THE AUSTRALASIAN

Radio World

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VOL. 9 ..... NO. 1 JUNE 15 1944

★ **List of prize-winners in our utility circuit competition.**

★ **Modern version of direct-coupled amplifier for local receiver.**

★ **Details of rules and conditions for Victorian amplifier contest.**

★ **Explanation of fundamentals for frequency modulation.**

Price 1/-

THE AUSTRALASIAN RADIO WORLD

Devoted entirely to Technical Radio

and incorporating

ALL-WAVE ALL-WORLD DX NEWS

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EDITORIAL

Every now and then a new reader takes me to task for my rough and ready way of sketching out circuit diagrams without paying due attention to indicating suppressor grids, for example.

Often enough I leave out the symbol for the heater, and my neglect of such things as iron cores in coils, or using the same condenser symbol for even electrolytics, is becoming almost notorious.

I can only plead "guilty" to these crimes, but I would point out to my critics that there are several extenuating circumstances to be considered.

I consider that "Australasian Radio World" is not the same as a text book, so there is not so much need to be pedantic. Most of our readers are men with a working knowledge of theory, and most of them are busy, so that they want simple circuits, easy to read at a glance, and with all essential details and values clearly shown but not cluttered up with intricacies. I consider, too, that the placing of capacity and resistance values right at the symbol is far more effective than giving each one a letter and then tabulating values, even if it doesn't look quite so professional.

Not that it would make much difference if my style was all wrong, for it is now just as much a part of me as my handwriting and my signature. It would be a most difficult task to change either after all these years.

—A. G. HULL.

DETAILS OF VICTORIAN AMPLIFIER CONTEST

A RECENTLY-HELD meeting in Melbourne culminated in some heartening news for the many radio enthusiasts "down south," and should provide a much needed stimulation to all and sundry connected in any way or interested in the science of the production of sound and music.

Similar to Last

The Australian DX Radio Club in conjunction with the "Listener-In" have announced their intention to hold another amplifier contest, run on much the same lines as that held in 1941, which proved to be a wonderful success, to say nothing of the tremendous interest and keen spirit it created among amplifier fans.

Conditions

Briefly the conditions are as follows: The Australian DX Radio Club Amplifier Competition is open to all comers and is divided into three grades. Grade 1 open to all comers, any amplifier of any description, power output unlimited (amateurs or professionals); Grade 2, open to any home built amateur amplifier not exceeding 18 watts output; Grade 3, open exclusively to members of the A.D.X.R.C. with no limit to power output.

Rules

Rule (1). The competition shall be conducted by the A.D.X.R.C. in conjunction with the "Listener-In."

(2) All entrants shall pay a fee of 2/6 for each amplifer entered.

(3) The decision of the judges shall be final and legally binding.

(4) Grand final judging shall take place on approximately the last Saturday evening in October, 1944.

(5) The "Listener-In" reserves the right to publish the circuit of any winning amplifier.

(6) Three competent judges shall be selected to judge the elimination and final tests.

(7) The entrance fee of 2/6 must accompany each application.

This completes all the information we have to hand at the moment, further details will appear in a subsequent issue.

PRIZES

Already it is apparent that there will be a good list of prizes.

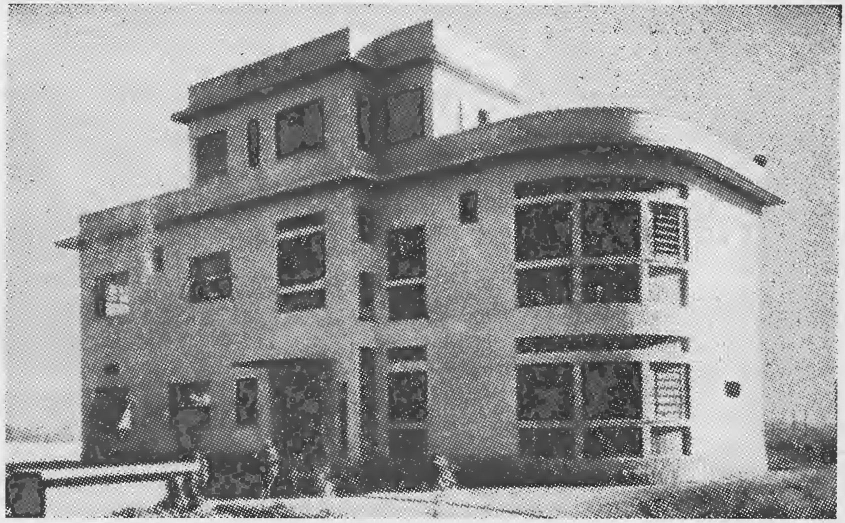
"This is a project worthy of strong support by the trade" said Mr. J. H. Magrath, of J. H. Magrath Pty. Ltd., as he donated three guineas to the prize list.

Another expression of support for the contest was a donation of five guineas by A. G. Hull of the "Australasian Radio World."

Further donations will be gratefully accepted by the Honorary Secretary, Mr. Norman H. Groves, of 135 Burgundy Street, Heidelberg. His telephone number is JL 1055.

Interstate Representation?

A movement is on foot to arrange for interstate competitors to be represented at the contest, provided that suitable transportation can be arranged for competing amplifiers. Any readers of "Radio World" who would like to compete are invited to get in touch with the Honorary Secretary at the address given above.



"Radio Nacional" of Rio de Janeiro

Details of Transmitter by Which Brazil Speaks to the World

Technical and functional details of the RCA Type 50-HF international short-wave radio transmitter, built and installed by RCA for "Radio Nacional" of Rio de Janeiro, have just been released as the station concludes its first year of short-wave operation.

Dedicated "to the service of civilization, to the purpose of good neighbour relations, to the sacred cause of freedom," Radio Nacional's achievement since the new 50-kilowatt transmitter went on the air last New Year's Eve is attested in letters from persons who have received its programmes in places as remote as Sweden, the Cape Verde Islands, Attu in the Aleutians, and other points around the world.

Eight Antennas Used.

Two of the station's eight antennas located a few kilometers outside of Rio, are beamed to the United States; two more are beamed to Europe, one to Asia, and the remaining three are non-directional. Short-wave broadcasts are transmited under the following identification calls: PRL-7, frequency of 9,520 kilocycles; PRL-8, frequency of 11,720 kilocycles; PRL-9, frequency of 17,850 kilocycles. Programmes are in Spanish, Portuguese, and English.

The station's streamlined studios, housed on the 21st and 22nd floors of the building of the leading Brazilian daily newspaper, "A Noite," were completely equipped by RCA. There are three control booths for the seven studios. Equipment includes speech input equipment, racks, turntable, and recording equipment. In the main studio are fifteen velocity microphones, along with six of other types, with deluxe boom and programme stands.

Of the same type as RCA 50-kilowatt transmitters in use at Leopoldville, in the Belgian Congo; at Brazzaville, in French Equatorial Africa, and elsewhere, Radio Nacional's transmitter was installed by the International Department of the RCA Victor Division through its subsidiary company, RCA Victor Radio, S. A., of Rio de Janeiro.—"Radio" (U.S.A.).

UTILITY BATTERY-OPERATED SET

WE cannot in Australia design one radio to suit all conditions. Therefore we shall make a survey of conditions in this country to see what the minimum number of models necessary to supply all needs would be. Pre-war, we had some dozens of different models, both mains operated and battery. These were again divided into A.C., A.C.-D.C., D.C., Dry Battery and Vibrator operated sets from about 1 valve to one or two. These sets all had their uses and enthusiasts, but now as there is a war on, we will have to be content with the bare necessities.

Minimum Requirements

I consider the following models the minimum necessary to supply the needs of the Australian public:—

(1) A 3.4 Valve A.C. set as described in the current issue of "Radio World" (March) for use in the large cities close to the broadcasting stations.

(2) A 4.5 Valve A.C. set for use in country towns where A.C. current is available.

(3) A Battery set for the man on the land.

Leaving the first two to the city designers, I will take the third. Having serviced and sold this class of radio since 1935, I think that I have a small idea of what is wanted in the country, and when I say country, that is what I mean, **not** the country town. Now the folks, as you know (or do you?), do nearly all their listening in the day time as they in bed as soon as it is dark. Most of the broadcasting stations are over 100 miles away, so the 3 or 4 valve sets are useless to them. The only set that is satisfactory is a 6-valve one. Some builders will say that this is too big to make at the present time, but I think that I can describe one that will be both cheap to build and good to operate. I have built up a number of these and they all perform o.k.

First let us check over the circuit and see what we have. We must have

AN ENTRY IN OUR CIRCUIT CONTEST

by

W. T. ROBINSON

Port Macquarie, N.S.W.

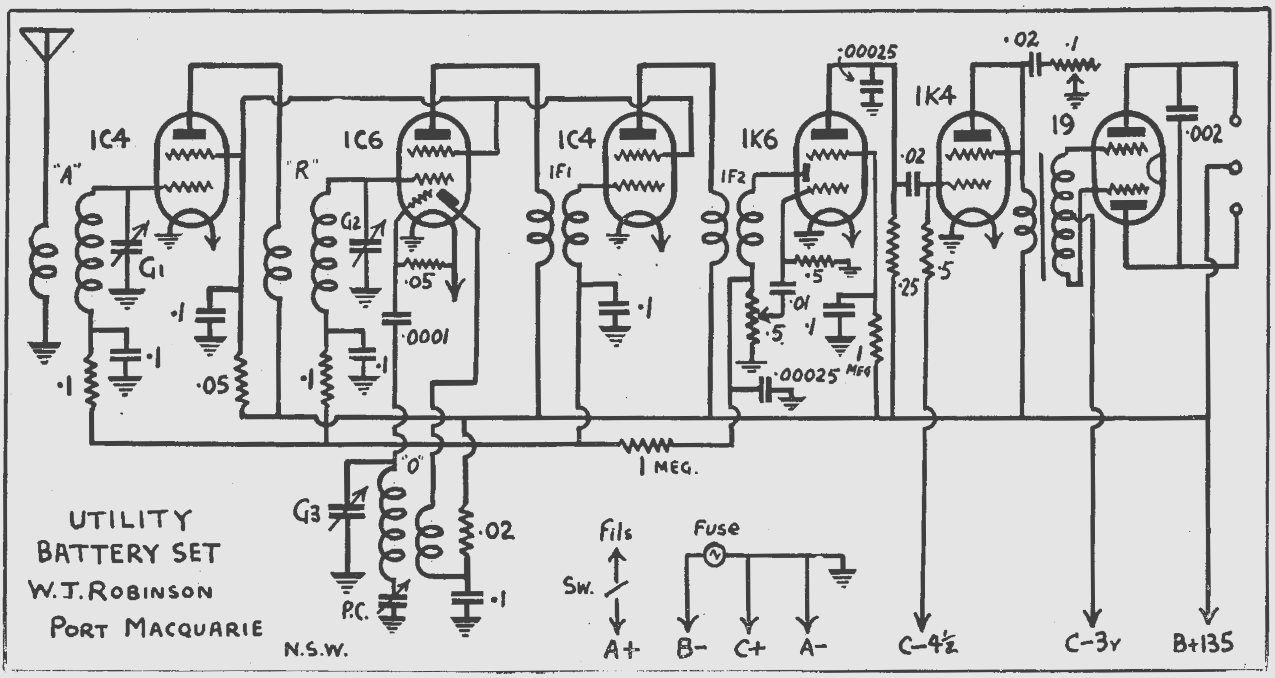
a stage of RF for sensitivity, selectivity and a minimum of background noise, one stage of IF at 175 K.C., second detector and A.V.C., driver and class B output. Many designers will raise their hands in horror at the mention of 175 K.C. intermediates, but I consider they are the best choice owing to their heavy sideband cutting and sharp tuning with restricted frequency range, making for noise-free operation. I do not see the use of striving for wide range and high fidelity when the whole result is going to be spoiled by noise and atmospherics, to say nothing of the added cost to achieve this result. Therefore we will have 175 K.C. I may say here that we are not considering short wave as the extra cost does not warrant its inclusion in the design, to say nothing of the shortage of switches, etc.

Valve Line-up

The valve line up is easily solved as here is not a great variety of battery valves to give the designer a headache if he sticks to the Australian-made "American" types, 1C4 RF., 1C6 Mixer, 1C4 IF, 1K6 Det., AVC and Audio, 1K4 driver 19 output. These valves are all available, also the octal equivalents. They are well tried and reliable valves. We could use the .06 amp. filament types such as the 1A4, 1D5, 1F6, 1F7, 1F5, etc., although some of these valves are hard to come by at present. They would save a slight drain on the A Battery, especially if air cells were used. The 1.4 valves need not be considered as they are too unreliable and give very poor service if in constant use every day, also they are too expensive.

Service Problems

The design of the set we will keep very simple with a view to being serviced by people who have not a great knowledge of the job in hand or an extensive range of test equipment. We will use simple hook-up in the AVC



but will use one diode for detection and one for AVC so as to obtain a delay in the AVC circuit, a necessity for receiving weak signals. We could use a 30 as a driver, but then we would have to provide a 9 volt bias battery at the present not being manufactured. Therefore we would have to use two 4½ volt batteries making for twice the expense. Besides, the 1K4 is a better valve as a driver, with plate and screen strapped together, of course, and 4½ volt bias. Alternatively we could use back bias by fitting a resistor in the B neg. but I do not consider this good practice with class B operation as the fluctuation voltage across the resistor gives a fluctuation bias, especially on heavy signals. This set could be used with dry B batteries, or vibrator operated without any alterations, by using a 4 volt vibrator and a 6 volt battery, using the 2 volts end of the battery to light the valves. But USE A RIGHTWAY BATTERY with a lid on it as I have seen literally hundseds of valves blown with the ordinary 6 volt types even by those who **know** how to connect them up. Personally I do not favour this arrangement, but as we want universal operation, we will have to put up with it.

Switching Arrangements

There are other ways of using the full 6 volts by switcing arrangements, etc., but the cost is too much in our case. By using the .06 amp. type valves, an air cell could be used in outback areas for filament supply where transport is difficult.

There are modifications that could be made to each individual set by just changing a connection, etc. For example, to save B battery drain, the full 4½ bias could be used on the output valve or with a slightly higher drain the more usual 3 volts could be used: if viabrator operated, the valve could be run at zero bias. I have used all these systems with good results. I have put out some of these jobs having good interstate reception in daylight (Queensland and Victoria) with only 12 mills, no signal drain.

Possible Criticism

I will probably be criticised by a lot of builders for the small frequency range of the job, but, I ask you, are Tex Morton or Jimmy Rogers high-fidelity wide-range volume-expansion artists, or just plain pain in the necks, for these are the favourite **stars** of 80 per cent. of the country listeners, especially the "kids." Why bother about wide range when it isn't appreciated, but usually just the opposite.

Just a word about coils, gangs and cabinets. This chassis could be fitted to a console cabinet or a table cabinet by building the speaker to the chassis as some of the commercial builders did a few years back. Then it would be truly universal. By using a B eliminator, it could be mains operated also.

This circuit will perform quite well with any of the older types of coils and gangs; in fact, value for money I prefer the old solenoid coils as they are cheaper to manufacture and also to repair, also they seem to be more reliable and perform almost as well as the latter types. Any type of I.F. transformers perform quite well, the type would be covered by the cost. I have used old gangs with late type coils and vice versa, and they will all perform more or less satisfactorily.

Using Salvage and Junk

Incidentally, this would be a good circuit for home builders at the present time as most of the material could be salvaged from dealers junk heaps.

Of course, this is only an austerity set, not meant for extensive post-war use. A set of this type was sold by the larger department stores of the city for about £20 to £25 just pre-war.

Conclusion

To sum up, we need a set with plenty of power, low noise level, low battery consumption, easy to service, with all parts available, and not too expensive.

By the way, I am situated in one of the worst positions in N.S.W. (mid North Coast) for useful signal strength. This would include a population of about 40,000 people with about 5,000 Radios, so even in this place, there would be a fair market for a radio of this description.

—W. J. ROBINSON,
Port Macquarie.

Results of Circuit Contest

Quite a few late arrivals brought the total number of entries to 123, not a big number as figures go, but representing a great amount of work and making a big job out of the task of judging.

After due consideration the first prize was finally awarded to:—

P. Stevens, "Westdale," Fletcher's Avenue, Bondi, N.S.W.

The winning essay will be published in full in next month's issue of "Australasian Radio World."

We feel sure that our readers will all agree that Mr. Steven's essay covers the subject most thoroughly, although there was little margin between his efforts and those submitted by the following enthusiasts who have all been awarded prizes of one guinea each.

We know that this small sum will not be adequate recompense for their work, but they will also have the satisfaction of knowing that our wide circle of readers will appreciate the essays, all of which have been published in the April, May and this month's issues.

Winners of guinea prizes:—

Charles Aston, 21 William Street, Double Bay, N.S.W.
L. G. McPherson, 14 Drummond Street South, Ballarat, Vic.
K. E. Hicks, 71 Francis Street, Bondi, N.S.W.
A Cleverly, Fraser Street, Lithgow, N.S.W.
Corporal E. C. Jamieson, Hut 49, R.A.A.F., Nowra, N.S.W.
N. C. Carroll, 40 Stanhope Grove, Camberwell, Vic.
W. J. Robinson, "Yulgilbar," Clarence St., Port Macquarie, N.S.W.

Quite a number of other essays have been approved as suitable for publication and these will appear from time to time in future issues, prizes of a guinea being awarded to each one on publication.

In thanking readers for their support of this contest your Editor would like to take the opportunity of expressing a hope that those with journalistic ability as well as technical knowledge, like those listed above, will make a point of writing technical articles and submitting them for publication whenever they find they have the necessary spare time.

Articles suitable for publication will be duly appreciated and paid for according to merit.

A LONG-RANGE UTILITY RECEIVER

FOR a set to be termed a Utility Set it must be constructed to give efficient operation at all times in the majority of locations. A set built solely for suburban operation is inadequate for the country listener.

For Distant Reception

In view of the foregoing, a good type of circuit is that of a 4/5 valve superhet. This set must be a Dual Wave receiver to suit everyone, some people listen to short waves more than others, so the extra coils must be there to serve those who so desire the reception on two bands. Sensitivity must be adequate for seasonable reception in country districts remote from transmitting stations, selectivity must also be considered to cater for those close to several transmitters, automatic volume control is to be incorporated for use in country districts where fading is prevalent, also as a means of reducing the noise level of the receiver in noisy locations, by reducing the amplification of the RF valves, and so in turn reducing the external noise picked up by the set. This AVC should preferably be of the delayed type, so as not to further weaken weaker signals. A delay voltage of about 3 volts provides a reasonable degree of delay for most locations.

For the converter valve the 6K8G seems to be the best. It is by far the most efficient valve for short wave reception locally produced. The English valves such as ECH4 are better than the 6K8G, but are not so readily available, so no purpose is served by using them at present. The screen grid and oscillator plate of the 6K8G should preferably be supplied with high tension through a common dropping

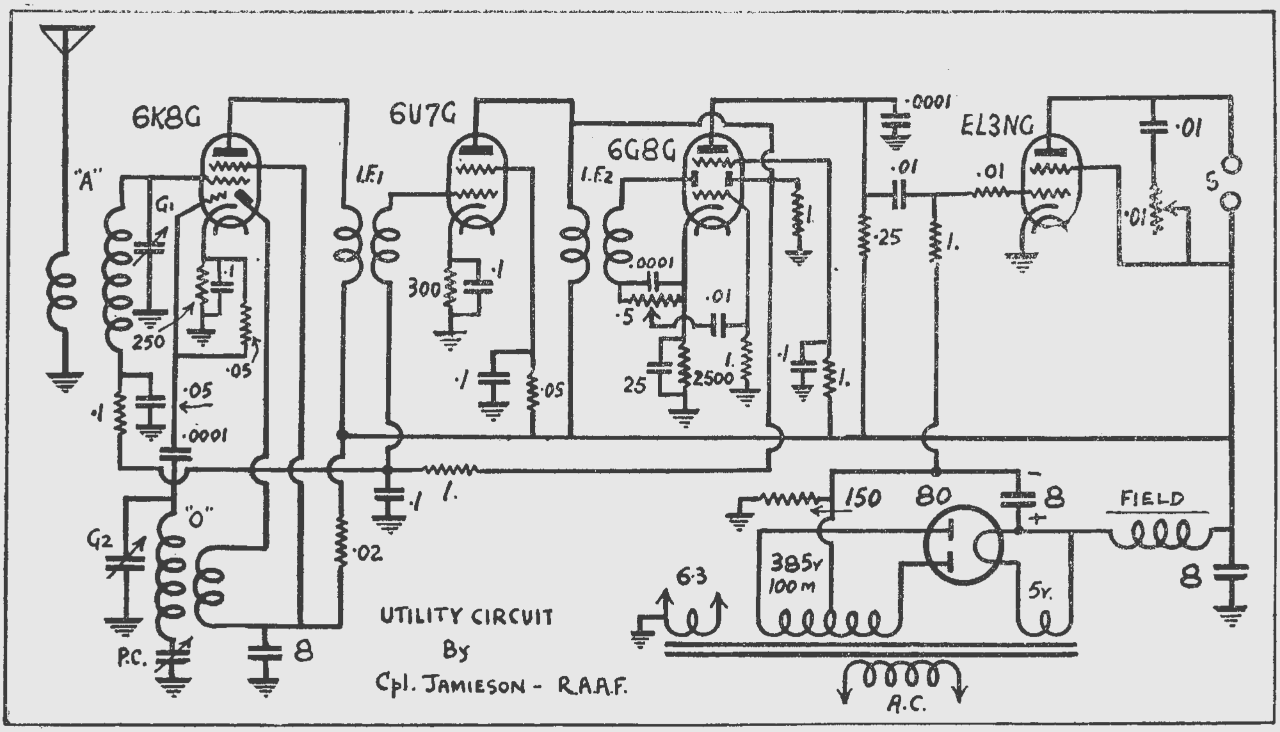
AN ENTRY IN OUR CIRCUIT CONTEST
from
Corporal E. C. JAMIESON
R.A.A.F.

resistor; this greatly reduces frequency drift, especially when on the short wave band. From past experience I have found an 8 microfarad condenser by-passing the screen of this valve also tends to aid in bringing about complete stability. For both selectivity and sensitivity the two IF transformers should be of the high gain iron-cored type, though these are harder to correctly align than those having condenser trimmers. The circuit shows condenser trimmers, as I have always preferred this type of IF transformer for the above reason.

A.V.C. should be added to both converter and I.F. stages in this type of circuit for effective control. The time constant of the dual wave receiver should be no more than 0.2 second and no less than 0.1 second. A too rapid time constant reduces the bass response at audio frequencies. This is due to the fact that rapid periodic fading is equivalent to bass frequency modulation. As stated before, 3 volts delay voltage appears to be quite effective. This same 3 volts, which is derived from a common cathode resistor of the 6G8G provides bias for the pentode section of this valve. The .0001 mfd. bypass condenser on the plate of 6G8G is not always necessary but is usually preferred for complete stability of the audio channel. No detector is perfect, so these is always a certain amount of R.F. passed into the audio frequency channels.

Output Valves

For an output value a certain amount of consideration was necessary. Available types were 6F6G, 6V6G, 45, and EL3NG, the latter being chosen for several reasons. The first and probably most important is that it requires only 6 volts signal on the grid of the valve to swing the valve to full output, whereas the 6V6G requires 12 volts and 6F6G nearly 16 volts. The low voltage input for the EL3NG allows full use of the high audio out-



put on weak stations. Where in sets using say a 6F6G the output would hardly fill a good sized room on a weak signal, the EL3NG would make good room level possible.

Power Transformer

In a small set of this type where a 60mA power transformer would be the normal equipment used, a saving of at least 4mA by the use of this valve is very acceptable and allows this valve to operate on its correct bias. The EL3NG is critical as regards bias voltages, so care is necessary in proportioning bias resistor. In the circuit shown back bias has been employed for this reason; 25 mfd. condensers are now listed amongst those unprocurable items of radio parts. By the use of back bias this condenser is eliminated. A 25 mfd. condenser, it will be noted, is used for a by-pass on the 6G8G, but this may be any valve from 2 to 25 mfd. A .1 mfd. for R.F. is quite often sufficient, though a 25 mfd. and a .1 mfd. in parallel across the bias resistor provides the perfect combination.

Feedback Not Used

Inverse feedback has not been incorporated, but in its stead a simple tone control has been included. This is more desirable, especially in country locations, where atmospheric conditions are not always favourable, as the high frequencies of the prevailing static may be eliminated.

An 80 rectifier has been used in preference to a 53G, as the former valve seems to be able to manage overloads better than the latter valve which seems critical insofar that the makers specifications be not exceeded, as regards maximum voltage per plate current drain, etc. Two 8 mfd. bypass condensers are usually adequate for effective elimination of A.C. hum.

As stated before a 60mA power pack is all that is necessary for this type of set. Total current drain works out at about 61mA for all four valves, so only slightly exceeds manufacturers specifications—this is at 235 volts H.T.

Oscillation Trouble

When this receiver has been built trouble may be had with an oscillating or badly overloading audio section. A 10,000 ohm resistor placed in series with the grid of the EL3NG to prevent parasatic oscillations is always very helpful. Secondly, make sure that No. 1 pin of the EL3NG is earthed as this provides a certain amount of shielding by means of the metal coating sprayed on the lower surface of the glass envelope.

With back bias on the last tube, neither side of the heaters should be directly earthed. Otherwise output tube will suffer. Heaters should be earthed through .1 mfd. by-pass condenser.

Taken all round, this receiver is an excellent performer; I have operated a set built to the circuit shown in many districts of Australia, including both suburban and country districts and performance has been magnificent, performing so very consistently. At present the receiver is operating at Nowra, N.S.W., 100 miles South of Sydney, and is in one of the worst locations I have ever been for wireless reception; static prevails nearly all the year around, fading is very prevalent, but the set still manages to give good reception even under these adverse conditions. It is working under almost impossible conditions at times but always provides the station desired, so I take no hesitation in recommending same to anyone anywhere. Of course if you live, say 500 miles from the city, it will take a very big set to give you daylight reception of city stations, if any reception at all—for you people, this set is not designed. This set is designed for those millions of people situated within 200 miles of city and other radio stations for daylight reception, and anywhere in Australia at night.

As A Short-Waver

This same set excels itself as a short wave receiver. Excellent reception can be had from stations from nearly every country possessing short wave stations.

Finally, if anyone contemplates building this receiver, I will be pleased to give any additional information on the subject.

E. C. JAMIESON.

DIRECT-COUPLED UTILITY DESIGN

Dear Sir,

With reference to your quest for a suitable utility circuit, as outlined in the February issue of your magazine, I wish to submit my own version, which is based on two considerations:

(a) The majority of listeners confine their attention practically exclusively to their local stations, and

(b) they do appreciate high-fidelity reception if this can be obtained reasonably simply and without the use of elaborate circuits, involving heavy expenditure.

The circuit I am submitting is one which I believe fulfils both these requirements, and furthermore, with the

Another Contest Entry from

N. C. CARROLL,

40 Stanhope Grove,

Camberwell, Vic.

eqception of one component, utilizes parts which are obtainable at the present time. In addition the design is not in the least critical, and approximate substitutes in valves may easily be employed.

Adequate Selectivity

Basically the circuit is composed of one radio frequency stage with preselection, anode-bend detector and direct-coupled triode output. An added refinement, which will be found well worthy of incorporation, is a simple acoustic labyrinth. The abovementioned circuit gives adequate selectivity and sensitivity for local reception, there are no alignment problems, little alternation of the sidebands, while the simple "single-ended" output stage provides really worthwhile fidelity at normal listening volume. The writer has had a set designed according to this circuit in operation since 1936, at a total replacement cost of one detector valve and one 500,000 ohm resistor in the output stage.

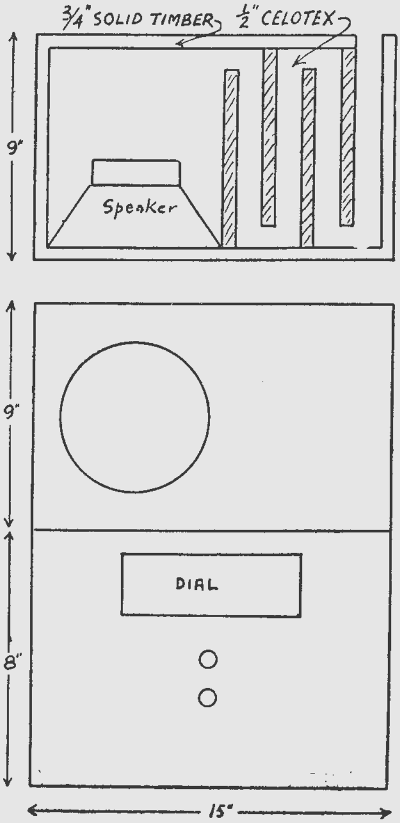
The Heater Circuit

There is only one minor difficulty, the provision of an extra winding in the power transformer to light the filament of the 245 type output valve, and even this may be avoided by employing an indirectly-heated pentode or beam power tube or utilizing the one filament winding. In such a case case there will, however, be a potential difference of some 50 volts between the filament proper and cathode emitting surface of this valve, although this does not seem to have any detrimental effect on its performance. It is not beyond the capabilities of most set builders to provide an extra filament winding for a 245 output valve, as at the most only 12½ turns of 20 gauge wire are necessary and the 245 is still I think the most faithful output valve yet designed.

I might add that in practice I have found the circuit constants of the output stage most flexible, with the exception of the bias condenser for the 245 or substitute, which should be at least 8 mfd. capacity, to ensure adequate bass response. No by-pass condenser is necessary for the detector screen tapping on the voltage divider.

A Handy Baffle

As regards the acoustic labyrinth, five sheets of half inch celotex provide

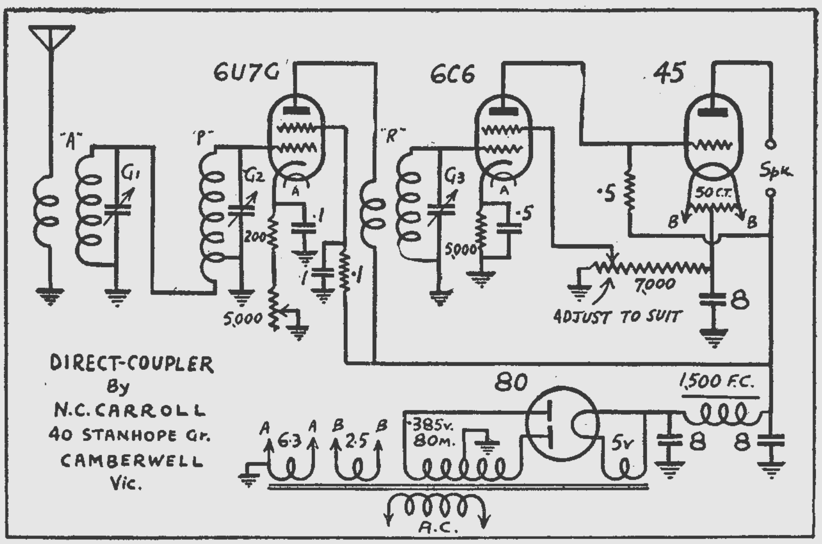


Suggested construction of an acoustic labyrinth for use with the direct-coupler or any other receiver with good tone.

the equivalent of a baffle four feet square, and permit a solid table type cabinet to be employed, with the speaker in the upper closed compartment, as indicated on the sketch.

Yours faithfully,

N. C. CARROLL.



DEATH RAY AGAIN

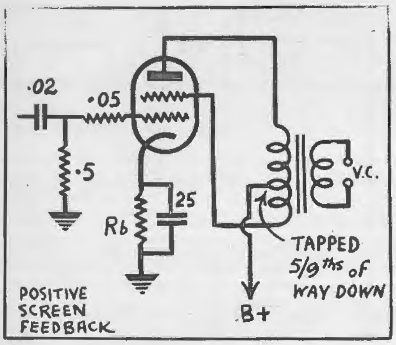
The "death ray" became headline news again a few weeks ago when two men were accused and fined £50 each at Lancaster for unlawfully possessing a wireless transmitter designed to be used as a navigational beacon, and other apparatus capable of being assembled into a transmitter.

The accused stated that they had the backing of the War Cabinet Scientific Committee for the apparatus with which, it was claimed, they had destroyed electric apparatus at Horsham, Sussex, 230 miles away.

SOME NEW IDEAS FROM MODERN CIRCUITS

Improving a Magnetic Pick-up.

ANY magnetic pick-up, however good, has certain resonant frequencies, i.e., there are certain rates of vibration, certain sounds, for which the output is excessive. Whilst the excess output at these frequencies can be removed by means of carefully adjusted tuned and aperiodic equalisers. this is not easy for the professional electronics man, and almost impossible for the home-builder. In this article is given a much simpler method based on the fact that the impedance of the pick-up is greater at these resonant frequencies. The pick-up forms part of a voltage divider in a simple inverse feedback circuit, the loss in gain due to feedback being made up for by an extra tube. The extra tube also allows sufficient gain for bass equalisation (records are naturally lacking in bass) which is very necessary once the bass resonances have been removed.



It is to be noted that the negative feedback used is quite independent of any feedback over the output stage. In fact there must be part of the circuit over which there is no feedback and the volume control is connected in this section. If feedback were applied over the volume control, the amount of feedback would be varied and the control would act only over a small portion of its range.

The extra valve should be a sharp cut-off pentode such as a 6J7G, 6C6, 57 or EF6. Two circuits are shown, the one marked A providing partial resonance compensation and normal bass compensation. Circuit B gives greater resonance compensation and an extra bass boost for those who like some "thump."

Reduces Wear

A peculiar thing about these feedback-to-pickup circuits is that **they reduce wear on the records!** Scientifically speaking, the feedback increases the input impedances of the pick-up so less energy is taken from the record. In ordinary language, the energy fed back helps to drive the needle in the pick-up, thus reducing wear on the record. Unfortunately the improved response makes needle scratch a little more noticeable on old records.

Simple Low-Pass Output Filter.

The only audio signal with a frequency of over 8,000 to 10,000 cycles per second found in an ordinary radio receiver is that obtained from noise, harmonic distortion and the like. It was shown in "Australasian Radio World" (March, 1943), that improved tone was obtained by the suppression of unwanted parts of the audio-frequency spectrum. At the low frequency end, a gradual cut-off is desirable, but at the high frequency end a very sharp cut-off is needed. Many high quality receivers contain a low-pass filter with a cut-off frequency of about 9,500 hertz, whilst communication sets have similar filters with lower cut-off frequencies. Some American amplifiers have filters with switches to give cut-off at any one of a number of frequencies, say 4,000, 6,000, 8,000 at 10,000 hertz.

Now these filters are expensive to build. To be very good they must consist of accurately made air cored inductances, tuned with accurate condensers.

The filter described here does not give quite so sudden a cut-off, but is much better than the simple condenser across the output.

A simple pi-type filter is composed of two condensers and the **leakage inductance** in the speaker transformer. The leakage inductance is made up of those parts of the winding that are not completely coupled to one another.

Capacities Required

The sizes of the condensers depend on the cut-off frequency desired, the voice coil impedance, the load impedance and the amount of leakage reactance. It is important that the ratio of the two capacities be the inverse of the ratio of the impedances. For example, if the required load is 5,000 ohms and

(Continued on next page)

WELCOME RE-APPEARANCE OF
J. W. STRAEDE, B.Sc.
A.M.I.R.E. (Aust.)
7 Adeline Street, Preston, Victoria.

RADIO POWER OPERATES LAMPS

The application of high-frequency radio waves to lighting homes, hotels and public buildings was recently demonstrated by Samuel J. Hibben, Director of Applied Lighting for the Westinghouse Lamp Division. Mr. Hibben showed how brilliant, vari-coloured fluorescent tubes could be fully lighted without being connected to any sockets or electrical wiring.

Power Generator

The generator used was a pre-war diathermy set, such as in general use by the medical profession. Mr. Hibben explained that far more powerful RF genrators are now serving in wartime radio and communications equipment and may bring about peacetime expansion of wireless power.

Some Applications

Experimental lamps whirh consume less than an electric lamp, and which may be left burning night and day for such jobs as lighting house numbers and clock faces, were demonstrated. Among other types, one lamp was devised from two glass pie plates, showing that fluorescent lamps are not limited to tubular shapes. These have practical and decorative advantages for hotel halls and public buildings.

NEW IDEAS

(Continued from page 11)

the voice coil impedance (at 400 or 1,000 c./s.) is 2.5 ohms, then the input condenser must be only one 2000th of the output condenser. If this ratio is not correct, a sharp cut-off is not obtained.

The larger the condensers the lower the cut-off frequency. A low voltage rating may be used for the voice-coil condenser.

Ideal for Public Address

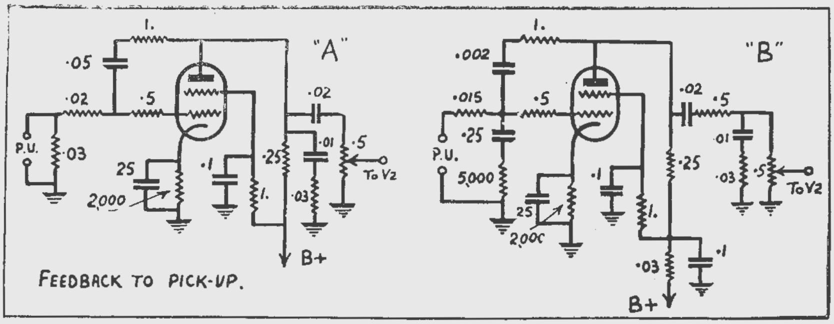
This system is especially suitable for small amplifiers that are to be run "flat out" on public address work, as the removal of every high frequencies allows more harmonic distortion.

High Fidelity Reflex.

A receiver built on the lines of the Local Tone Four (see "Australasian Radio World," February, 1941) required more gain for country use. It was decided to reflex the "second detector" valve but to use suitable circuit constants so that the tonal quality was not spoiled. (In most reflex receivers, the extra R.F. bypass condensers muffle the tone slightly.) At the same time, a 6L6G output valve was used, the total H.T. drain being now nearly 100 milliamps and adequate to energise the Amplion "T" model auditorium speaker. To prevent the usual "minimum volume" effect in a reflex (when the v.c. is turned right down, the valve acts as a poor detector and gives a weak, distorted, signal), a volume control was connected to control R.F. and A.F. gain simultaneously. The result was an outstanding receiver with plenty of gain, volume to spare, and magnificent tone.

As a Utility

Possibly a similar circuit using, say an EL3 output valve, would make a good contribution to the utility circuit contest, as a 4-valver of this type gives results much better than the "straight" 4-valver which relies on "high-efficiency" valves.



Extra Output With Positive Feedback.

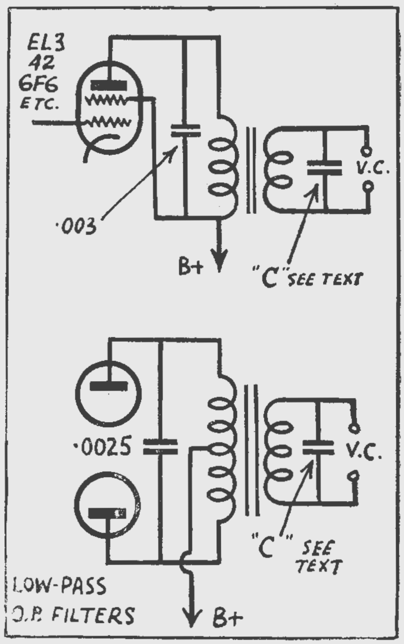
It is fairly well-known that the use of negative feedback from the output anode or from the voice coil, to the last grid or some preceding point, has little effect on the maximum output power, or on the power at "grid current point."

Over-Biassed Output

Actually the output valve is over-biassed, there is a slight increase in power and if the valve is under-biassed there is a decrease in power, BUT when the feedback is taken to the screen off the output valve a different state of affairs exists. With large negative feedback to the screen, the power is actually diminished as the plate current can no longer rise to its full value on positive grid peaks. How about positive feedback to the screens? **This results in a definite increase in power,** although a decrease in fidelity also takes place. The latter can be made up for by negative feedback to the control grid.

Added Power

Why the extra power? The function of a valve is to increase the plate current when the grid goes more positive (or less negative) and to decrease the plate current when the grid goes more negative. With positive screen feedback, the plate goes less positive when grid goes more positive, the screen being antiphase with the anode goes more positive, so that: the control grid and screen grid both become more positive, at the same time giving a double boost to the electron flow. Another way of looking at it: the screen acts as an extra control grid, being positive it requires a little driving power, and this drive is obtained from the anode.

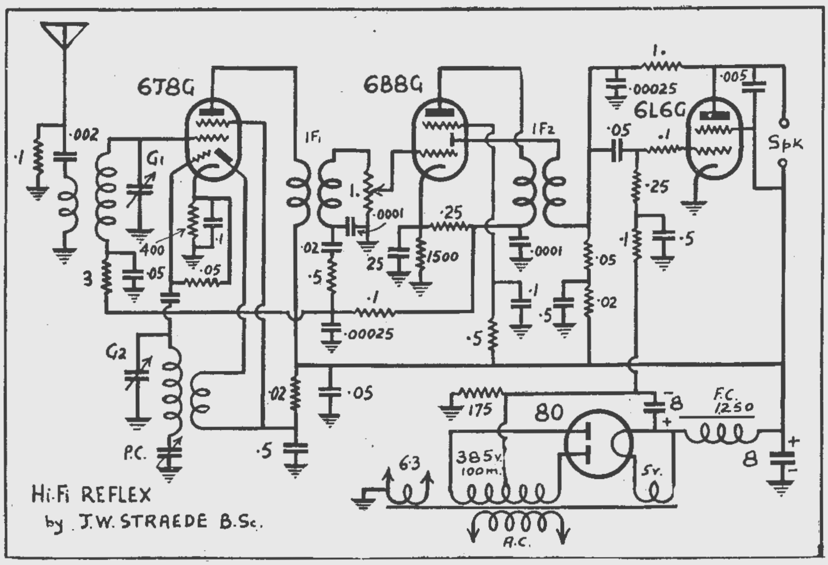


The main catch is that a special output transformer is required. An ordinary centre-tapped transformer was tried but the positive feedback was too much for most valves and oscillation resulted.

However, we can recommend the circuit to experimenters and amplifier designers.

It is noteworthy that a triode is

(Continued on page 26)



OUTPUT TRANSFORMER CONSTRUCTION

PROBABLY the most important consideration in getting results from an amplifier is to make sure that the speaker is correctly matched to the output load. This important point is quite often neglected and in some cases causes enthusiasts many headaches. With this point in view, perhaps we can clarify the position, without delving into complicated mathematics.

The Output Transformer.

The main point to be kept in mind regarding output transformers is that the primary and secondary windings are not completely isolated from each other. It is true that electrically they are insulated but they are closely coupled magnetically. This fact accounts for the reason that any circuit connected to one winding will cause a reflected circuit in the other. The reflected load will vary as to the square of the turns ratio between the two windings.

A transformer steps up or steps down according to the turns ratio, voltage and current. Similarly it transforms capacity, inductance and impedance according to the square of the turns ratio.

Assuming an ideal transformer having a turns ratio of 1:2, by connecting a 1 mf. condenser across the primary, the secondary will behave like a 4 mf. condenser.

Frequency Discrimination

The conclusion to be drawn from this fact is that the transformer will become frequency discriminating, i.e., present a low impedance at high frequencies; and a high impedance at low frequencies.

By substituting an inductance of 1 henry for the condenser across the primary, the secondary will have an inductance resistance equivalent to four henries and will present a high impedance at high frequencies and a low impedance at low frequencies.

If we now connect a non-nductve resistor of 10 ohms to the primary instead of the inductance, we will cause the secondary to have a reflected impedance of 40 ohms.

Thus the secondary has shown three distinct changes, although nothing has been connected to it. It is on these simple facts that we can work out the correct load for any amplifier or radio receiver.

The best load resistance into which an output stage works is based on a load which will give the highest output with the least distortion, which is termed the optum load.

Taking an actual case we will consider the 6L6 power tube. With a 3,500 ohm load we will find that we can obtain the highest power output with a minimum total distortion. And yet referring to our tube data books we find that a 2,500 ohm is specified. The reason for this being that with

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the lower load the third harmonic distortion is reduced by approximately 50 per cent. The power output under these conditions also drops from 7.3 to 6.5 watts and the total distortion jumps from 6 per cent. to 9.5 per cent. However despite the drop in output and increase in total distortion the fact that we can reduce the 3rd harmonic distortion more than compensates for other two factors, by the mere fact that this type of distortion is most distressing to listen to.

Now supposing we wish to match a speaker to an amplifier which has a single ended 6L6 output and we take the impedance of the speaker voice coil as 8 ohms, the turns ratio is calculated by taking the square root of the impedance ratios, viz.: 2,500 dividl ed by 8; the square root of 312.5 which is about 17.7 for the turns ratio. Thus for every turn of the secondary we have approximately 17.7 on the primary, other factors make it necessary to add to the calculated turns on the primary. Although our turns ratio stands at 17.7 to .1 the impedance ratio equals 312.5. Which means that if we connected an 8 ohm non-inductive resistor to the primary the secondary would present an impedance of 2,500 ohms to the tube at all frequencies, still assuming an ideal transformer. See fig. 1.

Connecting the Speaker.

By the addition of an 8 ohm speaker, however, we get a totally different story. We must now remember that the voice coil of a speaker is inductive and possesses a certain amount of inductance. Therefore it ceases to

(Continued on next page)

OUTPUT TRANSFORMERS
Continued)

have 8 ohms impedance at all frequencies.

The impedance of voice coils of speakers are rated at either 400 or 1,000 cycles. Taking this into consideration we would find that at 60 cycles the impedance would drop from 8 ohms to something like 5 ohms while at 3,000 cycles it would rise to 11.2 ohms. We already know that the impedance ratio of the transformer in question is 312.5:1. It then becomes easy to understand that the reflected load at 60 cycles will be 1,560 ohms because the voice coil impedance has changed to 5 ohms and at 3,000 cycles the reflected load will be 3,500 ohms the voice coil impedance now being 11.5 ohms. Looking at the valve manufacturers data sheets on output watts against various loads for a 6L6 tube we find that at 1,500 cycles the tube will deliver 4.8 watts instead of 6.5 watts (at 400 cycles). We can now see that this fact causes the apparent poor low frequency of many speakers. Again at 3,000 cycles (3,500 load) the output rises to 7.3 watts at 1.3 per cent 3rd harmonic distortion, whereas at 400 cycles this distortion drops to .6 per cent. We now can see the reason for increased distortion at high frequencies.

In connection with speakers we then have two types of distortion which are quite often overlooked, but which nevertheless must be taken into consideration.

(1) Power output varying with frequency termed amplitude distortion.

(2) Distortion which varies with frequency termed frequency distortion.

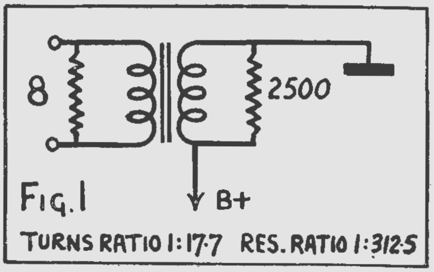
Feedback.

If we can use some method by which wide variations in speaker impedance are somewhat smoothed out or reduced we will have done a great deal towards attaining perfection in the matter of audio reproduction. In other words by making a form of compensation in the amplifier which instead of allowing the reflected load to drop, hence the power output to drop at certain frequencies, we will have in effect an automatic booster, which will serve the purpose of keeping the reflected load farily constant. It is here that we bring into use the much discussed inverse feedback. For maximum compensation, however, it is absolutely essential that the feedback loop encircle the output transformer not from the plate side or tertiary winding. See fig. 2. This circuit is known as constant voltage feedback.

When constant current feedback is desired in the output circuit, fig. 3 shows the method used to obtain this type of feedback. This circuit is mostly used with magnetic recording heads, which greatly change their impedance with frequency.

Low Efficiency

While on the subject of output transformers, it might be well to point out to readers that output transformers of the normal type supplied with the usual run of speakers on the market seldom reach efficiency figures of better than 35 per cent. However, considering the very low price range which we enjoy for most speakers we buy, we must realise that it would not be a commercial proposition to equip speakers with a high-fidelity output transformer without resorting to a figure which would be much in excess of the ruling prices to-day. Speaking generally the ordinary speaker transformer is sadly lacking in inductance, with its attendant lack of adequate low note response and the self capacity of the primary is excessive for good high note response. Faced with the alternative of paying in the region of £3/10/- to £5 for a high quality output transformer, with a frequency response flat within 1 DB from 30 to 10,000 cycles many amateur's enthusiasm cools off. However lots of people are not aware that the ordinary power transformer can be pressed into service and providing a little trouble and care is taken, quite gratifying results can be obtained.



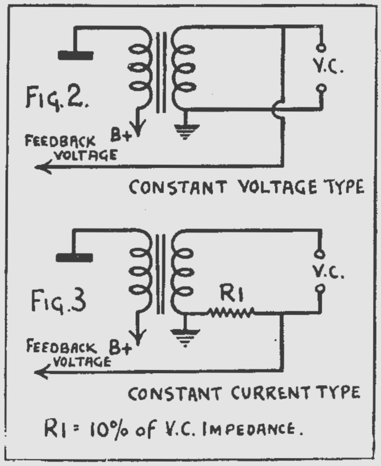
MIRACLE AERIALS

An individual named William Wheeler, who has been manufacturing and selling mechanical devices designed as attachments for radio receivers, recently was ordered by the Federal Trade Commission to cease and desist from misrepresentations of the devices called "Miracle Radio Control" and "Miracle Aerial Loop." Tests disclosed the control to be without value in improving radio reception and the loop to be no more effective than a length of ordinary copper wire.

—From an American magazine.

MAKESHIFT SOLDER

Melted toothpaste tubes were used in place of solder by Signal Corps technicians in Iceland when the supply of solder ran low. The men salvaged the tubes from their buddies in order not to delay the construction of vital communication facilities.



Converting Power Transformers to Output Transformers.

Almost any power transformer which has the high tension winding intact can be used to make a reasonably good output transformer. The first step will be to strip the transformer of the laminations, making sure that in the process the windings are not damaged and that the laminations are not bent about too much, keeping in mind that we have to use the laminations again. At this stage we must find out the turns per volt rating of the transformer. In order to do this choose any of the known filament windings such as the 5 volt rectifier winding or whichever is on the top layer. Assuming it is the 5 volt winding, if by counting the number of turns as we take the wire off we find there are 30 turns; we know then that there are 6 turns per volt on the transformer. Then proceed to remove any other filament windings which are left. There remains then only the 230 volt primary winding and the high tension secondary.

Turns Required

Assuming we wish to make a push-pull output transformer, we can utilize the H.T. secondary as the primary winding. Working on 6 turns per volt with a 385 — 385 volt secondary, the approx. number of turns would be $385 + 385 \times 6 = 4{,}620$ turns. Actually there will be more turns than this due to allowance being made for voltage drop across the winding, we can however work on the number of turns being fairly correct at the 4,620 figure. Next we look up the correct load impedance plate to plate for whatever tubes we require to use, also the voice coil impedance. With this information, we apply the formula given earlier in this article and we work out the turns ratio. Assuming a ratio of 30:1, we find by calculation that to get the correct turns ratio we want 154 turns

OUTPUT TRANSFORMERS

(Continued)

on the secondary. It is usually found that most output transformer secondaries are wound with approximately 20 to 22 guage enamel wire, so we can start and wind on 154 turns of say 22 s.w.g. enamel.

Using Hand Drill

Perhaps the easiest way out if no other facilities are available, is to make a wooden form which will fit tightly into the space for the laminations and drill about ¼ inch hole, through which can be passed a ¼ inch bolt, one end of which is inserted in the chuck of the workshop hand drill. Count the number of turns per one revolution of the drill handle and this will make your work less tedious. Two or even three layers may be needed, in which case one layer must be insulated from the other with empire cloth or some other like material.

Fine Tapping

Personally the writer has found that bringing a tap out every 5 turns over the last 20 turns of the winding helps considerably in getting just the correct reflected load in the primary. A point which must also be watched is that the space taken up by the new winding, does not exceed that of the old filament windings. Otherwise trouble will be experienced in getting the laminations back. Should it be found that this is the case, the only alternative is to pull out the old primary of the power transformer and wind on a new form, our new secondary and slip the new winding in space formerly occupied by the primary. The fact that the secondary will be next to the core does not matter; in fact, there are several commercial output transformers constructed in this manner.

Ample Inductance

The writer would like to point out, however, that this does not provide the ultimate in output transformer design, far from it, but at least we will be assured of plenty of iron in the core, which in turn will give us ample inductance in the primary for most ordinary purposes. In these hard times it is virtually impossible to obtain output transformers in the higher wattage ratings which are essential for good performance, with amplifiers designed for P.A. work, as well as quality amplifiers using outputs in excess of 8 watts. So that all that can be said is that "necessity is the mother of invention" and in conclusion the writer feels sure that any trouble gone to in this direction will be amply rewarded.

ADJUSTABLE I.F. SELECTIVITY

A Simple Method of Obtaining Changeable Band-Width.

By SEYMOUR LOBEL

Reprinted from Q.S.T. (U.S.A.)

ALTHOUGH the use of variable i.f. selectivity is not in any sense new, it seems to this author that its greatest assets have never been fully appreciated particularly by the amateur.

As the term implies, adjustable i.f. selectivity is a means of controlling the i.f. stages to various degrees of selectivity, each different band-width serving some special purpose. It is not to be imagined that this will require any great amount of design work; on the contrary, variable i.f. transformers are quite simple to construct and the results will be well worth a trial.

Let us examine the selectivity curve of a typical i.f. transformer, as shown in Fig. 1. This transformer is designed for an intermediate frequency of 455 k.c., and the curve shows that, when the transformer is perfectly tuned to this frequency, the band-width as measured at 2 times down is 10 k.c. This is the type of transformer used in communications receivers. As an explanation of this curve, the frequency is plotted along the linear horizontal base line, while the vertical scale is divided logarithmically. The curve shows the signal-input multiplication necessary at various frequencies off resonance to give standard output.

Practical Example

For example, assuming that an i.f. stage tuned to resonance has a gain of 40 and that the input voltage to the grid of the i.f. tube is 0.01 volt, the voltage measured at the grid of the following tube will be 0.4 volts. Now, maintaining 0.4 volts as a reference level for constant output, the input voltage is doubled, which in turn increases the output voltage to twice the original value, or 0.8 volts. If the source of voltage is a signal generator, the frequency of the generator can be varied either side of resonance until two frequencies are obtained where the output will be reduced to 0.4 volts. In the instance of Fig. 1, those frequencies are 450 k.c. and 460 k.c.

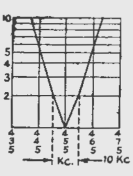


Fig. 1 — Typical selectivity curve for a single i.f. stage. The vertical scale is in terms of the ratio of voltage input off resonance to the voltage input at resonance required to obtain a standard output voltage.

It is obvious that, as the input voltage is increased, the generator can be taken further off resonance and still maintain the 0.4-volt reference output level. At approximately 13 k.c. either side of resonance the curve shows that the input voltage must be increased 10 times to bring the output up to the 0.4-volt level. Single-stage measurements are seldom carried beyond this point. When over-all curves are taken for several stages, they are usually extended to a point where the input must be increased 10,000 times.

Selection of Band-Width.

Let us take an average i.f. transformer. It is so designed that the band-width will vary anywhere between 6 k|c| and 12 k.c. at 2 times down. It should be understood that these figures represent single-stage measurements, since the band-width decreases with each added stage. If each of two transformers shows a band-width of 12 k.c. an over-all measurement of two stages may show a band-width of about 8 k.c. A receiver designer will select the i.f. transformer which gives him the required band-width for the particular job at hand. For example, he may decide upon a 6-k.c. band-width, his purpose being high selectivity, which makes for greater discrimination against unwanted signals and less noise. These are ideal conditions for receiving c.w. signals. The receiver can be made even more selective by employing a band-width of only 3 k.c. By making the i.f. amplifier regenerative, band-widths as narrow as 1 k.c. are obtainable.

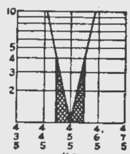


Fig. 2 — Characteristic selectivity curve of a highly selective i.f. stage. The dark area indicates the sidebands which have been cut as a result of the attenuation by the i.f. transformer.

Can be Harmful

On the other hand too much selectivity can prove harmful, for then one must suffer less intelligible reception on speech and extremely poor musical quality. This is because the sharp cut-off of the transformer will greatly attenuate all frequencies above a certain value. Naturally, much quality is lost. This is depicted in Fig. 2, which shows in the shaded area the side-bands which are cut-off. Very selective transformers of this type are appropriate for use in communication receivers for they serve most usefully in crowded channels where noise and interference might combine to make satisfactory reception impossible, were it not for the sharp cut-off. Quality under such conditions naturally is secondary.

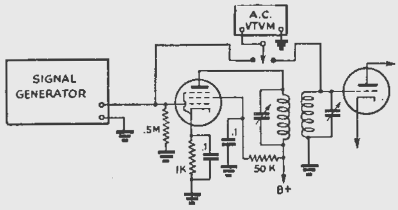


Fig. 3 — A simple single-stage test circuit for measuring selectivity. The values shown are not critical. Normal receiver voltages should be employed.

If a receiver employs no preselector stage, or perhaps an untuned stage ahead of the detector, the advantages of a sharp or regenerative i.f. will prove very gratifying. Thus, a narrow bandwidth serves a useful purpose, and so the first position for a variable i.f. transformer design should be for 5 k.c.

High Fidelity.

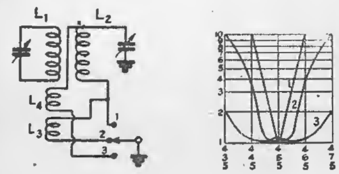
If the receiver must also cover the broadcast band, the i.f. stages can hardly rest at 5 k.c. The public today has become accustomed to certain definite standards for local radio reception, and this narrow band-width will hardly meet their approval since fidelity is paramount. Regulations for broadcasting studios call for a 10-k.c. band-width. Therefore, if one is to enjoy the full benefits of the transmitted signal the receiver should be, equipped to pass sideband frequencies up to 5000 cycles above and below the carrier with equal amplitude, and the i.f. stages must be designed to pass a band 10-k.c. wide.

Here the designer has more latitude. There is no demand for optimum selectivity, since the stations are well separated, and sensitivity is of no great importance. The signal strengths of the various local carriers are strong enough so that the gain available is more than ample. Therefore, the second position of a variable-selectivity design should call for a 12-k.c. band-width.

Up to now two different band-widths have been decided upon. For the average receiver this may be all that is required. However, the author has found it advantageous to go one step further. There is much to be gained by increasing the band-width to 25 k.c. On local broadcasting the quality is excellent. While it is true that there are times when it is impossible to employ so wide a band-width because of interference, in many cases it is possible to detune to one side of the carrier and thereby lose the interfering station without any noticable loss of quality. How well this can be accomplished depends upon the individual receiver. However, the r.f. stage is usually broad enough to make this possible. If the interference still persists, switching to the 12-k.c. position will clear up the matter instantly.

As for short-wave reception, there are many times when the broad band cannot be used because of interference. If the channels are heavily crowded, the sharp 5-k.c. band must be used.

However, the 25-k.c. band-width may be utilized in other ways. In many cases fading can be easily overcome, and signals which drift can be held relatively constant whenever interfer-



A B

Fig. 4 — A — L_1 and L_2 are the usual i.f. transformer primary and secondary windings. L_3 and L_4 are added windings adjusted to give the desired characteristics. B — Typical curves for the three switch positions.

ence permits. The receiver stands up well under vibration, where ordinarily the shifting of the oscillator frequency with vibration might easily lose the signal. Not so with this degree of spread, even though the oscillator may shift as much as 10 k.c. This is a distinct advantage in receiving equipment which is subject to rough treatment, such as mobile units in ambulances, trucks or tanks.

Temperature and humidity play havoc with a receiver. Variations in humidity will cause the oscillator to drift badly and, unless a negative temperature coefficient capacitance is employed the receiver is rendered useless. Even a negative temperature coefficient condenser has its limitations. Here again the broad i.f. will keep the signal coming through even though the oscillator may drift. Therefore, there is a definite purpose for this broad i.f. stage, and the third position of the variable i.f. design should be for 25 k.c.

Now that the three positions have been decided upon, the next step is to see how the desired result may be accomplished. The equipment necessary will include a signal generator, a vacuum-tube voltmeter and a simple single-stage test chassis. Fig. 3 shows the schematic of a simple test arrangement. The values indicated are for general i.f. testing but the designer

(Continued on page 18)

ADJUSTABLE SELECTIVITY
(Continued)

In this article the author points out some of the advantages which accrue if the i.f. selectivity of a receiver can be adjusted to various band-widths. A simple method of transformer design for accomplishing this result is described.

may use his own values, simulating the receiver under construction. The unit should be so made that the i.f. transformers are easily accessible for tuning or removal. The v.t.v.m. can be switched to measure either the output of the single stage or the output of the signal generator.

Transformer Design.

Many methods have been employed by designers to achieve required results. However, the author feels that the most suitable and least troublesome arrangement is that shown in Fig. 4. L1 and L2 in Fig. 4-A are the usual primary and secondary windings of an ordinary i.f. transformer. L3 and L4 have been added and are tightly coupled to L1. The inductance of L4 should equal that of L2. With the switch in the first position, only L2 is in the circuit and, as the corresponding curve of Fig. 4-B shows, the band-width measures approximately 8 k.c. at 2 times down for a single stage. With the switch in the second position, both L2 and L3 are in the circuit. The inductance of L3 is extremely small, and therefore the detuning of the secondary is negligible. However, the close coupling between L3 and L1 broadens out the band-width to 16 k.c. The gain is kept high by virtue of the much closer coupling.

In the third position, L2 and L3 are cut out and L4 is connected in the secondary circuit. L4 is tightly coupled to L1, and therefore the band-width is wide. There is only slight detuning in the secondary circuit, because the inductances of L2 and L4 are about equal. With this arrangement a band-width of 40 k.c. is easily obtained. The gain is kept rather high by winding L4 with Litz wire to increase its Q. The three characteristic curves obtained are shown in Fig. 4-B.

The proper adjustment of the relative positions of L3 and L4 will require a little experimenting to obtain the desired characteristics. After the three positions have been determined, the leads can be brought out to a switch on the panel.

The author feels that more advantage should be taken of the principles of variable i.f. selectivity, especially since it is so easy to obtain.

WORTHY D.F.C. AWARDS

A recent issue of "Air Force" (official service journal of the A.A.F.) tells how T/Sgt. Sachnoff, a radio operator-gunner, used his wits and his radio training. In the course of a bombing mission he picked up an S9 signal in the proper code of the day, giving instructions to change course and attack a different objective. Although the message seemed proper, T/Sgt. Sachnoff became suspicious. At that particular spot over Africa he had never before been able to receive strong signals from the base. By using his radio compass he determined that the message was coming from a position in front of the ship and he radioed a warning back to his base.

On the return trip the sergeant's flight encountered 150 Allied fighters at 30,000 feet, heading for the false target. When the fighters reached the area they found 45 Messerschmitts circling at 20,000 feet and promptly dove on them, destroying thirty.

T/Sgt. Sachnoff was presented with the D.F.C. for being the kind of a fellow who doesn't believe everything he hears.

A.B.C. OF FREQUENCY MODULATION

By

CHARLES H. MUTTON

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FOR the past decade we have seen the transmission of intelligence via the medium of radio go through many phases. The lowly spark transmitter, the oscillating valve, coupled with its many improvements, the self-excited oscillator, tuned plate tuned grid oscillator, improved methods of modulation, and crystal control. It is true that in a comparatively short space of time we have seen marvellous strides in the technique of radio and it was probably thought by many people that we had reached perfection, however, we found such things as television, ultra high frequency transmission, and radio direction finding being added to our existing scheme of things.

Enormous Possibilities

Of recent years a new innovation has arrived, none other than frequency modulation, which by virtue of its great improvement in the matter of fidelity and noise reduction, has enormous possibilities even at this early stage when frequency modulation is in its infancy.

The first question that most people will ask in connection with frequency modulation is: "What is the difference between frequency modulated signals and our present system of amplitude modulated signals?"

The Carrier Wave

Firstly we should consider what happens to the carrier wave with both types of transmission. With the present system of a.m. signals the carrier wave varies in amplitude.

With f.m. the carrier wave remains constant in amplitude.

In a.m. signals the modulation of the carrier wave causes the variation in amplitude whereas in the new system of f.m. the modulation causes the carrier wave to change frequency. This frequency change will occur in direct proportion to the level of the modulation signal. Putting this more simply we could say that the stronger the audio component applied to the carrier in f.m. the greater becomes the frequency deviation. Yet again the higher the frequency of the modulating signal the greater number of times the frequency deviation will take place per second.

Effect on Noise.

If we stop to think that in a.m. transmission any noise present on the carrier wave will cause the amplitude to vary, hence the noise will be rectified along with the audio component of the signal at the detector and will appear greatly amplified in the output of the receiver. When we consider, that in a frequency modulated receiver the section which is called the limiter stage is designed to smooth out any variation in the amplitude of the incoming signal, it becomes apparent that any noise present in the signal will be rejected by the limiter stage.

The Discriminator.

The part played by the discriminator in the f.m. receiver is to convert the varying frequncy signals to an audio frequency component and, as we are aware that noise does not play much part as to frequency change, it follows that the discriminator also plays a prominent part in reducing noise.

In the a.m. receiver the amplitude of the signal is changing in value until the detector stage is reached, where the audio component is separated from the carrier wave. Practically the opposite takes place in the f.m. receiver. The amplitude of the carrier is kept at a constant value up to the instant when demodulation takes place. In the a.m. system of transmission we known that the sidebands have a definite effect on the quality of the transmission and are governed by the frequency of the modulating voltage. If an audio frequency of 10,000 cycles is impressed on the carrier then the sidebands of the carrier will be 10 kc wide. Our present system provides for a frequency separation of 10 k.c. which limits the modulating frequency to 5,000 cycles.

Band Widths

The conditions in frequency modulation transmission are totally different. At present the band width of f.m. transmissions are in the region of 100 k.c. as against 10 k.c. for a.m. This fact alone opens up possibilities in the matter of extended fidelity range which would be staggering. However, before we can even think of reproducing Audio frequencies extending to possibly 15,000 cycles in future receivers, we have first got to do a great deal of work to improve the performance of our speaker systems in use at the moment.

Probably the greatest difference between receivers designed for f.m. and a.m. is that of the intermediate frequencies used and the difference in design of the intermediate frequency transformers. With a.m. receivers we are used to seeing I.F. frequencies from 175 k.c. to 465 k.c. with a band width of approximately 10 k.c. With f.m. receivers, I.F. frequencies are used varying from 4.5 megacycles to 10 megacycles with band widths up to 150 k.c. With this fact in mind we can readily see how easy it is to transmit an audio range up to 15,000 cycles when the bandwidth in the I.F. amplifier is approximately 75 k.c. each side of resonance.

All Should Learn

In conclusion, this article only serves as an opening to a clearer understanding of what actually happens with the f.m. system of transmission. Further articles will appear from time to time in which the writer hopes to cover each stage in detail of the f.m. receiver. It is quite evident that it behoves all of us to learn something of this new and interesting system, seeing that experimental work is being carried out on a.m. at the present time.

SKIATRON TELEVISION SYSTEM

The Scophony Corporation of America has developed a television system which is claimed to enable a definition of at least 1000 lines or more and a reduction of the band width required of at least 66 per cent. This development, invented by Dr. A. H. Rosenthal, Director of Research and Development for SCA, is called the Skiatron Electron Opacity Television System.

The Scophony Skiatron receivers achieve these results by making fuller use of persistence of vision and therefore require a much lower field frequency, about 20 per second or less. This should simplify television transmitter design and permit straight scanning instead of the present interlaced type. Further, it is expected that this development should make possible the establishment of six television broadcasting stations within the frequency range and geographical area where now only four may be located.

U.S. CLAIMS INVENTION OF RADAR

AMERICANS are losing little time cashing-in on the prestibe value of Radiolocation (or Radar). For some time the popular magazines have featured advertisements which dramatise the part played by their sponsors in Radar development.

A recent official U.S. Navy Dept. report which concluded "beyond a shadow of doubt that preliminary research and development of Radar originated in the U.S. through the work of two naval scientists."

In fact, it would probably come as a surprise to the man in the street to learn that the British had anything to do with the invention of radiolocation.

Not so Hush-Hush

Climax to the American Radar publicity boom is a recent issue of "Radio Retailing." While it reveals none of the technical secrets, this special Radar issue is something of a shock to those of us who imagined Radar to be still completely hush-hush.

"Radio Retailing" has a long and circumstantial report of how Radar was invented in America.

It is described how in 1922 Dr. A. Hoyt Taylor and Leo C. Young, observing that certain radio signals were reflected from steel buildings and metal objects, and that ships passing by a transmitter and receiver at such frequencies gave a definite interference of pattern, suggested that "possibly an arrangement could be worked out whereby destroyers located on a line a number of miles apart could be immediately aware of the passage of an enemy vessel between any two destroyers in the line, irrespective of fog, darkness, or smoke screen."

Experiments continued, and, it is stated: "L. A. Hyland observed in 1930 that aircraft crossing a line between a transmitter and receiver operating directionally gave an interference pattern clearly indicating the presence of such aircraft." In the same year Dr. Taylor summarised progress in a report on "radio-echo signals from moving objects," and two years later the Navy's findings were passed on to the U.S. Army. It was suggested that the Army might set up equipment around a defence area to test its effectiveness in detecting the passage of hostile aircraft.

Navy experiments continued meanwhile, and in 1932 aircraft in motion nearly fifty miles from the transmitter had been detected under certain conditions. From then onwards steady progress was made until in 1939 the first contracts were placed for the production of complete Radar equipments.

British Developments

Britain's activities in the field of Radar are referred to. In 1940 the British Technical Mission exchanged information with the U.S. Naval Research Laboratory and the Navy Department. "During this conference it was found that the British equipment for detecting aircraft was similar in many respects to that developed by the U.S. Navy. The British independently had developed their Radar system and independently had arrived at frequencies and circuits very similar to those developed in America.

A representative of the U.S. Navy spent the greater part of 1941 in England obtaining information on British Radar methods.

Not the least interesting feature of "Radio Retailer's" contribution to scanty published information on the subject lies in accompanying American radio manufacturers' advertisements which invest Radar with a prestige angle.

Peace-Time Applications

Suggested applications include safeguarding ships against collisions in fog, protecting aircraft against mountain-top crashes, measuring flying height above ground, detecting aircraft approaching in fog, patrolling harbours against smugglers, and surveying through underbrush and obstacles. These, in addition to vast associated research, which will influence all future designs of ultra-shortwave transmitters, aerials, receivers, and television equipment.

Philco Corporation talk of "Radar, the secret weapon, tells the story of Philco at war," claiming that "Philco pioneered in the science of ultra-high frequency radio waves upon which Radar is based." General Electric picture the principle of Radar, which "sends out a beam of ultra-high frequency waves, reflected back to instruments which determine aircraft's location, speed, and direction." A "New York Times" quotation is included to the effect that "the whole history of Radar has been an example of successful collaboration between Allies on an international scale."

Comment from R.C.A.

Radio Corporation of America publish a well-balanced statement under the heading, "Radar . . . Who Really Invented It?" stating that it is not an "invention" at all in the old fashioned sense; they prefer to give the credit chiefly to Clerk Maxwell, Hertz, or Marconi, or any of the famous pioners of radio waves.

"But from the modern perspective," they add, "we like to think of Radar as a joint contribution of British and American scientists, a triumph of United Nations' collaboration in winning the war."

Recently there has been mentioned the name of Sir R. A. Watson Watt in connection with Radiolocation.

He conceived and developed radiolocation to the point where it became one of the most formidable of British weapons. With traditional reticence, Britain has been slow to claim the credit rightly due to her for radiolocation development. But despite the publicity fanfare in other directions, to Britain belongs the credit for unobtrusively bringing forward a weapon which, when the story is told, may well be one of the saviours of the United Nations and more.

And, moreover, a blessing to mankind in time of peace.

—"The Electrical & Radio World" (Q.).

STANDARD FREQUENCY TRANSMISSIONS

Further details are now available of the standard-frequency transmissions from WWV the station of the U.S. National Bureau of Standards. As announced recently, new 10-kW transmitters have ben installed at Beltsville, Maryland, near Washington, D.C., with the result that the service has been extended and is now operated continuously throughout 24 hours.

Covers the World

Three standard radio frequencies are employed: 5 and 10 Mc/s continuously throughout the 24 hours, and 15 Mc/s during daylight in Washington. It has been found that, except for certain periods at night within a few hundred miles of the station, reliable reception is, in general, possible at all times throughout the United States and the North Atlantic, and fair reception over most of the world.

Each of the radio frequencies carries simultaneously two audio frequencies: 440 c/s, being the standard musical pitch correspond to A above middle C, an 4,000 c/s. In addition, there is a pulse every second heard as a faint tick lasting 0.005 second.

The audio frequencies are interrupted precisely at the hour and each five minutes thereafter for one minute during which the announcement of the station's call letters, WWV, is given in Morse, except at the hour and half hour when it is by 'phone.

The accuracy of all the frequencies is one part in 107, and the time interval marked by the pulse every second is accurate to 0.00001 second.

SIGNALS OFFICERS IN THE MAKING

MUCH has been written, both in the specialist and lay Press, on the work and training of those who operate the complicated technical equipment of modern war, but much less has been said about those who direct such work. It is the purpose of this article to remedy that omission, so far as wireless is concerned, by giving some insight into the way an officer of the Royal Corps of Signals is produced, and incidentally, some details of his subsequent work.

To secure a clear picture of the training of potential R. Signals officers "Wireless World" was recently granted the privilege of visiting the R. Signals Officer Cadet Training Unit in the Northern Command. Here were to be found some 800 cadets who had reached various stages in the twenty-six weeks' course. During the visit the weekly "passing out" ceremony was witnessed; about twenty-five cadets, having finished their course and attained the necessary percentage of marks in the many subjects studied, received their commissions.

It should, perhaps, be emphasised that, as the Commandant of the Unit pointed out to us, the R. Signals Officer needs to be firstly an administrator and secondly a technician. It must not, however, be concluded from this that cadets leave the Unit with little technical knowledge; the astonishing thing is that they absorb so much information on wireless and line technique in so short a time.

Reprinted from "Wireless World" (London)

The time allotted for technical training is approximately 430 periods, each of three-quarters-of-an-hour duration. During this time the cadets pass through a progressive course embracing basic electricity, magnetism and AC theory, wireless and line technique and wave propagation. Of the 430 periods about 200 are allotted exclusively to wireless. In addition to the time spent in the classrooms the cadets spend many days out on "schemes," putting into practice the theory learned.

The best method of describing the technical training given to R. Signals cadets, many of whom, it should be pointed out, have not previously studied wireless or line transmission, is to outline the various sections of the course as given in the manual, "Wireless Theory", which was prepared by the instructors and is used as a basis of the training.

The object of the method of treatment adopted in the manual is to lead the cadets, at as early a stage as possible, to an understanding of workable, though perhaps crude, circuits for both transmitter and receiver.

(Continued on next page)

SIGNALS OFFICERS

(Continued)

Subsequent steps then become a matter of detail additions to a picture already sufficiently complete for the importance of every point to be at once appreciated. Such a treatment is considered to dispel most of the "mystery" of wireless much sooner than is possible in the usual procedure, in which a laborious way is picked through variations of individual processes before completing the picture.

Before the cadet handles any of the Army sets with which he will later become familiar he must complete Parts 1 and 2 of the manual, which deal with the principles of radiation, the properties of resonant circuits, HF resistance and the valve and its functions in various stages of the transmitter and receiver.

Typical Questions

The following two questions from those set on Parts 1 and 2 of the manual will give some idea of the standard expected from cadets—"At 1 kc/s a certain conductor has a resistance of 2 ohms and at 10 Mc/s it has a resistance of 50 ohms. To what is this due?" "A sender (the official Army term for transmitter) using MCW is tuned to 7,540 kc/s; the AF oscillator is tuned to 1,00 c/s. What are the frequencies radiated?"

Having completed the training covered by this part of the manual the cadet is expected to handle Service sets with a reasonably intelligent understanding of their controls. He then proceeds to Part 3, which describes various other ways of obtaining oscillation, amplification, modulation and detection, and presents a more generally complete picture of the transmitter and receiver. AVC, decoupling, negative feed-back, interference, crystal control, and the principles of the superheterodyne are dealt with as fully as can be expected in the time available.

Two questions selected from those set for the examination covering Part 3 of the manual will suffice to show the knowledge of theory required.

"In the diagram (cathode bias) what purpose does the resistance serve and how does it achieve it? Why is the condenser included?" "To what extent does the use of the superheterodyne affect allocation of frequencies for use is a (military) formation and why?"

Practical Training

A feature of the training at the O.C.T.U. is that it is essentially a matter of practical demonstration. For example, a considerable part of the twenty-four three-quarter-hour periods spent on fault-finding, set analysis and maintenance is occupied by practical demonstrations. One block schematic diagram shows by illuminated bulbs the sections of a combined transmitter-receiver brought into use by the operation of the various controls. It is pointed out that in this way the cadet quickly learns the function of the various sections of a typical transmitter-receiver and can, therefore, more readily appreciate the purpose and action of the controls.

Training at the O.C.T.U. is not, of course, confined to wireless theory, in fact, during the course a cadet does the work of a linesman, line operator and wireless operator in addition to being fitted to undertake the duties of a signals or staff officer.

In order to give the cadet the opportunity of seeing both sides of the picture in a brigade or divisional signals office he takes part in two 3-day exercises. During the first of these he is an operator and in the second an executive officer. "Wireless World" was fortunate in being able to take part in one of these exercises. It was enlightening to travel in the armoured mobile signals office beside the 23-year-old cadet who was acting as Brigade Signals Officer. He was within a fortnight of completing the O.C.T.U. course and receiving his commission.

The vehicle in which we travelled was equipped with two No. 19 sets—one being high-powered. These transmitter-receivers, which derive their power from accumulators through a rotary converter, each combine three sets in one: (A) is the long-range set, (B) that for communication with other vehicles in the same formation, while (C) provides inter-communication for the crew.

Wireless Essential

The mobile signals office was the nerve centre of this exercise, during which the "armoured division" travelled from North Wales to the Yorkshire Moors. Wireless communication is an essential part of such an exercise, and the "Brigade Signals Officer" was elated when they were working, on phone, their base some 250 miles away.

The "attack," launched against heavy "enemy" forces, involved the use of "infantry" as well as "armoured regiments."

We have already referred to the C.O.'s statement that R. Signals officers must be first and foremost administrators. To equip the potential officer for the administrative duties, the course includes what is known as "the crowded hour." During this the cadet sits at a table equipped with a phone and the paraphernalia one would expect to find on a Brigade Signals Officer's desk. He is then bombarded with a series of messages by phone and messenger, his fellow-cadets being present to criticise his handling

(Continued on page 26)

Shortwave Review

CONDUCTED BY

L. J. KEAST

NOTES FROM MY DIARY—

NIGHT AND DAY

Owing to the onset of seasonal changes, it is quite likely by this time this edition is being read, the General Forces programme from the BBC will be difficult to hear, and we can expect poor night reception for a few months.

But those of us who are fortunate enough to be able to listen during the daylight hours will have a tremendous feast.

GEOGRAPHIC

Two new stations mentioned by Mr. Edel had me looking up my Atlas. I found that PETROPAVLOSKI in Kamschatka Peninsula is the most easterly of the Russian short-wave transmitters and is actually one hour ahead of Sydney time. TASHKENT in Turkestan with a population of 40,000 was the capital of the former Russian General-Governorship of Central Asia on river Syr Darya and has extensive silk manufactories and great commerce.

THE BALL GAME

Re-creations af the principal baseball games in U.S.A. are broadcast over KWIX 25.21 m. from 5.30—6 p.m. and over KROJ 30.31 m. from 8.30 till 9 p.m. daily except Tuesday.

RADIO NEWS REEL

The edition for U.S.A. is put over at 9.30 a.m. and repeated at 1 p.m. For the first transmission I find GVX 25.15 m. very good and at lunch-time GSB 31.55. On Sunday, May 21, heard the first instructions from General Eisenhower's headquarters to the underground people of Europe.

—— o ——

NEW STATIONS

Radio Dakar, Senegal, 11.410 mc., 26.29 m.: Not sure of schedule, but can be sorted out from Morse intereference when closing at 7 a.m. with "Ici Radio Dakar". Announcement is by a woman.—L.J.K.

AFHQ, Algiers, 9.60 mc., 31.22 m.: Heard at midnight with news in English. At 12.45 a.m. "Ici Radio Nations Algiers." At 1.15 am Yankee Doodle, then in German. Mr. Edel first submitted this one.

WCBN, New York, 11.145 mc., 26.92 m.: This is a new call sign for this CBS outlet and was first heard at 7.30 am on May 15. Signal was R8 Q4 and station was in parallel with WOOC 31.09 m. and WOOW 38.36 m. When closing at 9 am said: "Next broadcast to Europe will be at 2.15 am EWT, 6.15 GMT (4.15 pm Syd) over WCBN on 6060 kc, 49.5 m."—L.J.K.

WCBN, New York, 6.06 mc., 49.5 m.: Opens at 4.15 p.m. with signal that would be good if not spoilt by morse—L.J.K.

Radio Tashkent, Turketsan, 6.825 mc, 43.96 m.: Mr. Edel advises me of this new Russian. Heard at 11 pm with news in Russian, but often spoilt by morse. At 11.16 news in Uzbekistan; 11.35 news in Russian. At 11.45 takes a relay from Moscow and at midnight announces, "Attention here is Tashkent on short-wave of 43.96 m." Signal, apart from morse, is good.

VLC-2, Australia, 9.68 mc., 30.99 m.: Opened on May 1: "This is General MacArthur's Headquarters Australia, presenting The Philippine Hour." Schedule is 7-8 pm and programme consists of news, talks and musical items. Signal is affected by "skip" and during last few days bad morse, but at this listening post averages around R7 Q3.—L.J.K.

ABSIE (Americn Broadcasting Station in Europe) opened on April 30. Location is not mentioned, but at 8 a.m. announce they are operating over 1 station in the 4 m band 2 in the 41 and 4 in the 31 metre bands. Over a quick run through I figured the frequencies were: 6.01, 7.28, 7.18, 9.52. 9.545, 9.625, 9.64. the best signal being 9.625 m.c.

Identification signal is 7 notes from "Yankee Doodle" played on flute-like instrument. Broadcast-Dxers will be interested to know it is also on 307 metres.—L.J.K.

Radio PETROPAVLOVSK, Kamschata, 6.07 m.c., 49.42 m.: Another from Mr. Edel. Heard irregularly from 7 pm with local news in Russian at 7.15. At 7.30 announce are also to be heard on RW 102, 779 metres and bring a relay from Moscow. Has a good readable signal and close around 8.03 pm.

KROJ, 'Frisco 6.10 mc, 49.15 m.: A new outlet for this 'Frisco station in afternoon session for Alaska. Schedule is 1.30—5.45 pm. First heard on May 10. Signal is R7 Q3 at closing and will improve as winter draws on. When closing announce "next transmission to Alaska is at 8.15 am PWT (1.15 am Syd.) on 9.89 mc. Programme to Australia is still on 9.89 mc from 6—11 pm and most nights is splendid, both as regards programme and signal quality.—L.J.K.

——, Delhi, approx. 15.35 mc., 19.53 m.: Do not know call sign but heard announcement at 5 pm on Saturday May 20 when station was in parallel with 19.62 m.—L.J.K.

——, Stockholm, approx. 10.775 mc 27.83 m: Mr. Rex Gillett of Adelaide sends particulars of this new Swedish transmitter. He heard them opening at 3.35 am after the customary 11 note chimes. English was given at 3.40 following a German announcement. Signal R5-6.

PLEASE NOTE

Owing to shortage of space, Short-Wave Schedules have been held over till next month.

ALL-WAVE ALL-WORLD DX CLUB

Application for Membership

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

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

Name ....

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

My set is a ....

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

(Signed) ....

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

Shortwave Notes and Observations

OCEANIA

Auralia

Three new Australians are VLC-2 9.68 mc, 30.99 m., VLC-3, 11.87 mc, 25.27 m., and VLC-4, 15.315 mc, 19.59 m. One has already been heard, namely VLC-2 and is on the air daily from 5.30 till 6.30 p.m. in Japanese and from 7 till 8 p.m. in the "Philippine Hour."—L.J.K.

Heard VLC-2, 30.99 broadcasting to Philippines (Gillett).

Thought one night I heard Perth on 9615 kilocycles, 31.21 m. and call given as VLW-4.

New Zealand

ZLT-7 Wellington 6.715 mc, 44.68 m.: Heard for first time on April 19 from 7.15 till 7.40 p.m. (Clack).

New Caledonia

FK8AA, Noumea, 6.208 mc., 48.39 m.: Heard nightly from 7—8. On Mondays gives new and views from Home (N.Z. Nat. B/C).—L.J.K.

AFRICA

Algeria

AFHQ, 31.22 m. At 12.15 am says: "You have just heard the latest news in Basic English. The news is given every day at 14 hours GMT (M/n Syd.) This is the Voice of America. One of The United Nations." Programme goes on in German followed by French. At 1.45 dance records then BBC news. (Edel).

Heard Algiers on 31.22 at 3 a.m. (Gillett).

Belgian Congo

RNB, Leopoldville, 30.66 m is excelfrom 3 till 3.45 p.m.—L.J.K.

French Equatorial Africa

FZI, Brazzaville, 25.06 m is very good in afternoon, closes at 4.27—L.J.K. Has been heard at the unusual hour of 2.40 a.m. in French, fair signal (Gillett).

Gold Coast

ZOY, Accra, 7.050 mc., 42.54 m. Carries BBC news at 4 a.m. Good signal (Gillett).

Mozambique

CR7BE has moved from 30.38 to 30.42. First noticed Anzac Day when Moscow opening up at 6.20 a.m. on 30.43 interferes with them (Gillett).

(Correct—new frequency is 9.683 mc.—L.J.K.

Kenya Colony

VQ7LO, Nairobi, is now on 49.07 m (Gillett).

CENTRAL AMERICA

Costa Rica

TIPG, San Jose, 9.617 mc., 31.20 m. Can be heard at 11 a.m. (Cushen)

Has often been good around 10.30 p.m.—classical music frequently heard. (Gillett).

Guatemala

TGWA 30.96 m. Think I heard this around 2.20 p.m. the other day, although GRX opens up later, but feel sure was TGWA. (Gillett). Heard closing at 3 p.m. (Gandy).

U.S.A.

KWU, 'Frisco, 19.53 m. is good at 7.30 a.m. KWID, 19.62 m. is R6 at noon. KROJ on 19.75 m. is noisy at 8 a.m. (Gandy).

WRUS, 19.83 m. Supposed to open at 9.45 p.m. but I can't hear it (Gaden)

The following 19 metre band Yanks are heard at 11 p.m. when one's luck is in: WGEA, 19.57; WCBX, 19.64; WLWK, 19.67; WBOS, 19.72; WOOC, 19.75; WNBI, 19.81 and WWV on 20 metres (Gillett).

WRCA, 25.22 m. gives Sports News at 10.46. News in Italian at 11 and Spanish at 11.15 p.m. (Edel).

Dr. Gaden observes: WGEX, 25.33 m. Agree with you call is WGEX at 10 p.m.; WCRC is very nice on 25.36 when opening at 9 p.m.; WRUA on 25.45 m. is the worst of the 25 metre Yanks at night. WLWK 25.26 m. Very nice signal at 9 p.m.

KROJ, 30.31 m. is very good, especilly near 8 p.m. (Gaden).

WRUS, 30.93 m. has a very good signal when closing at 9.30 (Gaden).

KWIX, 31.35 m. gives World's News at 11 p.m. (Edel).

WGEO on 31.48 m. is fair at 11 a.m. (Cushen).

KRCA on 31.61 m. is splendid at 3 p.m. (Gaden).

WCBX on 31.61 can be heard at 11 a.m. (Cushen).

KES-3, 28.25 m. is just audible at 3 p.m., never very good. (Gaden).

KWV 27.68 m. is very good from 4 till 6.45 p.m. and is getting through nicely from 7 p.m. now.—L.J.K.

WOOW, 38.36 m. Heard call at 8 a.m. (Cushen).

WLWO, 39.6 m. at 5.05 p.m. gives list of bands employed in News in English broadcasts from "V. of A." stations for whole 24 hours. Good signal and easily copied.—L.J.K.

WRUA, 39.6 m. Heard call at 7.45 a.m. (Cushen).

KWID, 41.49 m. gives news at 11 p.m. and with fine signal (Edel).

KGEI, 41.38 m. has News from British News Room in 'Frisco at 10.15 p.m. —L.J.K.

WGEO, 42.86 m. is at very good strength in European service, closing at 5 p.m. and WGEO, 48.47 m. signs at 2 p.m. re-opening at 2.10 (Cushen).

WCDA, 49.50 closes at 4 p.m. in Spanish —no English announcement — then S.S.B. R7 Q4. — L.J.K.

SOUTH AMERICA

Argentina

LRX-1, Buenos Aires, 6.125 mc, 48.94 m.: Heard opening at 8.30 p.m. and held them till closing at 9.35. Signal on some nights reaches R7 Q4-5, while on others, morse prevents reception (Clack).

Brazil

PRL-7, Rio de Janiero 9.72 mc., 30.86 m is heard around 7.15—8.30 a.m. (Gillett).

ZYC-8, Rio de Janiero, 9.61 mc., 31.22 m. Have heard at 11 a.m. (Cushen).

Chile

CE970, Valparaiso, 9.73 mc., 30.82 m., can be heard at 11 a.m. (Cushen).

Ecuador

HCJB, Quito, 24.11 m.: Heard closing at 1.15 p.m. instead of 1.30 (Gillett)

Yes, I have noted they close at 1.15 and on Saturdays at 1.45 present "Challenge to Youth."—L.J.K.

Peru

OAX6A, Arequipa, 6.01 mc., 49.92 m.: "Radio Arequipa Sociedad Anonima de Radiodifusion (SAR)." Heard the other Sunday with concert at 1.10 p.m. First reported June 16, 1941, and just back this week (Cushen).

OAX4T, Lima, 9.562 mc., 31.37 m.: Quite a surprise today, gave usual S.A. recordings (Cushen).

THE EAST

China

XGOY, Chungking, 11.909 mc, 25.19 m.: News generally readable at 8.03 p.m. and some nights spreads over KWIX on 11.9 mc.—L.J.K.

XGOA, 9.72 mc, 30.86 m R4 at 9.30 p.m. (Gandy).

XGOY, 31.14 m. News at 11.58 p.m. (Edel).

India

At 11 a.m. Delhi is heard on 25.25, 25.45, 31.28, 31.15 (Cushen). Delhi on 9.63 mc, 31.15 interferes early in the evening with CBFX, but is very good at 2 a.m. with news. Announces as broadcasting on 25.27, 31.15, 31.28, 41.16, 48.47, 49 and 61 metres, also 367.4 metres. Strength is very good in the short (7 mins.) news — then comes a commentary and news in Hindustani at 2.15 (Cushen).

Delhi 11.87 mc 25.27 m. opens with news at 7.30 p.m. (Cushen).

Delhi, 15.29 mc., 19.62 m. gives P.O.W. messages at 1.15 p.m. Signal is very strong, so strong as to give an "echo."—L.J.K.

VUD-4, 31.28 m. is R6 at 9.30 a.m. (Gandy).

Colombo 4.90 mc., signs at 2.30 a.m. with "Good Night Sweetheart." (Cushen).

A new Indian is heard on approximately 19.54 m. during the afternoon around 3 o'clock signal is R5. (Gillett). (This is another outlet of all India Radio mentioned under "New Stations."—L.J.K.)

Mr. Gillett writes: "VUB-2, Bombay on 41.44 m. is at good strength with news in English at 2.30 a.m. VUC-2 Calcutta, 41.61 m. was R7 on May 6 at 1.15 a.m.

VUD-4, 31.28, VUD-2, 41.15, VUM-2 41.32 and VUB-2 41.44 all give news in English at 10 p.m.; the first two are best.

MISCELLANEOUS

Army Testin. 7.84 mc, 38.2 m.: Now gives time in GMT and Cairo time, also give call JCJC (Cushen).

Arabia

ZNR, Aden, 24.77 mc, is heard on occasions with fair signal at 3 am (Gillett).

Canada

CBFX, Montreal, 9.63 mc, 31.15 m.: Suffers slight interference from Delhi station when giving news at 9.30 p.m. Has news at 10 till 10.15 then devotional service and still audible at 11 p.m. Has replaced CBFY (Cushen).

Hawaii

KKH, Kahuku, 7.52 mc., 38.89 m. Heard at 9.45 p.m. occasionally. (Edel).

Iraq

Radio Baghdad 42.32 m. Arabic at 12.30 a.m. but spoilt by heavy morse (Edel).

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

S.J. (Randwick) asks about ways of testing condensers, resistors ond other smoll components without meters.

A.—Frankly, it is rather difficult to do much in radio without meters, or test equipment. Even the simpest voltmeter can soon be fitted up to act as an ohmmeter, and then you are well on the way to getting a reliable test for condensers, resistors and so on. It is not so easy to test the effective capacity of a condenser but capacity is seldom critical to within thirty or forty per cent., and the usuol practice is to test for leakage and accept the capacity as being according to the rating shown on the label. The leakage test of course, is purely a mater of testing the "resistance" with an ohmmeter.

Of course you can arrange a lamp and battery circuit so that the lamp will light if the terminos are short-circuited by o broken down condenser, but this will not reveol cases of leaky condensers which have not actually broken down.

W.W. (Kaniva) wants to know whether rodio can be learned by correspondence.

A.—Naturally a certain amount of keenness and concentration is required and we suppose that there are cases where students fail to get o full grasp of the game by mail, but on the other hand we can vouch for the high percentage of radio technical staff members who have started off with on A.R.C. course, or one from some other reliable correspondence school.

M.P. (Adelaide) hos in mind to experiment with extremely high goin amplifiers for sensitive microphone work.

A.—There is practically no limit to what you can do, especially if you use battery-operated valves and have separate high tension batteries for each stage, or a thorough system of decoupling. Eventually you will reach a limit of noise from even the battery heated filaments, but by this time you will have had some interesting experimenting. As with a sensitive radio recever, you will have to accept the fact that signals which are below the general noise level will not become clearer by amplifying both noise and signal. If it is possible we would appreciate an account of your experiments when you have completed them.

"Whistler'" (Elwood, Vic.) has a t.r.f. set which whistles on every local stotion and asks whether this is unavoidable.

A.—There is no reason why a t.r.f. set should have whistles unless it is unstable or suffering from feedback. There must be hundreds of similar receivers operating in the same locality yet giving complete satisfaction.

H.G. (Wogga) enquires about subscription to "Q.S.T." and other American technical rodio journals.

A.—Your local newsagent can arrange these subscriptions for you, or ony branch of Gordon ond Gotch, or any of the city bookshops, such as Swains, Angus & Robertson, McGills, etc.

W.L. Worrnambool, Vic.) is interested in the possibilities of television.

A.—We have not heard of any definite proposals for post-war television, not even as regards England, where a television service was in operation long before the war.

In discussing television possibilities, engineers are now thinking along the lines of even greater definition by using 525 lines and 450 frames per second. This should give exceptional clarity and brilliance, without flicker, but will call for the use of ultra high-frequency transmission. Fortunately the vast war experience with these frequencies should make it much easier to handle these than was the case a few years ago. Still confidential are the remarkable developments which have taken place on the ultra highs.

T.S.F. (Maroubra) enquires about our stocks of back numbers.

A.—We have fair stocks of the 1940 issues, with the exception of July and August, plenty of 1941 issues, but the 1942 stock is now practically exhausted.

NEW IDEAS

(Continued from page 12)

really a tetrode with 100 per cent. negative feedback applied to the screen and a triode has a lower output than a tetrode or pentode.

For the reduction of distortion, the reader is referred to the article in Australasian Radio World for February, 1942.

Thin silver coatings applied directly to crystal faces, in somewhat the same manner as mirrors are silvered, have been found to overcome the tendency of crystals to change frequency as a result of movement in mobile installations. Connections are made by soldering springs or fine wires to the silver film.

SOLDIERS' OWN STATION

U.S. Servicemen in the Mediterranean theatre on last December 15th listened to programmes celebrating the first anniversary of the first radio station in history operated by servicemen for their own entertainment.

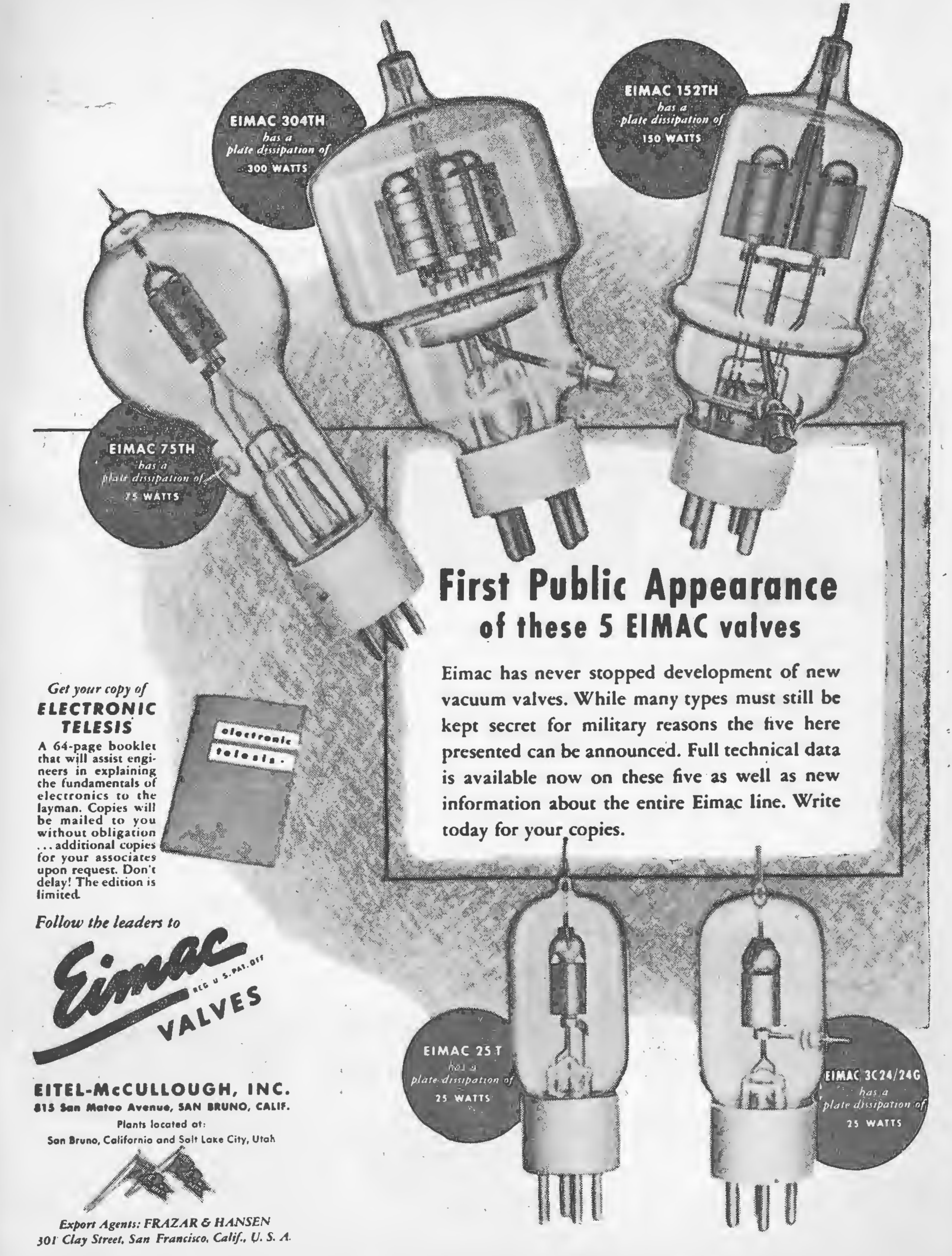
The original station, which came on the air just 37 days after the first shell was fired at Casablanca, was built by Captain H. A. Brown, formerly of W9YH, from materials found on the beaches and from old parts of a requisitioned French transmitter, connected together with miscellaneous scraps of wire. Now six stations operate in the area, and crews with modern station equipment move ahead as fast as the troops. W9YH is the technical director of the new commercial-type stations, but his first overseas handmade job, cut down now so that it fits into a suitcase, is still operating.

SIGNALS OFFICERS

(Continued from page 22)

of the situation. The diversity of the questions with which he has to grapple efficiently and expeditiously is exemplified by the following two problems dealt with during the writer's visit:—A truck fitted with a No. 19 set having met with an accident whilst being driven to another section, where it was urgently awaited, the A.T.S. driver was injured and the set and truck damaged. It was the cadet's job to get another set to the destination, arrange medical aid for the injured driver, secure repair facilities for the truck, and arrange for the repair or, if necessary, the replacement of the damaged set. While this rather involved situation was being grappled with, Signalman Jones was ushered in with a request for compassionate posting near his home as there was nobody to look after his children whilst his wife was in hospital!

In addition to being a technician and administrator the young officer must be fully trained in "battle" tactics. The type of warfare experienced in the campaigns in the Mediterranean theatre of war has shown the necessity for this. A cadet may, of course, go through the whole of his career as a commissioned officer in R. Signals without having to climb mountains, cross rivers, wade through a bog under fire or leap streams on a swing rope, yet it is imperative that he should know his own capabilities and what he can expect of the men under his command. Ten days of the twenty-six week course are, therefore, spent at the "battle school" in the Lake District. Here the cadet undergoes one of the hardest Army stamina tests.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