electro magnetic, electrostatic and photo electric types; secondly the vibrating or reed type of generator, and thirdly those generators using the oscillating valve circuit, which may be subdivided into types which oscillate continuously and those which only oscillate when the corresponding playing key is depressed.

Up until several years ago the only commercially produced electronic organs used either rotating generators; Hammond the electromagnetic type, and Compton the electrostatic type; or the vibrating reed type, Everett orgatron The oscillating valve type however, was represented by the famous "Coupleux-Givelet" organ of the pre-war Paris broadcasting station, also by the Hammond Novachord. which, however, is not regarded as an organ.

Regarding the production of the various tone colours, it may be well at this stage to state for the benefit of those readers who are not already familiar with the subject, that all musical sounds consist of a fundamental frequency, which fixes the actual pitch of the note. on which is superimposed a number of partials or frequencies harmonically related to the fundamental.

Now these frequencies may be present in greater or lesser numbers, intensities and combinations, and it is precisely these various complex mixtures of fundamentals and partials which gave each type of instrument its characteristic timbre and enable us to distinguish say the tone of a trumpet from a flute. The flute in fact has a tone containing relatively few partials and is known as a simple tone, the string family (violin) or the reeds, like the clarinet possess tones very rich in upper partials.

In the electronic organ there are three chief methods of compounding these different mixtures of frequencies, firstly frequencies generated singly in sine wave form may be mixed together in their correct number and intensity, in order to synthesise a given complex tone; secondly, complex tones of a predetermined wave shape may be generated complete;



and thirdly, highly complex tones may be generated, containing the fundamental and a whole string of harmonics and from this complex mixture the unwanted frequencies may be filtered out.

A noted English authority on electro-acoustics, Mr. J. I. Taylor, says: "The theory that a generator furnishing less than a hundred frequencies (Hammond generate 97) is capable of producing an endless variety of tone by mixing tempered partials, is not seriously considered by students of electro-acoustics. The number of partials is important, and whilst it is possible, with less than ten of the most prominent partials, such tones are too incomplete to satisfy a critical musical ear."

THE HAMMOND

To-day's Hammond Organ is much the same as it was ten years ago, a new "vibrator" has replaced the old monotonous tremulant which formerly characterised these instruments, the tones, however, are still produced in the same manner and consequently suffer from lack of enevelope control, and as only the first eight partials are used in the synthesis of the tones, and these from the tempered scale and with the seventh partiol missing altogether, it will be readily understood after reading the quotation from Mr. J. I. Taylor, why this instrument lacks true organ tone.

THE ELECTRONE

The Compton Electrone which, I would say, is the most highly developed electronic organ today, also synthesizes the various tone colors by mixing together the required partial frequencies and fundamental.

However, the "Electrone" uses up to the 23rd partial, all of which are the natural harmonics of the fundamental there are no tempered partials used. Compelte envelope control is also incorporated, which gives whatever type of attack and decay are needed for the production of flutes, reeds strings, etc., also this envelope control enables correction of accoustics of auditoriums where reverberation is lacking

The Electrone is made in various two manual models with up to 34 speaking stops at present a 3-manual instrument of 50 odd stops is being built for the B.B.C.

WURLITZER

The Rudolph Wurlitzer Company are now producing the Orgatron, having taken over from Everett. There has been very little improvement in the instrument during the last ten years. I had an opportunity of testing out the only post-war "Orgatron" yet imported into Australia, and although electric action has replaced the pneumatic action used by Everett, the response is no faster than before. Several new stops including mixtures and celestes are now used. This instrument sounds best when played softly and slowly, but is inclined to predominate in flute tones when played loudly.

OSCILLATOR TYPES

Perhaps the most spectacular development in recent years is the appearance of several electronic organis using the oscillating tube type of generator Three well known manufacturers of musical instruments in U.S.A. have been marketing electronic organs of this type for several years, and a further manufacturer has commenced production this year. Reports from abroad say that the sales of these instruments have outstripped the older types, despite the fact that their prices range around double that of the Hammond organ.

A FRENCH MODEL

Also in England, the Constant Martin Organ (of French origin) is being produced by the Miller Organ Co. All these organs produce tones in audio oscillators in which the harmonic development is very rich in upper partials. The various tone colors are derived from the generated tones by filtering out these partials which are not required. Each manufacturer favours his own particular type of oscillator circuit, and filter circuits, and in some cases special mixing circuits. The Baldwin Co. uses oscillators which are running all the time whilst others like the Connsonata, the Allen Organ and the Constant Martin Organ use oscillators which oscillate only when the required manual or pedal keys are depressed.

Of necessity this general survey of the development of the contemporary electronic organ has only been able to touch briefly on each type; however if sufficient interest is shown in the subject the writer will be pleased to write two further articles, one to be devoted to the technical make up of the electrone type organ, and the other will deal with the various types of organ using the Audio oscillator type of generator.

An ultra-high-speed electronic unit for use in the transmission and reception of messages and data has reached the development stage and is expected to replace many current methods of sending and recording printed material. Equipment can be designed to produce messages in printed form at the rate of one million words per minute.

FIXING AUTODYNES

In reply to B.R's. query in the May issue re autodyne frequency changers, they are, it is well known, tricky specimens, but, provided the 57 is O.K., there should not be any insurmountable difficulties in getting them back to normal—after all, the coil ratios and voltages were right before.

I encountered one recently that would work all right for a few days when nothing would come in between 700 and 550 kc., and finally nothing at all. The weather had been damp and the wax on the oscillator coil didn't look too good, so I held the soldering iron inside the coil to dry it—a crude but effective method, and simpler than removing the coil and baking it out. This brought all the band back with the exception of about 60 kc. at the L.F. end, so the coil was thoroughly re-waxed. This is easily done with the soldering iron. This brought the whole band back, but there was still some intermittent trouble which was cured by bolting the gang solidly to the chassis—it had originally been rubber mounted, but the rubbers had given up the ghost. Apparently the changing of the earthing of the gang had some effect on the oscillation. The only other likely trouble in B.R's. case is a high resistance in the first IFT primary—due to electrolysis, or a dry joint somewhere.

Incidentally, the sensitivity and silence of an autodyne is surprising.

—W. S. LONDEY.

DIRECT CURRENTS

Here is the second part of our new series on radio theory, given in an easy form for application to practical radio work. The first part appeared in the May issue, copies of which can be obtained from our Back Dates department.

DIRECT currents are very important in radio, as all amplifier valves must have smooth direct current supplies to their electrodes. The heaters or indirectly heated valves may be operated on D.C., as in the case of car radios, or A.C., as in household sets. Directly heated type valves generally require D.C. for their filaments.

When a radio is serviced, nearly all faults may be found by the measurement of voltages, currents and resistances, the first two being the most important.

Current. The rate of flow of electricity is termed the current, and this current is said to flow from the positive to the negative terminal of the battery, or other source of electrical energy. Current is usually measured by some form of ammeter, the practical unit of current being the **ampere.** As the currents involved in radio measurements are generally much smaller than an ampere, the milli-ampere (ma) is generally used. This is 1/1,000 or ·001 of 1 amp. Very small currents such as oscillator grid currents are sometimes stated in micro-amps., 1 micro-amp. being 1/1,000,000 of 1 amp. (e.g., oscillator grid current for type IR5 valve should be 150 to 250 micro-aps. — i.e., .15 to .25 ma). Each graduation on the average 0-1 ma. meter represents 20 micro-amps.).

Voltage.—The difference of electrical potential between two points is termed the voltage, and it is this voltage which tends to send a current through any conductor connecting these points. The unit is the **volt,** although the millivolt (1,1000th of 1 volt), and the microvolt (1/,100,000 of 1 volt) are used for small values, and the kilovolt (1,000 volts) is sometimes used for high voltages such as those encountered in transmitters and cathode ray tubes.

A few common voltages encountered in practice are:—

Ordinary dry cells, 1.5 v. each cell.

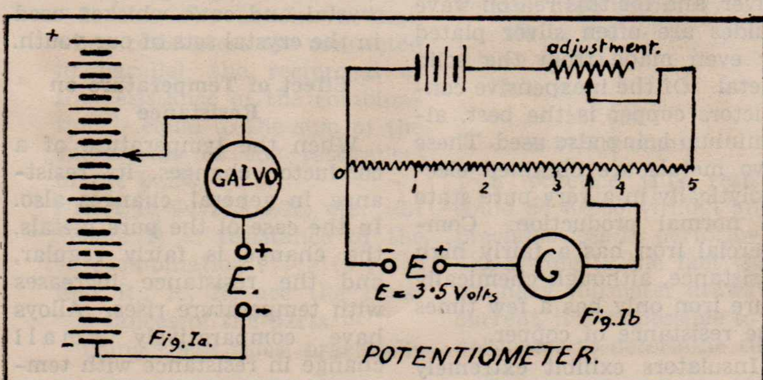
Lead-acid accumulator, 2 v. per cell.

Electrical radio H.T. supply, 250 v.

Voltage is measured by one or two methods:—

(a) a voltmeter which is sim- by balancing the potential to be a very high resistance.

(b) a potentiometer which measures potential difference by balancing the potential to be measured against some known potential. Fig. 1 shows the basic principle of the potentiometer. An unknown voltage E is connected through a sensitive galvanometer to an adjustable voltage, in this case shown as a battery with a movable tap. If the battery voltage to the tap is different from E, a current will flow through the galvo., but when they are the same no current will flow. In operation the tap is adjusted until the galvo. shows no deflection, and the voltage E is determined by reading the battery voltage. Practical poten-



POTENTIOMETER.

(Continued on next page)

tiometers do not use a battery, but use a very uniform resistance through which a known steady current flows, the resistance being graduated directly in volts (usually in volts, tenths, hundredths and thousandths). Fig. 1b shows the circuit of a simple practical potentiometer.

The vacuum tube voltmeter, in its simplest form, is a type of potentiometer in which the galvonometer is replaced by a valve amplifier so that the instrument is more sensitive, and does not draw appreciable current even when unbalanced.

The important difference between the voltmeter and the potentiometer (and V.T.V.M.) is that the voltmeter requires some small current to operate the meter, while the other instruments draw no current when adjusted correctly. The potentiometer type instrument, however, must have its own source of potential and is, therefore, much more complex than the voltmeter.

Power. There is one other electrical measurement which is often given, although it is rarely measured directly in D.C. work.

This measurement is power, and it indicates the rate at which energy is consumed (or supplied) by an appliance. In D.C. work the power consumed by a given appliance is the product of the current passing through it, and the voltage across its terminals. The unit of power is the **Watt,** and the relationship between voltage, current and power is given by the following rules:—

$$W = EI \quad (1)$$
$$E = W/I \quad (2)$$
$$I = W/E \quad (3)$$

Where W is the power in watts, E is the voltage in volts, and I the current in amps.

In radio work power is given in watts for resistance ratings, etc., but where small powers are involved, the milliwatt, 1-1000th or 1/1000th of 1 watt, is sometimes used.

Wattage rating of resistances is important because the operating temperature of a resistance is dependent on the wattage dissipated and the cooling surface. Resistances having a large power rating should never be placed in enclosed spaces without adequate ventilation as the larger cooling area requires air movement to carry away the heat.

Resistance. When a current passes through any conductor there is a certain opposition to its flow. This opposition is termed resistance. All conductors offer some resistance to electric current, some, such as pure metals, offer very little resistance, and are termed good conductors. Alloys, on the other hand, generally have many times the resistance of the metals in them, and are used to make resistances. Most non-metals are very poor conductors, or insulators, the important exception being carbon, which is a fairly good conductor. The best conductor is silver, and for this reason wave guides are often silver plated or even made from the solid metal. Of the inexpensive conductors copper is the best, aluminium being also used. These two metals are obtained electrolytically in a very pure state in normal production. Commercial iron has a fairly high resistance, although chemically pure iron only has a few times the resistance of copper.

Insulators exhibit extremely high resistance (there is no perfect insulator although some, like sulphur, paraffin and some of the modern plastics, are extremely good).

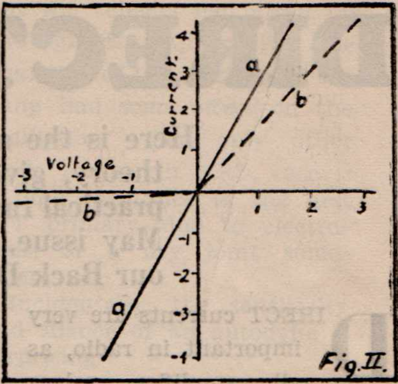


Fig. II.

There is a third class of substances, which includes copper oxide, galena, and several other materials.

The resistance of these is, in effect, polarised, that is, the resistance depends on the direction in which the current is flowing. A graph of current v. voltage for (a) a normal conductor, and (b) a semi-conductor, is shown in fig. II. The resistance to reverse current flow may be many hundred times the forward resistance. These semi-conductors have their main uses as rectifiers; for example, copper oxide meter rectifiers, germanium diode detectors, and, of course, the simple crystal and cat's whisker used in the crystal sets of our youth.

Effect of Temperature on Resistance

When the temperature of a conductor changes, its resistance, in general, changes also. In the case of the pure metals, the change is fairly regular, and the resistance increases with temperature rises. Alloys have comparatively small change in resistance with temperature, and the change may be in either direction. Special alloys such as manganin, constantan, etc., have practically no change in resistance with temperature, and are used to make resistance standards and measuring instruments. Even with the use of these resistance materials standard resistances should only be used at the specified temperature (usually 15°C.).

OHM'S LAW

The most important law used in electrical calculations is Ohm's law, which states that the current in a circuit is directly proportional to the total electromotive force (or voltage) acting in the circuit, and is inversely proportional to the resistance of the circuit.

That is — Current = Voltage/Resistance.

Or, as a formula:— I=E/R . . . (4)

Where I = current in **amperes,**
E = e.m.f. in **volts,**
R = resistance in **ohms.**

This rule may be expressed in two ways which are useful in calculations:—

E = RI . . . . (5)
R = E/I . . . . . . (6)

By the application of these rules it can be shown that when resistances are connected in series the resistance of the combination is equal to the sum of the resistances of the parts.

$R = R_1 + R_2 + R_3$, etc. . . . , (7)

It can also be shown that, when resistances are connected in parallel, the reciprocal of the resistance of the combination is equal to the sum of the reciprocals of the resistances of the parts.

$1/R = 1/R_1 + 1/R_2 + 1/R_3$, etc. . (8)

Where R = resistance of the combination

and R_1, R_2 R_3 are the resistances of the parts.

Using these rules, practically any resistance network may be solved. In radio work most calculations involving Ohm's law, etc., are concerned with determination of bias resistance values and voltage dropping resistances.

Examples:—

1. To calculate the bias resistance for two type 6U7 valves used as RF and IF amplifiers in a receiver.

From data sheet—
Plate current = 8.2 ma. (.0082 amp.).
Screen current = 2.0 ma. (.002 amp.).
Then Cathode current = .0102 amp. each valve.
Required bias = 3 volts.
Applying rule (6)—
R = E/I.
R = 3/.0204 ohms.
= 147 ohms.

In this case a 150 ohm resistance would be used.

2. To find the resistances for a screen voltage divider system to suit a single 6U7 valve (Fig. IIIa.).

H. T. supply 250 volts.
Screen voltage required = 100.
Screen current = 2 ma. (.002 amp.)
Try R_2 = 50,000 ohms.

Then the current in R_2 is given by (4)
I = E/R.
= 100/50,000
= .002 amps.
And total current through R_1 = .004 amps.
Voltage drop across R_1 = 250—100 = 150 volts.
Now by (6)—
R = E/I.
= 150/.004
= 37,500 ohms.

In practice this resistance could be 40,000 without any appreciable loss in performance.

3. Owing to the fact that an ordinary voltmeter draws some current, it is impossible to use a voltmeter to determine the ac-

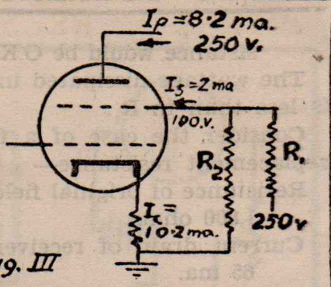


Fig. III
CURRENTS IN CIRCUIT USING 6U7 VALVE.

tual voltage at the plate of an ordinary resistance coupled amplifier. It is not difficult to arrive at this voltage if necessary by lifting the h.t. end of the plate resistance from its supply point and inserting a milliampmeter. Then, knowing the value of the plate resistance, and the current through it, the voltage drop through it may be calculated using rule (5) and this can be substracted from the h.t. supply voltage.

Power Rating of Resistances

All resistances used in radio work have some power rating and care should be taken to see that this rating is not exceeded as this will cause overheating, and, in the case of carbon resistances, a probable change in value and short life.

Applying Ohm's law to the rule
W=EI . . . . (1)
we get $W = RI^2$ . . . . . (9)
and $W = E^2/R$ . . . . . (10)

Consider the resistances determined above, —

R1—Voltage drop 150,
Resistance 40,000,
$W = E^2/R$
= 150 x 150 / 40,000
= 9/16 watt — a 1 watt re-

(Continued on next page)

sistance would be O.K.

The wattage dissipated in R_2 is less than in R_1.

Consider the case of a field replacement resistance—

Resistance of original field = 1,800 ohms.

Current drain of receiver = 65 ma.

Resistance of replacing choke = 300 ohms.

Resistance required = 1,500 ohms.

Power dissipation $W = I^2R$.

$= .065 \times .065 \times 1,500$.

$= 6.3$ watts.

In this case a resistance rated at 8 to 10 watts would be used.

When the resistance is of high value it would be impracticable to make up high rating wire wound or carbon resistances but by using a number of 1 watt carbon resistances in series or parallel any desired resistance and power rating may be made up.

For example:— a 4 watt resistance of 10,000 ohms can be made up of 4 40,000 ohm 1 watt resistances in parallel (rule 7), or of 4 2,500 ohm 1 watt resistances in series. Personally, I am inclined to prefer the parallel arrangement as it is easier to support the resistances and the failure of one will not put the set right out of action.

To calculate the value of each parallel resistance to make up a given resistance multiply the required resistance by the number in parallel paths. In the case of series resistances divide the required resistance by the number of resistances in series.

Measurement of Current, Voltage and Resistance

The measuring instrument most used by the radio servicemen is the multimeter, which consists simply of a 0-1 milliamp. (or better) arranged with switches, resistances and batteries so that it can read voltages and currents in various ranges, and also a range of resistances.

As the maximum current the meter takes is only 1 ma. some means must be employed to read higher currents. This is done by simply arranging that all the current but 1 ma. is bypassed. The by-passing is done by connecting a resistance called a shunt in parallel with the meter. The resistance of this shunt must, of course, be of the correct value, remembering that the current will divide inversely as the resistances.

Then, to determine the resistance of a shunt it is necessary to know:

the meter rating and resistance.

the current (full scale) to be read.

Example—Meter 0-1 ma. 100 ohms resistance (the usual values).

To make a shunt to make the meter read 50ma, full scale.

$i/I = R/r$ . . . . (11)

where i = meter current (.001 amp)

I = shunt current (.049

r = meter resistance (100 ohms.)

R = shunt resistance (required)

then $R = ir/I$ . . . . (1)

$= .001 \times 100/.049$

$= 2.0408$ ohms.

Using formula (11) the current distribution between any two parallel resistances can be determined, while (12) is the simplest to use to work out the resistance of a shunt. Note the current through the shunt is always less than the maximum current to be measured by the meter current.

Current measurements, in general, require the unsoldering of some connection for the insertion of the meter.

However, there are several points in the average receiver where currents can be read with fair accuracy — sufficient to indicate an expired valve, etc. For example the resistance of the output transformer is high enough to allow a fairly accurate reading of plate current by simply connecting the meter across the primary. Sim-

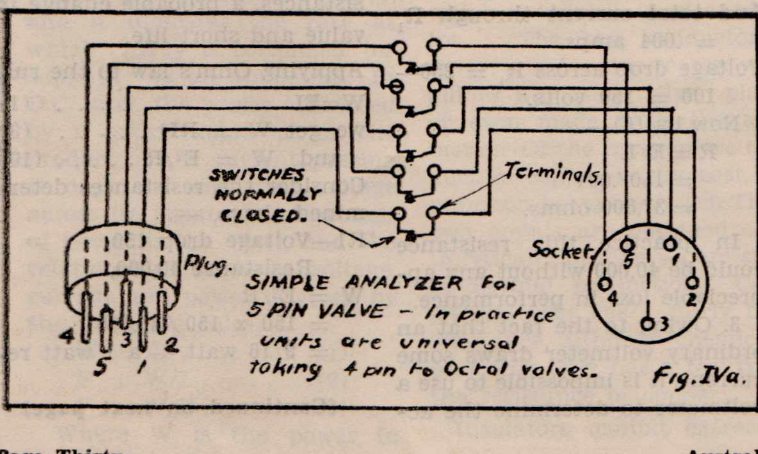


Fig. IVa.

ilarly connecting the meter across the I.F.T. primary will indicate—not necessarily extremely accurately—the anode current of the converter or I.F. amplifier valve.

A useful idea which can be used in push pull amplifiers, etc., where balancing of tubes for plate current is sometimes required is to fit a resistance of 20 to 100 ohms in each lead in which current is to be checked by a voltmeter across this resistance, a note having been made of the correct readings. These resistances may be used as plate or screen stoppers.

An analyzer, which consists of a lead with a suitable plug to fit into the valve socket, having a socket on the other end and a switch and terminals in each lead (fig. IVa) gives a simple means of checking the currents in all electrodes of any valve, but, when it is desired to make the tests with the set tuned to a station, there is no alternative to unsoldering a lead—at least as far as the R.F. and I.F. sections are concerned.

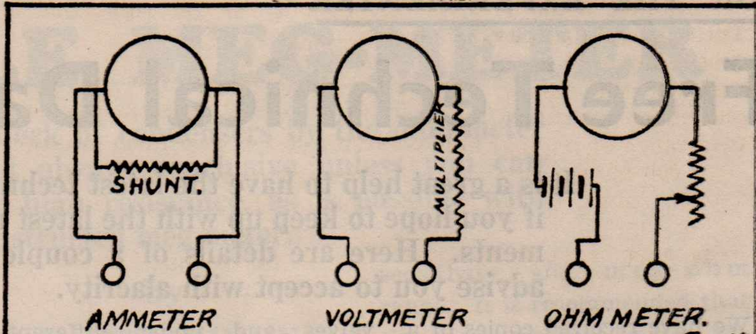


Fig. V.

Measurement of Voltage

In practice most radio checks are voltage checks and in order to limit the meter current to the rated 1 ma. a resistance called a multiplier is connected in series with the meter.

The value of the multiplier is found by dividing the voltage to be measured by the full scale current of the meter.

In the case of a 0-1 ma. meter the multiplier is 1000 times the voltage to be measured, i.e., for 20 volts the series resistance is 20,000 ohms and for 500 volts it is 500,000 ohms.

Care must be taken in interpreting voltage readings taken by means of a voltmeter as there may be some reduction in voltage due to the current taken by the meter. For example, the voltage at the screen of a 6J7G valve used as an audio amplifier could not possibly be read with any accuracy —or even approximately. Although the screen voltage is about 70 in operation the meter (100 volt range) would only show about 15. Fortunately it is generally only necessary when checking a circuit that has been operating O.K. to see that there is some voltage present at such points as the value of resistance does not generally change sufficiently to affect the operation of the receiver. An open circuited resistance would, of course, be found by this method.

Measurement of Resistance

The ohm-meter section of a multimeter is simply a battery connected through a resistance to limit the current to a safe value when the leads are shorted, a 0-1 ma. meter and the unknown resistance, all connected in series. The meter is usually calibrated to read directly in ohms but the range is limited without special circuits. To read accurately any resistance greater than about 100,000 ohms a high voltage supply is required; about 200 volts being required to read 10 megohms—and then only as a single unit of scale deflection on the meter.

In general any high resistance can be checked using the high tension supply of the set and a milliamp meter.

CAUTION — don't try and check a resistance less than about 500,000 ohms unless you use the meter as a voltmeter set above the H.T. voltage!

Examples 1.

Supply volts 250
Current = .95 ma.
R = E/I
= 250/.00095
= 263,000 ohms.

This would probably be a 250,000 ohm resistance.

2. Supply volts 320
meter set on 250 v. range.
current = .82 ma.
R = E/I
= 320/.00082
= 392,000 ohms.

But 250,000 of this is the meter resistance.

Then resistance under test is 142,000 ohms.

It is, in my opinion, good practice to test all coupling con-

(Continued on page 36)

FOR THE EXPERIMENTER

Free Technical Data Offers

It is a great help to have the latest technical literature if you hope to keep up with the latest radio developments. Here are details of a couple of offers we advise you to accept with alacrity.

We have received copies of a little bulletin on Rola transformers which has been prepared for general circulation.

All Rola transformers are designed to conform to given response standards.

B types are -3dB max. at 40 cps and -2dB max. at 10KC.

C and K types are -3dB max. at 70 cps and -1.5dB max. at 10KC.

D, F and G types are -3dB max. at 120 cps and -1.5dB max. at 10KC.

E types are -3dB max. at 140 cps and -1.5dB max. at 10KC.

As the frequency response is the standard, it follows that the inductance requirements vary with different types of valves and under different sets of operating conditions so that the impedance rating is not necessarily a true guide to the operating characteristics of a Rola transformer.

To ensure that the frequency response of each transformer will conform to the standards listed above each type of transformer has been individually designed for a given set of operating conditions and has been allocated a distinguishing code number. "Rola Transformer Codes," Technical Bulletin No. 3, gives details of the various types of transformers and lists the code number of the correct transformer to be used with various types of output valves under standardised sets of operating conditions.

Line transformer codes and the codes allotted to special types which have been called for by some set manufacturers are also included in the booklet.

The booklet is obtainable from Rola distributors in each state or from their Melbourne and Sydney offices.

A copy will be forwarded to any of our readers who write to the Rola Company asking for it, mentioning Radio World.

SHORT-WAVE MANUALS

Of exceptional interest to all radio enthusiasts are the Short Wave Construction Manuals, issued by Stratton and Co., Birmingham, makers of Eddystone components. These manuals have been selling in the past for 1/6 and 2/6 each, but special arrangements have now been completed with Mr. R. H. Cunningham, of R. H. Cunningham and Co., Australian representative of Eddystone components, to have a copy of each of Manuals Nos. 5 and 6 made available to our readers absolutely free of charge. All you have to do to get these manuals is to write to R. H. Cunningham and Co.. 420 William street, Melbourne, enclosing 1½d. stamp for postage.

Manual No. 5 contains full

(Continued on page 36)

A SIMPLE MEG-METER

The ordinary check of condensers by the ohm-meter method is not always conclusive unless you can measure very high resistance, as is possible with this easily-constructed meg-meter.

By
H. R. FITZSIMMONS,
Technician,
3WV Regional,
Horsham, Victoria.

THIS instrument is designed to measure resistance in meg-ohms, as accurately as possible for the average constructor.

It is used for testing condensers, as an insulation tester and for checking carbon resistors.

The inspiration to construct this instrument came after testing faulty condensers with a multimeter type of ohm-meter. It was found that some condensers do not show poor insulation on this low voltage type of instrument, but exhibit a fault in circuit where the voltage is in the region of 250 volts.

It was decided to design a resistance meter having a voltage supply as high as the test voltage of the most used condensers in receivers and transmitters. The two voltages are available, 500, 1000 volts, and are selected by a rotary switch.

The cost of the "Meg--meter" is low, and odd pieces of equipment can be pressed into service.

The meter used has an 0-50 micro-amp movement; these have been available uncalibrated at a very reasonable price. An 0-1 milli-amp meter may be used, but with reduced sensitivity and meg-ohm range. It is recommended that the most sensitive meter obtainable be used. Tables of dial calibration are given for each type of meter.

The instrument follows normal ohm-meter design and presents no hardships. It is pointed out that the resistors used must be as accurate as possible. These can be bought from suppliers within 5 per cent. and better; or if you have access to a resistance bridge, the resistors can be made up by selecting different values and wiring in series to obtain the correct value.

Some types of carbon resistors can be adusted by filing or

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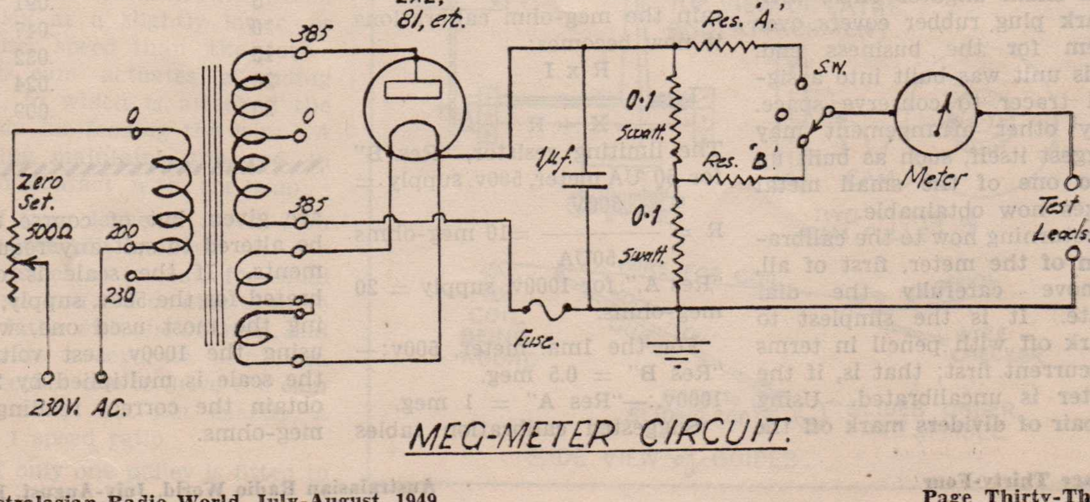


MEG-METER CIRCUIT.

grinding, but use good quality resistors for stability of values.

THE TRANSFORMER

The power transformer can be either 385 or 375 volts aside. Any high voltage rectifier is suitable, the load current is very low; 5-6 milliamps. The old 81 is doing a perfect job and heater supply was obtained by connecting a 5 and a 2.5 volt winding-in series and correct phase relation. Other rectifiers suitable are: 2 x 2, AVII, VU111; bear in mind their different filament voltages.

Make sure that the insulation of transformer leads and circuit wiring is adequate for 1000v. A further point, the H.T. filter condenser must be at least one micro-forad to obtain the voltage, a larger one can be used if this is at hand.

The meter zero setting control is in the 230v. primary supply and is an I.R.C. type "PR25" and can be of 500 ohms. The voltage selection switch should have at least one blank contact between the 500 and 1000 volt contacts to prevent shorting the supply when the switch is rotated.

The test leads were made up with banana plugs one end and small aligator clips, with spark plug rubber covers over them for the business end. This unit was built into a signal tracer to conserve space. Any other arrangement may suggest itself, such as built up into one of the small metal boxes now obtainable.

Returning now to the calibration of the meter, first of all, remove carefully the dial plate. It is the simplest to mark off with pencil in terms of current first; that is, if the meter is uncalibrated. Using a pair of dividers mark off the scale. If an 0-50 micro-amp meter, divide off into five equal divisions, then subdivide these into a further five divisions now making each one equal to two micro-amps. Or in the case of an 0-1 milliamp meter, divide the scale up into ten divisions; then subdivide into five divisions now making each one 20 micro-amps.

CALIBRATION

The resistance calibration, according to the table, can now be added to the scale in India ink and the pencil marks removed when completely dry.

The formula used to find the value of an unknown resistance by means of measuring the current passing through it is as follows:—

$$X = \frac{R \times I_1}{I_2} - R$$

where

X = unknown resistance
I_1 = full scale I of meter
I_2 = the new reading
R = resistance of meter, and limiting resistance.

Meter resistance is neglected because it is very small in comparison. Transposing the expression for I_2 so as to obtain the meg-ohm calibrations it now becomes:—

$$I_2 = \frac{R \times I_1}{X + R}$$

The limiting resistor, "Res B" for 50 UA meter, 500v. supply =

$$R = \frac{500V}{50UA} = 10 \text{ meg-ohms}$$

"Res A," for 1000v. supply = 20 meg-ohms.

For the 1ma. meter, 500v:— "Res B" = 0.5 meg.
1000v.:—"Res A" = 1 meg.

Suggested calibration tables are given, but of course may be altered to suit any requirements. If the scale is calibrated for the 500v. supply, being the most used one, when using the 1000v. test voltage, the scale is multiplied by 2 to obtain the correct reading in meg-ohms.

TABLES FOR METER SCALE CALIBRATION.

50 MICRO-AMP METER

1 meg.	45.45 UA.
2	41.66
3	38.44
4	35.75
5	33.35
7.5	28.6
10	25
15	20
20	16.68
25	14.3
30	12.5
40	10
50	8.34
75	5.9
100	4.54
150	3.13
200	2.4
250	1.92
400	1.22
INF.	0.

0-1 MILLIAMP METER

0.1 meg.	0.83 MA
0.2	0.71
0.3	0.63
0.4	0.56
0.5	0.5
1	0.33
2	0.2
3	0.15
4	0.11
5	.091
10	.047
15	.032
20	.024
25	.009

COMPONENT CONSTRUCTION

HOW TO WIND HONEYCOMBS

When you look at the honeycomb windings of r.f. chokes and i.f. transformers, you may wonder how they are wound. Actually the winding of honeycombs is quite easy.

By

ALAN G. DUNCAN,

Callignee North,

Victoria.

THOSE of you who possess a lathe of any type may consider it worthwhile to construct this little attachment which will enable you to wind your own honeycomb coils for radios, etc.

By studying the diagrams carefully it will be seen that the whole basis of operation of the gadget is simplicity itself.

There is a cam attached to a vee-pulley, and driven by a belt from the lathe headstock pulley at a slightly lower or higher speed than the lathe. This cam actuates a sliding rod, to which is attached the guide for feeding the wire. A spring maintains the rod in firm contact with the cam.

If your lathe is fitted with two vee-belt pulleys on the headstock as is usual for small lathes, you will be able to drive the lathe with one of them, and provide a separate belt from the other one to drive the cam at nearly, but not exactly, a 1 : 1 speed ratio.

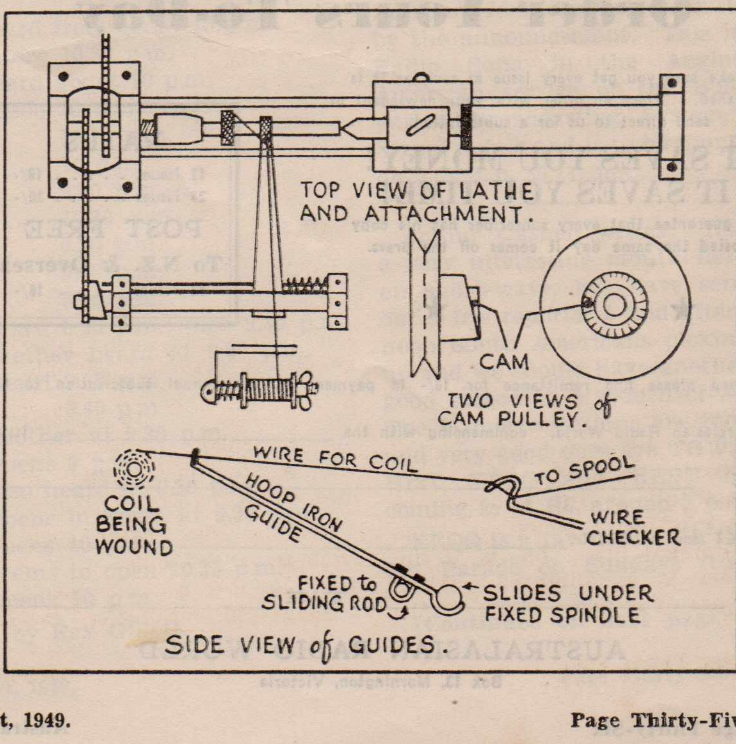
If only one pulley is fitted to your lathe, you may have to drive both the cam pulley and the lathe with the one belt, although an extra jockey pulley may be needed in such a case to minimise belt slip.

You should have no difficulty in making the cam. First, obtain a pulley of a suitable diameter with a protruding hub on one side. There are some excellent vee-pulleys suitable for this purpose on the market., and they have the advantage of being composed of duralium or similar soft metal, so that it is an easy matter to cut out the cam with the aid of a file and hacksaw.

Take care, though, to leave a hub in the centre of the cam, as shown, because it is essential for the cam pulley to turn freely on its spindle without any side-play, and this, naturally, entails having an even hub on the pulley.

The depth of the cam will goven the width of the finished windings. For ordinary small

(Continued on page 36)



HONEYCOMBS
(Cont. from Page 35)

r.f. chokes, a depth of 3-16 inch on the cam is sufficient.

All of the other parts may be easily made and assembled by following the diagrams. No exact shapes or dimensions are given here, as these will depend upon the size and type of lathe used, etc.

To wind coils, place the coil former between the lathe centres and thread the wire through the guides, attaching the end of the wire firmly on to the former. The lathe is best turned at a slow speed—treadle drive is recommended—and, as the coil former rotates, the wire is fed back and forth by the front guide, which is, in turn, driven by the cam.

For winding multiple pies, it is only necessary to wax down each winding as it is completed, then move the front guide along the rod until it is opposite the next winding position and continue winding.

TECHNICAL DATA
(Cont. from Page 32)

details, circuits, photographs and constructional data for the building of a four-valve battery-operated short-wave receiver, a V.H.F. frequency meter, a 15-watt transmitter, 3-valve a.c. operated converter for 5 and 10 metres, a two-valve pre-selector for a.c. operation, using EF39 type valves, and a c.w. or telephony transmitter for the 10 metre band.

Manual No. 6 contains articles covering a two-valve battery-operated short-wave receiver, 60 mcs. crystal-controlled transmitter, a heterodyne frequency meter, and also several general articles on circuitry, aerial systems, valve socket connections, etc.

Both manuals are splendid productions of about 24 pages each, and are well worth keeping on the bookshelf. We strongly recommend all readers to send their stamps along for a copy of each. Do it now, as the number of copies available is limited.

DIRECT CURRENTS
(Cont. from Page 31)

densers for leakage, using about 400 volts or more before fitting them in a receiver, also, if in doubt about a coupling condenser in a set it is well worth the trouble of taking the condenser out and checking it—this may save costly valve replacements, particularly around the output section. A good condenser draws a current for an instant and should then draw no more, while a faulty one will draw a small (or large) steady current. If the condenser is open-circuited there will be no initial kick.

(The third article of this series is due to appear in next month's issue. Order your copy now.)

Shortwave Review

Conducted By L. J. Keast

NOTES FROM MY DIARY

Daytime is Great Time

At this time of the year I always envy those lucky creatures who can spend time during the day at their receivers, because there seems to be such a lot of stations to be heard which are seldom if ever loggable at night.

Strangely enough the colder the weather the better the reception, and as I type these notes the temperature has just that little tang to make listening ideal.

Almost throughout the day there are numerous stations that have an entirely different programme to that heard during the evenings, for instance one can from around 11 a.m. find the B.B.C. special session to Central and South America and later in the day listen to the many and varied type of programmes put over by the Latin Americans, not forgetting the splendid Mexicans.

Later on in the afternoons a great opportunity is given by the splendid reception from the several Cincinnati transmitters and coming in at even greater strength is the U.S.A. West Coast stations.

For the benefit of those who, however, are unable to take the daytime periods, I am printing a fine list of Latin Americans being heard at Prospect during the evenings by Rex Gillet. However, Rex has been unable to establish all of the call-signs and would appreciate any help listeners can offer.

SAYS WHO ?

Rex Gillett believes he has been hearing YNVP, Managua, Nicaragua, just near BFEB Singapore, who are on 6.77 m.c. (The listed frequency of YNVP is 6.76 m.c. or a wave-length of 44.38 met. The slogan is "La Voz De Nicaragua," and address Radiodifusora YNVP, "La Voz De Nicaragua," Managua, Nicaragua. Language is, of course, Spanish, but interval signal each quarter of an hour the notes G-C-E-G should act as a guide. According to my latest list schedule is: Daily 8 a.m.-2 p.m.; 10 p.m.-1 a.m.; 9-6 a.m.—L.J.K.)

Mr. Gillett says Radio Sofia, Bulgaria's National short-wave station, now gives news in English at 7.45 a.m. following a 15-minute programme in French. Identification is easy by the announcement, "This is Radio Sofia in the Anglo-American service of the Bulgarian Broadcasting System." Signal is fair and is to be found on 7.67 m.c. 39.11 met.

Arthur Cushen writes: "Not a very interesting month here on short-wave, but have sent out a few reports: I find afternoon South Americans picking up and we should have another good season in a month or so. The 31 metre stations are good and very good ones are TGWA, HI2T, XEQQ and XEBT all coming in at R8. around 2 p.m.

XEQQ is a favourite with the Hit Parade on Sundays from

(Continued on next page)

THE LATIN AMERICANS

Kilocycles	Call Sign	Time Heard E.A.S.T.
6965	YNEQ ?	Heard from about 10 p.m.
6760	YNYP ?	Before 10.30 p.m.
6335	TGTA ?	Heard about 10 p.m.
6300	YNAS	Opens 10 p.m.
6295	TGLA	„ 10.15 p.m.
6275	YSR ?	„ 10 p.m.
6220	CE622	„ 9.30 p.m.
6215	?	„ 10.30 p.m.
6210	HC1AC	„ 9.30 p.m.
6200	HOB	„ 9.30 p.m.
6180	LRM	„ 9.30 p.m.
6160/5	?	Heard 8.30 p.m.; also 9.30 p.m.
6120	?	Another heard at 9.30 p.m.
6060	?	Heard 9.30 p.m.
6055	HJEX	„ 9.45 p.m.
6040	?	Another at 9.30 p.m.
6030	Panama	Opens 9 p.m.
6005	?	Also heard at 9.30 p.m.
5990	HCJB	Opens in Span. at 9.30 p.m.
5970	H14T	Opens 10 p.m.
5905	?	Seems to open 10.35 p.m.
5895	OAX4Z	Opens 10 p.m.

The above list kindly supplied by Rex Gillett.

1.3012 p.m. with English-Spanish announcements.

Heard OAX6E, 6.038 m.c. last night sign off at 3 p.m. with organ. OAX6E, "Radio Continental," on 6.33 m.c. is very good at 2:50 p.m. OAX4V, 5.905 m.c., heard to 4 p.m. and later with OAX4W 9.37 m.c.

I note many U.S.A. stations with the Russian language broadcasting 1.15-1.45 p.m. A good deal of jamming, which was not very effective, now.

BBC, with Radio Colombo, heard on 21.60 m.c. the past few evenings. Is fair around 9 o'clock. Have written Bucharest; heard them on 5.92 m.c. with news in English at 7 a.m.

Budapest on 6.25 m.c. is fair at 5.30 a.m. Helsinkie on the new frepuency of 9.55 m.c. signs off at 3 p.m. . . . good signal; also on 6.12 and 15.195 m.c. LLP, 21.67 m.c. fair at 5.30 p.m. KGEI opens at 7 p.m. on 9.67 m.c. (Is on till 8.30 directed to Mid-Pacific and then from 8.45-12.15 a.m. to Marianas-Philippines.—L.J.K.)

LRU, 15.29, and LRY, 9.45 m.c., both heard till 4 p.m. in new English broadcasts and LRS, 11.84 m.c. in unusual Spansh programme till 3 p.m.

Max Krumbeck, of Belmore, has had some good loggings, and he reports as follows: Logged HVJ, Vatican City, on 25.40 metres one Sunday from 5.30-6.30 p.m., with a fair signal which gradually fell off after 6 o'clock; were giving Canonisation Ceremony.

CHOL, 11.72 m.c., heard with a beautiful signal at 8.30 a.m.

HRE-7, 17.784 m.c., good strong signal at 9 a.m.

FZI, Zeazzaville, 11.97 m.c., is at good readability at 9 a.m., and can be heard at 3 p.m. but signal is weaker. (Think with colder weather this will improve —L.J.K.)

VUD-10, 17.83 m.c. at 6 p.m., with interesting English programme after the style of the BBC overseas service. (Quite likely you were tuned at a time when they were taking the BBC service, which they often do.—L.J.K.)

Radio Pakistan, 15.27 m.c., Just fair at opening at 9 p.m.

"Voice of America in Manilla" advises current schedule as 15.33 m.c., 5.15 p.m.-6.45 p.m. and on 11.89 m.c. 7 pm. till 1.15 a.m. (station now closes at 12:15 a.m.). The 5.15 session on 15.33 m.c. is directed to South East Asia and is on daily from Tuesday through Saturday. The 25 metre band is directed to Far East. For the benefit of those who would like to try the broadcast band, they transmit on 920 k.c. to East Asia from 8.30 p.m.-12.45 a.m.—L.J.K.)

The English s/k service of Czechoslavakia is: 11.84 m.c., 3.45-4 a.m., and on 9.55 m.c., 5.45-6 a.m. and 7.45-8 a.m.

Dorothy Sanderson, as usual, sends along a fine list. Here are some of them:—

Canada.

CBNX, 5.970 m.c. 50.26 met., at 7.45 a.m. Sponsored programme of music.

CKRA, 11.76 m.c., 25.51 met, at 6.30 a.m. Latin American service with news.

CBLX, 15.09 m.c., 19.88 met., 9.30 p.m. Birthday greetings and weather reports.

CKCX, 15.19 m.c., 19.78 met. News in English and Music at 12.30 p.m.

CHOL, 11.72 m.c., 25.60 at 8 p.m. Service to Australia in news and music.

Europe.

HER-6, 15.30, 19.61. Europe at work services at 11.30 a.m.

HER-5, 11.865 m.c. Swiss music at 11.45 a.m.

HED-7, 15.120 m.c., 19.83 met. Programme to Portugal at 9.15 a.m.

OIX4, 15.19 m.c., 10.75 met. Finnish news and music at 1.30 p.m.

OZF, 9.52 m.c., 31.53 met., at 2.30 p.m. English news and travel talk.

Leipzig, 9.73 m.c., 30.84 met. Good signal at 2.15 p.m.

LLK, 11.85 m.c. 25.31 met. Service to Whaling Fleets at 7 p.m.

SWISS TRANMITTERS

Here is a complete list of the Swiss Transmitters contained in a letter to Mr. C. R. Woolsey:—

HER-3:	6.165 m.c.	48.63 met.
HEI-3:	7.21	41.61
HER-4:	9.535	31.46
HEU-3:	9.665	31.04
HEI-5:	11.715	25.61
HEU-5:	11.815	25.39
HER-5:	11.865	25.28
HED-7:	15.120	19.84
HER-6:	15.305	19.60
HEI-7:	15.320	19.58
HER-7:	17.784	16.87
HER-8:	21.520	13.94

Those used for Australia and the Far East from 5.15 p.m. are: HER-5, 11.865; HEI-5, 11.715; and HER-6, 15.305.

Good news service as well as splendid talks and music are to be heard at great strength, especially in the 25 metre band.

The 13 metre transmitter, which is a new one, can be heard from 8-10.30 p.m. and 10.45 p.m.-12.30 a.m. The language used is French and German, but musical items and yodelling are good.

LLP, 21.67 m.c., 13.84 met. At 5.30 p.m. News and music to Whaling Fleets.

LLN, 17.825 m.c., 16.84 met. Whaling Fleet service.

LKQ, 11.73 m.c., 25.58 met. Norwegian news and English announcement, music.

RNE, 9.38 m.c., 31.98 met. News in Spanish and music at 7 p.m.

NEW FREQUENCIES

KCBF, Delano, 9.70 m.c. 30.93 met.: Directed to Japan/Korea from 7 p.m.-12.30 a.m.

KCBA, Delano, 15.20 m.c. 19.72 met.: Directed to Marianas-Philippines, 7 p.m.-12.30 a.m.

KNBA, Dixon, 21.46 m.c. 13.98 met.: Directed to South America from 10 a.m.-noon. Was during Aprii and May directed to Philippines from 1-1.30 p.m.

KNBI, Dixon, 17.08 m.c. 16.85 met.: Was being used to Pilippines from 1-1.30 p.m. Now appears to be idle.

KNBX, Dixon, 21.63 m.c. 13.87 met.: Arthur Cushen tells me this is a new frequency for KNBI but he gives no particulars, nor is it listed in my latest air-mail advice from Washington.

KGEI, San Francisco, 31.49 m.c. 13.96 met.: Same remarks as KNBX.

NEW STATIONS

RADIO MONTE CARLO, Monaco 9.79 m.c. 30.64 met.: Heard opening at 4 p.m. Signal is good, and news in Franch is followed by music.

RADIO MONTE CARLO, Monaco 7.35 m.c. 40.82 met: Heard at 7 a.m. and 4 p.m. Signal is not so good as on 9.79 m.c. at 4 o'clock.

HER-8, Berne 21.52 m.c. 13.94 met.: Using French and German is on the air from 8-10.30 p.m. and 10.45 p.m.-12.30 a.m. Programme also contains some fine music and yodelling.

VLX, Perth, 9.61 m.c. 31.32 met.: Present schedule, 12.30-6 p.m.

VLX-2, Perth, 6.13 m.c. 48.94 met.: Schedule: 8 a.m.-12.15 p.m.; 8.15-1.30 a.m.

Both the above West Australian stations have been brought into use to serve the outback of that State.

RADIO SPRINAGAR, Kashmir, 4.856 m.c. 61.79 met.: Miss Sanderson reports hearing this new Indian station at 10.45 p.m. with native programme of news and music. Advices from India give three transmissions, but the only one likely to be heard here is, I think, the nightly one, 9.30 p.m.-2.30 a.m. A re-lay from All India Radio is taken at 10.30 when news is heard, and again at 1.30 a.m.

The other transmission for the purpose of record are: 12.30-2 p.m.; 4-5.30 p.m.

Rome, 15.120 m.c., 19.83 met., at 7.45 a.m. news in English and Italian.

KZPA, 9.535 m.c., 31.47 met. News in German at 8 p.m.

SDB-2, 10.78 m.c., 27.83 met. German news and musical programme at 4 p.m.

OTM-3, 9.38 m.c., 31.98 met At 7 a.m. good programme of music and news in Swedish.

ORL3A, 9.550 m.c., 31.41 met. News in French and music but little QRM at 3.45 p.m.

PCJ, 15.22 m.c. 19.70 met. News in English, followed by music.

Monte Carlo, 9.79 m.c., 30.62 m.et., at 4 p.m. News in French, good signal.

Monte Carlo, 7.350 m.c., 40.81 met. Fair signal only. News in French at 4.10 p.m.

(Continued on next page)

Central and South America.

XEBT, 9.62 m.c., 31.17 met. Good signal in news at 2.45 p.m.

PRL8, 11.72 m.c., 25.60 met. Excellent signal at 11.45a.m.

LRM, 6.18 m.c., 48.54 met. News in Spanish.

ZYC9, 15.37 m.c., 19.51 met. Only a fair signal at 8.15 p.m.

COKG, 8.96 m.c., 33.5 met. News in Spanish and music at 9.30 p.m.

XEWW, 9.50 m.c., 31.58 Good strong signal at 11 p.m.

LRY1, 9.455 m.c., 31.73 met. Music and news in English, world and local, 2.45 p.m.

VERIFICATIONS

Arthur Cushen, Invercargill, N.Z., has received veries from:

HER-8 (21.520 m.c.); OZH-2 Maritius (7.34 m.c.); VUD-8, Delhi (9.57 m.c.); Saigon (7.20 m.c.); VLC-11 (15.22 m.c.); Red Cross (6.345 m.c.); CR6RL (9.46 m.c.); CR6RN (8.08 m.c.); WGEA (21.59 m.c.); LIN; YCN-3 (8.09 m.c.); PLB-9, Djocjakarta (5.61 m.c.); DZH-5 (9.69 m.c.); ZYN-8; VLX (1st N.Z. report); Pakistan (15.275 m.c.); WNRX (21.73 m.c.); Munich (9.54 m.c.); KGEI (9.7 and 15.12 m.c.); and WCBX (6.06 m.c.).

"Voice of America" now verifying with nice coloured card . . . shows radio tower, etc., like cover of their schedule.

Miss Dorothy Sanderson also received some nice veries:—

CE622 (6.2 m.c.); WRUL, WRUS (this was a new card); ZYK-2 and ZYK-3 (11.145 and 9,565 m.c.); and LIN (17.825 m.c.) (I'll bet you are proud of those two O.K's from Recife, Brazil.—L.J.K.)

Mr. C. R. Woolsey, of Terrigal, N.S.W., has received a "correct report" from HER-5, Berne, Switzerland, and elsewhere I am printing a complete list of the transmitters mentioned in his verie.

Rex Gillett received a prompt reply to his report to Radio Budapest. It took just 19 days from the time he posted his letter. Surprise was expressed by the head of the International Relations Department that their station using only 400 watts was heard so far away. Rex is justifiably proud his was the first report from Australia and it, incidentally, brought his list of verified stations up to 107. Truly a very fine performance. Radio Budapest broadcast on 6.25 m.c. 48 met.

FLUO LIGHT
(Cont. from Page 22)

two 20-watt tubes, arranged alongside of each other. These were mounted on a sheet of 18 gauge aluminium measuring 30 inches by 10. This was given a half-bend down along each side, about two inches in from the edge, thereby giving it the necessary longitudinal rigidity and forming a fair shape of reflector.

The four tube holders are mounted as required, about 23 inches apart, but best to check on this by measuring the actual tubes you obtain. For these holders it is necessary to cut rectangular holes, about 1¼in. x ⅜ in. This can be done by drilling three holes for each, breaking them into each other with your angle cutters, then inserting a flat file. The condenser and ballast are mounted on top in such a position that they balance the outfit fairly well. The ballast being heavy, and the condenser being light, they are not mounted in symmetrical manner.

Our diagram gives a rough idea, but in every case it will be best to balance up with the particular components you are using.

Wiring up is easily done with short lengths of V.I.R. housewiring wire, looped and fitted under the terminal screws on the holders and starter sockets.

Don't ask me to explain the theory behind fluorescent lighting, but the starter buttons are little gadgets fitted in sockets. It is said that if the tube doesn't start up when switched on, you turn the starter button and all is well. With my outfit it started first pop, and there has been no need to touch the starters.

When starting up, the fluorescent light takes a second or two before giving a couple of flashes and stutters, then settles down to give you a most effective form of lighting at low power consumption.

An electronic "eye" which is able to "see" dusk and dawn approaching, and turn on or off individual street lights has been developed by engineers of the General Electric Company, in America.

Sales of radio and television receivers this year (1949) will probably surpass the 750,000,000 dollar volume of 1948, **Max F. Balcom,** president of the Radio Manufacturers Associated, predicted at a meeting of radio technicians. **Mr. Balcom** pointed out that radio and television receiver sales last year exceeded all previous records, spite a 20 per cent. decline in radio receiver sales. Well over half the industry's income will come from television sets. — Universal Commerce (U.S.A.).

NEW INTERNATIONAL CALL-SIGNS

The following revised table of Call signs was agreed at the Atlantic City Conference, 1947, and came into use on January 1, 1949. The first character or the first two characters of a call sign indicates the nationality of the station using it.

AAA—ALZ	U.S.A.
AMA—AOZ	(Not Allocated)
APA—ASZ	Pakistan
ATA—AWZ	India
AXA—AXZ	Australia
AYA—AZZ	Argentina
BAA—BZZ	China
CAA—CEZ	Chile
CFA—CKZ	Canada
CLA—CMZ	Cuba
CNA—CNZ	Morocco
COA—COZ	Cuba
CPA—CPZ	Bolivia
CQA—CRZ	Portuguese Colonies
CSA—CUZ	Portugal
CVA—CXZ	Uruguay
CYA—CZZ	Canada
DAA—DMZ	Germany
DNA—DQZ	Belgian Congo
DRA—DTZ	Byelorussia
DUA—DZZ	Philippines
EAA—EHZ	Spain
EIA—EJZ	Eire
EKA—EKZ	U.S.S.R.
ELA—ELZ	Liberia
EMA—EOZ	Iran
ERA—ERZ	U.S.S.R.
ESA—ESZ	Estonia
ETA—ETZ	Ethopia
EUA—EZZ	U.S.S.R.
FAA—FZZ	France & Colonies
GAA—GZZ	Great Britain
HAA—HAZ	Hungary
HBA—HBZ	Switzerland
HCA—HRZ	Ecuador
HEA—HEZ	Switzerland
HFA—HFZ	Poland
HGA—HGZ	Hungary
HHA—HHZ	Haiti
HIA—HIZ	Dominican Republic
HJA—HKZ	Colombia
HLA—HMZ	Korea
HNA—HNZ	Iraq
HOA—HPZ	Panama
HQA—HRZ	Honduras
HSA—HSZ	Siam
HTA—HTZ	Nicaragua
HUA—HUZ	Salvador
HVA—HVZ	Vatican City
HWA—HYZ	France & Colonies
HZA—HZZ	Saudi Arabia
IAA—IZZ	Italy & Colonies
JAA—JSZ	Japan
JTA—JVZ	Mongolia
JWA—JXZ	Norway
JYA—JZZ	(Not Allocated)
KAA—KZZ	U.S.A.
LAA—LNZ	Norway
LOA—LWZ	Argentina
LXA—LXZ	Luxumbourg
LYA—LYZ	Lithuania
LZA—LZZ	Bulgaria
MAA—MZZ	Great Britain
NAA—NZZ	U.S.A.
OAA—OCZ	Peru
ODA—ODZ	Lebanon
OEA—OEZ	Austria
OFA—OJZ	Finland
OKA—OMZ	Czechoslovakia
ONA—OTZ	Belgium & Colonies
OUA—OZZ	Denmark
PAA—PIZ	Netherlands
PJA—PJZ	Curacao
PKA—POZ	Netherlands Indies
PPA—PYZ	Brazil
PZA—PZZ	Surinam
QAA—QZZ	(Service Abbreviations)
RAA—RZZ	U.S.S.R.
SAA—SMZ	Sweden
SNA—SRZ	Poland
SSA—SUZ	Egypt
SVA—SZZ	Greece
TAA—TCZ	Turkey
TDA—TDZ	Guatemala
TEA—TEZ	Costa Rica
TFA—TFZ	Iceland
TGA—TGZ	Guatemala
THA—THZ	France & Colonies
TIA—TIZ	Costa Rica
TJA—TZZ	France & Colonies
UAA—UQZ	U.S.S.R.
URA—UTZ	Ukraine
UUA—UZZ	U.S.S.R.
VAA—VGZ	Canada
VHA—VNZ	Australia
VOA—VOZ	Newfoundland
VPA—VSZ	British Colines
VTA—VWZ	India
VXA—VYZ	Canada
VZA—VZZ	Australia
WAA—WZZ	U.S.A.
XAA—XIZ	Mexico
XJA—XOZ	Canada
XPA—XPZ	Denmark
XQA—XRZ	Chile
XSA—XSZ	China
XTA—XWZ	France & Colonies
XXA—XXZ	Portuguese Colonies
XYA—XZZ	Burma
YAA—YAZ	Arghanistan
YBA—YHZ	Netherlands Indies
YIA—YIZ	Iraq
YJA—YJZ	New Hebridies
YKA—YKZ	Syria
YLA—YLZ	Latvia
YMA—YMZ	Turkey
YNA—YNZ	Nicaragua
YOA—YRZ	Rumania
YSA—YSZ	Salvador
YTA—YUZ	Yugoslavia
YVA—YYZ	Venezuela
YZA—YZZ	Yugoslavia
ZAA—ZAZ	Albania
ZBA—ZIZ	British Colonies
ZKA—ZML	New Zealand
ZNA—ZOZ	British Colonies
ZPA—ZPZ	Paraguay
ZQU—ZOZ	British Colonies
ZRA—ZUZ	South Africa
ZVA—ZZZ	Brazil
2AA—2ZZ	Great Britain
3AA—3AZ	Monaco
3BA—3FZ	Canada
3GA—3GZ	Chile
3HA—3UZ	China
3VA—3VZ	France & Colonies
3WA—3ZX	(Not Allocated)
3YA—3YZ	Norway
3ZA—3ZZ	Poland
4AA—4CZ	Mexico
4DA—4IZ	Philippines
4JA—4LZ	U.S.S.R.
4MA—4MZ	Venezuela
4NA—4OZ	Yugoslavia
4PA—4SZ	British Colonies
4TA—4TZ	Peru
4UA—4UZ	United Nations
4VA—4VZ	Haiti
4WA—4WZ	Yemen
4XA—4ZZ	(Not Allocated)
5AA—5ZZ	(Not Allocated)
644—6ZZ	(Not Allocated)
7AA—7ZZ	(Not Allocated)
8AA—8ZZ	(Not Allocated)
9AA—9ZZ	(Not Allocated)

Speedy Query Service

UNDER THE PERSONAL SUPERVISION OF A. G. HULL

D.E. (Albury) has written to a certain coil manufacturer three times but has been unable to extract a reply from them concerning their products.

A. Alas and alack, that is just the way it is. Following up your complaint we sent along two further letters, but we can't get a reply either. It seems that many manufacturers are having a pretty tough time of it with power restrictions, personnel problems, etc. Some of them seem to have given up their hopes and ambitions and don't care whether they stay in business or not. Under the circumstances we can only suggest that you enlist the aid of those coil manufacturers who still have faith and are battling against their problems.

C.V.S. (Maroubra) sends along a story about the illogical way in which disbelievers try to discredit direct-coupled circuits.

A. Yes, we know. No matter how much theory is introduced into the question the ears will always prove the final answer. At the Amplifier Championships the direct-coupled amplifiers have proved their appeal to the ears. It is not so much a matter of frequency response, or the frequency discrimination characteristics of condenser coupling, for a full frequency response is not necessary (or desirable) with present-day records or broadcasting. Your letter and many others are on hand for editorial attention and much more about this subject will appear in our issues in the near future.

M.M. (Coff's Harbour) writes to endorse recent statements in our columns about the lack of appeal in the tonal qualities of many of the latest sets.

A. Glad to get your views, which are most interesting. As a matter of fact, we have a special reporter making a study of this subject at present, making direct interviews with owners of old sets who have tried the latest models, yet refuse to part with the old-timers, even though having breakdown troubles.

C.A. (Ryde) wants circuits for the Kingsley "Ferrotune" units which are available cheaply at present.

A. We do not have any copies of the May, 1946, issue with the full details of the KFT1 five-valve set, but we have the September, 1947, issue with the bare circuit. We have the August, 1946, issue with full details of the Ferrotune Reinartz to use the KFT2 unit, also the November, 1946, issue with full details covering the four-valve mantel version with the KFT3 unit. These issues are available from our Back Numbers Department at 1/ each, post free.

F.E. (Whyalla) has heard about the "Junior Feedback Amplifier."

A. The original version was described in the November(, 1948, issue, with further references in February and March, 1949, issues. All of these are available from our Back Dates Department. The later versions used the 807 in the output stage, with a 6A3 in the original. We can give you a strong recommendation to build up this amplifier as it is most versatile. If you don't like the direct coupling there are plenty of alternative hook-ups which suggest themselves, with and without inverse feedback. Power output is from 8 to 10 watts and can be exceptional quality with the right output transformer and other components.

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.—Palec modulated oscillator, brand new condition, only 6 months old; £22/10/-. C. E. Everdell, Gleneagle, Beaudesert line, Queensland.

FOR SALE. — Radio Text Books, latest editions, perfect condition, 60 per cent. of cost price. J. W. Nairn, 22 McLean Street, Morwell, Vic.

FOR SALE. 1 Push-Pull, Class B, 809 Power Amplifier and Modulator, complete with 1,000 volt, 400 mill. Power Supply. In perfect working order. Also 2 Abac W.A.8 Horn Speakers. Brand new. Will sell separately or else accept £35 for the lot or nearest offer.

W. H. SMYTH,
50 Canberra Street, West Brunswick. FM 9018.

FOR SALE. — "Garrard" Electric Gramophone, motor and pick-up unit, brand new; delivered Melbourne or post free, £5/10/-. Write "8509," c/o Radio World, Box 13, Mornington.

FOR SALE.—VCT/V Valve and Circuit Tester, Calstan model 307A modulated oscillator and ouput meter. Both in good working order; £15 each. Frank Tilby, 169 Gosford Road, Adamstown, Newcastle, N.S.W.

WANTED.—Instructions to convert ex-army FS6 Transciever for use from a.c. power mains. Ian Alexander, 11 Clarendon St., West Coburg, Vic.

A.T.D. (Cremorne) asks for details of the Amplion speaker type AV34 (12P27) about 18 months old.

A. With a nice bit of co-operation, the Amplion company has supplied the following data: The AV35 is a 12in. permag speaker, fitted with a 12,000 ohm centre-tapped transformer. The voice coil impedence is 2.2 ohms, the resonant frequency of the cone between 70 and 90 cycles, frequency range from 60 to 6,000 cycles on a typical speaker curve. When properly baffled the power handling ability is rated at 15 watts.

RED LINE

TRANSFORMERS OF DISTINCTION

FILAMENT TRANSFORMERS

ITEM 34. **Type No. 7038**

Prim: 2.30v. .. .. 50 cps.
Secondary 6.3v.-3A
Base: 2½ x 2 x 2⅛" H, Wgt. 1lb. 4ozs.
Mntg: MH1A .. .. "S" is 1"
Insulation .. .. 500 volts

ITEM 35. **Type No. A246**

Prim: .. .. Auto Winding
V: Common .. 2.5v. .. 4v. .. 6.3v-3A
Base: 2½ x 2 x 2⅛" H, Wgt. 1lb. 4ozs.
Mntg: MH1A .. .. "S" is 1"

ITEM 36. **Type No. 2500**

Prim: Com-10-210-220-240v. .. 50 cps
Fils. .. .. 2.5v.-10A CT
Base: 4 x 3⅛ x 3¾" H, Wgt. 4lb. 8ozs.
Mntg: V10 .. .. "S" is 1"
Insulation .. .. 2000 volts

ITEM 37. **Type No. 5526**

Prim: Com-10-210-220-240v. .. 50 cps
Fils: 5v.-4A .. .. 2.5v.-10A CT
5v.-2A .. .. 6.3v.-4A CT
Base: 4 x 4 x 3¾" H, Wgt. 6lb. 12ozs.
Mntg: V10 .. .. "S" is 1¾"
Insulation .. .. 1000 volts

ITEM 38. **Type No. 5566**

Prim: Com-10-210-220-240v. .. 50 cps
Fils: 5v.-4A 6.3v.-3A
5v.-4A 6.3v.-3A
Base: 4 x 4 x 3¾" H, Wgt. 6lb. 12ozs.
Mntg: V10 .. .. "S" is 1¾"
Insulation .. .. 1000 volts

ITEM 39. **Type No. 66105**

Prim: Com-10-210-220-240v. .. 50 cps
Fils: 5v.-4A .. .. 6.3v.-3A CT
10v.-8A-CT .. .. .. 6.3v.-3A CT
Base: 5 x 4¾ x 4⅝" H, Wgt. 12lb. 8ozs.
Mntg: V15 .. .. "S" is 2"
Insulation .. .. 1000 volts

HIGH FIDELITY OUTPUT TRANSFORMERS
(DESIGNED SPECIFICALLY FOR NEGATIVE FEEDBACK APPLICATION)

The "AF" series of output transformers are superhigh quality units designed for minimum phase shift, and are intended for use in the types of negative feedback circuits using gain reduction of the order of 20 to 25 db and in which the transformer itself is included in the feedback loop. A very large sub-division and interleaving of primary and secondary coils confines leakage inductance to the phenomenally low values shown, while the open circuit inductances are designed to have a signal attentuation nnt greater than 3 db at 3.3 cps. Upper frequensy attenuaton is not more than 3 db at 60 KC.

ITEM 52. **TYPE No. AF8**

Primary Z: 10,000 ohms pp., Plus 34 db
Secondary Z: .. .. 8 ohms VC
Insertion Loss .. .. 0.5 db
Primary L: 125 Hys.
Leakage L: 22 mHY
Freq. Resp.: +/- 0.2 db 20 cps to 30 Kc/s.
Base: 4 x 4¼ x 4¼" H .. Wgt. 7lbs.
Mntg: VII .. .. "S" is 1¾"

ITEM 53. **TYPE No. AF10**

Primary Z: 10,000 ohms pp., Plus 34 db
Secondary Z .. .. 500 and 125 ohms
Insertion Loss .. .. 0.4 db
Primary L: 125 Hys.
Leakage L: 17 mHY
Freq. Resp.: +/- 0.2 db 20 cps to 30 Kc/s.
Base: 4 x 4¼ x 4¼" H .. Wgt. 7lbs.
Mntg: VII .. .. "S" is 1¾"

ITEM 54. **TYPE No. AF15**

Primary Z: 10,000 ohms pp., Plus 34 db
Secondary Z: .. 15 and 3¾ ohms VC
Insertion Loss .. .. 0.5 db
Primary L: 125 Hys.
Leakage L: 19 mHY
Freq. Resp.: +/- 0.2 db 20 cps to 30 Kc/s.
Base: 4 x 4¼ x 4¼" H .. Wgt. 7lbs.
Mntg: VII .. .. "S" is 1¾"

The "AW" range of output transformers listed in this section comprises units designed specifically for high fidelity audio systems. Their features are multiple interleaving of coils to confine leakage reactance within the limits permissable consistent with the upper frequency range covered; adequate primary open circuit inductances to maintain low frequency amplification; and comparatively large core structure if high quality transformer steel to reduce iron distortion by the use of low flux inductions at the MAXIMUM R.M.S. signal frequency voltages incurred.

OCL values are measured at 5v AC at 50 cycles per second, representing an extremely low signal level. The actual inductance at — 3 db from rated output would be many times that given.

ITEM 55. **TYPE No. AW1**

Primary Z: 5000 ohms pp., Plus 33 db
Secondary Z: .. 8 ohms or 2 ohms
Insertion Loss 0.44 db
Primary L. 80 Hys. Leakage L. 35 mHY
Freq. Resp.: +/- 1 db 30 cps to 12 Kc/s.
Base: 4 x 4 x 4¼" H .. .. Wgt. 6lbs.
Mntg: VII .. .. "S" is 1½"

ITEM 56. **TYPE No. AW2**

Primary Z: 5000 ohms pp., Plus 33 db
Secondary Z: 500 ohms and 125 ohms
Insertion Loss .. .. 0.38 db
Primary L: 85 Hys. Leakage L: 70 mHY
Freq. Resp.: +/- 1 db 30 cps to 12 Kc/s.
Base: 4 x 4 x 4¼" H .. .. Wgt. 6lbs.
Mntg: VII .. .. "S" is 1½"

RED LINE EQUIPMENT PTY. LTD.

TRANSFORMER ENGINEERS

WORKSHOP: Cent. 4773, 2 Coates Lane. Melb.
CITY OFFICE: MU6895 (3 lines), 157 Elizabeth Street, Melbourne.

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