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September, 1949

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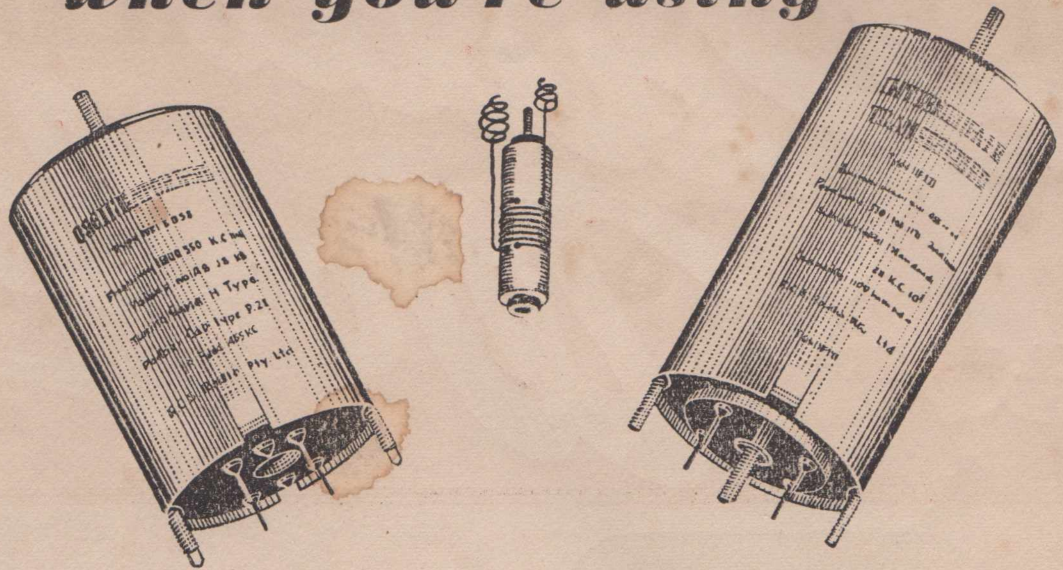

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CONTENTS

EDITORIAL

A GREAT many of our readers are not lily-white amateurs. Radio parts are expensive, experience costs money, and few can afford to pursue radio as a non-paying hobby. Little of the true interest in radio need be lost by those who combine some business with their play, accepting commissions to build sets to order for those who want something special, or doing repairs and modifications to existing receivers.

Judging from some letters received it appears that quite a few get badly "stung" when they set out to do work of this kind. It is quite easy to over-rate one's knowledge, for a start. It seems so simple to glance over the constructional article on a powerful receiver and feel confident that you can easily build it up in a matter of a few hours. In practice it is not quite so simple, unless you are prepared to work for a few pence per hour for your time. It is not every set which goes to perfection as soon as it is finished. The smallest error in the wiring, or a minor fault in almost any component, can give you trouble which may take hours of exasperating work to find and rectify. Getting the parts together may take hours of shopping. Installation and service are both time-eating jobs of work.

It is hard to give figures that will cover every type of job, but I would say that to build a set to order is worth at least £5 above the cost of the parts; more in the case of a set having special features or a lot of parts in it. To make it anything like a good business proposition the figure would be nearer a tenner in most cases.

Repairs, of course, should be handled on a basis calculated at the price of the parts, plus a handling margin, plus the cost of time, at so much per hour.

—A. G. HULL.

UNIVERSAL SPEAKER INPUT UNIT

Here is a handy piece of equipment for your radio repair bench, a unit which will couple up almost any receiver into a well-baffled, wide-range speaker.

ANYTHING which will save time is worth having in a radio repair business. Although it is always essential to test each repaired set on its own speaker, it is handy to have a speaker on the bench to which any set can be plugged. Since various sets require different loads and field coil resistances, and have different speaker plug arrangements, quite a lot of thought is required to make up a speaker which will suit any receiver likely to be encountered.

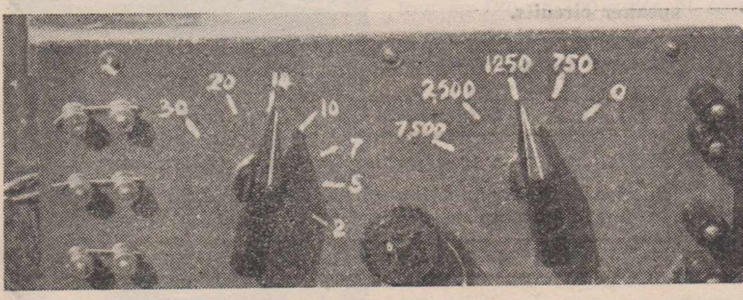
For some years past there have been universal speaker units on the market, but few seem to appreciate that the special components are readily available, so that a universal speaker can be built up quite cheaply by anyone with a normal knowledge of radio construction. The home-made unit can have several advantages, apart from economy. It is possible, for example, to build the input arrangements as a unit, then mount the speaker at a distance, or build it into a wall, so that it has effective baffling to allow full reproduction of the low notes. It is possible, with your home-made unit, to use a wide-range speaker, such as the Rola type 0-12. If a set tests well on this speaker you can rest assured that it will sound alright on its own speaker. The Rola "O," with adequate baffling, will reproduce lows so well that any trace of hum in the set will be readily noticed. Similarly, with a strong high note response the reproduction of distortion will be so clear that you will not fail to recognize even small traces of it.

We recently built up such an input for our own use, coupling it up to a Rola "0-12," fitted into the wall. For the base of the unit we folded up a piece of 18 gauge aluminium, fitted a piece of masonite for the front panel, and so we had a rough and ready, but serviceable job in a matter of an hour or so of work.

For the various input load impedances we obtained a special transformer which is available in the Ferguson range, known as type U1 and listing at 26/6. This transformer has a centre-tapped primary for either single ended, or push-pull input, and a secondary with a number of tappings. If these tappings are switched into the voice coil of a speaker with an impedence rating of about 2.3 ohms, the effective load presented to the receiver can be switched from 2,500 ohms up to 30,000 ohms in handy steps.

For the switch we obtained a small rotary job which is provided with 12 contacts, using only seven of them for the tapped secondary of the U1 transformer.

For the field arrangement we obtained a Ferguson choke to take care of hum, and then added a switch and a series of resistors as shown in our diagram. The resistance of the choke was about 250 ohms, so that we searched the junk box for heavy duty resistors, nothing less than 20 watts capacity, and found a couple of 500's, a 1250 and a 5,000. By fitting these as shown in the diagram we obtained a handy series of ranges. In the "O" position there is only the resistance of the choke, in the next position there is the resistance of the



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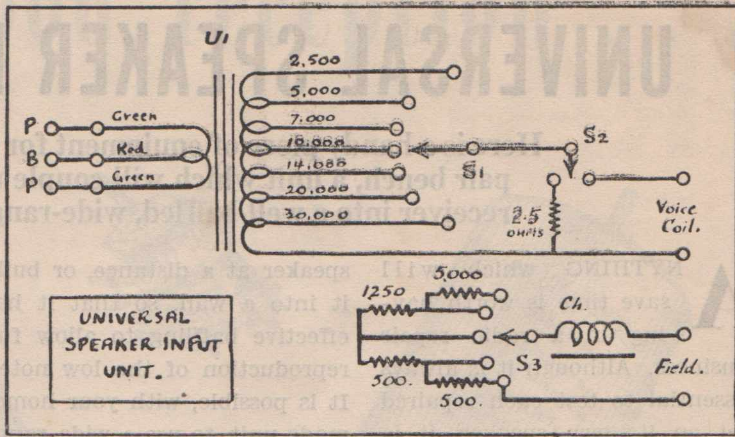
choke, plus one of the 500 ohms resistors, making it near enough to the same effect as a field coil of 750 ohms. On the next step of the switch the second 500 ohm resistor comes into circuit, bringing the total to about 1,250 ohms. This can be used for any set rated to use a speaker with a field of 1,000, 1,250, 1,500 or even 2,000 ohms. On the next step we get 2,500 ohms, a popular size with many old-time sets. On the last step we get 7,500 ohms, which was used in some sets of the 1930-1932 era. If your junk box does not provide the same values that we selected



it is easy enough to use other resistance values in series or parallel arrangements to make up a number of handy resistance values.

The front panel arrangement requires some thought, and we wouldn't say that ours was ideal, but it is simple. The voice coil terminals are brought

PARTS LIST

Piece of 18 ga. aluminium, size 10½in. x 10in., to be folded to make base.

Piece of masonite, 10in. x 4in. for front panel.

1-Input transformer, such as Ferguson type U1.

1-Filter choke, such as Ferguson type C20/ 150.

1 two-way switch.

2 7-way switches (or 12-way).

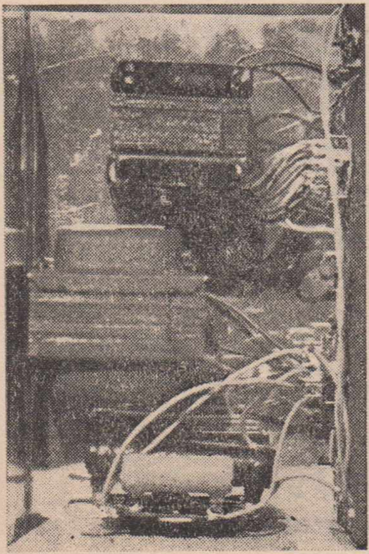
3 knobs.

10 terminals.

Several heavy-duty resistors; see text.

1 2.5 ohm resistor.

out at one side, with easy access, so that it is a simple job to connect an output meter across them, or the a.c. range of a multimeter, with a condenser in series. Then a switch is provided and a resistor, so that for prolonged testing on a single tone, the speaker can be silenced and



the tone signal watched on a meter.

On the input side a row of terminals is arranged in pairs, linked with short pieces of wire. These can be easily removed and a milliammeter inserted to give plate current readings for either output valve, or in the total h.t. run to centre tap. Permanently wired in to the back of these terminals is a speaker lead and plug, with a 5-pin plug connected in the usual way, viz., field across the filament pins, centre-tap to the grid pin and plates to the plate and cathode pins. An adaptor was built up to convert this plug into a four-pin one for those single-ended sets which use a four-pin socket with field on the filament pins. With this plug and adaptor it is possible to serve about 80 per cent. of the sets likely to be encountered.

CHECK LINE VOLTAGES

If you encounter a set which does not give performance up to expectations it is wise to check the line voltage. The fact that the line is supposed to be 240 volts doesn't mean a thing in these hard times. Owing to shortages of transformers, and one thing and another, the lines are often overloaded and run for long distances without stepping up. Nett result is that the line voltage may be as low as 180 or 190 volts ot some times of the day: A radio set with the transformer connected on the 240 volt terminals will not give proper performance on 180. Not only is the high tension voltage down, but also the heater supplies. In most cases it is quite safe to connect the mains to the 200 or 220 volt terminals, if these are provided on the transformer. Special arrangements can be dealt with by having a few plugs and leads on hand with solder-lug terminals on the ends of the leads. These can tnen be connected as required to the terminals on the front board.

In use, this speaker input unit proves most helpful. Running the multimeter over the terminals gives you a good check of the total current drain of the set, by measuring the drop across a known field resistance.

Effective Valve Checker

In response to numerous requests, here is a description of a valve-testing unit which you can easily build yourself out of readily-available parts. Its performance leaves nothing to be desired.

THE instrument described below permits tests of all descriptions to be carried out on all types of valves. Only one valve socket is shown in the circuit diagram, but every available type should be included.

Number 1 pins on each valve socket are wired together; all No. 2 pins together and so on. In addition they should all be wired to their respective numbers on the eight element selection "banana plug" sockets. The various elements are selected by plugging wandering leads into their correct positions along these sockets. These are shown by the dotted lines in the diagram as they would be set up for testing a 6V6 output valve.

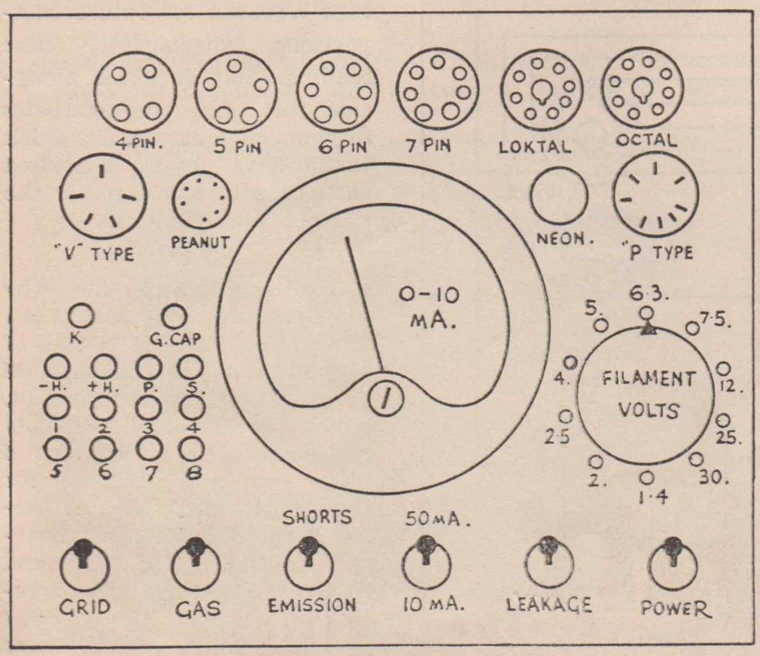
The grid lead is easily recognised by the grid cap in addition to the "banana plug," likewise the plate and screen leads are easily identified as the two are tied together. The other three leads, however, need some means of identification such as red for + heater, black for negative heater, and white for cathode, the variation of colour being either in the wire or the insulation on the plugs, or else the panel marked accordingly, as shown in the suggested panel layout.

The wandering lead idea has the advantage that any new type of sockets that may come on to the market may be added at any future date and the tester will never become obsolete.

The secondary of the power transformer must be rewound. The number of turns of one filament winding are counted before all of the original secondary windings are removed. Say, the five-volt winding turns are counted and found to be six, then the number of turns required from the start of the new secondary to each voltage tapping would be six times the voltage required at each particular tapping.

Switches Nos. 1, 3 and 4 are closed in their normal position and should be mounted upside down on the panel so that they open when switched down.

Switch No. 2 is wired so that the grid circuit is switched to the negative heater when the switch is up; that is, in its normal position. Switch No. 6 is in its normal (up) posi-



Suggested Layout for Panel

(Continued on next page)

VALVE CHECKER (Continued)

tion when switched to shorts. Switch No. 5 is a rotary 10 position switch for selecting the correct filament voltage for the particular valve under test.

To Test for Shorts.

With the switch in the shorts position (up) the neon lamps will glow if the plate or screen is shorting. This test should be the first carried out as it will reveal any short that is liable to damage the meter. Shorts by other elements are revealed when tests for mutual conductance and cathode-heater leakage are carried out.

To Test for Emission.

Pull down switch 6 to switch to emission, and the meter reading will give an indication of same. The 50 M.A. shunt is left across the meter (switch up) for testing rectifiers and output valves. For all other valves pull down switch 4 to decrease the meter range to 10 M.A.

To Test for Mutual Conductance.

Pull down switch No. 2. This gives a grid shift of 7.5 volts. An increase in the meter reading (plate current) will give an indication of mutual conductance. If no increase is obtained a short from control grid to cathode or heater is indicated.

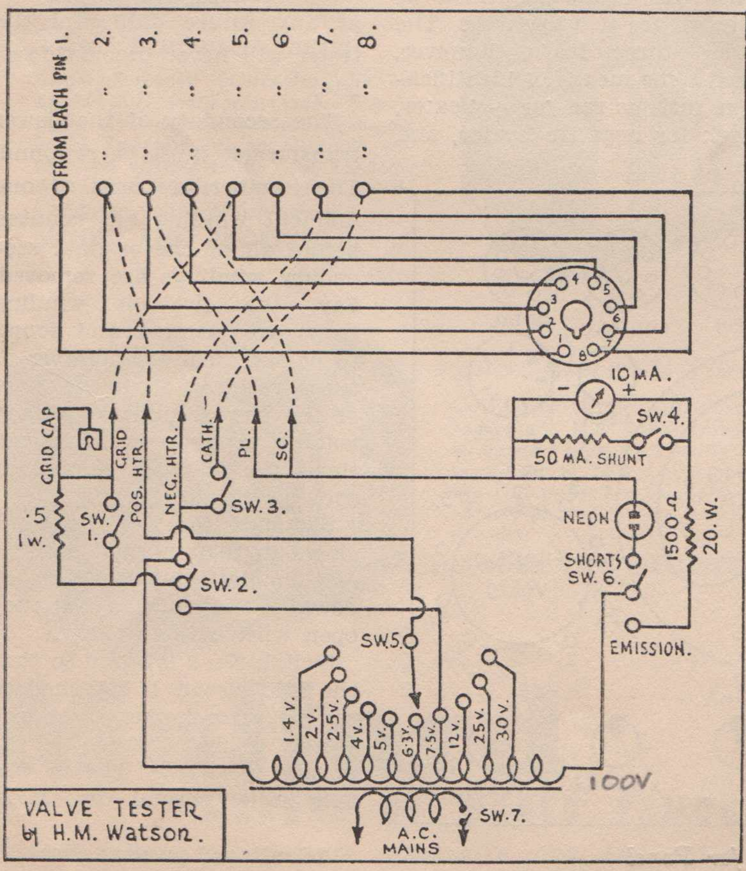
To Test for Gas.

Pull down switch No. 1, and if the valve is gassy, grid current will flow, causing a voltage drop across the .5 resistor and thus changing the meter reading.

To Test for Cathode-heater Leakage.

Pull down switch No. 3 and the meter reading should drop to zero, if it fails to do so a leakage or dead short exists between cathode and heater.

To calibrate the instrument a list of valves is drawn up; good valves are then tested and their relevant readings recorded for future comparisons. Alternatively these readings may be noted alongside the valve characteristics in your valve data book, which would have to be consulted each time in any case for the selector plug positions.



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Can anyone tell me why some manufacturers label their ½ meg. pots "500 M" instead of "500 K." As we all know M denotes milli or thousandths, which would make the pots resistance a half one ohm. I have seen the M used for thousands alongside of resistor values in American circuit diagrams also. Perhaps, like the colour coding of resistors, it is just another way to make things a little more difficult for the beginner.

FOR GRAMO REPRODUCTION

Versatile Amplifier Design

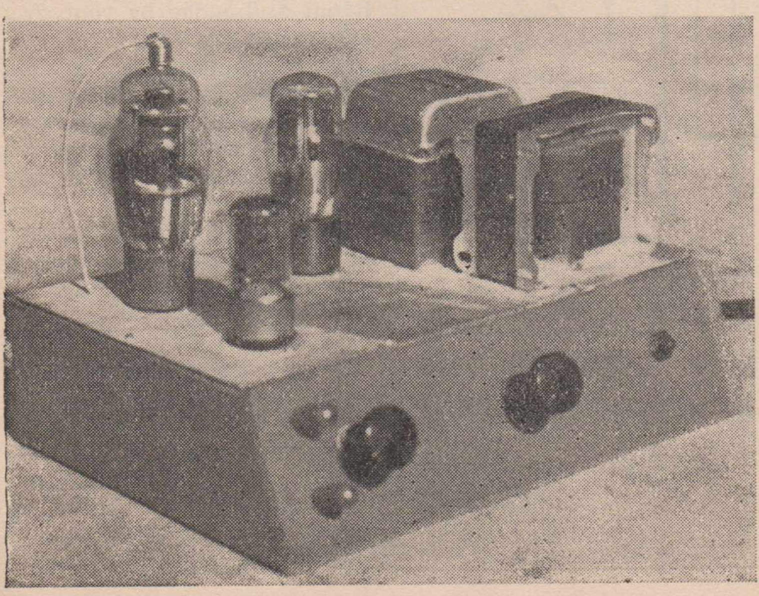
Here is an idea for an amplifier which lends itself to numerous minor circuit changes so that several different arrangements can be tried experimentally until one is found which suits your own paritcular taste or requirement.

AMPLIFIERS are easy to to build, easy to get into proper operating condition and give endless enjoyment from the superior quality of reproduction of gramophone recordings.

Biggest problem is, usually, to get an amplifier design which has the right amount of gain to suit your pick-up. The signal voltage from pick-ups will vary tremendously and it is never a hundred per cent. to use an amplifier with the volume control always retarded.

After giving this matter considerable thought, here is what we think is the answer; a simple amplifier design which lends itself to almost infinite variation. You can purchase the parts specified for this job, build up the amplifier according to our photographs and picture diagrams, and then settle down to weeks of interesting and instructive experimenting, trying out various valve element connections, coupling, and so on, noting results and then settling on that particular arrangement which gives you the amount of gain and the tonal quality which you find will suit your taste to perfection.

The first version of this amplifier, the one shown in the circuit diagram is the one which we found to be ideally suitable for the newest sensation in quality reproduction circles, the Acos type GP12 high-fidelity crystal pick-up. Stocks of this pick-up, which was described in detail in our issue of February, 1948, have now been landed from England and are proving most effective. Unlike most other high-fidelity pick-ups, this Acos GP12 has a fairly high signal voltage, and has its inherent bass compensation, so that no tone correction is necessary. Straight from the box and on to a good recording it is capable of handling the full range of frequencies likely to have been recorded in the first place,, without any of the harshness which is sometimes accepted as essential in wide-range reproduction. The needle in the new Acos pick-up is a permanent sapphire type, so that you have economy of operation as well as a low price, the list price being £3/12/6.



Most of our testing was done with this pick-up and a Rola type "0-12" speaker, so you can rest assured that if you use these accessories, and build up the amplifier exactly as described, you will have a mighty pleasing outfit.

The Circuit.

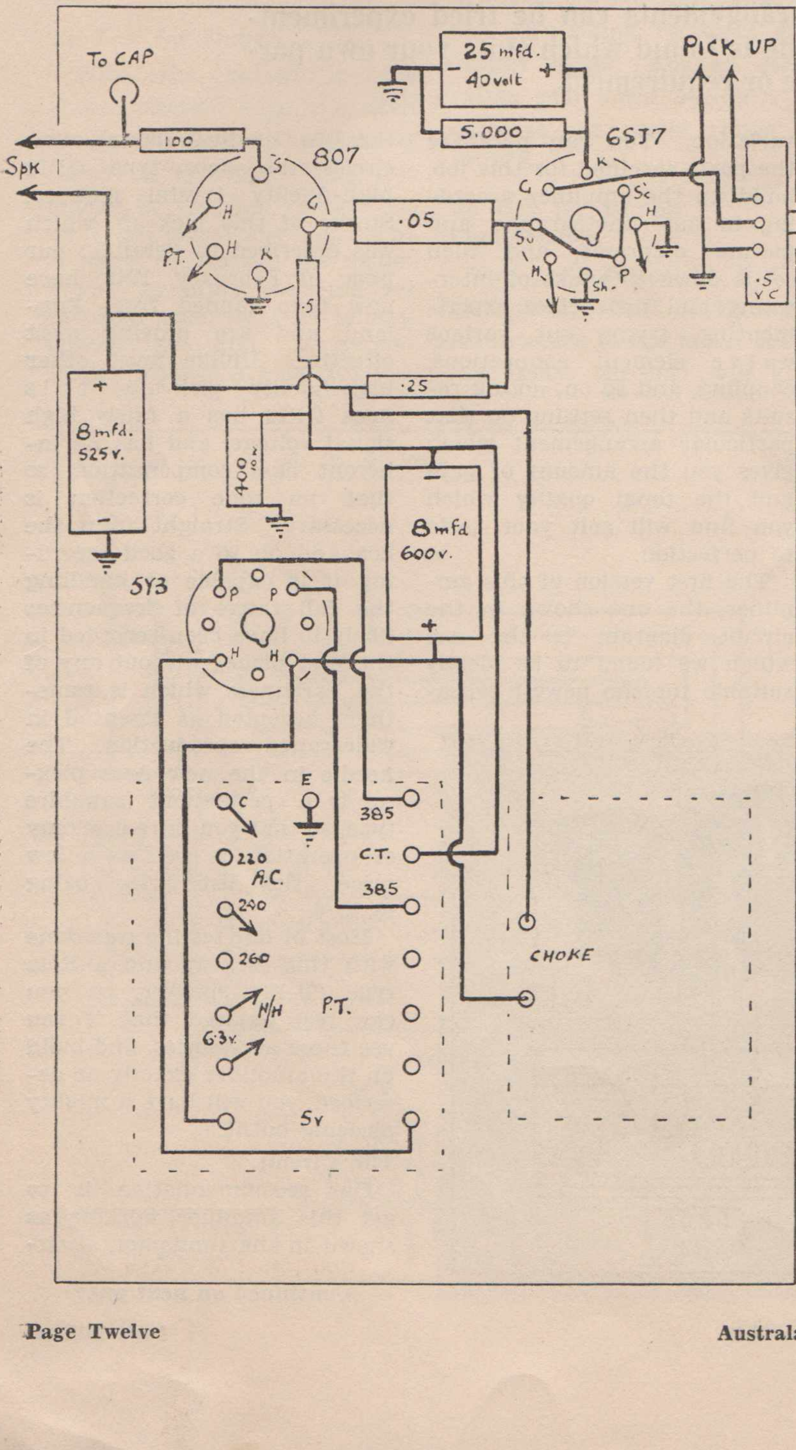
Our recommendation is to get this amplifier working as shown in the fundamental cir-

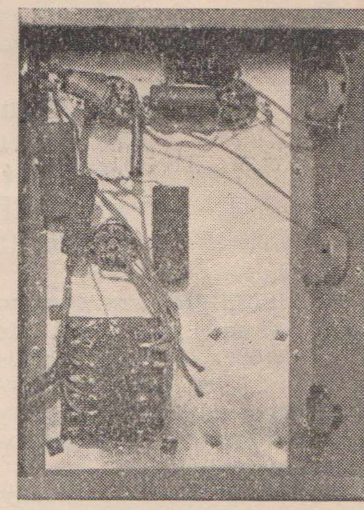
(Continued on next page)

cuit first, then you can play around with modifications, adding inverse feed-back and so on.

The fundamental circuit provides for all triode operation.

The first amplifier has the screen and suppressor tied to the plate, making it effective as a triode. This gives much lower gain than can be obtained by connecting the sup-





pressor to the cathode and feeding the screen from an independent voltage. This first valve feeds into the output valve by means of resistance-capacity coupling, which is probably the safest for the beginner. Improved quality can be obtained later by altering the circuit to direct-coupling, or at least you can easily start it out and judge by your own experience.

The output valve is the solid transmitter type, the 807, which is still available at a cheaper price than most ordinary power valves, yet can be used in several different ways. Being built to withstand high voltage in transmitters it has robust elements which will stand almost any amount of abuse.

For a start we suggest using this valve as a triode, too, by connecting plate and screen, or at least by coupling them together through a 100 ohm 1-watt resistor which acts as a parasitic suppressor. Before we forget to mention it, mount this resistor right at the valve socket with its pigtail cut back to about three-sixteenths of an inch long and soldered as close to the socket terminal as possible.

Bias for the output valve is taken from a resistor in the negative side of the high tension, this arrangement saving the cost of a by-pass condenser if nothing else, but also making the whole job more versatile.

Construction.

As will be seen from the photographs and diagrams, the job is a very simple one to wire. The components can all be fitted in without any need of insulated terminals, everything hanging on its own pigtails or terminals. This is not a nice way to build a set, of course, but it is the easiest and the quickest. Those who feel competent can easily use a terminal strip and mount the components rigidly on it.

EXPERIMENTS

Now to get deeper into the subject of changes which can be made, let us go into the subject of voltage gain. This can best be done by working back from the output valve. The 807 can be operated either as a triode or as a beam power valve. As a triode it will have a bias of about 30 volts and require a signal of about this amount in order to drive it to full power output. As a beam power valve it will require only about 16 volts for full power. As full power is considerably greater than as a triode, the amount of signal for equal power to that obtained when used as a triode will be only about 8 or 10 volts.

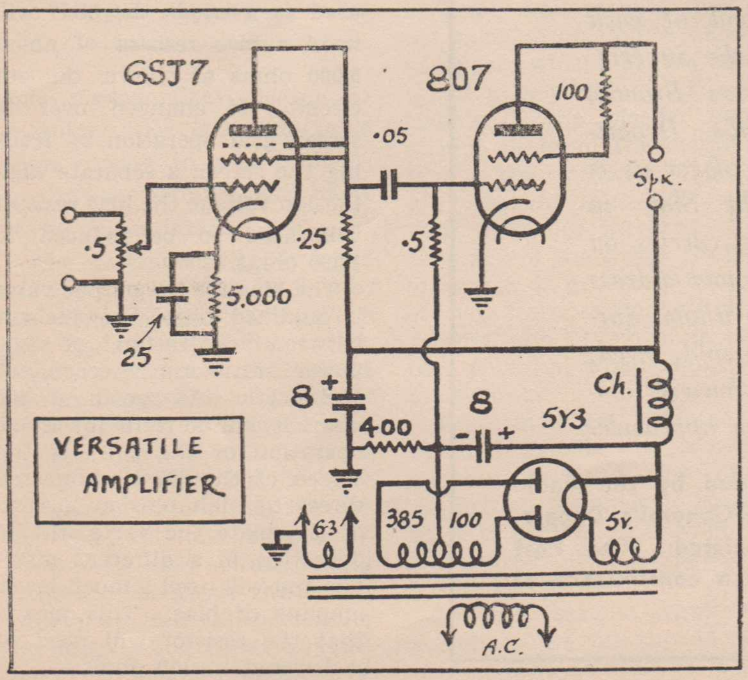
The signal output from a pick-up will be anything from a fraction of a volt up to about 5 volts, according to style, brand, etc., and will vary considerably even in pick-ups of similar type.

The Acos GP12 which we obtained from the stock of a wholesaler (not specially picked out for our benefit) delivers from a quarter of a volt to about 1 volt on peaks. It is the peaks which count, as the signal input to the output valve mentioned above is the absolute peak. The gain in the 6SJ7, when used with tri-

(Continued on next page)

PARTS LIST

Base, size about 18 x 12 x 3.
Power transformer, 385 v. @ 100/125 ma. 6.3v. etc.
Filter choke, 100/150 ma.
1- 8 mfd. electrolytic condenser, 600 volt.
1- 8 mfd. electrolytic condenser, 525 volt.
1- mfd. electrolytic 40 volt.
1- .05 mfd. tubular paper condenser, 600 volt.
1- Resistor, 100 ohms, 1 watt.
1- Resistor, 5,000 ohms.
1- „ 250,000 ohms.
1- „ 500,000 ohms.
1- Resistor, wire wound, 400 ohms 10-watt.
1- .5 meg. volume control.
1 4-pin (for speaker).
Sockets; 2-octal, 1 5-pin,
Valves: 1- 6SJ7, 1- 807, 1- 5Y3.
Speaker, 12in. permag. 5,000 ohm load.
Sundries: Power flex, knobs, terminals, screws, etc.



ode connection is about 13. According to these calculations, then, the triode first amplifier will only drive the output valve fully if the latter is used in the beam power connection. In practice, however, we found that the output of the 807 when triode connected was quite sufficient for normal household use.

By changing over the first amplifier from triode to screen grid operation the gain jumps from about 13 to over 100. This gives ample drive for the 807 as a triode, in fact it becomes desirable to cut back the gain a bit, by means of inverse feed-back. A simple and effective way of fitting feedback is to get two resistors of a ratio of about 10 to 1, such as 10,000 and 100,000 ohms. Connect these in series across from plate of the output valve to high tension, i.e., across the input to the speaker transformer. Now run the 250,000 ohm plate feed resistor to the junction of these two resistors, instead of to high tension. With the 10,000 ohm resistor nearest to high tension and the 100,000 one connected to the plate, the inverse feedback obtained is about 10 per cent., a handy amount for most general use.

Bias Adjustments

Bias for the first amplifier valve is obtained from the resistor in its cathode circuit. If used as a triode the 6SJ7 will need a bias resistor of about 5,000 ohms as shown on our circuit. If changed over to screen grid operation by feeding the screen a separate high tension voltage the bias resistor will need to be reduced to 1,000 ohms.

The bias for the output valve is obtained from the resistor between centre-tap of the power transformer secondary and earth. As shown at 400 ohms it will be right for triode operation of the 807. If the screen of the 807 is connected direct to high tension instead of the plate the valve will be operating in a different manner and will need a much lower amount of bias. This means that the resistor will need to be lowered to 150 ohms.

Electronic Voltmeter

An ordinary voltmeter will draw current and cause a load to be imposed in the circuit which it is measuring. This makes it useless for many applications, such as measuring signal voltages whilst a set is in operation. What is required for such work is a vacuum-tube or electronic voltmeter, as detailed here.

THE instrument is capable of measuring voltages of all frequencies up to 100 megacycles or more provided that high grade components are used and attention paid to the construction of the probe.

To keep the input resistance high 50 megohms is used as

By
H. M. WATSON,
89 Botting Street,
Albert Park (S.A.)

this figure gives nearly 17 megohms per volt; a value high enough to prevent loading of any circuit that is likely to be encountered.

The instrument is designed so that a grid shift of 3 volts in either direction will give a full deflection of the meter, which means that the voltage ranges have to be multiples of this figure, of which the most appropriate are—volts × 1, 5, 10, 50, 100 and 500 to give ranges of 0 to 3, 15, 30, 150, 300 and 1500 volts respectively. It is now only necessary to calibrate one range and all the others will fall into line automatically. The meter is graduated in tenths and the 0 to 3 range marked in, making thirty graduations in all.

With the 3 volts applied to the probe there is the 50 megohm bleed to earth. Other voltage ranges will require this figure divided by the voltage multipliers (5, 10, 50, 100 and 500).

The 40 megohm resistor taking the bleed from 10 to 50 megs has to be made up by placing four or more resistors in series but as these may be of ¼ or ½ watt ratings, they do not take up an undue amount of space, which, in any case, is not at a premium. The resistors in the bleeder chain should all be of the metalised type as the resistance of ordinary carbon types decreases with frequency increase. The accuracy of the meter reading, of course, is governed by that of these resistors amongst other factors, one of which is contact potential when using the diode probe.

This small D.C. voltage of about 7 volt is due to stray electrons reaching the diode plate from the cathode as soon as it is heated, even when no positive potential is applied to the diode plate.

Let us assume that the switch is set on the 15 volt range. The 15 volts it is desired to measure, plus the one unwanted contact potential volt, making a total of 16 volts, will be present. Now, if this 16 volts is picked off at 10 megohms above earth there will be

$$\frac{16}{50} \text{ of } 10 \text{ or } 3.2 \text{ volts}$$

applied to the 6SN7 grid which is .2 volt too much to meet the requirement of 3 volts. Adding the 1 volt contact potential to the other voltage ranges it is noted that for the 30 volt range = 31 volts picked off at 5 megohms

$$= \frac{31}{50} \times - = 3.1 \text{ volts,}$$

an error of .1 volt; and on the 150 volt range, 151 volts picked off at

$$1 \text{ meg} = \frac{150}{50} \times 1 = 3.02$$

an error of .02 volts. Then, of course, there is the total error of 1 volt when switched to the 3-volt range.

To compensate for these errors the zero-set could be changed for each range or preferably this inconvenience could be eliminated by designing a suitable bleeder chain

(Continued on next page)

and using the contact potential of the second diode to buck out that of the first so that the grid voltage of the 6SN7 can be held at 3 volts irrespective of range switch setting.

A 10 megohm resistor chain is used in this case so that with one volt applied a bleeder current of 1-10 microampere flows. Calculations are made to find the values of resistances required to give voltages equal to the above errors and these voltages are applied in phrase opposition to the contact potential voltage of the first diode. It will be noted that 10 megs are used for the 3-volt range, which means that 2 megs will be required for the 15 volt range, 1 meg for the 30-volt range, and .2 megs for the 150 volt range. The two higher voltage ranges need no compensation as 1 volt in 300 or 1500 is negligible. A potentiometer in series with the resistance chain allows for contact potential voltage adjustments of less than 1 volt.

As only .707 of the rectified peak voltage is required across the 50 megohm bleed to give a r.m.s. reading on the meter, the remaining .3 approx. is dropped across the 20 meg resistor in the probe which, with the .001 condenser forms a ripple filter for the rectified D.C. voltage

$$(.7 = 50 \text{ megs, total} = \frac{50}{.7} = 70 \text{ megs, difference} = 20 \text{ megs.})$$

The cathode follower operated at low plate voltages is used between input and the meter valve so that grid current in the final valve does not vary due to varying grid resistance as the ranges are changed. The final valve, of course, requires a plate voltage high enough so that 1 m.a. change in plate current is achieved when the grid bias is changed by 3 volts.

The power supply is balanced so that fluctuations of the mains voltage will balance out due to the balancing sections of the double triode valves.

The instrument is shown in the circuit diagram set for measuring 0—15 volts + D.C. Switching to DC — reverses the polarity of the 0-1 milliammeter. Switching to A.C. (high frequency) switches in the A.C. range adjustments in place of the D.C. range adjustment and also switches in the diode probe and contact potential balancing network.

On switching to A.C. (low frequency) the .02 condenser is brought into operation to prevent attenuation of these lower frequencies. This position should be used for all voltage measurements of frequencies below 100 k/cs where the rectified D.C. output of the probe gradually falls off in amplitude, this attenuation being due to the R.C. time constant of the .0005 probe condenser and the load resistance becoming less as compared to the time required for 1 cycle of the voltage being measured.

The range adjustment pots and contact potential balance pot all have the shafts cut off short, a saw cut is then made with a screwdriver. Once set these pots do not have to be altered.

For very high frequencies the diode valve in the probe should be of the U.H.F. type, as the ordinary types have a low shunt impedence at high frequencies. As a double diode is required a 6ALS is the logical choice.

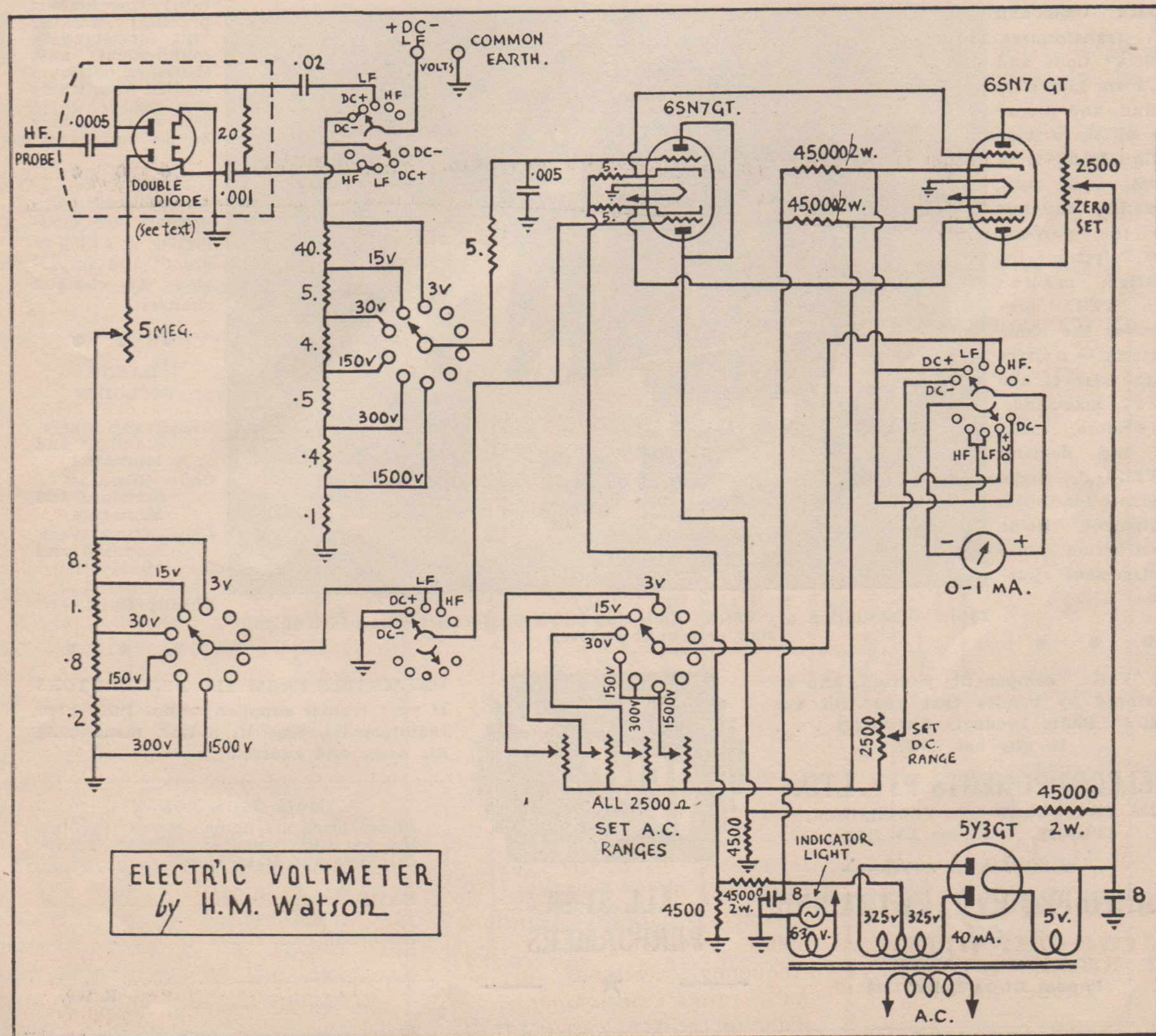
Another method would be to use an EA50 or 9006 both single diodes) and obtain the 1 volt to buck out the contact potential from a dry cell. The only alteration in the case of the latter scheme being adapted is the inclusion of a 5 megohm resistor between the moving arm of the pot and the 8 meg bleed resistor to make a total resistance chain of 15 megs without the pot, as the resistance network would now have a potential of 1.5 volts across it.

The plate cathode capacitance of the valve chosen should be as low as possible to prevent detuning.

The instrument measures 15 x 10 x 16, the meter being set in the top centre of the panel, midway between the left edge of the panel and left edge of the meter and in line with the centre of the meter is the outlet for the R.F. probe. In the same position only to the left of the meter is the indicator lamp. The common earth terminal and the DC + — LF terminal are situated in the top left hand corner. The four controls, zero set function switch, range switch, and rotary off on power switch are evenly spaced across the bottom of the panel and in that order. All components are mounted on the inside of the front panel, the three valves grouped together and stood off on a bracket to the left of the function switch, the pots for range set are mounted similarly on the right of the power switch, the shafts facing the rear of the instrument. The power transformer is bracketed to the top right of the panel. All resistors in the resistor chains are mounted directly to their relevant switches, and all other resistors mounted on strips where most convenient. All directions are given with the instrument viewed from the front.

The function switch has three banks, each of two circuits, with five positions and only four of which are used.

The range switch has three banks, each single circuit with 10 positions, only six of which are used.



SOUND FROM FILM

Pre-Amps For Talkie Work

From our friend in Northern N.S.W. comes another letter, this time dealing with the finer points of pre-amplifiers for photocell work, as used in talkies. Practical data on this subject is rather scarce, so we feel sure these details will be especially welcome. —Your Editor.

OTHER than a brief article in May, 1947, the subject of sound on film and associated apparatus has not found much space in your columns.

As I am a partner, operator and billposter, etc., in a small country theatre, I have devoted a considerable amount of time to the above mentioned subject, and hope the following notes may be of interest.

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

Being a devotee of high-fi, I had bench and service proof that AC exciter lamps were not a proposition.

Secondly, that frequency range from the optical system was directly controlled by P.E. cell loading, and the sensitivity of the optical system itself.

This ruled out the balancing of the output from two machines by conventional methods, that is by exciter lamp adjustment on the lowering of either P.E. cell voltage supply.

I approached the problem as in Fig. 1, and in practice, it worked out very well, balancing the output from two soundheads and allowing me to control the gain to the mixer stage.

The nominal practice to use a high gain pentode is inclined to amplify any machine noise present during low voltages as well as any microphonic troubles present in the valve itself.

Moreover, the output from P.E. cells of the non-gaseous type is extremely low and is directly controlled by the grid

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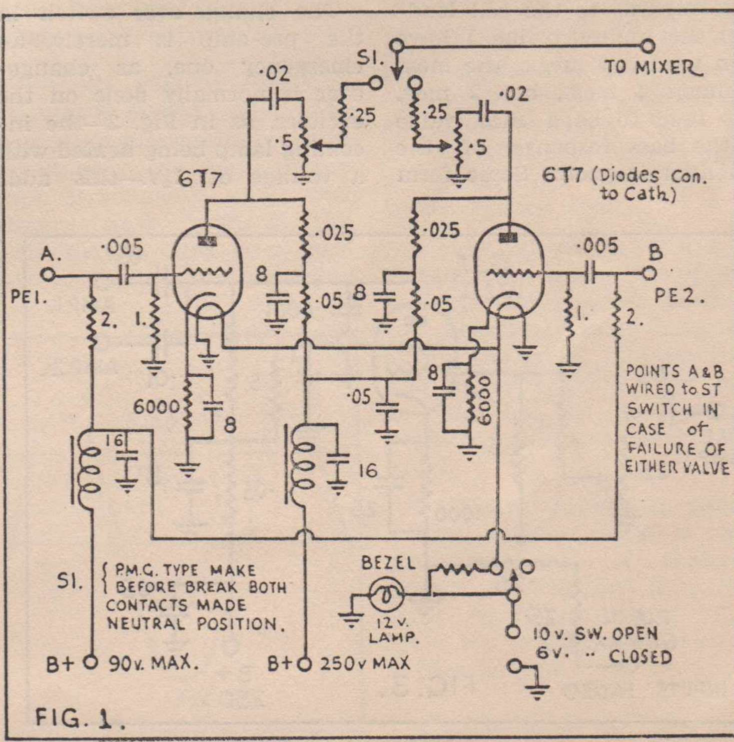


FIG. 1.

loading of the first amp stage.

The use of a leaky grid type of bias here would seem to be the answer, but, unfortunately, hum problems are rather hard to overcome even in low gain amplifiers, so their idea was also ruled out.

Floating of the P.E. cells, pre-amps and mixer valves was found to be necessary, and all new single ended types of valves were found to be a bad proposition anywhere in the amplifier.

As I had already arranged to have 10v. D.C. coming in for the exciters, the pre-amp fil. were also made D.C.

As both the 6T7 and 12J7 valves have 150 M/A fils. they could be supplied from the bias source in a push-pull amplifier of the 807 type where the output valves pull some 150 M/A's of current.

As regards to the cell loading, the highest value I have seen used is 3 megs., the most common 1 meg., but 2 meg. was foud to be a nice value if the bass response of the amplifier is good. Some form of bass boost is desirable, especially in small halls where the working output of the amp. is comparatively low.

The change-over switch in the pre-amp is merely an emergency one, as change-over is normally done on the exciters, as in Fig. 2—the incoming lamp being heated with a voltage of 1½v.—this adds greatly to the life of the lamp, and makes the change-over actually noiseless.

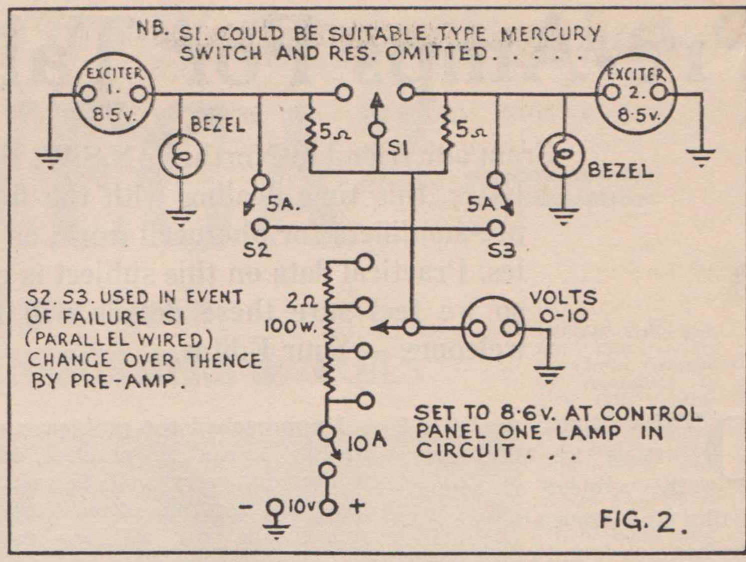


FIG. 2.

P.M.G. switches are used and wherever posible the contacts paralleled.

The mixer is arranged as in Fig. 3, and for theatre work the Technico pick-up, FP8, is outstanding among the cheaper variety. Whilst the frequency range may be low scratch is virtually non existent—a most desirable feature.

From the mixer two channels are fed, both being single-ended amplifiers of the 807 type.

One with heavy bass boost is fed to an A.W.A. P.A. special in a bass reflex box and the other to a Rola 8/42 in a multi cellular horn similar to the gramo combination printed in your January issue.

As regards to the frequency range, a 10,000 cycle note is just audible and no more, but

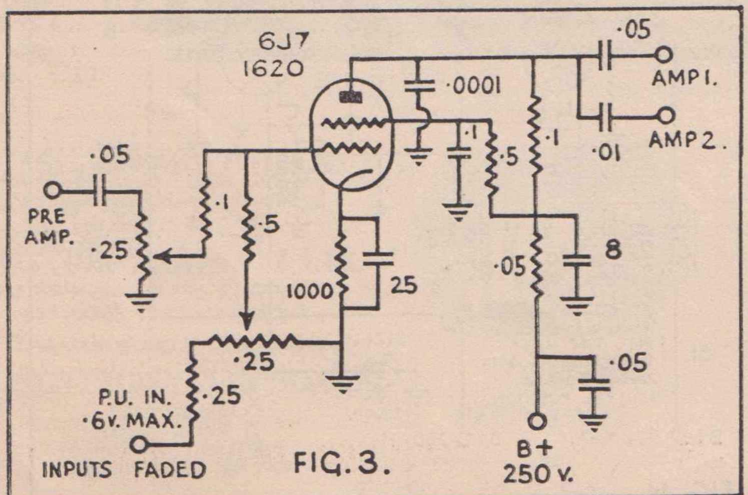


FIG. 3.

(Continued on page 40)

Alternating Currents

Now that our new theory course has reached the third session, the going gets tougher as we dig into that more difficult but important subject of alternating current.

ALTERNATING currents are very important in radio, as both radio and sound waves are alternating in character; that is, there is a regular periodic reversal.

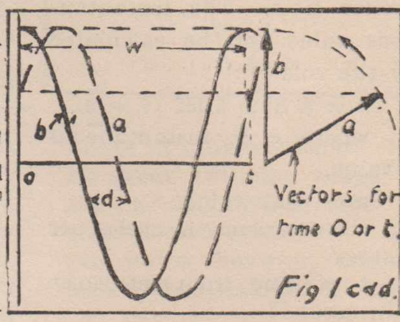
A sound is an alternative compression and rarefaction of the air—the air may be compressed and rarefied many thousands of times per second. These compressions and rarefactions act on the ear drums, giving the sensation we know as sound. The sound waves also operate on the diaphragm of a microphone which, by its movement, generates minute alternating currents.

Radio waves are themselves alternating electromagnetic waves which are capable of travelling through space. Any conductor in their path, such as an aerial, has small alternating voltages similar in form to the electromagnetic wave induced in it. These alternating voltages are amplified in the receiver and finally the sound modulation carried by them is separated from the radio frequency, and this is amplified further, and finally drives the speaker which re-converts it into sound waves in the air.

In the measurement of alternating currents it is not sufficient to simply measure current and voltage. In addition, power—which is not always equal to EI — frequency, wave, form and phase relationship are important.

Alternating Current Terms

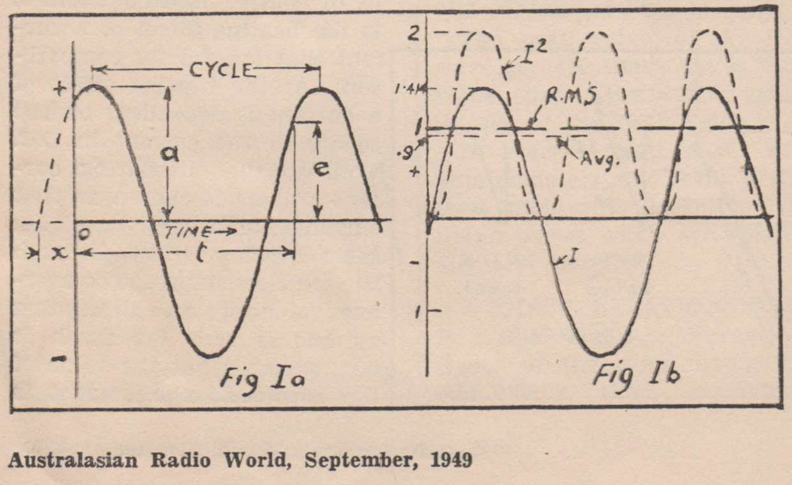
1. WAVE FORM. The wave form of an alternating current or voltage is the shape of the graph of voltage v. time. The primary wave form is the SINE WAVE. This is a pure wave form, and all other regular waves can be broken into combinations of sine waves.



2. INSTANTANEOUS VALUE. The instantaneous value of an alternating current is the actual current at a given instant —naturally this will be different an instant later. Then we can say that the wave form is a graph of instantaneous values against time.

3. MAXIMUM OR PEAK VALUE. The peak value of any wave is the greatest positive (or negative) value reached during the cycle. The positive and negative peaks may not be equal, but the positive and negative averages must be equal.

4. CYCLE. A cycle in alternating current work is the complete series of changes from a given instant until the same conditions recur. The cycle for a simple sine wave is from one peak to the next;



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for more complex waves there may be several peaks of different values, both positive and negative in one cycle.

Fig. 1a shows a sine wave—"a" is the peak value, "b" is the instantaneous value at the time "t" seconds from the reference time. The instantaneous value can be calculated by the rule

e = a Sine 6.28f (t $\underline{+}$ x)

where e = instantaneous value,

a = peak value,

f = frequency in cycles per sec.

t = time from reference in seconds

x = time to previous zero (from reference).

5. FREQUENCY. The frequency of a wave is the number of complete cycles in one second.

A few common frequencies in A.C. work are:—

Australian A.C. supply — 50 c.p.s. (Except W.A.—40 c.p.s.)

U.S.A. A.C. supply—60 c.p.s.

Vibrator power supplies for radios, etc.—100 or 150 c.p.s.

Audible frequencies—12 c.p.s. to 200,000 c.p.s. (The average person can hear about 20-12000 c.p.s. at normal volume levels.)

Radio frequencies—

Below 30,000 c.p.s. (30 kcs.). Very low freqs. V.L.F.

30 to 300 kc. Low freqs. L.F.

300 to 3,000 kc. Medium freqs. M.F.

3,000 to 30,000 kc. (3-30 megacycles). High freqs. H.F.

30 to mc. Very high freqs. V.H.F.

Above 300 mc. Ultra high freqs. U.H.F.

The latter band is now being divided into: Decimetric waves: 300 to 3,000 mc. (1 to .1 metre; 3 metre); Centrimetric waves, 3,000 to 30,000 mc. (.1 to .01 m.).

6. WAVE LENGTH. As the radio radiations move outward from the aerial transmitting them, a given peak will be some distance from the transmitter when the same conditions occur on the next cycle. This distance is termed the wave length of the transmitted signal. It is clear that the wave length will be dependent on the frequency of the signal. If the frequency is high there will be less time between succesive peaks and the wave length will be shorter. For example if the time beween peaks is 1/750,000 of 1 second—(750 k.c. signal), and radio waves, like light, travel at 300,000,000 metres per second, then two successive positive peaks will be 300,000,000/750,000 metres apart; a distance or wave length of 400 metres. Doubling the frequency to 1,500 k.c. will halve the wave length.

The relationship between velocity, frequency, and wave length is given by—

V = Lf

where V = velocity of light in

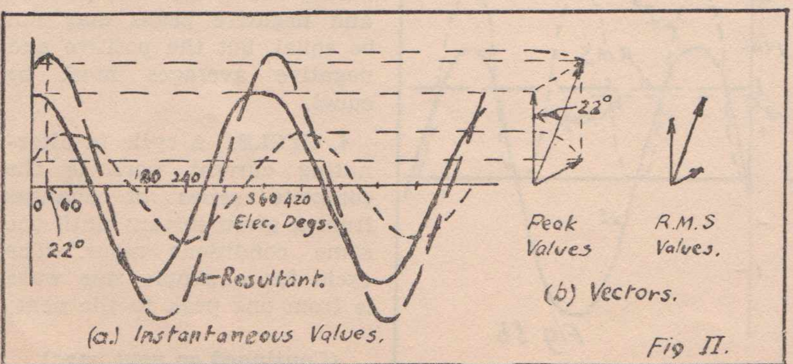
L = wave length in metres.

f = frequency in cycles per sec.

A simple basic reference which is easy to remember is that a wave length of 300 metres is equivalent to a frequency of 1 megacycle (1000,000 c.p.s.).

7. ROOT MEAN SQUARE. (R.M.S.). As in direct current work the usefulness of a current is best measured by the work it can do.

Some equivalence between alternating and direct currents is, of course, necessary, and it is the heating effect of a current that is used for comparison. As the heating effect of a current is dependent on the square of the current in D.C. work so the alternating current ampere is chosen as that current which will have the same heating effect through the same resistance. The average value of an alternating current is zero (as much is neg. as pos.), but the value of the square of the current is



(a) Instantaneous Values. (b) Vectors. Fig II.

always positive (the square of a neg. quantity is always positive) so the reversal of the current does not affect the power.

The R.M.S. value of the current is then the square root of the mean or average value of the squares of the instantaneous values of current throughout the cycle. In practice this is rarely determined experimentally as most metres which read A.C. are dependent, in themselves, on the square of the current.

For example the moving iron type meter depends on the repulsion occurring between two pieces of iron in a coil. This repulsion is proportional to the product of their pole strengths; but, as both are magnetized by the current and in proportion to the current, then the repulsion is proportional to the current squared. Similarly the hot wire instrument depends on the heating effect, i.e., the current squared. The inertia of the moving parts does the averaging and the calibration corrects to give the square root, so the meter reads R.M.S. values directly.

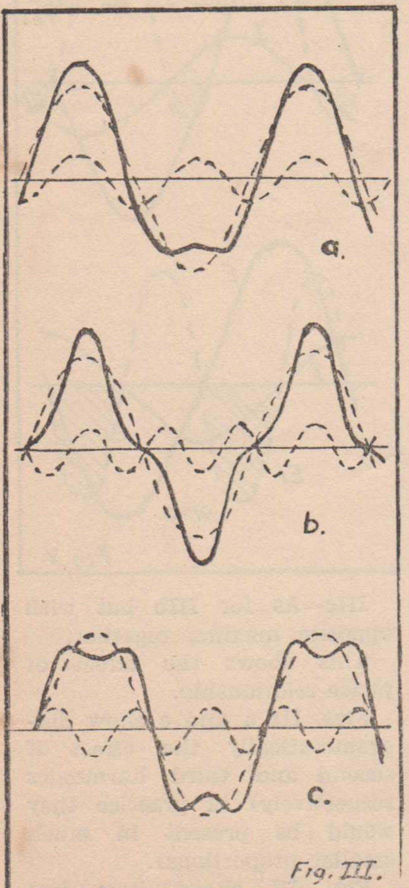


Fig. III.

8. FORM FACTOR. The average value of half a cycle bears a definite relationship to the R.M.S. value provided the wave is true sine form. The R.M.S. value is 1.11 times the average for a half cycle. Should the wave form differ greatly from the sine form the form factor will not be 1.11. A peaker wave will have a higher form factor, while that for a flat topped wave will be lower.

Form factor becomes important in the design of alternators as it enters the design equation and it is also important in the case of rectifier instruments, the scales of which must be corrected to read R.M.S. as the meter reads only average values.

Fig. 1B shows a sine wave together with the curve of current squared and the R.M.S. and average values.

The peak value of a sine wave is 1.414 times the R.M.S. value, that is the R.M.S. value is .707 of the peak value.

In practice most waves are approximately sine form (with the important exception of sound waves whch are generally very complex).

9. PHASE RELATIONSHIPS. It is clear that two alternating waves of the same frequency can have their maximum

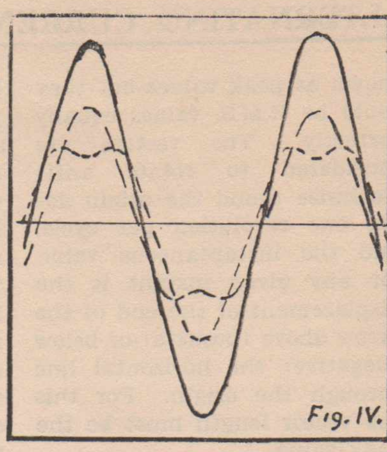


Fig. IV.

values at different times. Fig. 1C shows two sine waves "a" and "b," having the same frequency and amplitude. The two waves, however, are displaced a distance "d" apart, "b" having reached its max. value before "a." In this case "a" is said to lag behind "b," or conversely "b" leads 'a." The lag or lead is usually given as an angle of lag (or lead). In this case the angle of lag of "a" behind "b" is determined in degrees by the rule—

Angle = d × 360/w.

This is using the basis that one cycle is represented by 360 electrical degrees. This is also convenient when using vector representation in which voltages and currents are represented by arrows; the length of the arrow being the voltage, or current to a suitable scale, and the angular position being an indication of the phase relationship. Current arrows in vector diagrams are generally shown heavy with a solid head, while voltage vectors are represented by light barbed arrows.

The vector diagram corresponding to fig. IC is shown in Fig. 1D. These vectors are

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shown as peak values but they could be R.M.S. values equally correctly. The vectors are considered to rotate anti-clockwise round the origin doing one revolution per cycle, and the instantaneous value for any given instant is the displacement of the end of the arrow above (positive) or below (negative) the horizontal line through the origin. For this the vector length must be the peak value.

10. ADDITION OF ALTERNATING CURRENTS. When two sine waves of the same frequency and in phase are added the resultant is simply the sum of their values. If, however, they are different in phase the resultant wave is less than their sum. When they have different frequencies the result is even more complex as the resultant wave is no longer a sine wave. Waves of the same frequency are best added (or subtracted) by means of vectors but more complex problems may be solved using graphical methods.

Fig 2A shows the graphical summation of two alternating voltages, one lagging 60 deg. behind the other and having half its magnitude. The graphical summation consists of adding the instantaneous values at various points and joining the results with a fair curve. It will be noted that the resultant curve is a sine curve. The equivalent vector addition is shown in Fig. 2B. It will be noted that two vector additions are shown; the smaller vectors are R.M.S. vectors which are, of course, .707 of the peak values. The resulting vector is at a different angle to the two components, and, the angular relation is the same as that obtained graphically by summation of the curves.

When the two sine curves to be added have different frequencies vector addition cannot be used as the resultant curve is not a sine curve. The frequency ratio and the phase relationship of the waves to be added have quite a large effect on the resultant curve. Fig. 3 shows several of the more important combinations:

IIIa—One twice the frequency and ½ the amplitude of the other.

IIIb—One three times the frequency of the other and ¼ the amplitude—having similar maximum at the same time.

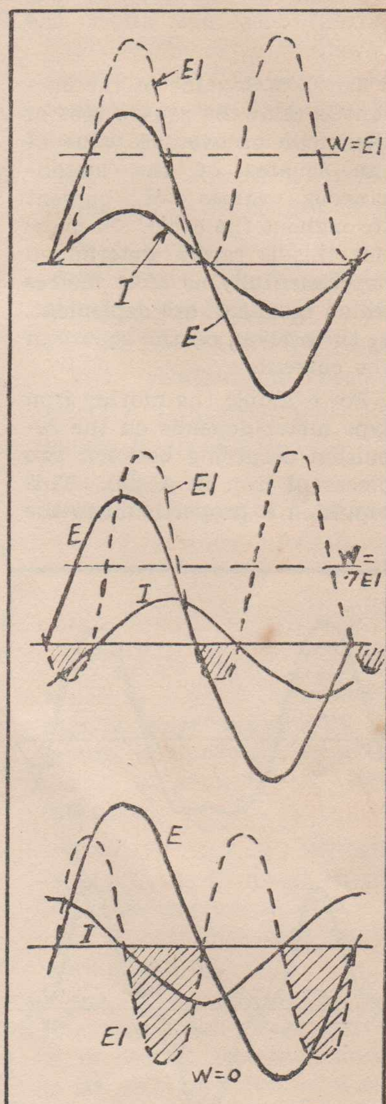


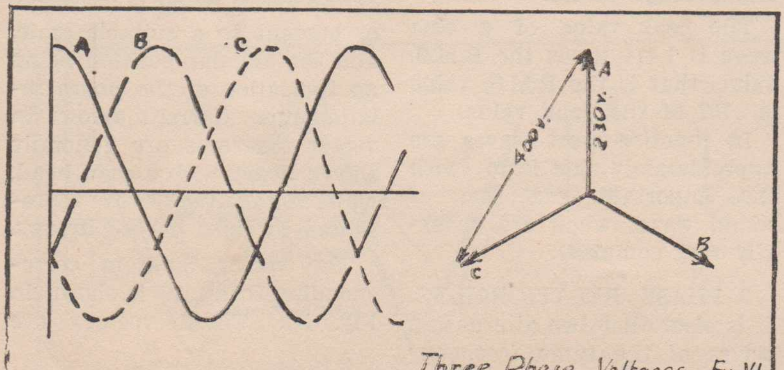
Fig V.

IIIc—As for IIIb but with opposite maxima together.

This shows the effect of phase relationship.

Figs. III a and c show diagrammatically the effect of second and third harmonics respectively) in practice they would be present in much smaller proportions).

Fig. IV shows how two



Three Phase Voltages. Fig. VI.

waves, each having opposite second harmonic content, may be added to give a pure sine wave. This is important in the case of push pull output systems, particularly those operating in class AB or B, because any second harmonics present —or, for that matter, any even harmonics (2nd, 4th, 6th, etc.) are cancelled out. Odd harmonics, however, cannot be eliminated in this manner.

11. ALTERNATING CURRENT POWER.

Power in the alternating current circuit, like that in a D.C. one, is the product of voltage and current, but, as they are both continuously varying, it is the instantaneous values that must be multiplied together, and the average of the products taken. A.C. power, therefore, is the average of the products of corresponding instantaneous values throughout the cycle.

If the current lags or leads the voltage it will be found that there will be times when the current is negative while the corresponding instantaneous value of voltage is positive, or vice versa. The power at this instant must therefore be negative and must be treated as such in making the average.

Fig. V shows curves of voltage (E), current (I), and power (EI), for several cases:

(a) Current and voltage in phase,

(b) Current lagging 45deg.,

(c) Current leading 90deg.

The areas shaded represent negative power, and the dotted horizontal line in (a) and (b) shows the average power.

In case (c) the negative power is equal in area to the positive power so that the net power is zero. This is the ideal case but it is almost impossible to obtain this in practice. Good quality condensers at fairly low frequencies consume too little power to be measured but they have losses at higher frequencies.

It is found that the average power is equal to the product E1 multiplied by the cosine of the phase angle between current and voltage.

That is $W = EI \cos A$

where W = power in watts

E = R.M.S. voltage,

I = R.M.S. current,

A = Phase angle between E and I.

It will be realised that all electrical equipment must be rated in some way and the usual limiting factor is heating caused by losses, a large proportion of which are resistance losses.

Now, the heating due to resistance is proportional to the square of the current so that in D.C. work it is sufficient to rate the machine on power as the voltage is fixed in most cases.

In alternating current work, however, a machine may be fully loaded on current rating, but, because of phase effects, the power may be quite low. For example, a machine rated at 1000 watts—(assuming $W = EI$) 5 amps. at 200 volts

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may, if the current were lagging 60deg. be fully loaded on 500 watts.

i.e. W = EI Cos. A
= 200 x 5 x Cos. 60deg.
= 200 x 5 x .5
= 500 watts.

Because of this A.C. machines are rated at so many volt-amps (VA or KVA).

The factor Cos A is termed the **power factor**, that is, the apparent power (EI) must be multiplied by this factor, to give the true power. In practice power factor is kept as close to unity as possible as this means that the current is a minimum for a given power and voltage and also allows the most economical use of generators and other plant. Supply authorities refuse to allow consumers to install low power factor equipment unless power factor correcting condensers are fitted, e.g., fluorescent lighting.

In practice it is difficult, without special equipment, to read the phase angle between current and voltage directly but this can be simply determined by reading voltage, current, and power simultaneously.

Then, as W = EI Cos A, Cos A = W/EI.

Although power and power factor are not often measured in radio work a lot of trouble is taken in circuit design to ensure a low power factor in inductances as this is necessary for maximum efficiency and selectivity. Power transformers are arranged to have as high a power factor on load as possible as this reduces heating.

Polyphase Systems.

No notes on alternating currents would be complete without some mention of polyphase systems.

A single phase system is one in which there is only one wave generated and this is transmitted along two wires (or three in the case of a 460/230 volt supply).

Now, if a second generator is arranged to generate a second wave at some definite phase angle to the first only one may be common and there one extra wire is required as are several important advantages. The principle advantage is that there is always some current flowing in one of the phases—single phase power is somewhat pulsating in character due to the periods when no current flowing (twice per cycle). Also, single phase motors are not self-starting, but two phase motors are—the ordinary single phase motor is arranged so that there is a second phase artistically introduced (usually by a condenser) for the duration of the start.

When two phases are used they are arranged with a 90 degree angle between them.

Practical power supplies use three phases, having an angle of 120 degrees between them. The victor diagram for a three phase supply is shown (voltages only). The currents are, of course, phased similarly and a little consideration will show that the algebraic sum of the currents is zero. Therefore, provided the load is balanced in the three phases the fourth or neutral wire can be dispensed with—even for unbalanced loads it need only be small. In practice high power equipment is connected directly between the outer or active wires, and light loads are connected between outers and neutral. Motors, of course, are wound for three phase supply and are self-starting. The voltages between actives and neutral are 230, and those between actives are 400.

When rectification is necessary a three phase rectifier system gives a smoother output with less filtering than the ordinary full wave sytem. In practice a double three-phase (six phase) rectifier system is often used.

The generator for polyphase supplies has the three phase windings arranged with the correct number of electrical degrees (which are not always space degrees) between them in the one machine.

QUEST FOR PLEASING TONE

Research Workers Needed

Here is a chance for everybody to join in and help us to discover what really makes for pleasing tone. You don't need a beat frequency oscillator or an oscilloscope. Forget instruments and let us have facts!

FOR years past I have been interested in high-quality reproduction from radio receivers and gramophone amplifiers. As far back as 1934, I organized Amplifier Championships to get a better idea of people's reactions to various types of reproduction.

My outstanding impression of the whole game is that most technical men haven't the slightest idea of what the public really likes. I have listened to technical men expounding about the way the fool public likes anything boomy, and then I listened to the amplifiers operated by these technical men. In many cases the reproduction has been brilliant, but nerve-wracking. In others, it has been simply terrible, with the most distressing of distortion in the biggest possible chunks. In one or two cases the culprits have been readers of long standing, who should have known better. A milliammeter in the plate circuit of even the early amplifier stages has given a good imitation of St. Vitus dance, one sure proof of distortion.

I have heard that nature has made us with accommodating characteristics.

They say that if you live near the skin works on the Saltwater River your nose becomes accustomed to the stink so that you don't notice it. It seems that there is something similar about amplifiers and radio sets. If you listen to them intently enough you can eventually fool yourself that you are hearing good reproduction.

The hi-fi Approach

Attempts to get the quality of reproduction down in black and white are usually futile. It is fairly easy to get a straight-line response from a pick-up, amplify it through a straight-line amplifier after suitable compensation for the bass loss on the recording, and feed the output into a good speaker with proper baffling. The whole set-up may be flat from 20 to 20,000 cycles, but the reproduction from a present day commercial recording is going to be unacceptable to the majority of ordinary listeners. Those who are technically-minded may thrill at the brilliance of the reproduction if the recording is one of the special Decca FFRR series, or some other recording of outstanding merit. But it takes an acquired taste, like eating frog's legs or winter-time surfing.

There are thousands who have ears that completely disregard scratch. They are in a class by themselves. For them and their strange tastes there will always be ample space in our columns, for I rank myself as one of them.

But I also know that there are a great many people who do not appreciate wide-range reproduction, and I feel that it is high time that someone took time off to find out just what it is that ordinary people find pleasing in style of reproduction.

Probably the person in closest touch with the ordinary radio listener is the radio repair man. So it is to radio repairmen in general that I appeal for co-operation. Can you help us to determine what it is that ordinary people want in the way of radio reproduction?

I feel sure that the tale about boominess is a fallacy. People only like boomy reproduction because they cannot tolerate distortion.

The fact that it is often found that co-called tone controls are in the boomy position does not prove that the listener objects to clear quality. In some cases the tone control is used to cut down the intensity of atmospheric and man-made static, but usually it is used to avoid harmonic distorton which abounds in many commercial sets. The almost universal use of beam power

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valves in the output stages has done much to make the tone control essential.

Sometimes the use of inverse feedback has dealt with a bit of the distortion, but often enough the feedback goes haywire and introduces parasitics and even worse distortion. Diode detectors are far from being perfect, too. Many of the elementary rules for getting distortion-free operation of diode detectors are neglected by even the leading set manufacturers.

Then there is that matter of balance. If a set has no true low note response it can't stand a lot of highs. The better the true low note response, the more highs that can be tolerated before they become unpleasant. This subject was dealt with quite thoroughly in our October, 1948, issue, but still doesn't seem to be appreciated by those who are responsible for the designs of sets now being offered to the public.

Selling New Sets.

As will be noticed, this article follows on thoughts expressed in previous issues which were induced by listening to the tales of woe from radio salesmen who are often rebuffed by owners of old sets who will not trade them in for new sets in spite of their unreliability because the tone of the new sets does not appeal.

Following up a couple of cases of this kind which were reported to us by a salesman friend, we happened to run across one feature common to both cases, detection was not of the type found in modern sets. In the first case the detector was a 57 of the anode bend type.

The reason why the set was so much appreciated was immediately evident, it was a t.r.f. type of set. It had two stages of r.f., then the 57 detector and a 2A5 output valve. To my ear the quality of reproduction was anything but outstanding, but I had to admit that the overall results, especially on the National stations, had some indefinable charm. The cabinet was a well-built one, without distressing low note resonance.

The Second Case.

The second case was even more marked. I had to admit that the reproduction was attractive. It was quite easy to understand why the owner would not part with his set for replacement by any modern one. He was a man of considerable logic, and although he had no technical knowledge of radio, he definitely knew what he was talking about. His many friends, relatives and casual visitors had often remarked favourably about his set. Listening to it with attentive ear I found that it had just the charm which we were after and so I proceeded to find out where it came from. Strangely enough the set was a factory-built one of 1938 vintage, a Croyden series 583.

Turning up this circuit in the Radio Service Mannual I found that it was a more or less conventional design of 5-valve superhet of the period, but with a few minor exceptions. First of these was the use of a detector on the diode-bias principal. This type of detector has been a fairly unpopular one with set designers because of the way in which the quality tends to fall off at low volume levels. But at normal room strength it sounds fine.

Noting that a set of somewhat similar design, with a similar line-up of valves was available among the second-hand bargains at a local dealer's shop, I bought it and brought it home to see how it sounded. It was awful, but that was due to several reasons, such as an error in the wiring which resulted in the i.f. screens getting the full high tension, while the plates of converter and i.f. valves were fed through the 50,000 ohm resistor that should have been in the screen circuit. So we ran over the job from aerial to power lead, replacing every doubtful looking component

(Continued on next page)

Moisture Control for Textiles

THE customary method of judging the degree of dryness of textiles during manufacture is by feel. Human judgment being far from infallible, electronics has now stepped in and apparatus is available for giving a more exact measure of the moisture content during the drying process.

The Fielden Drimeter can be used with any type of textile drying machine in which the material passes at a predetermined speed between drying elements.

Operation of the Drimeter is based on the fact that the dielectric constant of the material passing between two flat electrodes varies with its moisture content. Thus by constantly monitoring the capacitance of these electrodes variations can easily be converted into changes in current and applied to a visual indicator.

The equipment is first set up by inserting a sample of material, dried to the desired degree, between the electrodes and setting the pointer of the indicating meter to a predetermined zero. A knob is provided on the unit for this purpose. Alternatively, a moisture calibrating unit can be employed.

When the drying machine is in operation it is then only necessary to regulate its speed so that the needle of the indicator remains steady. The Drimeter can be supplied either with the indicating meter built-in or on a separate unit including the adjusting knob.

A more recent development is the production of a companion unit which gives full automatic control of the drying process. Control is electronic and the operating voltages are derived from the Drimeter and also from a small alternator driven off the main shaft of the machine. It functions on the difference principle and produces a voltage that is applied to an electric motor which operates the speed control mechanism of the drying machine.

The equipment is made by Fielden (Electronics), Ltd., Holt Town Works, Manchester, England.

RESEARCH NEEDED

(Continued)

and at the same time changing the circuit to agree with the Croyden 583. Then I fitted a Rola "0-12" speaker, left the high tension to run up to about 300 volts and sure enough, found that the charm of the original set was not merely a coincidence.

Results are so good, in fact, that in spite of all that it may mean to the prestige of our technical policy and all that soft of thing, I have in mind to run this circuit and full details of the set in an early issue for the benefit of those who want to try it out. To go back to a factory-built set of 1938 for the inspiration for a circuit design sounds pretty crazy, but I think we can only be candid about it.

I hope to pursue this type of investigation further, and would appreciate the co-operation of readers who are in touch with the public. Next time you come across a set which is treasured by its owner on account of its sweetness of tone I would like to hear from you about it. It is not much use taking any notice of designs which appeal to technical men on account of their theoretical considerations. We want to hear about sets which appeal to ordinary people with untrained ears and opinion untainted by technical considerations.

I hope that this little stunt will reveal some worthwhile facts. For example, it has already revealed that the slightest trace of hum is objectionable to most people. Even if buyers have become so accustomed to it that they don't raise any strong voice against a fair bit of hum, they do appreciate a quiet set. Set manufacturers may yet find that a little money spent on extra filtering will be well worthwhile.

India.—The Indian Minister of Industry and Supply has stated that the output of the four firms manufacturing broadcast receivers is 25,000 a year. He also stated that it is proposed to establishd a State radio factory for the manufacture of a variety of equipment ranging from transmitters to components and valves.

Revolution In America

Writing recently in "Radio-Electronics" (formerly "Radio-Craft," U.S.A.), Dr. Lee de Forest, the world-famous authority, pioneer and still-active inventor, gives some sound advice on television and its future in America.

MOST of my readers today can remember the strangely sudden upsurge of popular acceptance and eager enthusiasm which American radio broadcasting experienced 25 or 27 years ago.

To all such elder observers, and especially to those who played a part in the earlier phenomenon, the recurrence today of a closely similar revolution is at once amazing and most gratifying.

In some respects the present popular demand for television broadcasting and TV receivers is even more remarkable than was that which radio enjoyed a quarter of a century ago. Today almost every household has one or more radio receivers and is therefore already aware of the world outside its threshold and the varied types of audio entertainment available, but in 1922 few indeed were the homes wherein such miracles of science could be observed. Radio reception then was far more amazing than is now the sudden apparition of a distant scene upon the kinescope screen. There was then no precedent for that unparalleled miracle—the erecting of a simple wire and listening to distant voices and remote music.

Today radio, and its ambient atmosphere of electronics, has annihilated wonder and astrophied the sense of almost reverent amazement with which we of old donned our headphones, tickled our cat's whisker, and twirled our multidials, in those ancient 'twenties. So television comes forth today, upon a stage already well prepared for her somewhat bold and blatant debut, to confront an expectant, yet somewhat blase audience. The greater wonder therefore is this unleashed enthusiasm for our latest miracle—this crowning achievement of the electronics engineer—an eagerness which today strips the television receiver from retailers' shelves, unpacked and untested, and which compels set and tube manufacturers to work hard around the clock in futile effort to satisfy the demand.

Programmes.

In other ways also video is following paths long since blazed by the pioneers of radio. Programme quality serves as one analogue, one scale for comparison. Television programmes today are in an experimental stage very far behind in merit the high standards of excellence established by television's engineers.

Here, as in radio broadcast-

(Continued on next page)

NOTICE

It has been drawn to our notice that the articles by J. N. Walker (G5JU), which have appeared in recent issues, were originally prepared to the order of "Short Wave Magazine," published in London.

"Australasian Radio World" purchased the manuscripts of these articles from Mr. R. H. Cunningham, Australian representative for Stratton and Co., manufacturers of Eddystone components, and the firm which employs Mr. J. N. Walker.

Some of the articles which we published had already appeared in "Short Wave Magazine," some in "Short Wave Listener," others appeared later in the "Short Wave Magazine."

At the request of Mr. Austin Forsyth, editor of "Short Wave Magazine," we publish the above explanation of how it comes about that these articles appeared without acknowledgment.

ing, the engineer is far in advance of the man in the studio. The former's is an exact science, and his requirements demand nigh perfection. The engineer must know his media, his electrons, his cathode beam, his sweep circuits, the exactitude of his sync signals, his math formulae, his specified decibels of gain or noise suppression.

The programme director, in contrast, works wholly with nebulosities; likes, dislikes, and prejudices of human nature, and that unpredictable quality politely styled "temperament." Further, he is strictly limited by a budget (the only fixed quantity in his entire equation). Also, too frequently, his sponsor sadly smears his calculated concoction, upsets his omelette, to mix a metophor.

And so it comes to pass today that television, playing a variation of radio's insistent theme, has taken the "cheese" —the same corny lines, the same reiterative commercials—out of the ears and put it into the eyes of the populace; albeit with this saving grace; its commercials are sometimes intriguing, often interesting to behold, and generally far less painful to see and hear than only to hear.

Improvement Seen.

And definitely our TV programmes are improving. Since television's post-war start, a considerable sum of experience and knowledge has been acquired. To an outsider much of this might appear negative, but to learn what not to do is a step towards learnng what to do. Lacking adequate production budgets, television programming has had to develop as best it could; and, although it has developed, it is still brashly amateurish in the main.

There has been lack of understanding of television audiences as well as failure to take proper economic common sense of this procedure and urged that the directors of policy of the motion-picture industry, for self-interest even look frankly in the face of this "baby that will start with steps of a giant." For nothing is today more apparent than the fact that television will hold millions of potential cinema viewers home of nights.

And today's video studio practice already depends largely on motion picture films, either between the projector and iconoscope, or in the camera before the monitor kinescope. When one of the best known veteran motion picture producers, Hal Roach, wholly abandons conema film work to put all of his trained energies into making good short comedy films solely for television transmission we behold a highly significant augry.

It is of vital importance that both television and the motion picture producing nterests co-operate in mutual understanding and harmony. The latter will not long hold back from the inevitable, as most of them did when I was demonstrating to them that film could speak. They will not long repeat the same stubborn blunder, else the film industry will be merely postpon-

Unwritten Laws Of N.Z. Amateur Radio

In the "Break-in," journal of the New Zealand Association of Radio Transmitters, there is written a number of "unwritten" laws.

These laws are by no means official regulations but are compiled in the interest of all Amateurs who use any of our crowded bands particularly the 80 meter band. The self imposed rules have been gathered from long experience and information obtained from the questionnaire held amongst New Zealand Amateurs in 1946.

1. **No recordings of any description to be played between the hours of 7 p.m. and 11 p.m.**
2. **No duplex or triplex to be worked between the hours of 7 p.m. and 11 p.m. on any night of the week.**
3. **No testing of any description unless on a dummy antenna between the hours of 7 p.m. and 11 p.m. This applies to both phone and c.w.**
4. **Make your overs short and frequent.**
5. **Always sign your call on a test transmission.**
7. **On c.w. call at a reasonable speed until you contact a fast operator.**
8. **On phone use good plain English and not c.w. abbreviations. On no account whistle into a microphone.**

Remember, when you are using your frequency unnecessarily someone may be wanting to use it for communication purposes. Co-operation with these laws will enable us to get the most use of our bands.

ing a new prosperity which the new medium is openly offering it.

Use of Films.

It is the opinion of an ever-increasing number of television men that film programmes will constitute the bulk of television broadcasting, for such basic reasons, economic and mechanic, as the follow-inging: duplicates with sound on film can be made cheaply; such duplicates provide an inexpensive "chain system," saving charges paid to the telephone company; programmes can be altered, edited, after completion; letter-perfect live produitions requ'ring enormous rehearsal time and expense ian be eliminated; talent need not be forled to rigid schedule; the producton can be made at the most suitable or convenient location and time; programme libraries are created; optimum lighting conditions for the various scenes can be had far more readily. A good film-renting business is already established. Soon this is certain to include classical plays and other timeless tems, despite today's stubborn denials.

And, after all, where so much expensive and painstaking effort has been expended in the staging of a worthwhile drama or comedy, it is mere economic sinfulness to "waste its sweetness only once upon the empty air." Even gfanting nation-wide networks, co-axial or radio, by stratospheric airplane (or by the moon!) such worth-repeating spectacles must not be merely flashed and then forgotten—a lovely tapestry, artfully woven to be burnt to ashes and lost.

Furthermore the time differential alone calls for programme repetition by film, for example, East-West athletic events, though they are viewed hours after the uncertainties of fortune are resolved. For the eveninig hours moreover will necessarily continue to claim the far larger audiences everywhere.

So regardless of the spread of networks, whenever the factor of simultaneity is not paramount, what I long since dubbed the "tin-can network" will become more and more essential in profitable television transmissions.

The absolutely unrivalled possibilities of television for popular education are already evident to all observers. In the urban schoolroom (and soon n the rural areas) but emphatically in the home, television can be made a most po-

(Continued on next page)

QUALITY REPRODUCTION

DISTORTION—Does It Matter?

At a meeting of the Radio Section of The Institution of Electrical Engineers in England recently P. P. Eckersley re-opened a discussion on "To What Extent Does Distortion Really Matter in the Transmission of Speech and Music?"

He began by saying that the over-all impression left by the first discussion on the subject was that none of us knew a great deal about the subject, but many found it as engrossing as ever. Two questions still remained to be answered, namely, was it worth while to try to find out more and, if so, what line of attack against obscurities would be the best?

Although the final judgment of a transducer must be subjective, surely much could be learned by objective tests. For instance, the fact revealed, as we were told, by measurement, that the loudspeaker generated harmonics, should stimulate someone to produce an instrument that did not. Then the ear would judge whether the improvement on eliminating harmonics and combination tones were substantial. Further experiments with audiences listening to live performances, the sounds of which were modified artificially, ought to tell us a great deal more about what to aim for. Precise information could thus be obtained about the preferences of the air.

ARTIFICIALITIES

This led the observations concerning a misunderstanding that we revealed during the previous discussion regarding certain suggestions made in the opener's previous remarks, namely, that in the presence of inevitable artificialities due to the circumstances of reproduction of broadcast programmes and gramophone records, other artificialities might, with advantage, be introduced. The object of these suggestions was that the impact of the reproduction upon the senses might be the more certain to "evoke emotion" in the hearer than if an expert copy of the original were reproduced. Some speakers seemed to imagine that he proposed a wholesale cutting away of parts of the spectrum. There was, in fact, no proposal, explicit or implicit, to perform any major operation upon the spectrum, but rather, as in beautifying by plastic surgery, to reduce exaggerated features and to encourage those that were weak. By such methods, the reproduction should gain in beauty, even though the means to that end were artificial.

JUDGES OF QUALITY

Turning to detail, the dispute about the competence of musicians to judge loudspeakers was not resuscitated in the introduction, but it was raised apparently from the dead, during the discussion. It was revealed that B.B.C. engineers had discovered that certain of their musical colleagues could not form useful judgments on the qualities of loudspeakers. This was a limited discovery. pursued a little further, it would be found that some musicians had sensibilities which transcended those of some techni-

TELEVISION

(Continued)

tent agency for instruction for adults and young alike. The groundwork already accomplished by the FM network of the State of Wisconsin, under the auspices of their progressive State University, where countless homes are recipients of daily lectures by competent authorities on varied historical, agricultural, and cultural themes, is extremely gratifying to any informed educator. Witnessing the results attained by audio alone, one is stunned by the prospects which television offers along similar lines, where one picture is more impressive and longer retained "than ten thousand words."

America's greatest, most crying need today is mass education. Here then the gods of science have given to our nation a mighty weapon for its salvation.

Will the directors into whose hands fate has given this mighty potentiality for national uplift thus employ it? Or will they, as have many of their AM broadcasting predecessors, miserably fail?

Certain it is that within five years television programmes will be in the homes of 50 million Americans. What limitless good can television then bestow for the salvation of America?

cians. Continued research would reveal that the co-operation of each person, according to competence rather than trade or calling, would be of greater benefit than the dismissal of one class of persons by ill-considered generalities.

This second introduction, bridging the two discussions, must once more stress the importance of providing better transmission facilities. As it was, the best of loudspeakers had no value since the conditions of radio transmission, and often the background noise on gramophone records, made it impossible to use the upper parts of the audio spectrum. Thus, while there was no demand for a good loudspeaker because the lower and middle registers sufficed to give pleasure to most ears, there would, in the face of the poor transmission facility, be not much use for it even if it existed.

The contention remained that, if transmission facilities were improved an insistent demand would be created for a better reproducer. For nearly 30 years we had used the same type of radio transmitter and for 20 years the same type of receiver had cut off more and more of the spectrum broadcast at greater and greater levels. A solution of the problem of programme distribution, be it by frequency-modulated transmission or by the use of the much simpler wire networks to link microphone and transmitter, would put us on the way to find out which distortions did and which did not matter. We might also discover, in terms of a widespread high-fidelity service, how to shape an artificial spectrum for the greater benefit of the art of sound reproduction.

HERESY

The discussion which followed was by no means restricted to the technical and engineering aspects of transmission and reception. Valuable contributions came from representatives of the programmes department of the B.B.C., who put forward what to high-fidelity purists must have seemed paradoxical, not to say heretical views. In the broadcasting of eye-witness accounts the presence of considerable distortion, it was contended, would not only be tolerated by the listeners but would convey an atmosphere of actuality and excitement which could not be put over if the transmission had the impeccable quality of a studio broadcast. Even when distortion was so bad as to threaten intelligibility, there was still justification for re-broadcasting, for example, Mr. Churchill's speeches from the other side of the Atlantic.

In the broadcasting of symphonic music the best place for the microphone was not, according to one speaker, just above the conductor's head, or, indeed, any position which faithfully reproduced the sound in the immediate vicinity of the instruments. The experienced concert-goer did not like his oboe "neat," but always chose, if he could, the 10th or 20th row back, where the higher-order harmonics were to some extent absorbed. Too much "top" was often associated with what musicians would dismiss as a bad hall. Often it was also a symptom of faulty tone production, which would incur the conductor's displeasure; yet engineers were always trying to preserve what the musician wished to get rid of.

ATMOSPHERE

Support for this view was given by an authoritative statement that broadcasts of the Scottish Orchestra, which met with wide approval among the musically informed, were restricted to an upper frequency of little more than 6000 c/s; but the acoustics of the studio were exceptional. This quality, which might be likened to the background scenery

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DISTORTION (Continued)

and lighting of a stage presentation was largely fortuitous; we could avoid the grosser errors in studio design and reduce the bad effects of existing halls by placing the microphone closer to the performers, but much remained to be learned before the creation of naturalness, perspective and "atmosphere" could be described as a known art.

One speaker thought that the comparatively simple task of reproducing the voice of a solo artiste with naturalness had not yet been solved, and suggested that the "invention" of the crooner was an engineer's subterfuge to circumvent this particular problem. Musicians often tried to persuade those responsible for "Balance and Control" to place the microphone farther away, "because it sounds better," but they did not always appreciate that an estimate of the optimum distance made by direct listening would not hold for the microphone, which was a monaural device and would make the reverberation components of the sound seem more pronounced. It was for this reason that the engineers insisted on bringing the microphone closer to the performer.

Few listeners took much trouble to improve the acoustic background of their rooms. It was true that the scope for such treatment was limited, and one speaker revived the suggestion that high-quality headphones might solve the problem when conditions proved intractable.

It was agreed that comparisons of quality, using as a reference standard the sound that one imagined would come from the mouth of the loudspeaker if it were, in fact, an aperture in the wall separating the living room from an adjacent concert hall — the "Pyramus and Thisbe" theory, as the opener put it—could be of value in judging the performance of equipment, but the opinion of those who had had actual experience of listening to "live" performances under these somewhat unusual conditions was that the quality was far from satisfying and not much to be desired.

The aesthetics of listening covered such a wide field, and tastes were so varied that in the opinion of some speakers the B.B.C.'s function should not extend beyond the transmission of a "facsimile" of the original. It should then be left to the listener to modify this by tone and volume controls "according to his perversity." The difficulties of sus-

TRADE NOTES

FERGUSON TRANSFORMERS

Readers of "Radio World" may recall the particularly successful series of articles from the pen of Charles Parry. These were published in the 1941 era, just before the war got properly moving. They dealt with direct-coupled phase-changers, inverse feedback arrangements and other subjects well ahead of their time.

Just as we were wondering what became of Mr. Parry we happened to run into him in town the other day. Over a cup of coffee we heard that he is at present chief engineer for Ferguson Transformers, the well-known transformer factory whose products have been featured recently in several of our constructional articles.

Mr. Parry is still a keen radio enthusiast in his spare time and has been working on several novel things, about which he has promised to write us articles in the near future.

Mr. Parry was most enthusiastic, however, about the new Ferguson range of power transformers which have been developed, especially for the type of technically-inclined buyer who appreciates a quality product. These heavy duty transformers come in a range of types to suit all popular types of quality amplifiers and powerful sets, with high tension ratings of 285, 385 and 425 volts at current ratings of 100, 125, 150 and 175 milliamps. Transformers of this type have been a bit scarce on the market for some time past, but this new range of Ferguson units should fulfill every need.

There is also an additional range of still heavier type transformers, with voltage ratings of 385, 425, 500 and 585 volts at currents of 200 and 250 milliamps. These should find favor with those who build really high-powered amplifiers and with builders of amateur transmitters. All of these transformers have the usual heater windings, two at 6.3 volts and one at 5 volts.

A full range of filter chokes (smoothing reactors, to give them their proper title, as used by Mr. Parry) have been added to the Ferguson range to match up with the power transformers.

taining a wide audio-frequency spectrum on programmes of varied origin was recognised, and a plea was made for adequate top cut at the source when intermodulation distortion, which would be at once revealed by modern high-grade loud - speakers, could not be avoided. One speaker thought that binaural transmission would be a more welcome development than efforts to extend the higher frequency response.

PHYSIOLOGY OF HEARING

All agreed that studies of listeners' preferences should be extended, but that the results should be analysed with due caution to avoid drawing false conclusions. Much remained to be learned about the physiology of hearing and the importance or otherwise of phase distortion. The difficulty was to measure the true phase relationships of the sound at the observer's ear, and experiments which were based on observations of the input waveform to the loudspeaker were of little value, without detailed knowledge of the transient response of the diaphragm and its effect on the acoustic output. Clear thinking was necessary before making generalisations, and comparisons of aural quality involving changes in the make-up of complex waveforms from similar spectral components were invalidated if there were redistribution of energy with time. An interesting case was cited of a series of pulses of random sign and amplitude, equally spaced in time, which on analysis showed a continuous spectrum like that of random noise. The aural effect, however, bore no resemblance to the characteristic hiss of random fluctuations.

—Wireless World (Eng.)

BOOK REVIEW

ELECTRONIC MUSIC

A large number of our readers are interested in electronic music and musical instruments. They will be interested to know that a book on the subject has recently been released in England, So far as is known, stocks of this book have not yet reached Australia, but doubtless will do so soon.

According to a review of the book, published in the English "Wireless World," in his introductory remarks the author defines an electronic musical instrument as one in which electrical oscillations are produced under the direct creative control of the performer. He excludes pipe organs with electrically operated actions, the amplification or reproduction of recorded sound and also synthetic sound tracks, but includes electric pianos and guitars as borderline cases.

The treatment covers a wide field and the author has obviously made a diligent search of the files of the Patent Office and of the world's technical literature for any information bearing on his subject. The fruits of this search are recorded in a bibliography running to seven pages. The facts are marshalled under headings determined by the principles of operation of the various instruments, and a chapter is devoted to an explanation of the method of classification. The emphasis throughout is on principles, and would-be amateur constructors of electronic organs will not find immediate answers to all their practical problems. Diagrams are chiefly schematic and circuit values are given only in a few isolated cases.

As an historical survey and a comparative analysis of principles and methods, this monograph is strongly recommended.

The book in review is entitled "Electronic Musical Instruments," by S. K. Lewer, B.Sc., and published from the offices of Electronic Engineering, 28 Essex Street, London, W.C.2. Price 3/6.

GLIMPSE INTO THE FUTURE

An idea of the sort of thing us poor radiomen are in for in the near future can be gleaned from reading an article entitled "Me and Television," which appears in the August, 1949, issue of "Readers' Digest."

This short story is written by a non-technical person and deals with his experience when deciding to buy a television receiver. His home is located about 75 miles from the television transmitters, so there is doubt about whether the signal will reach that far. In order to have a test made it is found necessary to have engineers come out with testing gear, at a cost of about a fiver.

The story makes amusing reading, and a couple of serious points catch your attention. Apparently it is recognised in U.S.A. that 50 miles is the service limit of their powerful television transmitters. Beyond this distance there is so much doubt about reception that some receiver manufacturers will not sell sets to people who live in localities beyond what is considered a satisfactory distance from the transmitter.

WORLD OF RADIO

St. Paul's Sound System.—A sound reinforced system has been installed in St. Paul's, London, to combat the famous echo of the cathedral. This has been done by fitting the loud-speakers under the chairs. To obviate the need for connecting wires, an induction system has ben adopted. The output from the amplifiers is fed via a control desk in the nave to large wire loops on the ceiling of the crypt. Copper bands round each of the rows of chairs equipped with speakers provide the necessary pick-up.

French Television. — The system developed by the firm Radio-Industrie is to be officially adopted. According to a Government decree, the national system will have a definition of 819 lines with positive modulation and A.M. sound. The 455-line transmitter now serving the Paris area will remain in operation until January 1, 1958. It is expected that the first high-definition transmitter will be installed in Paris in 1949, and that a second station will be built at Lille in 1950.

Ceylon.—It is reported by the U.K. Trade Commissioner at Colombo that there is a wide scope in Ceylon for a moderately priced receiver, about Rs250 (£18/5/-), covering short and medium waves.

Railway Radio. — After six years' experimenting a new V.H.F. train radio system is being introduced in Sweden. F.M. equipment operating on approximately 2 metres with a range of 20 km is to be used, it having been found the most satisfactory in view of the extensive electrification of Swedish railways. The service is not yet available to passengers.

Cost of Television.—In reply to a question in the House, the P.M.G stated that whereas the cost of operating the B.B.C. television service during the financial year 1947-48 was £700,000 , the gross revenue from television licenses for the same period was £91,000.

Noise in the Home.—A report on the results of a survey to obtain information on the incidence of noise in houses and flats, published in England, under the title "A Survey of Noise in British Homes," shows that although the sound of neighbours' radio is "noticed" by the largest proportion of the 2,000 people questioned, it was considered by them to be much less troublesome than what is classed "banging of doors."

Pakistan's Director of Radio is proposing to install receivers in schools and for community listening and is desirous of securing information from manufacturers on sets that they are in a position to supply for the purpose. Most of the sets will need to be battery fed. Particulars should be forwarded to Z. A. Bokhari, Radio Pakistan (H.Q.), Karachi, Pakistan.

Increases of 63,100 "sound" licences and 6,750 television lcences during April brought the total in Great Britain and Northern Ireland at the end of the month to 11,823,000.

HINTS AND TIPS

KEEP PERMAGS CLEAN

It only takes a few iron filings to hang to the pole piece to put a permag speaker out of operation, so always make a point of keeping your radio and engineering departments separate on your work bench. When it comes to a job like changing an input transformer which has been rivetted to the frame of a permag speaker it is not so easy to keep cuttings or filings away from the magnetic attraction, yet most necessary to do so. One way is to cut a piece of paper to form an apron to catch the filings.

AUTOMATIC VOLUME CONTROL

Some automatic control circuits can cause plenty of trouble which is difficult to trace. When handling any repair job it is not a bad idea to short out the a.v.c. by earthing the F terminal of the aerial coil or first intermediate transformer to see if this makes any great difference to the tone or general performance. Sometimes the resistors in the a.v.c. circuit change value, or the by-pass condensers become open circuited or leaky.

With the a.v.c. out of circuit you will need to make due allowance for overloadinig.

Shortwave Review

Conducted By L. J. Keast

NOTES FROM MY DIARY

LOOKING BACK.

PERHAPS a better headline for this par might have been "Listening Back." Just as I was sending the last 'copy' to Melbourne for our July issue I received a letter from Rex Gillett telling me about his verification from Radio Budapest on 6.25 m.c. which, in addition to bringing his list of verified countries up to 107, it means he has only to get a verie from U.S.S.R. to have ALL Europe verified. When I re-read his letter I remembered a verie from Budapest away back in 1938. Looking it up, I find it was for a report sent in May 1938. The verification card, which is quite an elaborate affair with a photo of the St. Gillert Baths with artificial waves, gives a lot of technical detail, but the text of the reverse side of the card is certainly interesting.

"Budapest 7153 27th June 1938. Dear Sir. Many thanks for your kind letter which we received on June 2nd. Buda and Pest is only 1 city, the Danube separates Buda from Pest, the right side of the Danube is called Pest and the left side Buda, but together it is named Budapest. Hoping you will have much pleasure in hearing our shortwave stations in the future. Yours very truly, Radio labor Budapest." The report was for HAT-4 9.125 m.c. At that time they also had another station, HAS-3 15.370 m.c.

However, a lot has happened since then, and to-day they are broadcasting on 6.247 and 9.82 m.c. These transmissions, which are of an experimental nature, can be heard from 11 p.m. till 8.40 a.m., and News in English is read from 8.30-8.40 a.m. Address is: International Relations Dept., Hungarian Broadcasting Corporation, Budapest.

NEW STATIONS

RADIO BUDAPEST, Budapest, 6.247 m.c. 48.00 met:

This new Hungarian station, which is carrying out some experimental transmissions from 11 p.m.-8.40 a.m., has been reported by both Arthur Cushen and Rex Gillett. News in English is read at 8.30.

RADIO BUDAPEST, Budapest, 9.82 m.c. 30.55 met.:

Same remarks as above apply.

OAX4P, Huancayo (Peru), 5.95 m.c. 50.40 met.:

This is not a new frequency for this Peruvian, but it is being heard in N.Z. for the first time at good strength till signing at 2.45 p.m. (According to latest information I have received from there, slogan is "La Voz Del Centro Del Peru," and that reports are welcomed and will be acknowledged by QSL card. —L.J.K.)

. . ., Salisbury (Rhodesia), 3.320 m.c. 90.36 met.:

I'm not discounting Mr. Cushen's ability to log stations, but I suggest that for **us** to catch a 90 metre at 6 a.m. is expecting a little too much. But don't forget that means 8 o'clock in N.Z. Arthur says they are testing and asking for reports. (My "World Radio Handbook" says, "Announcements are in English. Interval-signal is recorded peal of church bells, and that reports will be answered by letter." Forgive me if I seem to be reminiscing in this issue, but the thought of Salisbury takes me back a few years when I was hearing a station every morning for a week or so signing off at about 7 a.m. with "God Save The King." I told my good friend, Ray Simpson, about it, and after a few days he got it . . . it was Salisbury. L.J.K.)

WILL HE EVER STOP ?

Talking about Hungary, Arthur Cushen drops me an airmail card to say that Verification from Radio Budapest gives him his 119th country verified, and means he has 'caught' every European country. Well, as I have said many times, will these two boys must easily be the Champions of Australasia.

VERIFICATIONS

Arthur Cushen's List

Radio Budapest, Hungary, 1st N.Z. report. Use 400 watts on 6.250 and 9.82 m.c. Monte Carlo on 11.80 and 9.49 m.c.; JKH. JKI; Radio Ceylon (21.60, 7½ k.w.); CKLX, 15.09 m.c.); Radio Rot-Weiss-Rot, Vienna (9.565,

SHORT-WAVE REVIEW (Continued)

800 watts); Bucharest (9.25 m.c. Nice card shows map of Europe); Moscow (15.43 m.c.); Radio Lebanon (8.035). Verifications just to hand this month include five under 1000 watts, which is quite the best month here for a long time. JJOY (8 m.c. 375 watts); Vienna (9.565 m.c. 800 watts); ZNB (5.90 m.c. 250 watts); Peitermaritzburg (4.875 m.c. 200 watts) and Budapest (6.25 and 9820 m.c. 400 watts).

Other verifications from VUD-5 (11.79 m.c.); VUD-7 (15.17 m.c.); VUD-3 (9.62 m.c.); VUD-10 (7.29 m.c.); YDA2 (6.17 m.c.) ; YDA3 (4.945 m.c.); YDB2 (4.915 m.c.); YDD2 (4.85 m.c.); YDA2 (2.415 m.c.); ZNB, Mafeking, was my 120th country.

Total verifications now 1645. Have also logged ZUD-24, 8.695 m.c., with the Rugby commentary at 2 a.m. I guess you know that on June 4 our Lourenco Marques broadcast at 5 a.m. when the N.Z. rugby results are broadcast, was the means of making the result known out here.

Rex Gillett writes that he has not been doing much DX lately, but as a result of past efforts some nice veries have come along. These include a first from Australia, namely Athens 15.330 m.c.; Monte Carlo, 9.50 m.c.; HH2S, Bucharest, 9.25 m.c.; JKD, LKI, HEU-3, CKA-19, LLN, CE1180 Radio Pakistan and Dacca.

And we welcome a newcomer to these pages, Mr. Jack Rogers, of Middle Brighton, Victoria, who writes:

"Dear Mr. Keast, — I have not done very much DX work, but decided to let you know what I have logged in the past few months. As I am not so interested in the DX as the construction of equipment and the technical design, I have not logged many stations. The following are stations for which reports have been sent to:—

KCBF, 9.650 m.c., VLT5 7.280 m.c.; KGEI, 9.700 m.c.; KWID, 0.570 m.c.; VLW5, 9.610 m.c.; VLG3, 11.710 m.c.; D2Ha, 9.640 m.c; VLQ3, 9.660 m.c.; VLA8 11.760 m.c.; ZL3, 11.780 m.c.; VLW3, 11.830 m.c.; VLI2, 6.090 m.c.; VLC9, 17.840 m.c.; VLH5, 15.230 m.c.; VLR, 9.540 m.c.; KWID, 11.900 m.c.; Voice of America (Manila), 11.890 m.c.; KWIX, 11.860 m.c.; CKNC 17.820 m.c.; HER7, 17.785 m.c.; VUD10, 17.830 m.c.; FZI, 11.970 m.c; KCBA, 15.150 m.c.; KCBA, 15.210 m.c.; XGOY 15.170 m.c.; CBLX, 15.090 m.c.; VLB5, 21.540 m.c.; YDC, 15.150 m.c.; VLH3, 9.580 m.c.; VLX2, 6.130 m.c.; Radio Moscow, 15.310 m.c.; ZL4, 15.280 m.c.; KDHO, 15.250 m.c.; CHLS, 9.610 m.c.; Radio Malaya, 6.025 m.c.; JKK, 6.015 m.c.; VLA6, 15.200 m.c.; WLKS, 6.105 m.c.; KGEX, 11.730 m.c.; DZH4, 6.000 m.c.; KCBF, 9.700 m.c.; DUH5, 11.840 m.c.; PCJ, 21.480 m.c.; JKL, 4.860 m.c.; Radio Ceylon, 15.120 m.c.

"Many other stations have been heard, but these are the only ones which I have sent reports to. Of these I have received minteen verifications so far. The stations are listed in the order they were received. The first was received on 21/2/49."

Mr. Rogers concludes his letter by saying he "hopes in the near future to be able to spare some more time for DX."

(Glad to hear from you, Mr. Rogers, and will look forward to some more notes.—L.J.K.)

SHORTS

RADIO BUDAPEST are building a new transmitter at Diosd, near Budapest, and it is hoped to have it in operation by April, 1950. This will have 100k.w. power.

4X4EA, ISRAEL FORCES BROADCASTING STATION, Box 150 Tel Aviv, Israel, operates till 7 a.m. On first Wednesday of each month carries English from 3-3.45 a.m. Transmission is on 6.725 m.c.

Greek Army Radio, Larisso 6.74 m.c., is being heard at good strength in what appears to be a new transmission from 6.30-6.45 a.m. with news in English on Mondays, Wednesdays and Saturdays. Closes about 6.55 o'clock.

PRE-AMPS (Continued)

very few sound heads shine around this frequency.

To sum up, possibly the average arrangement of a transformer coupled amplifier has its advantagements for low number of stages required, and local inherent noise and transformers with a frequency range to 12,000 cycles are readily obtained at moderate cost.

Whilst the speaker set-up mentioned is a very cheap one, it compares more than favorably with costlier set-ups and for small installations I earnestly think a speaker of the Goodman 15in. class, mounted in a vented enclosure, which is braced and lipped with a simple straight sided horn around the speaker opening only would be ideal.

I am working on a rectifier arrangement for the exciter lamps and will forward details when completed.

SOUTH AND CENTRAL AMERICANS

Last month I gave a list of Latin Americans being heard in South Australia by Rex Gillett at night, but for the benefit of those who like to take advantage of daylight listening and get that extra hour on Sunday afternoon (Saturday night over there) I am printing here a list of stations being heard in New Zealand by Arthur Cushen. All times, of course, are Eastern Australian Standard. ,

5800 CE8AA, Santiaga, very good signal to sign off 2.0 p.m.

5855 CP15, La Paz, Bolivia, heard at 1 p.m., but poor, morse bad.

5800 OAX4G, Lima, "Radio Lima," sign off 2.20 p.m., Goodnight Melody.

5889 OAX4Z, Lima, very fine signal, good round 2 p.m.

5910 OAX4V, Lima, "Radic America," to 4 p.m., and 5 p.m. on Sundays.

5920 HRA, Honduras, fair morse bad, sign off at 2 p.m. ,

5950 OAX4P, "Radio Del Centro Peru," Huancayo, here to 2.30 p.m., good.

6038 OAX6B, Aroquipa, Peru, very nice, sign off 3 p.m.

6054 HJEX, Radio Pacifico, sign off 1.15 p.m., just before GSA opens.

6055 CXA14, Colonia, heard to 2 p.m. once, but only fair.

6060 HORT, or HOLC, Balboa, heard to 1.15 p.m., but only fair.

6070 ??, weak signal, signs off 2 p.m.

6080 HI1X, heard 1.00-1.15 p.m. when Munich is silent.

6085 ZYK2, sign off at 1 p.m. with "Brazil."

6095 TGLB, Mazatenengo, Guatemala, news at 2 p.m., fair signal.

6120 ?, poor sign, off at 1.150 p.m.

6150 CE615, heard to 2.05 p.m. at fine strength.

6160 HJWD, sign off at 2 p.m., fair signal.

6170 HJKJ, heard to 2.50 p.m., mixed with Munich.

6180 LRM, terrific here, to 2 p.m. weekdays, and 3 p.m. Sundays.

6190 ??, several weak stations here around 2 p.m., then blotted out by Frankfurt opening at this time.

6200 HJCT, sign off 2.15 p.m., nice signal.

6210 HC1AC, "La Voz de Democracia," good around 2 p.m., off 3 p.m.

6220 CE622, the best S. American signal, to 3 p.m., no English now.

6250 YSUA, sign off 3 p.m., fairly good.

6270 YSR, good to 3 p.m.

6295 TGLA, fairly good around 3 p.m. on Sundays.

6330 OAX6E, very nice to after 4 p.m. Sundays, relaying OAX4W-OAX4V.

6540 YNBH, Managua, sign off 2.05 p.m., fairly good.

6710 OAX1A, heard around 2 p.m.

6850 YNOW, good to 1.58 p.m.

6950 YNEO, "La Voz de Victorra," to 2.05 p.m.

6870 HC4EB, morse troublesome, heard 2 p.m.

7320 HC2AN(good Sundays, 4 p.m.

5960 OAX4H - OAX4F, Lime very good to 2.45 p.m.

5970 HI4T, fairly good, sign off 3 p.m.

5990 HCJB, good, Spanish news 3.30 p.m., then takes English programmes.

6000 XEOI, Mexico City, heard round 4 p.m., never verified.

6000 HJKB, Bogota, very fine signal, sign off 2 p.m.

6012 CE601, Antofogasta, Chile very nice signal, sign off 2.08 p.m. after long list of network stations.

6018 HJCX, very nice signal, "Voz de Colombia," often given.

Speedy Query Service

UNDER THE PERSONAL SUPERVISION OF A. G. HULL

N.T. (Brisbane) has a pick-up of the low output type and is in trouble with hum from the two-stage pre-amplifier.

A. It is no easy task to get all the hum out of an amplifier with a good low note response which is fed from a two-stage pre-amplifier. Some people go to all the trouble of running the pre-amplifier from d.c. It might be quite a scheme for you to use a couple of "peanut" valves, with a 67½ volt. Minimax for h.t. and a couple of torch cells for the filaments. On intermittent use the cells would last quite a time as the drain would be low. For heavier service, and to avoid microphonicity, it might be better to use 6.3 volt indirectly-heated valves, with the heaters operating from a six-volt accumulator. With those little Rola chokes so cheap and effective it shouldn't be hard to filter out the h.t. completely by using two stages on each plate feed, so that you can draw the supply from the main h.t. supply of rectified a.c.

D.Y. (Dandenong) wants to know if we consider Ferranti transformers to be good, judged by modern standards, as he can get one cheaply.

A.—Judged by any standards, the Ferranti AF5C and AF5CC transformers are good and can be used as a basis for an amplifier which will fulfil any reasonable requirement of frequency range. There are, however, various other types of Ferranti transformers, such as the AF3, which is not of such a high standard, and others of even cheaper type. Most output valves will stand higher overloads if a transformer is used in their grid circuit, with its low resistance coupling. Doubt if it would be worthwhile shunt-feeding the primary, unless you are using a driver valve with a plate current of more than 3 or 4 milliamps. A low-impedence triode, such as a 27, should be used for the driver.

R.C. (Petersham) raises a couple of regular questions about liability for patent royalty on set building, and performing rights when playing records at a local "swing club." ..

A. In both cases there seems to be little doubt about you being legally liable, but in practice it is most unlikely that you will run into trouble. Unless some manufacturer complains of unfair competition it is hardly likely that the patent people wil go after you. Likewise, we doubt if the performing rights peope employ detectives to ferret out minor cases, such as the example you give. But don't tell anybody we said so.

D.T. (Albury) wants to know if we publish a book of circuits for crystal sets.

A. No, sorry but we haven't even a circuit for a crystal set on hand at the moment. You might try the Technical Book & Magazine Co. of 297 Swanston Street, Melbiurne, as they have many books on radio in general.

C.A. (Geelong) is troubled with a lot of noise which seems to completely drown out reception in the evenings, but is not noticed in the day time.

A. It is obvious that the trouble has nothing to do with the set. We have struck plenty of capricious sets, but never one which would go alright in the daytime, but not in the evenings. The most likely source of the trouble will be a faulty street light, or insulator of the street lighting. About dusk, some evening, put your set on at its most sensitive setting, off station, and then watch for the lights to come on. If the noise appears at exactly the same time as the lights you can be pretty sure of the cause, and report it to the local power supply authority.

W.K. (Northcote) wants a book on radio control for model aeroplanes.

A. There are some books about on the subject, but mostly a little out of date. Probably you would get all the information you need from an article on the subject which appears in "Model Aeronautics," by Dean & Warring, obtainable from Hearns Hobbies, 367 Flinders Street, Melbourne, at 3/6.

S.P. (Toowong) wants a replacement valve for a type 224 and asks if a 24A will do.

A. Yes, the first figure was dropped from a lot of American valve types about 1932, the 227 becoming known as the 27, the 224 as the 24, and so on. The 24A was the same as the 24, but with a slightly quicker heating cathode. For replacement purposes the 24A should be quite O.K. In the case of the 4-volt rectifier, this may be a problem to replace, but we have seen the old reliable 80 type rectifier doing quite a good job with only four volts on its filament instead of its rated 5 volts.

W.R. (Adelaide) wants a copy of September, 1948, issue. ..

A. Sorry, but the stock ran out under a bit of a rush in the past few weeks and we haven't a copy in the place. If any readers care to send back copies they don't want we will be pleased to buy them back at their original price of 1/- each. We doubt if this remark will solve the problem, but if we can get a few copies we will be able to let you have one, and will notify others in these columns.

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—2 P.M. Spkrs., -12 in. Magnavox new, 10,000 W. trans, 35/; 5 in. Sparton, no trans., 10/; 3 Elec.-Mag. Spkrs., trans. used but O.K. -12 in., 10/; 10 in., 8/; 8 in., 6/; Carbon mike, plug, etc., 4/; MK 17A dial unit (0-100) complete, 7/. Apply week-ends or by letter A. M. Griffiths, 8 Holyrood Ave., Nth. Essendon, Vic.

FOR SALE — English Receiver, M.C.R.I. 5 valve portable, including power back. Workson 100-240 AC or DC or 90 volt batteries. Covers 2.5-15 megacycles, 150 to 1600 kilocycles on four bands Best offer to Kiley, 588 Seaview Rd., Kirkcaldy, Sth. Aust.

FOR SALE—Rotary Convertor, 50V DC input, output 240 AC, 100 wtts, practically new, specially filtered for HF work. One Communication Receiver No. 4 (Phillips), in perfect order. One 10' mark 2 Transceiver, new, unused, no valves. One Transceiver FS6, new, unused, complete with leads and power pack; price £60 the lot or will separate. L. Edwards, c/o Radio World.

FOR SALE. — A.W.A. Oscilloscope, type 3R6673, two-inch screen, in new cndition. Cost over £40. Will sacrifice, £17/10/-. Write "8510," c/o Radio World, Box 13, Mornington, V.

FOR SALE.—Car-lectric Set, built up ready for installation, brand new. £19/10/-. Write "8511," c/o Radio World, Box 13, Mornington, V.

FOR SALE.—Number of latest overseas text books on radio, television, and technical subjects. Write for list of "8512," c/o Radio World, Box 13, Mornington, V.

WANTED—Amplion Speaker, type 12 P 64. E. J. Pelkington, 8 Fell Cres., East Malvern, Vic.

WANTED—Copy of circuit of Halicrafters SX16 receiver, 1938 model, with 6K7 r.f., 6L7 mixer and 6J5 oscillator. R. V. Francis. Box 250, Naracoorte, South Australia.

RED LINE

TRANSFORMERS OF DISTINCTION

ITEM 57 **Type No. AW3**

Primary Z: 3000 ohms pp Plus 34db
Secondary Z .. .. 8 ohms or 2 ohms
Insertion Loss .. .. 0.5 db
Primary L: 40 Hys. Leakage L: 55 mHY
Freq. Resp: +/- 1 db 30 cps to 12 Kc/s
Base: 4x4x4¼"H .. .. .. Wgt. 6 lbs.
Mntg: V11 .. .. "S" is 1½"

ITEM 58 **Type No. AW4**

Primary Z: 3000 ohms pp Plus 34db
Secondary Z: 500 ohms and 125 ohms
Insertion Loss .. .. 0.5 db
Primary L: 40 Hys. Leakage L: 50mHY
Freq. Resp: +/- 1 db 30 cps to 12 Kc/s
Base: 4x4x4¼"H .. .. .. Wgt. 6 lbs.
Mntg: V11 .. .. "S" is 1½"

ITEM 59 **Type No. AW5**

Primary Z: 12,500 ohms pp. Plus 39 db
Secondary Z: 500 ohms and 125 ohms
Insertion Loss . . . . 0.9 db
Primary L: 100 Hys. Leakage L: 150 mHY
Freq. Resp: +/- 1 db 30 cps to 15 Kc/s
Base: 4x4½x4"H .. .. Wgt. 9 lbs.
Mntg: V11 .. .. "S" is 2⅛"

ITEM 60 **Type No. AW6**

Primary Z: 12,000 ohms pp. Plus 33db
Secondary Z: 500 ohms and 125 ohms
Insertion Loss . .. . 0.6 db
Primary L: 100 Hys. Leakage L: 140 mHY.
Freq. Resp: +/- 1db 30 cps to 12 Kc/s.
Base: 4x4x4¼"H .. .. .. Wgt. 6 lbs.
Mntg: V11 .. .. "S" is 1½"

ITEM 61 **Type No. AW7**

Primary Z: 12,000 ohms pp. Plus 33 db
Secondary Z .. 8 ohms or 2 ohms
Insertion Loss .. .. 0.6 db
Primary L: 100 Hys. Leakage L: 140 mHY
Freq. Resp: +/- 1 db 30 cps to 10 Kc/s
Base: 4x4x4¼"H .. .. .. Wgt. 6 lbs.
Mntg: V11 .. .. "S" is 1½"

ITEM 62 **Type No. AW8**

Primary Z: 1500 ohms pp. Plus 37 db
Secondary Z: 500 ohms and 125 ohms
Insertion Loss .. .. 0.6 db
Primary L: 35 Hys. Leakage L. 28 mHY
Freq. Resp: +/- 1 db 30 cps to 12 K/cs
Base: 4x4½x4¼"H .. Wgt. 9 lbs.
Mntg: V11 .. .. "S" is 2⅛"

ITEM 63 **Type No. AW9**

Primary Z: 6600 ohms pp. Plus 37 db
Secondary Z: 500 ohms and 125 ohms
Insertion Loss .. .. 0.6 db
Primary L: 75 Hys. Leakage L: 85 mHY.
Freq. Resp: +/- 1 db 30 cps to 10 Kc/s
Base: 4x4¼x4¼"H .. .. Wgt. 7 lbs.
Mntg: VII .. .. "S" is 1¾"

ITEM 64 **Type No. AW10**

Primary Z: 10,000 ohms pp. Plus 39 db
Secondary Z: 500 ohms and 125 ohms
Insertion Loss .. .. 0.5 db
Primary L: 80 Hys. Leakage L: 100 mHY
Freq. Resp: +/- 1 db 30 cps to 10 Kc/s
Base: 4x4½x4¼"H .. Wgt. 9 lbs.
Mntg: V11 .. .. "S" is 2⅛"

LINE TO VOICE COIL MATCHING TRANSFORMERS

The transformers described in this section are complementary to those listed in the previous month, and are intended to match 500 or 250 ohm output lines to any number of speakers from one to twenty inclusive.

They are high efficiency units with interleaved cores and low insertion loss. Although in many cases their nominal specifications appear suitable for direct coupling of valves to speaker voice coils, no provision has been made to prevent saturation due to superimposed direct current, and they should not be used for this application.

ITEM 65. **Type No. LV10**

Primary Z: 1000 ohm tapped 500 ohm-5W
Secondary Z: Speaker V-Coil, 2 ohms
Base: 2⅝x2¾x2¼"H. Wgt. 1lb. 8 oz.
Mntg: MH1B .. .. "S" is ⅞"
Base plate fits standard 8in. speakers.
No. Speakers matched: 500 ohm-1 or 2
No. Speakers matched: 250 ohm-2 or 4

ITEM 66 **Type No. LV20**

Primary Z: 2000 ohms tap 1500 ohm, 5W
Secondary Z: Speaker V-Coil, 2 ohms
Base: 2⅝x2¾x2¼"H. Wgt. 1lb. 8 oz.
Mntg: MH1B .. .. .. "S" is ⅞"
Base plate fits standard 8in. speakers.
No. Speakers matched: 500 ohm-3 or 4
No. Speakers matched: 250 ohm-6 or 8

ITEM 67 **Type No. LV30**

Primary Z: 3000 ohms tap 2500 ohm, 5W
Secondary Z: Speaker V-Coil, 2 ohms
Base: 2⅝x2¾x2¼"H. Wgt. 1lb. 8 oz.
Mntg: MH1B . "S" is ⅞"
Base plate fits standard 8in. speakers.
No. Speakers matched: 500 ohm-5 or 6
No. Speakers matched: 250 ohm-10 or 12

ITEM 68 **Type No. LV40**

Primary Z: 4000 ohms tap 3500 ohm, 5W
Secondary Z: Speaker V-Coil, 2 ohms
Base: 2⅝x2¾x2¼"H. Wgt. 1lb. 8 oz.
Mntg: MH1B . .. .. "S" is ⅞"
Base plate fits standard 8in. speakers.
No. Speakers matched: 500 ohm-7 or 8
No. Speakers matched: 250 ohm-14 or 16.

ITEM 69 **Type No. LV50**

Primary Z: 5000 ohms tap 4500 ohm, 5W.
Secondary Z: Speaker V-Coil, 2 ohms
Base: 2⅝x2¾x2¼"H. Wgt. 1 lb. 8 ozs.
Mntg: MH1B . . .. . "S" is ⅞"
Base Plate fits standard 8" Speakers
No. Speakers matched: 500 ohm-9 or 10
No. Speakers matched: 250 ohm-18 or 20.

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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