THE AUSTRALASIAN

Radio World

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VOL. 8 . . . . . NO. 1

JUNE 15 1943

How electronics have influenced medical theories and practice.

Three-valve circuit for battery receiver is simple but effective.

Details of facsimile transmission system said to rival television.

New listing of shortwave stations makes ideal reception guide.

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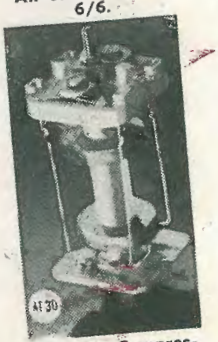

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THE AUSTRALASIAN
RADIO WORLD

Devoted entirely to Technical Radio

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EDITORIAL

Following on last month's editorial remarks about carrying on through strenuous times, we might also point out the debt which we and our supporters owe to those of our advertisers who have remained faithful.

Some firms found that they were short of stock and they no longer needed to advertise to maintain their business. But they did NOT cancel their advertising. They realised that advertising can be something more than merely a bait with which to catch buyers. By maintaining their advertising they are doing an indirect, but none the less effective, service to their most valued clients, the technicians, servicemen and radio enthusiasts throughout the Commonwealth.

We feel sure that we speak for all our readers, when we pledge ourselves to remember all this when peace returns and trading conditions return to normal.

ELECTRONICS IN MEDICINE

THE average radio enthusiast is almost unaware of the vast and increasing part played in medicine by the thermionic (or electronic) valve. Oscillators, amplifiers and television optics, besides the cathode-ray oscillograph are all put to use. In addition to the direct applications of the above, there are, of course, indirect examples such as the use of rectifying valves for the production of X-ray current supplies, electronic-timers for radiographic processing, the teaching of surgery by television, etc.

Diathermy

One of the first applications of electron tubes was in the production of

By J. W. STRAEDE, B.Sc.

Based on Notes and Ideas of the late Dr. W. F. Straede, M.B. B.Sc.

valve operated diathermy units. Such a unit consists essentially of a powerful (say 200 to 500 watts) valve oscillator together with a coupling coil. The high-frequency A.C. is fed to the part of the patient to be treated. Absorption of the energy produces heat within the tissues. Connection to the patient may be conductive, i.e., the leads are actually connected to the patient by cloth pads soaked in a saline solution; capacitive, making the body act as an imperfect dielectric between two plates, or inductive. In the last case, a coil of several turns is wound loosely around the part to

Above: A photograph of the "Hilco" diathermy unit, and left, an outline of the circuit used. This outfit, which is manufactured in Melbourne, is a typical example of the progress being made in the application of electronics to medicine.

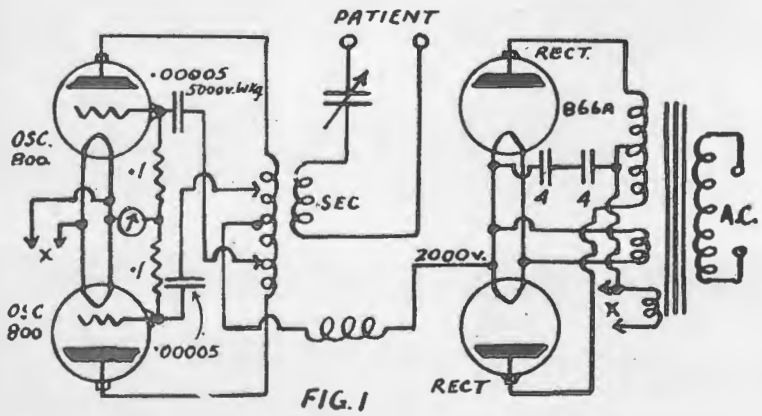


FIG. 1

be treated and eddy-current loss produces the heat.

A typical circuit is shown in Fig. 1 and a photograph of a unit built by Hilco in Fig. 2.

Diathermy apparatus causes radio interference, so it can be used only in screened rooms.

Some experimenters claim that the wave length (and frequency) of the oscillatory current generated, affects

(Continued on next page)

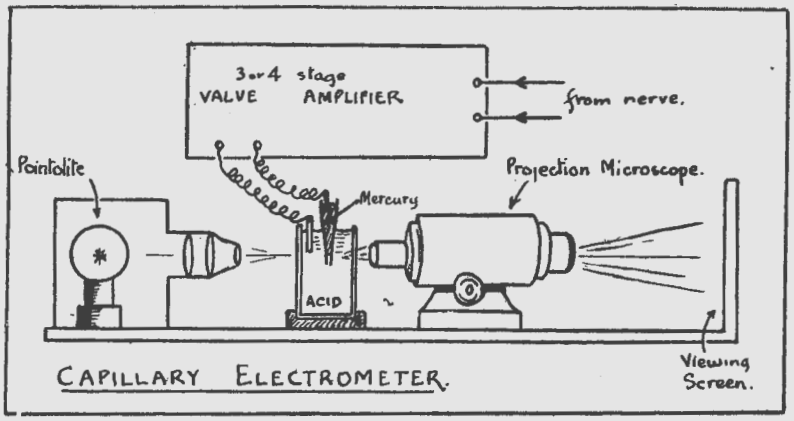


Figure 4. The capillary electrometer for recording minute electrical impulses.

ELECTRONICS
(Continued)

the therapeutic value. Very high frequencies are generally favoured. Pyrometer relays facilitate the treatment of unconscious patients.

Heart Sounds

The familiar stethoscope is not lacking in distortion and gives only a comparatively quiet sound. In the teaching of medicine, and for noisy locations the use of a valve amplifier is very necessary. The high-frequency component at the end of "lub-dup' is of great importance in diagnosing valve leakage, so the amplifier used must have a good high-frequency response. Special microphones, usually crystal or moving -coil, have been built for the job. Extraneous sounds must be completely eliminated.

As the chest wall has a continuous slow movement, the amplifier system must not respond to very low frequencies. A sharp cut-off, high-pass filter is therefore employed.

In teaching, a cathode-ray-oscilloscope may be used as well, so that the frequency/volume/time relationship of each heart-sound can be clearly seen. Screens with a high persistence-time and high intensity are necessary. The slow time-base frequency required may be obtained from a motor-driven potentiometer.

Nerve Currents

Research into the nature of nerve impulses has been possible only since the development of high-gain electronic amplifiers. Even then a special detecting device is necessary. A capillary electrometer (see Fig. 4 may be used. This consists of a very fine tapered glass tube containing mercury and dipping into a glass trough containing dilute sulphuric acid. When the potential difference between the mercury and acid changes, the surface tension at the junction between the two liquids also changes and the mercury moves up or down the tube. The slight movement is shown on a screen by means of a micro-projector.

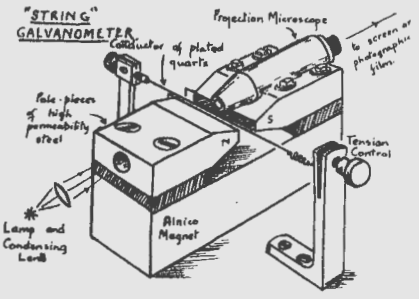
In conjunction with a 4-stage amplifier, the capillary electrometer enables the impulses from a single nerve fibre to be studied and not just the aggregate impulse from an entire nerve. Diagrams showing the nature of the impulses and how they vary, are given in Fig. 5. The amplifier used must have an extremely good low frequency response and may be entirely direct-coupled. New tubes with high transconductances (e.g., 14 ma/v.) may simplify the designing of these amplifiers.

Heart Voltages

Whilst working as a pump, there are very small voltages found between various parts of the heart. It is not clear whether these minute potential differences (about 1 millivolt max.) are from the working of the heart or from the nerve impulses actuating it. The former seems the more probable, for in certain defects of function some of the voltages found, are diminished or changed in direction.

These minute voltages were first shown by the Einthoven String Galvanometer (which compares with a ribbon microphone in somewhat the same way as a motor compares with a dynamo).

An intense magnetic field at right angles to the conductor carrying the current, causes the conductor to move in a direction at right angles to both. Modern Alnico magnets have greatly improved the old-style "electrocardiagraph," but even so it may soon be replaced by a suitable amplifier and oscilloscope. A diagrammatic view of a string galvanometer is shown in Fig. 6 and in Fig. 7 is an amplifier fore an electrocardiagraph of the



Simplified view of string galvanometer.

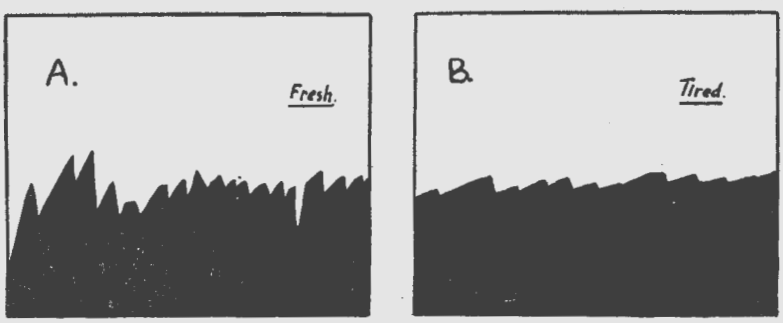
oscilloscope type. Note the very large coupling condensers, large grid leaks and battery valves. The frequency range required in such an amplifier is from 250 to ½ cycle per second.

It has recently been suggested that an extra couple of stages be tried on to the end of the amplifier shown, so as to give a large power output which could move the needle of a recording voltmeter sufficiently rapidly and so save the bother of recording the heart voltages on a photographic film.

Ultra-sonics

"Sound," or vibrations too rapid to be heard, are termed "ultra-sonic". Some high frequency ranges (35 to 50 kilocycles) are lethal to small animals, so it has been suggested that ultrasonic radiation (which can be confied to a narrow beam) be tried on cancer and malignant growths in place of X-rays, or rays from radium. The difficulty is the generation of a sufficiently powerful beam.

Ultra-sonic and sonic vibrations are easily transmitted along a metal rod and it has been suggested that such a rod be used to feed the vibration to the growth to be treated. Very high-frequency vibrations can emulsify oil



Impulses from a nerve attached to a muscle. A, when muscle is stretched. B, ten minutes later.

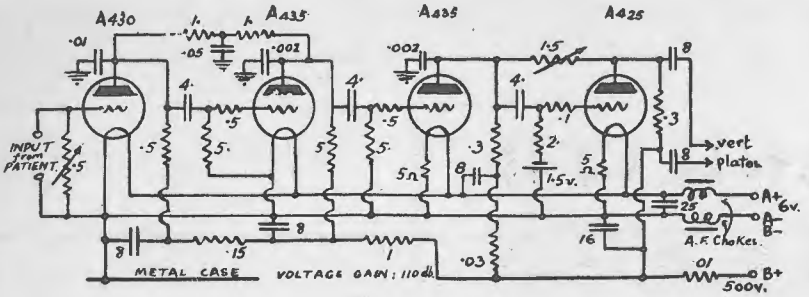


FIG 7

Typical circuit of an amplifier with exceptionally high gain.

and water, shatter crystals and generate considerable heat.

Possibly the surgeon of the future will break up kidney stones, get rid of excess fat, destroy cancer, stimulate tissue, by suitable sonic and ultrasonic vibrations. In Fig. 9 is a diagrammatic sketch of a ultra-sonic generator with metal "drive-rode."

Electron Microscope

The optical microscope cannot clearly distinguish particles smaller than the wave length of light, whilst the use of ultra-violet light (of shorter wave length) means that particles cannot be studied directly — photography must intervene.

The electron-microscope with optical optics replaced by electron-beam optics, with the light source replaced by an electron emitter, uses the same principles as a television tube and provides a means for investigating the "filterable viruses" — germs so small they cannot be separated by a filter and "bacteriaphage" — supposed to be an ultra-minute race of germs feeding on the germs themselves much as germs do on us.

Both optical projection microscopes and electron microscopes have been improved by the use of an intensifier tube so that a small dimly-lit image is converted into a large brightly lit one.

Deaf Aids

Until the shortage of batteries occurred, the valve-amplifier deaf-aid system was rapidly replacing the old carbon microphone and bar amplifier type. Now, however, the need for bulky 'B' batteries is being done away with by (a) development of midget vibrator packs that work from a 1½-volt dry cell, (b) development of space charge tetrodes and coplanar-grid tetrodes that work from very low voltages. Some ordinary battery triodes produce quite a fair amplification at zero H.T. (plate return going to A+), enough to cause oscillation in a superhet! (The A209 will work with 1½-volt filament supply and ½-volt H.T.)

A diagram of a simple deaf-aid amplifier is shown. Generally a midget crystal mike of the diaphragm type is used, with either a hi-fidelity earphone or bone-conductor. Valves with ¾-volt filaments have been consructed for these jobs. Just imagine two in series on a 1½-volt torch battery with two similar 16-volt cells as H.T. Perhaps the wrist-watch radio will really be possible some day!

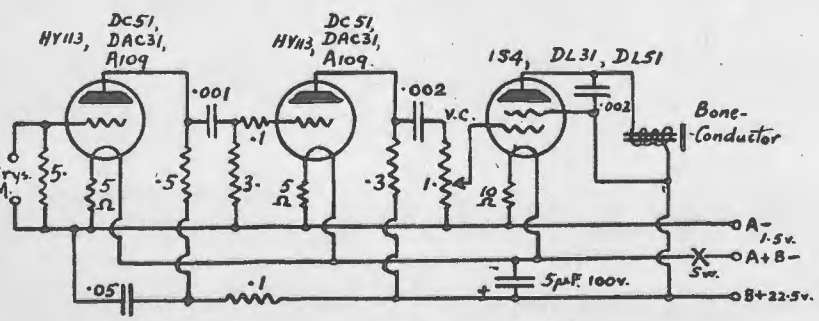


FIG. 11 Deaf-Aid Amplifier.

A typical circuit of an amplifier for deaf-aid work.

Psychiatry

Professor Halstead, of Chicago, perfected a 3-stage amplifier and recording device to show the minute voltages generated by moving eye-lids. Electrodes are attached near the eyes of the subject who sits in a shielded room. Technique for the study of brain lesion cases has been developed—reactions of the eyelids to light of various colours and intensities are recorded.

The "lie detector", a device using electron tubes to amplify current-changes due to skin-resistance changes gives a direct measurement of the moisture content of the skin.

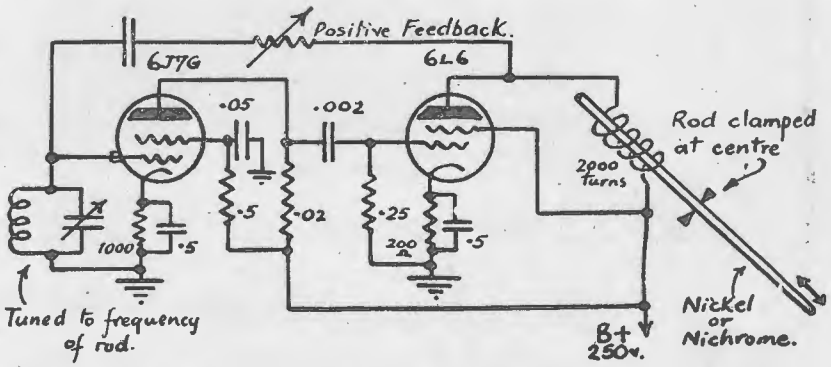


FIG. 9 ULTRASONIC GENERATOR.

Diagram of the ultra-sonic generator.

Just to conclude with: at Israel Zion Hospital in Brooklyn, engineers from American Television arranged the broadcast of a surgical operation to 150 medical students seated in an auditorium 500 feet away. The necessary signals were conveyed from the operating theatre, by means of a co-axial cable.

From this article, which touches only briefly upon a few of the major applications of electronics in medicine, it can be seen that the electronics engineer and medical man of the future will work hand-in-hand. It is hoped that this article will show the electronics enthusiast what an important subject he is studying and at the same time draw the attention of the doctor to the possibilities of electronics as a diagnostic and therapeutic agent.

WHEN A COMPASS MISBEHAVES

The compass in a bomber pilot's cockpit sometimes leads to a detailed investigation. When adjustments are made—"swinging the compass" it is called—mysterious deviations may be noticed, and the cause must be tracked down. The aircraft is turned slowly round to the magnetic north, and the compass checked. If the needle, or pointer, refuses to stay where it should an inquiry of experts is opened.

The story is told on one bomber station of a navigation officer, who, having cross-examined every witness about possibly hidden pieces of metal and crawled about the aircraft on hands and knees remarked: "Well, all I can think of is that it's caused by the magnetic personality of the pilot."

The explanation is usually much simpler than that. A knife may be found tucked down the flying boot of one of the men standing near. A metal stud which had become lodged in the heel of a pilot's boot has been known to affect the compass. Hours of investigation into the strange behaviour of a compass in a Halifax ended when the pilot discovered that a circle of wire, used as a stiffening in the inside of his hat, was the cause of the trouble. When he went near the compass he got a bad reading, until in desperation he flung off his hat, and then found that the compass's sensitiveness was no longer offended.

Lightning encountered during flight, a danger to any compass, may magnetise the aircraft. The compass must be "swung" every month as an aircraft, at its dispersal point, gradually becomes magnetised.

—"Practical Wireless," (Eng...

★

MEASURING CLOUD LIMITS

A photo-electric cell is incorporated in the latest type of meteorological balloon designed by a United States Government research worker. It is used to indicate the lower and upper limits of cloud through which the balloon rises. The variations in light intensity as the balloon rises into and emerges from a cloud cause the cell to vary the transmitter frequency, the changes in which are recorded by a ground station.

★

HANDY IN WARFARE

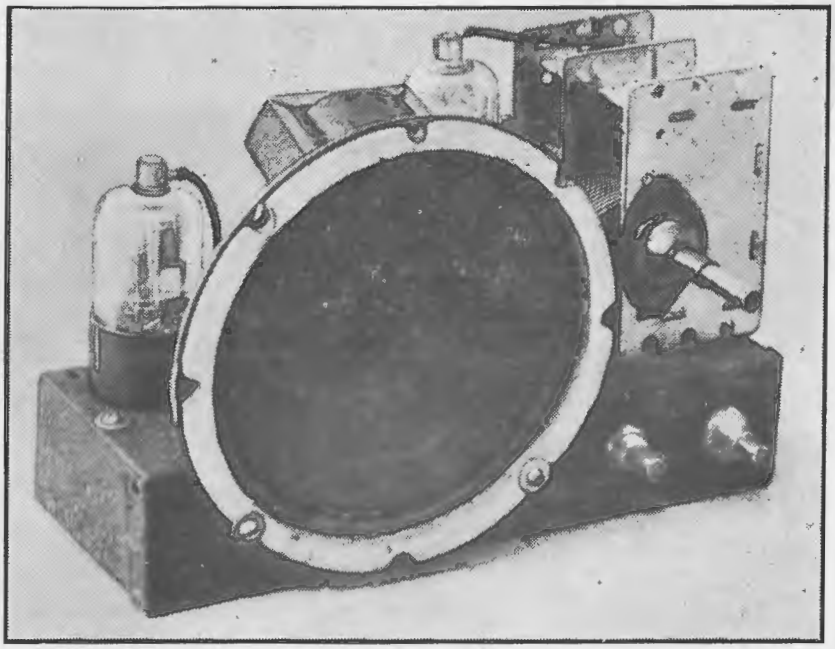
According to a special item in the "Newark News," the course for enlisted men in the Signal Corps includes mathematics, electrical theory, vacuum-tube theory, audio systems and wireless telepathy.

—Q.S.T.

A SIMPLE BATTERY CIRCUIT

A compact two-tuber suitable for a portable or mantel cabinet. Using a multiple tube as detector and power output, it gives excellent results.

USING a straight tuned radio-frequency amplifier in place of a superhet tuner, this simple receiver is easy to build, easy to align and free from snags. Only a small chassis is required and this can be of metal, 3-ply, masonite, or a combination of all three. Our own chassis was made from portion of an old radio chassis which had been finished with "wrinkle paint". A coat of black paint allowed us to keep the wrinkle effect, but fixed up a few scratched and rusted spots. In cutting the valve socket holes, a small hole was first punched and then using that as a centre, a large hole (1¼-inch) was carved out with a brace and centre-bit.



A phoptograph of the original receiver.

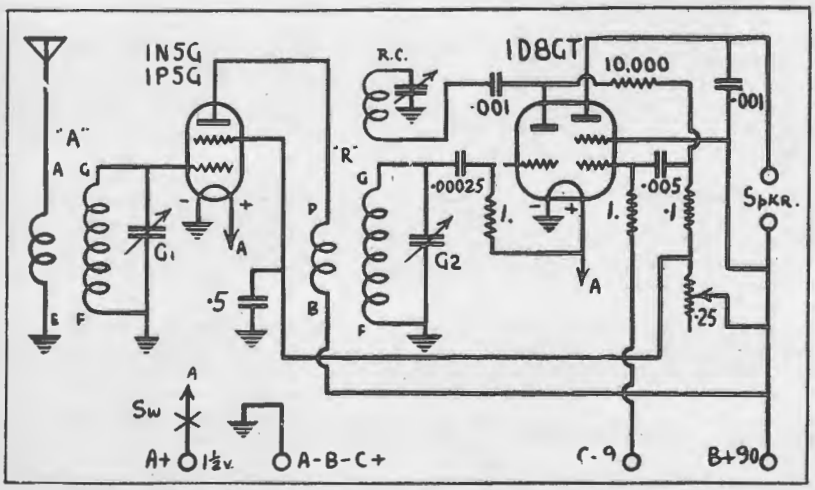
No I.F., No Padder

As the circuit is a T.R.F., there is no padder or I.F. transformer. What is more important is that no converter valve is required. If the worst happens and coils are not available, they can be wound by hand, but then a much larger chassis is necessary. The R.F. valve is 1P5G, 1N6G or a -GT equivalent. This is transformer-coupled to the detector, which is the triode section of a 1D8GT. Grid-leak detection is used as this is more sensitive than anode-bend. As regards tone, grid leak detection is almost equal to diode detection—it is, in fact, diode detection with "diode biassing" combined.

The output section of the 1D8GT is used as an A.F. power stage. Coupling between the two sections is capacitative, there being no room for an A.F. transformer on the midget chassis we used.

Low Voltages

.. As there is no oscillator to go "conk" when the H.T. voltage is low, the 'B" batteries last much longer than when used with a conventional super. If a really sensitive speaker with a large magnet is used, quite respectable output can be obtained with only a 45 volt supply. The limiting factor as regards any reception at all seems to be the loss in sensitivity at low voltages. This affects distant listeners more than those within reasonable distance of a station. A long, high, aerial and a good earth helps considerably in attaining sensitivity. However, we 'll have more to say on extra sensitivity later.



Circuit diagram, showing how two valves do the work of three.

Layout

To save space, the coils were decanned. One was mounted underneath the chassis with its axis parallel to the shaft of the 2-gang condenser. The other is mounted vertically in front of the R.F. tube, between the speaker and the 2-gang. The screw of its "permature" adjustment is just visible in the photograph.

Our 2-gang condenser had a built-in concentric-epicyclic vernier movement, but a small "portable" dial and drive shaft can be fitted in quite easily with a G type condenser.

The other two controls are the sensi-

(Continued on next page)

BATTERY SET

(Continued)

tivity (R.F. gain and regeneration) and an on/off switch.

Wiring

Neither order of wiring nor layout of the minor components seems to be critical. Our one and only slip was leaving a longish lead to the grid of the triode part of the 1D8GT and this picked up hum. A good earth reduced the hum considerably, as did putting a shield around the tube. Shielding was not found necessary for stability. Following time-honoured practice, we wired up the filaments first, then earthed the coils where necessary, earthed the "wipers" on the 2-gang and pins 1 and 8 on each socket. All control-grid leads were then connected and the grid lugs of the coils wired to the stators of the "gang."

Then came the screen grid of the R.F. tube, then sensitivity control and plate circuit of the detector. After that we gave up following our usual order of filaments-earthing-cathode-grids-plates as we were getting rather worried over lack of space! Battery wires were soldered directly to the various components (B+ to screen of 1D8GT, A+ to switch, A—, B— and C+ to a solder lug on chassis, C— direct to grid resistor of output section).

Speaker Impedance

Normally the 1D8GT requires a load of from 12,000 to 15,000 ohms. However, we decided to try the set on H.T. voltages lower than usual, and for these conditions a much higher impedance is required, especially if the output valve is over-biassed. As speaker transformers are scarce we adopted the idea of reducing the number of secondary (voice-coil winding) turns on the transformer we had. By removing one-third of the turns we multiplied the effective impedance by approximately 2¼. A specially made transformer would probably have been a trifle better.

Extra Sensitivity

The most useful method of improving sensitivity are the use of an A.F. transformer in place of the resistance-capacity coupler, the use of a really good speaker with a large magnet, but not too large a cone, and reflexing the output section of the 1D8GT as an extra R.F. stage (see the last few issues of "Radio World.") Another dodge is to make a short horn for the speaker. Only thin timber need be used as there is very little power to be handled. If an A.F. transformer

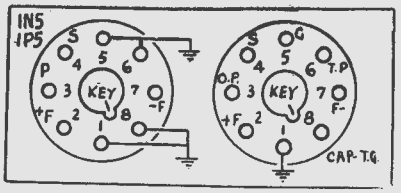


Diagram of the socket connections; left, the 1N5 and 1P5; and, right, for the 1D8GT.

is used, it should be a good one with a large primary inductance—at least 50 henry and a ratio of between 1 to 2 and 1 to 4.

Re the matter of battery voltages, headphone reception was obtained with 4.5 volts B battery and the C battery omitted (connect C— and C+ together).

Experimenters with 2-volt tubes on hand could try a 32 or 1E5G followed by a 1J6G or -19.

Adjustment of Reaction Trimmer

With sensitivity control on "full," screw up the trimmer until oscillation is obtained. If oscillation cannot be obtained, try (a) reversing leads to reaction coil (b) coupling the two control-grid leads by a loop of insulated wire.

TAP WATER FOR BATTERIES

In all the textbooks and the popular handbooks you'll find it laid down categorically that all kinds of horrible things will inevitably happen to secondary cells if anything but distilled water is used for mixing the electrolytic in the first place and for topping up the cells subsequently. I wonder how many writers of the aforesaid books have found their heavy warnings against the use of tap water on the results of practical experiments. Most of them, I'll wager, have been content to bank on what others have written before them. Personally, I don't think it matters two hoots whether you draw your water just as it comes from the tap or buy it distilled from the chemist. I think I'm right in saying that for years the G.P.O. people have used tap water widely for their secondary cells without noticing any ill effects. I, personally, never hesitate to use tap water, unless it's of the very hard variety. Even then, all seems to be well if you boil it first and allow it cool and settle before putting it into the cells. — "Diallist," in "Wireless World."

IDEAS FROM MODERN CIRCUITS

This month's collection:—

Reaction in T.R.F. Receiver.

Single A.F. Transformer for Push-pull.

Level Indicator Amplifier.

Reaction Devices

BUILDERS of the "Straight Four" (Australasian Radio World, November, 1940) or the "Victory" Mantel Four (A.R.W., Oct., '42) sometimes find that a little more gain is desirable. This is especially true for those listeners who are compelled to use short indoor aerials, or who are more than 20 miles from the city.

If the second coil has a reaction winding, all is well and a small reaction condenser (or even a couple of trimmers in parallel) will do the trick. If no reaction winding is there, then the primary winding of the second coil may be made to do double duty. The plate R.F. by-pass condenser is removed from the detector (it is .001 in the Victory, .00025 in the Straight). Then a length of **insulated** wire is twisted two or three times around he anode lead of the first valve (6U7G or 6K7G) and two or three times around the anode lead of the second valve (6B6G or 6J7G). This acts like two small condensers in series. Slight re-alignment of the second tuning condenser trimmer is necessary.

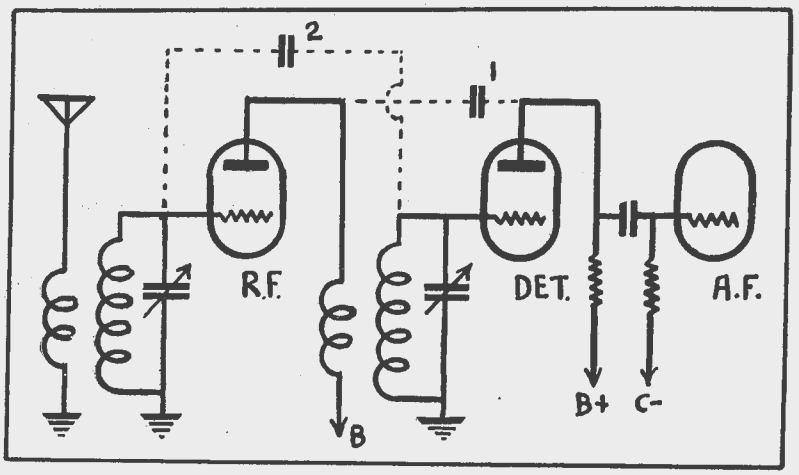


Diagram to indicate where capacity can introduce regeneration.

An alternative scheme, one much loved at one time by the mechanics called out to service T.R.F. sets in the 1929-131 era, is to capacitively couple the grid leads to the firt two tubes. It may be necessary to twist them together if the R.F. stage has only a low gain or only a close proximity (within an inch of one another) may do if the set is carefully aligned.

When realigning after adding the reaction, oscillation may be produced. If so, gradually reduce the coupling so that with perfect alignment and the volume control full on, the set just fails to oscillate.

If reaction is added, a longer aerial can be used without the stations running into one another.

Using A.F. Transformer for Push-pull

Most experimenters have seen the idea of shunting the secondary of an audio frequency transformer with two equal resistors in series and using the combination to feed two output tubes in push-pull. What are not generally known are the correct choice of resistance, the limitations of the system and the effects on response.

First, the output valve and its characteristics set a limit to the maximum size of each resistor. The higher the anode and screen voltages the lower the resistance must be. Self-bias allows a higher value than fixed bias. English and Continental type tubes, e.g., EL3, allow higher resistances than American type tubes such as 6V6G, but on the other hand require a larger "stopper" resistance at Rs (see diagram). If the resistance be too small, high-note response is reduced, the leakage reactance of the secondary and the grid resistor acting like a high-cut filetr. If L = leakage reactance in henry and R = grid leak resistance in ohms, then the ratio of high-note response to mid-frequency response is given approximately by

$$\frac{R}{\sqrt{R^2 + 4\pi^2 f^2 L^2}}$$

As well as this, the response is evened out and the usual high-fre-

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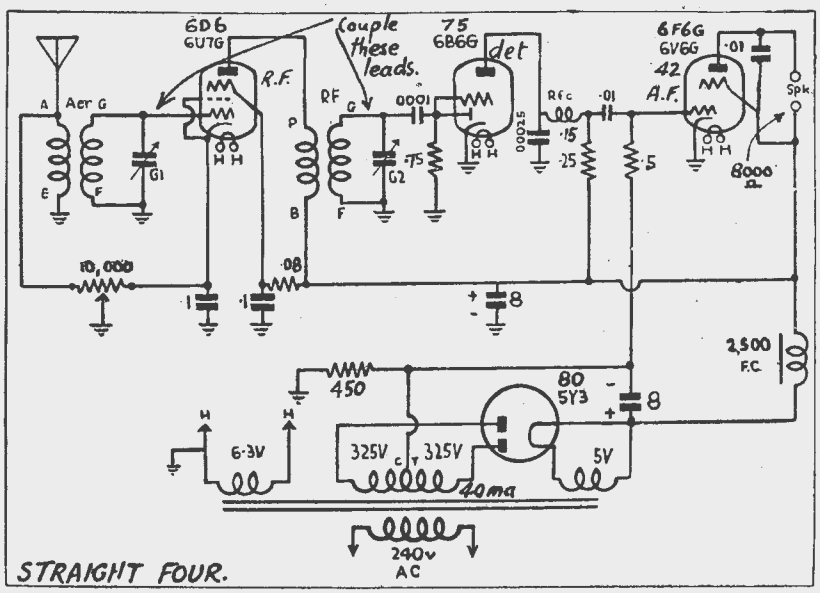


Circuit of the "Straight Four," indicating which leads to couple to get added gain

IDEAS
(Continued)

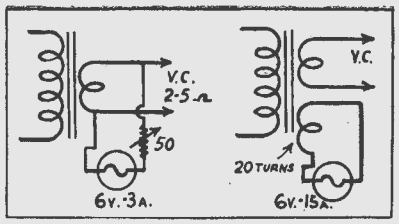
quency peak of the transformer is ironed out (the leakage reactance and distributed capacity act like a tuned circuit around the 3,000 to 7,000 hertz mark).

Another factor limiting the minimum value of each grid resistor is the characteristics of the driver valve. The "reflected impedance" due to the grid resistors is approximately

$$\frac{2R}{N^2}$$

where N is the ratio of the transformer.

If this "reflected load" is less than that recommended for the driver valve then distortion (mainly second harmonic) will occur on loud notes. This is most likely to occur for high impedance triode drivers (e.g., 79, 75, 6N7) and least likely for valves such as the 55, 56, 27. The reflected load should not be less than twice the anode resistance of the driver if the output tubes are sensitive, e.g., EL3, 6V6 or less than three or four times it for less sensitive output tubes such as 6F6, 6B5, 42, 2A3.



Two suggestions for fitting dial lights as level indicators.

Level Indicator for Amplifier

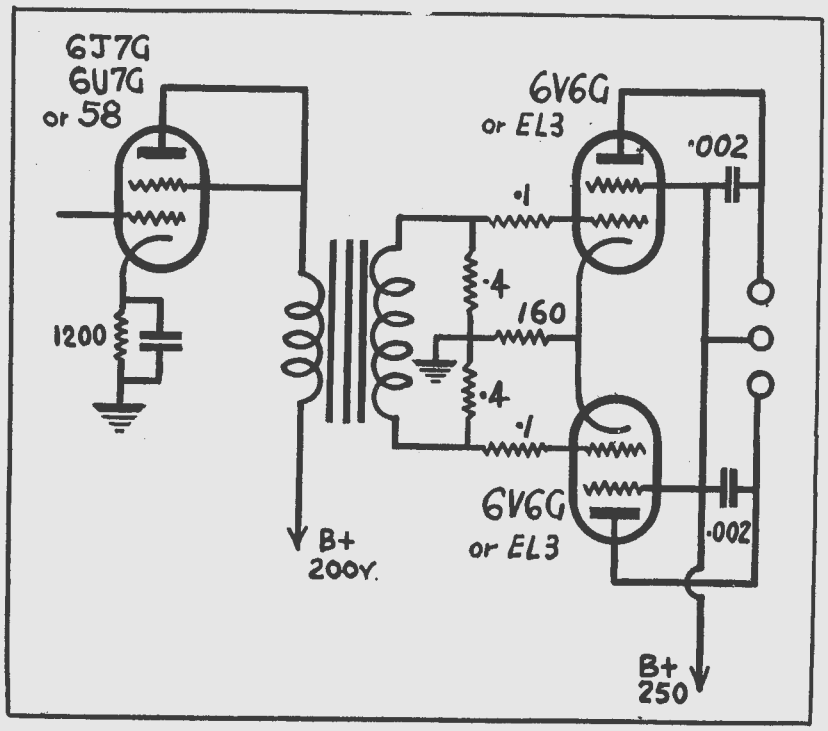
A small portion of the output power may be used to operate a pilot light the brightness of which gives a clue to the volume level. The simplest system is to use a 6-volt pilot lamp connected across a voice coil of from 1 to 4ohms impedance. At a volume level of 4 watts, the R.M.S. voltage across a 4-ohm V.C. is 4-volt. ($P = E^2 \div R$).

For large powers a separate winding on the output transformer may be used, or a resistor can be inserted in series with the lamp. Sometimes the lamp and resistor have a second function such as A.V.C. or A.V.E. (see April issue of A.R.W.).

There is no need for the lamp to glow white hot (unless, of course, it is being used for A.V.E., by direct shunting of the voice coil). In the table given, the characteristics of a 6-volt .3 amp lamp are shown. It will be noticed that less than 1/5-watt is all that need be absorbed in a suitably designed system.

Appearance	volts	amps	watts
Dim glow	.8	.08	.06
Red	1.2	.1	.12
Yellow	2.5	.15	.37
White	4.4	.2	.88
Dazzling	6.0	.3	1.8

Additional values are given for greater power absorptions for experimenters who use lamps for A.V.E. The results were obtained by students doing Grade 1C Physics at Melbourne Technical College, using the voltmeter-ammeter method of resistance measurements.



Circuit for a powerful push-pull amplifier to use a single-ended input transformer.

SCHEMATICS

The British have an eye for little things that sometimes prove bigger than one would have supposed. The art and technique of drawing schematic diagrams for instance.

What may or may not prove of some importance in the war effort is contained in a letter from Geoffrey Bocking, appearing in the November, 1942, issue of the journal "Electronic Engineering."

Mr. Bocking is of the opinion that there are certain definite advantages in looped cross-overs as against direct cross-overs in the drawing of circuit diagrams. As a support to this opinion he offers the following practical anl psychological points:—

(1) It is sometimes difficult in printing process to prevent the possibility of direct cross-over blurring into a dot, (thus falsely indicating a connection) especially when the diagram is on a reduced scale.

(2) In general, a draftsman will tend to omit loops less frequently than he will omit dots, and in the use of looped cross-overs the omission of a dot will be a matter of negligible consequence.

(3) In a diagram containing both direct cross-overs and dots the eye tends to "see' dots at every cross-over.

Mr. Bocking concludes with the notation that the results of experiments conducted by workers of the Gestalt school of psychology confirm the last two points.

(The above paragraph about schematics appeared in a recent issue of "Radio" (U.S.A.), and is a pleasing support of the diagram policy of "Australian Radio World," which has often been the subject of criticism from those who prefer direct cross-overs. —Editor.)

TELEVISION OR FACSIMILE?

IT is expected that as soon as peace returns there will be vast strides taken in the direction of improved radio service. One service which is likely to receive attention is television, but there is also a school of thought which considers that facsimile transmission can be of greater benefit than television.

One world-famous scientist who has done a lot of research work with both television and facsimile is John V. L. Hogan, who operates several experimental stations in New York, his station W2XR, licenced in 1929, was one of the first to tackle television in a big way.

Mr. Hogan feels that **facsimile** is a more useful and important service than televesion, for the following reasons: (1) Facsimile apparatus much less expensive than television apparatus; (2) Programmes much less costly; (3) Text and pictures can now be acceptably reproduced by facsimile whereas the best television technique is still unacceptable to many; (4) Facsimile programmes may be watched as they are presented, or the user's attention may be diverted elsewhere and pick up the programmes later with no loss of content; (5) Provision of advertising coupons where desired, and (6) Transmission by wire, or on long, medium, short or ultra-short waves, with very moderate channel-width requirements, whereas television is inordinately greedy in its demands for channel space and consequently is considered to be limited to special cables and the ultra-short waves.

Photographic System Discarded

In the studies leading to the design of a suitable recorder for **home** use, Mr. Hogan discarded photographic methods because of the processing and skill required; he set up as his first requirement that the recording should be visible and instantaneous, so that the user could see what was going on at all times, and could in fact check the tuning and other adjustments of his receiver, simply by observing the action of his recorder. This important characteristic requires that each recorded mark should be seen on the recording paper practically at the instant it is made; if the picture is recorded inside a box and, after a delay of some seconds or minutes, is fed out through a slot, the user is not only deprived of the fascination of seeing the picture build up line by line but ,more importantly, has great difficulty in tuning or setting the volume of his receiver.

A second requirement set up by Hogan in his earliest work was that the recording should be **continuous**, i.e., that the recording paper should be fed from a continuous roll, rather than used in sheets which would have to be individually placed upon an easel or around a drum. The advantages of the continuous feed, both at transmitter and receiver, are self-evident.

2 Images on 1 Receiver

At the transmitter there are two forms of pick-up, or scanner, used interchangeably. One type resembles the conventional drum scanner, around whose cylinder is wrapped a paper sheet carrying the text or illustrations to be transmitted. The drum scanners are used in pairs, the second one usually being reloaded for a coming programme during the time that the first one is actually being used for transmission. However, the two drum scanners may be used simultaneously, each one transmitting a different programme on the same channel, with only a **single** radio transmitter. In such dual-programme operation, any home user of a Hogan facsimile may reproduce whichever of the two programmes he desires, or, if he has two recorders, he may reproduce both programmes at the same time—and with only a **single** radio receiving set.

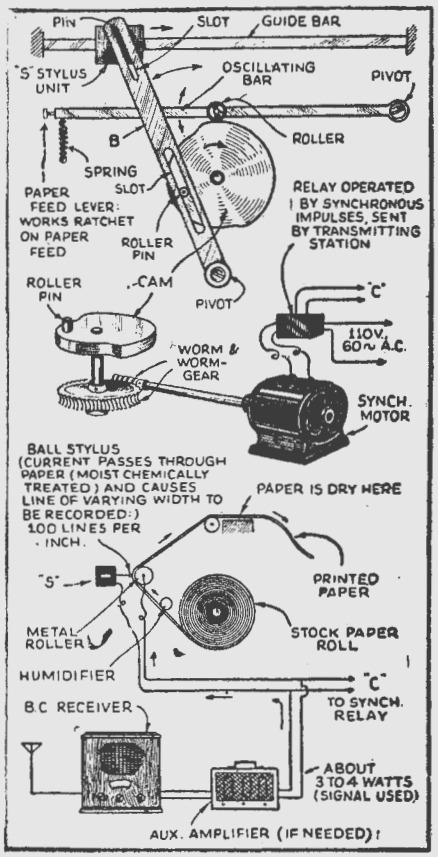
The second form of transmitting scanner takes the copy to be transmitted as a continuous strip of paper 8½ inches wide.

How Picture Reproducer Works

The reproducer is a compact and simple device for attachment to any **home** made receiver or for incorporation within the cabinet of a special facsimile set. The user loads it with a carton containing a roll of electro-sensitive paper, threading the dry leading end of the roll through the reproducer, much as a sheet of paper is inserted into a typewriter or a film placed in a camera.

After the paper has been turned into place by means of the typewriter knob on the right side of the reproducer, the user turns on his radio set and tunes to the facsimile broadcasting station, just as he would tune to a sound broadcasting station. He can adjust his tuning and volume controls either by listening to the facsimile signals (which usually sound like "peep-scratch, peep-scratch, peep-scratch") on a loud-speaker, or by watching his facsimile reproducer at the visible marking point, or by means of a tuning-meter or magic eye on his receiver. That is all he has to do, for the act of tuning on his receiver also starts his facsimile recorder.

The first ten or twenty strokes of the recording pen may be consumed in the automatic process of "framing" or centering the picture or text. The receiving machine does this all by itself, and therafter remains **in frame** and in **synchronism** as long as it is in operation. The automatic centering system, which prevents the machine from showing only part of a picture, off centre either to the left or to the right, has been designed so that it cannot be disturbed by static, interference or electrical noises so as to throw the pitcure off centre.



A diagram which explains the fundamentals of the Hogan facsimile system.

Recording Always Visible

The finished copy is visible from the instant it is recorded until it is fed out of the top of the reproducer as a dry, continuous strip of paper 7 inches in width. A tear-off edge is provided so that individual pictures or text units may conveniently be cut from the strip, if desired, as they are finished. The width of the pictures and text lines is 6 inches, and the paper feeds at the rate of one inch

(Continued on next page)

SUBSTITUTE OUTPUT VALVES

Details for use of 6U7G, 6K7GT, 6D6, 58 valves as small output tubes.

Now that power pentodes such as the 6F6G and 42 are following the fate of the beam tubes and are becoming increasingly scarce, other tubes are being made to furnish a respectable power output. Owners of battery sets with their modest .1 to .5 watt output often wonder at the desire of the A.C. set owner who demands at least 3 watts and often more. Increased power, of course, results in improved tone and enables one to not only fill the house, but also annoy the neighbours. However, in these times, a little economy could well be displayed. When the 6F6G, 6V6G or similar output tube goes, try the 6U7G, 6D6 or its equivalent as an output tube. Only slight circuit changes are necessary in most cases and an output of over .25 watt (greater than most battery portables) is easily realised.

Unfortunately, pentode operation of 6U7G and similar tubes demands a high load impedance for highest output, much greater than the highest impedance offered as standard by the speaker manufacturers, but nevertheless even a 25,000 ohm load (a standard size) gives good results. The ideal load is about twice this and gives about ½-watt or more output.

Triode operation requires only a comparatively low speaker impedance but suffers from reduced sensitivity, besides having the screen grid at a voltage exceeding the maker's maximum (125 volts).

Circuit changes involve connecting the screen grid (assuming pentode operation) to the same supply as that for the screen-grid(s) of the R.F., I.F., and/or converter valves (about 100 volts), changing the speaker transformer to 25,000 ohms, or as high as you can get, changing the bias resistor.

Following is a table giving practical values for various tubes. The voltages mentioned are, in the case of pentode operation, well below the maxima allowed by the makers.

The outputs shown are for a limited degree of distortion. If higher distortion is permissible, or if inverse feedback is employed, slightly higher powers are obtainable.

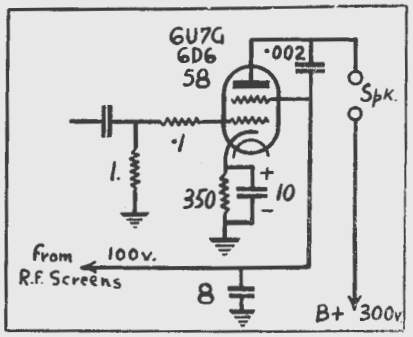


Diagram to show the altered screen feed when using r.f. type valves in the output stage.

Coming Soon: Valve data you do not get in the manuals. Load impedances for 6L6, Negative-grid characteristics of 79 and 6Y7, Suppressor-plate characteristics of 6J7 and 57. Class A2 and Class B1 operation.

	6U7G 6K7G 58 6D6	6J7 as triode	6B8 as triode	6B8 as pentode
Plate Volts	250	250	250	275
Screen volts	100	—	—	110
Bias Resistor (ohms)	300 to 500	1000 to 1500	2500	350 to 550
Speaker (ohms	25000	25000	20000	20000 to 25000
Output (watts)	.2	.25	.35	.35

TELEVISION

(Continued from previous page)

per minute, so that 6 square inches of copy or 7 square inches of paper are delivered each minute. The copy is reproduced in successive lines spaced by 1/100 of an inch, centre to centre and slightly more than 1/100 of an inch wide, so that the **lines overlap** enough to give the appearance of smooth, unbroken text or picture reproduction. The precision of operation is sufficiently high to give clear reproduction of newsprint in small type, of even the 6-point size occasionally used. Any larger type is easily readable, and text is transmitted at speeds to and beyond 100 words per minute.

When this facsimile system is used in territories where power-line synchronism is available, the transmitter and receivers are kept in step by the use of synchronous motors. These provide the simplest reliable means of synchronising. However in point-to-point services over long distances, or in broadcasting to aeroplanes or to homes in direct-current or non-synchronous districts, the synchronous motors cannot be used. To meet such special conditions, the Hogan laboratories have developed a simplified type of automatic independent synchronising system. This has been used successfully in service demonstrations of the picture transmission system between New York and San Francisco.

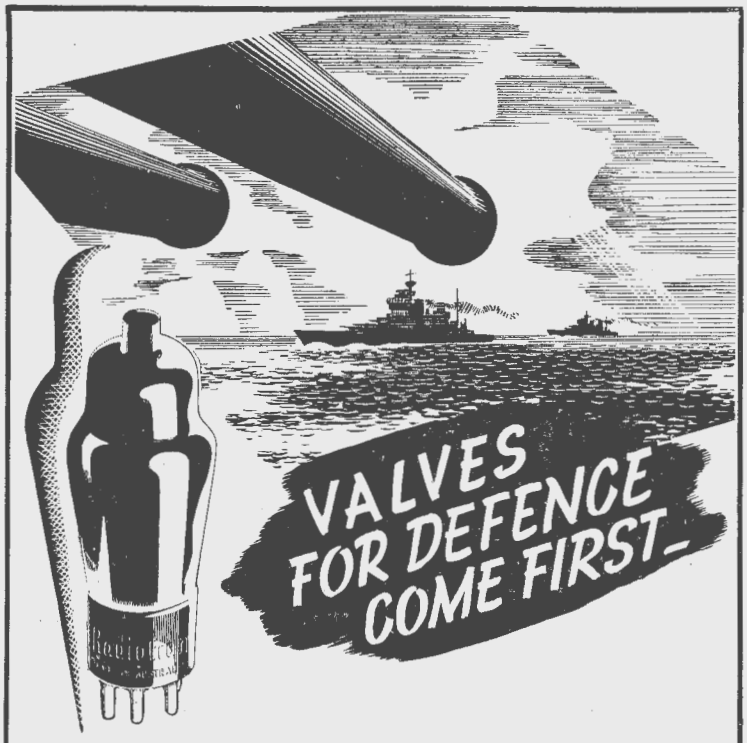
— "Short-wave and Television (U.S.A.)

PROGRESS AT A.W.A.

The latest report by the Chairman of Directors of A.W.A. (Sir Ernest Fisk,) reveals that the Company continues to make wonderful progress, although the production of articles for ordinary trade has practically ceased.

The total number of men and women on the staff is now in the vicinity of 6,000, with an annual wage bill of over a million and a half pounds.

Speaking of the staff, Sir Ernest said: "They have provided an impressive demonstration of the ability and efficiency of the Australian workers in all branches of this highly technical, thoroughly modern and very complex work."



. . . . . but civilian requirements of Australian-made Radiotrons have not been neglected. Most widely used types are available, but if the particular valve you want is not obtainable, consult your Radiotron dealer regarding an alternative type.

Radiotron

THE WORLD'S STANDARD RADIO VALVE

Buy . . . .
£10 National Savings Bonds and War Savings Certificates.

AMALGAMATED WIRELESS VALVE CO. PTY. LTD.

ARE THERE HOLES IN THE IONOSPHERE?

WAVES LOST IN SPACE

During magnetic storms the ionic density in the F layer is known to decrease very considerably, and failure of short-wave communication to occur, because the ionic density becomes insufficient to ensure refraction of the waves. There is evidence that this effect is brought about by the action of streams of corpuscles which arrive in the ionosphere from the sun, but the precise nature of their action is not yet understood.

In a recent magazine, T. L. Eckersley makes an interesting suggestion as to how this effect may occur. Assuming that the corpuscular stream is in itself neutral, i.e., composed of equal numbers of positive and negative particles, he states that, on entering the atmosphere, the electrons would be retarded much sooner than the positive ions, the former coming to a standstill in the higher atmosphere while the latter penetrate down as far as the E layer. When this has occurred a large electric force exists between the E and F layers, and this, together with the force of the earth's magnetic field, causes a violent drift of the electrical particles in the F layer, which is, in effect, a west to east current in the layer. In the E layer there is a tendency for an opposite drift to occur, but, owing to the large molecular density at this height, the current is much smaller.

The ionosphere, in the region of the earth where the electric force was set up, is thus swept fairly clear of electrons and positive ions, and a big hole in the refracting layer is thus produced. Through this the radio waves can penetrate and so be lost in space.

—"Wireless World", England

ITEMS OF INTEREST

Indicative of the wide use of glass for piping in the future is the news of an experimental system of welding the ends of the pipes together on the job. Portable equipment using oxy-hydrogen flames to act as conductors for a high frequency current has been developed.

To protect power lines, engineers have plotted "probability curves" from accumulated data to show how often thunderbolts are likely to strike. These charts show that every 50 miles of power line will be hit by lightning on an average of 50 times a year and each stroke will have a voltage of between 20 and 30 million volts.

An old adage states that you can't fit a square peg into a round hole. Nowadays, you don't even have to try because a bit is available that drills square holes and even hexagonal holes by rotary action. The secret of of this drill is in the design of the bit and the guide plates and the fact that the centre of the bit does not remain in a fixed position but follows a series of cycloid arcs.

The loudest continuous noise ever created by mechanical means is produced by an air raid warning siren recently constructed for use in large cities. The blower is powered by an 8-cylinder automobile engine. The volume of air handled is 2500 cubic feet per minute and the exit velocity is 360 miles per hour.

RADIO MARRIAGE

Courtship. — He broadcasts. She listens-in.

Honeymoon.—She broadcasts. He listens-in.

Now—They broadcast. The neighbours listen in.

—N:Z. "Radiogram."

IMPORTANCE OF RADIO IN WARFARE

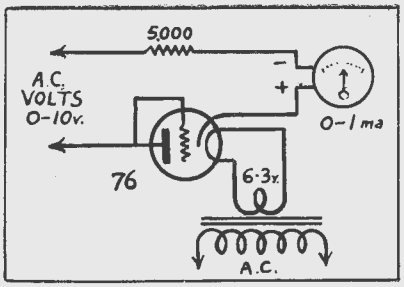
The great increase in the importance of wireless communication, radio-location and other applications of wireless technique in modern warfare were stressed in a statement recently released in England.

Mr. Lyttleton, Minister of Production, announced on December 9th that it having been considered necessary to strengthen existing organisation for controlling research, development and production in this field, a Radio Board had been set up "as the co-ordinating body in regard to inter-service policy, research, development and production."

Sir Stafford Cripps, the recently appointed Minister of Aircraft Production, who, in addition to his ability as a lawyer, has a scientific bent, will act as chairman in his personal capacity. Much of the work of the Board is carried out through two main working committees, the Production Planning and Personnel Radio Committee, and the operations and Technical Radio Committee of which Mr. Garro-Jones, Parliamentary Secretary to the Ministry of Production, and Prof. G. P. Thomson, F.R.S., are respectively chairmen.

The membership of the Board includes representatives of the Admiralty, War Office, Air Ministry, Ministry of Supply, Ministry of Aircraft Production, and General Post Office, as well as several special non-departmental members.

It will be remembered that when the Prime Minister asked Sir Stafford to accept the post of Minister of Aircraft Production he said "the production of aircraft and the development of radio technique lie at the very heart of our affairs."



A.C. VOLTMETER

Any ordinary milliameter can be converted to a low-voltage a.c. voltmeter by this rectifier circuit. A scale will need to be calibrated. Ten volts should read about .8 on the original scale.

RADIO v. SNAKES

According to an English report, the effect of certain radio frequencies on snakes is to dry up their poison ducts, making them harmless.

"BOOKS ARE WEAPONS"

President Roosevelt said in a recent speech: "In this war, we know books are weapons." This thought is echoed in many a high place. The Office of War Information has applied it in the slogan: "Books are weapons in the war of idea." In the British Parliament it was proclaimed: "Books are in fact weapons of war." The Book Mobilisation Committee has adopted the basic phrase, "Books are weapons," as its rallying call to workers in the publishing industry.

Most potent of these weapons are the technical books and manuals used for specialist training in the military and for their civilian associates. And in the top-priority bracket among these technical texts are the books which teach radio — the most critical of all the nation's specialised needs.

Every radio publication seems to be as vital a weapon for democracy as a rifle or an incendiary bomb. From its pages is imparted the lore that enables the Signal Corps to "Get the message through," the Air Forces to "Keep 'em flying," and the Navy to save our seas.

ITEMS FROM THE B.B.C.

LIGHTER ASPECTS OF THE BLITZ

In one of his 'London Letter' broadcasts in the BBC's North American Service the other week, Macdonald Hastings harked back to the Battle of Britain days and the London blitzes.

"All the memories which come to my mind in connection with that period have a grim humour about them. I remember how amused I was when a photographer who was working with me, had his trousers burnt off in the Great Fire of London. Then I remember an extraordinary evening out with a group of American Army officers — over here on a special mission — during one of the worst raids of all. In the early hours of the morning, I asked them if they'd come to my flat. They thought it was a good idea. But when we arrived, the whole building — including my flat — had been levelled to the ground. All the American officers said what fun it would be to tell the story to the folks at home. And — do you know? — they were so pleased about it that I was almost glad the flat was blown up. Then there was the delayed action bomb which buried itself under my mother's house. She moved about half a mile away, and when she asked how she'd know if the bomb went off, they told her that the pieces of the grand piano would probably come down at her new address!"

RADIO GUIDANCE

On the basis of present wartime developments in the ultra-high radio frequencies, peace will see devices by which air transport pilots will have constantly before them, on the screen of the cathode-ray tube, clear warning of any obstacles ahead, so that mountains will lose their terror in darkness and thick weather, and blind landings will be facilitated. At sea, the ship's pilot will detect nearby shipping or icebergs through fog and darkness as plainly as in clear weather by day.—"G.E. Bulletin."

●

WHAT A 'HOW DO YOU DO'!

Albury was one of the place names, common to both Britain and Australia, featured a short time back in the BBC series "Calling Australian Towns."

In that programme Colin Wills, Australian journalist, interviewedl Malcolm McEachern ("Jetsam" "Flotsam and ——") and Bob Driscoll, General Manager of a factory at Croydon. The recent meeting of these two was the result of an odd coincidence. They had lost sight of one another for thirteen years. Then the name McEachern on a concert bill outside the Albert Hall caught Driscoll's eye. Wondering it could be his old friend, Bob went to the nearest gramophone shop and got a McEachern record. Then he was sure . . . no mistaking those deep notes.

On that same day Malcolm, who had made efforts to trace Bob, noticed a "display" man in the window of a London store. Bob has been a display artist. The man in the window might have come across him. McEachern went in and put his question. The man **did** know him. He was manager of ——— store, now.

That was at three in the afternon. It was three in the morning before Bob and Malcolm finished saying "Hello" to each other.

NOTES ON FREQUENCY MODULATION

Modulation of a carrier wave is the process of applying audio frequencies to a constant r.f. oscillating system so that either the amplitude of the r.f. wave is caused to vary with the frequency constant, or the frequency is caused to vary with the amplitude constant.

Frequency Modulation.—When the frequency of the r.f. wave is varied according to the effect of audio frequencies, but the amplitude remains constant, the process is known as frequency modulation. The carrier frequency will vary more from unmodulated frequency for louder **sounds;** and a **high pitched** sound will cause escursions of carrier frequency to take place at a more rapid rate than would be effected by a lower pitched sound. Thus the intensity of the sound governs the degree of frequency deviation and the frequency of the sound governs the number of times per second that the frequency will be deviated. The mean or average frequency remains constant.

Amplitude Modulation.—With a constant-frequency radiated wave having its amplitude or the shape of the envelope varied by the application of audio frequencies the process is amplitude modulation. In this case, as the volume of sound to be transmitted increases, the amplitude of the modulation envelope increases. As the frequency of the sound increases, the rate at which amplitude changes take places, is increased.

Advantage of frequency modulation lies in the reduction of noise and static. Since all noise is an amplitude modulation a receiver that is insensitive to amplitude modulation will be little affected by noise. Such a type of receiver is used for the reception of frequency-modulated signals. The further advantage of countering fading is inherent in the f.m. receiver.

Practical Frequency Modulation.—The use of F.M. on a commercial scale being a recent development details of the modulating systems being used are difficult to obtain. However, it may be stated that in the Armstrong system (which is finding wide application) the basis is that of phase shift the frequency of the wave being varied when the phase of one component of the wave is shifted with respect to the other components. The amount of phase shift varies in various parts of the wave to correspond to the original audio voltage, and **instantaneous changes** in the frequency of the wave are made by shifting the phase at various times. The practical result is that the rate of change of frequency of the radiated wave depends upon the audio frequency, while the total deviation for any one cycle depends upon the audio volume.

Receiver Considerations.—An F.M. receiver uses a **limiter** in place of the orthodox second detector. The function of the limiter is to flatten out any modulation peaks, with the result that noise (which is amplitude modulated) is reduced and fading effects are minimised. It is customary to use a high-mn tube used as a grid biassed amplifier operating with low plate and screen voltages. A heavy signal is required (5 volts or more). When such a signal is applied to the grid the rectified current through the grid leak biasses the tube, and this, in combination with the low operating voltages causes the tube to saturate and become unresponsive to any amplitude changes above a certain level. To recover the audio modulation from the signal a **discriminator** stage follows the limiter. The discriminator is usually a variety of full wave diode rectifier. In a specific example two staggered tuned circuits are used. The primary of the discriminator transformer following the limiter is tuned to the I.F., one secondary is 100 kcs. above and the other 100 kcs. below. At any one instant only one frequency exists in the system. The voltage developed across the diode load depends upon the difference between the frequency and the centre-carrier frequency. Frequency excursions are translated back into audio freqeuncy.

—N.Z. "Radiogram."

MOLECULES GET TIRED

It has been discovered that not only does the human species get tired, but molecules do also. Research has shown that the molecules responsible for fluorescence in a special type of glass get "tired" and lose part of their activity when excited by ultra-violet radiations for a long period of time. After suitable rest periods in the dark, they regain their strength.

NINE-FOOT ELECTRICIANS

A construction company located in Tacoma Wash., is about to employ forty 9-foot electricians in the construction of an Army barracks. No, the story isn't being stretched a bit—the workmen are being stretched! Each electrician will be equipped with a pair of stilts so he can work at the required height without a ladder. It is estimated that the time saved will amount to about one-third that of the total job.

Ohmite News.

CAUSES OF HUM

A high hum level is too often accepted as a necessary evil in audio-amplifiers and tolerated, whereas one of the design factors should be the elimination of this annoyance. Hum, in the main, is due to one of the following causes: poor filtering, inductive pick-up, or chassis and ground loops. Poor filtering is the result of a deficiency of capacity, inductance, or resistance where resistance is used for decoupling and filter. A lack of filter and decoupling will also cause motor-boating and instability due to interaction between circuits.

Inductive hum is caused by insufficient shielding, poor layout, and crowding of parts within the amplifier. High inductance in chokes frequently is the cause of hum and the only cure is to move the offending part completely off the chassis and connect it by remote leads. This is especially true of chokes used for equalisation and the correction of frequency response.

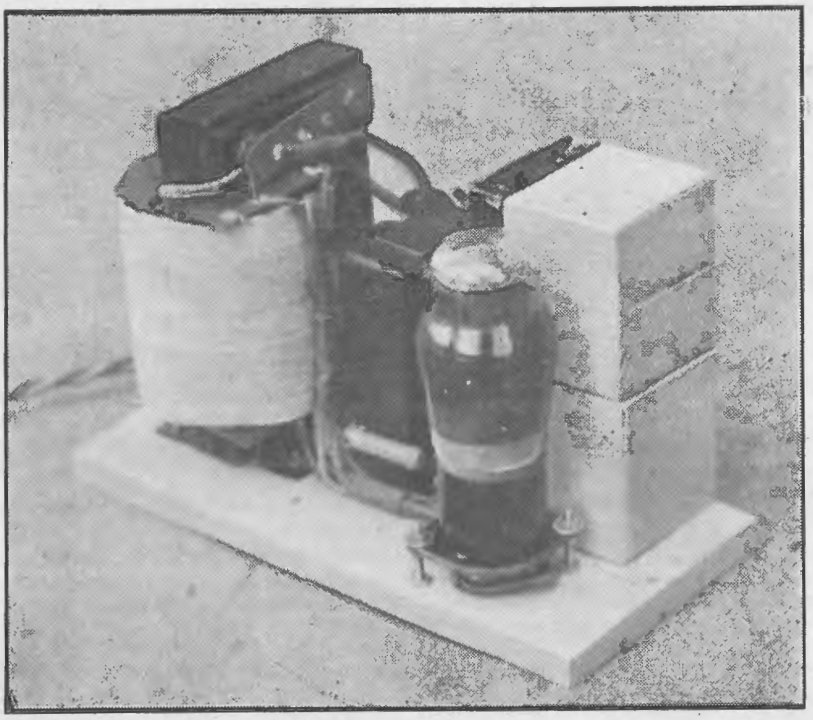
Ground and chassis loops result from a potential difference between points where the ground connections are made, and can usually be identified by the hum sound that comes from the speaker, which is that of sixty cycle A.C. Usually it is necessary to hunt and try until a neutral grounding point can be found.

When hum is due to causes in the stages ahead of the volume control, the hum will decrease as the volume is turned down, but if it is caused by defects following the volume control it will be much more evident at low volume. This is, of course, evident since in the second case hum content is constant while the sound output is decreased at the lower volume settings.

Hum is very annoying in the reproduction of music where a resonant type equaliser is used to compensate for bass lost in recording. The reason for this being that the equaliser cannot differentiate between sixty cycle hum and sixty cycle bass; and they are both increased equally.

—Extracted from an article in "Radio Craft," U.S.A.

(Note: Our a.c. supply is 50 cycle, giving a 50 cycle hum.—Ed.)



A HANDY "B" ELIMINATOR

This is a photograph of the handy little "B" eliminator which was described in the March issue. It has many uses, supplying a convenient high tension for sets, amplifiers and experiments.

HOW THE THIRD BRUSH WORKS

The output of any generator is determined by the rate at which the armature windings cut the magnetic lines of force. Three things determine this rate. These include the number of turns of wire on the armature, the speed at which the armature runs, and the density or strength of the magnetic field.

The number of turns of wire on the armature is fixed by the design. The speed of the generator varies with the speed of the car. But the strength of the magnetic field varies according to the amount of current that is sent through the field winding.

The greatest output is obtained from the armature at any given speed when the main brushes are across the greatest possible number of turns of wire. In most machines this means that the main brushes are directly oposite each other. A lesser amount of current would result if one of the main brushes were moved nearer the other main brush. Instead of this, a third brush is installed between the main brushes, and the field winding is connected from one main brush to this third brush. As this third brush is moved toward the other main brush in the direction of rotation, it picks up more current and so strengthens the magnetic field. This in turn increases the output. Moving the third brush against the direction of armature rotation connects the field across fewer turns of the armature, weakening the field and so reducing the output.

—Vesta Vamp.

RADIOLOCATION IN PEACE

Radiolocators may locate meteors and measure their velocity. From India comes word that radio short waves can be reflected from shooting stars.

While listening to the Delhi short-wave station only 10 miles distant, members of the Research Department of the All-India Radio report that they frequently heard whistles of a peculiar nature. Beginning with a shrill note, the pitch fell rapidly to nothing or disappeared in one-fifth to several seconds. This is the Doppler effect, which may be observed when a locomotive whistle is heard rapidly receding. From it can be determined the velocity of the object.

In this case, the velocities measured ran as high as 40 miles a second. Only meteors ever travel that fast through the air. In fact, watching the sky, observers noted that when a meteor passed, the peculiar whistle was heard. This provides a new method, they pointed out, of measuring the velocity of a meteor. It cannot be used at present because of restrictions on the use of radio, but after the war perhaps some of our many radiolocators may be put to astronomical use. — "Science News Letter."

The Signal Through the Set

The fifteenth instalment of a series of articles specially written for beginners.

IN the past fourteen instalments of this series of articles, enough of the elementary theory of radio has been explained for readers to be able to follow the simple outline given below of the way in which a typical three valve t.r.f. receiver operates. The circuit of this set is shown below.

Modulated Carrier Represented Diagrammatically

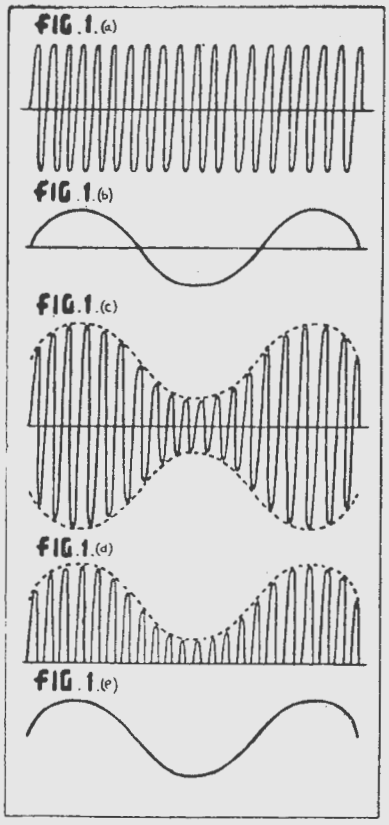
In a previous instalment it was explained how an unmodulated station carrier consists of a simple high frequency current alternating back and forth at an enormous number of times per second. This effect is illustrated by the curve in fig. 1 (a). Fig. 1 (b) represents a simple musical note with which the carrier wave is to be modulated, while fig. 1 (c) shows the two curves added, giving the resultant modulated carrier that is radiated from the aerial. This is the wave that is picked up the receiving set.

At the receiving end the aerial and earth form the two plates of a condenser, which means that the aerial will be charged and discharged at high frequency exactly as was the condenser in the simple oscillatory circuit described in instalment 7 (Feb., 1937, issue). This current induced in the aerial passes through the primary winding "L1" (see fig. 2). This is wound in close proximity to the earth end of the secondary winding "L2," and generally consists of about one-third of the total number of turns on the latter. The coupling between "L1" and "L2" is close enough to ensure that in passing through "L1" the aerial current sets up an induced current in "L2," thus feeding the signals into the set. With the number of turns on 'L1" halved, the signal strength will fall off considerably, but the selectivity of the aerial circuit will be greatly improved. On the other hand, with the number of turns doubled, selectivity would become extremely poor and volume would again suffer, though to a less extent.

An important point to remember is that the earth should be of particularly low resistance, as with signals passing from aerial to earth and back again in something like a millionth part of a second, even a small resistance is to be avoided.

Designing The Tuned Circuits

The inductance of "L2" (and, of course, that of "L4") is chosen so that the minimum and maximum capacity settings of the tuning condenser "C1" (and "C2") represent the lower and upper limits of the waveband it is desired to cover. Using tuning condensers with a maximum capacity of .000385 mfd., an inductance of about 220 microhenries will enable the set to be tuned comfortably over the broadcast band, extending from 200 to 550 metres. If desired, the condensers "C1" and "C2" can be ganged together and operated by a single control. To compensate for any minor difference in inductance between the windings "L2" and "L4", each section of a condenser gang is provided with a small semi-variable trimmer connected in parallel across the main tuning condenser.



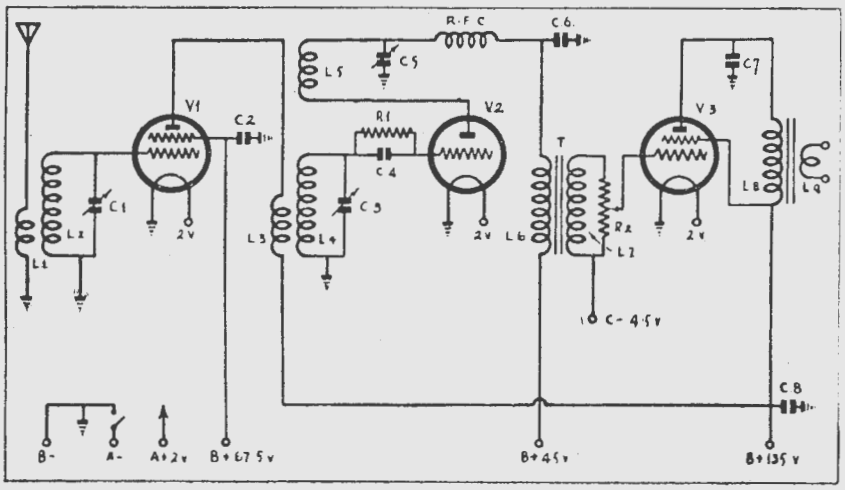
In sets of this type, the r.f. valve (V1) is invariably of the screen-grid variety, because it offers considerably more amplification than the neutralised triode, and at the same time gives considerably better stability. The introduction of the screen grid between the control grid and plate considerably lowers the tiny capacity existing between these two electrodes, and it is this capacity that causes back-coupling, with consequent instability.

So that the screen grid will not impede the flow of electrons from filament to plate, it is given a positive potential approximately equivalent to that of the point in the electron stream at which it is inserted.

Screen By-Pass Condenser Essential

However, the amplified high frequency currents that appear on the screen must be short-circuited to earth if the valve is not to act like a triode, with the screen grid as the plate. This short-circuiting is accomplished by the by-pass condenser "C2," which is generally of a capacity ranging from .1 to 1 mfd. This condenser should be of a non-inductive type, and

(Continued on page 23)



Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY—

WHAT REWARD?

I do not know what reward or compensation is given to transmitters that seem to work for the best part of the day, but I would be inclined to treat with particular affection, GRH, 9.83m.c., 30.53m., who from 7.15 a.m. till 2.45 p.m. gives such a fine signal here, in the North American Service. With a brief respite, on he comes again at 3 p.m. in the Pacific Service, and I would not be surprised if most listeners in Sydney hold him for the BBC programme till at 6.30 p.m. when he is rested.

Poor old GSD, 11.75m.c., 25.53m., seems to be mixed up with friends and foes alike, and no doubt, welcomes a sister station in GVU, 11.78 m.c., 25.47m. We often see radio receivers as having "knife-edge selectivity," but with the crowded 25 metre band, nowadays, one requires a set with "razor blade keenness". Maybe that is why GRH is putting in such a fine signal as situated where he is he can kick his legs about without interruption.

CALLING ALL NATIONS

To mark the 10th Anniversary of the first BBC broadcast to the Empire on December 19, 1932, the BBC have published a little booklet, "Calling All Nations." I came across it in a bookshop the other day and found it most entertaining. Well illustrated, with photographs and diagrams, it tells of the growth of this great organisation and from chapter one, "The World Falls Apart—The Empire Draws Together," to the illustration on the last page of the 47 languages put over daily, it contains a terrific lot of interest for listeners. I paid 1s. 6d. for it.

COOLING OFF

To relieve members who may worry at the absence of notes from Dr. Gaden, I would mention the doyen of radio has "pulled the big switch," and is taking a well-earned vacation. So while the tubes of his T.R.F. (built by another champion of radio—Don Knock), are cooling off, I am cherishing the hope the doctor will include Sydney in his three weeks spell.

NEW MEMBER

We welcome Mr. R. Churcher, of Devonport, Tasmania, as a member of the AW-DX-AW Club. Accompanying Mr. Churcher's application was a nice list of BBC and U.S.A. loggings — two of the United Nations.

NEW STATIONS

GVU, London, 11,780kc., 25.47m.: This is the correct call-sign and wave length for station mentioned in May issue. Is used in Pacific Service from 3 till 5.30 p.m. Good signal.

——, London, 15,060kc., 19.92m.: Another new Daventry transmitter introduced on Sunday May 16, "to replace GSF" but no call sign yet announced. Not a good signal here.

ZLT, Wellington, N.Z.) 6715kc., 44.67m.: Opened on May 3. Intended for News service to Forces in the Pacific. Schedule 8 till 8.12 p.m. Very poor signal here. As a matter of fact, the same programme can be heard much better on medium-wave through 2YA Wellington on 526 metres.

XGOY, Chungking, 9643kc., 31.11m.: On May 15 I heard Chungking (on 9625 k.c.,) say they were changing to 9643 kilocycles and at 11.55 they left the air and came back at midnight on 9643 k.c., and gave news. This method seemed to operate till about May 23, when they appeared to open 9643kc., at 9.45 p.m. in Chinese. At 10.45 Dutch was heard. Call-sign was given at 11.2 and at 11.40 Mailbag to U.S.A. Break of 3 minutes at 11.55 and at 11.58 announcements followed by news in English. Off at 12.13 a.m., back at 12.30 with talk in English. News at 1, 2 and signed at 2.30 a.m.

RW—, Moscow, 6070kc., 49.42m.: Missed exact call-sign, but frequency and wave length are O.K., and as given when I heard this new Russian on Wednesday, May 19, at 7.3 p.m. Splendid signal, R-9, Q-5. Yes, Q-5, a most unusual quality for a Russian station who, while putting in a wonderfully strong signal, generally fall down on clarity.

WLWO, Cincinnati, 7575kc., 39.6m.: Still another "Voice of America" and an excellent signal, R-9, Q-5. First heard on Sunday, May 16. Schedule: 5.15 till 7 p.m. When closing says: "Using our European Beam Antennae." This accounts for the reason that only the four languages are heard, viz., English, German, French and Italian.

WKRD, New York, approx. 6.00 m.c., 50 metres; WKTM, New York, approx. 6380kc., 47.01m.: Heard in parallel with WLWO. Signal is not anything like as good and they continue after WLWO.

KGEI, San Francisco, 11.79m.c., 25.43m.: First heard May 22 just before closing.

(Continued on page 22, col. 3)

ALL-WAVE ALL-WORLD DX CLUB

Application for Membership

The Secretary,
All-Wave All-World DX Club,
243 Elizabeth Street, Sydney.
Dear Sir,

I am very interested in dxing, and am keen to join your Club.

Name .....

Address .....
(Please print both plainly) .....

.....

My set is a .....

I enclose herewith the Life Membership fee of 2/– (Postal Notes or Money Order), for which I will receive, post free, a Membership Certificate showing my Official Club Number. NOTE—Club Badges are not available.

(Signed) .....

(Readers who do not want to mutilate their copies can write out the details required.)

Shortwave Notes and Observations

AUSTRALIA

An extra session for North America (West) has been introducd through VLG-6. 15.23 m.c., 19.69 metres, from 1.55—2.30 p.m. VLQ-3, Brisbane, 9660 kc., 31.05 metres, is not giving the same service as VLQ, (who it replaced) in the evenings according to Dr. Gaden and Hugh Perkins. In Sydney it fades in and out quite a lot. In early evening goes right out but around 10.30 comes in with a punch.

NEW ZEALAND

Am sorry that ZLT-7 is not received here, but if it is reaching the Forces O.K., then that is all that matters. I figure it is intended for the North Pacific. Bet friend Roy Hallett smiled when he found them better on that part of he dial he loves.

Atmospherics are bad, but just heard ZLT-7 Wellington (Perkins). (Good boy, Hugh, guessed you would be one of the first.Ed.).

OCEANIA

FK8AA, Noumea, 6162 m.c., 48.62 metres: Here is a station that seems to have benefited by a little attention to gear. Now one of the best signals on the air and some good music is heard opart from interesting news.

AMERICA

Daylight reception is gradually getting to its peak, and almost at any time of the day American stations are "getting through."

KWU, 'Frisco, 15,355 kc., 19.53 metres is the first on the air with a special beom to Australia and from 6.30 (7 a.m. Monday) till signing at 8.15 (8 on Mondays) puts in a good signal. Remember, it is NOT on the air on Thursdays.

KWU returns to the air at 9.45 a.m. ond till 11.30 a.m. presents a programme directed to the N.E.I. On favourable days is OK., but is off the air on Mondays ond Thursdays.

One has ceased to express surprise at the strength of American stations when directed to Australia, but a station situated in Cincinnati using an antennae beamed to Europe only 10 kilocycles from one beamed to Australia putting in a stronger signal makes even an old timer sit up. Well, that's the position with WLWO, 7575 k.c., 39.6 metres, and KWY, 7565 k.c.., 39.6 metres. You have a quarter of an hour to test the truth of this statement, fram 6.45 p.m. when KWY opens till 7 when WLWO closes.

Several have written in asking what has become of WGEO on 31.08 metres. This station went off the air about March 28, as far as this transmission is concerned. Most likely due to re-arrangement of the Bronze network.

KWID, 31.35 metres, is tremendous when beamed to Australia, too much punch here, so much, in fact, they often overload my speaker (Gillet.).

The General Electric Co. now use the call letter "A" for 25.33 metres. Don't know the reason for this unless it's a special antennae. — signal is fine at 9 p.m. when news is given in English, balance af programme is in French. (Ed).

WKLJ, 30.77 metres in parallel with WKRX, 30.31 metres, are coming through fairly well at 9 p.m. (Perkins, Gillett, Maguire).

(Unfortunately, at my location they are all mixed up with very strong morse.—Ed.)

WKRD, 12,967.5 k.c., 23.13 metres, is now getting through fairly well at Carlingford around 10 p.m. — up till then old man morse is the winner.

Heard news in English at 9 p.m. through WCRC, 25.36 metres. WKRD 30.31 metres, KRCA 31.61; WKRD 38.35. metres (Gillett).

KWU, San Francisco on 19.53 metres is R-7 around 6.45 a.m. (Perkins, Maguire, Gillett).

KWID, 19.62 metres, R-9 Q-5 ot 8.30 a.m. (Perkins). (Much later here before he warms up like that.—Ed.)

WLWO 39.6 metres, closes at 7 p.m. with "Old Glory" and is JUST clear of KWY (Perkins, Goard).

WGEA, 48.47 metres R-5 in French at 6 p.m. (Churcher).

WKLJ, News at 8 and 9 a.m. Fine signal (Churcher).

KRCA, 31.61 metres. R-4 in evening transmission (Goard, Ferguson, Churcher).

KWU, 19.53 metres. Decent at 7.30 a.m. with "Hi Neighbour" (Churcher).

KWID, 31.35 metres. Heard nightly. Excellent (Ferguson).

KWY, 39.66 metres. Good at 7p.m. (Ferguson, Goard).

KES-2, 33.58 metres. Good at 9 p.m. (Ferguson)..

KES-3, 28.25 metres. Good at 6 p.m. (Ferguson). Going off a lot, not to be compared with 4 weeks ago (Goard).

KWV, 25.43 metres. Closes at 2.45 p.m. Fair station at 5 p.m. R-9, Q-5 (Goard). (I concur.—Ed.)

KGEI, 25.43 metres. Cioses at 2.45 p.m. Fair signal (Goard).

Good morning stations are: KGEI, 25.58 m., WDL 30.77 m., WRCA 25.22 m., WBOS 25.27 m., and WKRD 30.31 m., (Gillet).

(KGEI is now on 25.43 metres from 7 a.m. to 2.45 p.m. and WDL is known as WKLJ.—Ed.)

GREAT BRITAIN

I have been hearing for a week or so on 31.41 metres what I think is "Radio Orange", although it is not listed on latest sheets from London.

Terrific signal before breakfast and was much in evidence on Holland's Day, last week.

Reports on BBC transmissions would indicate reception of Pacific Service is about the same all over Australia, GRH (30.53) and GRM (42.13) winning the laurels.

Seldom possible to hear Daventry after these two make their exit at 6.30.

After dinner, London is very unreliable, and for the 9 p.m. news I often tune to 2YA, Wellington (526 metres).

GVU, 25.47 metres, the new Daventry transmitter, seems to be well established already and says his piece from 3 to 5.30 p.m. daily.

Heard what I think is a new London transmitter on 31.12 metres in the afternoon with foreign programmes. Sounded like Turkish at 3.15 p.m.

Another is on about 25.58 metres at 7.45 p.m. in (?) Dutch—Beats on tom-tom were heard (Gillett).

(The first is undoubtedly the one I have referred to under 'India' and mentioned in May issue. The second is most likely a London transmitter and the beating is evidently . . . —(V for Victory) which is given every quarter hour.—Ed.)

GRH, 30.35 metres—This and KWID are the two best signals on the air (Churcher).

GRH,—The strongest Daventry on the air (Goard, Ferguson).

GSB, 31.55 metres — Never seems to get above R-5 toward end of Pacific Service (Churcher).

(Very good from 8.30 a.m.—12.45 p.m. in Latin American Service.—Ed.)

(Continued on page 23)

NEW STATIONS

(Continued from page 22)

Has apparently replaced the 11,730kc., session as it is on from 7 a.m. till 2.45 p.m. Is mixed up with a lot of others, but produces an R-5, Q-3 signal from about 12.30 to 1 p.m., perhaps a little better when closing.

WKLJ, New York, 9750k.c., 30.77m: This seems to be the new call-sign for WDL, as it has taken up WDL's schedule of: 6.15—9 a.m.; 6.45—8 p.m.

SHORTWAVE NOTES AND OBSERVATIONS

(Continued from page 22)

GSE, 25.29 metres — has been heard at 7am. in programme to Forces in Africa (Churcher).

GSD, 25.53 metres — Seems to have gone off a lot lately (Churcher).

GRV, 24.92 metres — R-7 at 11 a.m. (Goard).

GRX, 30.96 metres — R-7 at 6.30 p.m. (Goard, Perkins).

GRM, 42.13 metres and GRG, 25.68 metres — Excellent in Pacific Service (Ferguson).

THE EAST

CHINA

Cannot understand why we do not get a better service from Chungking. A programme opening with news is scheduled for 8 p.m., but it's a dollar to a gooseberry that six nights out of seven they are not to be heard. When they do burst through the chances are the news is over and Chinese is being given. Wonder if it would be possible to go back to 25.21 metres?

XGOY, Chungking on 41.84 metres was R-5 at 10 p.m. when calling 'Frisco — news commentary followed (Perkins)..

INDIA

Hesitate to say anything about this, but I have been hearing several times during the day on approximately 9653 k.c., 31.13 metres, what I think must be a new outlet for All India Radio. I thought I heard them say: "This is All India Radio, here is a relay of the BBC." Signal is very poor, only R-3, Q-3 on favourable days at 9.5 a.m. and 3.30 p.m. Language sounded like Hindustani, or what-have-you. Would be pleased to hear from any listener who has come across it.

In May issue under "New Stations" I referred to it as (?) BBC.

VUB-2, 41.44; VUD-2, 41.15; VUM-2, 41.32; VUD-4, 31.28; VUD-3, 19.61m., are all carrying the news in English from 10 p.m. Volume from each is good, although VUM-2 is interfered with by a station very close to it (Gillett).

SWITZERLAND

Heard HER-5, 25.48 metres and HER-3, 48.66 metres in parallel in an English session at 7.15 p.m. Signal R-6 on both transmitters. (Gillett.)

HER-3 very nice around 6 a.m. (Perkins).

PORTUGAL

Has anyone heard CSW-6, Lisbon, 11,040 k.c., 27.17 metres, of late? Only a few weeks ago I was commending them for their constancy, but at various times in the morning I have tried without success to land them.

RUSSIA

Mascow is being heard well at 7.30 a.m. on 19.7 and 19.85 metres in talk in English (Gillett).

(News in English is heard on these wave lengths at 7.15 and 8.47 a.m. At night time they give news at 9.40 on 9545 k.c., 31.43 metres, but while signal is strong, modulation is bad.—Ed.)

MISCELLANEOUS

CANADA

For those who have not yet logged this country, a unique opportunity is offered just at the present time, as CBFY, Montreal, 11,705 k.c., 25.53 metres, is coming in splendidly at 9.30 and 10 p.m. and 11 p.m. when news is given

ICELAND

TFJ, Reykjavik, 12,235 kc., 24.54 metres, is still being heard well here, with an R-5 signal. (Anthem is sometimes heard when they open). From 3.15 till 3.30 p.m. in their usual schedule (Gillett). Think I heard this one for a few minutes one afternoon (Perkins).

SCANDINAVIA

SWEDEN

SBU, Stockholm, 9535 k.c., 31.47 metres, has been heard opening at 8.20 a.m. with a good signal. Eleven chimes are given preparatory to opening announcement in English, "This is Sweden calling, you will now hear a programme from The Swedish Broadcasting Corporation." A talk in English takes 10 minutes and then "Achtung! Achtung!" and off into foreign language (Gillett).

CUBA

COCO, 34.48 metres is good at 10.20 p.m.; COCQ, 33.9 metres at 9.40 p.m. and at the same hour, COCX 32.36 metres and COKG, 33.48 metres.

COK, 25.93 metres is fair at 3.25 p.m. (Gillett.).

RADIO STEP BY STEP

(Continued from page 20)

should be connected as closely as possible to the screen-grid lug on the valve socket, so that the by-passing effect will be fully effective.

The signals applied to the grid of the r.f. pentode (see fig. 1 (c)) appear in greatly enlarged form in the plate circuit and flow through the primary winding "L3" of the second coil. This winding is inductively coupled to "L4" in exactly the same manner as "L1" is coupled to "L2", and so the signals are transferred by induction to the second tuned circuit, consisting of "L4" and "C3."

V2 is Leaky Grid Detector

The next valve, V2, is a triode detector, leaky-grid detection being used in order to give greatest sensitivity. The grid leak "R1" and grid condenser "C4" are inserted to enable this valve to rectify the incoming signals, as explained in instalment number 12. Suitable values for these components are 1-2 megohms for "R1" and .0001 mfd. for "C4," though the substitution of other values fairly close to these will make no audible difference. Fig. 1 (d) illustrates the rectifying action of V2.

For greatest sensitivity regeneration is incorporated, "L5" being the feedback winding and "C5" a small variable condenser of about .00015 mfd. capacity, used to control regeneration.

"R.F.C." is a radio frequency choke included in the circuit with the object of blocking r.f. in the plate circiut of the detector from passing through to the audio side of the set. "C6" assists this action in by-passing to earth any stray r.f. that happens to get through. A suitable value for this condenser is a capacity of from .0001 mfd. to .0005 mfd.

Thus the signal has now been received, amplified, rectified, and r.f. stripped from it, so that its waveform is similar to that shown in fig. 1 (e). If the primary winding "L6" of the audio transformer were now replaced by a pair of headphones, the signals would be audible.

However, for loud speaker operation, further audio amplification has to be applied, and this is accomplished by coupling the audio transformer "T" and the output pentode "V3." The operation of the audio amplifier will be dealt with in the next instalment.

Allied and Neutral Countries Short-Wave Schedules

These schedules, which have been compiled from listeners' reports, my own observations, and the acknowledged help of "Globe Circler" and "Universalite" are believed to be correct at time of going to press, but are subject to change without notice. Readers will show a grateful consideration for others if they will notify me of any alterations. Please send reports to: L. J. Keast, 23 Honiton Ave. W., Carlingford. Urgent reports, 'phone Epping 2511.

Loggings are shown under "Short Wave Notes and Observations." The great number of stations on the air makes it necessary to print schedules in sections. The 31 and 49 metre bands will be shown next month.

Symbols: N—New stations; S—Change of Schedule; F—Change of frequency.

Call Sign	Location	Mc.	M.	Time: Eastern Australian St'dard
GRZ	London	21.64	13.86	9—11.15 pm
GSH	London	21.47	13.97	8.30—1.15 am
OPL	Leopoldville	20.04	14.97	8.55—10.15 pm
HBH	Berne	18.48	16.23	Tues. & Sat. 11.45 pm—1.15 am
GVO	London	18.08	16.59	2—2.15 am
GRQ	London	18.02	16.64	8.45 pm—12.30 am; 2--2.45 am
EIRE	Athlone	17.84	16.82	10—11.30 pm; 3.30—4 am; News 2.45 am.
WRCR	New York	17.83	16.83	8 pm—7.15 am
GSV	London	17.81	16.84	3.45—4.45 pm; 8.45 pm—1.15 am; 1.30—3.15 am
WLWO	Cincinnati	17.80	16.85	11pm—2.30 am
GSG	London	17.79	16.86	8.45—10 pm; 1.30—2.45 am
WRCA	New York	17.78	16.87	11 pm—2.45 am
OPL	Leopoldville	17.77	16.88	8.55—10.15 pm; 4.30—6.30 am
WRUW	Boston	17.75	16.90	1—3.15 am
LRA-5	B'nos Aires	17.72	16.93	Sats. 6.45—7.30 am
—,	Brazzaville	17.71	16.94	6.30—8 am
GRA,	London	17.71	16.94	6 pm—2.45 am; News 7 pm
HVJ,	Vatican City	17.44	17.20	Mon. Wed. & Sat.: 11 pm—1 am; Tues, 11 pm—1.20 am; Fri. 11 pm—midnight.
WCW	New York	15.85	18.93	3 am—7 am
—,	Moscow	15.75	19.05	9.40—11.30 pm
WCB	Hicksville	15.58	19.28	7.15—8 am.
GRD	London	15.45	19.42	5.45—7pm; 8.45—10.30 pm
—	Accra, G. Coast	15.42	19.45	8—8.30 pm; 3—4 am.
GRE	London	15.39	19.50	5.45—7 pm; 10.15 pm—1 am; 1.30—5 am
KWU	'Frisco	15.35	19.53	Daily except Thurs. 6.30—8.15 am (Mon 7—8 am). Daily except Mon. & Thurs. 9.45—11.30 am
WRUW/L	Boston	15.35	19.54	8 pm—3.15 am; 3.30—4.30 am
FGA	Dakar	15.34	19.55	5.15—7 am
WGEA	Schenectady	15,33	19.57	7.30—9.45 am
WGEO	——	15,33	19.57	10.15 pm—5.30 am.
VLI-3	Sydney	15.32	19.58	3.10—3.40 pm; 8.15—9.45 pm
GSP	London	15.31	19.60	3.45—7.45 pm; 8—10.45 pm; 11—11.30 pm;11.45 pm—12.45 am;2—2.30 am; 2.45—3 am
HER-6	Berne	15.30	19.60	Testing Tues. and Sat. from 6.30—8 pm.
KWID	'Frisco	15.29	19.62	7—11.15 am
LRU	B'nos Aires	15.29	19.62	9.15—10.15 pm
VUD-3	Delhi	15.29	19.62	1.15—2.5 pm; 3—6.15 pm; 8.30—10.15 p.m.
WCBX	New York	15.27	19.64	8 pm—6.45 am; 7—9.45 am.
GSI	London	15.26	19.66	8.45 pm—1.15 am; 1.30—6.45 am
WLWO	C'cinnati	15.25	19.67	2.45—5.30 am
VLG-6	Melbourne	15.23	19.69	11.45 am—1.30 pm; (Sun. 12 noon—1.50 pm); 1.55—2.30 pm; 3.10—3.40 pm.
—	Moscow	15.22	19.70	7.15—7.40 am; 8.48—9.30 am; 11.15—11.40 am; 1.15—1.40 pm
WBOS	Boston	15.21	19.72	10.15 pm—1 am; 1.15 am—2.45 pm.
XGOY	Chungking	15.20	19.73	Exact schedule unknown, but bursts through some nights with news at 8 o'clock.
TAQ	Ankara	15.19	19.74	7.30—9 pm; 11.30 pm—12.45 am
XGOY	Chungking	15.18	19.76	Wed. only, 10—10.45 am
GSO	London	15.18	19.76	8.45—9 pm; 10.15—11.15 pm; 1.30—1.45 am; 3.30—4 am.
TGWA	Guatemala	15.17	19.78	3.45—4.55 am; (Mon. till 8.15 am)
PRE-9	Fortaleza	15.16	19.78	7—11.05 am
VLG-7	Melbourne	15.16	19.79	6.30—8.10 am (Sun. 6.45—8 am)
SBT	Stockholm	15.15	19.80	1—4.15 am. News 1.01 am.
WNBI	New York	15.15	19.81	10 pm—7 am.
GSF	London	15.14	19.82	8.45 pm—1.15 am; 3.30—3 45 am
HVJ	Vatican City	15.12	19.84	Mon. 10—10.15 am; 10.30—10.50 am; 11--11.20 am; Wd. 1.25-2.25 am; Fri 2-3.20 am
—	Moscow	15.11	19.85	7.15—7.40 am; 8.48—9.30 am; 11.15—11.40 am; 1.15—1.40 pm; 9.30—10.20 pm
HVJ	Vatican City	15.09	19.87	Thurs. m/n. to 1 am Fri.; Fri. m/n to 1 am Sat.
—	London	15.06 N	19.92	3—7 pm.
PSE	R. de Janiero	14.93	20.07	Fri. 7—7.30 am;10—10.30 am
WDO	N.Y.	14.47	20.73	11 pm—6 am
—	Malaga	14.45	20.75	11 pm—Midnight
—	Tunis	14.40	20.83	9—11 pm; 3—7 am
—	Dakar	13.34	22.48	No schedule
WKRD	New York	12.96	23.13	8.45 pm —2.45 am; 3—4.45 am
CNR	Rabat	12.83	23.38	9.30—11 pm
FIA	Douala	12.70	23.61	8.45—9.30 pm; 5.15—5.45 am
HCJB	Quito	12.45	24.11	9.45—11.45 pm; 2.30—5.30 am; 8 am—12.45 pm
—	Brazzaville	12.27	24.45	4.30—6 am.
—	Moscow	12.26	24.47	1 pm to 2 am (this is all Russian—far Home Service)
TFJ	Reykjavik	12.23	24.54	3.15—3.30 pm
—	Moscow	12.19	24.61	7.45—9.23 am; 10—10.50 am
—	Moscow	12.17	24.65	6—8 am; 2.40—3.45 pm; 4.45—5 pm; 7.30—8.50 pm; 11—11.15 pm; 12.30—12.45 am; 1.15—1.45 am.
R. France	Algiers	12.12	24.75	2.30—4.30 am; 5—7.30 am; 7.45—8.15 am.
ZNR	Aden	12.11	24.77	2.13—3.30 am
GRF	London	12.09	24.80	8 pm—2.45 am
GRV	London	12.04	24.92	3.45—6.45 pm; 8.45—9 pm; 10.15—11.30 pm; 11.45 pm—2.30 am; 2.45—4.45 am; News 4.15 and 6 pm.
CE1180	Santiago	11.97	25.04	9.30pm—m/n; 2.30 am—2 pm
FZI	Brazzaville	11.97	25.05	4—4.20 am; 11.30—11.45 am; 5—7.30 pm; 1—2 pm; News 5.45 pm and 1.45 pm.
ZPAS	Encarnacion	11.95	25.10	8.30—10 am
XGOY	Chungking	11.90	25.21	Not in use at present.
VLG-9	Melbourne	11.90	25.21	12.15—12.45 am.
CXAIO	Montevideo	11.90	25.21	9.25 am—12.10 pm
WRCA	N.Y.	11.89	25.22	6—10.45 pm; 3—6.45 am; 7 am—1.30 pm
VLR-3	Melbourne	11.88	25.25	11.45 am—6.15 pm (Sun. 12.50 pm—6.25 pm)
H13-X	Trujillo City	11.88	25.25	8.30 am—12.15 pm.
VLI-2	Sydney	11.87	25.27	4.55—5.25 pm
WBOS	Boston	11.87	25.27	8.15—10 pm; 3—7.15 am; 7.30 am—2 pm
HER-5	Berne	11.86	25.28	10.55—11.30 pm; 6.50—7.35 am; 11.45 am—1 pm
GSE	London	11.86	25.29	1—1.15 pm; 1—1.30 am; 2.30—7 am.
WGEA	Schenectady	11.84	25.33	10 pm—7.15 am.
CXA, 14	Colania	11.84	25.35	7 am—2 pm
VLG-4	Melbourne	11.84	25.35	8.15—9.45 pm
VLW-3	Perth	11.83	25.36	7.30—10.45 am; 12.30—8.15 pm.
—	Moscow	11.83	25.36	8.30—9.30 pm; 10.30—11 pm; 12.30—12.50 am.
WCRC	N.Y.	11.83	25.36	9.30 am—2 pm.
WCDA	N.Y.	11.83	25.36	8 pm—8.30 am
GSN	London	11.82	25.38	3—5.30 pm; 5—6.45 am
XEBR	Hermosillo	11.82	25.38	11—3 pm
COGF	Matanzas	11.80	25.41	2.30—5 am
KGEI	'Frisco	11.79 N	25.43	7 am—2.45 pm
WRUL	Boston	11.79	25.45	3.30—8 am; 8.15—9.25 am; 9.30 am—4 pm
GVU	London	11.78 N	25.47	3—5.30 pm
HP5G	Panama	11.78	25.47	11.15 pm—12.30 am; 2.45—6 am.
ZYB8	Sao Paulo	11.76	25.50	7 am—noon.
VLR-8	Melbourne	11.76	25.51	6.30—10 am (Sun. 6.45 am—12.45 pm)
GSD	London	11.75	25.53	3—7 pm; 1.30—6.45 om; 11.15 am—2 pm
—,	Moscow	11.75	25.53	9.30—9.55 am.
HVJ	Vatican City	11.74	25.55	Tues & Thurs. 5—5.30 pm; Mon. Wed. & Sat. 6—6.30 pm.; Wed. 1—1.30 am.
COCY	Havana	11.73	25.56	11 pm—4.15 pm

Call Sign	Location	Mc.	M.	Time: Eastern Australian St'dard
KGEI	San F'cisco	11.73	25.58	7 am—12.45 pm (Think has been withdrawn).
ZPA-2	Asuncion	11.72	25.60	8.30 am—12.10 pm.
—,	Leopoldville	11.72	25.60	8.55—10.15 pm; 4—6.30 am
PRL-8	R de J'niero	11.72	25.60	5 am—1.10 pm.
—,	Lisbon	11.72	25.60	10 pm—midnight
—,	Geneva	11.71	25.60	9.45—11.15 am
YSM,	San Salvador	11.71	25.62	4—5 am
VLG-3	Melbourne	11.71	25.62	3.55—4.40 pm; 4.55—5.25 pm; 5.30—5.50 pm; 6.25—7.25 pm; 7.30—8 pm)
WLWO	Cincinnati	11.71	25.62	5.45—7.15 am
CXA-19	M'tevideo	11.70	25.63	9—10 pm; 8 am—1 pm
SBP	Motala	11.70	25.63	1—4.15 am; 7.20—7.40 am; 11 am—noon
CBYF	Montreal	11.70	25.63	9.30 pm—1.30 pm
HP5A	Panama City	11.70	25.64	11 pm—3 am; 11.10 am—3 pm
CE1170	Santiago	11.70	25.64	10 pm—midnight
GRG	London	11.68	25.68	3—7 pm; 4.30—6.45 am
COK	Havana	11.62	25.83	2 am—2 pm (Mon. 3—9 am)
CSW6	Lisbon	11.04	27.17	4—8.30 am; 8.45—10.45 am.
KWV	San F'cisco	10.84	27.68	4—6.30 pm.
VQ7LO	Nairobi	10.73	27.96	12.45—5 am.
CEC	Santiago	10.67	28.12	10—10.15 am
KES-3	Bolinas	10.62	28.25	3—8 pm
VLN-8	Sydney	10.52	28.51	Idle at present.
—	Moscow	10.44	28.72	6 pm—1.45 am (often news at 9.40 pm).
PSH	R de Janiero	10.22	29.35	10.30—10.48 am
HH3W	P't-au-Pr'ce	10.13	29.62	2.30—8.45 am; 9 am—1.30 pm
SUV	Cairo	10.05	29.84	4.30—5 am; 8.45—9.30 am
HCJB	Quito	9958	30.12	9.45—11.45 pm; 2.30—5.30 am; 8 am—12.45 pm; (Sunday 10 pm—7.30 am
—	Brazzaville	9945	30.17	5—8.30 am.
WRX	New York	9905	30.29	8 am—2 pm; 2.15—7 pm.
WKRD	New York	9897	30.31	6.45—8.30 pm; 5—7 am
WKRX	New York	9897	30.31	8—10.45 am
LSN-2	B'nos Aires	9890	30.33	Noon—12.30 pm
EAQ	Madrid	9860	30.43	4—5 am; 9.50—11 am. News 4.15 am and 10 am.
—	Moscow	9860	30.43	8.48—9.23 am; 10—11.50 am; 2—3.45 pm
CR7BE	L. Marques	9843	30.48	3—4 am; 7.30—10 am.
COCM	Havana	9833	30.51	9.45 pm—3 pm
GRH	London	9825	30.53	3—6.30 pm
—	Moscow	9770	30.71	10—10.30 am
ZRO	Durban	9755	30.75	Midnight—7 am
WDL	New York	9750	30.77	6.45—8 pm; 6.15—9 am.
T14NRH	Heredia	9740	30.80	10—11 pm (Wed. Fri. & Sun. 1.30—3.30 pm)
CSW-7	Lisbon	9735	30.82	11 am—noon (not heard here lately).
CE970	V'paraiso	9730	30.82	9.30—11 pm; 7.30 am—2.30 pm
XGOA	Chungking	9720	30.86	9 pm—1 am. News midnight
OAX4K	Lima	9715	30.88	8.30 am—2.20 pm.
WRUW	Boston	9700	30.92	4.45—8 am; 8.15—9.25 am; 9.30 am—4 pm.
FIQA	Tananarive	9700	30.93	12.30—2 am
GRX	London	9690	30.96	3.30—6.15 pm
TGWA	Guatemala	9685	30.96	11.50 am—2.45 pm (Mon. 10 am—2.45 pm).
LRA-1	B'nos Aires	9688	30.96	1.30—4 am; 5.30—6.30 am; 7 am—noon
XEQQ	Mexico City	9680	30.99	Midnight—4.45 pm.
VLW-6	Perth	9680	30.99	8.30—11.15 pm

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

M.S. (Toora, Vic.) asks: What is a Beefer?

A.—A cross between a Woofer (speaker for low notes only) and a Tweeter (for high notes only). Where the aduio-frequency spectrum is divided into three parts, the Woofer handles only the very lows up to 200 hertz), the beefer from 200 to 2000 hertz and the tweeter from 2000 to 13000 hertz. This division into 3 parts (audio in tres divisa est?) enables smaller speakers to be used as distortion in the lower frequencies is not very objectionable.

●

T.A.K. (Donald, Vic.) wants to know if the A.F. response curve of an amplifier can be obtained without using an oscilloscope.

A.—Of course it can. The customary method is to supply the amplifier with a signal from a beat-frequency oscillator (which has a constant output over all audio-frequencies) and measure the voltage across the voice-coil of the speaker with a good quality A.C. voltmeter. The signal input and gain of amplifier are adjusted so that half the maximum useful output is obtained at either 400 or 1000 hertz. A simple vacuum-tube voltmeter for the purpose might consist of a 6X5G, 1V or 76 (diode-connected) as a rectifier in series with a 5000 ohm resistor and a 0-1 milliammeter.

●

K.E.W. (Braken Hill) has built the 1941 "Nugget" (Nov. 1941 issue of A.R.W.) and wants to increase the gain for DX work.

A.—Here are several things you can try:—

1. Reduce the common bias resistor for 6J8G and 6J7G from 350 to 250 ohms.

.2 Reduce the common screen-grid resistor (for same valves) from 40,000 to 35,000 or 30,000 ohms. A 2-watt type will be required.

3. Change 6B8G bias, screen and plate resistors from 2000 ohm, 1 meg. and .25 meg to 2500 ohm, 3 meg ond .5 meg respectively. Omit the 1 meg feedback resistor (between 6B8G and 6V6G plates) or replace it by a 3 to 7 meg one.

4. Replace output valve by EL3N. Reauce bias resistor from 250 to 175 ohm and reploce 5000 ohm speaker transformer by 8000 to 10,000 ohm type. The EL3N valve allows a higher value of grid resistor (1 meg max.) but requires a .1 meg. "stopper" resistor directly in series with the grid.

●

A.M.H. (Newcastle) asks how to determine the correct value for a buffer condenser in a vibra-pack.

A.—If a cathode-ray-oscilloscope is available, then it is a matter of getting a suitable waveform without peaks ond without a loss in the form factor. A good way, without an oscilloscope is to put an ammeter in one side of the input and try condensers until the drain is a minimum and then use that size or one just slightly larger. If .01 mfd. gives minimum drain, then .02 is too high, so .01 across the secondary may be assisted by a 1 mfd. condenser across the primary (equivalent to only a very small secondary condenser). If indirectly heated valves are used, then it is helpful to shunt the secondary buffer by a .25 meg. 1 watt resistor, or to wire a .01 meg. resistor in series with it.

●

(R.F.M. (?) asks what technical advances shall we see after the war.

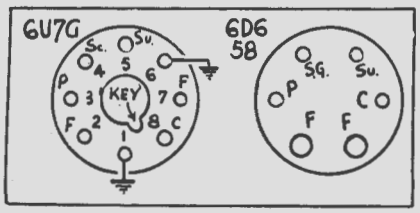
A.—Sorry, but we are not clairvoyant. Some things which are reasonably certain, include: vastly increased peak acoustic power due to more powerful output tubes, new output systems and better speakers, extended frequency ranges, general adoption of special baffles, a bid for frequency modulation, revivals of T.R.F. systems using coils of extremely high efficiency, valves to work from 30 volts high-tension, smaller midget sets, hi-fi magnetic pick-ups at popular prices, ultra-compact transformers using glass insulation, plastic speaker frames, and PLASTIC MAGNETS, tweeters of various kinds, onti-static devices. Besides these there will be, of course, mony developments from inventions at present secret and of national importance.

●

D.S.S. (Rakamea) who asked about valves working from 32 volts in February (see March issue), now asks "What is a voltage-doubling vibrator?"

A.—A split-reed vibrator used to charge alternately a pair of condensers in series. A D.C. voltage may be nearly doubled by this means, providing the drain is small and the condensers large.

SOCKET CONNECTIONS



Here are the socket connections for the valves mentioned on page 14.
Several readers have requested more of these diagrams. What do you think? Write and let us know which types interest you.

"BUSH-MAGIC"

(Recently the BC put over the air a story of some Servicemen, who found themselves lost in the bush far from their unit, and one of them, who had been a radio operator, made a transmitting set out of some bits of bamboo, some cocoa tins and pieces of string by means of which a rescue party saved the lives of the lost detachment.

Interviewed on behalf of Technical Radio Press the hero of this story made the following statement:

"How did I win my V.C., sir,
This one, with the double bar of gold–
Only one of its kind, sir—
At least, so I've been told.

"Read all about it in 'London Gazette,'
Anyone who desires,
How I saved the lives of my comrades
Of the good old 'Jungle Triers.'

"We were lost in the Burmese jungle,
And tigers had killed quite a few;
When we went to the river for water
The crocodiles bit us in two!

"And then I'd my inspiration
In a rush of brains to my head,
And I rigged up this here transmitting set
About what so much has been said.

"Only some cocoa tins I had,
Some string and some bits of bamboo;
But I puts them together the right way round,
And our message for help got through!

"I was asked by the BBC next thing
To let the whole world hear,
And now, as I've given all details,
My invention should be quite clear!

"And the King, as he pins my V.C. on,
Says, 'My lad, it's been splendidly won!
'Cos you've been and done something for radio
That Marconi could never have done!"
—"Torch."

—From Practical Wireless (Eng.)

●

SURPRISES OF MAGNETISM

No subject is more full of surprises than magnetism. An alloy of 75 per cent iron and 25 per cent nickel is practically nonmagnetic, while permalloy, which is composed of approximately 80 per cent nickel and 20 per cent iron, has a permeability of 20 or 30 times that of pure iron. An alloy consisting of manganese, copper and aluminium has been found to be strongly magnetic, although none of its components alone is magnetic.

—Q.S.T.

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It doesn't actually win the battle, but hobnobbing with a foreign buddy is a form of wartime communication that builds international morale. In the picture two Americans and a French soldier tell it with gestures to an English Tommy.

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2 Am I capable of earning more money?

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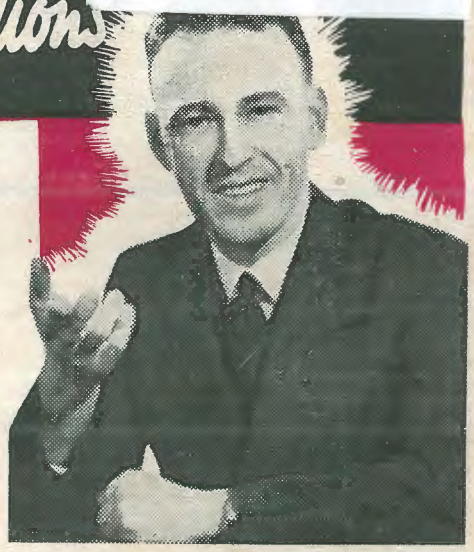

IF THE ANSWER IS YES! . . . THERE'S A BIG FUTURE FOR YOU

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LOOK WHAT A.R.C. HAS DONE FOR THESE MEN . . .

"Well, Mr. Graham, it was certainly a 'red-letter' day for me when I read through you advert, and decided to send for particulars. Words cannot tell what you have doe for me. Not only have you given me knowledge that places me amongst the leading servicemen, but, and I say this in all sincerity, Mr. Graham, you have lifted me out of a rut and have changed me from an ordinary laborer with no prospect into a radio man with a definite objective in view. Some idea of what you have done for me can be gauged from the fact that two years ago I was ignorant regarding radio, and now there people who send me their sets for repairs in preference to sending them to Brisbane.

G.H.T., Queensland.

"I was in a workshop recently, where a member of an Aussie Unit was working. He had various items of electrical gear and a few small receivers, which he was repairing. He made me welcome, and I poked about his workshop. Seeing a familiar-looking folder, I picked it up. The A.R.C. Fault Finder. Fancy seeing one of them in Syria! 'Who owns this?' I queried. 'I do,' he answered; 'the A.R.C. taught me all I know.' 'Same here,' said I, and we went into a huddle, so to speak.

From Somewhere in Syria.

To L. B. GRAHAM,
Principal of Australian Radio College.

Dear Sir—

Please send me, without obligation on my part, the free book, "Careers in Radio and Television."

NAME .....

ADDRESS .....

.....A.R.W.

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