THE AUSTRALASIAN

Radio World

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Super Amplifier 15

Lane 58

Prize contest for design of circuit for utility receiver.

Details of how to build or repair an electric soldering iron.

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EDITORIAL

The prize contest announced in this issue is something considerably more than a mere essay contest. It has two major objects in addition to the worthy one dealt with at greater length in the announcement; the production of a standard circuit to relieve the pressure on design engineers.

The first additional object is to provide suitable editorial matter, which is a great difficulty in these times of shortage of manpower. Technical radio has a most important role in the war effort and "Australasian Radio World" has its place in technical radio, yet we agree with manpower authorities that its publication should be carried on with as little drain on the manpower supply as is reasonable. Hence, if some radio enthusiasts can devote their leisure to indulging in a little journalism, it is going to be an indirect assistance to the war effort.

The second additional object is to give us some guidance as to the prospects of securing the services of a suitable technical editor for a vast expansion programme which is ready to come into action immediately victory has been accomplished. The prospects of post-war radio are truly vast, and for our part we have laid our plans to maintain a position right out on the top of technical radio developments.

Our choice of a suitable person for the congenial position of technical editor will be largely governed by the merit of technical articles contributed between now and then.

—A. G. HULL.

IN WAR— NO LESS THAN PEACE

R.C.S. have not — and never will —lose sight of the fact that amateur construction and experiment is important in war no less than peace. Many servicemen now operating in forward areas recognise with confidence the familiar R.C.S. brand with which they experimented in their civilian days. Many enthusiastic young constructors of today are the wireless operators and signalmen of the near future.

R.C.S. are proud to acknowledge their debt to that band of never-tiring "hams" and constructors whose constant acceptance of R.C.S. improvements has enabled the company to reach their present unexcelled standard of radio component manufacture.

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THE HISTORY OF PIEZO CRYSTALS

THE past decade has witnessed the wide acceptance of Rochelle salt crystal products in the fields of broadcasting, communications, sound recording and reproduction, and public address. These crystal products generally have taken the forms of phonograph record cutters and phonograph pickups, microphones and earphones and are found in the home, school, studio and auditorium.

Many Applications

Other crystal products which have found considerable use in the fields of science, industry and medicine are: the Surface analyser, the direct-inking oscillograph, several types of vibration pickups, a fluid pressure pickup, electral stethoscopes, and reflecting-type galvanometers. The surface analyser and direct-inking oscillographs are playing vital roles in the present war effort. The former for the instantaneous and permanent recording of surface smoothness (in millionths of an inch) of highly finished aircraft and automobile engine parts; the latter for recording vibration and noise in engines and for recording dynamic strains.

Commercial Development

Many applications of Rochelle salt crystals can be found in the business office, being employed in inter-office communication systems, paging systems, "one hour per side" disc recording equipment, and dictating machines.

All of those products have been made commercially possible through the extensive research and development work accomplished in the past few years which has resulted in a highly improved method of growing rochelle salt crystals and fabricating crystal elements from such crystals.

History of Development.

Piezo-electricity or pressure electricity, as exhibited by rochelle salt, appears to have been perceived first by Coulomb about 1780. Work started forty years later by Becquerel, led to his report in 1833 of the measurement of the piezo-electric effect in various substances.

Radium Pioneers

The Curies, who later pioneered in radium research, were chiefly interested in the relationship between piezo-electricity and pyro-electricity (electricity from heat (and in 1880 published the results of their work with quartz in connection with the determination of the amount of electricity generated by unit pressure along various axes of the substance. The following year, Lippman predicted that if quartz were subject to an electrostatic field, a deformation would result. Later this was experimentally confirmed by the Curies who demonstrated that according to the principle of the conservation of energy, any piezo-electric substance which acts as a generator of electricity in response to mechanical motion, will act conversely thereto. Further contributions along these lines were also made by such famous men as Kelvin, Roentgen, Henkel, Braun and Voigt. Roentgen, in particular, suggested the possible acoustic application of piezo-electric substances.

By the close of the 19th century, it was generally recognised that, of all the known substances exhibiting the piezo-electric effect, sodium potassium tartrate or rochelle salt was by far the most active, being approximately 1000 times more active than quartz.

Serious Difficulties

The application of crystals commercially presented many serious difficulties. Paramount among these were hysteresis and saturation effects, wide variations in piezo-electric performance of the crystal at different temperatures, and the fact that different crystals produced different results at identical temperatures. The fact that crystals are not found in a natural state such as quartz, but have to be grown artificially also presented a serious difficulty in commercial applications.

The Bimorph Element

Through the introduction of the "Bimorph" crystal element and the accurately controlled processes developed for its fabrication, these difficulties mentioned have been practically overcome in present-day rochell salt crystal devices. Briefly, the present "Bimorph" crystal element consists of two crystal plates cemented together and so orientated that when a potential is applied, one plate contracts while the other expands, resulting in an overall twisting, or bending, of the whole unit.

(This article is condensed from one by Roy S. Sawdey, Jnr., of the Brush Development Co., which appeared in a recent issue of "Radio," U.S.A.)

SUPER X-RAY

The Research Laboratory of the General Electric Company announces that on Saturday, August 21, 100,000,000-volt x-rays were produced for the first time in the history of science.

They were obtained from the large induction electron accelerator recently completed. The characteristics of this new type of radiation will be published as fast as they can be determined. The first few observations suffice to show that these characteristics differ radically from those with which physicists are familiar.

Sawing up a big block of rochelle salt to make crystals for the control of transmitter oscillators.

WHAT IS THE MOST SUITABLE

THE specification of a receiver grows from the performance desired, so let us first be clear about what is expected from the so-called "utility" receiver. (1) It must receive Home and Forces programmes under wartime conditions. (2) It must be as simple to operate as the sets to which the public has been accustomed for the past five or ten years. (3) It must be built as a sound engineering job to have a reasonable life; shortage of materials will continue for some time after the war, and in any case there must be some delay in restarting normal production, so the "utility" receiver will not be scrapped on Armistice night in the expectation of buying a new high-performance receiver next morning.

The two-valve detector-LF combination relies on reaction for the sensitivity and selectivity needed in all but the most favourable circumstances, and the use of reaction on the aerial circuit is not admissible today. It was bad enough in the early days when half the users of radio receivers had some technical knowledge, and the others regarded the apparatus with awe; today, nobody will trouble to **learn** how to handle a wireless set, and the distribution of thousands of receivers capable of oscillating would cause pandemonium. The art of obtaining adequate selectivity with the aid of reaction and volume control calls for even more skill than obtaining sufficient volume, and even for the reception of Home and Forces programmes selectivity may be necessary. It must be remembered that the "utility" receiver is required to work under **wartime** conditions (unlike the German **Volksempfanger,** which was a peacetime proposition), and this may still include operation during air raids; now the BBC must have expended much effort on their system which avoids a complete shut-down during air raids, but gives a service which may be reduced in strength and liable to fading in particular districts. It would be a pity to waste this service by providing receivers which could not profit by it because (a) they had no AVC, and (b) their selectivity was so poor that after dark any reduction in field-strength from the BBC would result in a neighbouring German station breaking through. The straight two-valve set is therefore, inadequate for wartime conditions.

If we are driven to a superheterodyne, what is the simplest type of such a receiver that can be made? A two-valve set containing frequency-changer, IF circuits but no IF valve, and detector-output valve is the minimum; it could give adequate selectivity by means of the IF circuits, and a slight degree of AVC on the frequency-changer, but its sensitivity would be very low. Reaction from the output valve on the IF circuits would help, and could not radiate at signal frequency, but an output pentode probably would not give smooth reaction and a band-pass circuit is a difficult subject for reaction. A scheme which is attractive on paper is to use frequency-changer, double-diode-triode,

AN ENGLISH OPINION

OUR PRIZE CONTEST

WHILST we all have every faith in the war being cleaned up this year, there must always be the slight doubt that things may take longer than anticipated, and even if Germany is finished off to schedule, the wily little Japs may be able to hang out for two or three years.

Since there is no certainty about such matters, it behoves every thinking man to appreciate that he cannot prophesy the end of hostilities with any degree of precision, therefore he must take all possibilities into account.

Should the duration of the war extend beyond another year or two it would appear to be sound policy for the authorities to consider the advisability of allowing a limited number of utility receivers to be manufactured for amenities and also for civilian use.

Radio technicians are immediately interested in such a suggestion, because it brings up the question, "What is the most suitable circuit for a utility set?"

The question is given greater importance by the thought that there is a possibility of government control of industry extending for the difficult period of settling back to business which will occur for months and even years after hostilities have been completed. It may be found highly desirable, for example, to eliminate cut-throat competition between receiver manufacturers for at least six months after the armistice. During this period the idea might be to allow the production of nothing but this "Utility Set", which we have in mind. Its production could be carried on to keep the factory staff engaged whilst the technicians go into the problem of developing the communications-type short-wavers, the big super-fidelity frequency-modulation type consoles and the many other special post-war models which are sure to be added to existing types to provide a wide range of receivers to fulfill the huge demand.

To return to the present, what is the most suitable circuit for a utility receiver?

Many of our readers must have worthy ideas on this subject, and so it seems to us to be a logical scheme to get these ideas into print, thereby offering an interesting and instructive series of articles.

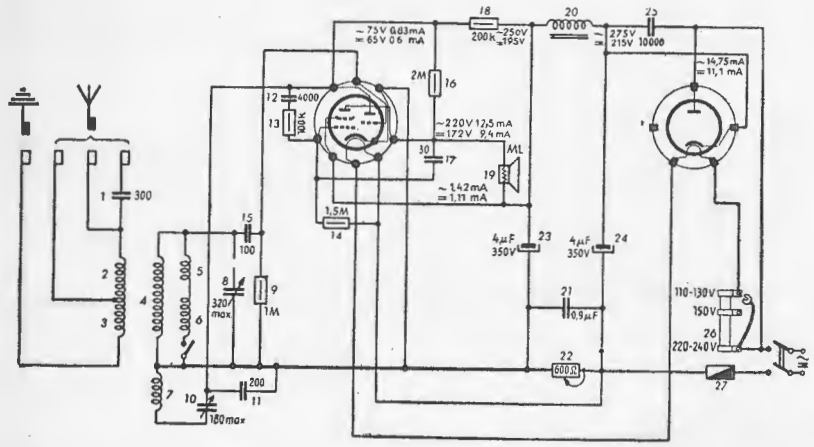
Therefore we announce this little contest, offering a prize of five guineas for the best answer to the question, "What is the most suitable circuit for a utility receiver?" In addition to the prize, a fee of one guinea will be paid for every other entry found worthy of publication.

All entries should be posted to "Australasian Radio World" at 243 Elizabeth Street, Sydney. Circuit diagrams submitted need only to be roughly sketched in pencil.

Send your entry in as soon as possible.

To give some idea of how the question can be answered, we give the British reply, which was published in the English "Wireless World" in reply to a similar question. This reply is of great interest, but, of course, Australian conditions are vastly different from those prevailing in England.

CIRCUIT FOR A UTILITY RECEIVER?



Circuit of the German "People's Receiver" which Hitler introduced before the war in order to allow radio development engineers to work on armaments.

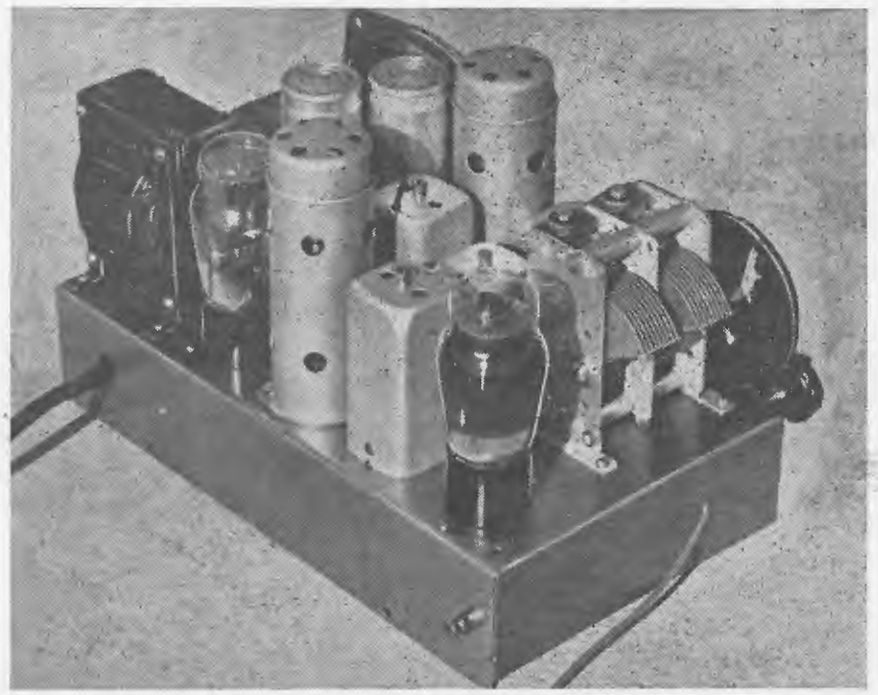
and output pentode, with reaction from the triode section of the DDT on the IF circuits. The additional AF gain from the triode section of the DDT would be very welcome, but we are still up against the problem of applying reaction to an IF circuit which must (for adequate selectivity) consist of a band-pass transformer or other multi-circuit arrangement. In addition, the voltage at the diode will be very low, perhaps a tenth of a volt, so that it will not suffice to provide AVC of any kind; even if we use a special circuit in which the triode acts as AVC amplifier (either RF or DC) there is only the frequency-changer to control. Although the circuit has the attraction of very little increased HT current consumption (perhaps 1½ mA for a high-impedance DDT) it does not seem a very practical proposition.

Another Possibility

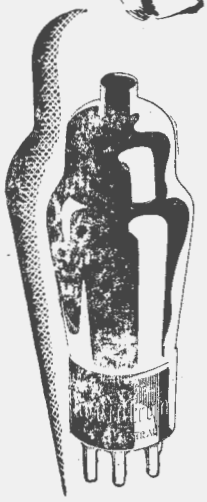
The next possibility is frequency-changer, IF valve, and double-diode-pentode output valve. Admittedly the DD-Pen is not a common type of valve, but it has been made, and no doubt could be produced without undue difficulty. We now have reasonable sensitivity and selectivity without reaction, a fairly high signal level (say, 5 to 10 volts) at the diodes, which makes AVC possible, and both frequency-changer and IF valves to control, so that AVC can be reasonably effective. This seems to be the most promising arrangement to try, and the power supply system must be scrutinised for any possible economy now. The output valve will presumably be of high sensitivity but only moderate power output capacity, with an anode current of perhaps 20 to 25 milliamps; with only two other valves, the total anode current will be too small to energise the field of a loudspeaker with winding of normal resistance, and any increase of the high tension voltage above that required by the valves involves higher ratings of smoothing condensers, etc., so that a permagnetic speaker is indicated. This in itself should be easier to make, since it has no hum-bucking coil. We now need a smoothing choke (since the speaker field is no longer available for this purpose) which appears to involve additional iron and copper; but this can be more than off-set by omitting the mains transformer and building the set as an AC/DC model. Since 4 volt valves are practically obsolete, it is assumed that 6.3 volt valves would be used in any case, so that the heater consumption of a series-wired set presents no great difficulty. It would, however, mean that the set would have to be sold complete in a cabinet, to protect the user against contact with the live chassis, etc., but in any case the idea of selling a loose receiver chassis and leaving the purchaser to find a housing for it is probably bad. Wood is likely to be more available for a cabinet than plastics, and the elaborate press tools required for a moulded cabinet would probably be prohibitive even if moulding material were available.

Conclusion

The suggested design is, therefore, a three valve plus rectifier AC/DC superhet. in a simple wooden cabinet, the valves being frequency-changer, IF amplifier, and double-diode-pentode as detector-output valve."



Chassis of the "Tip-Top" receiver, which was probably the most popular 3-4 valve superheterodyne ever described in "Australasian Radio World."



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

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THE CASE FOR THE SINGLE-ENDER

By
A. G. HULL

SO much has been said and written about the advantages of push-pull output valves for quality amplifiers that there is a tendency to completely overlook the fact that it is possible to design a single-ended amplifier which is capable of giving good reproduction. In fact, to prove the point we may mention that the big amplifier for the Western Electric "Mirrophonic" high-fidelity talkie outfits is a single-ender!

In actual practice the push-pull amplifier is not always perfect, and many experimenters would be lots better off with a simpler type of amplifier in perfect operating condition. We feel sure that if someone goes to the trouble to check up the performance of all the push-pull amplifiers in any one district he will find that about fifty per cent. of them are infested with parisitics, far from balanced in their operation and suffering from other complaints to such an extent that their actual performance is far below that obtainable with a properly designed single-ender in a state of perfect operation, which is so much easier to attain that with a push-pull job.

Choice of Valves.

As with push-pull there is the choice between triodes and pentodes or beam power valves. A further consideration enters into the problem, however, as something around four to eight watts of power output is usually desirable for a quality amplifier and this is not so easy to get from a single valve, two valves in push-pull giving practically twice the power output of a single valve. Of course, it is possible to have two small valves in parallel, thereby getting twice the power output of a single valve and at the same time enjoying the advantages of single-ended operation.

Suitable Pentodes.

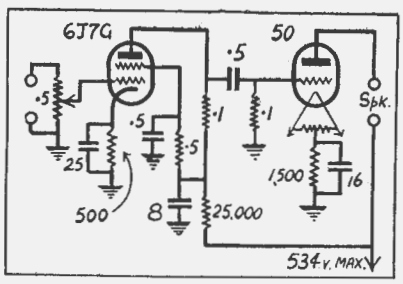
In the pentode and beam power valve range there are quite a few valves which will give better than four watts of power output. The good old 42, and its later version, the 6F6, will operate to fine purpose if operated with higher plate voltage than the 250 originally specified. They are quite safe at up to 315 on the plate, with a bias of 22 volts and a combined plate and screen current of 50 milliamps. Under such operating conditions the power output is 5 watts.

The 6V6G and 6L6G beam power valves might be expected to give lots of power with higher potentials than specified, but there is an unfortunate trap here, and we cannot recommend more than 250 on the plate unless the precaution is taken of running them with reduced screen voltages. By designing a suitable arrangement to provide 200 volts for the screens it is possible to jump the plate voltage up to 300, thereby getting about 6½ watts of power output, but this can also be obtained by running a single 6L6G with 250 on the plate and screen, so the scheme is only worthwhile when working with the 6V6G.

In every case in which beam power valves or pentodes are used it is imperative to use inverse feedback to deal with the distortion which is otherwise introduced.

Suitable Triodes.

In the range of the simple and reliable old triodes we start with the 45,



A suggested circuit, with a large power triode driven by a pentode first-audio valve.

which has hardly enough power output to be much good if the maker's ratings are respected. But the 45 is a robust old-timer and will stand almost infinite overload. We can still recall a case where we happened to be demonstrating an amplifier down the South Coast some years ago and broke one of the DO40 output valves. No replacement being immediately available, a pair of 45 type were borrowed, the filament voltage changed over and then about 500 volts applied. Of course, the bias voltage was also adjusted to greater than normal and we were not surprised to find that the valves ran for several hours under these circumstances without any apparent ill-effects.

The 45 is ideally suited for parallel operation, too. In fact, they say that a 2A3 is simply made up by putting a pair of 45 type elements in a single glass envelope and connecting them in parallel.

Both the 2A3 and 6A3 are suitable triodes, but their power output is a trifle on the low side, being only 3½ watts if the makers' ratings are respected, as seems to be safest with these unless the bias is increased by about 50 per cent. to bring the characteristics in line with a pair of 45, as referred to above.

High Voltage Triodes

Best of all are the big triodes with plate voltage ratings of 400 volts and more. There are still quite a few of these in English types of which little has been heard. Sometimes these valves can be picked up quite cheaply. Excellent valves which are suitable include the Mullard DO series, DO20, DO40, DO60, etc., and the Osram LS6A. In the American range the only valve of similar characteristics is the old 50, a triode which seems to be capable of exceptionally fine reproduction, either singly or in push-pull. The 50 is rated to take 450 on the plate with 84 bias, calling for a high tension supply of 534 volts.

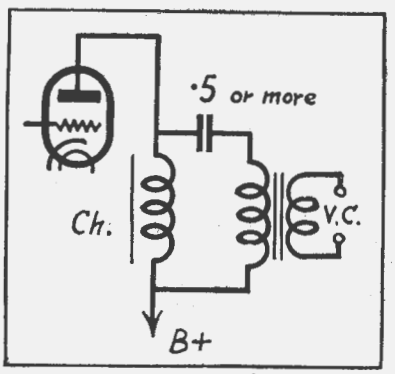
All of these high-voltage triodes share the disadvantage of requiring non-standard power supply, bringing up the problem of suitable filtering, and so on. The filtering can best be overcome by using two 16 mfd. electrolytics in series, each with a 525 volt rating and with a pair of 10,000 or 25,000 ohms resistors in series across them to make sure that the potential is divided across them fairly evenly.

Field energising also tends to become a problem with these high-voltage triodes, or should we say that it provides further scope for the designer to displav his initiative?

Grid Drive Necessary.

A point to watch about the high-voltage triodes is the amount of signal input necessary to full load them up. For all practical purposes we can assume that we want more signal voltage than grid bias. In the case of the 50, for example, with its 84 volts of

(Continued on next page)



Schematic to show shunt-feed arrangement to improve efficiency of the output transformer.

bias, we can say that we need the preceding valve to be capable of delivering a signal voltage of at least this amount.

Fortunately, the pentode type a.f. valves, such as the 57, 6C6 and 6J7G are capable of giving high-gain, together with big signal output and yet they do not suffer from the same disability as pentode output valves. With a suitable screen voltage and feeding into a resistance loading these pentode audio amplifiers do not give any considerable distortion, and yet are strong in their ability to handle "highs."

Points to be Watched.

Several precautions are desirable to make sure that the single-ender is not going to suffer from a restricted frequency range.

The first of these which comes to mind is in respect to the output transformer.

With push-pull we have the static plate current flowing through the two halves of the primary winding in opposite directions, thereby cancelling out the effect of the current on the effective inductance. Consequently, it is possible to use a small core and still get satisfactory quality with push-pull. But the single-ender needs a weighty output transformer of good design, with ample core and yet not too much distributed capacity.

Good quality output transformer can be obtained, however, or the problem can be dodged by using shunt-feeding for the output transformer, passing the high tension current through a heavy choke, such as a big filter choke and then feeding the speaker's transformer through a capacity. For good reproduction of the lows the capacity needs to be as large as reasonably permissible, depending on the effective inductance of the choke at low frequencies.

Incidentally, speaking of output transformers it is sometimes possible to use a power transformer if one is available with a suitable turns ratio between two of the windings. Remember that this turns ratio needs to be the square root of the ratio between the load required and voice coil impedance of the speaker used.

In passing we might also mention that the shunt-feeding of the speaker transformer is a sound scheme to apply to any ordinary commercial set or amplifier, nearly always paying good dividends in improved reproduction.

By-passing the Bias Resistor

Another point which crops up in the case of the single-ender is the adequate by-passing of the bias resistor to stop degeneration.

With push-pull amplifiers there is no need to by-pass the bias resistor if its common to both output valves, as is usually the case. But with a single-ender the by-passing becomes an important factor in obtaining full gain and power output. The problem is further complicated in the case of valves needing high bias voltages, as the ordinary by-pass electrolytics of 25 mfd. 25 or 40 volt rating cannot be used across a resistor with a drop of 84 volts Fortunately, the higher the higher the resistance used the lower is the capacity necessary to maintain low note response, other things being equal. Consequently it is possible to get good results with a by-pass of 2 or 4 mfd. across a bias resistor of 1500 ohms.

Quite a sound scheme is to use an electrolytic condenser of the filter type, such as 8 or 16 mfds. with a 525 volts rating.

Regulation of Power Supply

With push-pull valves the matter of regulation of the power supply is not critical because one valve tends to draw less current when the other draws more. Although not revealed on a mlliammeter, except under conditions of severe distortion, there is considerable variation in the current drawn by a single valve. If the voltage tends to drop every time there is an increased demand on the current there will be a form of degeneration which will not allow full power output to be obtained. To make matters worse, the degree of degeneration from this source will vary according to frequency. In practice, however, it is a fairly simple matter to get good regulation, running the power transformer well within its ratings and using filter condensers of 8 or 16 mfds. capacity.

Interlocked with the problem of regulation is a tendency to motor-boating if the high tension supply for the plate of the driver valve is taken direct from the same source as that for the output valve.

A sure cure is to employ a de-coupling resistor and by-pass for the plate feed of the driver valve. This de-coupling is also an assistance in removing the last ounce of hum, as is always highly desirable with any amplifier striving to give good quality reproduction.

Still dealing with regulation of the power supply we might mention that it is highly desirable to maintain a constant potential on the screen of a beam power valve when running it with a higher plate voltage than on the screen. The proper potential for the screen should be obtained from a voltage divider across the high tension and with a heavy bleed.

This can often present an opportunity of arranging a neat way of energising a speaker field.

Not So Hard.

Dealing with all these possible difficulties with single-enders may give an impression that the single-ender is full of pitfalls and problems. Actually such is not the case and any single-ender of reasonable design is almost certain to get into perfect operating condition with infinitely less difficulty than a push-pull amplifier of similar performance.

MAKE YOUR OWN ELECTRIC SOLDERING IRON

THERE are two main advantages, in addition to decreased risk of electric shock, in using a comparatively low-voltage heating element (e.g. 12 to 40 volts) in a light soldering iron. Thick heater wire can be used, which is easy to handle in the construction and repair of elements and can fairly readily be obtained from old electric fire or flat-iron elements — a consideration in these times. Secondly, the iron can be run from accumulators if mains supplies are inconvenient or not available. The disadvantages are that such irons cannot economically be used with series resistance on DC mains, owing to the comparatively heavy current they require, and for use of AC mains a step-down transformer is necessary. The latter disadvantage, however, is not very serious, as suitable transformers are easily constructed and are not bulky.

Repair or Construct

There are two possibilities. Either an old or burnt-out mains-voltage electric soldering iron can be altered by the fitting of a low-voltage element in place of the original element, or an entirely new iron can be constructed if a non-standard type is needed for special work. In each case the first consideration is that of the low voltage heating element. This may consist of a length of comparatively thick wire (usually nickel-chrome) wound on a slip of mica. The wire may be obtained from an electric fire or flat-iron element. The length of this wire in the soldering iron element is determined by the ratio of the wattage required for the soldering iron, to the wattage of the fire or flat-iron element being used. Thus:—

$$l1 : l2 :: W1 : W2 \quad \text{or} \quad l1 = \frac{l2W1}{W2}$$

where l1 is the required length of wire for the projected soldering iron element, l2 is the measured total length of wire in the fire or flat-iron element, W1 is the wattage of the projected iron and W2 the wattage of the fire or flat-iron element. An extra half or one inch may be added to l1 to connect it to the power leads.

Two examples will be given. The first assumes that a 230-volt, 450-watt flat-iron element is available, the wire on which when unwound is 16 feet long (the length will, of course, vary with the wattage of the element being used, its type, etc.) The wattage of the projected iron is, say, 65. Thus, l2 is 192 inches, W2 is 65, W2 is 450. Then

$$l1 = \frac{65 \times 192}{450} \text{ or } 27.7 \text{ inches}$$

approximately.

It would be safe to take 28 inches as the total length required, including sufficient to join on to the power leads.

The second example assumes that a fire element rated at 1.5kW is available, with a length of 20 feet of wire.

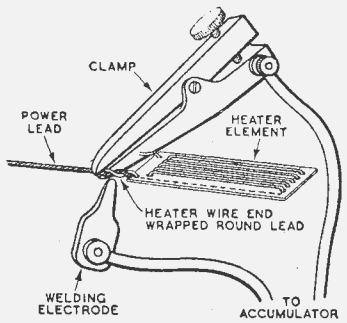


Fig. 2. Suggestions for an improvised electric welder for joining the power leads to the leading-out wires of the heater element. The accumulator leads must be of heavy cable, as short as possible.

$$l1 = \frac{65 \times 240}{1{,}500} \text{ or } 13 \text{ inches}$$

approximately.

The current and voltage requirements have next to be found. The 450-watt element carries very nearly 2 amp. normally; the 1.5 kW element carries a trifle over 6.5 amps. Since each is to handle 65 watts, the voltage required, given by $E = \frac{W}{I}$, is $\frac{65}{1.9}$ — or approximately 35 volts for the 2 amp. element and $\frac{65}{6.5}$ — or 10 volts for the 6.5 amp. element. The former would be very suitable for use with a mains transformer, the latter for use with, say, two 6-volt car batteries in series.

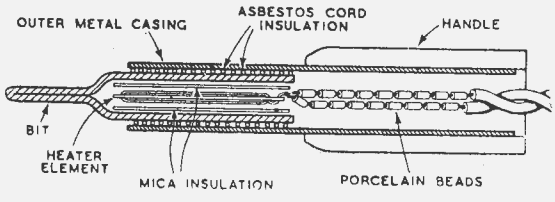


Fig. 1. Sectional sketch (not to scale) showing construction of the iron. The bit is made of a single piece of copper, bent to shape. To avoid losses, clearances between the heater element and the copper should be as small as possible.

Joining to Element

Construction depends on the requirements of the user and what is available in the way of materials. Fig. 1 shows the structure of a light iron constructed by the author for instrument work. The attachment of the resistance wire of the element to the power leads is not very easy. Soldering is out of the question, of course, owing to the heat during work, and brazing, silver soldering and rivetting all present awkward technical difficulties without the proper equipment. In the end the author carried out a successful electric welding between the resistance wire and the copper lead, using a 60-ah, 2-volt accumulator. The method, referring to Fig. 2, consists essentially of momentarily shorting the accumulator across the junction of resistance wire and copper lead, the current so passed being heavy enough to fuse the two together. It can be done with a clamp and one movable welding electrode as shown. The power leads of the iron are then insulated from each other and the metal shaft of the iron by porcelain beads or short bits of glass tubing up to the point where they remain cool enough while in use for soldering to the flex leads of the power supply.

Size of the Bit

The size of the copper bit is not critical provided the element inside or beside it dissipates the required wattage. A large bit merely takes an inconveniently long time to reach working temperature, and if it is too large, the loss of heat through an excessive cooling surface may prevent it ever reaching the working heat. It has the advantage of holding a considerable body of heat so that it is not too quickly cooled when applied to largish work. A small bit gets very hot in a short time and this may cause pitting or burning; moreover, when applied to large work, it cools very quickly. For instrument work, a small hot iron is very desirable, since its use avoids heat being spread to other parts of the instrument through having to hold the iron on to the work for a long time or through radiation from

(Continued on next page)

SOLDER IRON

(Continued)

a large surface. If it is merely a matter of replacing a mains-voltage element by a low voltage one, the dimensions will have been fixed and need not be altered, provided the new element is rated at the same wattage as the old one.

A few details of a suitable transformer may be of service. The author removed the HT and LT secondaries from an old receiver type 80-watts mains transformer — counting the turns on one of the secondaries which was rated at 4 volts 2 amp. There were 25 turns, indicating 6 turns per volt. To run a 35-volt iron, therefore, 215 turns of 20 SWG DCC wire were wound on as the secondary with taps at the 210th and 205th turn. To start work, the full 215 turns were used; when the iron was at working heat and had to be put aside for a while, it was switched to 205 turns, which kept it warm. More taps could, of course, be provided. To run a 10-volt 6.5 amp. iron, the secondary would have been 65 turns, of say, 16 or 18 SWG DCC wire, with taps at 57, 60 and 63 turns, and the leads from the secondary to the iron of ample gauge to carry the heavy current without overheating and to avoid voltage drop.

—Wireless World. (Eng.)

NEW PHONETIC ALPHABET

The combining of the British and American Forces in a growing number of theatres of war necessitated the revision of many of the rules of procedure in wireless telegraphy and telephony.

For obvious reasons it is not permissible to publish the various changes introduced. It is, however, possible to give the revised phonetic alphabet now used by the Allied Forces to avoid confusion between similarly sounding etters in telephony.

In the first column are the new code-vords, those in the second column are

A	Able	America	Able
B	Baker	Boston	Boy
C	Charlie	Canada	Cast
D	Dog	Denmark	Dog
E	Easy	England	Easy
F	Fox	France	Fox
G	George	Germany	George
H	How	Holland	Have
I	Item	Italy	Item
J	Jig	Japan	Jig
K	King	Kentucky	King
L	Love	London	Love
M	Mike	Mexico	Mike
N	Nan	Norway	Nan
O	Oboe	Ontario	Oboe
P	Peter	Portugal	Pup
Q	Queen	Quebec	Quack
R	Roger	Radio	Rot
S	Sugar	Santiago	Sale
T	Tare	Turkey	Tare
U	Uncle	University	Unit
V	Victor	Victoria	Vice
W	William	Washington	Watch
X	X-ray	X-ray	X-ray
Y	Yoke	Yokohama	Yoke
Z	Zebra	Zanzibar	Zed

the most frequently used by British amateurs prior to the war, while the third column gives those used by American amateurs.

SOME THOUGHTS ON POST-WAR RADIO

THE following views about post-war radio are expressed by the bright radio columnist "Diallist", in the latest issue of "Wireless World" from England. He appears to feel sure that improved quality of reproduction will be appreciated and throughout the article his reasoning takes full cognisance of the influence which will be evident from army training in radio theory and practice.

"We shall have to find solutions of the quality - at - a - distance problem," writes Diallist, "the one that appeals to me most is to cover the country with a network of small relay stations, transmitting with frequency modulation for choice. That, I believe, is what will eventually happen, for it seems to be the only way in which television can be brought into the homes of those who live far from the densely populated districts. As I see it, such stations as we have at present will continue to broadcast with AM for a considerable time and some will be retained for a very long time. But the place of the majority will gradually be taken by the low-powered FM network, combining speech and music with vision transmissions. Television will then be available to all who provide themselves with vision receivers. Those who either don't want them or can't afford them will have the speech and music for their entertainment. The great advantage of FM is that it makes high-quality transmission and reception possible and eliminates interference to a very large extent. It has to be done on very high frequencies. Therefore the range is limited and the old mutual interference problems, which have hitherto made the evolution of international broadcast wavelength schemes so difficult, just disappear. The FM sound-cum-vision scheme, then, has a great deal to recommend it.

Wired Broadcasting.

The alternative — if it is strictly an alternative — is wired broadcasting which has caused such a flutter in the dovecotes of late. Whatever may be said for this kind of entertainment distribution, it will never meet the requirements of the large body of amateur radio enthusiasts. Their strength was considerable before the war; it will be vastly greater when peace comes back, for so many men and women in all the three Services have acquired a sound elementary (or even advanced) knowledge of the workings of radio and have developed a deep enthusiasm for it. Both the old hands and the wireless war-babies will be filled with the itch to have lots of knobs to twiddle and the burning desire to improve the performance of any apparatus that comes their way that are characteristic of the wireless fan. They will never be satisfied with "piped" broadcasting. As I have said, they will be a large body, and I think they will make themselves felt. I expect to see the wired system developed considerably, but I do not think it is going to oust ether-borne broadcasting, at any rate not for a very long time to come. There are some, I know, who think that the wireless set should be just as much a piece of furniture as the piano. Few people, with the exception of professional pianists or piano tuners, know much about the theory or the inner workings of the instrument, or tune or adjust their own pianos. Why, then, say the supporters of wired broadcasting, should the ordinary person bother his head over the innards of the radio receiver or care two hoots about wireless problems? If by the "ordinary person" they mean he or she who neither knows nor cares anything about wireless, I agree wholeheartedly. But, as I have shown, the number of people back in civil life when the war is ended who do know something and do care a lot is going to be very large. Everybody wants and needs a hobby, and wireless is going to be the hobby of a far bigger section of our people than has ever previously been the case. Lots of these people have had a good deal to do with cathode-ray tubes, and television will be just meat and drink to them. Wired broadcasting probably would not give them that, and certainly it would not give them the scope that their enthusiasm for real radio craves. An FM and television relay network seems to me to be by far the best way of satisfying everyone's demand.

Drinking It In.

What people in the Army (and I am sure it is true of the other Services) have learned about wireless during the war is almost incredible. One of the best radio mechanics that I have had was in civil life a crofter in the far north of Scotland. His home is

(Continued on next page)

IMPROVED CONVERTER OPERATION

An interesting suggestion for improved operation of converter valves, especially in battery sets, comes from D. J. Bedford of 5 Ratho Street, Hobart, who writes: "I was looking through some copies of 'Radio World' recently, and notice that there are quite a few remarks passed about troubles with 1.4 volt valves as regards the oscillator section.

"I know from my own experience that there is a tendency for the 1A7G to give trouble as soon as the high tension voltage starts to fall. I enclose a circuit, quite conventional in all respects, except that of the oscillator portion.

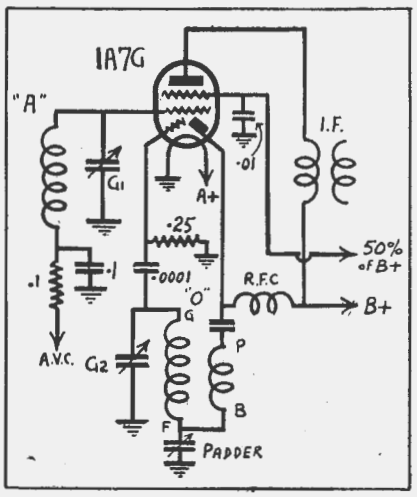
"I have used the system extensively and have found it reliable in all cases, including short-wave.

"I first used it in a certain commercial portable set. At the time both the 1A7G mixer and "B" battries were unobtainable here. The 1A7G went out of oscillation around 7HO and "B" voltage had dropped to approximately 80 volts.

"Well, in a 'nut-shell' here is what happened: the 1A7GT showed no signs of going out of oscillation with 22½ volts high tension. The only difference noticed was naturally the loss of gain and sensitivity.

"With 90 volt high tension it is a good idea to increase the oscillator grid leak to a quarter megohm.

"The same idea can be used with a.c. type converters, such as the 6J8G.



"The radio frequency choke is replaced by a resistor of 25,000 ohms, but otherwise the circuit is fundamentally identical with that used for the 1A7G.

"In the case of 6J8G it is possible to obtain oscillation on 9 metres, but it is necessary to increase the grid leak to .1 megohm."

We feel sure that readers will be most interested in Mr. Bedford's suggestions.

POST-WAR RADIO

(Continued)

more than 60 miles from the nearest railway station and such things as electricity in general, and wireless in particular, were complete mysteries to him in 1939. Nor had he ever used any but the simplest tools. Today he will trace a fault in a highly complex piece of electrical apparatus and put it right. He has a respectable knowledge of theory and a burning enthusiasm for all departments of wireless. He is a first-rate hand at small, neat soldering jobs and a good all-round mechanic. Then I know girls who as soon as they look at you will discuss the mathematical analysis of detection or bowl you fast ones in the shape of questions on aerial theory. Yes, the number of girls who have taken to Radar and other departments of wireless as ducks to water is remarkable. I have had hundreds of them through my hands and all but a very small percentage work like niggers, are as keen as mustard and just drink in what you teach them. Many of them, I believe, will be real radio fans when they return to civil life.

Servicemen

One thing we should not be short of when the war is over is good radio service-men. Thousands have had a very thorough training in wartime, and after the complicated gadgets with which they have had to deal the ordinary broadcast receiver, mains or battery, that needs an overhaul will be just money for old rope to them. Before the war the really efficient serviceman was far too rare. Too many were just dabblers, who found anything but the simplest fault beyond them. I have come across instances of sets returned to the makers for repair — and needless expense imposed on their owners — on account of breakdowns of the most elementary kind; troubles that could have been tracked down quickly and set right by any moderately competent man. We shall have no more of this kind of thing, for properly trained men will be available. And they will be duly qualified, too, if the theoretical and practical exam. inaugurated by the Radio Trades Examination Board receives the backing that it deserves.

RADIO QUIZ

QUESTIONS

1. What is a Transceiver?
2. What is another name for Thermion?
3. You know what an Army Tank is, but what does Tank refer to in radio?
4. Supply a word which means the same as Non-Synchronous.
5. Node is?
6. What do the following abbreviations stand for:—
   (a) S.C.C.
   (b) S.W.G.
   (c) H.F.C.
   (d) D.A.V.C.
   (e) S.P.
   (f) D.X.
7. What is the Q Code?
8. What is the R Code?
9. An Ohm is the unit of resistance. When an electrical pressure of 1 volt is required to force a current of 1 amp through a circuit, the circuit is said to have a resistance of 1 ohm. But how else could an ohm be defined?
10. If you were connecting up a socket to take a valve with an octal base, how many connections would you have to make to the socket?

(Answers on page 16)

SECOND-HAND CHASSIS—£500

Melbourne enthusiasts were quick to notice a recent advertisement in the "Age" offering a second-hand radio chassis for £500, and it was NOT a misprint. The job was a 28-valve model of the American Scott brand.

SUPER - QUALITY AMPLIFIER DESIGN

ONE of the finest amplifier circuits which we have seen for many a day turned up in the mail recently in our query service. This circuit is so outstanding, from the number of valves used down to the range of its control, that we feel compelled to share its interest with our readers. Therefore we have re-drawn the circuit and here it is.

The circuit is submitted by Mr. H. Smith of 85 Rainbow Street, Randwick, who says, "It is the best-sounding amplifier I have built to date and I have had quite a few, including a dual-channel job with push-pull 2A3 for the lows and push-pull 2A5 for the highs. As the main portion of the amplifier is almost identical with one of the 15-watt Radiotron designs I can justly claim that output power. Actually, all I know is that I get plenty of output to load up the speakers I am using, an Amplion 12E22 and a Rola K10, and all the volume that can possibly be used in my home.

Tone Control

The tone control stage and volume expander were added on after the original set was built. Again I don't know the why and wherefores, but I do know that the tone control allows a remarkable control over both treble and bass. The treble control is rather sudden at one end, the boost end, but that is not a very serious fault and taken all round it is quite versatile. The volume expander works quite well too, judging by the effect it has an orchestral items, a milliameter in the plate circuit of the 6U7G proving the effectiveness of this section.

I'll admit that there are a lot of valves in this amplifier, but I had them on hand, so I decided to use them. This also explains why I used pentodes as triodes and rectifier.

Two Power Transformers

I found that by using two transformers I could get what amounted to fixed bias, at the same time using 150 milliamp transformers with the good old 80 type rectifiers, which are all I had on hand. The output tranny is a bit on the high side as regards loading, but I can't detect any defects in the output, and since what is heard is the main thing I don't worry about this point.

As far as the frequency response is concerned I haven't the equipment to find out whether it is flat or not. As a matter of fact I think by the use of the tone control, at time it is anything but flat, but what really matters is that it sound first class."

Lay-Out Suggestions

Any amplifier or radio set should be arranged so that as far as possible, the signal comes in at one end of the chassis and goes out at the other without doubling back anywhere. The first valve and input should be as far as possible from the power transformer and rectifier to prevent hum pick-up.

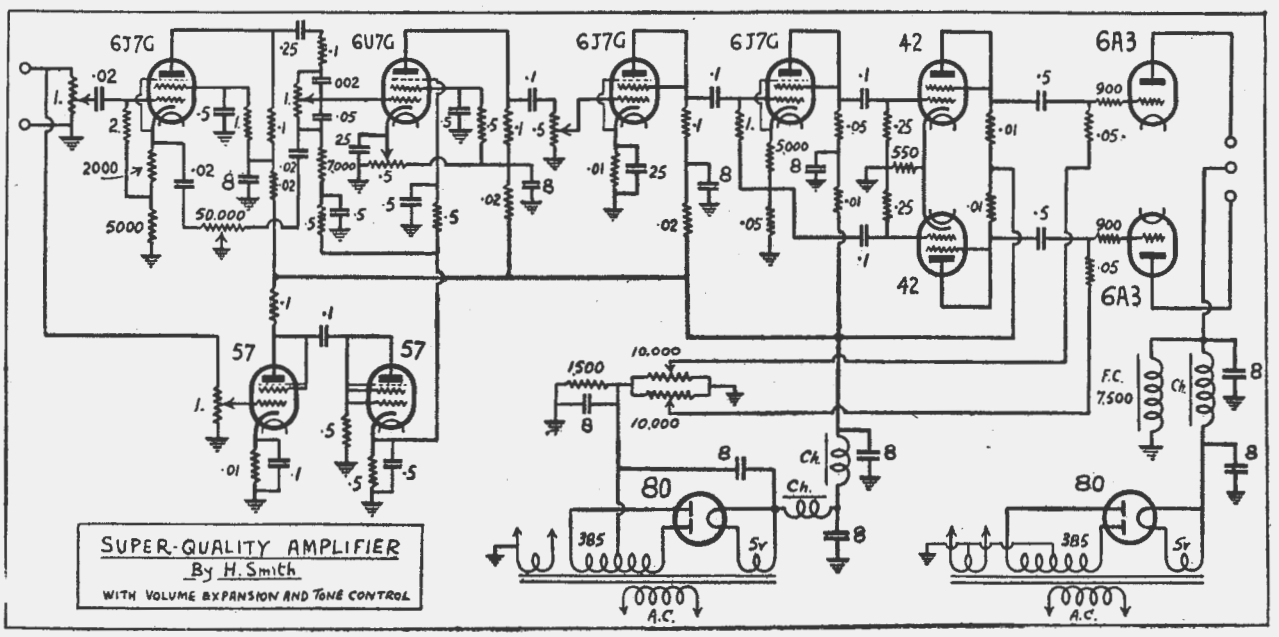
Bypass condensers should be right at the valve socket; for the first two valves they are best connected right across the socket, from screen to earth or from cathode to earth lugs. The No. 1 pin on an octal socket is usually earthed. The No. 6 pin is often a dummy and can be used as a clincher, or dummy lug, to carry a resistor or condenser. Do not connect the No. 1, or shield pin, to the H.T. supply as someone may shove in a metal valve and get a dangerous shock.

Contrary to popular opinion, it is usually possible to mount the speaker transformer quite close to the choke and/or power transformer. There is no amplification after the speaker transformer, so what little hum that is picked up, is not amplified.

FM AND FOLIAGE

Measurements taken in Milwaukee, Wisconsin, have shown that the foliage on trees has an adverse effect on the reception of frequency-modulated transmissions.

The president of FM Broadcasters, Inc., states it has been proved that within the 1 mV/m service area of an FM station there was a fall in signal strength during the summer of an average of 15 per cent. where receivers were installed in houses completely surrounded by trees. Outside the ½ mV/m area the drop in signal strength is said to average as much as 50 per cent. The strength of the signal increased considerably during the autumn and winter.



Proper Operating Conditions For Valves

By
J. R. HUGHES, A.M.I.E.E.
(British Radio Valve Manufacturers' Association)

THE recently issued War Emergency British Standard B.S. 1106 sets out a code of good practice in respect of the use of radio valves; by due regard to its provisions optimum operating conditions and good valve life can be ensured. This article, which is a survey of some of the basic theoretical considerations which form the justification for the Code of Practice, explains the reasons for the recommendations made in the Code.

Only a small part of the Code of Practice deals with the more general and perhaps more obvious aspects of valve use. The major part is devoted to information and advice on specific points, much of which appears not to be generally known or for which the reasons are imperfectly understood.

Valve Ratings.

The manufacturers' published data includes a number of "Ratings" which must be considered as limiting values. It must not be assumed that any one of them may be exceeded because others are not approached. To take as an example a rectifier, the ratings would normally include the maximum input voltage and the maximum DC output current. The use of an input voltage lower than the rated maximum cannot justify a DC output current higher than the rated maximum.

A radio valve is a complicated structure, the design of which must always be a compromise between a number of physical, mechanical and chemical considerations. For instance, the design features which determine the input voltage rating of a rectifier are not the same as those which determine the output current rating. The permissible maximum current may be limited by anode dissipation or by cathode emission or both, whilst the permissible input voltage may be limited by inter-electrode spacing, as well as by the anode dissipation. Evidently then, the different ratings of the valves are interdependent to some degree, but certainly not interchangeable in any simple manner.

Many valves include among their ratings the maximum frequency of operation. A variety of different factors may call for this rating, such as the eddy-current heating of the valve electrodes and connections, the dielectric loss heating of the glass seal through which the electrode connections pass, the loss of valve efficiency due to transit time (i.e., the time taken by an electron to travel from the cathode to the anode) or, in the case of a mercury vapour rectifier, the time necessary for the ionised vapour to de-ionise. It will be evident that it may be possible in some cases to raise the frequency of operation above the rated maximum if other ratings of the valve are appropriately reduced, whereas in other cases the frequency limit will be an absolute limit which may not be exceeded in any circumstances. Accordingly, the advice of the manufacturer should always be taken when contemplating the use of a valve at a frequency in excess of the rating.

Heater Voltages and Currents

The Code of Practice stipulates that in general the heater voltage should not vary more than 7 per cent. each way from the rated value and that in some cases the regulation must be even closer. Moreover, emphasis is laid on the lesser-known requirement that "low heater voltages are as much to be avoided as high voltages . . ."

In a valve the emitted electrons collect round the cathode to form a space charge. This space charge acts as a kind of reservoir from which the electrons constituting the space current of the valve are drawn. In practice the valve will be designed so that the space current (which is made up of the anode current and the screen currents if any) will be far below the total possible cathode emission.

The cathode emission, however, is a high-order function of the cathode temperature, which in its turn is a function of the heater voltage. Thus a comparatively small drop in the voltage gives rise to a considerable drop in the cathode emission.

If the valve is, for example, an output valve, the total cathode emission under the reduced temperature conditions may be insufficient to maintain the anode current, and in this event the grid voltage/anode current characteristic will not be linear and distortion will result. In the case of a rectifier, the consequences of too low a voltage are somewhat different but not less serious. Here the decrease of emission will give rise to an increased voltage drop across the valve and this will raise the power dissipated in the valve. The point is considered at greater length later in this article, hut it can be said that one consequence of this increased dissipation may be the release of residual gase from the electrodes, and this in turn will result in a still further decrease in emission. Thus a vicious circle is established which will ultimately destroy the valve or its associated equipment. Even if the normal anode current of the valve is fairly small and the total emission is adequate to maintain the anode current, the operation of the cathode at too low a temperature is still undesirable, for another reason.

Cathode Coating

It should be appreciated that the condition of the cathode coating is largely determined by the processing which takes place in manufacture and that this processing is designed to distribute the active element through the thickness of the coating and in its surface. The maintenance of the emission during the useful life of the valve is dependent upon the surface of the coating being continually replenished by active material migrating to the surface. This migration is dependent upon temperature, and the operation of the cathode at too low a temperature may result in its rapid de-activation and the consequent shortening of the valve life.

On the other hand, it should not he supposed that the main risk arising from the use of too high a voltage is that the heater may burn out. If the

RADIO QUIZ
ANSWERS

1. A combined Transmitter and Receiver.
2. Electron.
3. The term applied to the band-setting condenser used in a short wave tuner, in which band-spreading is employed.
4. Asynchronous.
5. A point of zero current or potential in an oscillating circuit.
6. (a) Single Cotton Covered.
   (b) Standard wire gauge.
   (c) High Frequency Choke.
   (d) Delayed Automatic Volume Control.
   (e) Single Phase, or Single Pole, or Series Parallel.
   (f) Long Distance.
7. Code of abbreviations used hy amateur transmitters.
8. Code of abbreviations denoting strength of reception.
   e.g. R1, Very faint signals — unintelligible.
   R9, Extremely strong signals.
9. By that resistance offered by a column of mercury at the temperature of melting ice; 14.452 grammes in mass, and of a uniform cross section and with a length of 106.3 centimetres.
10. It would depend on the number of elements in the particular valve to be used.

cathode is operated at an unnecessarily high temperature, excessive evaporation (sublimation) of the emissive coating will take place. Not only does this shorten the life of the cathode coating but it results in excessive deposition of the active material upon the grid and other electrodes. Some of the undesirable consequences of such deposition are considered more fully later in this article, particularly in relation to grid emission.

Heaters in Series

A further point which is often overlooked is the undesirability of connecting valve heaters in series, unless they have been specially designed for this purpose, as, for example, in the case of AC/DC valves. Normally the manufacturer's data will make clear whether a valve is designed for constant voltage or constant current operation, but in cases of doubt it is wise to make specific enquiries of the manufacturer if series operation is desired. If several valves designed for constant voltage operation are connected in series (thus giving the same value of current through all the heaters) and if one should have a resistance slightly greater than the the others, the power dissipated in that one heater will be greater. The heater material has a large positive resistance/temperature coefficient, and thus the resistance and hence the temperature, of the heater which is already running hotter than the others, will rise further still. In this way a small percentage change in the supply voltage can result in a considerably larger percentage change in the voltage across one of the heaters which are connected in series across the supply.

Mounting.

The Code of Practice recommends very strongly that valves should be mounted vertically with the base downwards. It is a not uncommon practice to squeeze valves into odd corners by mounting them out of the vertical, and it is also true that in many cases no apparent harm results. In the case of mercury vapour rectifiers no exception to the recommendation for vertical mounting is admissible since it is essential that liquid mercury should be prevented from collecting on the electrodes or on the upper portions of the bulb. Even with other valve types mounting out of the vertical is not to be recommended; partly on the grounds of heat distribution, partly because of the risk of electrodes becoming displaced and so causing changes of characteristics, and partly because of the possibility of the valve being more susceptible to vibration and so causing microphonic noise.

Amongst receiving valves, rectifiers or output valves run rather hot and an unequal distribution of the total heat may easily result in part of the valve structure reaching an excessive temperature. One common consequence of running a valve in an inverted position is that the increase in temperature loosens the bases.

Directly-heated valves with their relatively long and thin filaments are likely to be rather more troublesome so far as electrode sagging is concerned than are indirectly-heated valves where the cathode is of more rigid construction. Valves having a flat grid structure rather than a circular structure may also be more prone to this trouble if the valve is not vertical. In both these cases the difficulty can be minimised by mounting the valve in such a way that the plane of the filament or grid is vertical even if the valve itself is not vertical.

In the case of valves in mobile or portable equipment the arrangement should be such that the valves are vertical when the apparatus is in its usual operating position.

Heater-Cathode Insulation

Indirectly heated valves with automatic bias or in cathode-follower or phase splitting circuits, provide some examples of applications calling for an appreciable potential difference between the cathode and the heater. BS.1106 deprecates the use of standard indirectly-heated valves in circuits where this potential difference exceeds 100 volts.

The cathode assembly of an indirectly-heated valve consists of a small metal tube on the outside of which is sprayed the emissive coating and inside which the heater wire is inserted. The insulation between the heater and the metal tube is normally effected by spraying the heater with an alumina cement before insertion. It is a relatively thin coating and undue liberties should not be taken with it. In valves specially designed for operation under conditions where a high potential difference is to be maintained between the heater and the cathode, additional precautions are taken during manufacture both in regard to the insulating material and its subsequent processing.

The insulation resistance between the heater and the cathode is dependent upon the cathode temperature and also upon the potential difference and the sense of polarity of this potential. The capacity between the heater and the cathode, too, is a somewhat erratic quantity since the heater is liable to move within the cathode under the influence of temperature changes. For these reasons the heater-cathode impedance should not be included in radio-frequency circuits where high stability is required.

It is worth bearing in mind that one of the consequences of a potential difference between the cathode and the heater may be the attraction of electrons from the cathode coating to the heater. Since the heater normally has an alternating potential applied to it any electron current between heater and cathode may be modulated by this potential and so cause the introduction of hum. It is preferable, therefore, that any potential difference should maintain the heater negative with respect to the cathode, but it should be appreciated that it is similarly undesirable for the heater to be appreciably negative with respect to the grid.

Electrode Temperatures and Gas Release.

With the exception of mercury vapour rectifiers and a few other special valve types the majority of radio valves are "hard," i.e., the bulb contains the minimum of gas. If gas enters the bulb, the valve is said to have gone "soft" and the effect on the valve's characteristics will be very great indeed. These effects arise from the gas molecules being broken up as the result of collisions between them and the electrons flowing in the normal way from the cathode to the anode. The gas is then said to be ionised and there will be present ions carrying positive or negative charges. Many of the positive ions move to the cathode, and under the influence of the potential existing between the anode and the cathode their velocity when they arrive at the cathode may be sufficient to cause considerable damage by the bombardment of the emissive surface. Apart from this point the mere presence of positive ions in the vicinity of the cathode has the effect of partially neu-

(Continued on next page)

OBTAINING A BAKELITE FINISH

Here is a hint for obtaining a bakelite finish on a plain wooden panel or cabinet. Two sticks of different shades of sealing wax are obtained, and each is broken up into small pieces and placed in a separate jar or bottle containing methylated spirit. The wax will be found to have dissolved in a few hours.

The darker of the two liquids should be painted on the cabinet lightly with a very soft brush, two or three coats being necessary, giving each a reasonable time to dry. A small sponge should then be very sparingly coated with the other colour. It is best to paint the substance on the sponge with a brush.

The sponge is then pressed on the cabinet. On removing it the surface beneath will be found to have a perfect mottled appearance. Continue this process over the whole surface of the cabinet. If a brilliant finish is desired, the cabinet should be given a thin coat of varnish. If the correct shades of sealing wax are used, very attractive results can be obtained.

VALVE OPERATION

(Continued)

tralising the space charge and the effect of this will be to increase the anode current which, as we shall see, may result in the release of still further quantities of gas.

It is very exceptional for gas to be able to enter a "hard" valve as a result of any sort of leakage, but the valve electrodes and the electrode supports are metallic and will contain a certain amount of occluded gas which may be driven from "solution" by an excessive increase of temperature.

This point is taken care of in fixing the valve ratings, and several of the recommendations in the Code of Practice are also based upon it. For instance the Code emphasises the need to avoid the use of valves ". . . as oscillators or under any other circuit conditions which result in appreciable grid current unless such a requirement is covered by the specification . . ." The grid current referred to here is, of course, the so-called "grid positive current" formed by a flow of electrons from the cathode to the grid when the instantaneous grid potential is allowed to become positive, or insufficiently negative, with respect to the cathode. This grid current necessarily dissipates power at the grid and the consequent rise in temperature of the grid may result in gas release. Moreover, apart from the temperature rise, the bombardment of the grid by the arriving electrons may also contribute to the release of occluded gas from the grid surface.

Control of Screen Voltage

The avoidance of gas release is also one of the explanations of another interesting recommendation in BS.1106, which is probably very far from generally known. The recommendation in question reads: "It is desirable that the resistances used in the supply network for voltages on screen grids of multi-electrode valves should be kept as low as possible. Aligned grid valves operating with the screen voltage substantially lower than the anode voltage should derive the screen supply by means of a series resistance." Unaligned grid valves, other than frequency changers, may derive the supply by means of a s eries resistance."

Small manufacturing variations in the positioning of the electrodes in aligned grid valves result in rather wide variations of screen current from one valve to another. Thus the replacement of a valve in a circuit where the screen supply was derived through a series resistance rather than from a potentiometer might cause the screen voltage to depart greatly from the designed value. This would cause a marked change in performance and the rise in anode current might result in raising the anode temperature to a value at which appreciable gas release takes place. Unaligned grid valves employing a suppressor grid are not normally so critical in this respect.

Grid Primary Emission.

In any simple consideration of the operation of a radio valve, it is assumed that the cathode is the sole source

of the electron stream. Ideally, the control grid of a valve when operated under "Class A" conditions would neither collect nor lose electrons, and the input resistance of the valve would be infinity. In practice these simple conditions do not hold exactly and the valve electrodes other than the cathode can and do emit electrons which produce irregularities in the operation of the valve.

Grid Emission

Grid primary emission is a thermionic emission occurring in exactly the same way as, but fortunately to a much lesser degree than, the thermionic emission from the cathode. It will be appreciated that the valve grids, and more particularly the first or control grid, are heated by thermal radiation from the cathode and that this effect is increased by reflection and radiation from the surfaces of the other electrodes. The resultant grid temperature under certain conditions may be sufficient for appreciable electron emission to take place.

Since grid primary emission is thermionic in character, its prevention or reduction is evidently in part a question of grid colling. The valve will have to be designed in such a manner that, under the conditions permitted by the ratings, the grid or grids will operate at a temperature at which grid primary emission is not troublesome. The cooling of the grid is effected partly by conduction through the grid supports and partly by radiation from the grid or from special cooling fins which may be provided. The efforts of the valve designer will be defeated if a valve is used under conditions where more heat is dissipated on the grid than has been allowed for in design, and this adds further weight to those clauses of the Code of Practice which are concerned with the avoidance of the use of valves under conditions where electrode temperatures may rise unduly.

Cathode Temperature

It was mentioned, earlier in this article, that an excessive cathode temperature could result in the evaporation (sublimation) of the emissive coating of the cathode and its deposition upon the other electrodes of the valve. If a grid becomes contaminated the possibility of primary emission is very greatly increased since the contaminated surface has a greater thermionic emissivity than the original clean metallic surface.

The electrons so emitted will tend to pass to an electrode carrying a more positive potential. In general, this electrode will be the anode, but in any event the stream of electrons leaving the grid will constitute a current which, under the normally accepted convention, flows from the grid to earth through the external path. Such grid current is called "grid negative current" to distinguish it from the "grid positive current" which flows from earth to the grid through the external path whenever the grid potential permits the collection of electrons from the cathode stream.

This flow of grid negative current may set a limit to the resistance which may be connected between the grid concerned and the cathode, since the flow of grid negative current through the external resistance gives rise to a voltage drop which, in the case of a control grid, would offset the bias potential by a value proportional to the external grid resistance. This point explains the necessity for keeping such external resistance as low as possible.

Grid Current

Although it does not occur as a result of grid primary emission, it is necessary to consider here the case of grid negative current arising from another cause, and generally referred to as "gas current." It has been mentioned already that a small residual quantity of gas may be present in the bulb and further gas is liable to be released by an increase in temperature of the valve electrode. Collision between the electrons from the cathode and gas molecules results in ionisation of some of the latter, which become positively charged and will travel to the grid and other negatively charged surfaces. The arrival of positively charged ions at the grid can be regarded as constituting a grid negative current comparable with the loss of electrons from the grid. It has already been pointed out that the flow of grid negative current offsets the bias potential on the valve to an extent determined by the external resistance of the grid circuit. The reduction of bias voltage increases the anode current and this will raise the temperature of the anode. A vicious circle may therefore be established in which the flow of gas current in the grid circuit causes an increase in temperature of the anode and so results in the release of more gas and consequently in an increase in the gas current itself. This danger of the valve "running away" is obviously dependent upon the external grid resistance and may be avoided by ensuring that this resistance is as small as possible.

Grid Leak Valves

These considerations requiring a low external resistance apply equally to all valve grids, but the Code of Practice is more specific in the case of the first or control grid and quotes recommended maxima which should not be exceeded. For voltage amplifying½ valves, the figures are 1MQ when automatic bias is used and 0.5MQ with

(Continued on page 26)

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY—

A LA RANDWICK

The bookies often call the odds, 6/4, but with me it's odds on that daily from 4/6 we will have thunder and that disturbing static which precedes the storm. Did you ever know such weather as we have experienced during December and January to date (18th)? As a matter of fact, on reflection, it goes back to November and round about that time when the BBC made such changes in the Pacific Service. Perhaps the ether was protesting at what it knew would be a mistake. I think I can safely say I am echoing the voices of a great many listeners when I state that it is the poorest treatment we have had from the BBC.

As it is at present, although opening at 4.15, that poor old veteran, GRH, is lucky if he can make himself heard much before 6 o'clock. One afternoon during his vacation, Ted Whiting, of "Radio and Hobbies" dropped in to see me and when I tuned to GRH and we HEARD it at 4.45, both of us received a shock, but the next day there was not GRH at that hour.

Admittedly we have a choice of several transmitters, but does anyone go up to the 41 metre band unless compelled to do so, at that time? Just as GRM works himself up to a good lather by 7.15, he, with his pal, GSU, politely withdraw, their friend GSL having slipped away at 6.45. As GSL makes his exit, GSD steps into the breach and at 7.45 GWC (intended for N.Z. and Pacific Area till 8 p.m.) shows up and is assisted by GSN till 8.45. The number of occasions the ABC have been unable to relay the BBC news at 5 and the many times even the Radio News Reel at could not be put over is ample proof that the majority of householders relying on the 4 or 5 valve Commercial set would have even more headaches than those of us with an array of Custom buit receivers.

THREE HEARTY CHEERS

Here is some great news and the following appeared in "The Sydney Morning Herald" on December 31.

Technicians Beat Aurora

Washington, Dec. 30 (A.A.P.)—

The war Department announced that the Army, the Air Forces, and the Signal Corps had solved the problem of the Aurora Borealis, which has for long upset radio communications.

One Army Communications System has installed six long-wave stations linking the United States, Newfoundland, Labrador, Greenland, Iceland, and Britain, thereby assuring continuous radio, telegraph, and teletype communication, uninterrupted by atmospheric disturbances during magnetic storms which distort and sometimes "black out" short-wave communication.

HOPE BOB BOBS UP HERE

It was with a feeling of pleasure and regret that, when listening to Radio News Reel, Pacific Edition No. 1094, on Wednesday, January 12, I learnt with regret that Robt. Harris was leaving the BBC. For the last three years he has been closely associated with Radio News Reel, and it is with pleasure I heard that returning to his profession as an actor, he will be with a unit that may take in Australia in the course of their travels. He said he had always been most anxious to come to this country, and had it not been for the war he would probably have accepted a position offered him with a Radio concern in Australia. So let us hope he does journey this way, and may be here when the "All Clear" is finally sounded. Australia could do with men who have the experience of Robt. Harris.

WHAT'S IN THE AIR?

And so at last I know why Arthur Cushen can tell what's on the air by what he has in the air. For short-wave listening he uses an inverted L 50 feet high and 300 feet long, while when trying to bring in those overseas broadcast bands he has an aerial 600 feet long. Well, there you are, and if you still insist a piece of wire about 16 feet long and hung around the picture rail is good enough, then prove it by displaying your QSL cards alongside Arthur's.

On the ends of these aerials is an 8 valve English made ECKO receiver, which, in 5 bands, covers from 530 to 33,000 kilocycles.

BBC SERVICE OPERATIVE ON AND FROM SUNDAY, JANUARY 23

All Times Australian Eastern Daylight Saving

Note.—Has been extended 30 minutes 4.45—9.15 p.m.

AUSTRALIA

GRH—9.825 mc., 30.53 m. Throughout
GSL—6.11 mc., 49.10 m., 4.45—7.15.
GRM—7.12 mc., 42.13 m., 4.45—7.15
GRV—12.04 mc., 24.92m., 6.30—9.15.
GWE—15.435 mc., 19.44 m., 7.45—9.15
GVQ—71.73 mc., 16.92 m., 7.45—9.15.

NEW ZEALAND AND PACIFIC AREA

GRH—9.825 mc., 30.53 m., Throughout
GSU—7.26 mc., 41.32 m., 4.45—7.15.
GRM—7.12 mc., 42.13 m., 4.45—7.15.
GWE—15.435 mc., 19.44 m., 7.45—9.15.
GSH,—11.82 mc., 25.38 m., 7.45—9.15.

Shortwave Notes and Observations

AUSTRALIA

VLI-8, Sydney, 17.80 mc., 16.85 m. Heard at fair strength 8.30—9 p.m. in second transmission to Great Britain. Also heard over VLI-3. (Cushen).

OCEANIA

New Caledonia

FK8AA, Noumea, 6.20 mc., 48.39 m. Signal mainly R7-8 from 8 p.m. (Clack).

AFRICA

Algeria

AFHQ, Algiers, 4.85 mc., 61.85 m.: Heard at 7 a.m. (Nolan). (See "New Stations").

AFHQ, Algiers, 6.04 mc., 49.67 m.: Good strength at 5 a.m. (Cushen). Heard closing with English anouncement at 10 a.m. (Walker).

AFHQ, Algiers, 9.53 mc., 31.46 m.: Heard with news at 9 p.m. At 9.30 gives programme summary in English. News at 10, signs 10.15 (Cushen).

AFHQ, Algiers, 11.88 mc., 25.24 m.: Heard at 9 p.m. (Walker).

Arabia

ZNR, Aden, 12.11 mc., 24.76 m.: Heard opening at 3.15 a.m.; closes at 4.15 with "You are listening to ZNR, Aden, Arabia, broadcasting on 24.76 m. We will be on the air tomorrow night at the same time and wavelength, Station ZNR, Aden, Arabia, now closing down. Good night." (Nolan).

French Equatorial Africa

FZI, Brazzaville, 15,595 mc., 19.25 m.: Heard very strongly in a transmission to the South Pacific area 10.15—11.45 p.m. daily. No English, all French. (Walker). (Signals from Brazzaville in W.A. appear to be much better than here. The morning transmission on 25.06 is invariably mixed up with morse, but the new evening outlet, 19.33 m., augurs well and opens earlier than 10.15.

Reports on reception will be welcomed by the French Delegation in Australia, 60 Hunter Street, Sydney. —L.J.K.).

Ethiopia

Radio Addis Ababa, 9.62 mc., 31.17 m.: This one relays the BBC news at 3 a.m. From opening at 1.30 a.m. is troubled by the new BBC, GWO, on the same frequency cutting in and out. (Walker).

Belgian Congo

RNB, Leopoldville, 9.78 mc., 30.66 m.: Very good when closing at 5.45 p.m. (Cushen). French heard at 3.15 a.m. (Edel)

Another African to give us some English. Time to hear it, 10.15 a.m. Session lasts half hour, and some popular records are played. At 1.30 a.m. in programme for South Africa is one of the strongest signals I have heard (Walker).

FZI, Brazzaville, 11.97 mc., 25.06 m.: A splendid signal is heard when this one gives the news in English at 7.45 a.m. Other English news periods are 5.45 and 10.45 a.m. The first two are R9 and the latter R7. Lady announcer mostly (Walker).

Egypt

—, Cario, 5.84 mc., 51.37 m.: Heard 5—5.30 a.m. (Nolan). (See "New Stations.

SOUTH AFRICA

—, 9.92 mc., 30.24 m.: This one is rather hard to hear, being weak on opening at 1 a.m. Hope it will improve. English is used and the South African Broadcasting Corp. is mentioned (Walker).

(This is a new one, can anyone give it a name?—L.J.K.)

VQ7LO, Nairobi, 27.96 m.: Musical programme at 3.15 a.m. (Edel).

AMERICA (Central)

Costa Rica

TIPG, San Jose, 9.617 mc., 31.20 m.: "La Voz de la Victor" has returned to the air, signing off at 2 p.m. (Howe, "Universalite.")

Guatemala

TGWA, Guatemala, 9.68 mc., 30.96 m.: Heard till 6 p.m. Xmas Day and till .30 p.m. on New Year's Day (Cushen).

TGWA, Guatemala, 15.17 mc., 19.77 m.: Heard till 6.30 p.m. Xmas Day (Cushen).

TGWB, Guatemala, 6.49 mc., 46.22 m.: Good at 3 p.m. (Cushen).

U.S.A.

WLWO, C'nnati, 17.8 mc., 16.85 m.: Gives news in Basic English at 2 a.m. (Nolan). News at 5 a.m., signs 5.45 (Cushen).

KWID, 'Frisco, 15.29 mc., 19.62 m.: Heard opening at 4 a.m. with news (Cushen).

KWIX, 'Frisco, 11.87 mc., 25.27 m.: Very good from 6.30 till 8.45 p.m. — remaining half hour interfered with by the New Delhi (Cushen).

WKLJ, New York, 9.75 mc., 30.77 m.: News at 7 and 8 a.m. (Cushen).

WGEA, Schenectady, 9.53 mc., 31.48 m.: Excellent signal when giving news at 7 a.m.—L.J.K.

WKRD, New York, 7.82 mc., 38.36 m.: Quite good through morse at 5 p.m. (Cushen).

WRUW, Boston, 7.80 mc., 38.44 m.: News heard at 6 p.m. (Cushen).

KGEI, 'Frisco, 7.25 mc., 41.38 m.: R6-7, Q5 through noise from 7 p.m. (Clack).

KWID, 'Fisco, 7.23 mc., 41.49 m.: R5 Q4 through terrific noise level from 9.30 p.m. (Clack).

KEL, Bolinas, 6.86 mc., 43.7 m.: Heard from 7 till closing around 7.08 p.m. (Clack).

WGEO, Schenectady, 6.19 mc., 48.47 m.: R7 at 6.30 p.m., one night (Clack).

WBOS, Boston, 6.14 mc., 48.86m.: Back on this frequency again. News at 8 p.m. (Cushen).

WCRC, New York, 6.12 mc., 49.02 m.: Signs at 5.45 p.m. (Cushen).

WKTS, New York, 6.12 mc., 49.02 m.: In the clear, sometimes from 7 p.m. till closing at 8 (Clack).

WLWK, New York, 6.08 mc., 49.34 m.: Good at 6 p.m. signs at 7.30 (Cushen).

KWIX, 'Frisco, 25.27 m.: On Friday, January 7, ran away from KWID and went all Eastern, even giving its own version of the news, and at 8 p.m. called "All Americans on the High Seas," and gave the news at dictation speed. Next night kept in step with KWID and has done since, but KWID makes no reference to KWIX and both sign off individually. KWID, when signing, says nothing about coming back in 14 minutes.

WOOC, New York, 9.65 mc., 31.09 m.: Other than announcements each quarter hour have not heard English from this station.

KWU, 'Frisco, 15.35mc, 19.53 m.: Heard with fair signal when giving news at 8 a.m.—L.J.K

KWV, 10.84 mc., 27.68 m.: when closing at 7.45 says, "Programme for the South West Pacific will be resumed in 15 minutes over Station KWY on 7.56 mc." They then leave the air without the American National Anthem. I have not been able, so far, to hear KWY through the morse and noise. KWV, of course, returns at 8 o'clock for Latin America. Signal most nights while starting off well fades by 9.30—L.J.K.

WCRC, 9.59 mc., 31.28 m.: This new one is heard with news at 9 p.m. (Edel). French at 9.30—L.J.K.

WRUW, 15.35 mc., 19.54 m.: Heard in Spainsh at 2.15 a.m. (Edel).

SOUTH AMERICA

Argentine

LRX, Buenos Aires, 9.66 mc., 31.06 m.: Has returned to the air after a brief absence. (Howe, "Universalite.")

(Roy Hallet tells me he has been hearing LRX for some time now, around 7—8 a.m.—L.J.K.)

LRX-1, Buenos Aires, 6.125 mc., 48.94 m.: Was relaying LRI's "Radio el Mundo" programme whilst LRX was off the air. (Howe, "Universalite.")

Brazil

ZYC-8, Rio de Janiero, 9.61 mc., 31.22 m.: This is a new one and "Radio Educadora do Brasil opens at 10 a.m. closing at 1 p.m. (How, "Universalite.").

ZYC-9, Rio de Janiero, 15.37 mc., 19.51 m.: This is another new one, but do not know schedule. (How, "Universalite.")

Chile

CE960, Santiago, 9.60 mc., 31.25 m.: Good at 3 p.m. (Cushen).

CE970, Valparaiso, 9.73 mc., 30.82 m.: Very good at 3 p.m. (Cushen).

Colombia

HJCT, Bogota, 6.18 mc., 48.54 m.: This is a new frequency mentioned by Mr. Howe, Shortwave editor, "Universalite." Schedule is 10 a.m.—3.15 p.m.

Dutch Guiana.

PZX, Paramaribo, 5.75 mc., 52.17 m.: Using this frequency from 11—11.45 a.m. (Howe, "Universalite").

(Not likely to be heard here at that time, but can be added to station lists —L.J.K.)

Peru

OAX4W, Lima, 9.40 mc., 31.90 m.: Heard closing at 4 p.m. (Cushen).

THE EAST

China

XGOY, Chungking, 6.13 mc., 48.94 m.: R-6 through bad heterodyne from opening at 10.35 p.m. (Clack). (Am told they have now moved to 6.10 mc., 49.10 m.—L.J.K.).

XGOY, Chungking, 11.90 mc., 25.21 m.: From January 6 for a few nights moved to approximately 11.945 mc., 25.11 m., and signal appeared to be better. Now back again on 25.21 m.—L.J.K.

INDIA

VUD-, Delhi, 11.87 mc., 25.27 m.: Very good after KWIX shuts down at 9.15 p.m. Broadcasts a lot in French. Gives news in English at 11 and closes 11.15 p.m.—L.J.K.

Heard in Japanese from 9.30 till 10 p.m. (Edel).

VUD-2, Delhi, 7.29 mc., 41.15 m.: R7-Q5 from 10 p.m. (Clack). Very good at 2 a.m. (Cushen).

VUC-2, Calcutta, 7.21 mc., 41.61 m.: Heard from 10.30 p.m. (Clack).

VUD-2, Delhi, 6.19 mc., 48.47 m.: R5-6 around 11 p.m. (Clack). Heard at 2 a.m. (Cushen).

VUD-3, Delhi, 6.085 mc., 49.3 m.: R5-6 every night from 9.30 p.m. (Clack). News in English at 1.45 a.m. (Edel).

VUD-3, Delhi, 6.01 mc., 49.92 m.: R6 around 10.30 p.m. (Clack).

VUD-, Delhi, 4.96 mc., 60.48 m.: Fair signal at 4.55 a.m. (Nolan). Heard at 2 a.m. (Clack).

VUD, 48.47 m.: at 2.45 a.m. announces: "You have been listening to All India Radio on 48.47 m." (Edel).

VUC, Calcutta, 4.9 mc., 61.2 m.: Snifter signal at 2.45 a.m. (Nolan).

Heard in Church service at 10.30 p.m. on Sunday (Clack.)

Very good with news at midnight (Cushen).

GREAT BRITAIN

GRH, 9.825 mc., 30.53 m.: Have been hearing this one before 11.30 a.m. in General Overseas Service. Is also improving in Pacific Service and now apart from morse presents excellent signal from opening at 4.45 p.m.—L.J.K.

GRK, 7.18 mc., 41.75 m.: Heard through the noise at 6.30 p.m. (Clack).

GRM, 7.125 mc., 42.13 m.: R 6-8, Q5 at 6.30 p.m. R4-5 Q4-5 at 7 a.m. (Clack).

GRF, 12.095 mc., 24.80 m.: Heard in religious service (for Europe) at 9.15 p.m. and in Dutch at 9.30 — L.J.K.

From 2.15 till 2.45 a.m. heard with good signals, GRO, 48.54; GRN, 48.43; GRB, 49.92; GWN, 49.26; and GSA, 49.59 metres. (Edel).

U.S.S.R.

Moscow, 9.86 mc., 30.43 m.: Good at 5.30 p.m. (Cushen). (Arthur, please loan me your Static Eliminator. — L.J.K.)

Moscow, 8.94, 33.56 m.: The best Moscow signal at night for News in English. Only on for 20 minutes, 10.21 till 10.39, but "Bureau of Information News" and 'Snapshots from the Front" are good.

When closing says, "We will return to the air in about one minute in the 19 metre band." Could not find them on 19 metre band.—L.J.K.

NEW STATIONS

Radio Tananarive, Antananarivo, 12.13 mc., 24.73 m.: Mr. Edell tells me of this new outlet for the Madagascan station. Heard from 1 till 1.30 a.m. in French. Badly heterodyned at start, but signal improves from R7 to R9.

COBH, Havana, 11.805 mc., 25.41 m.: This one first reported by Mr. Walker of Applecross, W.A., was, unfortunately, too late for Jonuory issue. It relays CMCX-CMCF and call sign is given immediately after four blosts on a car horn, as is slogan, "La Voz de . . ." Heard at 9 a.m. and is very good also around 10.30 p.m. to midnight. (Sorry, cannot help with slogan. This is evidently a very new station as it is not listed in Radio Guia, the Cuban Radio Guide—L.J.K.)

—, Cairo, approx., 5.84 mc., 51.37 m.: Mr. Ray Nolan of West Perth, submits this one. Mr. Nolan says, "Copied this one from 5 till 5.30 a.m. Was still going at 6 a.m. Strength excellent."

AFHQ, Algiers, approx. 4.85 mc., 61.85 m.: Another one from Mr. Nolan. "Heard calling New York at 7 a.m. Strength was fair missed a lot owing to noise." (Mr. Clack refers to a station around this frequency and owing to noise is unable to tell whether language is French or Spanish, but favours the former. Signal is R3 Minus and noise very high. Closes at 8.15 a.m.—L.J.K.)

RNB, Leoplodville, 15.53 mc., 19.33 m.: When listening to Leopoldville on 16.88 m. on December 28, at 10.15 p.m. heard: "Here is an important announcement. As from Sunday, January 2, this transmission will be on 19.33 m., a frequency of 15.530 kilocycles." Signal is, most nights, around R8, Q4.

WOOC, New York, 15.19 mc., 19.75 m.: This new transmitter of the Columbia Broadcasting System first heard on January 1, 1.45 a.m. Station announced, ". . . and may be heard also on WOOW 25.3 m." Then went into Italian. Signal on WOOC R4 Q3, but could not find a trace in the 25 metre band of WOOW.

WOOW, New York, 6.12 mc., 49.02 m.: A New Yorker found by Mr. Walker. Opens at 10.15 a.m. directed to Europe — signal soons weakens.

WOOC, New York, 9.65 mc., 31.09 m.: Another station transmitting programmes of The Columbia Broadcasting System. Excellent signal at 7.30 a.m. and good till 9 a.m., but then gradually fades and by 9.45 is gone, although Mr. Walker writes stating it is heard in Perth till 10 a.m.

WCRC, New York, 9.59 mc., 30.28 m.: Still a further outlet for Columbia Broadcasting System. Heard at quite good strength in News at 9 p.m. Goes through the various languages at the usual times.

ERRATA

One or two mistakes crept into the January issue.

GWQ, London, should have read 11.84 mc., 25.34 metres, and GWH, Landon, is correct call for 11.80 mc., 25.42 metres.

British Mediterranean Station is nearer 11.72 mc., making the wave length 25.60 m. instead of 25.62.

Allied and Neutral Countries Short-Wave Schedules

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

Loggings are shown under "Short Wave Notes and Observatians." Symbols: N—New statians; S—Change of Schedule; F—Change of frequency.

NOTE: S indicates change of schedule other than those affected by change of time system.

Call Sign	Location	Mc.		M.	Time: East. Australian Daylight
GRZ	London	21.64		13.86	10—12.15 am.
GSH	London	21.47		1397	9.45—2.30 am.
OPL	L'poldville	20.04		14.97	10.55—midnight.
—,	L'poldville	19.20		15.63	3.45—4.30 am; 5.30—5.45 am; 10.15—10.30 pm.
HBH	Berne	18.48		16.23	Tues & Sat 12.45 am—2.15 am
HER-	Berne	18.45		16.26	Tues. & Sats. 6.30—8 pm
GVO	London	18.08		16.59	2—3.15 am
AFHQ	Algiers	18.02	N	16.64	10.20 pm
GRQ	London	18.02		16.64	Midnight—2.15 am.
VWY	Kirkee	17.94		16.72	Around 10.30 pm.
GRP	London	17.87	S	16.79	9—11.15 p.m. ; 2.45—4.15 am
EIRE	Athlone	17.84		16.82	11—12.30 am; 4.30—5 am; News 3.45 a m
WCDA	New York	17.83		16.83	12 am—5.30 am.
WCRC	New York	17.83		16.83	8.15—10.15 am
GSV	London	17.81		16.84	Not in use.
VLI-8	Sydney	17.80		16.85	8.30—9 pm
WLWO	Cincinnati	17.80		16.85	8.30—9.45 am; 12.15—5.30 am
GSG	London	17.79	S	16.86	9—9.30 pm; 2.15—3.45 am
WRCA	New York	17.78		16.87	12—3.45 am
OPL	L'poldville	17.79	S	16.88	5.55—7.15 am.
KROJ	'Frisco	17.76		16.89	Noon—1 pm; News at noon.
WRUW	Boston	17.75		16.90	2—4.15 am
GVQ	London	17.73	S	16.92	7.45—9.15 pm; 12.30—2.30 am
LRA-5	B'nos Aires	17.72		16.93	Sats. 7.45—7.30 am
—,	Brazzaville	17.71		16.94	7.30—8 am
GRA,	London	17.71		16.94	7 pm—3.45 am; News 7 pm
GVP	London	17.70		16.95	8 pm—1 am
KMI	'Frisco	17.09		17.5	2—5 am
WCW	New York	15.85		18.93	4 am—8 am
LSL-3	Beunos Aires	15.81	N	18.97	
—,	Moscow	15.75		19.05	10.40 pm —12.30 am
FZI	Brazzaville	15.59	F	19.25	10.15—11.15 pm
RNB	L'poldville	15.53	N	19.33	10 pm—midnight
KKR	Bolinas	15.46		19.4	News and commentary 1—1.30 pm
GRD	London	15.45		19.43	2.30—3.45 am; 5—8 am
GWE,	London	15.43	S	19.44	7—9.15 pm;10—11 pm
GWD	London	15.42	S	19.46	8.30—8.45 pm; 9 pm—1 am 2.15—2.45 am.
GRE	London	15.37		19.51	6.45—8 pm; 11.15—2 am; 2.30—5 am.
ZYC-9	Rio deJ'niero	15.37	N	19.51	Schedule unknown
KWU	'Frisco	15.35	S	19.53	2—5 am; 7.30—9.15 am; 10.45 am—11.45 am
—	Masocw	15.35		19.54	9.15—11.20 pm. (English from 10.40)
WRUW/L	Boston	15.35		19.54	9 pm—4.15 am; 3.30—4.30 am
WGEA	Schenectady	15,33		19.57	8.30—9.45 am
KGEI	'Frisco	15.53		19.57	Closes at noon.
WGEO	Schenectady	15.33		19.57	10.15 pm—6.30 am
VLI-3	Sydney	15.32		19.58	8.30 pm—Midnight
GSP	London	15.31		19.60	4.45—6.15 am; 10.30 pm—1 am
KWID	'Frisco	15.29		19.62	4.30—Noon; 4—5.45 pm
VUD-3	Delhi	15.29		19.62	2.30—8.30 pm; News 2.30 and 6.
WCBX	New York	15.27		19.64	10 pm—7.45 am; 8—10.45 am
GSI	London	15.26		19.66	4.45—6.15 pm; 2.45—7 am
WLWK	Cincinnati	15.25		19.67	8.30—11.15 am; 11.30 pm—8.15 am.
VLG-6	Melbourne	15.23		19.69	11.45 am—12.20 pm; 1.40—1.50 pm (Sun. 1.15—1.50)
—	Moscow	15.22		19.70	8.15—8.40 am; 9.47—10.30 am; 12.15—12.40 pm; 10.40—11.20 pm
HVJ	Vatican City	15.21		19.72	11.15 pm—2 am; 2.15 am—3.45 pm
XGOY	Chungking	15.20		19.73	Heard testing with U.S.A. 6—8 pm
TAQ	Ankara	15.19		19.75	8.30—11.15 pm; 12.30 am—1.45 a.m.
KROJ,	'Frisco	15.19		19.75	7—11.45 am
WKRX	New York	15.19		19.75	6.30—8 am
XGOX	Chungking	15.18		19.76	Wed. only, 11—11.45 am
GSO	London	15.18		19.76	9.45—10 pm; 11.15—12.15 am; 2.30—2.45 am; 4.30—5 am
TGWA	Guatemala	15.17		19.78	4.45—5.55 am (Mon. till 9.15 am)
VLG-7	Melbourne	15.16		19.79	6—8.10 am (Sun. 6.45—8 am)
SBT	Stockholm	15.15		19.80	2—5.15 am. News 2.01 am
WNBI	New York	15.15		19.81	11 pm—8 am.
GSF	London	15.14		19.82	10 pm—1.45 am; 2—5.15 am
KGEI	'Frisco	15.13		19.83	4.15—5.15 am
WRUS	Boston	15.13		19.83	6—7.30 am.
HVJ	Vatican City	15.12		19.84	Irregular in afternaons
—	Moscaw	15.11		19.85	8.15—8.40 am; 9.48—10.30 am; 12.15—12.40 pm; 2.15—2.40 pm; 10.30—11.20 pm
HVJ	Vatican City	15.09		19.87	See 19.84m.
GWC,	London	15.07	S	19.91	7—8.45 pm; 9 pm—1.45 am
GWG	London	15.06		19.92	No schedule.
WWV	Washington	15.00		20.00	See 10 m.c.
—	Moscow	13.42		22.35	Around 11.45 pm
WKRD	New York	12.96		23.13	11 pm—10.15 am
CNR	Rabat	12.83		23.38	10.30—11 pm
HCJB	Quito	12.45		24.11	7—8 am; 10.55 pm—midnight
—	Moscow	12.26		24.47	2 pm to 3 am
TFJ	Reykjavik	12.23		24.54	4.15—4.30 pm
—	Moscaw	12.19		24.61	8.45—10.23 am; 11—11.50 am
—	Moscow	12.17		24.65	7—9 am; 3.40—4.45 pm; 5.45—6 pm; 8.30—9.50 pm; 12—12.15 pm; 1.30—1.45 am; 2.15—2.45 am
R. France	Algiers	12.12		24.75	3.30—5.30 am; 6—8.30 am; 8.45—9.15 am
ZNR	Aden	12.11		24.77	3.13—4.30 am
GRF	London	12.09	S	24.80	11 pm—2.15 am
GRV	London	12.04	S	24.92	6.30—9.15 pm
FZI	Brazzaville	11.97	S	25.06	5.45—9 am; 2—3 pm; 5—5.15 pm; 12.30—1.15 am
—,	Moscow	11.96	N	25.08	Around 10.30 pm
GVY	London	11.95		25.09	9 pm—2.45 am; News 10 pm, midnight and 2 am.
GVX	London	11.93		25.15	8 pm—1.30 am; 2.30—6 am; (Eng 8.15—8.45 pm; 12—12.30 am.
XGOY	Chungking	11.90		25.21	9—10.30 pm; 2.30—3.30 am.
VLG-9	Melbourne	11.90		25.21	Not in use
CVAIO	Montevideo	11.90		25.21	10.5 am—1.10 pm
WRCA	N.Y.	11.89		25.22	7—11.45 pm; 4—7.45 am; 8 am—2.30 pm
VPD-2	Suva	11.90	N	25.22	9.30—11 am
WKTM	New York	11.89		25.23	9—11 am.
AFHQ	Algiers	11.88	N	25.24	7.57 pm
VLR-3	Melbourne	11.88	S	25.25	Daily 11.45 am—5.45 pm; Sun. from 12.50 pm
VLI-2	Sydney	11.87		25.27	5.55—6.25 pm
WBOS	Boston	11.87		25.27	9.15—11 pm; 6—8.15 am; 8.30 am—3 pm
VUD-,	Delhi	11.87		25.27	8.45—11.30 pm; News 8.46
KWIX	'Frisco	11.87		25.27	6.30—9.15 pm
HER-5	Berne	11.86	S	25.28	11.55—1 am
GSE	London	11.86		25.29	10 pm—6 am.
WGEA	Schenectady	11.84		25.33	11 pm—8.15 am
VLG-4	Melbourne	11.84	S	25.34	Noon—1.45 pm; 7.10—8 pm; 8.30—9 pm; 9.15—10.45 pm
GWQ	London	11.84	N	25.34	8 pm—1.30 am; 2.30—5.45 am
VLW-3	Perth	11.83		25.36	9.30 am—12.45 pm; 2.30—9.15 pm; (Sun. 9.45 am—9.15 pm)
—	Moscow	11.83		25.36	3—3.45 pm; 4—5 pm; 10—10.30 pm; 12—12.4 am; 1.30—4.45 am.
WCRC	N.Y.	11.83		25.36	6.15—7.15 am
WCDA	N.Y.	11.83		25.36	No schedule
GSN	London	11.82	S	25.38	7.45—9.15 pm; 11 pm—11 am
XERR	Hermosillo	11.82		25.38	12—4 pm
COBH	Havana	11.80	N	25.41	Heard at 9 am and 10.30 pm
COGF	Matanzas	11.80	S	25.41	Said to be off the air.
GWH	London	11.80	N	25.42	8 pm—1.30 am; 2.30—5.45 am
WRUL	Bostan	11.79		25.45	4.30—9 am; 9.15—10.25 am; 10.30—5 pm

Call Sign	Location	Mc.		M.	Time: East. Australian Daylight
VUD-6	Delhi	11.79		25.45	8.45 pm—1 am; News 8.45
KGEI	'Frisco	11.79		25.43	8 am—3.45 pm
GVU	London	11.78		25.47	5—7 am
HP5G	Panama	11.78		25.47	12.15 pm—1.30 am; 3.45—7 am
VLR-8	Melbourne	11.76		25.51	6—10 am (Sun. 6.45 am—12.45 pm)
GSD	London	11.75	S	25.53	6.45—8.45 pm; 2.45—7 am; 7.45—11 am.
—,	Moscow	11.75		25.53	10.30—10.55 am.
GSB	London	11.75		25.53	3—3.45 pm.
HVJ	Vatican City	11.74		25.55	Mon. & Thurs: Calls Eng. 5 pm, Thurs & Sat calls Aust 6 pm.
COCY	Havana	11.73		25.56	12. pm—5.15 pm.
GVV,	London	11.73		25.58	9.45 pm—2.15 am; 2.30—7.30 am
WRUL,	Boston	11.7		25.58	7—10.15 am
CKRX	Winnipeg	11.72	N	25.60	4—8.45 am
OPL	L'poldville	11.72		25.60	10.55—m/n; 5.55—7.15 am.
Brit. Medit. Stn		11.72	N	25.60	11 pm—3 am
HER-5	Berne	11.71		25.61	Daily: 5—8.45 am; Tues & Sat. 6.30—8 pm
YSM,	San Salvador	11.71		25.62	5—6 am.
VLG-3	Melbourne	11.71		25.62	4.55—5.40 pm; 5.55—6.25 pm; 6.30—6.50 pm.
WLWO	Cincinnati	11.71	S	25.62	5.45—8.15 am; 9.30 pm—midnight; News 10 and 11 pm.
CXA-19	M'tevideo	11.70		25.63	10—11 pm; 8 am—2 pm
SBP	Motala	11.70		25.63	2—5.15 am; 8.20—8.40 am; 12 am—1 pm opens again at 10.05 pm
CBFY	Montreal	11.70		25.63	10.30 pm—2.30 pm
GVW	London	11.70		25.64	2.30—7 am
HP5A	Panama City	11.70		25.64	12—pm—4 am; 12.10 pm—4 pm
CE1170	Santiago	11.70		25.64	11pm—1 am
GRG	London	11.68		25.68	5—7 am; 11 pm—4 am.
—,	L'poldville	11.67		25.71	Now on 30.66 metres.
COK	Havana	11.62		25.83	3 am—2 pm (Mon. 4—10 am)
WRUA	Boston	11.14		26.92	11 pm—7.30 am.
CSW6	Lisbon	11.04	S	27.17	6—9.30 am.
KWV	San F'cisco	10.84		27.68	5—7.45 pm; 8—10 pm
VQ7LO	Nairobi	10.73		27.96	1.45—6 am
KES-3	Bolinas	10.62		28.25	4—9.15 pm
VLN-8	Sydney	10.52		28.51	Idle at present.
—	Moscow	10.44		28.72	7 pm—2.45 am (often news at 10.40 pm)
—	Moscow	10.23		29.33	5.15—6.50 pm; 10 pm—midnight
SUV	Cairo	10.05		29.84	5.30—6 am; 9.45—10.30 am
WWV	Washington	10.00		30.00	National Bureau of Standards frequency check, in speech on hour and half hour.
—	Brazzaville	9.98		30.06	5—6.20 am; 8—8.30 am 8.30—9.30 pm; 12.45—1.15 am
HCJB	Quito	9958		30.12	7—8 am; 10.55 pm—1 am
WRX	New York	9905		30.29	9 am—3 pm; 3.15—8 pm
WKRD	New York	9897		30.31	7.45—9.30 pm; 6—8 am.
WKRX	New York	9897		30.31	9—11.45 am.
KROJ,	'Frsco	9.89		30.31	1.15—6.45 pm; 7 pm—midnight; 2—5.15 am.
—	Moscow	9.88		30.34	Irregular, but often heard around 9.30 pm
CR7BE	L. Marques	9.88		30.38	5.30—7.30 am; News 6.50
EAQ	Madrid	9860		30.43	5—6 am; News 5.15
—	Moscow	9860		30.43	9—10.15 pm
COCM	Havana	9833		30.51	10.45 pm—4 pm
GRH	London	9825	S	30.53	8.15—am—1.15 pm; 4.45—9.15 pm; 1.45—2.15 am.
RNB	L'poldville	9.78	S	30.66	4—5.45 pm; 2.55—3.30 am 4.15—9.30 am
—	Moscow	9770		30.71	11—11.30 am.
WKLJ	New York	9750		30.77	6.30—9.30 am
T14NRH	Heredia	9740		30.80	11—12 pm (Wed, Fri, & Sun. 2.30—4.30 pm).
CSW-7	Lisbon	9735	S	30.82	See 27.17 metres.
CE-970	V'paraiso	9.73	N	30.82	Heard around 3 pm
XGOA	Chungking	9720		30.86	6—7 am; 10 pm—2 am; News 1 am
OAX4K	Lima	9715		30.88	9.30 am—3.20 pm
WRUW	Boston	9.70		30.93	5.45—10 am; 3—4 pm
FIQA	Tananarive	9700		30.93	1.30—2 am.
GRX	London	9690		30.96	News 8 pm; America calls Europe 8.15 pm.
TGWA	Guatemala	9685		30.96	12.50 pm—3.45 pm (Mon. 11 am—3.45 pm)
LRA-1	B'nos Aires	9688		30.96	2.30—5 am; 6.30—7.30 am; 7 am—1 pm
VLG-8	Melbourne	9.68		30.99	Idle at present.
XEQQ	Mexico City	9680		30.99	1 am—5.45 pm
VLW-5	Perth	9.68		30.99	9.30 pm—2.30 am
WNBI	New York	9.67		31.02	8.15—5 pm
Brit. Medit. Stn		9.67		31.02	11 pm—3 am; 5 am—

Call Sign	Location	Mc.		M.	Time: East. Australian Daylight
VLQ-3	Brisbane	9.66		31.05	11.45 am—5.15 pm. (Sun. 11 am—5.15 pm).
GWW	London	9.66		31.06	Heard at 11.30 pm
LRX	B'nos Aires	9.66		31.06	9.30—10.; 11.30 pm —2.10 pm (Sundays 4 pm)
HVJ	Vatican City	9.66		31.06	3—5.30 am
WGEO	Schenectady	9.65		31.08	Not in use at present.
WOOC	New York	9.65	N	31.08	7—9.45 am
WCBX	New York	9.65		31.09	2.45—5 pm.
XGOY	Chungking	9.64		31.10	10.35 pm—2.40 am; News 1 and 2 am
COX	Havana	9.64		31.12	3.50—3 pm
LRI	B'nos Aires	9.64		31.12	8.57—11 pm; 4.30—5.30 am; 6 am—2 pm
GVZ	London	9.64		31.12	7—8.45 am; 4.30—8 pm; 9 pm—2.15 am; 3—6 am
GWO	London	9.62		31.17	No schedule.
—	Addis Ababa	9.62		31.17	2.40—3.30 am
XERQ	Mexico	9.61	N	31.21	Heard at 3 pm
ZYC-8	Rio de J'n'ro	9.61	N	31.21	10 am—1 pm
ZRL	Capetown	9.60		31.22	6.15 pm—1.30 am
HP5J	Panama City	9.60		31.23	11 pm—5.30 am; 12.30 am—2.30 pm; Sun. 12 pm—2 pm. Mon.
CE960	Santiago	9.60		31.24	10 am—3 pm.
GRY	London	9.60		31.25	4.30—8 am; 10—11 pm
—	Athlone	9.59		31.27	8.05—8.25 am; News 8.10 am
VUD-4	Delhi	9.59		31.28	9.30—12.35 am; 1.15—2 am; 3.30—5.30 am; News 11 pm 1.50 am and 5 am
WLWO	Cincinnati	9.59		31.30	10 am—3 pm
WLWK	Cincinnati	9.59		31.30	Idle
VLR	Melbourne	9.58	S	31.32	6—11.30 pm daily
VLI-10	Sydney	9.58		31.32	Idle at present.
VLG	Melbourne	9.58		31.32	1.15—1.45 am (Eng. for India) 2—2.45 am (for Nth America
GSC	London	9.58		31.32	7.45 am—2.30 pm; 4—6.15 pm
WRUS	Boston	9.57		31.35	7.45 am
KWIX	'Frisco	9.57		31.35	11 am—3.45 pm; 4—5.45 pm; 10.30 pm—1 am.
KWID	'Frisco	9.57		31.35	6—9.15 pm; opens again 12.45 am
—	Khabarovsk	9.56		31.37	6.30—8.12 am; 8.40—9.45 am; 1—2.12 pm; 2.45—3.40 pm; 7—10.30 pm; 11.30 pm—1 am.
OAX4T	Lima	9.56		31.37	Midnight—1 pm
XETT	Mexico	9.55		31.39	Continuous
GWB	London	9.55	S	31.41	7.15—8.45 am; 5.10—5.30 pm 6.10—7 pm; 7.30—8.30 pm; 9.45—11 pm; 11.45 pm—12.15 am; 2.30—6.45 am.
WGEA	Schenectady	9.55		31.41	Not in use at present.
—	Moscow	9.54		31.43	10.40—11.20 pm; 1.15—1.30 am
VLG-2	Melbourne	9.54	S	31.45	4.10—4.40 pm; 11 pm—1 am; 2—2.45 am
AFHQ	Algiers	9.53		31.46	1.45—2 am; 3—9.30 am; News 6 am
SBU	Stockholm	9.53		31.47	8.20—8.35 am; 12 am—1 pm, News 8.20 and 12 am.
HER-4	Berne	9.53		31.47	See 25.61 metres.
WGEO	Schenectady	9.53		31.48	6.15—8.15 am; 8.30 am—10.30
GWJ	London	9.53		31.48	8—11.45 pm; m/n—1.30 am
ZRG	Joh'burg	9.52		31.50	6.30 pm—1.30 am
COCQ	Havana	9.51		31.53	11 am—2 pm; 9.20—12 pm
GSB	London	9.51		31.55	5.15 am—1.15 pm; 4—6.15 pm.
PRL-7	R de Janeiro	9.50		31.57	9 am—2 pm
XEWW	Mexico City	9.50		31.58	12.58—6.45 pm.
GWF	London	9.49		31.61	6 pm—1.30 am; 2.30—5.30 am
KRCA	'Frisco	9.49		31.61	4 pm—4 am
WCBX	New York	9.49		31.61	10.50 am—2.30 pm
—	Moscow	9.48		31.65	5—6 pm; 9.30 pm—1.45 am; 2.45—3.15 am.
TAP	Ankara	9.46		31.70	2—6.45 am; News 4 am. Talk at 7.15 am on Fridays.
GRU	London	9.45	S	31.75	4—7.30 am; 7.45—8.45 am; 4.30—8 pm; 11.30 pm—2.45 am.
COCH	Havana	9.43		31.80	9.45 am—4.15 pm
—	Moscow	9.43		31.81	8—8.25 am; 3.15—3.45 pm; 4.30—5 pm.
GRI	London	9.41		31.88	3.45—9.30 am; 6—8.45 pm
FGA	Dakar	9.41		31.88	4—5.15 am
OAX4W	Lima	9.40	N	31.90	Heard closing at 4 pm
—	Moscow	9.39		31.95	10.30—12 pm; 2.30—3 am; 11 am—2 pm.
COBC	Havana	9.37		32.00	12 pm—4.15 pm.
OAX4J	Lima	9.34		32.12	10 am—5 pm; 12 pm—1 am; 4—7 am
LRS	B'nos Aires	9.32		32.19	9 am—1 pm; 11—12 pm; 5—5.30 am
COCX	Havana	9.27		32.26	11.45—4 pm.
COBQ	Havana	9.22		32.54	11 pm—12.15 pm
HC2ET	Guayaquil	9.19		32.64	11.30 pm—4.30 pm

Call Sign	Location	Mc.		M.	Time: East. Australian Daylight
CNIR1	Rabat	9.08		33.03	5—9.50 am; 5.30—5.50 pm; 10.30—12 pm.
VWY	Kirkee	9.04		33.16	Around 9 am.
—	Brazzaville	9.04		33.19	12.45—1 am; 5—6.15 am; 8—8.30 am; 8.30 pm—9.30 pm
COBZ	Havana	9.03		33.23	11.45 pm—3 pm
—	Kuibyshev	8.99		33.37	6.50—7 am.
AFHQ	Algiers	8.96		33.48	3—10 am; News 5 and 6
—	Moscow	8.94		33.54	Around 9.45 pm
KES-2	'Frisco	8.93		33.58	9.15 pm—4 am
—	Dakar	8.83		33.95	6.15—7.45 am; 6.30—6.50 pm; 11.15—12 pm.
COCQ	Havana	8.83		33.98	9.20 pm—3.15 pm
COCO	Havana	8.70		34.48	8.30 pm—4.30 pm
COJK	Camaguey	8.66		34.62	3.30—4.30 am; 7.30—10 am; 12—12.30 pm:
WOO4	New York	8.66		34.64	11 am—5 pm; 5.15—8 pm.
—	Kuibyshev	8.05		37.27	2—2.30 am; 3—5.15 am; 8.15 9.45 am
CNRI	Rabat	8.03		37.34	5—10.45 am; 4—6 pm
FXE	Beirut	8.02		37.41	Midnight—8 am.
YSD	San Salvador	7.89		38.00	11 am—2.30 pm
SUX	Cairo	7.86		38.15	4.30—5.30 am; 6.15—8.45 am
WKRD	New York	7.82		38.36	10.30—12.15 pm
WKRX	New York	7.82		38.36	8—11 pm.
WRUW	Boston	7.80	S	38.44	Heard in news at 6 pm
WRUA	Boston	7.57		39.6	7.45 am.
WLWO	Cincinnati	7.57	S	39.6	3.15—5.30 pm
WKTS	New York	7.57		39.6	11 am—1 pm
—	Moscow	7.56		39.68	2—7.30 am; 9—10 am; 12.10—12.30 pm.
WDJ	New York	7.56		39.66	10.15 am—7 pm
KWY	'Frisco	7.56		39.66	11.30 pm—1.30 am
SU—	Cairo	7.50		40.00	2.30—4 am
YN2FT	Granada	7.49		40.05	11 am—2 pm
HER—	Berne	7.39		40.56	2.15—2.47 am
GRJ	London	7.32		41.01	5.30 am—2.30 pm; 3.45—6.15 pm
—	Moscow	7.30		41.10	3—10.30 am; 11—12 am; 2—4.45 pm; 5.30—6 pm
VUD-2	Delhi	7.29		41.15	8.45 pm—12.25 am; News 8.45 pm; Special news for 15 minutes at 5 am.
VLI-9	Sydney	7.28		41.21	Idle at present
GWN	London	7.28		41.21	No schedule
VUM-2	Madras	7.26		41.32	7—7.40 pm; 10.45—12.30 pm; 1.45—1.50 pm. News 11 pm and 1.45 am.
GSU	London	7.26	S	41.32	5—7.30 am; 8.15 am—3 pm; 4.45—7.15 pm; 10.35 pm 1 am
KGEI	'Frisco	7.25		41.38	2 pm—3.45 am
GWI	London	7.25		41.38	5 am—2 pm; 3.45—8.15 pm
VUB-2	Bombay	7.24		41.44	5.15—6.10 pm; 10.25—11.45 pm. News 6, 10.25 & 11 pm
VLQ	Brisbane	7.24		41.44	6—10 am.
KWID	'Frisco	7.23		41.49	9.30—4.05 am
GSW	London	7.23		41.49	6 am—2.30 pm; 3—6.15 pm
VLI-4	Sydney	7.22		41.55	12.35—1.45 am
VLQ-2	Brisbane	7.21		41.58	5.30—11.30 pm
Brit. Medit. Stn		7.21		41.58	5 am—
—	Moscow	7.21		41.61	8.50—10.30 am
VUC-2	Calcutta	7.21		41.61	9.30—10.30 pm
—	Madrid	7.20		41.63	7—10 am
GWL	London	7.20		41.64	No schedule.
YSY	San Salvador	7.20		41.65	11.30 am—3 pm
GRK	London	7.18		41.75	
XGOY	Chungking			41.80	9 pm—4 am; 5.30—8 am
—	Moscow	7.17		41.80	6.20—7.30 am; 8.15—10.55 am 11—11.30 pm; 2—5.30 am
GRT	London	7.15		41.96	1.45—3 pm
EAJ-9	Malaga	7.14		42.00	7—10.05 am
—	Ovideo	7.13		42.05	6—8.30 am
GRM	London	7.12		42.13	4.45—7.15 pm
EA9AA	Melilla	7.09		42.31	Heard around 8 am
GRS	London	7.06		42.46	3.30—9.45 am.
EAJ24	Cordoba	7.04		42.61	7.40—8 am
EAJ-3	Valencia	7.03		42.65	7—11 am
—	Ponto Delgada	7.02		42.74	6—7 am
WGEA	Schenectady	7.00		42.86	11 am—3 pm
FO8,AA	Papeete	6.98		42.95	Wed & Sat. 2.57—3.45 pm
—	Moscow	6.98		42.98	3 am—10.23 am; 11—11.30 am
YNOW	Managua	6.87		43.67	11 am—3.30 pm
KEL	Bolinas	6.86		43.7	8—8.25 pm
ZLT-7	Wellington	6.71		44.68	9 pm in news session only
TGWB	G'temala	6.54		45.87	10.30 am—4 pm
COHI	Santa Clara	6.45	N	46.48	10.30 pm—3.15 pm

Call Sign	Location	Mc.		M.	Time: East. Australian Daylight
WKTM	New York	6.38		47.01	6.15—8 pm
	Berne	6.34		47.28	5—8.45 am; News 7.53
SUP-2	Cairo	6.32		47.47	5—8 am
FK8AA	Noumea	6.20		48.39	6.15—6.27 pm; 8—9 pm
GRN	London	6.19		48.43	6.45—7.30 am; 1—3.45 pm
VUD-2	Delhi	6.19		48.47	10.30—11.15 pm; M/n—2.45 am News 11 pm; 12.45 am; Special 15 mins at 5 am
XECC	Puebla	6.19		48.47	From 3—5 pm
WGEO	Schenectady	6.19		48.47	3.15—6.15 pm
LRM	Mendoza	6.18		48.51	9.30—2 pm
GRO	London	6.18		48.54	6—11.45 am; 3.40—8.45 pm
HJCT	Bogota	6.18	N	48.54	10 am—3.15 pm.
WCBX	New York	6.17		48.62	3—6 pm
—	Antananarivo	6.16		48.62	2—3 am
HER-3	Berne	6.16		48.66	See 47.28 metres
GWK	London	6.16		48.66	6 am—2 pm; 3.45—5.45 pm; 9.30 pm—1.30 am.
HHBM	P-au-Prince	6.16	N	48.66	10 am—1 pm
HJCD	Bogota	6.16		48.70	Around 3 pm
CBRX	Vancouver	6.16		48.70	12.30 am—5.30 pm
EQB	Teheran	6.15		48.74	2.30—7.30 am; News 3.45 and 6.15
GRW	London	6.15	S	48.78	4—7 am; 7.45 am—2.30 pm; 3—6.15 pm
CKRD	Winnipeg	6.15	N	48.78	10 am—1 pm
WBOS	Boston	6.14		48.86	7.—9 pm
XGOY	Chungking	6.13		48.92	10.35 pm—2.30 am; News 1 and 2 am. Also heard around 4.45 am
VPD-2	Suva	6.13		48.94	4.55—9 pm
GWA	London	6.12		48.98	7 am—1 pam; 2.45—7.30 pm
HP5H	Panama City	6.12		48.99	10 am—3 pm
XGOY	Chunking	6.12		49.02	10.35 pm—3.30 am
XEUZ	Mexico	6.12		49.02	Around 3—4 pm
WKTS	New York	6.12		49.02	5—7 pm
WOOW	New York	6.12	N	49.02	Opens at 10.15 am
WCRC	New York	6.12		49.02	Heard closing at 5.45 pm
GSL	London	6.11	S	49.10	8.15 am—3.45 pm; 4.45—6.45 pm; 2—2.45 am
XGOY	Chungking	6.11	N	49.10	News at 1 am
CBFW	Montreal	6.09		49.25	10.30 pm—2.30 pm
GWM	London	6.09		49.26	No schedule.
ZNS-2	Nasau	6.09		49.25	12—12.15 pm; 4.45—5.15 am
VUD	Delhi	6.08	N	49.3	9.30 pm—3.20 am
VQ7LO,	Nairobi	6.08		49.32	3—6 am; News 3.15 am.
WLWK	Cincinnati	6.08		49.34	11.30 am—3 pm; 3.15—7.30 pm
CKFX	Vancouver	6.08		49.34	12.30 pm—5.30 pm
CFRX	Toronto	6.07		49.42	10 pm—4.30 pm
—	Moscow			49.42	7.30—8.30 pm
GRR	London	6.07		49.42	4.45 am—1 pm; 2.45—6.45 pm
SBO	Stockholm	6.06		49.46	Try around 8.30 am
WCDA	New York	6.06		49.50	10.30 am—5 pm
—	Moscow	6.06	N	49.50	Heard around 1.30 am
GSA	London	6.05	S	49.59	2—4.30 am
XETW	Tampico	6.04		49.66	11 pm—5 pm
WRUW	Boston	6.04		49.66	3.15—7 pm
AFHQ	Algiers	6.04	N	49.67	3—10am; News 5 and 6 am
HP5B	Panama City	6.03		49.73	10 am—2 pm; 2.30 am—5 am
—	Moscow	6.03		49.73	10.40—11.19 pm
CJCX	Sydney (Nova Scotia)	6.01		49.92	10 pm—5.30 am; 9 am—2 pm
VUD-3	Delhi	6.01		49.92	11.25—12.45 am
GRB	London	6.01		49.92	3—4.30 pm
ZRH	Joh'burg	6.00		49.95	2.—8 am
CFCX	Montreal	6.00		49.96	11 pm—5 am; 9 am—3 pm
ZOY	Accra	6.00		49.96	9.30—10.15 pm; 3.15—6.15 am News 6 am
XEBT	Mexico City	6.00		50.00	2 am—4.30 pm
WKRD	New York	5.98		50.12	3.45—7.30 pm
VONH	St. John's	5.97		50.25	11.30 pm—5.30 am; 8—1235 pm; News 8.30 am
HVJ	Vatican City	5.96		50.26	5.30—7.45 am
ZRD	Durban	5.94		50.47	10.30—11.10 pm; 2—8 am
—	Khabarovsk	5.93		50.54	9 pm—1 am
—	Moscow	5.89		50.90	8 pm—7 am
—	Lisbon	5.85		51.19	4.45—8 am
PZH	Paramaribo	5.75	N	52.17	11—11.45 am
VUB-2	Bombay	4.88		61.48	12—12.15 pm; 1 am 1.15 am; News Midnight
VUC-2	Calcutta	4.84		61.98	11—11.10 pm; midnight—12.10 pm; 1 am—2 am.
WWV	Washington	5.00		60.00	See 30 metres
VUD	Delhi	4.96	N	60.48	11.30 pm—6 am
VUC—	Colombo	4.90		61.2	10.30 pm—3.20 am. News midnight and 2 am.
GRC	London	2.92		102.9	10 am—3.45 pm

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

J.G.M. (Sydney) enquires about the probable standing of the radio "ham" in post-war plans.

A.—We have not seen any reference ot this subject, nor heard any views expressed from official quarters, but it is only reasonable to expect that experimenters wil be given every encouragement to take up transmitting as a hobby. So many thousands having been trained in Morse code and radio theory, we expect that a great many people will get their "ham" tickets when hostilities cease. Official encouragement for ham radio would be a fitting tribute to the present war effort of hams in every branch of services and in the factories on the home front.

●

W.P. (Flemington) has gone to a lot of trouble to erect big aerial ,but is now disappointed with the improvement in results, especially an the short-wave bands.

A.—From what you say we gather that you have made the new aerial too long. It is good to have it high enough to be well clear of the house wiring, but the length should be kept fairly short, somewhere oround 30 to 40 feet long for the short-waves should be ample.

●

C.M. (Bondi) is in doubt about power supply mains.

A.—There is no negative or positive main with alternating current, the polarity alternating as indicated by the title. There is, however, one main at earth potential and the other above or below, so that if you make contact between one side and earth you will get the full voltage, wheres between the other side and earth there will not be any measur able voltage. If you haven't an A.C. meter available, we suggest that you use a lamp with a couple of pieces of flex; but do be careful!

●

B.H.H. (Parkes) asks: "What is the correct value of bias resistor for 2A3 valves in push-pull? One valve book says 375 ohms, while another says 780 ohms."

A.—You forgot that valves are operated at diferent voltages, into different loads and wiith different grid-driving voltages.

The first value (375 ohms) is for class A operation at 250 volts between anode and filament, total supply voltage being 295 volts, while the usable output is 7 watts, a load of 5000 ohms being required.

If the voltage is increased from 250 to 300, then the current must be reduced or valves are overloaded as regards anode dissipation. This is done by increasing the bias resistor to 750 to 800 ohms. The supply voltage required is now obout 370 volts, the power output being increased to 10 wotts, whilst the current drain has been decreased from 120 to approximately 95 ma. (it varies with signal, but 95 is about average).

When in doubt, always use a larger value of bias resistor rather than a smaller one. Using a value 20 per cent too high has a negligible effect on tone and volume (most people can't tell the difference) and gives the valves an easier time.

●

S.L. (Cranbourne) enquires about tone control for an amplifier.

A.—Since you are using a crystal pick-up, you will find it by far the simplest and most effective way to put a loading resistance across the pick-up. Take a 1 megohm potentiometer and connect the centre terminal to one side of the pick-up and one of the outside terminals to the other side of the pick-up, right at the actual pick-up cartridge, or on the pick-up side of the volume control. By adjusting this control you will then be able to alter the loading across the pick-up which will be the effective resistance of this load in parallel with the resistance of the volume control, which can be raised to 1 megohm if desirable. Feeding into a load of half a megohm or more the pick-up should give a definite rise in the low note response. Reducing the load to a quarter megohm should flatten out the low note response to something approaching flat, whilst lowering the load to about 100,000 ohms will cut the lows, giving the same effect os increasing the high response. Of course the lower loading will also lower the effective output of the pick-up, but your amplifier should have ample gain to handle this point.

●

C.B.G. (Redbank, Q.) enquires about the 6F7.

A.—This valve is still available for replacement purposes in small quantities and we might put it that it is no harder to get than any other imported valve type. In certain circumstances it is possible to substitute with any of the converted valves, but sometimes trouble is encountered through the coupling effects between the triode and pentode portions, which are adequately shielded in the original 6F7.

VALVE OPERATION

Continued from page 19)

fixed bias, but in the case of output valves having an anode dissipation of 10 watts or over, these limiting resistances are still further reduced to 0.5MQ when automatic bias is used and 0.1-MQ with fixed bias. Output valves generally run rather hotter and have a larger grid surface, and for these reasons grid emission is likely to be greater and the external resistance must be correspondingly reduced.

The distinction which is made between the permissible external grid resistances with automatic bias and with fixed bias arises from the fact that, as mentioned already, the flow of gas current offsets the bias potential and, in turn, may bring about a still further increase in gas current. If, however, automatic bias is used, the increase of anode current arising from the offsetting of the bias voltage will cause a compensatory increase of bias voltage. Because of this the conditions are more stable than when fixed bias is used, and the employment of larger values of grid resistance is justified.

FINDING RESISTANCE OF VOLTMETER

It is sometimes very useful in radio engineering to know the resistance of a voltmeter. This is particularly important if one uses a low-resistance instrument. If this is not indicated on the meter, the following method can be used.

Using a known current source of which the voltage can be measured with the meter, and giving a nearly full-scale deflection on the meter, the meter should be connected in series with a known resistance, the value of which should be so chosen that the needle shows about half-scale deflection if both are connected across the current source. The P.D. across the meter resistance will then be indicated by the needle, and P.D. across the known resistance is Er=Er—Em. Knowing this voltage, the current flowing in the circuit can be calculated by using Ohm's law $I = \frac{Er}{Rr}$.

As the current flowing through the meter and the voltage across it is known, the resistance of the meter Rm can be found easily. $Rm = \frac{Em}{I}$.

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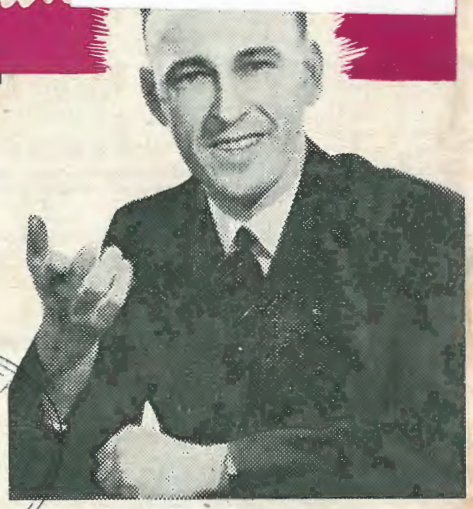
2 Am I capable of earning more money?

3 Am I willing to use my spare time to build myself a future?



L. B. Graham, A.INST.R.E. (Aust.) Fellow of the Television Society (Eng.) Principal of the Australian Radio College —the foremost institution of its kind in the Southern Hemisphere.

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H.B., Western Australia.

I am writing to let you know that I, who took your service engineering course, am now in camp with the 1st Corps, HQ Sigs of the 2nd A.I.F. I am in as a radio maintenance man and instrument (radio) mechanic. Because of the training I received from you, I am able to take my place as engineer in a wireless station or mobile van radio station. Because of the training I have had I am able to pass tests set by the instructors where many fail, and it will probably mean two or three stripes for me as N.C.O. in charge of full transmitting equipment.

C.T.S., Melbourne.

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

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

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