THE AUSTRALASIAN

Radio World

Registered at the G.P.O. Sydney, for transmission by post as a periodical

VOL. 7 ..... NO. 11 APRIL 15 1943

Twenty-two watt amplifier design has many novel features.

Relative merits of audio coupling systems considered by technician

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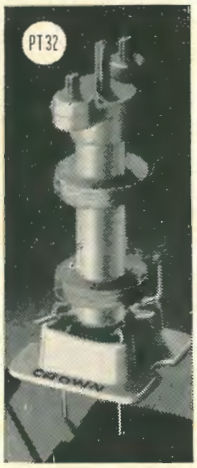

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EDITORIAL

One of the outstanding features of this war has been the way in which rumours have been proved to be so dangerous. The power of suggestion is capable of wreaking havoc, even with people who would normally show reasonable discrimination.

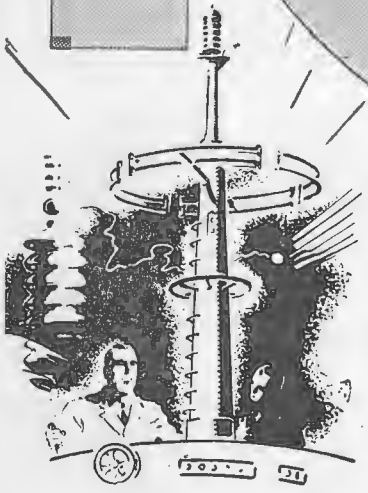
Which might lead you to think that we are going to tell you not to listen-in to the powerful Jap signal which romps in on the short-wave bands, or to repeat the oft-told tale of Station Ananias.

Actually, however, our aim is more to dispel the many rumours about the difficulty of obtaining parts for the maintenance of receivers. There are many shortages and it would be futile to assert that all types of valves are readily available. On the other hand, things are not nearly as bad as they might be, and we have a long way to go before conditions will be as difficult as they are in England, where it has been estimated that more than a million receivers are silent for want of replacement parts.

Strangely enough, some parts which might be expected to be scarce are readily available, and surprising results can sometimes reward a little scouting around the shops.

We made an outsize in errors in the Queries page of last month's issue, by suggesting that certain old-type battery valves would be unobtainable, only to be corrected by the Mullard people, who happen to have handy stocks of many valves of types of which little has been heard for several years.

Watch R.C.S.



Right now R.C.S. are unable to supply the general public with the radio kit parts and components that have made the Company—and its products—so well and favourably known throughout Australia.

There's a war to be won, and every ounce of technical skill—every precision tool—must be placed at the disposal of those who are defending these shores against the invader.

But the future of radio was never better.

Under the stimulus of war, great advances have been made in set construction and design, and the post-war period will see the introduction of receivers possessing a range and performance rating far beyond anything known today.

R.C.S. is taking an active part in these developments, and when happier days return, both the amateur and the commercial set builder will find the Company ready with the exact type of equipment required.

R.C.S. RADIO PTY. LTD., SYDNEY, N.S.W.

THE "S.R.L. SPECIAL" AMPLIFIER

Details of 22-Watt Amplifier with Six Controls

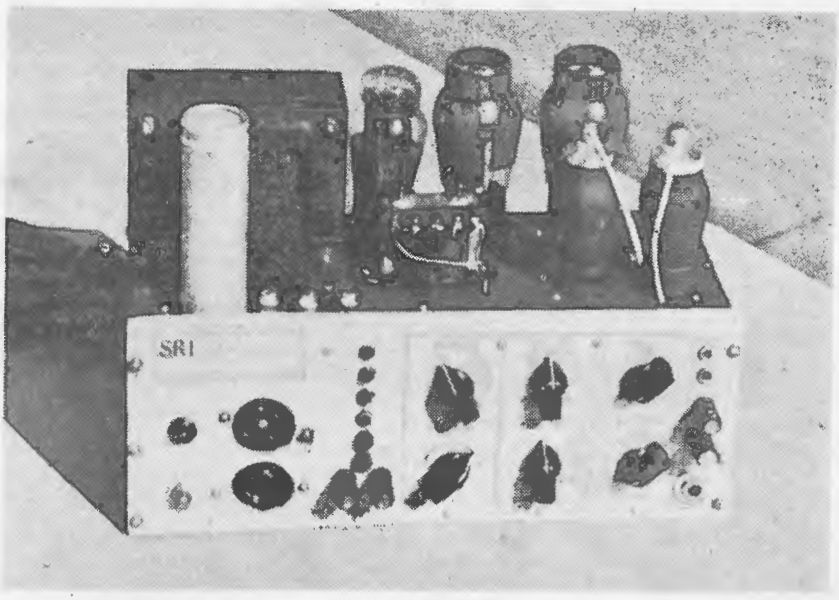
LAST month the relative merits of triode, tetrode and pentode tubes were discussed. Well, here's a rather unorthodox beam-tube amplifier.

Optional Valves

In place of the 6B8G valves, 6G8G's can be used, the last requiring a different type of socket. A 6J7G connected as a triode or a 6C5 would give slightly greater gain if used as the second tube.

In place of the 6L6G output tubes, a pair of 6F6G, or 42 valves can be used with very little change in the circuit; but, of course, there is a fair reduction in the output. A different plate load is required, but this is obtained by merely rotating the speaker impedance swich until the tone is O.K.

The 5V4G rectifier may be replaced by a 5Z3, 5V3G or 80. With the last two, the current drain will be around the limit for the tube if 6L6G's are used, but well within the limit for 6F6G tubes.



The finished amplifier, built on to a deep base with control panel in front

Power Supply

A vertical 15 ma. power transformer made by the Trimax people is used, the space underneath it being occupied by a power choke. This choke was of the home-made variety, as the commercial ones were just too large. It consists of an old speaker-transformer core wound as fully as possible with 30 gauge enamelled wire. Being rather dubious about core-winding insulation it was connected in the negative side of the H.T. supply, so that if it shorted, nothing serious would happen.

Designed and Described by

J. W. STRAEDE, B.Sc., A.M.I.R.E.

7 ADELINE STREET, PRESTON, VIC.

The full 385 volts from the transformer was not required, so it was reduced by using a smaller first condenser. Instead of the customary 8 mfd., there is a pair of 2mfd. paper condensers connected in series.

To simplify things it was decided to use the same voltage for both screen and anode of the output system, thus doing away with a screen dropping resistor.

Inverse Feedback System

Inverse feedback is taken right from the voice coil side of the speaker transformer to the cathode of the first tube, thus reducing distortion all along the line and avoiding overload of the driver.

It is essential that the feedback be inverse and so only a good quality transformer should be used for the coupling between driver and output tubes. If excessive phase shift occurs at a high or low frequency, then motor-boating or a hissing whistle will result, or perhaps quality will be poor on low or high notes.

Because of the high gain (3 stages) only a very small amount of feedback is required and this should not be exceeded.

SPECIFICATIONS

Useful Output: About 22 to 25 watts.

Inputs: Jack for microphone, Tip-jack for phono, also terminals for signal-generator.

Outputs: Two speaker sockets, one for a 12P64 Amplion hi-fi speaker, other with an assortment of impedances. In addition there are terminals and a speaker impedance selector so that almost any load can be used.

Valves: Two 6B8G's followed by 6L6G's in push-pull. The rectifier is a 5V4G, high vacuum low impedance type.

Gain: Voltage required for full output: Microphone .1 v R.M.S. Phono .5 volt R.M.S. (These are with the opposite control set at zero volume and with moderate A.V.C. action.

Features: Individual tone controls for microphone and phono operation. Distortion-reduction by inverse feedback. Combined fuse and pilot light in H.T. circuit. 2-way mains voltage switch.

A.V.C. and A.V.E. by feedback variation

Speakers: An Amplion 12P64 is used for home reproduction of records. A pair of Rola 10/42 permags. with short horns is used for outdoor work.

A.V.C.-A.V.E. Control

Small amounts of automatic volume compression, or automatic volume expansion may be obtained by varying the percentage of feedback with the volume level. This is done by using a network of pilot-lights and resistors across the speaker transformer secondary. One pair of lamp and resistor give A.V.E. in the manner described in "Radio World" for May, 1941, whilst the other pair does the opposite. Switching from one to the other is accomplished by a potentiometer. Midway between the positions, there is a point of minimum feedback, useful when the utmost in gain is required as when an orator talks several feet away from a low-level mike.

Dual Tone Controls

Most amplifiers use the same controls for both mike and phono, which

(Continued on next page)

22-WATT AMPLIFIER

(Continued)

is not always a good thing if both are being used at the same time.

The microphone control consists of a high-cut-or-boost system connected across the microphone volume control. It is actually another volume control connected in parallel, but working from the high notes only. Ribbon mikes require a high-boost, while crystal mikes are often the reverse.

The pick-up tone control is quite different in operation and comes after the pick-up volume control. At one end it gives the conventional high-cut, useful in making scratch and giving a bass-effect. At the other end, a bass-cut is obtained. This is very handy when the amplifier is to be played really flat out. At high levels, the ear is more sensitive to low notes, so less bass is required and more power can be devoted to the higher notes. It's the high notes that "carry."

Speaker Transformer

This was constructed from a standard Rola transformer. The existing secondary winding was tapped at approximately .7 of its length (for two Rola speakers in parallel) and an extra winding of 1.4 times the original was added to bring the total secondary winding up to a 12.5 ohm output for the Amplion speaker. This extra winding was done with 26 gauge wire. As a 5-way switch was available, a couple of extra taps were made, one at half the original winding and the other half way along the additional winding. (These were handy when using 6F6G outputs.

As the speaker leads run direct to the voice coils, it is essential that they be of low resistance. Ordinary twin flex is O.K., up to about 30 feet; past that, power flex is necessary. For very long distances a high impedance line must be used, i.e., the output is stepped up by a transformer to around 30 volts and stepped down again at the speaker. The higher the voice coil impedance, the longer the line without the necessity for extra transformers.

Wiring

Owing to the compact nature of the amplifier, wiring was a bit of a problem. Luckily the back of the chassis was removable, making things a bit easier. Filaments, inputs and tone controls were wired first. Then came the outputs, intervalve coupling (except the A.F. transformer), cathode, and screen condensers, etc. The power choke and audio transformer were connected last, these components being mounted at opposite ends on the ends of the chassis. The transformer was held by only one screw at first and later rotated to position of minimum hum. The filament wiring, instead of being earthed on one side was connected to about 50 volts positive to remove some hum, due to heater emission.

Rather unwisely, perhaps, an earth busbar was not used, but every earthing point except one which was rather inaccessible, was connected together later to see if it made any improvement, but the hum, although satisfactorally low, was not appreciably diminished.

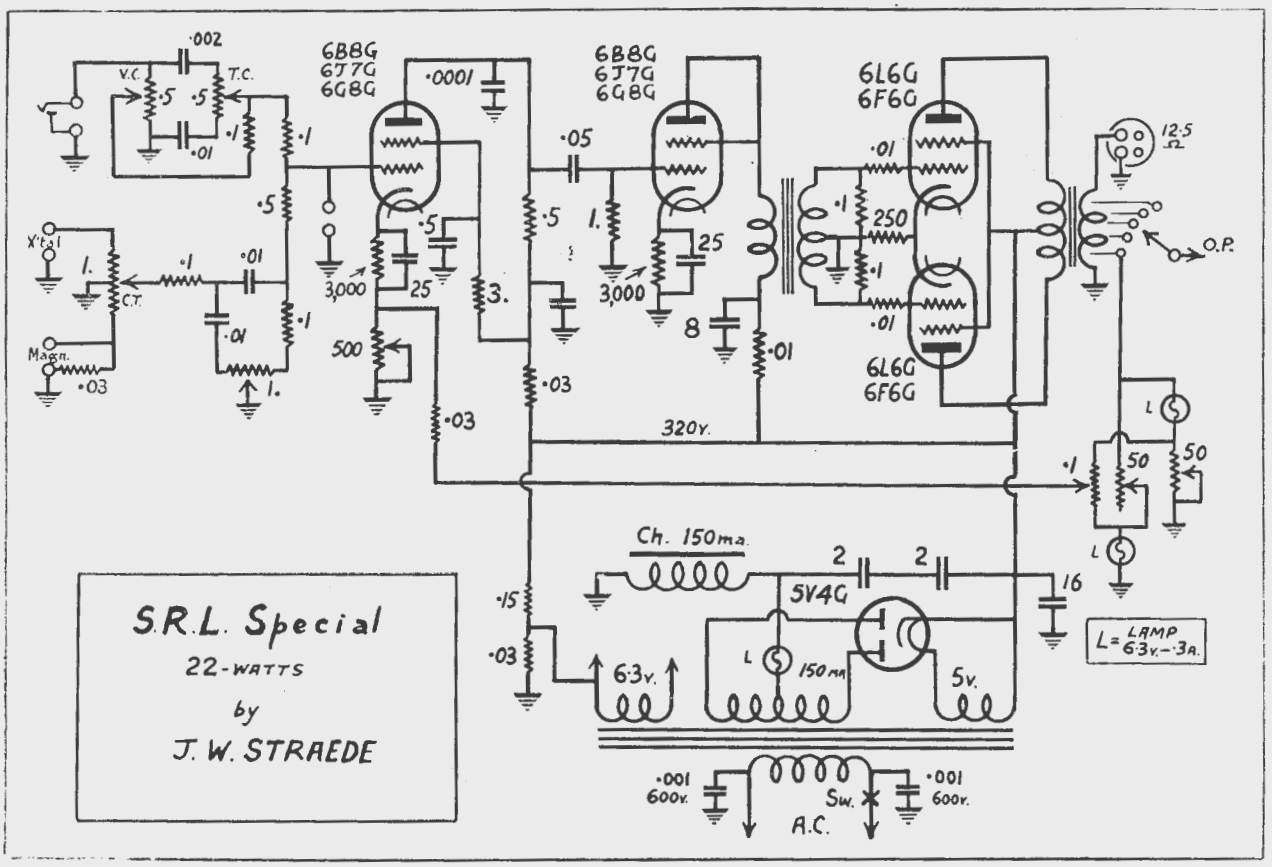
After a lot of experimenting it was noticed that the main flex was dragging across the chassis and it was this that was causing the majority of the hum!

Other hum sources that had been traced down were: incomplete electrostatic shielding (overcome by bypassing each side of the mains with .001 mfd. 600 volt condensers) and volume control covers that had not been earthed.

Volume Expansion

A powerful amplifier such as this is really desirable for volume expansion, as otherwise too much distortion occurs on the loudest passages. The

(Continued on page 26)



AUDIO FREQUENCY COUPLING METHODS

A discussion of the advantage and disadvantages of each type with a note and their present use.

Requirements

The main function of the coupling device between one A.F. stage and the next is that the grid of the second tube must receive a signal. In addition a certain impedance must be offered to the plate of the first valve, or no amplification is obtained. In fact, if the impedance is too low, attenuation may result,

Apart from those two considerations which are for the purpose of "having things work," the signal voltage applied to the grid of the second tube should not depend on frequency and the wave-form must not be distorted.

Again, the amplitude of the signal must not affect the amplification obtained over the audio system. Such factors as picking up hum, R.F. etc., really come under distortion of the wave form.

Economically, the device must not be to expensive or unreliable. On the other hand, it must be rugged, long-lasting and not liable to damage any other component if things are not "just so". The six devices considered in this article are arranged more or less in historical order as regards popular radio design (most of them were first used prior to 1920, anyway).

Historically

As far as popular set-building was concerned, the transformer held the field for many years, even though the primary was of low inductance and the bass notes consequently missing (the speakers wouldn't have noticed them, anyway!) and the windings liable to corrosion. Bigger and better transformers appeared from time to time, the size and price being in most most cases guides to the tone and performance. Resistance-capacity coupling gradually edged its way in, although resistors were noisy and paper-insulated condensors leaky (some of them still are). Tone was the big factor and higher B-battery voltages the stumbling block.

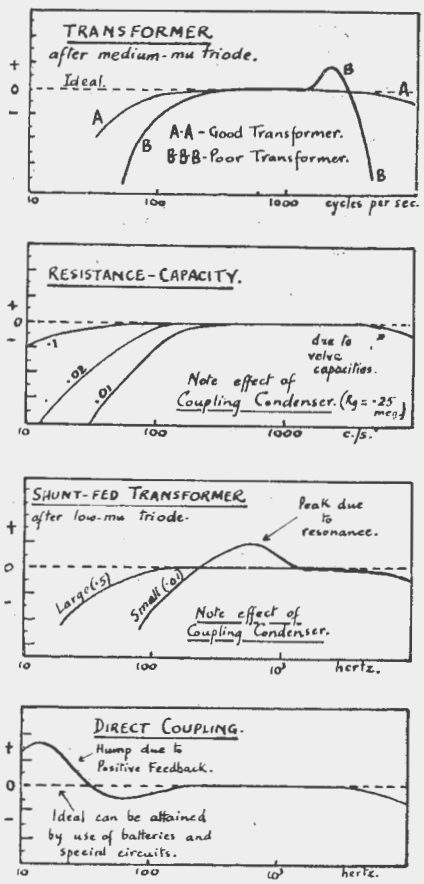
When "electric" sets first came into vogue, transformers were deliberately made lacking in bass response (it saved money to use smaller primaries, too) to reduce the hum. Resistance-capacity coupling then came to the fore, increased gain being possible with the screen-grid tube, and today it is by far the most popular method.

The shunt-fed transformer, a system designed to give improved tone withuot losing all the step-up, found favour with a few builders from time to time, especially in England, but remained quietly in the background until the recent development of high-fidelity transformers.

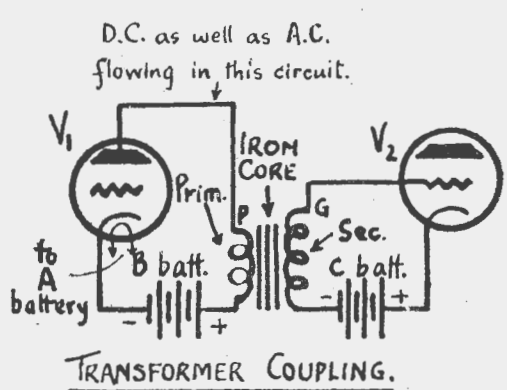
Impedance coupling, or choke-coupling as it is sometimes called, provided a way of getting the utmost in gain from the screen-grid valve and so was used in many of the "two-tube and rectifier" sets of twelve to fourteen years ago.

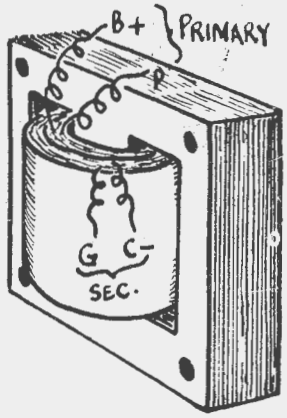
With the demand for "tone," direct coupling, Loftin-White style had a brief but furious innings, furious sometimes, in more ways than one. Direct coupling still crops up now and again, but its real use is in the laboratory using batteries as the power supply and providing perfectly uniform frequency response from 0 to 100,000 hertz. Ordinary direct coupling is not much better than resistance-capacity coupling as regards frequency response, and may be worse.

The reverse of "impedance" coupling or resistance-capacity-choke coupling has been used, but is not common.



Fidelity response curves for the various types of caupling.





Transformer Coupling

Its advantages are increased gain (due to the step-up between the primary and secondary windings), a low resistance in the plate circuit and a low resistance in the grid circuit.

The last is very handy when using 2A3 or type 50 output tubes with fixed bias, as these high-power triodes demand a grid resistance as low as 50,000 ohms. The low resistance in the plate circuit means that only a moderate anode voltage is required, thus allowing for decouplings.

Disadvantages of the transformer are that it cannot be used after a high-impedance tube such as a screen-grid or pentode, and a good transformer is surprisingly expensive.

If the core is too small, hysteretic distortion may take place — the iron core tends to convert complex waveforms to a wobbly edition of a sine-

(Continued on next page)

COUPLINGS

(Continued)

wave. The larger the core, the bigger the cost.

If the primary winding is too small, the primary impedance will be less than the valve impedance at low frequencies, introducing distortion. Again, if the resultant impedance of valve and primary in parallel drops, then the gain drops. This occurs most in the bass region, small transformers lacking low-frequency response.

Unless the secondary windings is in a number slightly separated "pies", or slabs, capacity effects produce both a resonant frequency and a diminution of the extreme highs. All of which boils down to one thing: A good transformer is expensive.

Resistance-Capacity Coupling

The use of a condenser means a partial restriction of the lower frequencies, but not such a restriction as in the case of a poor transformer. Besides, even if the coupling condenser is very small, the anode load is maintained (in fact, it rises) so there is no harmonic distortion of the lows. Because of the high anode and grid resistances, there is also a slight drop in the ultra-high frequencies due to capacities in the valves; but this is usually all to the mustard, because the average speaker doesn't reproduce these ultra-highs, so why allow them to load up the output tubes! Any R.F. picked up in the audio section is likewise eliminated.

Early resistance-coupled circuits suffered from noise and motor-boating. The former has vanished with the introduction of good quality resistors such as the "metallised" types, whilst the latter has been eliminated by decoupling. Sometimes motor-boating was due to an open, or broken grid resistor. Resistances were formerly noisy, unreliable and expensive. Today they are relatively cheap, and their cost forms only a small fraction of the cost of a set, so it is foolish to try to economise on resistors. Only the best should be used.

The coupling condenser has likewise improved. In the days of the 60 or 90 volt B battery, almost any paper condenser was O.K., but today the voltage across the condenser may be as high as 550 volts during the "warming up" period. A leaky condenser reduces the grid bias, causing distortion, besides straining the valve. For A.C. sets, a good quality moulded condenser of 600 or 750 volts rating is desirable. Mica insulation is an asset.

For maximum voltage output, the plate resistor should be about the same as the D.C. resistance of the tube and the grid resistor as high as the following valve allows. The capa-

city of the coupling condenser is inversely proportional to the size of the grid resistor and directly proportional to the bass response required.

Shunt-fed Tansformer

This system has two advantages over the simple transformer. Because direct current is kept out of the primary winding, the inductance is increased, thus raising the bass response and also hysteretic distortion is lessened because the core acts under better magnetic conditions.

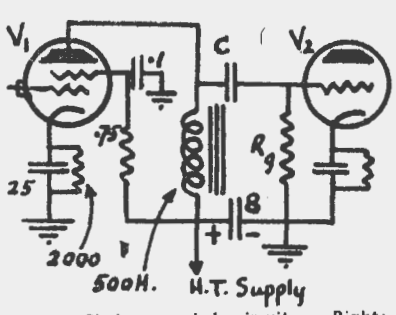
The plate resistor has a damping effect, reducing the usual high-frequency resonance, while the coupling condenser may produce a low-frequency resonance if the valve has a low impedance (e.g. 6C5G, or low-mu triode). The condenser must be large in capacity and the voltage rating is the same as for a resistance-capacity coupled circuit. Sometimes damping is improved by shunting a resistor across the secondary, but too low a resistor causes serious distortion. Not only is the reflected load small, thus reducing the plate load of the valve below its optimum, but the shunt resistor, combined with the leakage inductance of the secondary acts as high-cut filter. Shunt feed makes a great improvement in the tone of a "cheap" transformer, and it is well worth the time in experimenting with different sizes of coupling condensers and shunts.

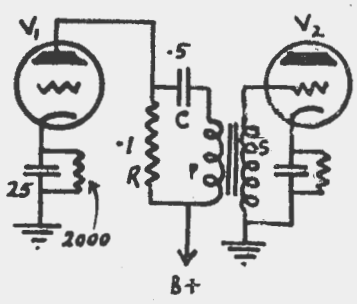
Impedance Coupling

To obviate the drop in plate voltage from a resistor, a choke coil or "impedance" may be substituted. Unfortunately, the choke coil has the same defects as the transformer, viz., reduced bass response, resonant frequencies, hysteretic distortion. Besides, there is no step-up.

High impedances were frequently used with such tubes as -24 and -57 to get very high gain (over 400 for one stage, sometimes) but tone was definitely not of the best.

A certain circuit once featured a 57 detector followed by a 250 Henry choke (and no shunt resistor!) as a high-note correction device to allow for sideband cutting. The resultant





Left: Choke coupled circuit. Right: Transformer coupling with shunt feed.

frequency response curve looked like an ant-hill.

Today impedance coupling is used only in short-wave receivers where a small H.T. voltage is available.

Direct Coupling

For many, a snare and a delusion. D.C. enthusiasts claim terrific bass response ("no coupling condenser, therefore no bass loss") but when a pronounced bass effect is obtained, the cause is probably positive feedback due to filter condensers having a finite reactance, especially at low frequencies. Direct-coupling is sometimes used for simplicity as in the direct-coupled phase inverter analysed mathematically in Radio World" for January, 1942.

If direct coupling is employed between an indirectly heated tube such as a 24a, 57, 6J7G and a directly heated valve such as a 45, then a very nasty overloading of the latter takes place while the set is "warming up." Instead of the usual negative bias, a positive bias is on the grid, causing an extremely large plate current to flow. In the case of high-conductance directly heated valves such as the 2A3 and PX4, this overload may be positively ruinous.

Early direct-coupled circuits often suffered from "blocking" and it so happened that if the circuit were designed not to block (by connecting the plate resistor to the same B + as for the output tube), then the second valve was more strongly overloaded during the warming-up period.

In America, direct-coupled amplifiers using 6J7G's and 6L6G's have been designed with every stage having two two tubes in push-pull, but resistor values are rather critical. If you must use direct coupling, then use an indirectly heated rectifier valve.

Centre-Tapped Choke

If a centre-tapped choke is substituted for the grid resistor in a resistance-capacity circuit, a simple form of push-pull operation is obtained. This system has been used on car radios and in some amplifiers, but not the best.

With a class A output stage, reasonably good tone is obtained if the choke coil is of suitable construction, but if class AB is used, then the out-of-balance of the highs due to capacity effects may cause plenty of second harmonic.

The C.T. choke is really acting like a 1:1 ratio transformer in a "shunt-fed transformer" circuit. If the choke is too small, the bass response is reduced as in the case of a transformer. A 25,000 C.T. speaker transformer has been used after a 6B8G (triode, connected), feeding into a couple of 6V6G's. The voice coil winding is left open or shunted by a pilot-light (giving a form of A.V.E.).

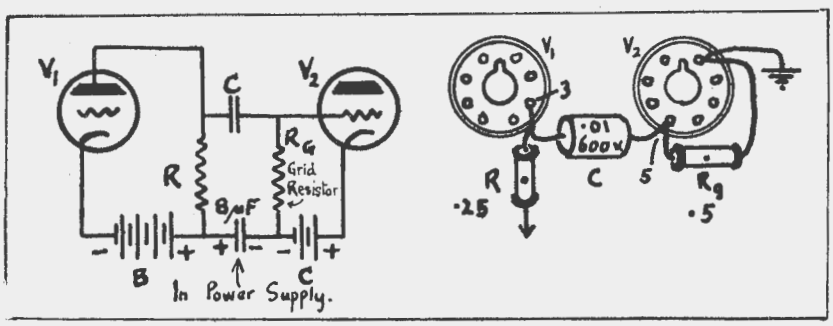
Other Systems

A shunt-fed transformer using a choke in place of a resistor has been used at times, but has little to recommend it. Sometimes the coupling condenser with the two inductances is aranged to give a boost in the extreme bass.

Similarly a choke condenser-coupled to a C.T. choke has been used for push-pull.

Coupling for Class AB2 and Class B

Whenever the flow of grid current is part of normal operation, the grid circuit resistance and impedance must be low. (If only the resistance is low, the high-frequency response is diminished). AB2 and B operation, therefore, demands transformer coupling



Resistance coupling in both schematic and pictorial diagrams

(Continued on page 18)

IDEAS IN CIRCUIT DESIGNS

Direct-Coupled Valves

Although direct coupling is a very tricky business and usually provides no advantage over a well-designed resistance-coupled circuit, it is nevertheless of interest, and some d.c. arrangements are noteworthy for their simplicity and for the few parts they employ.

The circuit shown is quite simple, but like all direct coupling arrangements depends for its success on the accuracy of its resistors. Included in its resistors is the field coil of the speaker and this valve is quite critical. If the field has any other resistance, then shunt or series resistors could be added to give the correct value.

As shown, the circuit has a response down to only a few cycles per second, but this is not attained in practice owing to the inefficient transfer of energy by the speaker transformer at low frequencies.

For the first tube, a 6U7G was chosen as its plate current varies more slowly with grid bias than in the case of the 6J7G. It is coupled to the second tube, a 6F6G by means of a .06 meg. resistor, and biassed by a 500 ohm resistor. The screen grid of the 6U7G is directly connected to the cathode of the 6F6G to give a stabilising effect. If the 6F6G is underbiassed, the current rises and the cathode becomes more positive. This makes the screen of the 6U7G more positive and so more current flows in the .06 meg, resistors. The anode of the 6U7G becomes less positive and so the grid of the 6F6G is more negative. A bleed resistor of .25 to .3 megohm (1 watt) is connected between the cathode and screen of the output tube will be slightly over- ohms is not available, then one of 2500 ohms together with a 30,000 ohm 1 watt resistor in parallel can be used. With too large a field coil, the output tube will be silghtly overbiassed. Correctly adjusted, the circuit has a useful output of about 4½ watts.

This Month's Series:

Direct-Coupled Circuit with Values

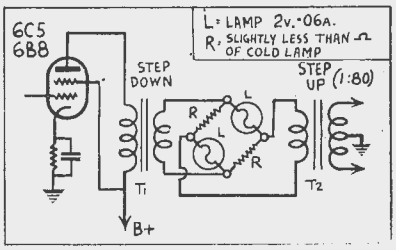
Two Volume Expansion Circuits

Tone Control for Transformer Coupling

Volume Expansion — Pilot Light Bridge

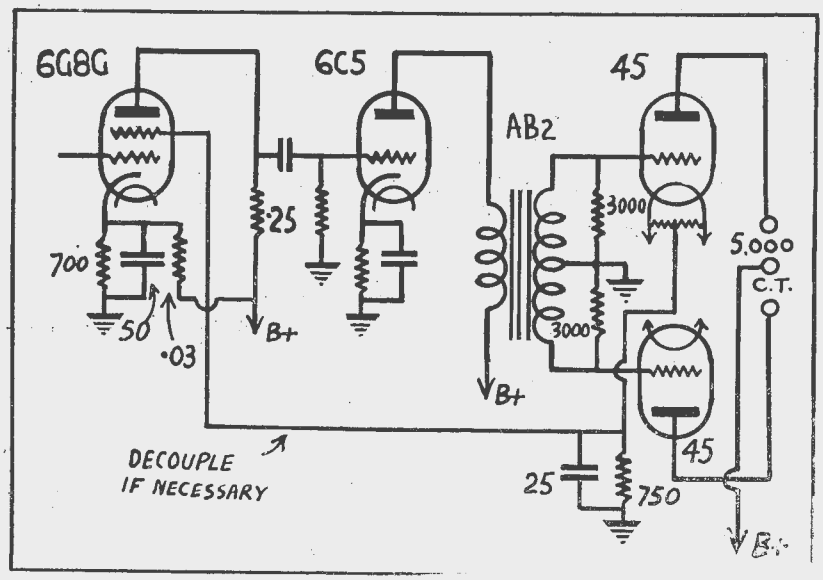
Pilot lights have been used in simple A.V.E. circuits, usually as direct shunts across the voice coil, or with resistors in a feedback circuit. The first method involves a loss of power and a variation in speaker load, while the second provides only a small degree of inverse feedback at full volume, the time when plenty of negative feedback is required.

To overcome these defect, it is possible to use a Wheatstone Bridge between the driver and output valve. One or two arms of the bridge consists of 2 volt .06 amp. pilot lights (the low consumption battery type) and the circuit is so arranged that the bridge is balanced at zero volume. At low volumes, the bridge near-balanced and only a small fraction of the signal is fed to the output stage, whilst at large volumes, nearly all the signal goes to the output. Very large degrees of expansion are obtained in this way. If less is required, then the pilot lights



A pilot light bridge arrangement for automatic volume expansion.

can be shunted by fixed resistors (try 5 to 30 ohms) or the bridge can be unbalanced at zero volume. In the latter case, care must be taken not to unbalance it in the wrong direction, or signals at medium level may be reduced to almost zero volume whilst the background noises are well amplified. Matching transformers are required on each side of the bridge and these may consists of loudspeaker transformers if care is taken with the design. Should the driver supply too much power to the bridge, the lamps may be burnt out and it is a good idea to first try out the circuit with 6-volt .3 amp lamps. The driver could consists of a 6B8G or 6J7G connected as a triode. A pentode driver can also be used, as the resistances of the bridge prevent excessive distortion from varying load impedance. The circuit shown is the "de Rosi." It is possible to design simpler circuits using only one lamp and one fixed resistor. These may be described in a later issue.



Circuit for automatic volume expansion, taking the screen voltage from the bias resistor of the output valves.

A.V.E. by Screen Variation

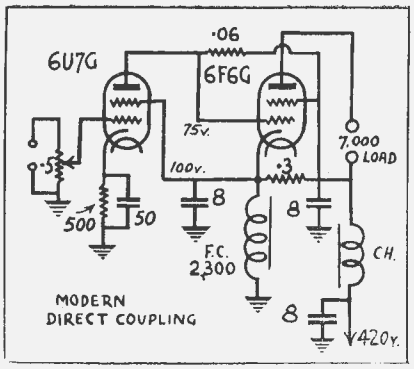
The amplification of pentode tubes varies considerably with the screen-grid voltage. When tubes are used as outputs in class AB, and Class AB2, the bias voltage (if self-biassed) changes considerably from no-signal to full-signal conditions. The suggestion immediately arises: Why not use the variation of bias voltage provide A.V.E. by varying the screen voltage? The answer is O.K. with a couple of

provisors: First, the bias variation must be sufficient, a mere volt or two difference is of no use. Second, the driver must have its no-signal screen voltage set for low amplification, i.e., it must be considerably over-biassed.

A variable-mu pentode such as the 6D6, 6U7G, 6G8G, etc., is advisable, as otherwise there may be excessive distortion at either low or high volume levels. In the circuit shown, a 6G8G (or 6B7S) is shown. Between the 6G8G stage and the output section there is a third stage to give sufficient gain. The intermediate stage consists of a 6J7G connected as a triode or a 6C5, and coupled to the 45's in the output by means of the usual push-pull transformer for AB2 operation. At zero signal the 45's take only 36 milliamps., while at full volume (12 watts), the total plate current is 90 ma. Consequently the bias voltage (and screen voltage for the 6G8G) is 28 volts at zero volume and 70 volts when "flat out." Bias for the 6G8G is obtained from a voltage divider (actually the usual cathode resistor together with a stabilising bleed resistor) and is approximately 6 volts. As volume increases, the gain of the 6G8G stage rises from about 12 to a maximum of about 50 (appprox. 12 db. increase) and then falls off silghtly so as to reduce overloading of the output stage. This latter feature is a distinct advantage as most A.V.E. systems cause bad overloading except when powers of over 20 watts are used.

THIN GLASS

The manufacture of fibred glass starts with ¾-in. diameter highly refined glass marbles which are melted and the liquid glass allowed to flow through 204 tiny holes. The resultant filments are so fine as to be nearly invisible. They are then gathered together to form a continuous filament 97 miles long. Continuous fibres as long as 5,000 miles have been made.



Circuit of a modern version of direct coupling, which was so popular a few years ago.

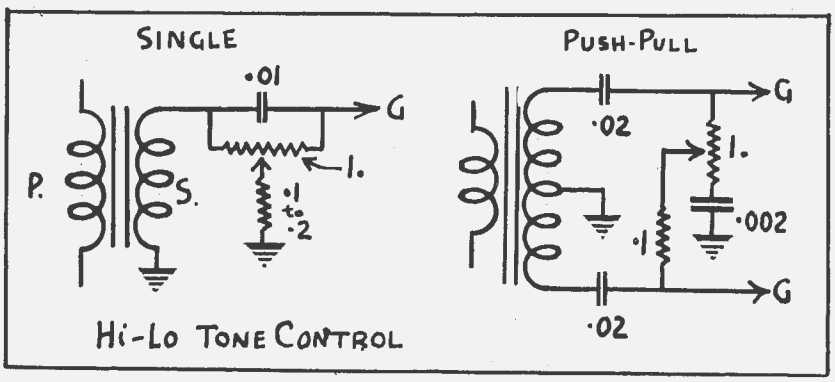
Tone Control for Transformer

When transformer coupling is used between two stages of an amplifier (or in the A.F. section of a receiver), it is difficult to arrange a tone control except as a shunt across the output in the good old hi-cut fashion.

Unfortunately, the output stage is a power stage, and the use of a shunt type tone control causes a loss in available power. As the transformer is a reactive device, the use of a condenser (and resistor) as a shunt may produce undesirable resonance effects when used to cut the highs.

The circuit shown incorporates what is really a double-acting tone-control which does not give excessive tone-change, but provides a smooth balance. At one end a diminution of highs together with the smoothing out of peaks is obtained, whilst at the other there is slight chop of the lows. Neither effect is extremely pronounced, so ease of control is obtained. If more contrast is desired, then the fixed resistor can be decreased to half, or one-third of the value shown and the condenser may also be reduced in capacity.

Alternatively, the fixed resistor can be omitted altogether, a condenser of .002 mfd. inserted in series with the left-hand end of the potentiometer and a .03 meg. resistor in the right-hand end. This gives variations between a pronounced hi-chop and a pronounced lo-cut.



GREMLINS NOW TROUBLING RADIO

We wouldn't bother to mention the Gremlins at all, except that they have presumably invaded the radio field. We'd prefer to ignore them, as Gremlins and Fifinellas (female Gremlins) love to be talked about, particularly if it has to do with some mischief they've been up to. But we've received disturbing reports of Gremlins snapping rubber bands at mikes, sliding down radio beams, sending out false messages, and creating static interference.

The Gremlins are little folk and according to "Time," were first discovered by the R.A.F., the first one having been seen—if we are to believe the "Cosmopolitan" — by a pilot called Gus. More recently it has been reported by "The New York Sun" that Gremlins are an old story to the boys at Boeing Aircraft, which proves beyond contention that the little folk are not peculiar to Britain.

Usually, says "Time," Gremlins are about a foot high, wear tight green breeches, red jackets and stocking caps, and have pointed ears. Other sources claim Gremlins have horns, like a bull, but the Boeing people insist that all Gremlins have a Pitot tube, which acts as an air-speed indicator, attached to the tops of their heads — which goes to show that no one really knows much about Gremlins anyhow.

An eminent radio engineer is of the belief that what the Boeing people have confused with a Pitot tube is nothing less than a quarter-wave aerial, and he is of the opinion that the Gremlins originally sprung from the square root of minus one. He offers as a support of this theory the persistent reports that Gremlins drill holes into plane receivers, climb in, and have all sorts of sport playing b.f.o.

All sources, however, agree on two points: (1) that Gremlins can be seen and heard only by aircraft pilots and their associates, (2) they do not make their presence known to **any** of the enemies of the United Nations — so you can see that, as mischievous as Gremlins may be, they do not carry secrets to the Axis Powers.

The R.A.F. has instituted Training Schools for Gremlins and Fifinellas to make them good and helpful. No doubt training centres also will be opened over here; and it's about time! The little folk are multiplying like rabbits and over-running almost everything. There has, for instance, been a wave of errors in technical publications, and as early as August, "Electronics" reported on their editorial page the existence of a Jinx who threw some type away on them. It was unquestionably a Gremlin. In our own case, we had a Fifinella who played hob with Doppler's Principle (page 48, September "Radio") and left the impression that a plane flies backwards, like a Dodo bird.

We wish to caution radio manufacturers that Gremlins have been using Widgets (baby Gremlins) to unscrew padders after receivers have come off the production testing line. If this difficulty is experienced, the solution is to spread Grape Nuts around on the test benches for the little folk to eat. What happens is, they glut themselves and fall asleep.

Bibliography

Battle of Europe, "Time," September 14, 1942, page 37.

The Gremlins, "Cosmopolitan," December, 1942, page 37.

American Gremlins, "New York Sun," November 2, 1942, page 25.

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—From "Radio," U.S.A.

EVOLUTION OF THE RADIO VALVE

Part 4 of an interesting series of articles

The earliest thermionic, or electronic valve was that made by Edison. It consisted of a filament lamp to which had been added a metal plate. Edison and Swan noted that when the metal plate was connected to the positive end of the filament, a current flowed, but that when connected to the negative end, no current flowed. Thus the lamp plus metal plate acted as a one-way valve for the current.

In the early years of the twentieth century, Fleming put this one-way valve into use in the detection of wireless signals. Detection is a rectification process and the newly-introduced "audion", or di-ode, valve proved very reliable in performance.

Lee de Forest added a "grid", or control electrode, to the audion, thus making a three-electrode tube or triode. The valve was still a one-way device in that electrodes flow only from the filament to anode, but now the flow was controlled mainly by the voltage on the grid and not by the plate voltage. The amplification of a valve is due solely to the grid having more effect on the amount of thermionic current than the plate. The closer the grid to the filament and the farther the plate, the greater the amplification factor is.

Early triodes took on many shapes. Tubular valves with various arrangements of the connections were popular. All these old-time valves were very inefficient, as the filament needed to be very hot to emit sufficient electrons and the heating current might be as high as 1 or 2 amperes at 6 volts.

Coated Filaments

Gradually filaments coated with oxides of barium and calcium, came into use. The coating material gave out more electrons at a lower temperature so less filament current was required. The UV201 required 1 amp. at 5 volts, its successor only .25 amp. at 5 volts, while its modern equivalents, the 1H4G and 1G4G, require only .06 and .05 amp. at 2.0 and 1.4 volts respectively. In the English valves, the Ediswan "R" required 1 amp. at 4 to 6 volts, the AR .75 amp at 4 volts, the A.R.D.E. (D.E. = dull emitter) .25 amp. at 4 volts and this in turn was followed by the AR.06 which required only .06 ampere. Battery chargers are no longer a necessity.

As filament efficiency increased, so the structural relationships of the electrodes improved. Improved accuracy enabled manufacturers to place the grid closer to the filament, thereby increasing both amplification factor and mutual conductance (or "slope.") Round about the 1927 mark, the Philips' B406, with a slope of no less than 1.5 ma/v. was hailed with enthusiasm (the old .2 to 1.0 a/v. seemed sufficient previously) as it also possessed an amplification factor of 6 and required very little filament current. The Philips people introduced, a few years before this, a very sensible method of numbering and lettering valves. Each figure and letter actually meant something. Today, unfortunately, similarity of numbering is no guide to similarity of valves.

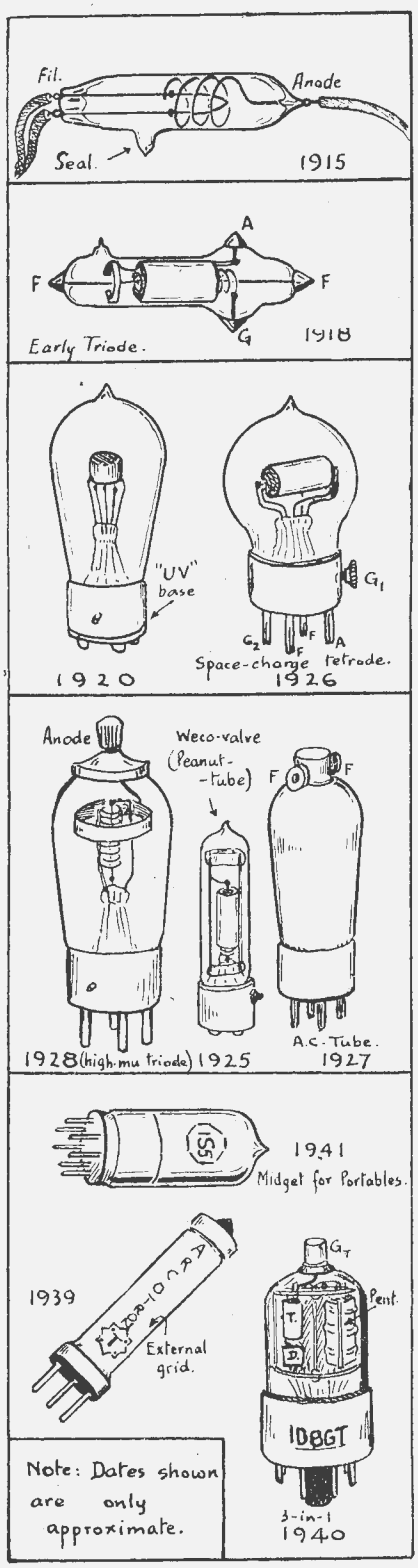
Drawbacks of Triodes

The triode valve suffered from several drawbacks. Capacity between the grid and plate was apt to cause unwanted oscillation in R.F. amplifiers. The amplification factor was limited (about 100 was obtained by some English and Continental makers).

Both these drawbacks were overcome by the placement of a second grid as a screen between the first, or control grid, and the plate. The increased amplification from this arrangement had been discussed before 1920, it was the reduction in grid-anode capacity that was important.

Just prior to the introduction of the screen-grid tube, there had been some low-capacity triodes such as the

(Continued on next page)



VALVES
(Continued)

"A430", which had the anode connection at the top, thus looking like its screen-grid successor, the A442.

Several years previously there had been a small amount of interest in a different kind of tetrode, the "space-charge" arrangement. Here, the second grid is used as a control electrode, the first being connected to a source of positive potential. These early four-electrode valves operated from exceedingly low plate voltages, as low as 3 to 9 volts. Connection to the first grid was usually made by a terminal on the side of the valve base. So far as I know there has been no attempt to add a screen grid to such a valve.

As amplification was more easily obtained, so the final valve in the radio became more often over-loaded and the demand for more power grew. In the good old days, an undistorted (?) output of about 20 milliwatts was ample, many people being satisfied with much less. Genuine "power" tubes such as the 171A were expensive to operate and contributed little to the amplification on distant signals.

The screen-grid valve was adapted for power amplification by the introduction of a third grid, placed between the screening grid (second grid) and the plate. The Mullard PM24, Philips B443 and Radiotron 33 enabled the battery set user to obtain increased power without terrific battery drain.

Just before the screen-grid valve was popular in Australia, the demand for electric sets had brought grey hairs to more than one radio designer. Valves for a.c. operation had been introduced, but were not outstandingly successful until the "227" (now called the 27) made its appearance. Previous tubes had featured separate a.c. connections at the top, extremely low filament voltage, etc., but had not caught on to any great extent. English designers produced a.c. operated screen-grid and pentode tubes (E442, MPT4 are examples) and American manufacturers followed with the 2½-volt equivalents, the UY224 (there had been a flutter around an "A.C.222") and the 2A5.

Since then, tubes have increased in complexity, sometimes by addition of grids up to a total of 6 grids or 8 electrodes, sometimes by having two or three valves in one glass envelope.

The metal envelope was rather a novelty, but its main virtues appear to be compactness and shielding. In Australia, only glass-enveloped tubes are made.

The Diagrams

The early diode and triode are notable for the alignment of electrodes. The 1920 triode was made by the General Electric Company (America). Its filament required 1.1 amp at 3.6 volts. Amplification obtained was about 8½ times. The 1926 tetrode had a 4 volt "dull-emitter" filament and operated from a H.T. supply of 4½ to 9 volts. The valve base was of metal. Grouped together are the A430 with a small, widely spaced, anode and anode top connection, the Wecovalve (the "peanut" valve) and an early a.c. tube. The lowest three are a 1.4 volt midget tube which will work from a H.T. supply of 45 volts, the German-made "Arcotron" with the "grid" sputtered on the outside and a 3-in-1, the ID8GT which combines a diode, triode, and output pentode and requires only .1 amp at 1.4 volt for filament supply.

Next month we hope to present the various stages in the making of a modern television tube.

RADIOMEN IN BRITISH ARMY

New Corps to Maintain Telecommunications Equipment

To avoid the duplication and overlapping of engineering services which have arisen in England, between the Royal Army Ordnance Corps and the Royal Engineers, a new Corps, which is known as the Royal Electrical and Mechanical Engineers, officially came into being recently.

In the past the R.A.O.C. has been responsible for ordnance stores, i.e., everything from guns to personal equipment of soldiers, and also for the engineering stores, including the technical maintenance of electrical equipment, instruments, wireless and line telecommunication equipment and radiolocation apparatus.

The new Corps will take over the supply, distribution and maintenance of all electrical and mechanical equipment other than the exceptionally heavy engineering equipment handled by the Royal Engineers.

A feature of the organisation of the modern army is the provision of facilities for the mainteannce of equipment in the first echelon or front line. So far as radiolocation apparatus is concerned, this will in future be serviced by Radio Maintenance Detachments of the R.E.M.E.

In the case of signals equipment, simple repairs are undertaken in the first echelon by Royal Signals personnel. The "permissive repair schedule" for this work has been laid down by the R.E.M.E. Where more detailed repairs are necessary equipment is returned to the second echelon (or support lines), where it will be undertaken by mobile wireless detachments of the new Corps. Where necessary, apparatus will, of course, be sent back to the telecommunications workshops in rear areas. Experience has shown that prevention is better than cure, and with this in mind "preventive maintenance" — regular tests of apparatus — will be undertaken by the new Corps in the second echelon.

The Telecommunications Division of the R.E.M.E. will deal with radiolocation apparatus as well as wireless and line communication equipment.

The personnel of the R.A.O.C. to be transferred to the R.E.M.E. includes Radio Mechanics, who wear the blue and red wireless flash and maintain radiolocation apparatus; Wireless Mechanics (who wear the white and blue flash); Armament Artificers (Radio and Wireless), who supervise workshops for their respective spheres; Radio and Wireless Maintenance Officers; and Ordnance Mechanical Engineers (Wireless), who will become Electrical and Mechanical Engineers, with the probable suffix "Tels." — the official abbreviation for telecommunications.

DUTCH STATION SABOTAGED

The powerful shortwave transmitter PHOHI at Kootwijk, which was one of the first high-power short-wave stations in the world, has not been transmitting since the beginning of August. The Dutch correspondent of "The Times" states that the Germans have arrested four Dutchmen who, it is said, committed on act of sabotage against a wireless transmitter, which is presumed to be PHOHI.

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GERMANY'S CLANDESTINE LISTENERS

In spite of the severe action taken by the Nazi authorities, it appears that many Germans have not revealed the existence of their receivers. From April, 1941, until March, 1942, the tribunals brought more than 1,700 actions against clandestine listeners; 1,482 of these have been sentenced, 40 to imprisonment and the others to fines of as much as 1,000 Marks.

ARE DEAF AIDS RADIO BUSINESS?

DEAFNESS has always seemed to be the Cinderella among what may be loosely termed diseases of function. Not only has it always been the butt of music-hall comedians but it has been, and still is, singularly ill-served in the matter of scientifically designed apparatus to relieve it and of qualified persons to "fit", supply and maintain such apparatus. The simpler defects of vision seem to be adequately dealt with by the optician. He holds a diploma recognised by the medical profession, and as well as supplying spectacles and other aids for defective sight, carries out tests to determine the nature of these defects. If he suspects serious disease, he will advise his customer to consult an oculist.

It has been suggested that a strictly comparable state of affairs might well bring about economy and efficiency in the distribution of hearing aids to sufferers from deafness. It is assumed that the aids would be produced cheaply on mass-production lines by the wireless industry and sold by the wireless dealer. A role comparable with that of the optician in the field of vision might then be fulfilled by a qualified "otician" (either the dealer himself or an assistant), who should possess not only a diploma recognised by the medical profession but also evidence of competency on the electro-acoustic side. It has been pointed out that it would be wasteful to train newcomers to the art where there already exists a large number of men with wide knowledge and experience in the second and more difficult part of the subject. But, in addition to that, they must know how to choose or adjust a hearing aid to compensate for the defects of hearing of the person with whom they are dealing, and must be able to distinguish one type of deafness from another. A brief outline of some of these latter aspects of the subject will be of interest to all radio technicians who may wish to concern themselves with what is likely to become a very important offshoot of their art.

How the Ear Hears

The ear is divided into three main portions, known as the outer, middle and inner ear. The outer ear consists not only of the shell-like collector of sound known as the auricle or pinna which is visible to us, but also of a short channel — the auditory canal — leading to the ear drum or tympanic membrane which the air waves of sound cause to vibrate. At the other side of the drum the vibrations cross the middle ear by purely mechanical means, there being three small bones or ossicles which transmit them to the inner ear, which consists of a spiral cavity shaped something like a snail's shell, from which it derives its medical name of cochlea. This cavity contains fluid, the degree of compression of which is varied by the incoming vibrations. In the cochlea, among other things which do not directly concern us, is the basilar membrane with which is associated a very delicate part of the ear anatomy which analyses the vibrations before they pass via thousands of small nerve endings up the auditory nerve to certain centres of the brain which interpret them as the sensation which is called sound.

Deafness Classified

Writing in the July, 1942, issue of Electronics, Ira Kamen points out that deafness may be divided into three main types, so far as hearing aids are concerned. The first of these he calls conductive deafness, which is, as its name suggests, associated with those parts of the ear where vibrations travel along to the cochlea, where, as already mentioned, they are converted to what may conveniently be called nerve pulses. The causes of this kind of deafness are many and varied, among them being thickening of the ear drum, and stiffening of the joints of the ossicles. Sundry types of illness, among which the common cold is prominent, are in most cases primarily responsible for the trouble, although of course, an accident may give rise to it. The main subjective symptom is a feeling that the ears are stuffed with cotton-wool. Probably most of us have been temporary sufferers from it at one time or another.

The second type of hearing defect, namely, nerve deafness, is due to trouble in the inner ear or cochlea where mechanical conduction ends and nerve transmission begins. Childhood diseases are frequently responsible and very often the trouble does not make itself evident until some years after the primary cause has passed away. In the case of sufferers from this type of deafness the hearing loss for low intensities of sound is relatively greater than for high. At high levels of sound the defective ear becomes practically as sensitive as a normal one and, at certain frequencies, what is known as the "threshold of pain" is reached far earlier than in the case of an ear not afflicted with this particular trouble. Anybody unfamiliar with this threshold need only don a pair of headphones and connect them across

(Continued on page 17)


Conserve your Valves-
LESS VALVES USED FOR DOMESTIC RADIO - MORE FOR DEFENCE
★
SELECT . . . your programmes and conserve your valves but . . . WHEN . . . a new valve is needed in your radio set insist on RADIOTRON
Radiotron
AUSTRALIAN-MADE RADIO VALVES

DEAF AIDS

(Continued)

the primary of the LS transformer of a receiver which is operating at full volume in order to become acquainted with it.

It will be evident that some form of amplification limiter is a desirable addition to a hearing aid designed for this type of deafness in order to prevent the threshold of pain being reached. But, since this trouble, like other types of hearing defects, usually varies considerably with frequency, the limiter must be a selective one and must, of course, be variable both in frequency and in amplitude adjustment in order that it can be adapted to the requirements of any particular sufferer. Another desirable feature is some form of negative feedback, as distortion greatly impairs the value of the hearing aid in practically all types of deafness, but more especially when the sufferer is advanced in years.

Cortical Deafness

The third type of hearing impairment is referred to as cortical deafness. It is characterised by the fact that although the ear may be in good condition there is failure to interpret the incoming sounds correctly, and the person concerned is said to suffer from a loss of the "language factor." It mostly affects old people and those who have experienced a stroke or other cerebral troubles. In popular parlance the sufferer is "slow in the uptake," so far as hearing is concerned, but it will usually be found that if addressed slowly and deliberately he will be able to understand perfectly well. The only way in which a hearing aid can assist here is in cases where this kind of deafness does not exist alone but is accompanied by one of the other types. It should, in fact, be pointed out here that for the most part one type of deafness seldom does exist completely on its own.

Cortical deafness is sometimes due to long-standing conductive or nerve deafness. What happens is that due to long neglect of these other types of deafness the brain centres suffer from loss of sound memory. In other words, sufferers forget how to hear, so that when the actual ear defect is relieved there arises a temporary form of hearing impairment known as confusion deafness. This trouble can be cured by exercising the hearing faculties for a period; this has the effect of re-educating the brain centres.

Before the sufferer can be supplied with the correct type of hearing aid the otician would apply tests analogous to those used by the optician in the case of defective eyesight. The process of testing has been widely developed in America. The first thing to be done is to decide which types of deafness is affecting the sufferer.

The principal tool in testing hearing is the audiometer, which, it its commonest form, consists of an oscillator calibrated in multiples of two in the audio spectrum. Its output can be varied in steps of 5 db. from the brink of audibility to the threshold of pain. It determines hearing losses up to 4,096 c/s quite accurately, but at 8,192 c/s it is less precise. Curves are taken both with the normal "air" earpiece and with a bone conductor, a compensated amplifier being used to counteract the peculiar frequency characteristics of the latter.

From the readings obtained, curves of the ear response are prepared and, apart from giving the frequency response of the deaf person's hearing faculties, a fairly accurate idea is obtained as to the type of deafness which is present. From what has already been said about conductive and nerve deafness it will be fairly obvious how the curves distinguish between them. If it is a case of conductive deafness a curve of ear response plotted against sound input at any given frequency will remain more or less level. In the case of nerve deafness, however, a point will be reached at which the curve will take a sharp upward turn. This will indicate that the ear response has started to increase out of all proportion to the sound input. Usually this upward turn of the curve will be indicated by the sufferer sharply removing the ear-piece as the threshold of pain is suddenly reached. Cortical deafness will not be revealed by this use of the audiometer, as the pure tones of the oscillator are readily interpreted by the brain, and to detect this type of deafness a speech test is employed, as has already been briefly indicated. From the curves it can be decided what the output of a hearing aid should be at various frequencies; also at what sound level, and at what frequencies, the amplification limiter should come into operation if its use is necessary.

A hearing aid consists virtually of three parts the microphone, the amplifier and the reproducer (earphone or bone conductor). Frequency compensation may obviously be brought about by varying the characteristics of one, two or all three in combination. It is usually more convenient to design two of the parts to provide a fixed characteristic as flat as is possible. The third part may be so designed that its characteristics can be readily varied, partly to compensate for any unavoidable defects of the other two, but mainly, of course, to compensate for the hearing defects of the person concerned.

Required Frequency Response

In general, it is suggested that the hearing aid should be designed to give normally as flat a response as possible between 500 c/s and 3,500 c/s. The response should be made to fall off below 500 c/s partly in order to minimise the rumbling noise of street traffic, but chiefly in order to permit the manufacture of a unit that is physically small and inconspicuous. The response above 3,500 c/s should be made to fall away in order to lessen background noises of the hissing type. The hearing aid must, of course, have a certain amount of response between 3,500 c/s and 5,000 c/s in order to reproduce the harmonics of speech. It should be emphasised that the above figures refer to the normal frequency response of the instrument, but this should be variable within wide limits to meet the needs of the particular sufferer concerned.

Bone conductors are fitted when severe conductive deafness is present. They act by mechanically short-circuiting the outer and inner ear and connecting the vibrations direct to the inner ear via the mastoid bone. The response of this instrument is such that, in order to compensate for it, it is usually necessary that it be fed with an input having a rising characteristic between 2,500 c/s/ and 5,000 c/s. This produces a flat output between 500 c/s and 3,500 c/s, and a teristic between 2,500 c/s and 5,000 c/s, which, as we have already seen is what is required from the hearing aid before it is corrected to suit the individual sufferer.

—"Wireless World," England

CHINA'S TRANSMITTERS

The Chinese Central Broadcasting Administration has established at Chungking the headquarters of the broadcasting service which now operates a dozen transmitters. The chief station is the medium-wave 75-kW transmitter XGOA, which has been transferred from Nanking at the present Chinese capital. Also situated at Chungking are two short-wave transmitters each of 35 kW There is also a 10-kW short-wave transmitter in the province of Kweichow, and a 60-kW mediumwave transmitter in the province of Yunnan. In addition there are low-powered regional stations in other provinces. The Chungking transmitting apparatus has been installed in bomb-proof shelters within the hills on which the city is built.

CAN THERE BE RADIO TO THE PLANETS?

THE mere fact that we are able to observe the light which is reflected from other planets shows that there is nothing to prevent an electro-magnetic wave traversing the space intervening between the earth and htose planets--or rather between the earth and the planetary atmospheres. For it must be noticed that this light — which originally comes from the sun — is not necessarily reflected by the surface of the planet itself, but may come from its outer atmosphere. Some planets have very dense atmospheres, others atmospheres of great rarity, while, in the case of Mercury, there is hardly any atmosphere at all. The spectra of some planets contain marked absorption bands, indicating that the light has penetrated the planetary atmosphere, the gases of which have caused absorption of certain frequencies. The light waves in these cases have probably reached the surface of the planets themselves. In other cass the planetary spectra are very similar to that of the solar spectrum, which would indicate either that the planet had no atmosphere, or that the light had been reflected from the outer part of the atmosphere itself.

Planetary Ionospheres

In some cases, therefore, though not in others, an electromagnetic wave —even one of such a high frequency as that of light — can penetrate the planetary atmosphere and reach the surface of the planet itself. And if a wave of light frequency can do this, why cannot also one of radio frequency? Where there is an atmosphere which is penetrable by the sun's rays there is probably also an ionosphere, brought into being by the action of the rays upon the gas molecules of the planetary atmosphere. And since the nature and distribution of the gases of planetary atmospheres differ from those of our own it is reasonable to suppose that the ionospheres of the planets — if they exist — would exhibit different characteristics from those of the terrestrial ionosphere. There is also the question of the intensity of the sun's rays at the planets to be considered in this connection. It is probable, therefore, that there may be planetary ionospheres which are impervious to different ranges of radio frequencies than those to which our own ionospheres is impervious.

It would appear to be possible, however, for a wave of radio-frequency to penetrate to the surface of a planet in some cases. The frequency used would have to be of such a value that the wave would easily penetrate both in our own ionosphere and that of the planet in question, and would not be greatly attenuated by absorption in either of these regions. So far as the terrestrial ionosphere is concerned these conditions are suited by a radio wave in the "ultra high" part of the spectrum — of a frequency of, say, 50 Mc/s or higher.

Is There Habitation?

In order to hold wireless communication, however, habitation of the planet by intelligent beings is implied in order that the communication may be two-way. This would rule out a number of the planets ,for it does not seem reasonable to think that intelligent beings could exist on those planets whose density is very low—in some cases is less than that of water. In other cases there are other reasons for thinking that habitation of the planet is improbable. But in a few cases — such as that of Venus and of Mars — the existence of intelligent life is not so highly improbable.

Attenuation and Absorption

The practicability of holding wireless communication with an inhabited planet is quite another matter, and does not at present appear to exist. When a radio wave travels outward from a transmitter — even when it is sent out in the narrowest possible "beam" — it gradually "spreads" out in direction at right angles to its direction of travel, so that it covers a greater and greaeer area the farther it advances. But the energy present in the wave front at a great distance from the transmitter is the same as it was when the wave front was near the transmitter, and, since the wave front covers a greater and greater area as it advances, the energy present at any one point in it becomes less and less the farther it travels. This weakening of the wave with distance travelled is called "spatial attenuation" and will occur even when no absorption at all is taking place.

Distances Involved

Considering the relatively great distances involved between the earth and other planets — 40 to 50 million miles is about the shortest distance— it is evident that spatial attentuation would be very great, and that colosal power would have to be used at the transmitter in order to overcome it and provide a workable signal — according to our standard — at the receiving end. A rough estimate indicates that a transmitter power of the order of 6,000,000 kW would be necessary in order to provide a radio field intensity of 5 microvolts per metre at the nearest planet in the absenc of any absorption. True the power necessary could be considerably reduced if a highly directional transmitting aerial array were used, but even so it would still be far in excess of that radiated by any existing transmitting station. So we may rule out the possibility of getting through to the planets at present.

As to whether there are any inexplicable radiations reaching us from outer space. no ionisation which is detectable by present-day apparatus occurs at the earth's surface which cannot be attributed either to cosmic rays, gamma ray radiation from the earth itself or to radioactive emanations in the atmosphere. The cosmic rays themselves are thought to be due to radiations occurring during the creation (or possibly during the disintegration) of atoms in interstellar space, and therefore, not to be associated with any agency on one of the planets. There may, however, be radiations reaching us which are of an entirely different character to those capable of being detected by existing apparatus.

—"Wireless World", England.

COUPLING

(Continued from page 9)

unless the output valves are directly coupled to the cathodes of push-pull drivers.

The AB2 or B transformer is usually step-down so that the primary offers a high impedance to the driver whilst the secondary is of quite low impedance (200 to 500 ohms).

References

"Wlreless World," August, 1942. (Transformer distortion).

"Australasian Radio World," January, 1941 (Various Push-Pull Circuits).

"Radiocraft," October, 1939 (D.C. Push-pull Amplifier).

LISTENERS CONDEMNED TO DEATH

The authorities at present governing Norway take more and more severe measures against those who listen to forbidden stations. Several of these "criminals" have been condemned to death, and not, as hitherto, only to forced labour.

THE LEAKY-GRID DETECTOR AT WORK

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

NEXT to the diode detector, now almost universally used in commercial receivers, the leaky grid system of detection is the most popular. Its most important advantage is that it is highly sensitive, while its main drawback is that it cannot handle large inputs. However, in most applications where it is used, power handling capabilities is of secondary importance, highest possible sensitivity being the main requirement.

Fig. 1 shows a single valve receiver using a triode as leaky grid detector. When a signal is applied via the grid condenser "C1," the grid potential changes in sympathy with it. The resistance "R" is the grid leak; this is generally returned to the negative side of the filament, though with some types of battery valves returning it to "A+" gives best all-round operation. With indirectly heated valves, the grid leak is returned to the cathode.

How Rectification Is Accomplished

In the leaky grid detector, rectification is made possible by the curvature of the grid-voltage, grid-current curve. A typical curve for a valve of the indirectly-heated variety is shown in fig. 1 (a). It will be noted that a tiny grid current, amounting perhaps to a microamp. or so, flows even when the grid is negative to filament. This is due to the fact that a few of the electrons leave the cathode with sufficient velocity to pass to the plate through the grid, despite the repelling force exerted by the latter.

This tiny grid current flows through the grid leak "R", the resultant voltage drop across it being such that the grid end is negative in respect to the filament. Thus the value of the grid leak (usually of the order of 5 megohms) governs the position of the operating point on the grid current curve. To ensure rectification, this point should fall on the curved portion, as shown at "X" in fig. 1 (a).

If a modulated radio frequency signal is now applied to the grid via "C1," the grid voltage changes in sympathy. Because of the bend in the grid current curve, the grid current increases more when the grid is positive than it decreases during the negative half-cycles of the alternating input voltage. Thus the negative half-cycles are largely suppressed, while the positive half-cycles are allowed to pass.

Cumulative Charging Effect

Each wave-train of high frequency alternations has a cumulative effect on the grid, as owing to the high resistance of the grid leak, a charge given to the grid by one high frequency impulse does not have time to leak away before the next comes along. Thus the constantly varying charge on the grid follows more or less faithfully the shape of the modulation envelope impressed on the radio frequency carrier at the transmitting station.

The result is a net change in the grid current — in this case as an increase. This increase in grid current means an increase in voltage drop across the grid leak, which in turn means an increase in negative bias applied to the grid. This has the changes.
effect of decreasing plate current. Thus, the audio grid current changes produce corresponding plate current

Detection And Amplification Combined

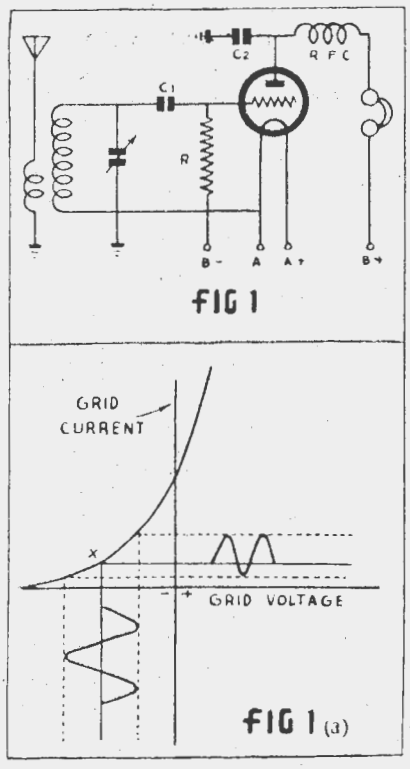
In a leaky grid detector, therefore, there are two effects. detection and amplification. The grid and filament (or cathode) can be regarded as a simple diode detector effecting rectification.

As well, the audio frequency voltages appearing on the grid as a result of this rectification directly influence the filament-to-plate electron stream, so that an amplified version of the audio frequency voltages developed on the grid appears across the plate load resistor, which in the case of fig. 1 is a pair of headphones.

Removing Unwanted R.F.

Condenser "C2" and the radio frequency choke "R.F.C." are included to remove unwanted radio frequency voltages that appear in the plate circuit of the detector. The reactance of the choke is such that while it is high enough to block r.f., it has no effect on audio frequency.

Also, the condenser "C2", which generally has a capacity varying from .0001 to .0005 mfd., allows the blocked r.f. impulses to pass unhindered to earth. At the same time ,a condenser of this capacity has far too high a reactance to permit audio frequency currents to pass freely through it.



Power Grid Detector

The power grid detector is an adaptation of the leaky grid detector, to allow bigger inputs without distortion. So that power can be developed, the plate voltage is increased to 150 or 200 volts, while the capacity of the grid condenser is reduced to .0001 mfd. A typical value of grid leak for this purpose is .25 megohm.

For sensitivity and power handling capability, this type of detector can be regarded as a compromise between the "C" bias and leaky grid types.

PLEASE NOTE—

Our Telephone Number

now is MA 2325

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY

OUR RUSSIAN ALLY

Moscow Radio announced that, commencing at 23 hours Middle European Summer Time (8 a.m. Sydney) from March 30, the following wave lengths would be used in European services: 28.72m, 31.65m, 25.36m, 42.98m, 40.76m, 40.21m, 41.81m, and 41.61m.

FREQUENCY DRIFT?

Dr. Gaden writes me he considers VUD-3, Delhi are much below their announced wave length of 25.45m. I find it hard, also, to reconcile their claim, making the wave length nearer 25.42m. Perhaps they are having a little crystal trouble; remember how CBFY, Montreal, wandered about — and did not know it for quite a while?

Another station in which Dr. Gaden and I agree seem to be off register, is WLWO, who we think are on 49.34 metres, although announcer states 49.5m.

TIME

Readers will please note that all times mentioned in these notes are Eastern Australian STANDARD time, but in all instances, unless otherwise mentioned, the stations were heard before Sunday, March 28.

With so many programmes directed to Australia it is only to be expected that changes will be made to conform to our alteration in time. Already I notice KWID and WGEO have announced they are putting some of their regular features back to enable us to hear them at the time to which we have become accustomed, and it is quite possible the BBC will do likewise.

With the change in season rapidly approaching, various frequencies may also be altered with little, if any, notice, so I will ask readers to be charitable and bear with us if any of the schedules shown are found to be incorrect.

STOP AND LISTEN

Time was, when most listeners to the short-waves were anxious to hear as many stations as possible and after making a note in the log book of a country heard, would twist the dial again in the hope of finding another. While this is certainly not to be discouraged, conditions today are very different. All stations consider they have a story to tell and various devices are used to encourage one to stop and listen. But do we need to go past "The United Nations Stations?" I don't think so, and if we want the truth, we know it is being given, and if entertainment is desired it is certainly available. Like the BBC "The Voice of America," is searching all the while to choose the best frequencies. The U.S.S.R. is renowned for their changes of frequency, but, my goodness, they have found some wavelengths that suit us. And China, I'm referring to Chungking, has got transmitters for almost any time of the day that reach us with splendid clarity.

But apart from news, the regular features from London such as "The Stones Cry Out," "The Brain Trust," "Science Notebook," "An English Village," etc., and "The Voice of America," regulars, "Hi Neighbour," "G. I. Jive," "Command Performance," "Cavalcade of Victory," "Are You a Genius?" and the many others compel us to Stop and Listen.

EUROPEAN BEAM REACHES AUSTRALIA

Heard WLWO, Cincinnati, 6080kc, 49.34m., closing at 8 p.m. with splendid signal. Considered the volume and clarity all the more remarkable when announcer stated, "Using European Beam antenna." Just before closing, news in Italian was given.

BERNE TESTS

Anxious to find a still further channel for broadcasts to Australia, we were advised by Consulate General of Switzerland, Sydney, to listen for a test on Tuesday, March 9 and Saturday, March 13, between 7.45 and 9.15 p.m. I tried hard on both occasions, but beyond a very weak female voice followed by a band on the Tuesday night, I could not distinguish anything. I am afraid another channel will have to be sought, but in the already crowded bands I cannot make a suggestion as to a suitable frequency. However, I am surprised they do not make use of the now defunct League of Nations transmitters, HBO 26.31m., and HBJ, 20.65m., which, on the first Sunday in the month, gave us fine signals on the Sabbath afternoons.

While talking about Switzerland, they can be heard at 11 p.m. on 25.28 metres. This is a special transmission for the Orient. News is given in German, Italian, French and Swiss, between 11 and 11.30 p.m. Station then closes and opens again at 11.45 p.m.

No. 1 GAGSTER MAY COME TO AUSTRALIA

Elsewhere is this issue is a photograh of Bob Hope, whose shows have been heard over KGEI on Wednesday evenings. This popular radio and film star will be heard in "America Talks to Australia," on Wednesday, April

14, at 1.10 p.m., through 2FC, 2NR, and 2CY. For those who miss this session it is repeated on Friday, April 16, at 9.10 p.m. on 2BL, 2NC and 2CR.

Hope was born in London, but was taken to America as a lad, where his family settled in Cleveland, Ohio.

Bob, even as a lad, was fond of Scotch jokes and his collection made him an authority on this kind of humour. His natural wise-cracking, together with this store of fun, got him a job in a motor organisation as a salesman. Bob says he was kept on because they needed a master of ceremonies at the salesmen's meetings.

Amusing wholesale people instead of amusing people wholesale gradually got him down, so he teamed up with a friend of his named George Byrne.

Hope went on and on until he appeared in New York and later signed up with RKO Films.

Bob's first really big success was in Paramount's "The Big Broadcast for 1938," in which he scored a sensation with Shirley Ross in the song hit, "Thanks for the Memory." He has appeared in several films with Bing Crosby, and one due shortly is "Road To Morocco."

And now that the country that has adopted him has gone into this war too, Hope has been lending his services to the Morale Division of the United States Government. Of all the motion picture and radio stars who have toured the camps of the armed forces, he is way out in front in popularity. Recently Mr. Hope returned from a tour of American outposts in Alaska, and if he has his way, he will be leaving shortly to entertain the boys in the South Pacific Islands and Australia.

Radio listeners will be the losers, temporarily, but the Commonwealth will gain, through the call-up of Austin Condon, of Laura, South Australia, to the R.A.A.F. For months Austin has been watching the postman, and at last the welcome instructions arrived. So now AW738 becomes AC2 and let us hope it will not be long before he is talking to the country he has so often listened to, and when he does speak that the good Australian expletives will be accompanied

This is the face ofa man who is wanted by every major film and radio studio in America for stealing show after show. He is their No. 1 "gagster"—Bob Hope——and he may be heard in an interview on April 14 on the popular series, "America Talks to Australia." Tune to 2FC, 2NR or 2CY at 1.10 p.m. Talk will be repeated on Friday, April 16, through 2BL, 2NC and 2CR.

—(U.S. Office of War Information Radio Photo.)

by some quick-fire and that tuning to their wave-length he will bring the "slant-eyes" down to "airth." I am sure all readers of these pages will wish Mr. Condon best of luck. In the letter that gave me the news he refers to KWY, 39.66 metres and WKRX, 38.40 metres, as being very good around 9.30 p.m. And in the mornings WGEO, 31.48 and WLWO, 31.28m., come in well at 11 a.m. with programmes directed to South America. Language used in Spanish and Portuguese.

AFH, Algiers, on 33.48m. was heard on March 18, at 4.50 p.m., with fair signal in French. This one is often picked up when American correspondents are talking to New York.

VERIFICATIONS

Several have waxed enthusiastic at having several verifications from the U.S.A., and have more or less poked boric at me for stating in February issue that The Office of Censorship in America had forbidden the export of verification cards. I think it is quite possible that the cards received have been laying in the Post Office over there for quite a while awaiting a boat to bring them over here. So while reports can still be sent there, I figure the chances are that it will be found the edict is in operation.

SOUTH AMERICA

I read in the "Sun" the other day of South America's prosperity, nad think portion of the same will interest readers.

"Producing nearly every raw commodity which the world demands, South America is now reaching a state of prosperity undreamt of when Britain first poured money into that continent to develop its rich resources. The list of products now coming from South America to help the United Nations covers cereals, animal products, oil, copper, tin, nitrate, molybdenum, coffee, rice, iron ore, bauxite, sulphur, bismuth aluminium, manganese, mercury, gold, silver, artificial silk, rubber and fruit."

Reason for mentioning this is that I feel certain we can expect South America to improve their short-wave outlets and I would not be surprised to hear any day of special broadcasts to this country. Therefore, as we are coming on to the season when the Latin-American stations can be heard, here are some that may be possible to tune-in. It does not include all the

(Continued on next page)

South Americans (Venezuela has been omitted) and the times are a guide to the schedules believed to be in operation. Any reports will be welcomed.

Argentina:
LRU, Buenos Aires, 15,280kc., 19.62m: 10.15 to 11.15 p.m.
LRX, Buenos Aires, 9,660kc, 31.06m.: 11.30 p.m. to 2 p.m.
LRS, Buenos Aires, 9300kc., 32.15m.: 11 p.m. to midnight.
LRA-1, Buenos Aires, 9688kc., 30.96 m.: 2.30 p.m. to 5 a.m. 6.30 a.m. to 7.30 a.m.

Bolivia:
CP38, Lapaz, 9480kc, 31.65m.: 11 p.m. to 1 a.m. Also around 7 a.m.
CP-5 La Paz, 6200kc, 48.39m.: Used to be heard around 9.30 to 10 p.m.
CP-2, La Paz,, 6110kc, 49.10m.: Around midnight and 7 a.m.

Brazil:
PRE-9, Fortaleza, Ceara, 15,165kc, 19.78m.
PSE, Rio de Janiero, 14,935 kc., 20.07 m.: Fridays, 7 a.m.
PSH, Rio de Janiero, 10,220kc, 29.35 m.
ZYB-8, Sao Paulo, 11.765kc., 25.50m.
PRE-9, Forteleza, 6105kc, 49.14m.
PRA-8, Recife, Pernambuco, 6010kc., 49.92m.

British Guina:
ZFY, Georgetown, 6080kc, 49.34m.

Colombia:
HJCF, Bogota, 6240kc, 48.08m.: Around 3 p.m.
HJCD, Bogota, 6160kc, 48.70m.: 2 a.m. and 8 a.m.
HJDE, Medellin, 6140kc, 48.86m.: Around 1 a.m.
HJFB, Manizales, 6105kc, 49.14m.: Around 2p .m.
HJFK, Manizales 6097kc, 49.21m.: 11 p.m. to midnight.
HJCK, Bogota, 6075kc, 49.38m.: 11 a.m. to 3 p.m.
HJFA, Pereira, 6054kc, 49.55m.: 1 a.m. to 4 a.m., 10.30 a.m. to 2.20 p.m.
HJKF, Bogota, 6018kc, 49.85m.: Around 2.30 p.m. "The Voice of Colombia signs off with a march and the "Indian Love Call."

Chile:
CE1180, Santiago, 11975kc, 25.04m.: 10 p.m. to 1 a.m. and around 3 p.m.
CE117, Valparaiso, 11.700kc, 25.64m.: Fair at 2 p.m.
CE970, Valparaiso, 9730kc, 30.82m.: Has been heard around 10.30 p.m.
CE960, Santiago, 9600kc, 31.25m.: Best on Sundays around 3 p.m.
CE1174, Santiago, 11,740kc, 25.55m.: 11 p.m. to midnight. 2 a.m. to 2.30 a.m., 9 a.m. to 3.30 p.m.

Dutch Guiana:
PZH, Paramaribo, 11,515kc, 26.05m.: This one used to be heard on Tuesdays and Fridays at 9.30 a.m.
PZX3, 5865kc, 51.15m.: According to schedule, 9.40 a.m. to 11.40 a.m. Before signing off 2 chimes are sounded and 3 gongs, and transmission ends with Dutch Anthem. Not likely this would be heard in Australia, but possible in New Zealand.

Ecuador:
HCJB, Quito, 12.460kc, 24.08m.: Heard at 8 a.m. and around 10 p.m.
HCJB, Quito, 9958kc, 30.12m.: Not as strong as 24.08m. English at midnight.
HC2ET, Guayacal, 9190kc, 32.64m.: Around 2.30 p.m.
HCIQRX, Quito, 5972kc, 50.23m.: Opens at 9.45 p.m.

Paraguay:
ZP14, Asuncion, 11,721kc, 25.60m.: Around 9 a.m. has been heard by Dr. Gaden.

Peru:
OAX4T, Lima, 9562kc, 31.37m.: From midnight to 1.15 a.m.
OAX5C, Ica, 9500kc, 31.58m.: 11 a.m. to 4 p.m.
OAX4J, Lima, 9340kc, 32.12m.: Heard around 2.45 p.m.

Uruguay:
CXA-10, Montevido, 11,900kc, 25.21m: Around 9 a.m.
CXA-14, Colonia, 11,825kc, 25.37m Around 7.30 a.m.
CXA-19, Montevideo, 11,705kc, 25.63 m: 10 to 11 p.m.
CXA-6, Montevideo, 9625kc, 31.17m: From 2 a.m. to 10 a.m.

NEW STATIONS

WKRD, New York, 9897kc, 30.31m: This Press Wireless station appears to have replaced WLIO and WHL-5 Open at 6.45 a.m. in foreign languages. English at 8 a.m. Great signal.
WOO, New York, 12,840kc, 23.36m: Heard in same programme as WGEO (31.08m) but closes at 8 p.m.
WGEO, Schenectady, 6190kc, 48.47m: A new Outlet for this popular General Electric Station. Heard well in late afternoon and signal good till about 6 p.m.
KRCA, San Francisco, 9490kc, 31.61m: Another out let for "The Voice of America." Very good in late afternnon.
WOO4, New York, 8760kc, 34.25m: This is reported to be one of the foreign outlets of the American service. Is heard nightly around 6.30 p.m. in French. Mr. Condon says is now on 8660kc, 34.54m. (I have not heard either—Ed.)
——Berne, 11,955kc, 25.09m: This seems a new outlet for this Swiss station. News in English is heard from 12.20 a.m. to12.30 a.m. Station then signs off in French and Italian giving frequency. Very weak. Signal is heard again at 3.10 a.m. in Swiss, French and Italian. (See also "Diary.")
VLI-9, Sydney, 7280kc, 41.2m: New transmitter used for special session to Australian Forces in S.W. Pacific from 7.30 to 8 p.m.
XGOY, Chungking, 7168kc, 41.85m: A new outlet from the Chinese wartime capital heard in parallel with XGOY, 49.01m. Good signal. English at 11.30 p.m. Reported by Austin Condon.

CHANGES IN FREQUENCY

VLI-3, Sydney, from 15,315kc, to 15,320kc.
VLG-4, Melbourne, from 11,835kc, to 11,840 kc.

BBC PACIFIC SERVICE

As from Monday 29th, the new schedule for Pacific Service is 3 p.m. to 7 p.m. Australian Eastern Standard Time, and the transmitters in operation are:
GSV, 17,810kc, 16.84m: 4.45 p.m. to 7 p.m.
GRD, 15,450kc, 19.42m: 5.45 pm. to 7 p.m.
GRE 15,390kc, 19.50m: 5 p.m. to 7 p.m.
GSF, 15,140kc, 19.82m: 3 p.m. to 7 p.m.
GSD, 11,750kc, 25.53m: 3 p.m. to 5.30 p.m.
GRG, 11,680kc, 25.68m: 3 p.m. to 7 p.m.
GRH, 9825, 30.53m: 3 p.m. to 6.30 p.m.
GRY, 9600kc, 31.25m: 3 p.m. to 4.30 p.m.
GSB, 9510kc, 31.55m: 3 p.m. to 7 p.m.
GRM, 7125kc, 42.13m: 3 p.m. to 6.30 p.m.

Some of the regular features are:—
3.45 p.m.—Programme announcements.
4 p.m.—Front Line Family.
4.15 p.m.—News.
5.30 pm.—Head Line News
6 p.m.—Radio News Reel
6.25 p.m.—London Calling.

BBC EASTERN SERVICE

Opens at 8.45 p.m. on GSV, 16.84m. GRD, 19.42m; GSF, 19.82m; GSD, 25.53m; I found signal good on GRD, but best on GSD.

At 10.15 GRE, 19.50m, is brought into play, but is a very poor signal at my listening post. News is given at 9 p.m. and 11 p.m.

Late listeners on Thursday can hear "Command Performance" at midnight. The one announced for April 1 was the Bob Hope show heard over 2FC on Sunday, March 28.

I think, probably later in the year, the BBC will bring GRP, 16.77m, and GRQ, 16.64m., into play.

ARE YOU A GENIUS

Here is a splendid session from "The Voice of America" stations WGEO 31.08m, and WKRX 38.4m. Conducted by Eddie Mayehoff from 9.45 p.m. till 10 p.m. on Fridays—Ed.

Verification has arrived from CRFX Toronto, 6070kc, 49.42m. This is the Roger's station and a letter accompanied the QSL card written by Alan E. Fraser, of the Control Room staff. He says, "Owing to wartime restrictions, conservations and priorities, we have curtailed the operating scedule of CFRX for the duration"—Perkins.
(Full call sign is CFRX-RB—Ed.)

HCJB, Quito, 12,460kc, 24.08m relays the news in English from KWID at 8 a.m. Time as announced from "The Voice of the Andes" is 6 p.m. Eastern War Time.—Perkins.

The MONTH'S LOGGINGS

ALL TIMES ARE EASTERN STANDARD TIME

Loggings only show Allied and Neutral countries.

Please have reports sent to L. J. Keast, 23 Honiton Avenue West, Carlingford, to arrive by 24th of month. Urgent reports 'Phone Epping 2511.

Australia:

VLI-3, Sydney .... 15,320kc, 19.58m Note slight change in frequency. 8.15 p.m. to 9.45 p.m. for Asia in Mandarin, English, Malay and Dutch. (See VLG-4 for times.) Not a good signal in Quilpie, (Gaden).

VLG-6, Melbourne, ... 15230 kc., 19.69m National programme from 10.45 a.m. to 12.30 p.m. Mandays to Saturdays.

VLG-7. Melbourne 15160kc., 19.79m National programme 5.30 a.m. to 7.10 a.m. Mondays to Saturday. Opens again at 6 p.m. with news till 6.18 p.m. each night. On Sundays programmes opens at 5.45 a.m. closing at 7 a.m. opens again at noon, closing at 1250 p.m.

VLI, Sydney .... 9615kc, 31.2m From 10 pm to 10.45 pm to Nth America (Eastern States).

VLR-3, Melbourne .... 11,880kc, 25.25m National programme from 12.45 a.m. to 5.25 p.m. Monday to Saturday. From 11.50 pm to 5.30 pm on Sundays.

VLI-2 Sydney .... 11,870kc, 25.27m 4.55 to 5.25 pm for British Isles.

VLG-4, Melbourne .... 11,840kc, 25.35m Note slight change in frequency. 8.15 p.m. to 9.45 p.m. far Asia; 8.16 to Chungking (in Chinese); 8.30 to Shanghai (in English); 8.50 to Batavia (in Malay); 9.15 to Batavia (in Dutch).

VLW-3, Perth .... 11,830kc, 25.36m 7.30 a.m. to 10.45 a.m.; 12.30 p.m. to 7.45 p.m. Relays W.A. National programme. Tune at 8.45 a.m. for BBC News.

VLR-8, Melbourne .... 11,760kc, 25.51m National programme from 5.30 a.m. to 9 a.m. Monday to Saturday from 5.45 a.m. to 11.45 Sundays.

VLG-3, Melbourne .... 11.71kc, 25.62m 3.10 p.m. to 3.45 p.m. to North America West; 3.55 p.m. to 4.40 p.m. to Tahiti in French; 4.55 p.m. to 5.25 p.m. to British Isles; 5.30 p.m. to 5.50 p.m. to New Guinea in Japanese; 6.25 p.m. to 7.25 p.m. to New Caledonia in French; 7.30 p.m. to 8 p.m. to Australian Farces in S.W. Pacific.

VLG-9, Melbourne .... 11,900kc, 25.21m From 12.15 am to 12.45 am for Asia in English.

VLN-8, Sydney .... 10,525kc., 28.51m Session to Nth America from 3.10 pm to 3.45 pm. Probably the best of all (Gaden).

VLQ-3, Brisbane .... 9660kc, 31.05m 5.30 am to 9 am; 10.45 am to 5.35 am Mondays to Saturdays. 5.45 am to 11.45 pm Sundays. R6 through the day, but a nasty surger (Perkins). 6

VLW-2, Perth .... 9650kc., 31.09m 8 pm to 12.30 am relays W.A. National programme.

VLG, Melbourne ..... 9580kc., 31.32m For Western States of North America from 1 am to 1.45am.

VLR, Melbourne .... 9580kc., 31.32m National programme from 5.45 pm to 11.30 pm. Gone off here at night this month (Perkins).

VLG-2, Melbourne . ... 9540kc., 31.45m For Eastern States of Nth America from 10 m to 10.45 pm. From 11 pm ti midnight to Saigon in French; 11.35 to Bangkok in Thai.

VLI-9, Sydney .... 7280kc, 41.21m 7.30 to 8 pm for Forces in S.W. Pacific.

VLQ, Brisbane .... 7240kc., 41.44m 6.50 to 10.30 pm Monday to Saturdays 5.45 pm to 10.30 p.m. Sundays. Slight whistle at 7 p.m. (Perkins).

VLI-4, Sydney ..... 7220kc., 41.55m Excellent when giving special programme for Forces in S.W. Pacific from 7.30 pm to 8 pm. Heard on March 18 at 8.45 to 9 pm (D.S. Time) on announced frequency of 7.28mc, 41.21m.—Ed.

Oceania:

New Caledonia:

FK8AA, Noumea . 6162kc., 48.68m From 5.15 pm to 7 pm with news at 6 pm. Closes 6.15 on Sundays. Still R7 at 5.30 pm (Perkins).

AMERICA

Central:

Costa Rica:

T14NRH, Heredia .... 9740kc, 30.80m Wednesdays, Fridays and Sundays: 1.30 pm to 2.30pm. Sametimes heard from 10 to 11 pm.

TIEMP, San Jose .... 10,050kc, 29.85m Said to be on air from 1 to 2 pm.

Panama:

HP5A, Panama City .... 11,700kc, 25.64m 11 pm to 1 am; 11.10 pm to 3 pm, No reports.

Guatemala:

TGWA, Guatemala City . 15,170kc, 19.78m 6 am to 8.15 am on Mondays.

TGWA, Guatemala City .. 9685kc, 30.98m 2 pm to 3 pm on Sundays. Signal will improve.

North:

WCRC, New York .... 17,830kc, 16.83m Bad on opening at 11 pm (Gaden).

WCB, Hicksville .... 15,580kc, 19.28m Heard with fair signal from 7.15 till 8 am, otherwise good signal spoilt by R7 morse.

KWU, Dixon .... 15,355kc, 19.53m 6.30 am to 8.15 am, News 6.30, 7, and 8 am. Very good signal.—Ed.

WRUW, Boston .... 15,350kc, 19.54m Excellent at midnight. Mostly foreign languages.

WGEA, New York .. .. .. 15,335kc, 19.57m 11.01 pm to 5.30 am.

KWID, 'Frisco .... 15,290kc 19.62m 7 am to 11.15 pm. News hourly on the hour.

WLWO, Cincinnati .... .. 15,250kc, 19.67m 11.30 pm to 3.30 am. Opens again at 7.30 for Latin America, closing at 9.45.

WBOS, Boston .... 15,210kc, 19.72m 11.01 pm to 2.45 am. News hourly on the hour.

WNBI, New York .... 15,150kc, 19.81m In parallel with WCRC, etc., is audible, but poor at 10.30 p.m. (Gaden).

WDO, Ocean Gate (N.J.) 14470kc, 20.73m 6.45 am to 8.45 am.

WOO, New York .... 12,840kc, 23.36m In parallel with WGEO, closing at 8 pm.

WRCA, New York .... 11,893kc, 25.22m Heard at 2 pm; fluttery (Hallett). From 9.30 pm, splendid but all in French (Gaden)

WBOS, Boston .... 11,870kc, 25.27m 3 am to 8.30 am. Sporting results at 6.45 News at 7. Think is on air around 10 pm—Ed. Is a real winner after 10.15 pm (Gaden).

WGEO, New York .... 11,847kc, 25.33m 11.01 am to 10 am.

WCDA, New York .... 11,830kc, 25.36m 4 am to 7.30 am.

WCRC, New York .... 11,830kc, 25.36m In parallel with WGEO, WCBX and WKRX, closes at 10.45 pm (Gaden).

WRUL, Boston .... 11,790kc, 25.45m 3.30 am to 8.30 pm. News 6 and 8 am.

WLWO, Cincinnati ...., .. 11,710kc, 25.62m 3.15 am to 7.15 am. Good at 7 am.

KWV, Dixon .... 10,840kc, 27.68m 4 pm to 6.30 pm. Sporting results at 5.45 pm. Closing at 6.30 pm. Is probably the strongest Yank of all (Gaden).

KES-3, 'Frisco .... 10,620kc, 28.25m 2 pm to 8.15 pm.

WKRD, New York .... 9897kc, 30.31m 6.45 am to 9.15 am. Also heard closing at 10.30 pm.

WDL, Ocean Gate (N.J.) .... 9750kc, 30.77m 6.15 am to 9.15 am

WRUW, Boston .... 9700kc, 30.93m 4.45 am to 10 am. News 6 and 8 am.

WNBI New York 9670kc, 31.02m 7.15 am to 6 pm. News 7.45 am. Heard in Italian at 8 am (Gaden).

WGEO, New York .... 9650kc, 31.08m 7 pm to 10 pm. News is every hour on the hour.

WLWO, Cincinnati .... 9590kc, 31.28m 10 am to 2 pm. News 10.30.

KWID 'Frisco .. .... 9570kc, 31.35m 11.30 am to 8.15 pm. News every hour on the hour. Sporting results at 5.45 pm. Excellent from 5 pm till closing (Re-opens at 8.30 pm on 41.49m.—Ed.) Great signal (Gaden, Maguire).

WGEA, New York . . . . 9550kc. 31.41m Heard with fair signal around 7.30 am.

WGEO. New York .... 9530kc, 31.48m 5.45 am to 7.15 am. News at 6 and 7.

KRCA 9490kc, 31.61m

(Continued on next page)

LOGGINGS

(Continued)

At 5 pm was heard carrying same programme at WGEO, 48.47m.

WCL, New York 9390kc, 31.95m
Not too good at 8 am, but very nice in Portuguese. Closing 9 am (Gaden).

KES-2, 'Frisco 8930kc, 33.59m
8.15 pm to 11.30 pm.

WOO4, New York 8760kc, 34.25m
This is a new American outlet and appears to use French language. Mostly heard around 6.30 pm.—Ed. Not a great success, clearer but weaker than TPZ-2 (Gaden). (Dr. Gaden's Algiers station now uses call sign AFH-2.—Ed.)

WKRX, New York 7820kc, 38.4m
Has replaced WBG-4. Heard in parallel with WGEO from 7 pm to 10 pm. Great signal (Gaden).

KWY, 'Frisco 7565kc, 39.66m
6.45 pm to 9.5 pm. My favourite (Gaden).

KGEI, 'Frisco 7250kc, 41.38m
3 pm to 4.05 am. News on the hour. Has improved a lot (Gaden).

KWID. 'Frisco 7230kc, 41.49m
8.30 pm to 11.30 pm. News hourly.

WGEO, Schenectady 6190kc, 48.47m
New transmitter for this General Electric Station. Heard well in late afternoon.

WBOS, Boston 6140kc, 48.86m
Heard from about 6 to 8 pm. English every hour on the hour.

WLWO, Cincinnati 6080kc, 49.34m
5 pm to 8 pm. Announcer states 49.5m but this is hard to reconcile. Dr. Gaden has also heard them announce 49.5m.

WRUS, Boston 6040kc, 49.67m
4 pm to 8 pm.

Mexico:

XEFT, Mexico City 9550kc, 31.40m
Heard just before closing at 3 pm on some days.

XEWW Mexico City 9503kc, 31.57m
3 pm to 3.45 pm. Good in afternoons and is heard some nights at 10.30 pm.

South America:

Chile :

CE1170, Valparaiso 11,700kc, 25.64m
Fair at 2 pm.

CE970, Valparaiso 9735kc, 30.82m
Only fair about 9.30 pm.

CE960, Sontiago .... 9600 kc 31.25m
Best on Sundays around 3 pm.

Ecuador:

HCJB, Quito 12,460kc, 24.08m
Heard at8 pm.

HCJB. Quito 9958kc, 30.12m
9.45 pm to 11.45 am; 2.30 am to 5.30 am; 8 am to 12.45 am. Slogan: "The Voice of the Andes."

THE EAST

China:

XGOX, Chungking 15,195kc, 19.74m
No report.

XGOY, Chungking 11,900kc, 25.21m
4.30 am to 6 am; 8 am to 9.30 pm. News 8 pm.

XGOA, Chungking 9720kc, 30.86m
4.30 am to 6 am; 9 pm to 1 am. News at midnight.

XGOY, Chungking 9625kc, 31.25m
Irregular broadcasts to U.S.A. at 10 pm.

XGOY. Chunking 6130kc, 48.92m
7.30 pm to 2.30 am. News 10.30 pm; 12 am, 12.30 pm, and 2 pm. Excellent signal. —Ed.

India:

VUD-3, Delhi 15,290kc, 19.62m
1.30 pm to 7.30 pm. News 1.30 and 5 pm, 8.30 pm to 10.15pm. Good afternoon and night (Maguire).

VUD-4, Delhi 11,840kc, 25.34m

VUD-3, Delhi 11,790kc, 25.45m
8.30 pm to midnight. News 10 pm. Wonderful signal from 11 pm when its gives news and commentary (Gaden).

VUD-3, Dehli 9670kc, 31.02m
8.30 pm to 11 pm; News 10.30 pm. At 10.30 pm announces "This is the United Nations calling."

VUD-2, Delhi 9590kc, 31.28m
9 pm to 2.30 am. News 10 pm and 10.50 am. R5 at 9 pm (Gillett).

VUM-2, Madras 7270kc, 41.27m
Heard well after midnight.

VUD-4, Delhi 7260kc, 41.32m
Midnight to 4 am. (Good, Gillett).

VUC-2, Calcutta 7210kc, 41.67m
Splendid here at 9.30 pm. Nearly up to Yank form (Gaden).

VUC-2, Calcutta 4840kc, 61.98m
Gives English late at night.

VUM, Madras 6150kc, 48.78m
8 pm to 1.30 am. News 10 pm. Good at 1 am in Hindustani (Condon, Gillett).

VUD-4, Delhi 6130kc, 48.94m
Midnight to 4 am.

VUC, Calcutta 6010kc, 49.92m
9 pm to 4 am. Good in Hindustani at 10.45 pm. News in English at 11 pm. Good at 3 am in native programme.

VUM-2, Madras 4920kc, 60.98m
Heard from 10.30 pm till 12.30 am.

GREAT BRITAIN

"This is London Calling"

GSH 21,470kc, 13.97m
8.45 pm to 1.15 am. Fair at 9.10 pm. (Gillett, Condon) (Not audible here now. —Ed.)

GVO 18,080kc, 16.59m

GRQ, ... 18,030kc, 16.64m
8.45 pm to 1.15 am. Heard nightly, good (Ferguson).

GRP, ... 17,890kc, 16.77m
Not reported.

GSV, ... 17,810kc, 16.84m
4.45 pm to 7 pm; 8.45 to 11.15 pm; 1.30 am to 4.15 am.

GSG 17,790kc, 16.86m
Not reported

GRA 17,715kc, 16.94m
Fair, some nights after midnight (Condon).

GRD, ... 15,450kc, 19.42m
5 pm to 7.45 pm; 8.45 pm to 11.30 pm. Excellent signal. Excellent in night session. Announcements at 8.45 pm.

GRE, ... 15,390kc, 19.49m
5 pm to 7.45 pm; 10.15 pm to 1 am; 1.30 am to 5 am. Heard nightly, Good (Ferguson).

GSP, ... 15,310kc, 19.6m
3.45 pm to 7.45 pm; 8 pm to 8.30 pm.

GSI 15,260kc, 19.66m
8.45 pm to 11.15 pm; 1.30 am to 6.45 a.m.

GSO 15,180kc, 19.76m

GSF 15,140kc, 19.82m
3.45 pm to 7.45 pm; 8.45 pm to 1.15 am; 1.45 am to 3.25 am

GRF 12,095kc, 24.80m
4.30 pm to 8.30 pm. Good at 6.45 pm.

GRV, ... 12,040kc, 24.92m
3.45 pm to 6.45 pm; Mr. Condon reports good signals at 2.10 am.

GSE 11,860kc, 25.29m
1.30 am to 6 am; 6 am to 7 am.

GSN 11,820kc, 25.38m
8.30 pm to 1.30 am; 5 am to 6.45 am. Good at midnight (Goard). Good in English in African service at 4 am. (Condon).

GSD 11,750kc, 25.53m
3.45 pm to 4.45 pm; 8.45 pm to 1.15 am; 1.30 am to 6.45 am; 7.15 am to 3.45 pm.

GRG, ... 11,680kc, 25.68m
3.45 pm to 7.45 pm; 5 am to 6.45 am; 7.15 am to 2.45 pm. Splendid in evening session (Gaden).

GRH 9825kc, 30.53m
3.45 pm to 6.45 pm; 7.15 am to 2.45 pm; good in both sessions. Wonderful at 6.30 (Gillett).

GRX 9690kc, 30.96m
4.30 pm to 8.30 pm; 8.30 pm to 1.30 am; 2 am to 8 am. This transmitter is used for European Service.

GRY, ... 9600kc, 31.25m
3.45 pm to 4.30 pm; 3.30 am to 6.45 am; 7 am to 8.45 am; good signal in all schedules.

GSC 9580kc, 31.32m
2 am to 7 am; 7.15 am to 2.45 pm. This latter session intended for Nth America will shortly be heard right through.

GSB 9510kc, 31.55m
3.45 pm to 7.45 pm; 8.45 pm to 10 pm; 11.30 pm to 1.15 am; 1.30 am to 3.15 am; 3.30 am to 7 am; 7.15 am to 8 am.

GRU 9455kc, 31.75m
4.30 pm to 8.30 pm.

GRI 9415kc, 31.86m

GRJ, ... 7320kc, 40.98m
2 am to 8 am (foreign languages)

GSU, ... 7260kc, 41.32m

GSW 7230kc, 41.49m
2 am to 8 am (foreign languages).

GRK 7185kc, 41.75m
R5 at 5.30 pm in home service, heard irregularly (Perkins).

GRT 7150kc, 41.96m
4.30 pm to 8.30 pm.

GRM 7125kc, 42.11m
12.45 pm to 2.45 pm; 3.45 pm to 6.45 pm. Cannot understand why they cut off at 6.45 as at this hour are better than GSB (Gaden).

GRS 7065kc, 42.46m
4 am to 8 am; 1 pm to 2.45 pm; Good with programme for the Forces at 6.30 am. (Condon).

GRN 6195kc, 48.43m
4.30 pm to 8.30 pm; 7.15 am to 2.45 pm; Good on opening in Nth American service at 7.15 am on most days.

GRO 6180kc, 48.54m
3 am to 7.45 am. Heard well and also again from 5 pm to 7 pm.

GRW, ... 6140kc, 48.86m
R6 in Home Service at 6 pm (Perkins).

GSL 6110kc, 49.1m
4.03 pm to 8.30 pm; 2 am to 8 am; 8.45 am to 2.45 pm. Quite good some mornings. —Ed. R4-5 at 5.20 pm. (Perkins).

GRR 6080kc, 49.34m
4.30 pm to 8 pm.

GSA 6050kc, 49.59m
4.30 pm to 8.30 pm; 2 am to 8 am, another European Service.

GRB 6010kc, 49.92m
Not reported.

GRC 2915kc, 102.9m
This one has not been reported. Understand is used for broadcasts to Canada and U.S.A. in both N.A. and African services (Clack).

EUROPE

Italy:

Vatican State:

HVJ, Vatican City 15,120kc, 19.84m
1 am to 1.20 am on Wednesdays; 7.30 pm to 8.05 Sundays.

HVI, Vatican City 5969kc, 50.26m
4 am to 6 am; talk daily except Mondays at 5.15 am. Good at 4.30 (Gillett).

HVJ, Vatican City 9660kc, 31.06m
Fair signal in P.O.W. session at 2 am. directed to the British Isles. (Condon, Gillett)

HVJ, Vatican City 11,740kc, 25.55m
5 pm is best time for this one, when it is strong (Gillett). R6 at 3 pm. Perkins).

Portugal:

CSW-6, ... 11.040kc, 27.17m
4 am to 8 am; Audible till just before 7 am. R5 at 5.30 am (Perkins).

Russia:

——,Moscaw 15,745kc, 19.05m
9.30 pm to 10.20 pm. News and talks to Great Britain. Fair signal.

——, Moscaw, ... 15,228kc., 19.7m
7.15 am to 7.40 am; news 7.25. Opens again at 8.47 am with war bulletins. English throughout. News and talks again from 1,15 to 1.40 pm.

——, Moscaw 15,110kc,, 19.85m
Some schedule as 19.7 and signal in afternoon slightly better.

——, Moscow 12.190kc, 24.61m
Heard opening at 6.30 pm (Gaden). Splendid signal at 8.20 pm.—Ed.

Leningrad Radio Leningrad 10,807kc, 27.76m
Mr. Condon says: "After a lot of trouble I finally identified this one. Gives the news in German at 11 pm. Closes at 11.37 pm.

——, Moscow 10,445kc., 28.72m
One of the best signals on the air at 9.35 pm with Kremlin Bells at 9.40 pm. Special news and talks to Great Britain and America.

——, Moscow 9870kc., 30.4m
8.15 pm to 9.25 pm. Talks and music.

——, Moscaw 9765kc, 30.72m
1 am to 2 am. News 1 am. Good with English commentary at 1 am.

——, Moscow 9545kc, 31.43m
9.40 pm to 10.20 pm.

Siberia:

RW-15, Khabarovsk 9566kc, 31.36m
5.50 am to 7.30 am. Physical exercises at 6.15 am; 6 pm to 11 pm. R8 to 9 at 6 pm (Perkins).

——, Khaborovsk 5910kc, 50.76m
8 pm to midnight.

Spain:
EAQ, Madrid ..... 9860kc, 30.43m 4 am to 5 am; gives news at 4.5 am. Signal is fair and from end of news till closing in Spanish

Switzerland:
HER-6, Berne .... 15,305kc, 19.60m Said to be heard between 6.45 pm to 8.15 pm; but not audible at Carlingford.
——, Berne .... 11,955kc, 25.09m 12.20 to 12.30 am. Also heard again at 3.10 am. See "New Stations."
HER-5, Berne ... . 11,865kc, 25.28m This transmitter is used for special broadcasts to Nth America from 11.45 am to 1.15 pm, but is heard in Sydney at 11 to 11.30 pm.
HER-3, Schworzenburg .... 6165kc, 48.66m 4 am to 8.05 am; 3.20 pm to 4.40 pm.

Scandanavia:
SBT, Stockholm .... 15,155kc, 19.8m 1 am to 2 am. News 1 am.
SBP, Stockholm .... 11,705kc, 25.63m 3.56 am to 4.15 am; 5.40 pm to 6.30 pm; and on Sundays 6 pm till 11 pm.

MISCELLANEOUS

Arabia:
ZNR, Aden .... 12,115kc, 24.77m 2.15 am to 3.30 am. Gives identification in English at ZED-N-R every 15 minutes.

The following was omitted from March issue, but times shown are Eastern Standard Time.

Canada:
CFRX, Toronto .... 6070kc, 49.42m Heard some night at 11 pm. Interfered with by nearby station (Condon). (May be VUY-2, Dacca, 49.39m or YV5RU, Caracas, 49.42m.—Ed.)
CBFY, Montreal .... 11,705kc, 25.63m 9.30 pm to 1 am. Generally 11.30 before audible. Call sign given at 11.30 states CBM and Short-wave CBFY. Signal weak News midnight and 1 am. Haven't heard this for quite a while (Perkins). (Not heard here at present.—Ed).

Iceland:
TFJ, Reykjavik .... 12,235kc, 24.52m Definitely identified when listening with Wally Young. Operates from 3.15 pm to 4 pm. Fair signal usually. All Danish programmes. Short anthem played on opening. "Reykjavik" is mentioned on opening. Announcer has high-pitched voice. (Condon). (Gillett). Dr. Gaden says hear them OK, but no anthem when I'm listening.

Iran:
EQB, Teheran .... 6185kc, 48.5m 4.30 am to 6 am. News 5.15 am.

Syria:
FXE, Beirut .... 8035kc, 37.34m 1.30 am to 6 am, news 3.20 am. English session at 2 am. "God Save the King" is played at the end of English session (Gillett).

Turkey:
TAQ, Ankara .... 15,195kc, 19.74m 7.30 pm to 8 pm. Listen for flute notes just before opening (Gillett).
TAP, Ankara .... 9460kc, 31.7m 1 am to 5.50 am, news 4.15 am. Excellent signal right up till closing—Ed.

West Indies:

Cuba:
COCY, Havana .... 11,740kc, 25.55m English from 2.30 pm to 3.45 pm.
COK, Havana ..... 11,623kc, 25.83m Fair at 7.15 am with English and Spanish announcements (Condon).
COCH, Havana .... 9435kc, 31.80m Heard at 9.45 pm on some nights. R4 around 10 pm. Perkins).
COBC, Havana ..... 9365kc, 32.05m Good signal at 8 am (Perkins). R5 at 11 pm (Gillett).
COCX, Havana .... 9270kc, 32.36m Good at 10.15 pm. (Rogers, Maguire, Condon)
COCQ, Havana .... 8850kc, 33.9m 8.20 pm to 12.15 pm English at 9.45 p.m. One of the regular Cubans. Good strength at 10.30 pm (Gillett, Perkins). Gives call sign at 8.28 pm.

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

R.G.D. (Malvern) says that since he has shifted, there is more hum in his set and wants to know why.

A.—Possibly you are now on a different kind of a.c. distribution. In some districts, the return wires are deliberately earthed and the polarity of the supply to the set may determine whether or not there is hum. In other districts there is no earthed lead. Try changing over the wires in the a.c. plug if it is of the polarised, or 3-pin type. Another idea is to provide a good earth for the set.

A third possibility is that there are unshielded mains wires close to your present location of the receiver and the hum is being directly picked up. Careful shielding of valves (and of the entire set) will eliminate that, and, of course, there is always the possibility that your set was damaged during shifting — a pigtail electrolytic may have come adrift, or maybe a grid clip is making only a very poor contact.

★

C.W.T. (Epping) has a powerful battery set with two I.F. stages. He wants to amit one I.F. stage to save H.T. current.

A.—Omitting the second I.F. stage will certainly save current from the L.T. supply (aircell, accumulator or 1½ volt dry battery) but it will have no appreciable effect on the droin from the high-tension or "B" battery. The reason for this is as follows: The omission of an I.F. stage lowers the gain to about one-fiftieth of its original value, and so a smaller signal is fed to the second detector ond A.V.C. tube. To counteract this reduction in signal, the A.V.C. action comes into play, reducing the negative bias on the remaining I.F. stage (and on the R.F. stage, if any) in an attempt to increase the gain. The reduction in bias causes the remaining I.F. stage to draw more H.T. current. If it's a very powerful local station, the drain on the H.T. supply might even increase! To keep your B battery drain to a minimum we suggest a slight increase in bias on the output stage and the use of a longer aerial (so that the A.V.C. provides plenty of bias).

★

A.G.D. (Manangaton) has an amplifier, said to be push-pull. One output tube glows a bright red inside the plate and gives no power.

A.—It sound very much as if one of your output tubes is a pentode or beam tube with no voltage on the anode (plate). This is probably due to a breakdown in one side of the speaker transformer: When the anode is not positive, the entire cathode current lands on the screen-grid making it very hot (it may have melted it). As to the cause of the breakdown, it is rather difficult to say. If there is a condenser between each anode and the chassis then probably one of these has broken down. Other possibilities are overloading of the transformer due to insufficient bias or too high an effective load for the valve.

★

G.A.A. (Timboon) wants to fit a tone-control to the "Radio World" 4-watt amplifier.

A.—A suitable circuit is printed on this page. It consists of a small condenser .003 to .005 microforods in capacity and voltage rating of 600 or over. A mico condenser would do. The voriable resistor is a "potentiometer" with only two of the three lugs connected. The centre lug goes to a solder lug screwed to the chassis, whilst one of the outside lugs goes to one side of the condenser. The other side of the condenser goes to the anode (or plate) of the first valve, which is probably a 6J7G or 6U7G. For other types of tone-controls we refer you to past issues of "Radio World."

★

W.B. (no address) wants data on winding a speaker transformer to match a 4 ohm voice coil to a valve requiring 5,000 ohms load.

A.—You're an optimist. However, if you can get the material, try this:—

For the core, get lengths of soft-iron wire (as thin as possible) or very narrow strips of sheet-iron, length about 4½ inches, and enough to make a bundle 1 to 1¼ inches in diameter. Wrap a couple of layers of adhesive tape over the central inch of the core and over that wind 3,000 turns of 38 gauge enamel wire for the primary. Then comes onother layer of adhesive tape ond 85 turns of 22 to 26 gauge wire for the secondary. After wrapping the secondory, the ends of the core are folded over ot each end to complete the magnetic circuit. The core-ends should at least touch and preferably overlap slightly. The entire transformer could be covered with empire tape, or mounted inside a tin can with transformer compound. Such a transformer has a power-handling capacity of about 7 watts with reasonable fidelity.

The core could be made up from the cores of two old Ford spark coils. Wire for the primary could come from a burnt-out field coil of the 1500 to 2500 ohm type. Two important points are: Correct number of turns, good insulation.

Note !

BACK NUMBERS

On and after April 15 the special offer of back numbers at reduced price will be withdrawn, and all back numbers available will be supplied only at 1/— each, post free.

22-WATT AMPLIFIER

(Continued from page 6)

crescendo in a rousing march is really glorious when there is plenty of power, but only when.

Another Amplifier

Later, a less compact amplifier with more power was built up with a less complicated circuit and no A.V.C. or A.V.E. The output stage consisted of four 6B5 tubes in push-pull parallel, giving 40 watts. These tubes are unobtainable at present, but four type 42 tubes could be used in class AB2 to give about 35 watts. The circuit features high and low tone controls. If you are interested, write and let us know.

References to Amplifiers in "Radio World"

Feb., 1941: Compensated Acoustics. sion.

May, 1941: Amplifier with Expan-

Nov. 1941: Handy 12-Watt Circuit.

Feb., 1942: Victorian Championship Amplifier.

April, 1942: Hi-fidelity Amplifier.

March, 1943: Choice of Output Valve.

OLD-STYLE VALVES AVAILABE

It has been brought to our notice that, contrary to expectations, many types of old-style valves are still available. We have a note from Mullard—Australia Pty. td., to say that they have small stocks of the following valve types, and these can be readily obtained through any radio dealer:—

Type	Equivalent
PM1HL—UX base	(B217)
PM1HL—English base	(B217)
PM2A—EB base	
PM2B—J base	(B240)
PM2BA—J base	
PM3—UX base	(A409)
PM4—UX base	(B406)
PM4—EB base	(B406)
PM4DX—UX base	(A415)
PM12A—UX base	(B242)
PM12M—UX base	(B255)
PM12M—English base	(B255)
PM14—UX base	(A442)
PM22A—UY base	(C243N)
PM24—UY base	(B443)
PM24A—EBO base	(C443)
PM243—UY base	(D243)
PM244V—UY base	(E424)
S4V—UY and O base	(E442)
S4VA—UY base	(E442S)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PERFORMANCE begins on
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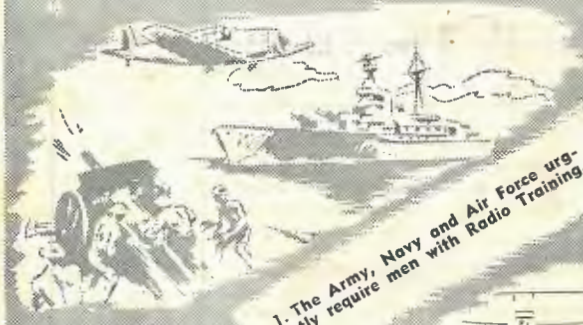

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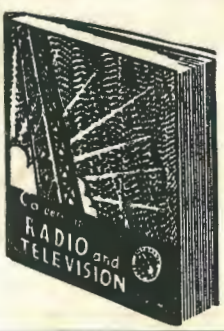

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