THE AUSTRALASIAN

Radio World

PRICE, 1/-

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

VOL. 6 . . . . . NO. 2 JULY 15 1941

DEALERS WANTED FOR LATEST BREVILLE RADIOS . . . . See page 3.

- COUNTRYMAN'S VIBRA FOUR
- THIRTEEN-WATT AUDIO AMPLIFIER
- POWER OSCILLATOR FOR CODE CLASS
- SHORT-WAVE RECEPTION DATA

CROWN RADIO PRODUCTS SPECIALLY SUITABLE for the VIBRA 4

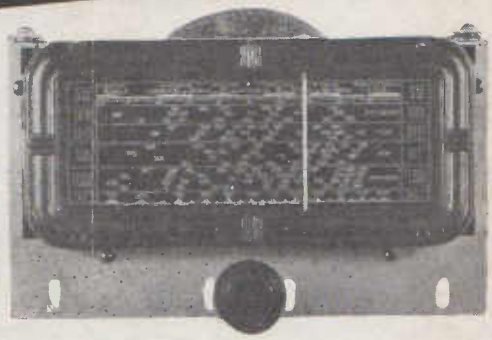
Crown Radio Products can supply you with the coils, coil kit and dial for the "Vibra 4." Moreover, by using Crown coils in the "Vibra 4" you will be certain that the set is being built with the same high standard components as the original. The dial is specially calibrated to suit the "Vibra 4," with the minimum of adjusting.

SPECIFIED AND RECOMMENDED FOR THE "VIBRA 4"

1—Crown Aer. Coil, type AC47.
1—Crown Osc. Coil, type AC49.
1—Crown Padder, type P13 or P12.
1—Crown I.F.T. No. 1, type AT29 or PT31.
1—Crown I.F.T. No. 2, type AT30 or PT32.
1—Crown Dial, type ST1.

Crown Radio's laboratory technicians set themselves to the task of finding out what was the "exelsior" of radio achievement. It took eighteen months' painstaking laboratory research, but the result was the 1941 Crown Trolitul Components. The specific gravity of Trolitul is approximately 1.05, so that it will almost float in water, to which, incidentally, it is impervious. Mechanically, it is very strong, while electrically its internal and surface resistance is 50 kilo-volts per milliameter. Consequently this strong, light, extra-insulated, easily moulded material is ideal for successful radio construction.

Use Crown Radio Components in the "Vibra 4." This will prove to you much more practically than a page of writing that "you can't beat Crown — the RELIABLE line."



The dial is tastefully coloured and complete with dial movement and escutcheon.

P.12. A five - plate 455 K.C. Padder.

A.T.30 No. 1. Intermediate Frequency Transformer.

A.C.47. Air Coil.

Crown RADIO PRODUCTS PTY. LTD.
91-93 MURRAY STREET
PYRMONT - SYDNEY
Telephone MW 2626 (2 Lines)

The RELIABLE LINE

The Australasian
RADIO WORLD
Incorporating the
ALL-WAVE ALL-WORLD DX NEWS

Vol. 6 JULY, 1941 No. 2

CONTENTS:

The "Australasian Radio World" is published monthly by A. G. Hull.

Editorial Offices: 117 Reservoir St., Sydney, N.S.W. Telephone: MA 2455.

Subscription rates: 1/- per copy, 10/6 per year (12 issues), post free to Australia and New Zealand.

OPPORTUNITY FOR READERS

The makers of Breville radios want to increase the number of their agents. They are especially keen to have the assistance of readers of the "Radio World" who have sufficient technical knowledge to appreciate the performance of the new Breville models.

The latest catalogue of Breville receivers has just been released. It reveals the comprehensive nature of the Breville range.

We suggest that anyone interested should send to us for a copy of this catalogue and for details of the special Breville agency proposition.

The VIBRA 4 Demands the R.C.S TROLITUL COIL KIT FOR THE MAXIMUM RESULTS

R.C.S. COIL KIT K181 FOR THE "VIBRA 4"

You'll find this R.C.S. Trolitul Coil Kit unequalled for sensitivity, selectivity and ease of mounting. Specially developed by R.C.S., the "Coil People," and incorporating Trolitul wherever possible, for high "Q." specify

R.C.S. Coil Kit K181 ..... £1/10/6
Use R.C.S. DA5 Dial £1/2/6
And C74S Vibrator £6/6/-

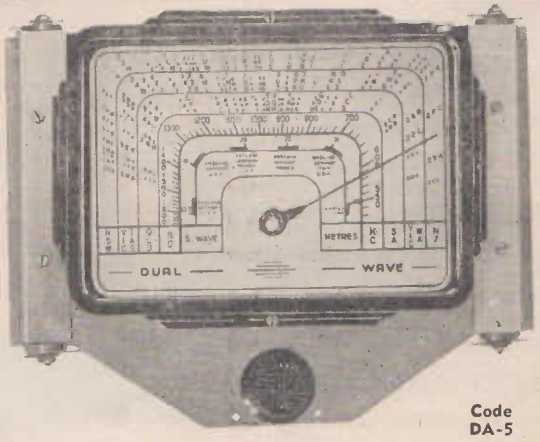
R.C.S. VIBRATOR UNITS

These units are made for 2, 4, 6 and 12 volts input, the output being either 135 or 220 volts. They are self contained, and consist of the necessary filter chokes, transformers, condensers, etc., assembled and wired in a metal chassis, complete with cover shield, and have two low voltage input and high voltage output terminals.

Code	Volts Input	Volts Output	M/A	Price
C89S. Directly heated	2	135	30	£6/19/-
C87S. Directly heated	2	100	15	£6/19/-
C88S. Indirectly heated	2	220	60	Quote
C83S. Directly heated	4	135	30	£6/19/-
C84S. Indirectly heated	4	220	60	£6/19/-
C74S. Directly heated	6	135	30	£6/6/-
C78S. Indirectly heated	6	220	60	£6/19/-
C75S. Indirectly heated	6	135	30	£6/6/-
C79S. Directly heated	12	135	30	£6/19/-
C80S. Indirectly heated	12	220	60	£6/19/-

NEWLY-RELEASED DIALS

For some time we have felt we should provide dials for use with coils of our manufacture, thus assuring perfect tracking. Types DA-1 and DA-2 are single glass dual-wave, the type DA-2 having been designed especially for use with our Five-Band Communications Receiver coil kit, and the "H" type Condenser, Code DA-1, is a standard dual-wave dial for use with the R.C.S. Coils and the "F" type Condenser. The DA-5 is for 1600 to 550 k.c., and 13.7 to 40 metre bands, and the "H" type Condenser. All of this series are edge-lit and wedge-driven. The aperture for the escutcheon is approximately 7" x 4-7/8."



Code DA-5

DA-1 Standard D.W. Dial	22/6
DA-2 Communications Dial	22/6
DA-5 13.7 to 40 metres D.W. Dial, "H" Condenser	22/6
DA-6 Mantel Set Dial, D/W "H" gang	18/9
DA-7 Portable Kit Dial, D/W "H" gang	9/-
DA-8 Same as DA-7, but ready assembled	13/6

R.C.S. TROLITUL BROADCAST COILS

These coils are available in both Air Core and Permeability tuned types. The latter are adjusted to ensure maximum efficiency in our laboratories.

AIR CORE "H" GANG

E342 Aerial	6/6
E343 R.F.	6/6
E344 Os.	6/6

PERM. TUNED "H" GANG

E345 Aerial	8/6
E346 R.F.	8/6
E347 Osc.	8/6

T.R.F. TYPE-AIR CORE

T88 Aerial	6/6
T89 R.F.	6/6
T87 R.F. with reaction	6/6
T72 Reinartz	3/3

R.C.S. AUDIO TRANSFORMERS AND CHOKES

Long experience in the production of highly efficient transformers, combined with extensive research into raw materials and design, has resulted in the production of an audio transformer of excellent performance and complete reliability.

TB6—"B" Class

Code		Price
TA1	Audio Choke Bakelite Case	18/6
TM1	Modulotion Transformer — Power	30/-
TB4	Single Input 'A" Class Bakelite	20/-
TB5	Pysh-pull "A" Class Bakelite Case	21/-
TB6	Input "B" Class Bakelite Case	18/6
TB35	"A" Class High Fidelity Steel case	67/6
TB36	"B" Class Input High Fidelity Steel Case	67/6
TB37	"AB" Class Bakelite	28/6

R.C.S. TUNED I.F.'s

The new R.C.S. permeability-tuned I.F.'s are wound on special Trolitul formers into which are inserted the adjustable iron cores. These R.C.S. permeability - tuned I.F.'s are the most dependable and efficient I.F.'s it is possible to produce. They should be used whenever the optimum in results is required.

IF162

465 K.C. I.F.'s

When two I.F.'s are used:

IF162 1st .. 13/9
IF163 2nd .. 13/9

When three I.F.'s are used:

IF164 1st .. 13/9
IF164 2nd .. 13/9
IF163 3rd .. 13/9

Air Core I.F.'s

Air Core 465 K.C.
IF107 1st .. 7/6
IF108 2nd .. 7/6

Air Core 175 K.C.
1E68 1st 7/6
1E69 2nd 7/6

OBTAINABLE FROM YOUR LOCAL DEALER

R.C.S. RADIO Pty. Ltd.

50 GLEBE STREET, GLEBE — Telephone: MW 2405

"VIBRA 4" for the COUNTRYMAN

★ No "B" Batteries

★ Ample power

★ Cheap to build

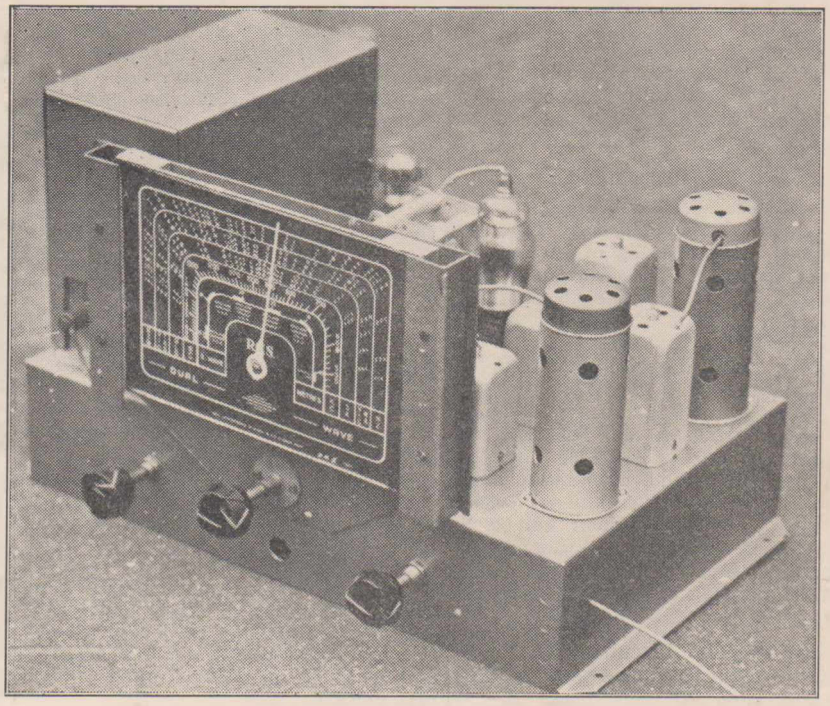
★ Stock parts used

●

FOR the first time in many moons we offer this month as our feature technical article a description of a receiver which has been designed to offer the countryman an outstanding proposition in a vibrator-powered model.

It represents about the cheapest and simplest possible design of a broadcast receiver to give ample range and selectivity for good all-round results, yet to cost quite a modest sum for a kit of parts, including the vibrator unit which is recommended for those with battery-charging facilities.

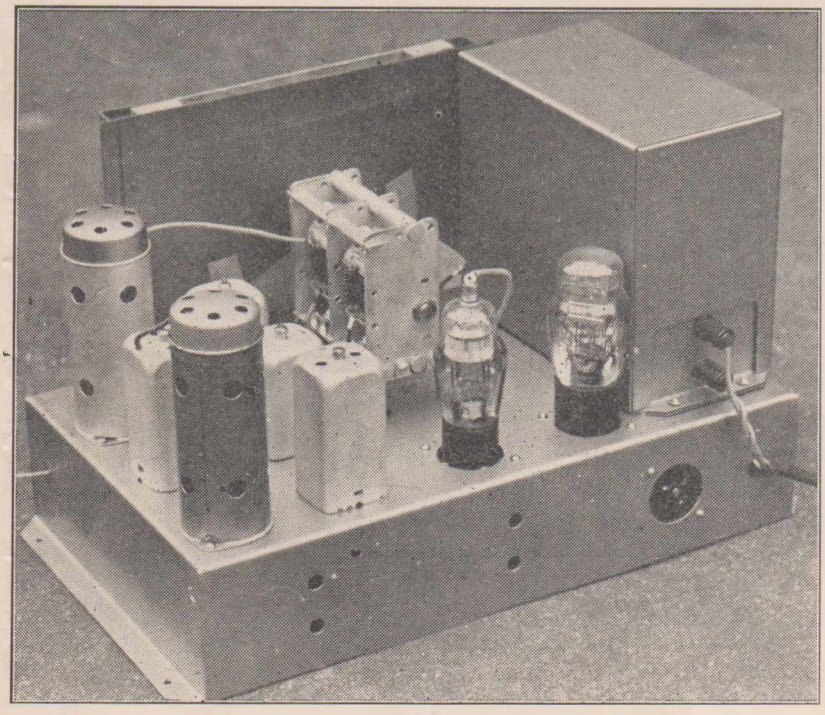
The use of a vibrator unit means an end to the worry and cost of frequent replacement of "B" batteries, which not only cost a lot in the first place, but are also expensive when it comes to sending them any great distance by rail.



Front view of the "Vibra 4" chassis.

The vibrator unit, as surely everyone must know, is a little device which changes the six-volt supply of an accumulator to pulsating D.C., which is fed to the primary of a small transformer, thereby causing the transformer to deliver A.C. of a higher voltage in the secondary. This secondary current is then rectified to D.C. and used as a high tension supply to make "B" batteries unnecessary.

The use of the vibrator unit is not essential, however, and full details are given for using the circuit as a straight battery-operated receiver with a six-volt accumulator for the filament supply. Used under such circumstances, the set is most economical and the filament current drain is about a third of the usual figure.



Rear view showing terminals of the vibrator unit.

History

Vibrators were originally introduced for use with car receivers, operating from the car battery to supply suitable high tension. Batteries are too heavy and bulky to carry in a car, and, of course, costly. The use of vibrators in car sets allowed them to be fully operated from the car's ignition and lighting system, so that they required no upkeep. Naturally they were appreciated as a wonderful boon for car receivers and can be held almost solely responsible for the practicability of modern car radios.

(Continued on next page)

"VIBRA 4" (Continued)

It wasn't long before those handling car sets felt that it wasn't only in connection with cars that batteries could be considered bulky and expensive and so vibrator sets were introduced several years ago and have proved highly successful in every way.

That they are not more popular is mainly due to the high initial cost of vibrator sets and vibrator units.

Is It A Proposition?

The question "Is a vibrator-powered set a proposition?" can only be answered after a study of the charging facilities which are available. For example, let us consider an extreme case, the case of a resident of an island 500 miles off the coast. If no charging facilities are available it would be a poor proposition for him to use a vibrator and a heavy accumulator. To send it so far for recharging would be hopeless. But on the other hand, if he happens to have a home lighting plant (and no petrol rationing), he would soon find it a much better scheme to use a vibrator instead of paying the high cost and freight charges necessary to keep his set supplied with "B" batteries.

The Circuit

The circuit used is a more or less standard type of broadcast superheterodyne, with a frequency changer valve, one stage of intermediate frequency in the 460 k.c. band, a diode-pentode detector and a resistance-coupled audio end with a conventional output valve.

The valves used throughout are the standard two-volt types, as made in our local valve factories, so that stocks are readily available and replacements are never likely to be unobtainable.

Care has been paid to the finer points to ensure maximum gain with stability. All screens are kept entirely independent, with their own voltage-dropping resistors and by-pass condensers. The r.f. filter at the detector has been carefully designed to ensure stability, and still further precautions have been taken in this direction by providing ample by-passing at the plates of both audio valves. An effective design of a.v.c. has been incorporated.

The Filament Network

An interesting point of design is shown in the filament network, where four valves with filament current ratings of .12 and .24 amperes at 2 volts are arranged to take .24 amperes at 6 volts, and at the same time provide correct biassing for the receiver.

Working from positive to negative, we might explain the current as going first through the output valve filament, where there is a two-volt drop at the full current of .24 amps. This current is then divided into two streams of .12 amps. each, one stream feeding the filament of the detector and then the converter valve, giving two volts to each.

The other stream goes to the filament of the intermediate valve, where a resistance of 16.6 ohms is fitted in series, so that there is a drop of 2 volts across the valve and 2 across the resistor.

The above is a rough and ready explanation of the arrangement of the voltages across the filaments, but now let us consider the matter of the bias voltages.

The grid of the output valve is returned to earth, so the grid can be considered as at earth potential, whilst

"VIBRA FOUR"— Parts List

1—Base, size 14" x 8½" x 3" (Arcadian).
1—Aerial coil (R.C.S., Radiokes, Crown).
1—Oscillator coil for 1C7G (R.C.S., Radiokes, Crown).
2—Intermediate transformers (R.C.S., Radiokes, Crown).
1—Padding condenser (R.C.S., Radiokes, Crown).
1—Two-gang tuning condenser (Stromberg-Carlson).
1—Dial to suit (R.C.S., Radiokes, Crown).

CONDENSERS:
2—.0001 mfd. mica condensers (T.C.C.).
2—.00025 mfd. mica condensers (T.C.C.).
1—.005 mfd. mica condensers (T.C.C.).
1—.01 mfd. mica condensers (T.C.C.).
8—.1 mfd. tubular condensers (T.C.C.).
1—.5 mfd. tubular condensers (T.C.C.).
2—500 mfd. 12-volt electrolytic condenser (T.C.C.).

RESISTORS:
1—16.6 ohm resistor (I.R.C.).
3—50,000 ohm resistors (I.R.C.).
2—.1 meg. resistors (I.R.C.).
1—.25 meg. resistor (I.R.C.).
1—.5 meg. resistor (I.R.C.).
4—1 meg. resistors (I.R.C.).
1—500,000 ohm volume control (I.R.C.).

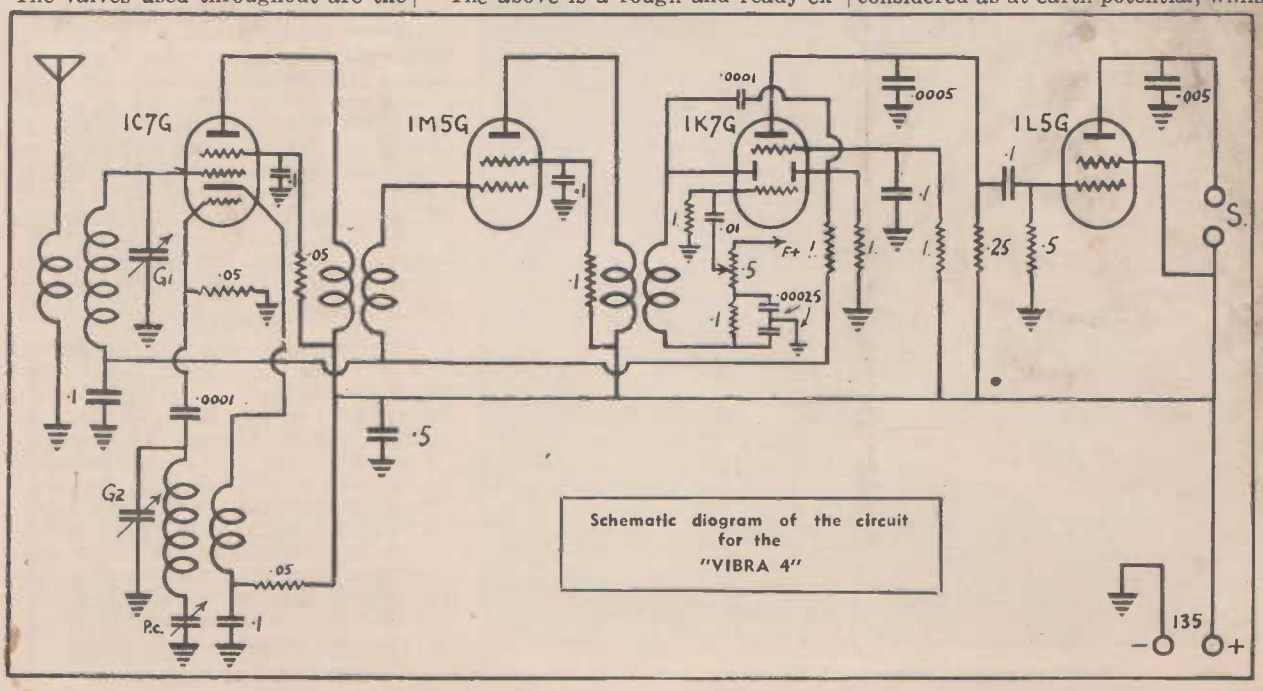
VALVES:
1—1C7G, 1—1M5G, 1—1K7G, 1—1L5G (Philips, Mullard, Radiotron, Brimar).

SPEAKER:
1—Permagnetic type to suit 1L5G (Rola, Amplion).

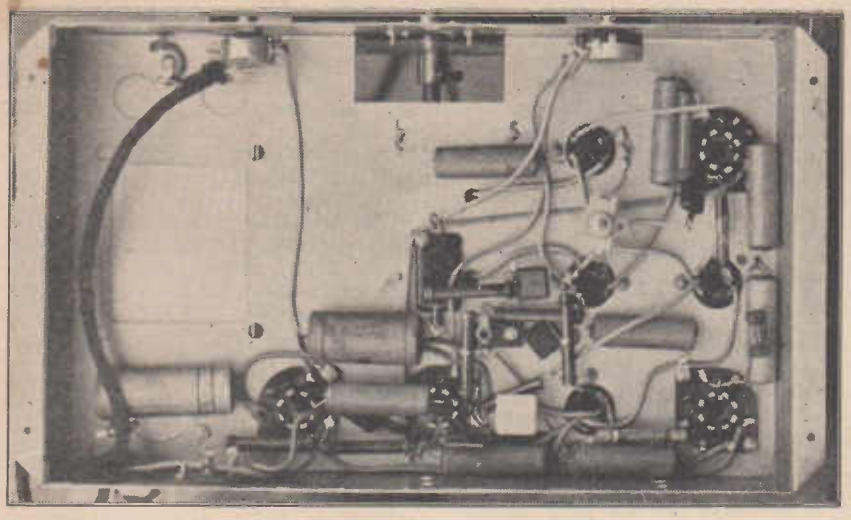
ACCUMULATOR:
1—Six-volt high capacity (Clyde, Vesta).

VIBRATOR:
1—For 6-volt input, 135-volt output (R.C.S., Radiokes).

SUNDRIES:
Valve cans, sockets, screws, wire, nuts, lugs, etc.



Schematic diagram of the circuit for the "VIBRA 4"



A view of the wiring, which also reveals how an a.c. type base is used with the vibrator unit covering the power transformer cut-aways.

the negative side of the filament is maintained four volts positive in respect to earth. Therefore a nice four volts bias is obtained quite automatically. The negative side of the detector valve filament is kept a couple of volts above earth, so that when the grid of the audio portion is returned to earth this valve has been biassed nicely. The converter valve operates without bias. The intermediate valve has its filament on the positive side of the balancing resistor, thereby having its negative side maintained at 2 volts positive in respect to earth. Since the grid of this valve, not taking the a.v.c. action into account, returns to earth through the 1 megohm de-coupler and 1 meg. diode load resistor, it also has a static bias of a couple of volts as required. Of course, as soon as the set goes into practical operation the rectified r.f. on the a.v.c. grid causes current flow in the diode load to increase the bias on this valve and to impose bias on the converter, but that is another tale.

We think it may interest students of radio design to explain this interesting filament network, hence the above somewhat long-winded covering of this point.

We trust that it is not necessary to mention that the circuit as shown is designed only for use with this filament network which provides bias, and to attempt to use it for a straight two-volt receiver would be quite futile without a complete re-arrangement of the bias.

On the other hand, the arrangement brings to light the many advantages of using a six-volt accumulator and this filament arrangement, either with or without a vibrator unit. In other words, Mr. Countryman, it's quite a good plan to figure out whether it wouldn't pay to use a six-volt accumulator with a set using two-volt valves.

Using Indirectly-heated Valves

The easiest type of vibrator set to get into operation uses the indirectly-heated valves as used in all-electric sets. These have complete insulation between the heater and the cathode, so that it is almost impossible to introduce noise through the filament circuit. In a.c. receivers it is possible to use alternating current on the heaters without getting hum trouble. In vibrator sets they make the elimination of noise from the vibrator a simple matter. A vibrator-operated set of this type was the "Club Special" described in the April issue.

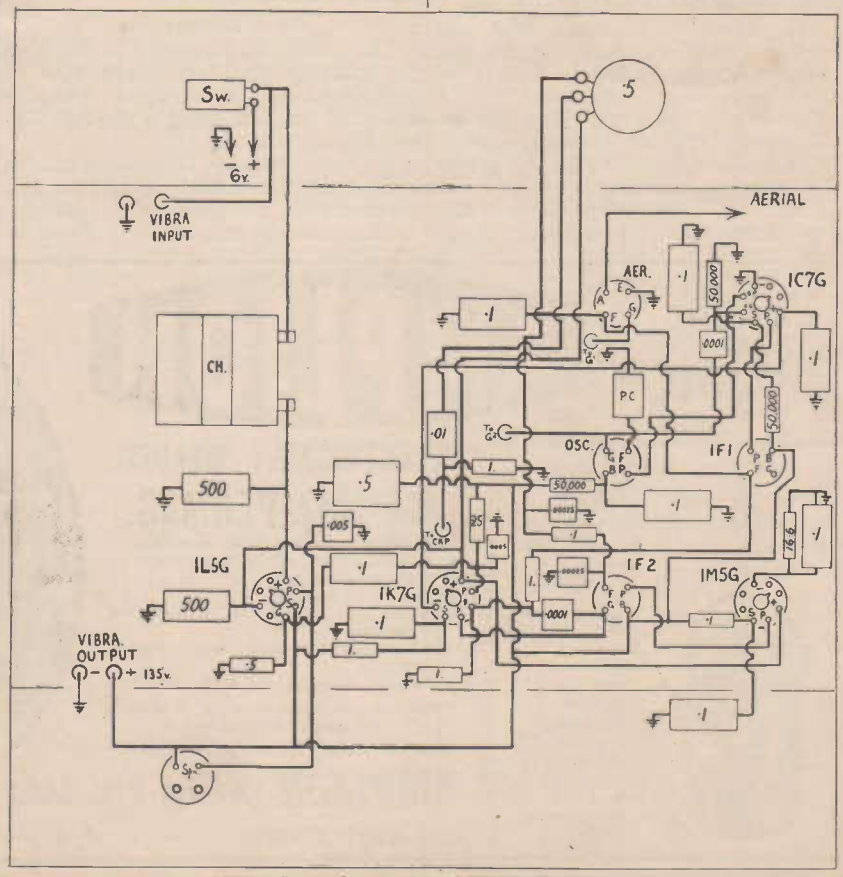
The drawback is the heavy current drain of the heaters, there being considerable loss of efficiency in the conduction of the heat from the heater to the cathode through this insulation which is otherwise so helpful.

With indirectly-heated valves the current drain of a set of this kind, using the types of valves which are at present available, would be at least five times as heavy as with directly-heated valves. Since this saving in filament current is a vital matter with most country people, we use the directly-heated valves and take the necessary precaution of using a filter which will eliminate the hash.

The Filter

The filter in the filament circuit consists of a special choke and two filter condensers.

Owing to the popularity of vibrator-powered receivers, these special components are now readily available at



any good radio store. We had no trouble to get them at first asking.

The choke is designed to give good filtering at the higher audio frequencies and so need not have any great inductance, but must be wound with heavy enough wire to carry the .24 ampere current drain of the filament circuit without appreciable voltage drop. Chokes of this type are readily available.

Vibrator units are also available with this type of filament filter built into them. In the R.C.S. brand there is the ordinary vibrator unit without the filament filter, known as type C75S. With an in-built filament filter of the above type the code number is C74S. In the Radiokes brand the ordinary vibrator is coded RC75S, and the type with the in-built filter is RC74S.

Filter Condensers

The filter condensers are special electrolytics which have been specially developed for work of this kind. They are rated at a capacity of 500 mfds., with a working voltage rating of 12 volts. Condensers of this type are readily available, have been produced and placed on the market for the special purpose of providing ample filtering for filament circuits of vibrator-powered receivers.

Not actually associated with the filtering of the filament circuit, but fitted as by-passes are a couple of ordinary tubular condensers of .1 mfds. It may be found that the set will operate without these by-passes, but they should be fitted in order to give maximum stability.

Whilst on the subject of the filament circuit and the "special" items which are really stock lines, we might mention the filament resistor of 16.6 ohms which is used to balance up the filament network. This resistor appears an odd value to the radioman who is not accustomed to handling vibrator sets, but we found no difficulty in picking one up at the first radio wholesale house where we enquired for it.

Filtering the High Tension

Filtering of the high tension supply from the vibrator is also necessary, but this is carried out in the actual vibrator unit, and so we do not need to deal with it. We assume that the builder of this set is to use a ready-made vibrator unit. Should he, by any chance, want to assemble his own unit, then we would refer him to the full article on the subject of vibrator design which appeared in our May issue, copies of which back number are available from our office at 6d. each, post free.

GANG TRIMMERS

If unable to obtain a gang condenser fitted with trimmers, it is simply a matter of getting separate trimmers and mounting them across the terminals of the gang or coils.

As A Battery Set

The circuit as published is designed for vibrator use, but might also be considered as a straight battery-operated set, but using a six-volt filament accumulator.

In many battery charging stations they make a nominal charge for any accumulator, irrespective of voltage. Under such circumstances it would be a grand proposition to use this circuit. With the filaments arranged in the series-parallel network as shown in our circuit the bias battery is eliminated and the filament current drain is cut down to almost one-third of the normal filament drain for a similar set running from a two-volt accumulator.

This filament current drain is less than a quarter of an ampere, which means that a decent-sized car battery or heavy-duty radio accumulator would give about 400 hours of service between each re-charge. Under certain circumstances this might mean a considerable saving in transportation charges and offer an attraction to those who don't want to be bothered disconnecting the accumulator every week or two.

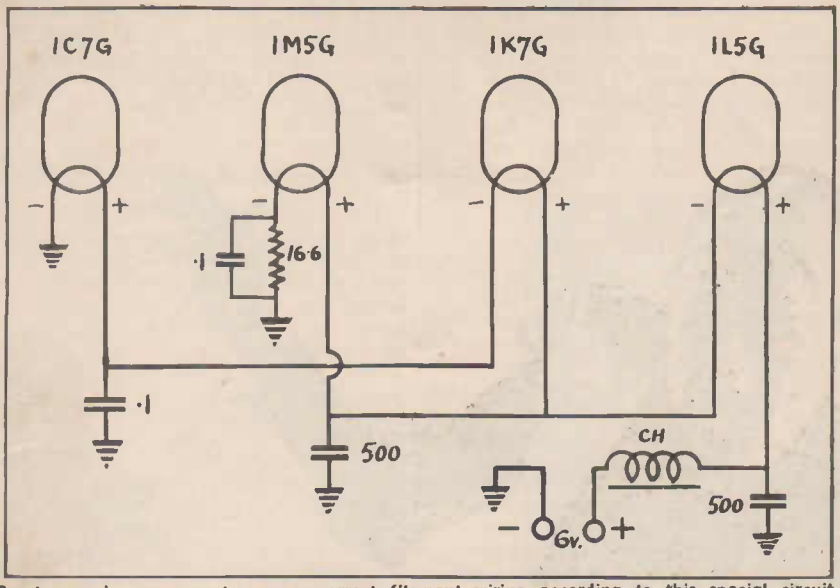
There is no disadvantage to the scheme of using a six-volt accumulator in this way, except, of course, that you have to be careful to wire up the filaments exactly as shown in our special diagram, as otherwise they may be burnt out by excessive voltage accidentally applied.

If the circuit is to be used with batteries and a six-volt accumulator, there will be no need for the filtering in the filament circuit, and the choke can be entirely eliminated.

Instead of the two 500 mfd. condensers, ordinary .1 mfd. tubular condensers can be used. In most cases it will not be necessary to use any condensers, but they can be fitted on a point of good practice and, under certain circumstances, they may prove helpful in giving added stability.

The Components

Only standard components are used throughout, and so there should be



Great care is necessary to ensure correct filament wiring according to this special circuit.

little difficulty in getting a suitable kit of parts together.

As usual, care has to be exercised to see that the coils suit the gang condenser and the dial in turn suits them both.

Unfortunately, there are few dials available with only a broadcast scale, but a dual-wave dial can be used, the short-wave scale being overlooked for the time being.

The oscillator coil should be of the right type to suit a 1C7G converter valve. Most coils designed for ordinary A.C. receivers will work with this valve, but to be on the safe side it is just as well to specify an oscillator coil suitable for use with the battery-operated valve.

The Base

For our base we used a standard base designed for use with four-five valve A.C. operated sets, and then put the vibrator unit over that part of the base designed for the power transformer, electrolytic condensers and rectifier valve. This made quite a neat job and was entirely satisfactory in every way. It might have been a better plan, however, to keep the vibrator unit at two or three feet distance from the actual set, and for those who do not necessarily want a neat job we suggest that the set be built on any ordinary standard four-valve battery base, and the vibrator mounted at a distance.

When selecting the base remember that the set is a broadcast job only and does not use a dual-wave bracket. It is therefore necessary to see that the base is drilled with suitable holes to accommodate the coils.

The Intermediates

When using a 1C7G converter and a 1M5G intermediate valve it is possible to use very high gain intermediate transformers and still maintain stability, especially with a circuit with such careful attention to the minor details and the r.f. by-passing. As a result we are able to recommend the use of two No. 2 intermediate transformers instead of the usual pair of No. 1 and No. 2. The No. 2 intermediates have bigger windings with more turns of wire and less tuning capacity. They may not give the last ounce of selectivity when used in this way, but will give splendid sensitivity. Extreme selectivity is seldom a problem in the average country location.

Construction

Actual assembly and wiring of the set is simple enough and is fully covered by the circuit diagram, picture diagram and the photograph of the underside wiring.

As usual, care should be taken with the effective earthing of the gang condenser framework and all the by-pass condensers.

The aerial lead-in should be kept clear of the audio end of the set and should not run back to the rear of the base through the rest of the wiring. Such an arrangement makes for a feedback circuit which will result in instability long before maximum performance is obtained.

Vibrator Stocks

At the moment fairly sound stocks of vibrators are held by the factories concerned, but we strongly advise those who contemplate building this set to make a point of getting a good vibrator as soon as possible. We would even go so far as to say that a vibrator unit is a sound investment for any person living in the country but having charging facilities handy.

Dual-wavers

At the moment we are not recommending dual-wave receivers with vibrators for home construction.

On short-wave the suppression of the hash from the vibrator becomes something of a problem. Properly tackled by competent engineers in a factory, it is possible to design a filtering system which will give completely satisfactory results with that particular vibrator and that particular receiver design. We do not, however, feel that it is likely that we can design a set which will give completely satisfactory performance on short-waves, built in half-a-dozen different ways and with any one of several different vibrator units.

Of the factory-built vibrator sets we have tested several at one time or another, getting splendid all-round performance on both short-waves and broadcast from Ultimate, Kriesler, Breville and others.

Those who must have a dual-wave receiver are advised to buy one of these commercial receivers rather than attempt to build one with directly-heated valves and a vibrator.

Yes, there's a bridge —

but he won't use it

His progress is impeded by a river over which he can easily cross by the bridge. He doesn't know that it's there. And there are hundreds like him. Hundreds of radio dealers whose Philips valve sales are limited because they do not realise that RADIOSERVICE is the bridge to permanent, profitable radio business.

Established RADIOSERVICE is a bridge to more sources of profit than one: labour profits, spare parts profits — and new Philips valve profits. RADIOSERVICE leads to new set sales. Throughout Australia there are thousands and thousands of sets in need of repair, and the retailer who is prepared to go out after this business and handle it in an ORGANISED way CANNOT FAIL to make big money.

Philips will help you put your service section on the map. Write your nearest Philips office to-day for details of the RADIOSERVICE campaign.

PHILIPS VALVES

HOW TO BUILD
A Five-Band Modulated Oscillator

Ideal for the radio dealer is the latest "University" oscillator kit which is offered by Radio Equipment Pty. Ltd., of Broadway.

●

JUST as the introduction of superheterodyne receivers made the oscillator an essential part of the equipment a serviceman must carry, so the introduction of wider band coverages in modern receivers necessitates that the oscillator used should keep in step with the receivers.

Frequently modern radio receivers have as many as five bands covering the short-wave and broadcast, and, consequently, the oscillator, to be of maximum use to the serviceman, must also cover these bands. The following is a description of how an oscillator having a five-band coverage can be built from a kit of parts.

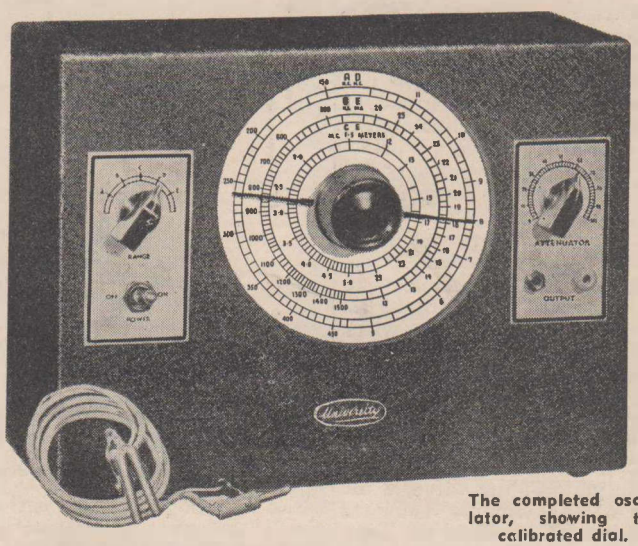
The total band coverages of the oscillator is from 144 k.c. to 26.0 megacycles. This is covered in the total of five bands, the first one ranging between 144 k.c. to 480 k.c., the second one from 470 k.c. to 1,540 k.c., the third one from 1,500 k.c. to 5,200 k.c., the fourth one from 5,000 k.c. to 12,000 k.c., or 5 to 11.7 megacycles, and the fifth one from 11.2 to 26 megacycles. These frequencies are directly calibrated on the dial, so that it is only necessary to turn the pointer to the correct dial setting to obtain any frequency within the total coverage of the oscillator. The entire unit is housed in a solid steel box finished with an attractive black brocade surface and having indicator plates for each control. In addition to the shielding provided by the steel case, the coils are individually shielded.

Assembly

When you receive the kit of parts you will find that most of the assembly has been completed, and it only remains to place on the gang, valve socket, the modulation choke and the battery bracket. The other components, such as the coil unit, on-off switch, the attenuator and output jacks are already assembled on the front panel.

The first part in the assembly will then be the assembly of the condenser. Before this is done, the four insulated mounting pieces and the insulated shaft extension should be assembled on to the condenser. The mounting pieces are already drilled and tapped with 5/32 holes, and should be screwed on to the gang with four of the 5/32 bolts supplied. The gang may then be placed in its correct position in the middle of the chassis, and the remaining 5/32 bolts used to fasten the mounting pillars on to the chassis. In this way the gang is held very firmly in its correct position.

The valve socket may now be assembled, and, before assembling the modulation choke, it is necessary to put in the bolt for mounting the battery bracket underneath the chassis. It is difficult to get to this bolt if the choke is placed on before it is put in position. With the placing in position of the modulation choke, the assembly of the oscillator is complete.



The completed oscillator, showing the calibrated dial.

Wiring

The circuit of an oscillator is essentially simple, the only difficult part being the coils, and to avoid trouble in this respect the coils are already assembled and wired on to the selector switch. It is only necessary to bring wires from the switch to the various required connections. These wires are colour coded and the connections are shown in the accompanying circuit diagram. The leads from the coil unit should be as short as possible and made in such a manner that there is very little likelihood of them bending or twisting out of their position. The important leads — the leads to the gang — are kept well away from other components so that there is little danger of a change in calibrations. Following the coil connections, the various leads to batteries, etc., should be connected. Then the necessary components should be wired to a valve socket underneath the chassis. The pigtails of all resistors should be kept as short as possible, and here again they should be placed in such a position that they are not readily bent to cause drift in calibrations. The wiring of the attenuator circuit is one of the most critical points in the oscillator, as any excessive length of wire will tend to nullify the effect of the control. In the assembly you will notice that the output jacks are situated immediately beneath the potentiometer, and the wires between these parts should be as short as they can possibly be made. The

(Continued on next page)

TECHNICIANS

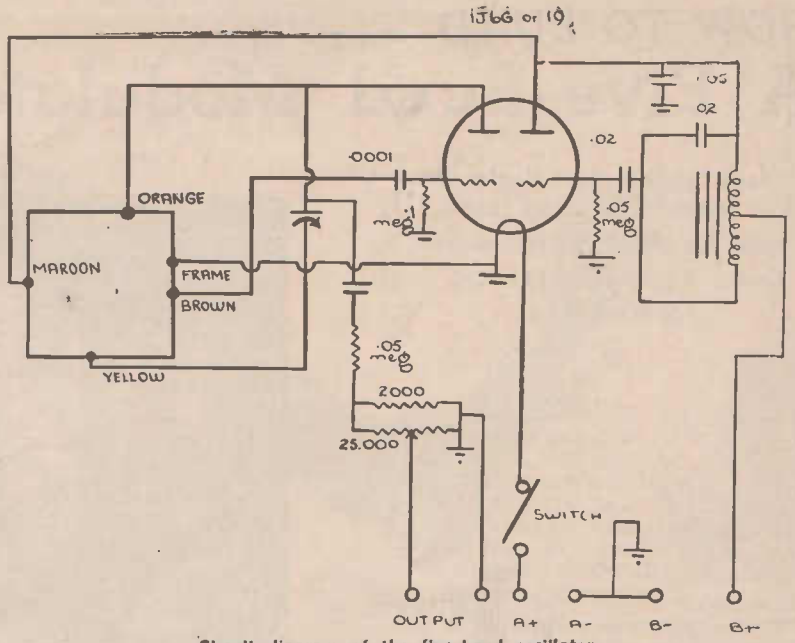
●

Promised for next month's issue is a feature technical article from C. Parry which covers 800 experiments with push-pull. The article, one of the finest of its kind ever written, is sensational in the way it de-bunks accepted theory with its practical proofs.

—A.G.H.

FIVE-BAND OSCILLATOR
(Continued)

pigtails of the resistor should be cut as short as possible and soldered directly to their connections. Another important lead is the one connecting to the grid of the oscillator section of the tube. This lead runs underneath the chassis, and should be kept as far away from the metal or the other leads as possible without extending the length of the lead to too great an amount. The lead should be stretched to prevent it bending once in place. The circuit diagram shows clearly the connections of the various components. The small trimming condenser should be soldered directly across the gang, the screw end being connected to the frame while the other end connects to the stator plates. To connect the modulation choke, the three wires should be insulated with spaghetti and soldered to the three-lug bakelite strip which is assembled on the front bolt holding the choke. The lead from the inside of the winding, that is the one nearest the core, should be connected to the plate of the valve, while the outside of the winding connects through the .02 condenser to the grid. The centre tap is the "B" plus connection, and the lead from the battery may be terminated on the lug connecting to the centre of the winding. After having been wired, the circuit should be thoroughly checked particularly that part of the circuit relating to the filament connections of the valve. When everything has been found to be perfectly correct, the batteries may be placed in position underneath the battery bracket and connections made to these batteries. The corrugated cardboard supplied should be placed between the batteries and the chassis. The oscillator is now ready for operation.

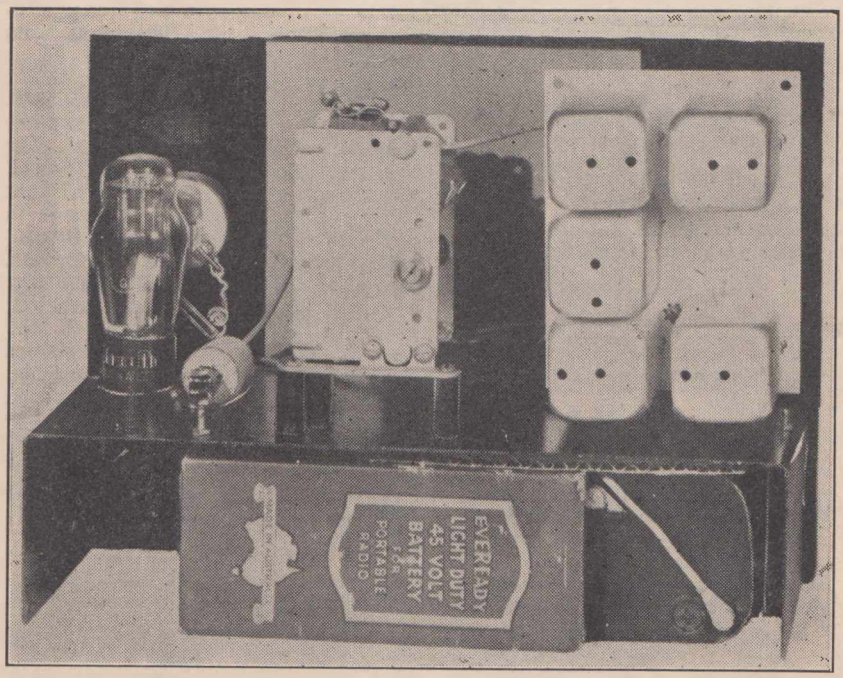


Circuit diagram of the five-band oscillator.

To adjust the dial so that it gives the correct frequencies for the various settings, it is necessary to set the needle correctly at a low frequency station, while the trimmer, by compensating for variations in wiring, etc., allows the needle to be adjusted correctly at the high frequency end.

The correct procedure is to obtain a receiver which is capable of receiving certain stations on the broadcast band, connect the output leads of the oscillator to the aerial and earth terminals, respectively, and tune the set to a station at the low frequency end, approximately 600 k.c. In New South Wales 2FC will be suitable. The oscillator should now be switched to the broadcast range, that is, range "C," and the dial turned, starting at the low frequency end until a beat is noticed in the receiver. With the oscillator turned to zero beat, the needle should be adjusted until it reads the same frequency as the station being received by the set. In the case of 2FC, this frequency will be 610 k.c., and when the beat is obtained the needle should be moved until it points exactly to 610 k.c. on the calibrated dial.

After having adjusted correctly at the low frequency end, the receiver can be tuned to a station operating at a frequency of approximately 1400 k.c., and the oscillator gang turned until a beat is found at this frequency also. Should the dial needle not point to exactly the same frequency as the station, the trimming condenser should be adjusted until the two coincide exactly. When this setting is reached, the oscillator will be correct for all remaining bands. It is advisable to start these operations with the trimmer at approximately its lowest capacity, that is, with the plate all the way out.



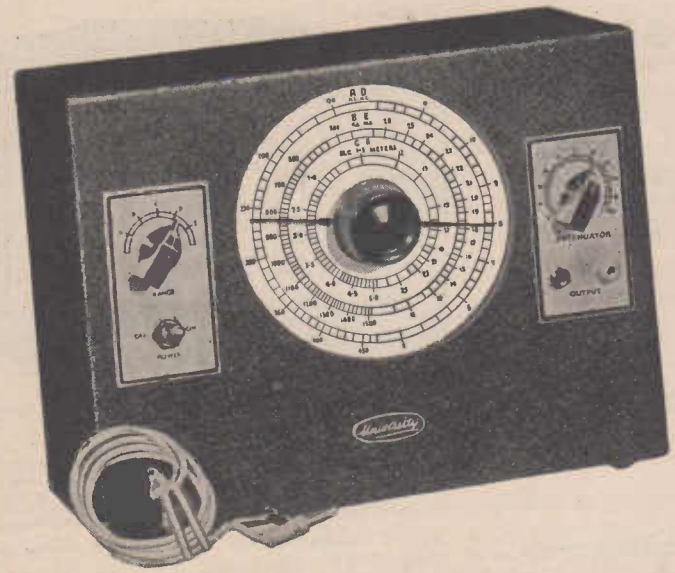
A rear view, showing the arrangement of the batteries.

ACHIEVEMENT!

The VERY LATEST in OSCILLATORS YOU CAN BUILD YOURSELF

Just Released . . .

"UNIVERSITY"



Available either ready built or in kit form, the range is from 144 k.c. to 26 megacycles in five bands. You will find them fully described elsewhere in this issue. Full building instructions supplied with all kits of parts.

PRICES :

SOB Battery Kit of Ports	£7	15	0
SOB Battery, Built and Calibrated	£8	8	0

Plus Sales Tax. Freight extra. Terms available.

Entirely new!

The UNIVERSITY VOLTOHMETER

A remarkably new, small-size set checker. You can build it yourself.

Note the ranges:—

Voltage: 0-10, 0-50, 0-250, 0-1,000. Ohms: 0-500, 0-50,000. Special zero adjustment for accuracy on ohms scale. Meter, 1,000 ohms per volt. There's quality, grace and accuracy, together with economy, in this sensational new checker.

PRICES:
Kit of parts
£3/15/—
plus tax
Wired and tested
£4/2/6
plus tax

ALL SERVICEMEN'S AND SETBUILDERS' REQUIREMENTS

Being radio engineers and warehousemen, we specialise in your requirements. We stock all radio replacement parts, including Calstan and Palec test gear, "University" portables, test equipment, radio kits, amplifiers, etc. Before deciding on your next kit get the Radio Equipment price first.

RADIO EQUIPMENT PTY. LTD.

E.S. & A. BANK BUILDING, BROADWAY, N.S.W. 'Phones: M 6391 - M 6392. Telegrams: RAQUIP, SYDNEY

Dear Sirs,—Please send me full details of the University Oscillators and Voltohmeter. At the same time please quote me for.....

NAME .....

ADDRESS .....

RADIOKES

The Name to Know in Radio!

the COIL KIT for the "VIBRA 4"

Once again Radiokes steps to the fore with a perfectly-matched Kit for the "Vibro4"— featuring speciolly-designed and constructed Rodiokes Trolitul Coils. You can't do better than specify Radiokes Coil Kit, CK1039 £1/10/6

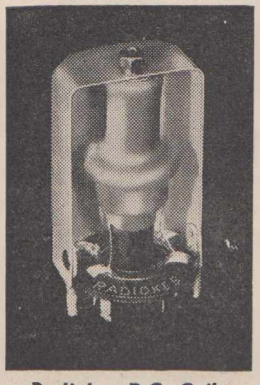
Rodiokes DWD-5 Diol £1/2/6

Rodiokes RC74S Vibrator £6/6/-

RADIOKES BROADCAST COILS

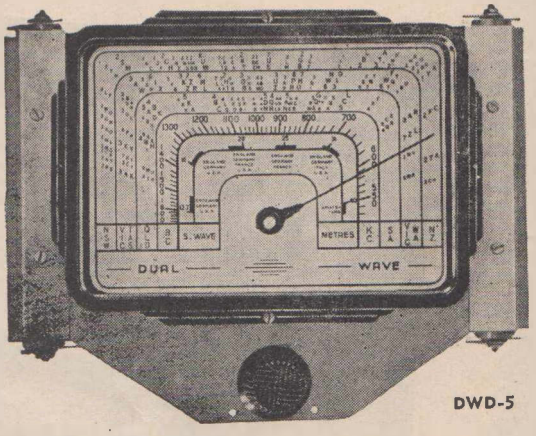
Trolitul rigid construction, available in air core and permeability types.

Type ACB, Aer., R.F. or Osc. List Price 6/6



Radiokes B.C. Coil

RADIOKES "H" TYPE COILS WILL TRACK WITH RADIOKES "H" TYPE DIALS ONLY



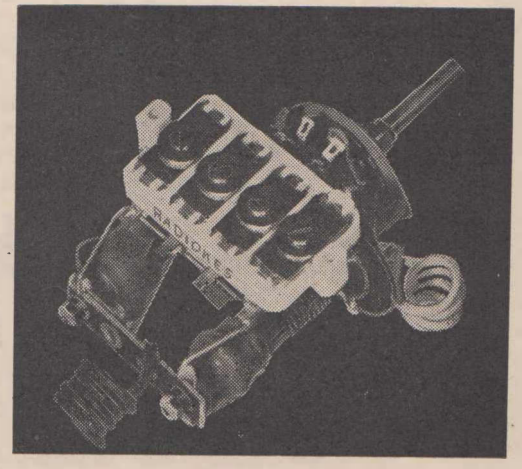
DWD-5

Radiokes Dials, DWD-1, DWD-2, DWD-5, are all edge-lit and wedge-driven, and dial apertures required are 7" x 4-7/8.'

DWD-1 Standard D.W. Dial, "F" type condenser 22/6

DWD-2 Communications Dial "H" type condenser 22/6

DWD-5 13.7 to 40 metres D.W. Dial, "H" condenser 22/6



RADIOKES D.W. UNIT

Highly-selective unit with exceptionolly wide ronge. To motch "H" type gong condenser. Incorporoting 4-in-1 podder. Solidly mounted with coils.

Type DWU-1 — List Price 27/6

RADIOKES PTY. LTD. P.O. Box 90, Broadway, Sydney, N.S.W.

Rodiokes can give you delivery from stock of ony of the following Precision Products—

Audio Transformers	**I.F. Transformers**	**Terminals**
Audio Chokes	**Line Filters**	**Trimmers**
Bakelite Stampings	**Laminations**	**Volume Controls**
Coils of all types	**Midget Condensers**	**"Trolitul" Mouldings**
Coil Units	**Power Chokes**	**Formers, etc.**
Dials	**Solder Lugs**	

If you hove difficulty in obtaining immediate delivery of any Radiokes Products, let us have your name and address. We can arrange supplies. Our new Radiokes leaflet is available post free.

NAME .....

ADDRESS .....R.W., July

THIRTEEN-WATT AMPLIFIER

LATEST RADIOTRON DESIGN GIVES SUPERLATIVE PERFORMANCE

THE maximum power output obtainable from two 6V6-G valves in Class A1, with plate and screen voltages of 250 volts, is 9 watts. If the plate voltage is increased to the maximum rating of 315 volts, it is necessary to decrease the screen voltage to 225 volts in order to prevent the dissipation limits from being exceeded. The power output with Class A_1 operation under these conditions is 11 watts, which is the highest possible power output with Class A_1 operation.

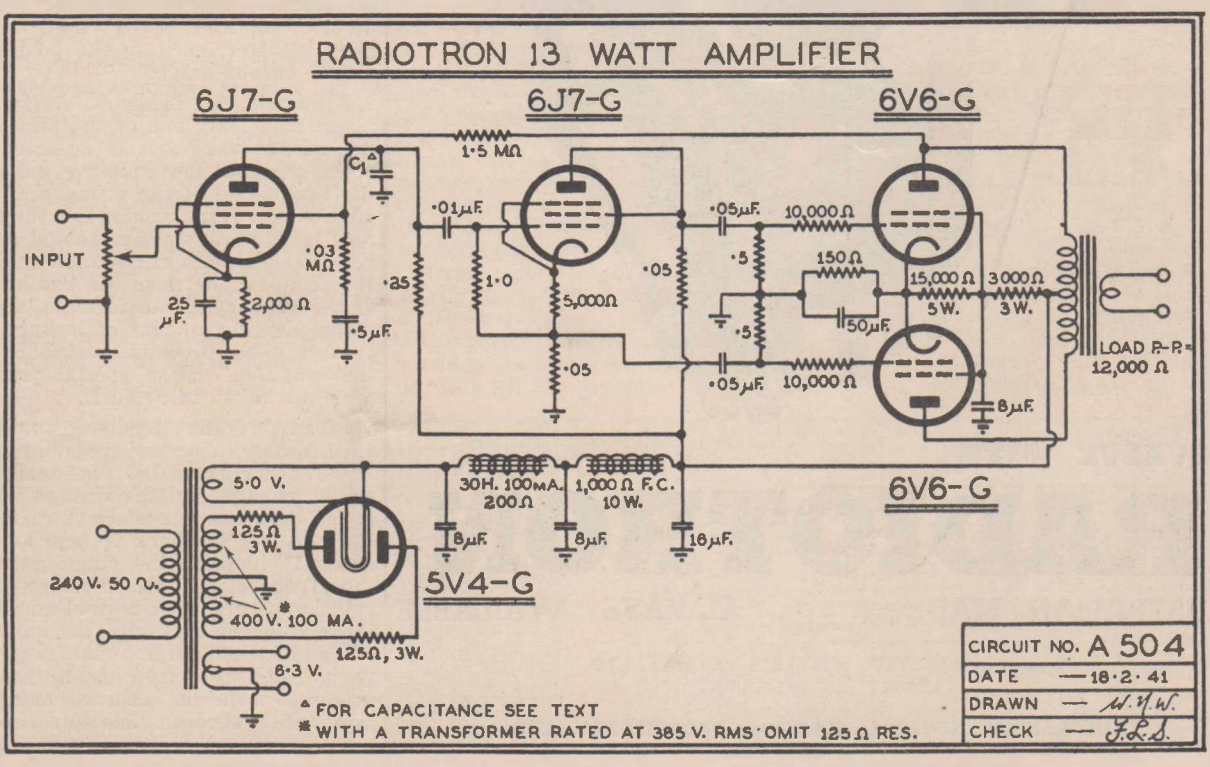
If still higher power output is required it is necessary to adopt Class AB_1 operation, under which conditions the screen voltage may be increased to 250 volts. A power output of 13 watts is obtainable with plate and screen voltages of 315 and 250, respectively, a load resistance of 12,000 ohms plate to plate and cathode bias. The harmonic distortion may be reduced to exceedingly low proportions by means of an efficient negative feedback circuit, and at the same time the output resistance may be reduced so that the damping factor is better than that for a pair of 2A3 valves.

With any Class AB_1 amplifier the plate and screen currents at full output tend to rise above those at zero signal. In extreme cases this may introduce complications in the power supply, since very good regulation is required. The rise of plate current at maximum signal can be avoided by the choice of a suitable plate-to-plate load resistance and as this resistance is increased the plate current at maximum signal may even be made less than that at zero signal. The screen current, however, will rise from its value at no signal to a higher current at maximum signal. In order to avoid having to use a power supply having good regulation a special arrangement has been adopted in this amplifier so that the current drain is practically constant; in fact, the total supply current at maximum signal is slightly lower than that at zero signal. This fact has been brought about by the use of a suitably designed screen voltage divider, which is returned to the cathodes of the 6V6-G valves instead of to earth.

Designed by the engineers of the Radiotron factory, and originally published in "Radiotronics," this amplifier circuit has been thoroughly tested in our own laboratory and we can vouch for its splendid performance.

The screen voltage divider is made up of two separate resistors, a dropping resistor of 3000 ohms from the supply to the screens and a bleed resistor from the screens to the cathodes. This additional current flowing through the cathode bias resistor has the effect of maintaining the grid bias at a fairly constant value, so that satisfactory class AB_1 operation is possible.

The power supply is thus required to deliver a practically steady current of from 100.5 mA at no signal to 98 mA at maximum signal, at a voltage of 330 volts. The arrangement shown in the circuit diagram uses a typical 400-0-400 volt transformer with a 5V4-G rectifier having a resistor of 125 ohms resistance connected in



Circuit of the Radiotron amplifier design, showing the inverse-feedback arrangements.

13-WATT AMPLIFIER

(Continued)

series with each plate. This has the advantage that the life of the rectifier valve is prolonged since it is not subjected to such onerous conditions during the warming-up period each time the set is switched on. The rectifier valve is also less likely to arc over with a heavy surge, and is less likely to be damaged in the case of failure of a filter condenser.

An alternative arangement is to use a typical 385-0-385 volt transformer without any additional resistors, while a still further combination is a 375-0-375 transformer of low impedance, also without additional resistors. All these arrangements will be found to give very nearly the same output voltage. If allowance is to be made for supplying plate power to a radio tuner, it is suggested that the transformer be rated at 425-0-425 volts 150 mA and that a resistor of 125 ohms resistance be connected in series with each plate. The choke would require to be one rated at 150 mA, while the field rating would be 750 ohms at 13 watts.

The Circuit

The first stage is Radiotron 6J7-G as a high gain pentode with the negative feedback network connected to the screen. The second stage is another Radiotron 6J7-G, used as a phase splitter, exciting the push-pull 6V6-G output stage.

Although the feedback voltage is taken from only one of the plates of the output valves, it is effective on both, through the coupling between the two halves of the primary of the loudspeaker transformer. For the best results this transformer should be of good design, with the maximum possible coupling between the two halves of the primary. Transformers having a considerable amount of leakage reactance tend to cause instability in the amplifier unless special precautions are taken to avoid it.

In any negative feedback amplifier with feedback over one stage, a phase-angle other than 180° between the signal voltage and the voltage which is fed back has the effect of reducing the effective feedback voltage and so tends to increase the stage gain at the frequencies at which phase-angle rotation occurs. In a normal amplifier these frequencies are in the extreme low and extreme high audio frequency region, and therefore usually suffer attenuation in the absence of feedback. If it were possible to construct a feedback amplifier free from phase-angle rotation in the feedback network,† the effect of negative voltage

feedback would be to give more nearly constant output voltage over the whole audio frequency range. If, however, phase-angle rotation occurs in the feedback network at low and high audio frequencies, the output voltage at these frequencies may be greater than that at the middle frequencies. In no case, however, can the gain at any frequency be higher than the gain at that frequency without feedback.

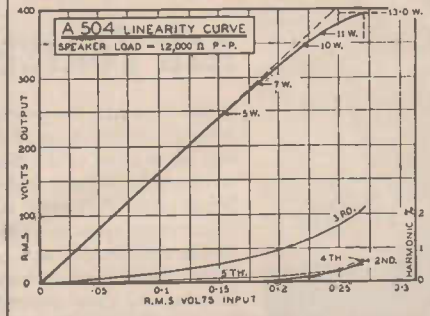
In a negative feedback amplifier with feedback over more than one stage, there tends to be a similar rise of output voltage at the extreme limits of audio frequency response as the result of phase-angle rotation, but in such a case the rise is no longer limited to the point at which the gain is equal to that without feedback. A poorly designed amplifier having feedback over three stages may actually be unstable since the feedback may be positive at very low or (more usually) very high audio frequencies.

The principle which has been adopted in the design of Radiotron Amplifier A504, is to reduce to a practicable minimum all phase-angle rotation both in the amplifier itself and in the feedback network and then to introduce, at a single point, attenuation of sufficient magnitude to prevent any rise of response over the whole audio frequency range. This attenuation cannot itself result in phase rotation as great as 90,° and the risk of instability is thereby reduced.

In order to investigate the effects of the phase angle rotation, it is necessary to take curves of output against frequency up to frequencies of 30,000 c/s. or higher. Tests on amplifier A504 have been carried up to frequencies of 50,000 c/s. with two output transformers, the first being a typical loudspeaker transformer with the secondary connected to the voice coil of a loudspeaker, the second being a transformer of good design with a constant resistive load.

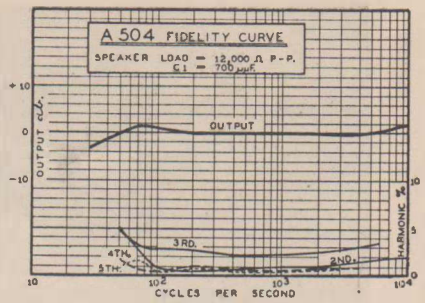
Loudspeaker Load

The curves of output versus frequency with the typical transformer and speaker loading are given in Fig. 2 and separate curves are shown for selected values of capacitance (C_1) shunting the plate of the first 6J7-G valve. When this capacitance (C_1) is zero, there is a rise in output of about 10db at 25,000 c/s., and as the capacitance is increased so the magnitude of the rise is decreased until in the most extreme case, with a capacitance of 1000 mF., no peak whatever is found. It was decided to adopt a capacitance (C_1) of 700 mF. for this amplifier - transformer - speaker combination so as to give a rise of just over 1.5 db at 10,000 c/s. In this case the curve cuts the zero line at 14,500 c/s. and reaches the level of –2 .db at slightly over 17,000 c/s. This slight rise in the 10,000 c/s region may be of some advantage in lifting the top end of the audible frequency response. It would be quite optional to adopt a higher capacitance if an extended high frequency range is not required.



The linearity of the amplifier is also excellent, as shown by this graph.

These results apply only to the particular transformer and loudspeaker which were used. With any other transformer-speaker combination, it would be necessary to adjust the value of C_1 until the response is approximately level or slightly falling at a frequency of 10,000 c/s. In some cases, a capacitance of 100 mF. will be sufficient, while in other cases a higher capacitance is desirable. This is a test which can easily be carried out with the aid of a beat frequency oscillator and output voltmeter. In all cases, it is desirable for the adjustment to be made to suit the conditions rather than to accept any particular value of C_1 which, although suitable under other conditions, may be totally unsuitable for the actual conditions of operation.

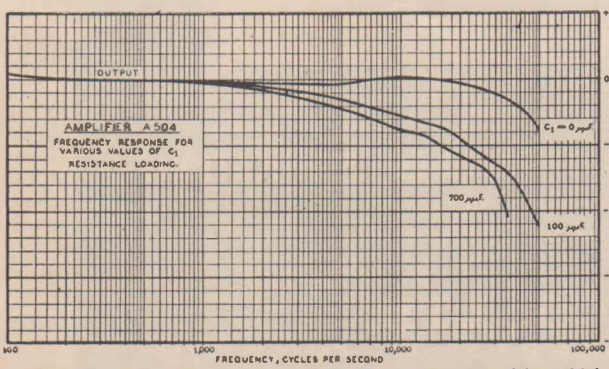


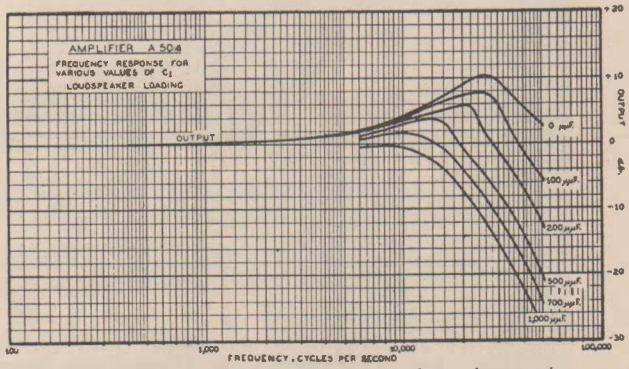
Fidelity curve of the amplifier which is practically flat.

Resistive Load

On a resistive load with a good quality transformer the position is different. The load resistance remains constant and there is no rise of impedance in the high audio frequency region, as with a speaker load, and any capacitance shunted from the plate of the 6J7-G to earth tends to decrease the high frequency response below zero level. With a good transformer and resistive load there is no necessity for this condenser, which should, therefore, be omitted. Under these conditions the response curve will be as shown in Fig. 3 and curve marked $C_1 = 0$. When this capacitance is increased to the values of 100 and 700 mF. the response will be as shown by the corresponding curves. It will be seen that the curve for $C_1 = 0$ has a peak reaching slightly over 0 db at a frequency of about

†It is assumed that no phase-angle rotation occurs in the amplifier, since this is only of one stage.





At left, curves showing the effect of the various capacities which can be used for condenser C1. At right, a graph to show various responses available by the variation of this capacity.

Ask Yourself WHY!

Within the past five years Eimac Tubes have moved into first place. Today they are in the sockets of some of the most important radio transmitters in the world. What is the reason behind this? Perhaps it is because of the extraordinary economies they bring about in day-in and day-out operation. Perhaps it is their unusual performance capabilities, their stamina and great dependability . . . or perhaps it is because Eimac tubes never fail prematurely because of gas released internally (they're guaranteed against such failures, the only tube on the market that carries such a guarantee). Chances are though, you'll find it is not any one but all these points combined that has won this recognition . . . anyway you find it, the fact remains that . . .

In the Field of Electronics, the overwhelming trend is to

Eimac TUBES

Eitel-McCullough, Inc. · San Bruno, California

FOLLOW THE LEADERS IN THE FIELD OF RADIO COMMUNICATIONS

There's an Eimac tube to fit your needs from 35 watts to 2000 watts plate dissipation . . . *Get full information now!*

Foreign Division

FRAZAR & CO., LTD.

301 CLAY STREET, SAN FRANCISCO, CALIFORNIA, U. S. A. CABLE "FRAZAR"

13-WATT AMPLIFIER

(Continued)

10,000 c/s., this peak indicating some degree of phase-angle rotation but not sufficient to cause any bad effects.

In no case was any appreciable rise noticed at the low frequency end of the audible range and it is likely that the attenuation is sufficient to reduce such an effect to negligible proportions.

These curves probably hold for other similar amplifiers previously described in Radiotronics, and in any case the principles are the same.

Effect of Transformer Inductance

In this amplifier, irrespective of the negative feedback circuit, a plate-to-plate load of 12,000 ohms is necessary. This loading is obtainable with typical loudspeaker transformers and is quite satisfactory under normal conditions. If, however, it is desired to extend the low frequency range it will be found that there is difficulty in obtaining sufficient inductance on the transformer primary. The effect of this is to reduce the output voltage at frequencies below 50 c/s., or alternatively, the distortion will be high if the amplifier is pushed to full output at these frequencies. This is a disadvantage which is fairly general with with small push-pull pentodes and beam power amplifier valves and therefore limits their usefulness to applications in which the low frequency response does not require to be exceptionally good. Push-pull triodes or large beam power amplifier valves are more satisfactory in this respect since the plate-to-plate load is considerably less and the transformer inductance need not be so high. A plate-to-plate load resistance of 6,000 or 7,000 ohms is the highest for which a transformer can readily be constructed to give really good low frequency response, combined with reasonable size and good high frequency response.

Linearity

The linearity curve is shown in Fig. 4, from which it will be seen that the linearity is extremely good up to an output of 5 watts and is very close to the ideal up to an output of 11 watts the curves deviates somewhat watts. Above 11 watts and up to 13 markedly from the ideal line, although no more than for similar amplifiers approaching maximum output.

The second and fourth harmonics are shown to decrease to zero at half the output power, while the third and fifth harmonics decrease according to a power law, only reaching pero at zero output. At an output of 7 watts, the total harmonic distortion is less than 1%.

Fidelity With Loudspeaker Load

The fidelity curves of amplifier A504 on a loud-speaker load are shown in Fig. 5. The output voltage, measured at the primary of the speaker transformer with a value $C_1 = 700$ mF, is –3.2 db at 30 c/s., –2 db. at 37 c/s., and level within ± 2 db from 37 c/s. to 17,000 c/s. The harmonic distortion is mainly third harmonic over the whole range and this is below 3% from 75 to 4,000 c/s. The second harmonic is negligibly small at all frequencies above 100 c/s. but rises sharply to 5% at 50 c/s. This rise is due to selective harmonic distortion at a frequency approaching half the bass resonant frequency. The fifth harmonic is 1% over the whole audio frequency range.

Fidelity With Resistive Load

The fidelity curves of amplifier A504 with a constant resistive load are shown on Fig. 6. The capacitance C_1 was taken as zero for these curves. It will be seen that the response is –3 db at 30 c/s., –2 db at 37 c/s. and constant within +1 and –2 db from 30 c/s. to 29,000 c/s.

The harmonic distortion, as for the loudspeaker load, is mainly third harmonic, which is less than 3% from 55 c/s. to 6,000 c/s. The rise of third and fifth harmonics below 60 c/s. is believed to be due to the output transformer employed in the test. The fourth harmonic is approximately 1% over the whole audio frequency range. The fifth harmonic is below 1% for all frequencies above 90 c/s., but rises with the third harmonic at lower frequencies. The second harmonic is negligible over the whole audio frequency range.

SUMMARY OF TEST RESULTS

	No Load	Full Load
1. Power Stage and Power Supply:		
Plate current†	76.5	70.0 mA
Screen current†	4.9	10.5 mA
Current through screen dropping resistor†	21.5	26.5 mA
Current through screen bleed resistor†	16.6	16.0 mA
Current through filter choke	100.5	98.0 mA
Voltage plate to cathode†	314.5	321 volts
Voltage screen to cathode†	249.5	242 volts
Grid voltage†	*15.6	*15.0 volts
Supply voltage at input to filter choke	450.5	453.5 volts
Supply voltage at input to speaker field	430	434 volts
Plate dissipation	24.0	— watts
Screen dissipation†	—	2.75 watts
2. Overall:		.38 volt peak
Input voltage for 13W. output		.27 volt RMS.
Overall voltage gain**		1600
Negative feedback —		
Gain reduction factor		3.5
Gain reduction		–10.9 db
Feedback factor		–.134
Voltage gain in 6V6-G stage		18.66
Output resistance (Ro) —		
Plate to plate		1960 ohms
One valve		980 ohms
Damping factor ((RL/Ro)		6.13
Maximum power output (400 c/s) —		
For 2.5% total harmonics		13 watts
For 10% total harmonics		15.3 watts
For unlimited distortion		21 watts
Harmonic distortion at full output (13 watts), 400 c/s. —		
Second harmonics		0.6%
Third harmonic		2.2%
Fourth harmonic		0.65%
Fifth harmonic		0.5%
Total harmonic distortion for output of 13 watts without negative feedback		2.45%
Hum (reference level 13 watts)		–70 db

† For both 6V6-G valves.

* The measured value of the cathode resistor as used is 155 ohms.

** Output voltage (plate-to-plate) divided by input voltage to first stage, at low input voltages.

Conditions Affecting Short-Wave Reception

AN AUTHORITATIVE ARTICLE FROM THE ENGINEERS OF THE B.B.C.

WHETHER or not a listener in any part of the world gets good reception of the B.B.C. short-wave programme is dependent upon conditions prevailing in the ionosphere and upon the solar cycle. An explanation of this, in language, which can be understood by the ordinary listener, is given in this article, specially prepared by the B.B.C.'s Engineering Division.

The frequencies used for short-wave broadcasting have to be chosen with strict regard to the conditions prevailing in the inosphere over the particular route on which they are to be used. It is in the ionosphere — mainly in that part of it which lies about 180 miles above the earth and which is known as the F layer — that the waves are refracted or "bent round," so that they return to earth again at a distant point. And the behaviour of the wave in the ionosphere will depend upon the conditions existing there at the time, as well as upon the frequency used.

Briefly, it may be said that if the frequency is too high to suit the prevailing ionosphere conditions, the wave will pass clean through the ionised layers, and will not be bent back to earth at all. On the other hand, if the frequency used is too low, the loss of energy in the layers will be so high that a good signal will reach the receiving end of the circuit only if enormous power is used at the transmitting end.

Hence it is most important that the frequency used be such that the wave will be properly dealt with by the ionised layers, i.e., that it will be well refracted and returned to earth with the minimum loss of energy in the layers. The frequency which is best suited to the prevailing ionosphere conditions is called the "optimum" frequency.

Conditions in the ionosphere are, however, in a constantly changing state. At any one moment they are different for different latitudes, while at any one point above the world's surface they are subject to three changes of a periodic nature. These are, firstly, a change in conditions from day to night; secondly, a change from season to season; and, thirdly, a change which takes place over a relatively long period of time.

The reason for these changes is that the condition of ionisation — or electrification — of the air in the layers is brought about by the action of the sun. The layers are, in fact, produced mainly by the sun's radiation of ultra violet light. Hence, conditions prevailing at any particular point in the ionosphere will depend, in the main, upon the position of that point relative to the sun, and also upon the state of activity of the sun.

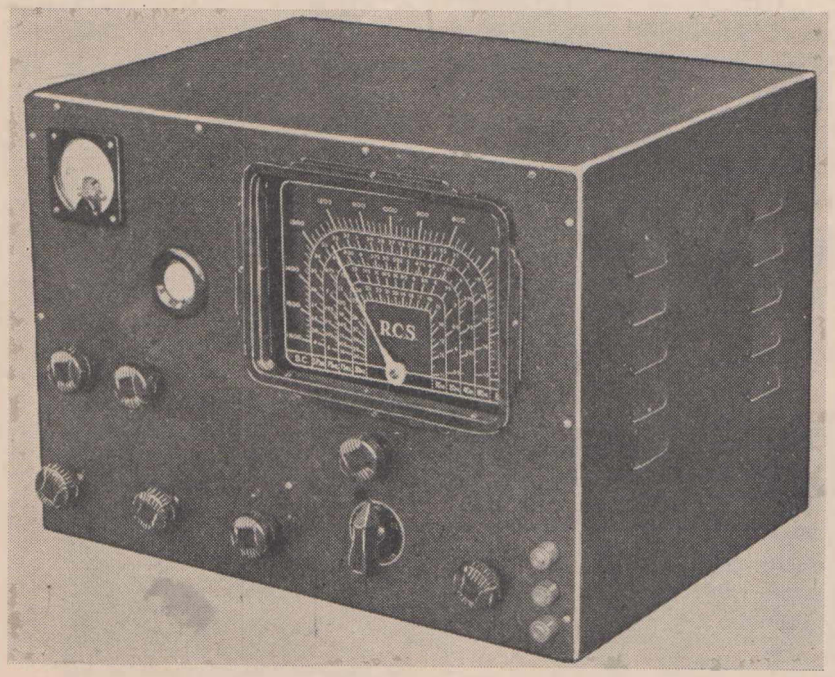
It is because of these changes that the frequencies used by a short-wave broadcasting station have to be changed from time to time. Over a long transmission path, where the wave must pass from earth to ionosphere and back again several times, as it were in a series of "hops," the "optimum" frequency will really be the frequency which best suits ionosphere conditions at a number of widely separated points. This must necessarily be something of a compromise, as it is rare that conditions at any two consecutive "hops" are the same.

Daily and Seasonal Changes

As far as the daily changes in ionosphere conditions are concerned, they are such as to render necessary the use of low frequencies during the night and relatively high frequencies during the day.

In summer the degree of change as between day and night is much less than in winter, the consequently the difference between daylight and darkness frequencies is least during the summer. Nevertheless, it is still necessary to use lower frequencies during the night than during the day. The highest frequencies which are usable during the summer become most suitable just before sunset. During last summer the highest frequency suitable for long distance working — by normal methods — in Lat. 50 degrees N. was about 22 Mc/s just before sunset, and about 12 Mc/s, just before sunrise — when the ionisation of the layers is at its lowest.

It is in winter that the change of conditions as between day and night is greatest, and, as a result, the working frequencies for winter nights are lower than at any other time of the year, while the winter daytime frequencies are higher. The highest usable frequencies in winter become most suitable about noon. During November the highest frequency suitable for long distance working in Lat. 50 degrees N. was about 32 Mc/s at noon, and about 9 Mc/s just before sunrise. In December the night-time



To obtain best short-wave results it is desirable to be able to switch from one wave-band to another quickly, as with the "American-style Communications" receiver which was described in our August, 1940, issue. It had band-switching for five bands.

working frequencies were even lower than in November — about 6 Mc/s.

Summarising the daily and seasonal change in working frequencies, we have a change from high to low frequencies from day to night, a change from low to still lower frequencies from summer night to winter night, and a change from high to still higher frequencies from summer day to winter day.

The Solar Cycle

In addition to the above changes — which are brought about by the varying position of the sun with regard to any particular point in the ionosphere — there is a further change in conditions brought about by a variation of activity within the sun itself. This is such that periods of maximum activity are reached about every eleven years, with periods of minimum activity about half-way between the maxima. The rise and fall in activity is not quite regular, though it is possible to estimate the degree of activity which will exist some time ahead with a fair amount of accuracy. The degree of solar activity is evidenced by the number of sunspots which appear on the sun's surface, and also by the size of the areas of flocculi, or clouds of gases, which can be observed around the sun.

The point is that the amount of ionising radiation emitted by the sun varies according to its general degree of activity, and therefore it decreases considerably from the maximum to the minimum period of activity in the eleven year cycle. It is this radiation which produces the layers of the ionosphere, and so the amount of ionisation existing in the layers rises and falls in sympathy with the eleven-year solar cycle. During the year 1937 a period of maximum activity was reached and since then the general level of ionisation in the layers has been falling. The next period of minimum activity is epected to occur about 1945, so that ionisation is expected to occur about 1945, so that ionisation is expected to continue to fall towards that year.

When ionisation in the layers is low we are obliged to use lower frequencies for short-wave communication, so it appears that we shall have to make more use of the lower broadcasting frequencies as year succeeds year until 1945. We must remember, however, that the decrease in work-

(Continued on page 22)

SHORT-WAVE RECEPTION
(Continued)

ing frequency is not a steady one and that, superimposed upon the gradual fall of ionisation, we have the seasonal changes already mentioned.

Actually, there is a far bigger decrease in working frequency as between maximum and minimum periods of activity during the winter day than at any other time, a smaller one during the summer day and summer night, and a still smaller decrease during the winter night.

During last summer the highest daytime frequency suitable for long-distance working in Lat. 50 degrees N. was about 12 per cent. lower than it was in the summer of 1937, while the highest night-time frequency was about 14 per cent. lower.

How the Changes Affect the Frequencies Used

So we have now passed the mid-winter of the third year after the solar maximum, and the use of lower frequencies will have been noted by listeners.

What has been said about the changes in ionisation and the consequent change in working frequency applies mainly to one particular point in the ionosphere. It must be remembered, however, that long transmission routes often pass from day into night or from night into day, and sometimes from midwinter into midsummer; so that ionosphere conditions will vary widely over the route, and the frequency used must be one that will suit the worst conditions encountered over the whole transmission route. In the case of very long routes conditions vary so widely at certain times of day and year that it sometimes becomes impossible to communicate over the route, for any frequency which will escape severe loss at one end of the route will penetrate the ionosphere of th other. Fortunately, this does not apply to many routes, nor at all times and seasons to the others. In fact, such a variety of conditions are encountered over a number of transmission routes that each one has to be separately examined for all seasons and times of day.

Conditions of the Empire Routes

We may now consider a few of the routes over which the B.B.C. regularly transmits, and see how the frequencies are likely to be affected during the coming summer in the northern hemisphere.

Let us first take the route to India. The period during which it is most desired to serve India is during the evening hours in that country, and this will be from about 11.00 a.m. to 6.15 p.m. G.M.T. The transmission route will lie entirely within the summer hemisphere, and, as darkness falls in India several hours before it does in England, we shall be transmitting, for some part of the time, from day into night. We can therefore begin the transmission on summer day frequencies — 17 Mc/s and 15 Mc/s — and, in this connection, we may mention that the frequency of 21 Mc/s, which was used with success during former summers, has now become too high to provide a reliable service, although it may again become serviceable during the autumn. Soon after darkness falls in India there will be a gradual fall in ionisation, and lower frequencies will become necessary. It is expected that between about 3 p.m. and about 7 p.m. G.M.T., the optimum frequency will fall from 17 Mc/s to 12 Mc/s, so that we shall probably finish the period on frequencies of 12 Mc/s and 11 Mc/s. Compare this with the recent mid-winter period, when, between about noon and 7.0 p.m. G.M.T., the optimum frequency fell from 21 Mc/s to about 6 Mc/s. This was met by the successive introduction of lower frequencies during the English afternoon. Similar considerations apply to the routes to the Far East and to Malaya.

In the case of the route to South Africa different conditions exist. In the first place we shall have summer conditions at the English end of the circuit and winter conditions at the South African end. A few months ago this position was reversed. Secondly, there is very little time difference over the route, so that, generally speaking, we transmit from day into day or night into night. Both these facts help to account for the fact that there is relatively little change in the optimum frequency from winter to summer. The working frequency usually has to be a compromise that will suit both summer and winter conditions, and its choice is rendered easier by the fact that the time difference over the route is small. Up to the present, the higher frequencies have been found to suit the summer and winter conditions during the day, and this applies also to the equinoctial periods. This year, however, owing to the fall in ionisation caused by the effect of the solar cycle, it is possible that conditions at the English end of the circuit may be such as to render 21 Mc/s too high a frequency. A good daytime service in Africa, however, should continue to be given by 17 Mc/s. At night conditions are likely to be somewhat difficult, for then, during the northern summer, the extreme south of South Africa requires a lower frequency than is suited to more northerly areas. It is expected, therefore, that, in the case of the extreme south, the optimum frequency will fall from 17 Mc/s to 9 Mc/s — possibly even lower — between 4 p.m. and 10 p.m. G.M.T. In the case of the more northerly parts of Africa 11 Mc/s should still be a serviceable frequency at 10 p.m. G.M.T.

Shortwave Review

CONDUCTED BY
L. J. KEAST

NOTES FROM MY DIARY

Mark Twain once said "Golf is a good walk spoiled." Most golfers, however, will agree that it is the very uncertainty of the game that makes it so interesting. By the same token, it was the uncertainty of short-wave in its early days that kept some of us plugging away always swearing "to-night's round must be better than last night's." But to-day all this is changed — the enthusiast must forego the excitement of uncertainty, but the ordinary listener must relish the assurance that the countries he seeks will be found. Transmission is, of course, better than it ever was, whilst the modern radio receiver is a real miracle of efficiency. The sets built in this country are comparable with the very finest imported and almost unbelievably remarkable in their ability to bring in the weakest of stations. It is now about fourteen years since I commenced listening — or endeavouring to listen — to overseas transmissions. My paraphernalia consisted of a little two-valver that positively resented anyone else entering the room and went on strike if the family responded to my excited invitation to come and hear this or that foreign station. However, the guid wife and bairns would beat a hasty retreat to enable me, by dint of great concentration, to recapture the station and check up on him. Can you imagine my delight when I received my very first verification from Radio Saigon. Now — from a lounge chair, with no greater effort than the twisting of one knob, we have the world at our fingertips. I have never known daylight reception to be better than it is at the present time, and the choice of stations increases almost weekly. Go to it my friends — make the most of it!

Cheers Follow Cusses

In April issue I mentioned KGEI would be moving from Treasure Island to down-town San Francisco. Norman Paige and baggage have arrived at the new address. So the cusses occasioned by the silence from June 10 to 14 gave way to smiles when the increased power was noted, and developed into cheers with the longer time on the air. Now, from 3.30 p.m. till 7 p.m. one of the most popular of the American stations can be heard at splendid strength and with excellent clarity. Again, from 10 p.m. till closing at 3.10 a.m., a fine programme with many novel features is available.

Cognisant of the importance of news, this General Electric station will cut-in on any programme feature with a news flash. On Sunday, June 22, the customary News Review of the week gave way, as friend Paige explained, for the latest news from International News Service, and in the manner peculiar to American reporters we were given tit-bits of the German-Russian debacle. I am sure listeners join with me in thanks to KGEI for the improved service.

At Long Last

At long last our Bananaland friends can tune in on the 19-metre band and hear the Department of Information broadcast to North America (west). I am referring, of course, to VLR-4, 15.23mc, 19.69m. I am sure that Queenslanders in general and Dr. Gaden, of Wallumbilla, in particular will welcome the new frequency. If I remember rightly, it was Dr. Gaden who, many moons ago, recommended a 19-metre transmitter for the benefit of the Australian outback; the doctor advanced very good arguments in support of his suggestion but the powers-that-be would not listen. It seems that the authorities might well hearken to the advice of those listeners whose enthusiastic study enables them to speak with authority. "The Australasian Radio World" is dedicated to the furtherance of every aspect of radio and, whilst it has concentrated upon short-wave with its world-wide significance, the journal has not lost sight of the importance of keeping our own people outback au fait with current events. Whilst the new frequency is intended for the United States, it is a happy accident that our folk of the Never-never are also well served by the same means. Perhaps the Minister will have the grace to blush when he receives your letters of appreciation.

Mr. Allan Beattie, of New Lambton, writes that he has heard on several mornings at fair strength what he took to be CSW-8, Lisbon, on 41.32m.

A note from Roy Hallett, of Enfield, contains some interesting information regarding the invasion broadcasts of Sunday, June 22. Roy was obviously right on the job, and says, "At 1.35 p.m. I noticed that the Germans had abandoned their schedule of news and were all taking the one programme — a speech. At 1.50 I was on KKQ (testing with C.B.S. for the 2 p.m. Hit Parade relay to Honolulu) and they broke in with a news flash that Goebbels was then making a speech from Berlin. I turned back to DZD and there it was. The speech began at 1.30 p.m. and concluded at 2 p.m.; at 2.5 London flashed the news that Germany was at war with Russia. At 2.15 the Germans began another speech, and DJD was translating it into English. It was Von Ribbentrop's note to the Moscow Government. Hitler's personal interpreter was on the job — Dr. Schmidt, and he continued till after 3 p.m. WRCA remained on after 4, and KGEI remained on its 19.56 channel instead of coming up to 31. WCBX, 48.6, remained on until 7. WCAB was also still on at 4.45 p.m. (on 49-metre band). XEQQ was also on till after 5. So ended another invasion broadcast."

Brief Mention

I was reading in the New Zealand "DX-TRA" that several reports written on official forms of the N.Z. DX Club and addressed to overseas stations had been returned by the local authorities marked "Not Transmissable." Maybe the "R" and "QSA" code offended. Therefore, a good tip is to adhere to plain English and refrain from mentioning the weather. Some time ago when the British Broadcasting Corporation sent out a questionaire, they stated that reference to the weather was of no interest or help to their engineers.

Several have asked me why I show Italian call-signs as 2RO-, etc., and not 12RO-. Actually the call-sign is 12RO, and not 12, but noticing the short cut when receiving programmes regularly from the 'soft end of the axis" before they went silly, I adopted it.

(Continued on page 28)

STOP PRESS

KGEI, 'Frisco, are now being heard from 3.30 p.m. till 7 p.m. and again from 10 p.m. till 3 a.m. on 9530kc, 31.48m.

(Quite by accident on Saturday, June 28, I was running over the 31-metre band and happened to hear the "Richfield" news from Hollywood on 9530kc. At first, thought it must be **WGEO**, but, waiting till 4.15 heard announcement, **KGEI**. Checking again at 10.30 p.m., sure enough they were "dead" on 9670kc (which accounts for me not being able to hear them for two or three nights), but at terrific strength on 31.48m. Once more we must bow down to the prerogative of S.W. stations and accept what must have been a hasty decision, as programme list for July, received two weeks ago from General Electric Co., Schenectady, shows **KGEI** as 31.02m.

The MONTH'S LOGGINGS

ALL TIMES ARE AUSTRALIAN EASTERN STANDARD

Owing to pressure on space, complete schedules cannot be given, but principal changes are shown. (See June issue for complete schedule.)

AUSTRALIA AND OCEANIA

VLR-4, Melbourne 15,230kc, 19.69m
Trans. VI. to North America (West), 3.55 p.m. to 4.40 p.m.
Very good signal (Beattie, Gaden).

VLR-3, Melbourne 11,880kc, 25.25m
Trans. III. to North America (East), 9.20 p.m. to 10.05 p.m. Trans. V. to North America (West), 1.25 a.m. to 2.10 a.m.

VLQ-2, Sydney 11,870kc, 25.27m
Trans. IV. (a) to A.I.F., North Africa and Palestine, 12.45 a.m. to 1.15 a.m. Trans. VI.(a) to A.I.F., 3 to 3.30 p.m.

VLW-3, Wanneroo 11,830kc, 25.36m

VLR-8, Lyndhurst 11,760kc, 25.51m

VLQ-5. Sydney 9680kc, 30.99m

VLO, Sydney 9615kc. 31.2m
Trans. IV. to South-east Asia, 11.10 p.m. to 12.40 a.m.: In French, Dutch and English. Trans. V.(a) to Mexico, 12.50 a.m. to 1.15 a.m.: English and Spanish.

VLR, Lyndhurst 9580kc, 31.32m
Have not been able to hear this station at night for some time (Hallett).

VLW-2, Wanneroo 9560kc, 31.38m
From 9 p.m. to 12.45 a.m., National programme.

Fiji:

VPD-4, Suva 14,425kc, 20.80m
Heard once or twice at 3.45 n.m. (Perkins).

VPD-2, Suva 9535kc. 31.46m
Schedule: 7-8 p.m. except Sunday.
Splendid news service at 7 pm. French session 3 to 3.30 p.m.

New Caledonia:

FK8AA, Noumea 6130kc, 48.94m
Schedule: 5.30 to 6.30 p.m.
On opening and closing plays "Marseillaise," "God Save the King" and "The Star-Spangled Banner."

AFRICA

Algeria:

TPZ, Algiers 12.120kc, 24.76m
Schedule: 5.30 p.m. to 6.15 p.m.
Still heard in mornings (Beattie). R4 (Nelson).

TPZ-2, Algiers 8960kc, 33.48m
Schedule: 4 a.m. to 9 a.m.
R5 in mornings (Nelson).

Belgian Congo:

OPM, Leopoldville 10,140kc, 29.59m
Schedule: 4.55 a.m. to 5.45 a.m.

Egypt:

SUX, Cairo 7865kc, 38.15m
Schedule: 4.30 a.m. to 6.30 a.m.
R5 at 6.30 (Nelson).

French Equatorial Africa:

FZI, Brazzaville 11,965kc, 25.06m
Fair in afternoon (Beatie, Nelson). English session at 1.45 p.m. (Hallett).

French West Africa:

Senegal:

FGA, Dakar 9405kc, 31.90m
Talk in English at 7.15 a.m. Wednesday and Saturday.

Gold Coast:

British West Africa:

ZOY, Accra 4915kc, 61.04m
English sessian at 4 a.m.
Mr. Hallett says "**ZOY** is now on approx. 49.95m. Heard closing at 5.30 a.m. Relayed B.B.C. at 4 p.m. Talk at 5.15 p.m."

South Africa:

Rhodesia:

THE POST OFFICE STATION, Salisbury 7317kc, 41m
Schedule: 2 a.m. to 6 a.m. Relays Daventry at 4 a.m. Closes with "God Save the King." R5 at 5.30 a.m. (Cushen).

Portuguese East Africa:

Mozambique:

CR7BE, Lourenco Marques 9710kc. 30.9m
Schedule: 5 to 7 a.m. except Mondays News 5.55.
Still the best African station. R8 at 6.30 p.m. (Nelson).

AMERICA

Hawaii:

KHE, Kahuku 17,980kc, 16.69m
R6 closing at 11 a.m. Sundays. Listen to "Hawaii Calls" (Nelson).

Central:

Costa Rica:

TIPG, San Jose 9620kc, 31.19m
Schedule: 10 p.m. to midnight.
Loudest of the Central Americans. Also heard fairly well till 2.30 p.m.

Panama:

HP5A, Panama City 11,700kc, 25.64m
Schedule: 2 p.m. to 3 p.m., 10 p.m. to midnight.
Best of the Central Americans. Closes at 3 p.m. with "Merry Widow Waltz" (Beattie).

HP5J, Panama City 9607kc, 31.22m
Schedule: 10 p.m. till midnight.

North:

KGEI, 'Frisco 15,330kc, 19.56m
Schedule: 10.15 a.m. to 3 p.m. News, 10.45 a.m. 2.55 p.m.

KKQ, Bolinas 11,950kc, 25.11m
Strong on Sunday, June 1 (Nelson, Perkins).

WNBI, Boundbrook 11,890kc, 25.23m
Often heard fairly well till 3 p.m. (Beattie).

WBOS, Boston 11,870kc, 25.26m
Schedule: 7 a.m. to 2 p.m. News, 9 a.m. and 1 p.m.
Good signal at 9 a.m. (Beattie).

WRUL, Boston 11,790kc, 25.45m
Schedule: 4 a.m. to 8 a.m. (News 6.30 a.m.)

WRUW, Boston 11,730kc, 25.58m
Schedule: 8.15 a.m. to 12.30 p.m. (News 8.15 a.m. and 10.15 a.m.).

WLWO, Cincinnati 11,710kc, 25.62m
Schedule: 8 a.m. to 10.45 a.m. News, 10.30 am.

KGEI, 'Frisco 9670kc, 31.02m
Schedule: 3.30 to 7 p.m. (News 4 p.m. and 5.55 p.m.). From 6 to 7 p.m. session is "Good Neighbour Hour" in Chinese from Chinatown, San Francisco. 10 p.m. to 3.10 (News 10.30 p.m., 12.30 a.m., 1.30 a.m., 3 a.m.).
New location and increased power greatly appreciated. Believe have moved to 31.48m. —Ed.

WRCA, Boundbrook 9670kc, 31.02m
Schedule: 6 a.m. to 3 p.m.

WLWO, Cincinnati 9590kc, 31.28m
Schedule: 11 a.m. to 3 p.m.

WGEA, Schenectady 9550kc, 31.41m
Schedule: 8.15 a.m. to 11.15 a.m.

WGEO, Schenectady 9530kc. 31.48m
Schedule: 5 a.m. to 7.45 a.m., 8 a.m. to —2 p.m. (News 6.55 and 8.25 a.m.).
Good in mornings (Beattie).

KGEI, Schenectady 9530kc, 31.48m
See notes under Diary.

KEI, Bolinas 9490kc, 31.61m
Heard on 1/6/41 in afternoon (Nelson).

Mexico:

XEQO, Mexico City 9680kc, 30.99m
Schedule: 11 p.m. to 2 a.m.

XEWW, Mexico City 9503kc, 31.57m
Between 2 and 4 p.m.

XEUZ, Vera Cruz 6120kc, 49.02m
Closes 2 p.m. (Cushen).

South:

Argentine:

LRX. Buenos Aires 9660kc, 31.06m
(Quite good at 9.15 p.m. (Edel).

Bolivia:

CP-5, La Paz 6200kc, 48.39m
Heard at 10 p.m. (Gaden).

CP-2, La Paz 6110kc, 49.10m
Fair when closing at 3 p.m. (Cushen).

Brazil:

PRA-8, Pernambuco 6010kc, 49.92m
R7 at 6.30 a.m. (Hallett).

PSH, Rio de Janiero 10,220kc, 29.35m
Becoming audible at 8.30 a.m. (Nelson).

British Guiana:

VP3BG, Georgetown 6130kc, 48.94m
R6 between 7.30 and 8 in English (Hallett).

Ecuador:

HCJB, Quito 12,460kc. 24.08m
Schedule: Noon to 1.10 p.m., 9.55 p.m. to 11 p.m.
R6 at noon (Byard).
(A correct report to this station will bring some fine literature.—Ed.)

HCORX, Quito 5,975kc, 50.21m
Opens at 9.45 p.m. with march. Spanish news 10 p.m.(Cushen).

Colombia:

HJCT, Bogota 9630kc. 31.15m
Closes weakly at 2.30 p.m. (Gaden).

HJFB, Manizales 6110kc, 49.10m
R6 when closing at 1 p.m. (Cushen).

HJFK, Pereira 6090kc, 49.20m
Heard in afternoons and sometimes till 5 p.m. on Sundays.

Paraguay:

ZP-14, Villarica 11,720kc, 25.60m
Heard at R6 when closing at 11 p.m. (Cushen).

THE EAST

China:

FFZ, Shanghai 12,090kc, 24.83m
Schedule: 7 p.m. to 1 a.m. News 10 p.m.

XGRS, Shanghai 12,015kc, 24.97m
Schedule: 6.30 p.m. to 1 a.m. "The Voice of Europe." News 8.45 p.m., 9.30 p.m. and 11.15 p.m.

XIRS, Shanghai 11,980kc, 25.02m
News in English at 9.15 p.m. (Nelson).

XMHA, Shanghai 11,853kc, 25.31m
Schedule: 6.30 p.m. to 1 a.m. News, 9 p.m. and 11.15 p.m.

XGOA, Chungking 9720kc, 30.85m
Good at 9 p.m. News at midnight (Beattie).

XGOY, Chungking 5950kc, 50.42m
10.30 p.m. to 11.55 p.m. News 10.30 p.m.
Good at 11 p.m. (Cushen).

Thai:

HSP5, Bangkok 11,715kc, 25.61m
Schedule: 10.50 p.m. to 1 a.m. except Mondays. News, 11.45 p.m.
Signal weak lately (Beattie).

Dutch East Indies:

YDR, Tandjonpriok 4470kc, 67.11m
Good at 1 a.m. (Cushen).

YDA, Tandjongpriok 3040kc, 98.68m
Schedule: 7.30 p.m. to 1.30 a.m.

French Indo-China:

Radio Saigon, Saigon 11,780kc, 25.47m
Schedule: 8.40 p.m. to 2 a.m. News, 9.15 p.m., 1.45 a.m.
Signal strength again excellent. News is now given at 9.15 p.m., and our old friend, Miss Dorothy Vivienne, is back.

Radio Saigon, Saigan 6180kc, 48.54m
Schedule: 8.40 p.m. to 2 a.m.
Very loud signal.

Hang Kong:

ZBW-3 .... 9525kc, 31.49m
Schedule: 8 p.m. to 1 a.m. Relays B.B.C. News at 11 p.m.

India:

VUD-4, Delhi 11,830kc, 25.36m
Schedule: 9.30 p.m. to 3.20 a.m.
News, 10.30 p.m., 1.50 a.m., 3.15 a.m.

VUD-2, Delhi 9590kc, 31.28m
Schedule: 9.30 to 2 a.m. News, 10.30 p.m., 1.50 a.m.

VUD-2, Delhi 7290kc, 41.15m
Schedule: 9.30 p.m. to 3.20 a.m. News 10.30 p.m. to 1.50 a.m.

VUM-2, ... 7270kc, 41.27m
Heard at 9.30 p.m. (P. L. Smith).

VUB-2, Bombay 7240kc, 41.44m
Good around 10.30 p.m.

VUC-2, Calcutta 7210kc, 41.61m
Fair about 10.30 p.m.

Japan:

(Tokyo considered source of supply unless otherwise mentioned)

Pressure on space does not permit of full schedules.

JLU-4 .... 17,795kc, 16.86m
11 a.m. to 1 p.m. News 11.05 a.m.
R4 at 11.45 a.m. (Byard).

JZK 15,160kc, 19.79m
1.30 p.m. to 4 p.m. (News 2.55 p.m.). 4.30 to 6.30 p.m. (News 4.35 p.m.). 11 p.m. to 12.30 a.m. (News 11.30 p.m.).

JLG-4, —— 15,105kc, 19.86m
5 a.m. to 8.30 a.m. (News 7.30 a.m.). 11 a.m. to 1 p.m. (News 11.05 a.m.).

JVZ, —— 11,815kc, 25.39m
7 p.m. to 11 p.m.

JZJ 11,800kc, 25.42m
5 a.m. to 8.30 a.m. (News 8 a.m.). 7 p.m. to 12.30 a.m. (News 8.30 p.m.).

JVW-3 .... 11,720kc, 25.6m
Schedule: 6.45 a.m. to 8.30 a.m. (Exercises 7.7 a.m.). 6.45 p.m. to 12.30 a.m.

MTCY, Hsinking 9545kc, 31.43m
Fair at 7.03 a.m., with News (Beattie).

MTCY, Hsinking 25.48m
7 a.m. to 7.50 a.m. (News 7.03 a.m.).

Philippines:

(Manila, unless otherwise stated)

KZRH 9640kc, 31.12m
Schedule: 7.30 a.m. to 9.30 a.m. (News 8.15 a.m.). 6 p.m. to 2 a.m. (News 6 p.m., 10.30 p.m. and midnight).

KZRM 9570kc, 31.35m
Schedule: 6.45 p.m. to 1.30 a.m. News, 8.35, 10.45 and 11.45 p.m., also 12.45 a.m.

LOGGINGS (Continued)

KZND, Manila 8790kc, 34.13m
Heard from about 9.30 till 10.30 p.m. (Beattie). See "New Stations."

GREAT BRITAIN
"This Is London Colling"

GSV 17,810kc, 16.84m
E.T., 8.55 p.m. to 2.30 a.m. News 9 p.m., 11 p.m. and 2 a.m.
Reception doubtful.

GSP 15,310kc, 19.60m
P.T., 5.30 p.m. to 6.15 p.m.; Af.T., 5.30 a.m. to 8 a.m.

GSI 15,260kc, 19.66m
P.T., 2.57 to 6.15 p.m.; Af.T., 2.55 am. to 5 a.m.

GSF 15,140kc, 19.82m
P.T., 2.57 p.m. to 6.15 p.m.; E.T., 8.55 p.m. to 2.30 a.m.; Af.T., 2.55 a.m. to 5.15 a.m., 6.45 a.m. to 8 a.m.

GRV 12,040kc, 24.92m
Eur., 2.55 a.m. to 4.15 a.m. (News at 4 a.m.).
Heard in French at 7 a.m. (Beattie).

GSN 11,820kc, 25.38m
Eur., 11 p.m. to 1.30 a.m. (News 11.30 p.m.). 8.40 a.m. to 12.30 p.m. (Spanish and Portuguese).

GSD 11,750kc, 25.53m
2.57 p.m. to 6.15 p.m.; E.T., 11.45 p.m. to 2.30 a.m.; Af.T., 2.55 a.m. to 8 a.m.; Am.T., 8.20 a.m. to 2.35 p.m.

GRX 9690kc, 30.96m
Eur., 2.55 a.m. to 8.30 a.m., 8.40 a.m. to 12.30 p.m. (Spanish and Portuguese), 6 p.m. to 8 p.m. News, 8 a.m. and 6 p.m.

GRY 9600kc, 31.25m
P.T., 2.57 p.m. to 5 p.m.; Af.T., 2.55 a.m. to 8 a.m.; Am.T., 8.20 a.m. to 2.35 p.m.

GSC 9580kc, 31.32m
Am.T., 8.25 to 2.35 p.m. Radio Newsreel 1.30 p.m. News 2.30 p.m.

GSB 9510kc, 31.55m
P.T., 2.57 p.m. to 6.15 p.m. (News 4.15 p.m.). 8.40 a.m. to 12.30 p.m. (Spanish and Portuguese).

GRU 9450kc, 31.75m
E.T., 11.45 p.m.to 2.30 a.m. News, 2 a.m.

GRW 48.82m
Home Service, 2.30 p.m. to 6 p.m. (News 3 p.m. and 4 p.m.).

GRR 6075kc, 49.38m
2.30 p.m. to 6 p.m. (News 3 p.m. and 4 p.m.). 2 a.m. to 8.30 a.m.

GSA 6050kc, 49.59m
Eur., 2.30 p.m. to 8 p.m., 2.55 a.m. to 8.30 a.m. (News 6 p.m. and 8 a.m.).

EUROPE

France:
(Of course, Nazi controlled)

"Y" 9520kc, 31.51m
Schedule: 7.50 a.m. to 2 p.m. News, 11.30 a.m. and 1.30 p.m.
Good when Moscow closes at 1 p.m.

Germony:
"Station Ananias," Berlin. Consistent noise would suggest Berlin is apparently being jammed. Reception on 16 and 19 metre-band at present time of year is doubtful, between 6.15 and midnight.

DJR 15,340kc, 19.56m
Schedule: 3 p.m. to 2 a.m. News 5 p.m. and 10 p.m.
Reception between 6 p.m. and midnight doubtful.

DXT 15,230kc, 19.70m
R8 at 2 p.m. (Byard).

DZE 12,130kc, 24.73m
Heard well at 8 a.m. (Beattie). Heard at 11.50 a.m. (Byard, Perkins).

DZC 10,290kc, 29.25m
R9 at noon (Byard).

DJD 11,770kc, 25.49m
Schedule: 1.40 to 7.25 a.m. News, 2.15, 5.15 and 7.15 a.m. Talk at 3.30 a.m.
7.50 a.m. to 2.05 p.m. (News 11.30 a.m. and 1.30 p.m.

DJA 9560kc, 31.38m
Schedule: 2.30 a.m. to 6 a.m. News, 2.30, 3.30 and 5.30 a.m. (Lord Haw-Haw).

——— 31.8m
Heard closing at 1.45 p.m., using Spanish or similar language (Beattie).

Hungary:

HAT-4, Budapest 9123kc, 32.88m
R9 at 10.30 a.m. News at 11.15 a.m.
Asking for reports (Cushen). (Correspondence to this country will not be accepted at G.P.O.—Ed.)

Italy:
"This is Radio Roma"

2RO-18 .... 9765kc, 30.74m
11 a.m. to 2.20 p.m.
R7 at 2 p.m. (Byard). Heard at 6 a.m. (Beattie).

NEW STATIONS

CBFY, Montreal, 11,705kc, 25.63m: Heard early in June just after mid-day. Close at 2 p.m. with anthem, followed by "God Save The King." Open again at 9.30 p.m. If free from morse are easily followed although they speak in French. Careful tuning is required just before 2 p.m. on account of strength of **HP5A,** Panama City, on 25.64m. Address is: Canadian Broadcasting Corporation, 1231 Catherine St., Montreal. The station is situated in Vercheres in the Province of Quebec.

CBFW, Montreal, is the call-sign of Radio Canada, 6.16mc, 48.70m. Can be heard opening at same time as **CBFY** in the evenings.

KZND, Manila, 8790kc, 34.13m: This is "The Station of the Department of National Defence." Heard from about 9.30 till 10.30 p.m. What would be an excellent signal and quite an interesting station is often spoilt by morse.

OIE, Helsinki, 15,190kc, 19.75m: Carrying same programme as **OFD** and **OFE,** is heard from 1.30 a.m. to 8 a.m.; news at 4.15 and 7.15 a.m.

CSW-8, Lisbon, 7260kc, 41.32m: Mr. Alan Beattie, of New Lambton, writes that he has heard on several mornings what he takes to be this station. It will be remembered I mentioned this transmitter in March issue and asked for reports. Schedule is supposed to be: Wednesday, Friday and Sunday, 7.05 to 8 a.m.

And here are one or two to try and find:—

ZMEF, Sunday Is., 9.20mc, 32.59m. Schedule: 4.45 p.m. till 5.15 p.m. Latest issue of I.S.W., Ohio, recommends Australian and New Zealand listeners to watch for this one, and also —

———, Tangiers, 5.88mc, 51.00m: 5 p.m. to 7 p.m. (If I remember rightly, friend Arthur Cushen, of N.Z., once logged **ZMEF,** which, of course, is in one of the Kermadec Is. group in the South Pacific Ocean, just north of N.Z.—Ed.)

Pressure on space prevents further list of New Stations, nor are we able to give "Station Particulars" in this issue.

——— 9683kc, 30.98m
Heard from 6.15 a.m. (Beattie).

2RO-11 .... 7220kc, 41.55 a.m.
2.30 a.m. to 8.55 a.m. Fair at 7 a.m. (Beattie).

HVJ, Vatican City 48.47m
5.15 a.m. to 5.30 a.m. Talks.

Portugal:

CSW-6, Lisbon 11,040kc, 27.17m
Schedule: 3 a.m. to 6.45 a.m.

CSW-7, Lisbon 9740kc, 30.8m
Schedule: 6.50 to 9 a.m. Talks: On Wednesday, Friday and Sunday from 6.50 a.m. to 7.15 a.m.

CSW-8, Lisbon 7260kc, 41.32m
Have heard on several mornings what I took to be this station (Beattie). This is the one I mentioned in March issue.—Ed.

CS2WD, Portugal 6200kc, 48.38m
Schedule: 6 to 9 a.m.

Russia:
("This is Radio Centre, Moscow, calling")
RW-96 .... 19.47m
Schedule: 8 p.m. to midnight.
Only fair at present.—Ed.
RW-96 .... 15,180kc, 19.76m
Schedule: 2 p.m. to 5.30 p.m., midnight to 3.30 a.m. News, 1 a.m.
RWG 14,720kc, 20.38m
Irregular.
RNE 12,000kc, 25.00m
Schedule: Noon to 6 p.m., physical jerks; 12.30 and at 1.20 p.m., 10 p.m. to 9 a.m. News 10.30 p.m. and 8 a.m.
RAL/RVG 11,645kc, 25.77m
Irregular.
——, Moscow 9628kc, 31.16m
Heard at great strength till about 7 a.m. (Muller).
RW-15, Khobarovsk 9565kc, 31.36m
Schedule: 6 p.m. to midnight.
RW-96 .... 9520kc, 31.51m
Schedule: 12.30 p.m. to 1 p.m. (English). 10 p.m. to 8 a.m. News 4.30 a.m., 6.15 a.m. and 7 a.m.
RKD 8035kc, 37.33m
RW-96 .... 6061kc, 49.5m
Midnight to 8 a.m.
RV-59 .... 6030kc, 49.75m
Irregular.
RW-96, Moscow 6000kc, 50.00m
Irregular.
RV-15, Khabarovsk 4273kc, 70.2m
Very fair signal.

Switzerland:
HBH, Geneva 18,480kc, 16.23m
Schedule: 11.45 p.m. Fridays to 1.10 a.m. Saturdays. Mostly English, little French. News 12.5 a.m., 11.45 p.m. Mondays to 1.10 a.m. Tuesdays, Italian. German and French.
HBJ, Geneva 14,535kc, 20.65m
First Sunday in the month. 3.45 p.m. to 5.10 p.m.
HBO, Geneva 11,420kc, 26.31m
Same remarks as **HBJ.** Fair signal.
Very good on June 2.
HER-3, Schwarzenburg 6165kc, 48.66m
Schedule: 2.40 p.m. to 3.37 p.m. Good signal. 3.30 a.m. to 7.05 a.m. Splendid signal.

SCANDINAVIA

Denmark:
RADIO DENMARK, Copenhagen
9680kc, 30.99m
Heard from 3.30 to 3.45 p.m. Good signal (Beattie).
Finland:
OIE, Lahti 15,190kc, 19.75m
1.30 a.m. to 8 a.m. News 4.15 a.m. and 7.15 a.m.
OFE. Lahti 11,780kc, 25.47m
Schedule: 1.30 a.m. to 8 a.m. (News, 4.15 and 7.15 a.m.); 3.30 p.m. to 6 p.m.
OFD, Lahti 9500kc, 31.58m
Schedule: 1.30 a.m. to 8 a.m. News, 4.15 and 7.15 a.m.
Norway:
LKQ, Oslo 11,735kc, 25.57m
Schedule: 3.05 to 6 p.m.; 1.30 to 7.30 a.m.
Sweden:
SBT, Stockholm 15,150kc, 19.8m
Schedule: 6 p.m. Sundays to 7 a.m. Mondays. Daily: 3.56 a.m. to 7.15 a.m.
SBP, Stockholm 11,710kc, 25.63m
Schedule: 3.56 a.m. to 7.15 a.m. Opens again at 11 a.m. with News for U.S.A. 4.40 p.m. to 6 p.m. (Sundays 6 p.m. to 7 a.m. Mondays).
SBO, Stockholm 6060kc, 49.46m
Schedule: 7.18 a.m. to 8 a.m. News, 7.20 a.m.

MISCELLANEOUS

Arabia:
ZNR, Aden 12,110kc, 24.76m
This is a 500-watt station operated by Cable and Wireless Ltd. Heard at 3.45 a.m. (Cushen).
Canada:
CBFY, Montreal 11,705kc, 25.63m
Heard closing at 2 p.m. with "God Save the

SHORT-WAVE REVIEW (Continued)

German Influence

Evidently German influence is responsible for the increased power of the Finnish stations. **OIE, OFD** and **OFE** are now heard very well in this country, the power of 15 kilowatts helping considerably. **OFH**, who, on 6.12mc I do not remember being reported, is still left on the old allowance of 1 kilowatt.

Radio Saigon, Saigon, 11,780kc, 25.47m, is now giving news at 9.15 p.m. Heard our friend Dorothy Vivienne, conducting a good session with the orchestra before reading the news. My friend, Roy Hallett, tells me she is retiring from radio at the end of the month, and he surmises Linda Douglas will conduct the two English sessions, 9 to 9.30 p.m. and 1.30 to 2 a.m.

Running over the bands the other night, I found **COCQ**, Havana, 47.06m, one of the best signals on the air at 9 p.m.

Have been hearing a Russian round about 5.30 in the morning on approximately 31.16 metres. Notwithstanding his close proximity to **2RO-3**, he can be separated from the Italian. If any reader should hear the call-sign, would be grateful to have a note of same.

My friend, Gus Muller, of Newtown, mentions hearing a German (or what he takes to be a German) on 39.7 metres from 5.30 to 5.45 with a very strong signal.

By now probably most listeners have heard the new Manila station, **KZND**, on 34.13 metres. I am grateful to Mr. Max Stevens, of Broadway, for tipping me off regarding this newcomer. Unfortunately, this station of the Department of National Defence is in a noisy part of the band, but very often from 9.30 p.m. (when opening) they provide quite a good signal, which is only marred by intermittent morse right on top.

Revolutionary Station

The European Revolutionary Station, 9658kc, 31.06m, can be heard quite well at 3 p.m., but you will have to be quick, as they are only on the air for fourteen minutes as a rule. They still persist in claiming they are on 31.2 metres, but I still maintain that their wavelength is 31.06 metres.

There is a station on approximately 10,190kc, heard nightly from about 8.30, using a language that I have not been able to identify, but the voice is very much like our lady friend from Radio Centre, Moscow, and I therefore suspect that this station on 29.50 metres is another Russian.

Talking of Russians, I notice that our old friend, RW15, Khabarovsk, on 49.06 metres, has been missing for quite a while, but on 31.36 metres is going great guns at night.

ZHP-3, Singapore, 7250kc, 41.38m, is heard in French nightly at 9.40 and at 11.45 in Dutch.

I have been hearing what sounds like a Chinese or Japanese station on top of **PMN**, Bandoeng, 10,260kc, 29.24m, from about 8.45 p.m. Any suggestions?

Struck a noisy patch at 1.55 p.m. on Saturday round about 25.63-4 metres. Managed to separate **CBFY**, Montreal, on 25.63m, from **HP5A**, Panama, on 25.64m. The former closed at 2.5 p.m. with an anthem, followed by "God Save The King."

Another Saturday afternoon note I have in front of me is that I was listening to Berlin sending messages to the German Internment Camp in Kingston, Jamaica. Calling the prisoners by numbers, followed by their names, it appeared to me they were using **LSX**, Buenos Aires, 10.35 mc, 28.99m.

I am indebted to Mr. Sam Nelson, of Cairns, for a programme sheet he has received from Guatemala. Apart from information regarding the schedules of **TGWA, TGWB** and **TGWC** and the fact that they broadcast in English, French, German and Italian, I was intrigued with the claims made for this Central American country as a tourist resort.

"Myth Columnists"

"Unfortunately," writes "Thermion" in "Practical Wireless" (London), "there are thousands of people suffering from the 'I know something which you don't' complex. They have heard it on the radio when they were listening to Timbuctoo, Tokyo or some other remotely-situated station, to give the impression that they have a wonderful set, and are thus au fait with all of the world's news. Such a trifle as the various languages involved does not seem to worry them. Thus, the rumours they spread cause damage. One or two of them have been caught and then have been compelled to admit that they have invented the story. These are the myth columnists, and they are just as dangerous as the fifth columnists."

S.W. ADVISORY BUREAU

My readers and fellows of the short-wave brotherhood have always known that it is my pleasure to hear from them and to see them whenever possible; in the past it has not always been easy to track me down, but now I'm easily get-at-able. I have a "den" on the third floor of David Jones' George Street Store, from whence I am conducting a Short-wave Advisory Bureau. There I am, at your service, and shall welcome your visit whether you are in search of advice or merely wish to swap yarns regarding our adventures as short-wave tourists. My own touring is more adventurous than ever nowadays, because the Company has installed in my home a set that really exemplifies the absolutely last word in radio receivers. My colleagues call it the super-dooper. Well! Call it what they like, it's certainly super.

Technical men in charge of some of the biggest radio manufacturing concerns in this State have been out to see it and, in enthusing over the construction, can realise why the many different stations are obtained with mathematical exactitude.

But don't think I am taking any unfair advantage; the stations mentioned in loggings have been checked on a standard commercial receiver.

LOGGINGS (Continued)

King" (Gaden). Opens again at 9.30 p.m. in French.—Ed. See "New Stations."

CJRO, Winnipeg 6150kc, 48.78m
Heard till 3.30 p.m. on occasions (Cushen).

CBFW, Quebec 6160kc, 48.70m
Heard opening in same programme as **CBFY** at 9.30 p.m. Good at 9.30 p.m. (Cushen). (Note correct call-sign.—Ed.)

Turkey:

TAP, Ankara 9465kc, 31.70m
Schedule is: Midnight to 6.30 a.m. News at 4.15, and on Sundays English at 5.50. Excellent signals. Splendid dance records N.Y. Times' correspondent at 9 a.m. Good, but sometimes noisy.—Ed.

Location Unknown:

"Christian Peace Movement," 9440kc, 31.76m
Between 5.45 and 6 a.m. Not reported this month.

Location Unknown:

EUROPEAN REVOLUTIONARY STATION 9658kc, 31.06m
Heard from 7 to 7.20 a.m. with fair signal (Beattie, Nelson). Heard from 3 to 3.14 p.m.—Ed.

UNCONNU 30.77m
This Free French station heard in early mornings (Beattie).

WEST INDIES

Cuba:
Havana unless otherwise mentioned

COK 11,570kc, 25.93m
Back on the air again. R4 at 2 p.m. (Byard). R9 at 3 p.m., and asking for reports (Cushen).

Martinique:

RADIO MARTINIQUE, Forte-de-France 9705kc, 30.92m
R4 at 10 p.m. (Cushen).

FOR SALE

POWER OSCILLATOR for CODE CLASS

Easily put together, this little audio oscillator and power amplifier has many uses.

★

THERE seems to be unlimited scope for the applications of electronics. The radio valve can be made to perform dozens of jobs quite remote from its original purpose.

An interesting development is the big air-raid siren installation which has been put up in our city streets by engineers of the Kriesler radio factory.

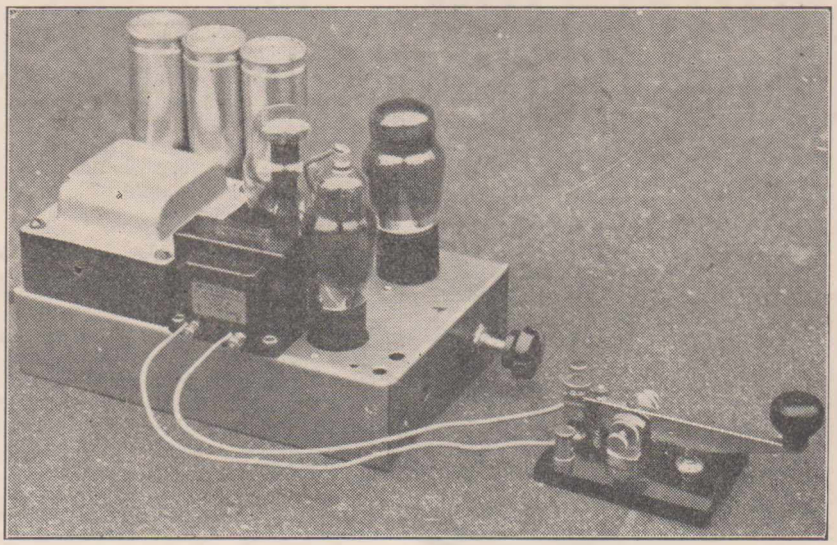
This outfit, with its hundreds of speakers, can make a terrific din, and has many advantages over the mechanical types of sirens. Probably last, but not least, of these advantages is the way in which the installation can put over dance music in between air raids or amuse those sheltering from the bombs!

Thinking of this big air-raid siren turned our attention to the many useful purposes to which a lower-powered siren could be applied.

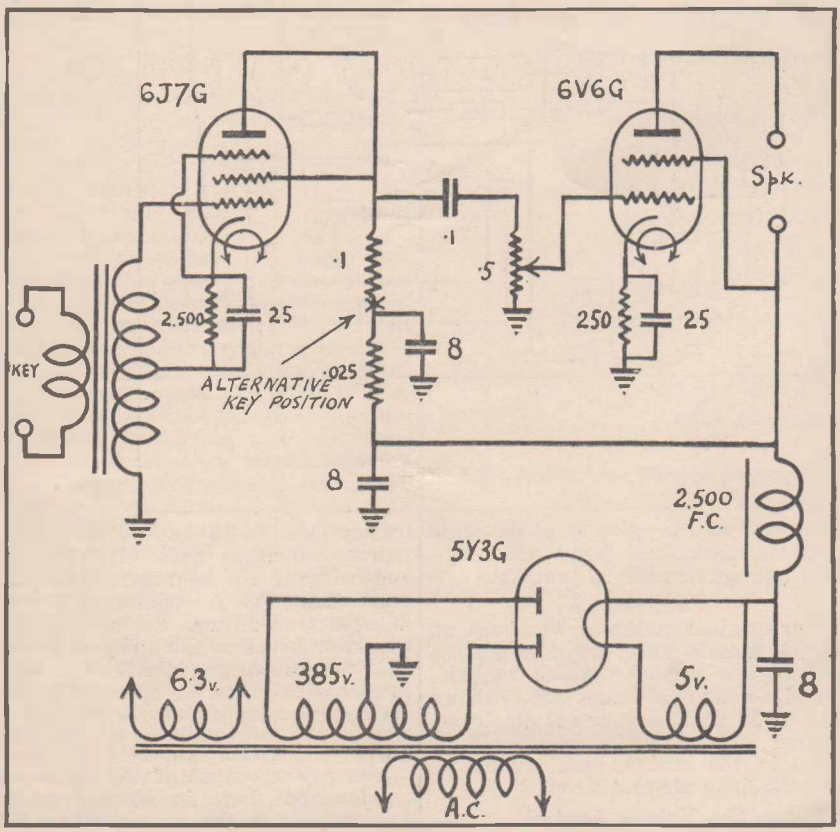
To mention just one of these, it make a super "electric bell" for factory use.

Down in our printery the machines make a fair bit of noise and it is quite a job to call any particular operative to the telephone or the boss' office. So we tried the use of this power oscillator, operated from a push-button, and with a morse code symbol for each man. "A" stood for Albert, and the boss had only to send out "di-dah" on the push-button and Albert came at the double. For the telephone call the symbol is repeated, so Albert knows that he is wanted on the telephone when he hears the siren roar out "di-dah di-dah."

Another suitable application for the oscillator is for teaching the morse



A general view of the outfit with morse key.



Circuit diagram, showing two key positions.

POWER OSCILLATOR

Parts List

1—Base, size 5½" x 8½" x 2" (Arcadian).
1—Power transformer, 385-volt at 60 m.a. (Radiokes).
1—Audio transformer, push-pull, class "B" (Airzone, R.C.S., Radiokes).

CONDENSERS:

3—8 mfd. electrolytics (T.C.C.).
2—25 mfd. electrolytics (T.C.C.).
1—.1 mfd. tubular condenser (T.C.C.).

RESISTORS:

1—250 ohm (I.R.C.).
1—2,500 ohm (I.R.C.).
1—25,000 ohm (I.R.C.).
1—100,000 ohm (I.R.C.).
1—500,000 ohm volume control (I.R.C.).

SPEAKER:

1—2,500 ohm field, 7,000 ohm load (Rola, Amplian).

SUNDRIES:

Sockets, valve can, screws, wire, lugs, etc.

POWER OSCILLATOR

(Continued)

code. A class of several hundred can be covered at one time by means of this outfit, and the note can be adjusted to make it almost identical to the sound of an actual morse code signal. The oscillator will handle high-speed morse signals as fast as ever likely to be needed and with a clear-cut note and no sign of chirping or key-clicking.

The Circuit

The circuit used provides for an audio oscillator, with resistance-capacity coupling to a beam power valve, which feeds an ordinary electro-dynamic speaker. In other words, the circuit is very similar to a small gramophone amplifier except that the first valve is made to oscillate at audio frequency by coupling the cathode and grid circuits through the secondary winding of an audio transformer. This method of coupling is somewhat different from those usually suggested for audio oscillators and code practice sets, but we can give it a thorough recommendation as being most reliable and serviceable in practice.

Construction

Our original oscillator was built up on the chassis which we used for the Porto-gram amplifier which was detailed a couple of issues ago. All we had to do was to fit the audio transformer and make one or two alterations in the wiring, and, presto, we had the baby air-raid siren.

The Volume Control

A volume control is an absolute necessity and must be fitted between the oscillator and the power output valve. The simplest arrangement is shown in the circuit.

Adjusting the Note

The actual note of the oscillator will depend on the characteristics of the secondary of the audio transformer, but it can be altered by the use of condensers fitted across the secondary terminals. With the original transformer a condenser was not considered necessary, but capacities of from .001 to .01 mfds. might be found desirable with other types and brands of transformers.

Taking Out Hum

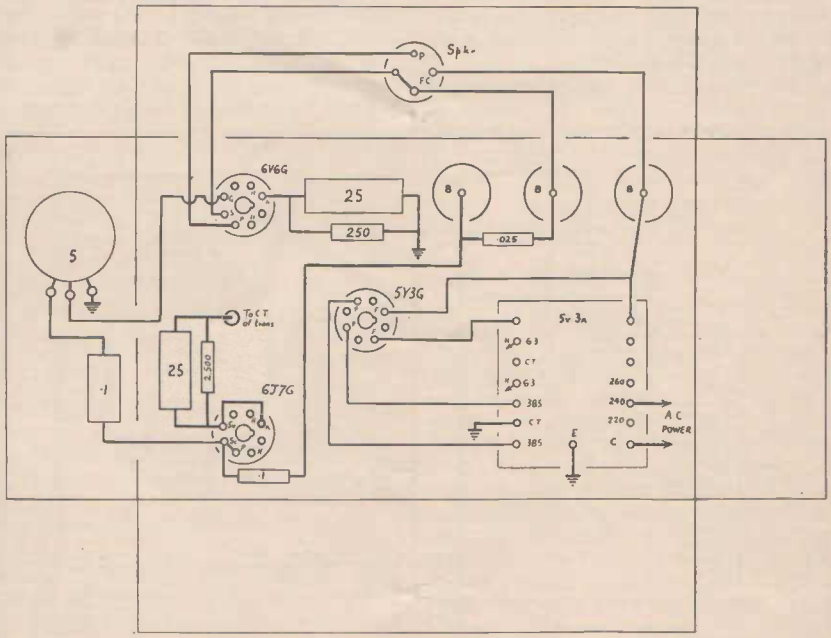
A high level of hum in the amplifier would be most undesirable, and so the necessary precautions have been taken to de-couple the plate circuit of the oscillator. At the same time this oscillator removes any possibility of motor-boating or other forms of unwanted feedback and oscillation which might otherwise occur.

No Radio Interference

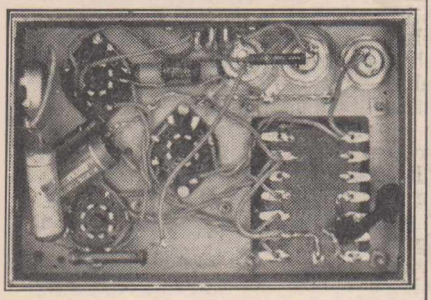
Some people might be afraid that the outfit would radiate radio frequency oscillations as well as audio, thereby creating radio interference and bringing the operator within the hand of the law for operating an unlicensed transmitter. Fortunately the oscillator keeps to the audio only and does not cause any interference even to a sensitive receiver operated in the next room, only a few feet away.

Power Ability

The power output of the oscillator as described here is about four or five watts and this power, when fed to an ordinary speaker at the constant



frequency of the output, is enough to load it up so fully that the voice coil bottoms on the pole piece. Needless to add, such treatment of the speaker will soon damage it, and we leave it to the operator to use normal intelligence and adjust the volume control



A view of the wiring.

so that the speaker is not overloaded in this way. Even a couple of watts at a constant frequency sounds a hell of a lot of noise and by choosing a penetrating note it will be found easy to over-ride the noise of heavy machinery, the hum, buzz and chatter of a class-room or anything like that.

Keying

The key may be connected in either of two ways. The most effective keying is obtained by putting the key across the primary of the audio transformer.

The only point to watch is that the action of the key has to be reversed, the primary being normally shorted out by the key.

Pressing the key needs to open the circuit and allow the valve to oscillate.

With most keys it is a simple matter to arrange to have the leads connected to the back stop and the frame so that the closed circuit is obtained when the key is up.

A desirable feature of keying the primary is that the terminals of the key are not at high potential and it is quite impossible to get even the slightest shock from touching them.

If by any chance it is found quite impossible to reverse the action of the key it can be fitted in the circuit at the position shown with a cross, where it will break the high tension supply for the plate of the audio oscillator valve.

Care should be taken to make sure that the connection is on the plate side of the electrolytic condenser, which then helps to absorb key clicks, chirps, etc.

With this arrangement it should be noted that it becomes possible to get a startling, but not dangerous, shock by touching the terminals with one hand and the base of the outfit with the other. Perhaps it is a good idea to get used to handling a key with high tension on its terminals as such an arrangement is often encountered in real radio transmitting practice.

Making the Most of a Modulated Oscillator

SOME HINTS FOR THE RADIO SERVICEMAN

APART from alignment, an oscillator of the type described on page 11 can be used for several other purposes almost as important in radio service work. Its uses are set out below:—

(1) Alignment of I.F. and R.F. circuits.
(2) Adjustment of dial tracking.
(3) Checking automatic volume control characteristics.
(4) Testing valve and circuit components under working conditions.
(5) Signal tracing.

1. Alignment

Alignment of modern superheterodyne receivers has been fully dealt with from time to time in various articles and, consequently, only a brief description is given here.

The first point in aligning superheterodyne receivers is the adjustment of the intermediate frequency transformers. To do this, the hot (red) oscillator lead is connected to the grid of the intermediate tube, while the earthed lead connects to the chassis earth. If the receiver possesses two intermediate stages, the lead is connected to the second intermediate tube before the first one. The oscillator is now switched on and the dial turned until the needle points to the intermediate frequency required by the receiver under test. The intermediate transformer following the tube to which the oscillator is connected is now adjusted to give maximum reading on an output meter or maximum signal is heard by the ear. When this action is completed, the hot lead is transferred to the first intermediate tube or the first detector, as the case may be, and the action already described is carried out on the remaining I.F. transformer. The one which had been previously aligned should now be re-adjusted to give maximum output. It is a wise precaution, when aligning sets with automatic volume control, to keep the signal input as low as it can conveniently be kept.

This prevents the automatic volume control from interfering with the correct alignment.

After having aligned the I.F. transformers, the hot lead of the oscillator should be transferred to the aerial terminal, and the range switch turned to the broadcast band. The oscillator should now be tuned to a frequency of approximately 1400 k.c., and the receiver tuned in to this signal. From this position, the oscillator and R.F. trimmers should be adjusted. The oscillator and receiver are then tuned to a frequency of approximately 600 k.c., and the padder adjustment made. After having adjusted the padder, the action previously carried out on 1400 k.c. should be repeated, except that the oscillator trimmer should not be moved.

2. Dial Adjustment

The adjustment of the dial is part and parcel of the alignment of the receiver. The work of the oscillator in this adjustment is to supply the correct frequency, so that by adjusting the oscillator trimmer and the needle of the dial, the correct frequency setting will be registered. For this purpose, the oscillator should be fed into the aerial and earth as previously described, and the range selector switch turned to the broadcast band when the correct frequencies can be taken from the correctly calibrated dial.

3. Checking A.V.C.

The action of automatic volume control may be checked very easily with an oscillator. The test consists of feeding the signal into the aerial and earth at various frequencies and noting the effect of the automatic volume control voltage on one of the tubes controlled by this a.v.c. In a valve using a bias resistor in the cathode circuit, it is only necessary to place a meter across the cathode, having sufficient range to measure the full bias voltage, and to increase the signal from the oscillator from zero to maximum, noting the effect of this signal on the voltage developed across the bias resistor. If the automatic volume control is working properly, the voltage registered by the meter will decrease as the signal strength is increased. The amount of automatic volume control voltage can quite readily be judged by the reduction of bias voltage. This action should be tried on all tubes which are controlled by the automatic volume control system.

In such tubes as octodes or pentagrid converters, as the majority of the cathode current is made up not by the ordinary plate current but by screen and oscillator plate current, the effect of automatic volume control will be hardly noticeable with a meter connected across the resistor in the cathode circuit. In this case, as in the case of valves which are biassed by a back bias method, it will be necessary to insert a milliammeter in series with the plate circuit or the screen circuit. and note the effect of the increased signal on the plate or screen current. As the automatic volume control voltage increases due to increased signal strength, the plate or screen current will be reduced. The effective return is again an indication of the automatic volume control voltage. Of course, the range of the milliammeter must be correct for the type of tube being tested.

4. Valve and Circuit Testing

Frequently in radio service work, various components will test quite in order under normal testing conditions, but, when operated in a receiver, may cause considerable trouble. In such cases, it is obviously necessary to test these components under their actual working conditions. The oscillator may be used very conveniently for this function, as it can be made to feed an unvarying signal strength into the receiver and, consequently, any variation which takes place in the output will be due to some fault in the receiver itself. By feeding a signal of broadcast frequency into the aerial

(Continued on page 34)

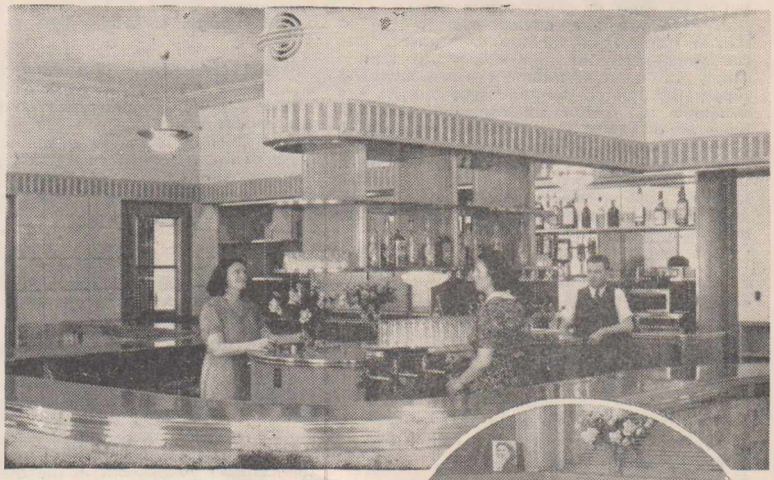
MODERN SOUND FOR MODERN HOTELS

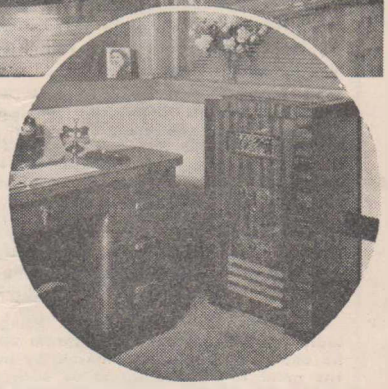
The installation of modern sound systems in hotels offers unlimited scope for the live radio dealer.

●

THE fact that travelling has become a far greater pleasure than in the previous century is not due exclusively to the evolution of faster and more luxurious methods of transport, but also to the way in which the hotel industry has progressively availed itself of the benefits of modern science and engineering. The astute hotel proprietor not only makes every effort to offer his guests clean, comfortable accommodation and courteous, attentive service, but follows this up with a psychologically correct endeavour to create around the "stranger within his gates" as homelike an atmosphere as possible. And this is where radio comes into the picture.

One of the most recent installations is that at the Oriental Hotel, located in Sydney's most colourful and cosmopolitan quarter — King's Cross. Moreover, this system is one of outstanding efficiency. Designed, built and installed by Philips, it represents sound reproduction in its most elastic form and with a simplicity of operation and ease of maintenance that is quite new. Basis of the installation is, if we may coin a phrase, a "quadruple receiver"— in other words, a large cabinet in which four separate Radio-player chassis are housed. Provision has been made for a fifth; in fact, any number, within reason, could be installed, as could facilities for reproducing gramophone records and for paging by microphone.





Note the loudspeaker in the saloon bar canopy at the New Canterbury Hotel. Inset: The manager's office, where the ultra-modern Philips sound system is controlled.

Connections run from this central receiving unit to every one of the 50 or so bedrooms in one newly-renovated section of the establishment. Each room contains an attractive bedside cabinet designed in harmony with the rest of the ultra-modern furnishings. This cabinet incorporates a sound reproducing unit complete with speaker grille and controls, enabling the guest to enjoy any of the four different programmes being picked up on the "quadruple receiver" mentioned above.

Typical bedside cabinet, with loudspeaker and controls, at the Oriental Hotel, where guests are offered a choice of four programmes by means of Philips sound.

Volume Control

The volume level cannot rise sufficiently in each room to disturb the occupant of the next, but within this limit it may be adjusted by each guest to suit his own taste. As a result of this excellent arrangement, no arbitrary restriction need be placed on the enjoyment of radio in the rooms even in the small hours of the morning.

New Canterbury

Another highly-successful Philips installation is that at the lavish New Canterbury Hotel — a front-rank addition to the Harbour City's ever-growing list of ultra-modern hostelries. The installation here is in-built; decorative loud-speaker grilles are incorporated in the walls of the dining room, lounge, bottle department and ladies' parlour. In the public and saloon bars the speakers are built into the bar canopies. There is also a monitor speaker in the manager's office, where the amplifying unit is installed, the latter being incorporated in a specially-designed polished wooden cabinet housing also a radio receiver and record-playing device. The equipment is used to provide soft music in the dining room and lounge, and race results, war news, etc., in the bars.

SPEEDY QUERY SERVICE

Conducted under the personal supervision of A. G. HULL

"Tassie" (Mosman) is a keen experimenter, but a bit short of power transformers.

A.—We wouldn't advise you to get a special transformer for the experiment. Use the original for the high-tension supply and simply fit a small filament transformer to supply the heater. Suitable transformers are available for a few shillings, and you will have no difficulty in picking up one with a 6.3-volt winding, which is practically a standard these days. You can easily mount it under the chassis and run a couple of twisted leads of hook-up wire to connect the primary in parallel with the primary of the original transformer.

* * *

T.L.P. (Bondi) wants details of how to use oscilloscopes.

A.—This subject was treated fully in the two issues, August and September, 1939, and as both these issues are still available it is unlikely that we will be running another article on this subject at the moment. A good general knowledge of radio practice is highly desirable before attempting to use the oscilloscope.

* * *

G.A.C. (Barellan) wants articles on subject of converting old motor-car starter motors to make them suitable for 240 a.c.

A.—We doubt if articles of this kind would have a very wide appeal amongst our readers, and we doubt whether the job could be done properly. It is unlikely that the brush gear would stand up to the higher voltage; in fact, the insulation throughout is not likely to be serviceable when used so far beyond its original design.

* * *

W.J.P. (Newcastle) is building the Fidelity Eight from the May, 1940, issue, but wants to use a pair of 6L6G type valves which he has on hand.

A.—It is possible to use the valves in place of the triodes specified, simply arranging the necessary screen connection and using a bias resistor of 250 ohms. There will be added gain and this may give you trouble with motor-boating or hum. Quite a good scheme is to use a class "B" (step-down) audio transformer, which will cut down the gain to a reasonable amount, and give you good quality, even with a cheap transformer.

* * *

E.S.H. (Wingham) wants data on the adjustment of permatune coils.

A.—In most cases the cores should not be adjusted, being left at the maker's settings, whilst the trimmers are used for the trimming. However, there was an article on the subject towards the end of the special serviceman's supplement in the May issue and we would refer you to this. If it does not give you all the data you require we will be pleased to hear from you again.

* * *

J.R. (Pokeno, N.Z.) asks several questions about an amplifier with 2A3 type valves in push-pull.

A.—The correct input transformer should be marked 5,000 ohms, but we doubt if the extra couple of thousand ohms could possibly account for the lack of power to the extent you mention. As might be expected, the original circuit was quite correct, having been designed by the engineers of the Valve Company, makers of Radiotron valves. There are two alternative ratings for the 2A3. The first uses a bias resistor of 375 ohms, with a plate voltage of 250 and a total plate current of 120 milliamps for the two valves. The other is with a 750 ohm bias resistor, a plate voltage of 300 and a total current of 80 milliamps. The first rating should give slightly less distortion, but not to an extent noticeable to the ear. The maximum power output is greater with the second. In our "Fidelity 8" the loading resistors were fitted across the transformer secondary sections to flatten the response by limiting the impedance at high frequencies, as recommended by the transformer manufacturers. Similar resistors are also recommended by Ferranti in their official circuits. Speakers of a few years ago not being particularly strong on highs, it become common practice to drop the resistors and allow the response of the transformer to peak at the high end, thereby giving a certain amount of compensation.

Type 250 valves are not made at our local factory, but the 45 type are, and when banked up in push-pull parallel circuits and loaded up with plenty of high tension (up to 350, which is beyond the maker's ratings), they give plenty of power. There is no reason why any circuit should not be broken up into separate tuner, audio and power sections, but we find that readers do not like the idea. We have from time to time described sets with the power supply on a separate base, but we find quite an antagonism to the idea, goodness knows why. The idea has lots to recommend it.

Referring to some remarks made by a reader in our May issue, Mr. Koen, of Adelaide, writes:

"I would like to take to task L. J. Alexander for his remarks on the service that you offer constructors of your sets (May issue). He thinks 'you should do more to encourage set-builders to learn something about radio besides soldering together a kit of parts.'

"I think he is barking up the wrong tree, as that is exactly what you are doing. He criticises you on printing a circuit diagram, a point to point diagram and a picture or two of the completed chassis.

"How on earth is a fellow going to learn to read a schematic diagram unless he can work it out for himself by using the point to point diagram as well, and also with the help of one of those fine valve charts, which the various makers supply.

"It's only the right thing to do, to supply full information by circuit diagrams and pictures, so as to get fellows fully acquainted with every aspect of the set-building game. And just because they get pretty good in time and do not need these diagrams then, that does not mean that the young chaps just breaking into the set-building game should be denied these advantages.

"And he calls it 'spoon-feeding'! How does anybody construct anything that is fairly complicated, except by blueprints or circuit diagrams. And, of course, the more information supplied, the easier and quicker the job is completed.

"I am inclined to think that L. J. Alexander thinks that he is pretty good; that may be so, but I think he should be more tolerant of the young fellow who is feeling his way into the set-building game by 'spoon-feeding' circuits and diagrams."

OSCILLATOR (Continued)

and earth terminals, and by adjusting the attenuator unit to a reasonable signal strength, various components in the receiver can be replaced to see whether they are working satisfactorily or not. It is advisable to use some form of output meter to measure the output being obtained, as the ear is very inaccurate in measuring changes of signal strength. In this way, if a valve is suspected of being faulty, it may be tested under its actual conditions by replacing with one known to be good while the test is being undergone. Any increase in output represents greater gain from the new tube than from the old and, consequently, the old tube may be considered as being faulty. Various minor components such as resistances and condensers may be tested in a similar manner.

5. Signal Tracing

The correct means for locating a fault in a radio receiver for service consists of what is known as stage testing. Stage testing is a means of localising particular faults being experienced to one individual stage. The various components of this stage may then be checked quite readily, resulting in a greatly reduced time of operation. The oscillator is a very fine instrument for locating faulty stages. To do this, the oscillator should be switched on and the range switch and dial turned to the correct intermediate frequency of the set under test. The hot lead should then be fed into the grid of the last intermediate tube, while the earth lead connects to the chassis. The receiver is now functioning only from the last intermediate stage and, consequently, if the function here is quite normal, it immediately eliminates the second detector, power tube, speaker, and power supply unit. The hot lead should then be transferred to the first intermediate or first detector, and if the receiver still continues to function, then the fault exists before this first intermediate or first detector, and the remaining sections between the intermediate or detector and speaker have been proved to be in good order.

Switching now to a broadcast frequency and feeding the signal into the aerial and earth terminals will locate the fault in the remaining few stages. The action of stage testing has been described in detail in other articles.

Technicians particularly interested in signal tracing, which is undoubtedly worthwhile to every serviceman, are advised to obtain a copy of the monthly publication made available by the Australian Radio College, of Broadway, entitled "Service." The issue of September, 1940, carries an article upon this form of service tracing. Copies are available for 4d. each, post free.

LEVENSON'S WIRELESS

Wholesale, Retail. Wholesale, Retail.

Games, Hobbies, Novelties, and Slot Machine Specialists.

226c PITT STREET, SYDNEY

Everything from A to Z in Radio at Sane Profit Prices.
'Phones:—M 2525 and M 2526-7. Goods forwarded C.O.D. Post or Rail. (C.O.D. Mail within N.S.W. only. Not Interstate). We welcome Prepaid Telegrams and Long-Distance 'Phone Calls.

VALVES AT SANE PROFIT PRICES. ALL GUARANTEED.

New 227 Valves, 5/9; used, 3/6. New 4XP, 5/-; S215, 5/-; MH4, 2/6. 38, 78, used 5/6. Raytheon B.H. Rectifier, new, 15/-; DU10, 5/-; 2A6, 35, used, 5/6. Used 224, 5/6. 610RC, 610XP, new, 6/6. Used 42, 5/6. New 41MRC, ML4, 3/-. 44SU Rectifier, 5/-. PM22, new, 7/6. Used 1C6, 6A7, 6A8, 6B7, 6U7, 6F6, 6F7, 6L7, 6/6. Used 57, 58, 59, 6/6; 201A, 3/6; A409, 6/6; A615, E406; E452, 6/6. Used PM6, PM5B, A609, 6/6. Used 6J7, 6J8, AL2, EK2, 2B7, 226, 5/6. New PM12, PM2A, 18/-. Let's know your valve wants.

Cone Speaker Units. Leading makes. Were up to 35/-. Now 7/6 and 10/6.

VALVES. MADE IN U.S.A.

Type	Price	Type	Price
57	10/6	85	12/6
58	10/6	6D6	11/-
38	12/9	6C6	11/-
32	11/3	6A7	11/9
2A5	10/6	1D8-Gt	24/3
2B7	14/-	42	12/-
27	11/9	2A7	13/6
6E5	5/-	71A	11/9
19	13/6	47	13/3
5K3	8/9	75	11/-
6J7	11/3	1A7G	15/-
2B7	10/-	30	11/-
6H6	12/9	80	9/6

SPECIAL! SPECIAL!
Cosmocord Crystal Pickup
British manufacture
84/-
Now 49/6
Special price to traders, lots of 6 or more

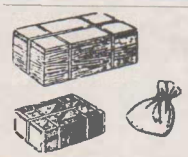
COSMOCORD CRYSTAL TYPE BRITISH BUILT AND DESIGNED GRAMOPHONE PICK-UP DE LUXE, with volume control built in as illustrated, 59/6.

AMPLION British built Gramo-Radio Pick-up with volume control. Moulded bakelite tone arm. List Price 37/6 Now 32/6.

Just landed! B.G.E. MICROPHONES. Table model. As good in performance as £6/6/- types. NOW 45/. Complete with Volume Control.

Reconditioned Hygrade 'phones, 15/-, 17/6, 20/-. Headphones—12/6, 15/-, 17/6, 21/-. Ericsson's Professional 4,000-ohm 'phones, 47/6.

Radio and other Publications Learn Morse, 1/-. Radio Dictionary, 1/-. Beginners' Radio Book, 1/-. Everyman's Radio Book, 5/6. The Television and Short-wave Handbook, 5/6.



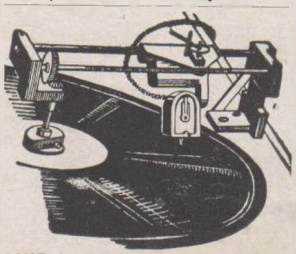
"PRESTO" THE MAGIC BOX
The most Amazing Trick — Just out

"Presto"— the grandest, most alluring and outstanding little trick ever introduced. 2/9, post free. Special quantity price.

Pick-up Heads. Fit and suit all tone arms and gramophones. For operating gramophone through radio. 15/-, 19/6 each.

Fixed CRYSTAL DETECTORS, 2/6, 3/6. Semi-fixed Crystal Detectors, 2/6, 5/6 6/6. Rubber Headphone Pads, 2/6.

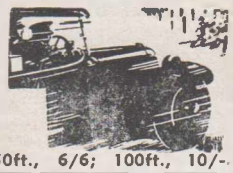
Little Jim's Mate BATTERY SET. In neat cabinet, with 'phones and all batteries. £3/16/5. Ready for use. Charts, 6d.



LIKE-A-FLASH Overhead Cutting Head and Cutting Gear £5/5/-.

HOME RECORDING

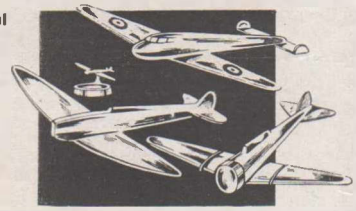
MAKE YOUR OWN RECORDINGS. Cutting head ond overhead cutting unit complete, £6/6/-. Plain Records, 2/11, 3/11, 4/11, 5/11. Cutting Needles, 2/-. Aluminium discs, 1/-, 1/6. Special price in trade lots.



Police Patrol Multi-Strand Rubber-covered Aerial. Needs no separate lead - in. 50ft., 3/3; 100ft., 5/-.
Man - o'- war Heavy Duty Insulated Aerial, multi-strand wires, 50ft., 6/6; 100ft., 10/-.

Rough Gunmetal Castings of Model Planes

● Write for Full List

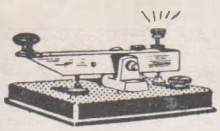


Rough-cast Propellor, with space for clock mounting in hub; length, 11," and stand 5/-
Rough-cast Ashtray, with mounting standard; diameter 4" 3/6
Rough-cast tear-drop shaped Ashtray, with mounting standard; length, 6" 3/6
Rough-cast Circular Concave Ashtray, with mounting standard, diameter 4¾" 3/6
Rough-cast Model Planes. Need little filing and finishing.
Comet, 3/-; Spitfire, 2/6; Hurricane, 3/-; large Foirey Battle, 4/-; Hudson, 2/6; large, 6/9; large Flying Boat, 12/6; Skua, 3/9; Wirraway, 2/6, 3/-; Anson, 2/6; Curtis, 2/9; Douglas, 3/-.
Chromed Ribbed Spun Metal Ashtry with standard (curved or straight) for mounting Plane Model; diameter, 6"; height, 1¾" 6/-
Chromed Hurrican, Lockheed, Spitfire or Wirraway Plane Model mounted on tear-drop shaped Ashtray 22/6

PLEASE ADD SUFFICIENT POSTAGE

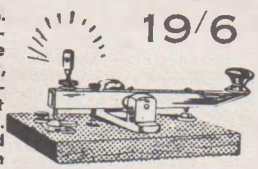
Set Test Leads, 2/9.

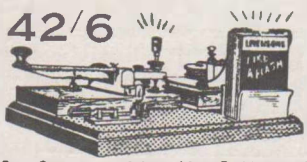
Three - Reading Pocket Meters. 0 to 8, 0 to 180 volts, 0 to 30 M/A. 10/6.



No. 1. — Adjustable Morse Code Key, with long or short tapper arms, splendidly made and finished. Strong reliable heavy plated fittings mounted on bokelite moulded base, 12/6.

No. 2.—P.M.G. Type odjustable Morse Code Key, strong and reliable; will last a lifetime. Heavy plated fittings on thick solid wooden base. Perfect action.





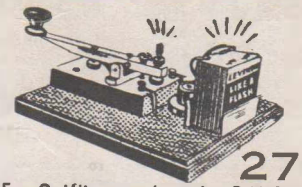
No. 3.—Set comprising No. 2 Morse Code Key P.M.G. Type, with light. Professional De Luxe Buzzer Battery. Throw-over Switch for buzzer or light. Use as required. Mounted on baseboard. Complete.

Large-size Hydrometers, 3/.

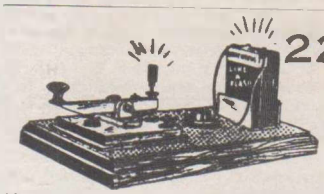
Nickel-cased two-reading Low and High Voltage Meters, 4/6.

Nest of 4-in-1 Metal or Bakelite Fountain-pen-size SCREWDRIVERS, 2/6.

Radio Amateur Call Book. 1938 copy, 5/-.



No. 5.—Outfit comprises the P.M.G. No. 2 Morse Code Key, with adjustable buzzer and battery all mounted on a stained baseboard, ready for immediate operation. Battery included.



No. 6.—A real good little outfit which incorporates the No. 1 adjustable Morse Code Key, in moulded bakelite base, with a smart little adjustable buzzer all complete to operate. Junior model, 13/6.

No. 102 — "Like-a-Flash" adjustable Buzzer. 4/6. Bakelite Case High Pitched.

Special price trade lots.

At left: PYREX TYPE INSULATORS. 3" barrel type, 1/-. Pyrex, 4," 3/6; 5½," 6/6; 7½," 30/-.

Ormond Slow Motion Front Panel 2-action Vernier Dial, 8/6.

P.M.G. type Heavy Brass FITTING SOUNDERS 35/-

WAR IS WON in the factories

TRAIN Yourself NOW TO TAKE YOUR PLACE IN A VITAL INDUSTRY

THE RADIO and COMMUNICATIONS INDUSTRY URGENTLY NEEDS TRAINED MEN

Total war, as its name implies, means conscription of the nations' resources in men, materials and wealth. It's up to you as an individual, therefore, to DECIDE FOR YOURSELF, before it is too late, just what place you are going to occupy in the national effort. The Radio and Communications Industry is attractive from two main angles: (1) It is a vital war industry that NEEDS skilled men; (2) it MUST grow and expand AFTER the war, thereby ensuring a bright FUTURE for the men who have the courage and foresight to TRAIN NOW!

WE CAN TRAIN YOU AT HOME OR AT OUR OWN BENCHES

The Australian Radio College offers ambitious men a sound, proven course in Radio Engineering. Sound because it is the result of many years' successful operation, proven because hundreds of ex-students owe their present jobs and success to the College. You can learn with equal facility in your own home (by means of our correspondence course) or attend night classes at the modernly-equipped college workshops.

PREVIOUS KNOWLEDGE UNNECESSARY

You don't need a knowledge of Radio or Electricity. We'll give you all you need of both — you'll start at the beginning, building-up knowledge just as carefully and systematically as you would lay brick after brick in its place when building a wall. You get the knowledge you want presented in a manner that makes it easy to learn FAST.

COSTS LITTLE

Think of this — for a few pence per day — actually less than many fellows spend on tobacco, you can prepare yourself for a man-sized job in Radio.

SEND FOR FREE BOOK

First thing to do if you want to secure the facts about Radio is to send in for "Careers in Radio and Television," a lavishly-illustrated book published by the College and available to approved enquirers. Send in coupon for your copy now. IT'S FREE AND POST FREE!

AUSTRALIAN RADIO COLLEGE PTY. LTD.

CORNER CITY ROAD AND BROADWAY, SYDNEY **PHONE: M 6391-2**

CONVINCING PROOF FROM EX-STUDENTS

". . . I am writing to let you know that I, who took your service engineering course, am now in camp with the 1st Corps HQ Sigs. of the 2nd A.I.F. I am in as a radio maintenance man and instrument (radio) mechanic. Because of the training I received from you, I am able to take my place as engineer in a wireless station or mobile van radio station.

"Because of the training I have had I am able to pass tests set by the instructors where many fail, and it will probably mean two or three stripes for me as N.C.O. in charge of full transmitting equipment."—C.T.S., Melbourne.

"I would like to thank you for my Certificate which I received quite safely. I would also like to thank you and the staff for your sincere co-operation while and since doing my course. I have also just received a position in the control room of one of our national stations, and like this work very much."—H. L. Hobart, Tas.

MAIL COUPON NOW **MAIL COUPON NOW**

To Mr. L. B. GRAHAM, Principal,
Australian Radio College Pty. Ltd.,
Broadway, Sydney. Phone: M 6391-2.

Dear Sir,

I am interested in getting into the Radio and Communications Industry. Please send me without obligation on my part the free book, "Careers in Radio and Television."

NAME .....

ADDRESS A.R.W.15

MAIL COUPON NOW **MAIL COUPON NOW**

MAIL COUPON NOW

"Careers in Radio and Television" is a book every man must read. Thickly illustrated with photographs of radio equipment and engineers at work, this book shows you how you can speedily enter a fascinating industry.

Printed by the Bridge Printery, 117 Reservoir St., Sydney, N.S.W. for the proprietor of the "Australasian Radio World," 117 Reservoir St., Sydney.