THREE FOUR PORTABLE

Practical Wireless

9D. EVERY MONTH

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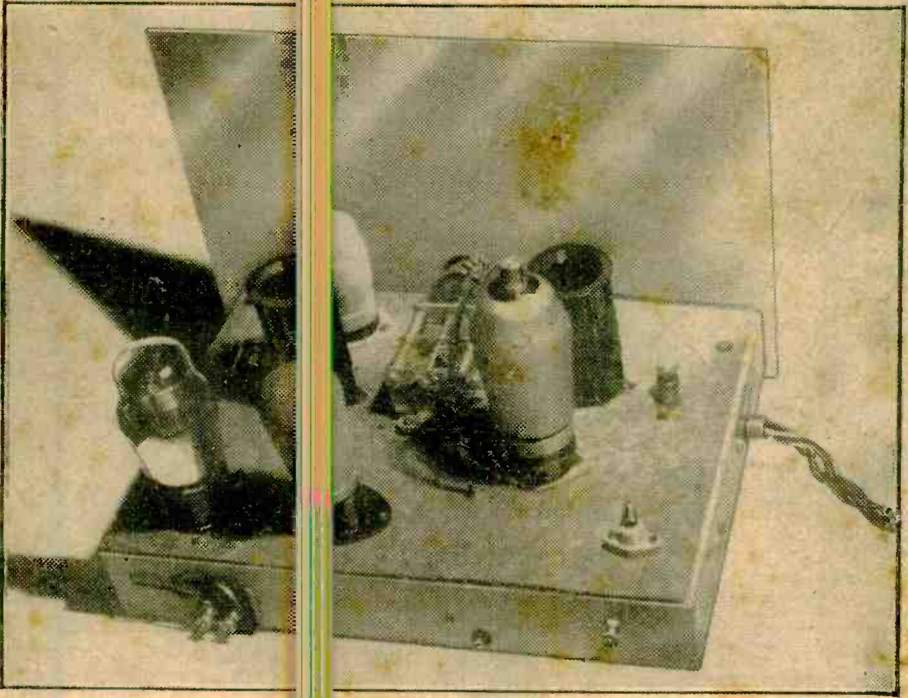

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PRINCIPAL CONTENTS

Practical Wireless

and PRACTICAL TELEVISION

15th YEAR OF ISSUE

EVERY MONTH
VOL. XXIII. No. 492. JULY, 1947.

Editor F. J. CAMM

COMMENTS OF THE MONTH BY THE EDITOR

The Fiftieth Milestone

IN April of this year was celebrated the 50th anniversary of the first demonstration of wireless telegraphy by Marconi; for it was in 1901 that Marconi first succeeded in sending signals across the Atlantic from Poldhu in Cornwall to Newfoundland.

Marconi, of course, was a true amateur in that he had few, if any, scientific qualifications. He experimented along the lines laid down by many previous scientific experimenters.

We are surprised that in the celebrations to commemorate the great work of Marconi so many famous names were forgotten. Sir Ambrose Fleming, Edison, de Forest, Sir J. J. Thompson, who discovered the electron, and many others were deserving at least of mention. Some did not even gain a passing reference.

It is true that the real starting point of much of the great achievements in radio science dates from the experiments of Marconi, whose feat was startlingly successful and confounded the critics. It was 20 years later that the existence of the Heavyside Layer was proved.

It was Sir William Preece who provided Marconi with the necessary facilities and encouragement, and they remained collaborators for many years. In the early days when radio waves were produced by sparks, it was these two collaborators who set themselves the task of finding some other and more satisfactory means, although it was some years before electrons and thermionic valves provided the solution. It was not until the end of the first World War that a revolution in radio took place largely as the result of the experiments and developments which had taken place during that war.

Radio workers then considered that long waves were better than short waves for communicating with the Antipodes. It was largely due to the work of the Marconi engineers that the possibilities of the short waves were examined. They found that although almost useless for short distance work, they could be received thousands of miles away at great strength, and it is only now after 20 years of further experiment that we are really beginning to understand what happens to short radio waves when they span the great distances between the component parts of our Commonwealth.

A great more, however, has to be done, for television is the inevitable next step, and to-day it is not much more advanced than was radio telephony at the end of the 1914-1918 war. It is true that its problems are perhaps greater notwithstanding the advance of our knowledge of electronics, but certainly the financial difficulties are not so great since we now have a Broadcasting Corporation drawing millions a year from the British public which it can devote to scientific advancement of electronics of which television forms but a small part.

The recording of programmes remains the great problem, but it is not insoluble. Someone may shortly discover the means, notwithstanding the great technical difficulties involved and the wide band of frequencies encompassed, of recording the programmes so that they can be repeated without requiring the presence of the artistes.

A great deal more is known to-day of the science of transmission, so television does at least start off on a firmer foundation than did radio in the days of Writtle, and 2LO. The sightless broadcast must eventually become as obsolete as the silent films.

Then there is the problem of colour television already well on the way to solution. It merely needs practical development. It is worthy of note that a system of television existed 20 years before the close of the last century and it was produced by Nipkow, a Russian, whose experiments were continued, not very successfully, by Baird.

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The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Wireless." Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, "Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Our Query Service

ONCE again may we remind our readers that our Technical Query Service is suspended and that a notice will appear in this journal when it is re-introduced. This does not apply, of course, to normal queries aroused by articles appearing in these pages.

We also regret that, owing to the absence of technical data relating to the very many items of ex-Service equipment which are now on the market, we are unable to answer queries concerning the modification, use or servicing of such apparatus.

ROUND THE WORLD OF WIRELESS

International Telecommunications Conferences

THE United Kingdom Government has accepted an invitation from the United States Government to send delegations to attend the following international conferences to be held at Atlantic City during the coming summer :

(1) An International Radiocommunication Conference, which opened on May 15th, for the purpose of revising the International Radiocommunication Regulations, last revised in 1938, including the allocation of the radio frequency spectrum between the various types of wireless service.

(2) An International High-frequency Broadcasting Conference, to be held immediately following the International Radiocommunication Conference, for the purpose of securing a better regulation of long-distance broadcasting services.

(3) A Plenipotentiary Conference of the International Telecommunication Union, which will begin on July 1st, for the purpose of drawing up a new International Telecommunication Convention to replace that signed at Madrid in 1932, and framing statutes under which the International Telecommunication Union will enter into relations with the United Nations Organisation.

R.S.G.B. Visits Eddystone's

DURING the morning of Sunday, April 20th, the president, council and regional representatives of the R.S.G.B. inspected the works of Messrs. Stratton & Co., Ltd.

They were then taken on a conducted tour round the various sections of the factory and were greatly interested in the many mechanical and electrical processes involved in the production of modern high quality radio equipment and components.

Following the tour of inspection, they saw a new item, the model "640" amateur communications receiver, an all-British product incorporating the latest methods of manufacture. This receiver has been designed as the result of close collaboration between a number of leading amateurs of wide practical experience.

Then came the presentation to the society (by Mr. Malcolm Laughton, a director of the company) of an Eddystone "640" receiver, for use at the new Headquarters station GB1RS. In preliminary speeches, Mr. A. C. Edwards (G6XJ), commercial manager of Stratton & Co., Ltd., said that many amateurs were on the staff of the company, which devoted much of its business to the needs of the amateur.

Broadcast Receiving Licences

THE following statement shows the approximate number of licences issued during the year ended March 31st, 1947.

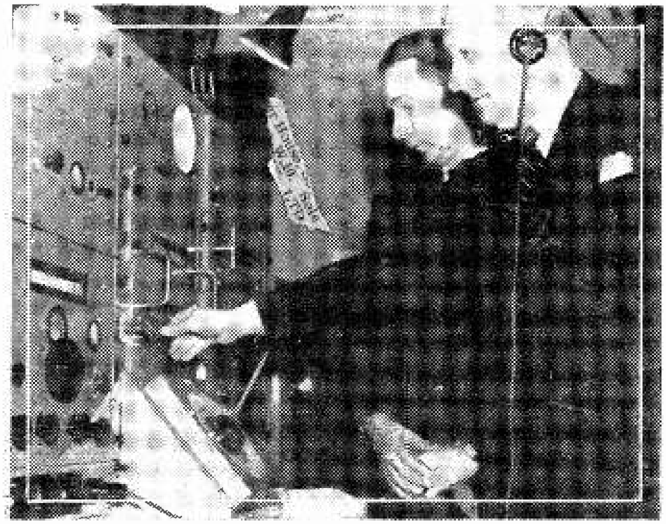
Region	Number
London Postal	2,016,000
Home Counties	1,431,000
Midland	1,531,000
North Eastern	1,652,000
North Western	1,426,000
South Western	921,000
Welsh and Border	615,000
Total England and Wales	9,592,000
Scotland	1,033,000
Northern Ireland	155,000
Grand total	10,780,000

During March there were 166 prosecutions for operating wireless receiving apparatus without the requisite P.O. licence.

1947 Radio Convention at Bournemouth

A RADIO CONVENTION, organised by the British Institution of Radio Engineers, was held at the Tollard Royal Hotel, Bournemouth, from May 19th to May 23rd, 1947. This was the first post-war event of its kind to be held by the Institution and was an extremely successful function.

The programme included lectures by authors of high repute in the scientific and engineering fields



Sir George H. Nelson recently opened an exhibition in London to commemorate the 50th anniversary of the Marconi Company. In the illustration above, Sir George, on the right, is seen with the Marchesi Guilio Marconi inspecting one of the exhibits.

of the British radio industry, as well as by French authors of equally high standing. The lectures covered a variety of subjects ranging from radio navigational problems to television and other aerials, valves, instruments, wave-guide multi-channel communications and transmitters.

Mr. Laughton presenting the new Eddystone "640" to Mr. Lewer, president of the R.S.G.B.

Another lecture of particular interest will be that on the ever controversial subject "High Fidelity Recording and Reproduction." This also will be accompanied by a series of demonstrations of modern technique developments.

Radiolympia Press Officer

THE Radio Industry Council have secured the services of Mr. Andrew Reid as Press agent.

Mr. Reid was Press Officer of the British Industries Fair for six years and of numerous other trade and public exhibitions before the war, as well as acting all the year round for various national industries. He served in the R.E. (Signals) in France in 1918 and in the Royal Signals from 1940 to 1945. From 1943 he held a General Staff appointment at the War Office.

Until immediately before the exhibition, Mr. Reid will work from his own offices at 11, Garrick Street, W.C.2 (Telephone: Temple Bar 4844), and he will welcome early information from exhibitors about their exhibits.

R.S.G.B. Delegates for Atlantic City

THE President (Mr. S. K. Lewer, B.Sc.) and General Secretary (Mr. John Clarricoats) of the Incorporated Radio Society of Great Britain are attending the World Telecommunications Conference in Atlantic City as representatives of the International Amateur Radio Union.

Their chief duty will be to endeavour to secure for the benefit of all amateurs additional frequencies and other privileges to as great an extent as circumstances will permit without endangering present frequencies and regulations.

Mr. George W. Bailey (President of I.A.R.U.) will be chairman of the delegation, and Mr. Kenneth B. Warner (Secretary of the I.A.R.U.) will act as his alternate.

The R.S.G.B. has proposed to the G.P.O. that the following bands of frequency be assigned to British Isles amateurs:

1,715-2,000 kc/s, 3,500-3,800 kc/s, 7,000-7,300 kc/s, 14,000-14,400 kc/s, 21,000-21,500 kc/s, 28,000-30,000 kc/s. Either 50-54 Mc/s or 58.5-60 Mc/s or 66-67.5 Mc/s. 166-170 Mc/s. 220-225 Mc/s, 400-430 Mc/s, 1,200-1,300 Mc/s, 2,300-2,450 Mc/s, 5,600-6,000 Mc/s, 10,000-10,500 Mc/s and 20,500-22,000 Mc/s.

With the exception of the frequencies 1,715-2,000 kc/s and 7,200-7,300 kc/s all allocations to be exclusively for amateurs.

Field-Marshal Montgomery Praises Army Set

IN a message to the Radiocommunication Convention recently, Field-Marshal Lord Montgomery gave high praise to the Army No. 10 Wireless Set, which provided eight telephone channels safe from interruption by the enemy. Lord Montgomery said (*inter alia*): "I have no hesitation in saying that I consider the No. 10 Set to be a very marked and rapid advance in wireless technique. No other army, allied or hostile, possessed equipment equally effective in its role.

"I had considerable personal experience of this Set during the campaign in N.W. Europe, most noticeably perhaps at the crossing of the Rhine and during the final pursuit through Germany. By using a chain of No. 10 Set stations I was enabled to maintain my Tactical Headquarters as far forward as I did and still have direct contact with London."

A new radio which incorporates an alarm device and switches itself on at a desired programme. Seen at the B.I.F. and known as the Goblin.

A Short-wave Four

A T.R.F. Receiver for Battery or AC/DC Operation —This Month We Deal with the Battery Version

THIS receiver may be built up for use with either mains or batteries, the supply being either AC or DC, and up to 250 volts in the former case. Both the versions have a similar layout, and plug-in coils are used so that efficient operation over all the usual short-wave bands is obtained. The receiver is quite compact, and special care has been taken to obtain the best results from the tuned R.F. stage, which increases selectivity and adds considerably to the sensitivity of the complete circuit. As will be seen from the illustrations, the receiver is tidy and not particularly complicated.

The Battery Circuit

The circuit of the battery-operated receiver is shown in Fig. 1. The aerial circuit is loosely coupled, a pre-set condenser also being used to reduce aerial damping. Volume control is obtained by adjusting the screen voltage of the R.F. stage by a .1 megohm potentiometer, as besides controlling volume this enables the screen voltage to be adjusted to the optimum figure when listening. The R.F. coil has a panel trimmer so that immediate adjustment for best results can be achieved with each pair of coils.

Transformer coupling is used between the R.F. stage and detector, followed by an R.C.C. amplifier, which feeds the output valve through a parallel-fed transformer. This gives good gain with stability, resulting in a circuit which gives ample loudspeaker reproduction from all the more powerful stations.

Battery connections are reduced to two only for H.T., but separate grid-bias connections are used so that the best voltages can be selected.

Mains Circuit

This will be given next month. The tuned circuits are the same, but volume control is obtained by adjusting the cathode voltage of the R.F. valve. As a rectifier has to be included no intermediate L.F. amplifier can be used, as this would require five valves. A pentode detector is used, however and combined with the somewhat greater efficiency of mains valves, the receiver provides results comparable with those given by the battery receiver.

No mains transformer is used, so that operation from DC is possible. Valves which operate efficiently with a comparatively low H.T. voltage are used, and it will be found little increase in gain results from increasing the H.T.

As is usual, the heaters are wired in series with a wire-wound dropper resistor and half-wave rectification is used. A second tapping on the dropper is used for the rectifier anodes, and the H.T. voltage applied may therefore be adjusted at will. Two condensers and choke provide smoothing, and no difficulty should arise in following this circuit.

Practical Considerations

The illustrations give a good idea of the layout. It was not found necessary to screen the coils as they are some distance apart, and this simplifies construction. In addition, no anode or grid leads require screening if the wiring is run as shown.

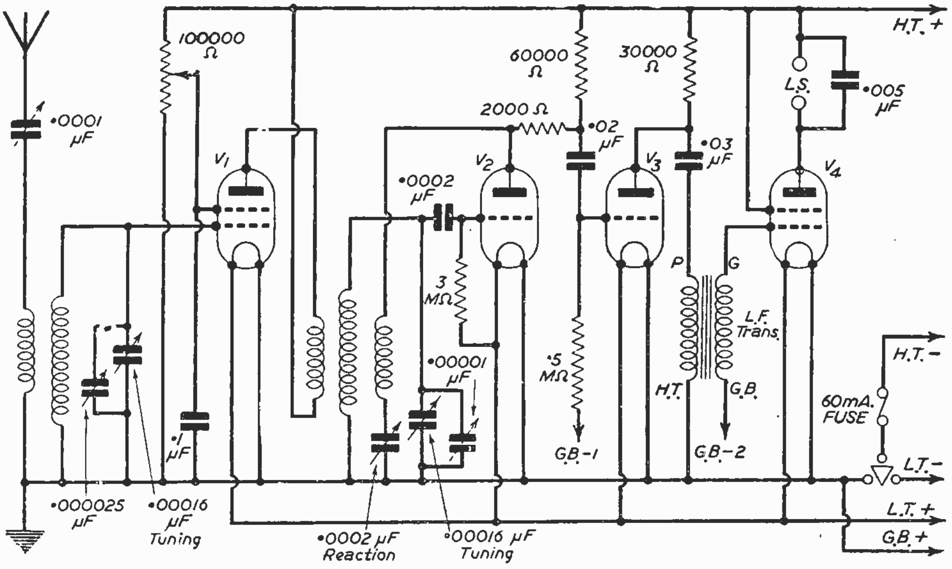


Fig. 1.—Theoretical circuit of the battery short-wave four.

COMPONENT LIST. BATTERY-OPERATED RECEIVER

4- and 6-pin coils (with holders) for wave-ranges desired.
2-gang, .00016 mfd. tuning condenser, with reduction gear drive and dial.
.0002 mfd. reaction condenser with reduction gear drive and knob.
.000025 mfd. panel trimmer with knob.
.0001 mfd. pre-set condenser.
.0002 mfd., .02 mfd., .03 mfd., and .005 mfd. fixed condensers. .1 mfd. paper condenser.
100,000 ohm potentiometer.
2,000 ohm, 30,000 ohm, 60,000 ohm, .5 megohm, and 3 megohm resistors.
Parafed L.F. transformer.
3-point on-off switch.
60mA fuse and holder.
Aerial insulator, and speaker terminals with block.
4-pin low loss holder; octal low-loss holder; 4- and 5-pin ordinary chassis holders.
Flex and plugs for battery leads, etc.
Valves: Mullard PM12M for R.F. Mazda HL23 octal for Detector. Osram H.L.2 for L.F. Cossor 220 O.T. for Output. (Or similar types.)

To simplify operation a reduction drive is used on the reaction condenser. Tuning is by means of a two-gang .00016 mfd. condenser. A reduction with a ratio of 36 : 1 makes tuning quite easy, and the trimmer scarcely requires adjusting except when coils have been changed, or the utmost volume is required.

A metal chassis (manufacturer's surplus) 9in. by 11in. is used, with a metal panel 9in. by 12in. The top of the chassis should be covered with a sheet of metal bolted in place, and the components placed on top. When everything is correctly located, the securing holes should be marked and the chassis carefully drilled, using 1¼in. diameter holes for the valve-holders.

The panel should then be drilled out, and secured to the front runner of the chassis by the lower control bushes. The coils should not be too near the valves, nor too near the centre where the tuning condenser is situated. Take care to have the key-ways of the octal holders positioned as shown when bolting them in place.

Constructing The Battery Receiver

The position of valve and coil holders is shown in Fig. 2. When wiring up, there are only four leads to take through the chassis. One of these goes from the insulator to which the aerial is to be attached to the .0001 mfd. pre-set. The second goes from the R.F. valve anode to the primary of the detector coil. Two leads from the gang condenser to the grid windings of the coils completes these connections.

Fig. 3 shows under-chassis wiring. It is best to commence with the important coil, grid and anode leads. 20 s.w.g. tinned-copper wire is suitable, with insulating sleeving where required. Leads carrying R.F. currents (those to the coils, and grid and anode of R.F. and detector valves, and aerial pre-set) should be kept clear of the chassis. It is recommended wiring be done as shown, with short earth-returns to the coils, etc.

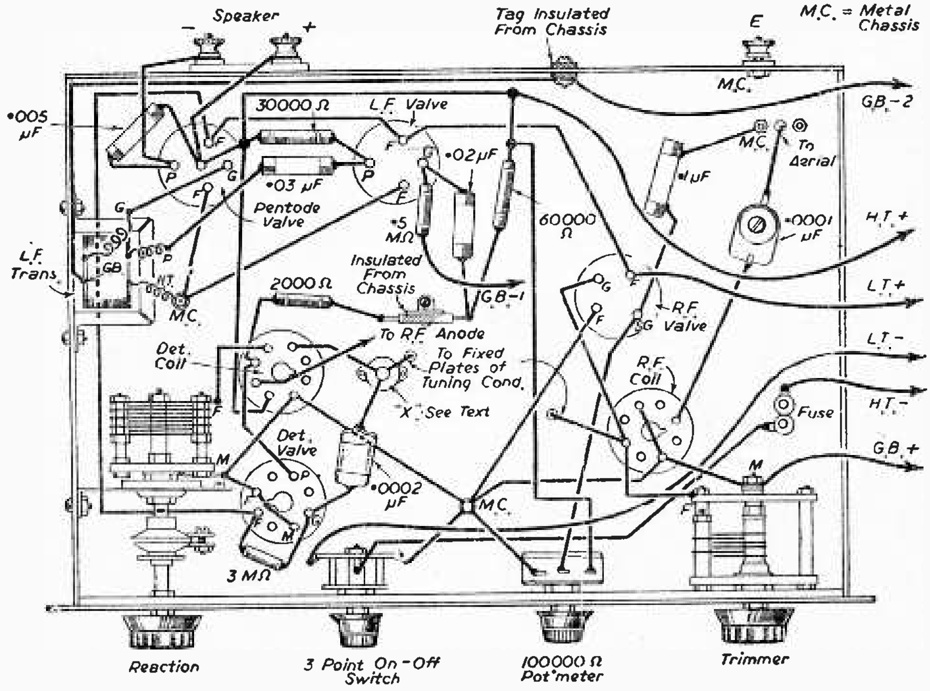


Fig. 3.—Layout and wiring of the battery receiver.

The 100,000 ohm potentiometer must be insulated from the chassis and panel unless it is of a type with a neutral spindle. The screen of the R.F. valve will otherwise be shorted to earth.

A small insulated tag is used to support the .02mfd. condenser and 2,000 and 60,000 ohm resistors connected in the detector anode circuit. A second tag can support the long lead from the transformer. All the battery leads are taken to a terminal block secured to the side of the chassis, not shown in Fig. 3. (The cover illustration shows this.)

The insulator marked "X" supports a plate forming a capacity to the chassis, so that the R.F. stage may be trimmed. This will be explained later.

Next month we will deal with the AC/DC version of this receiver. and give operating notes.

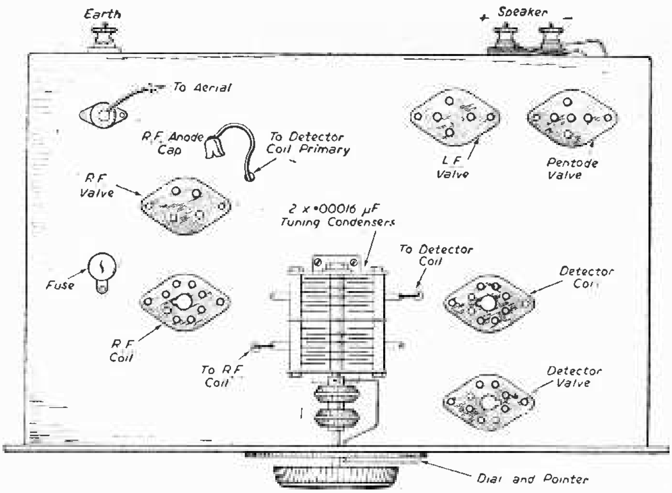


Fig. 2.—Chassis layout details.

New AC/DC Valves

A NEW range of Mullard A.C./D.C. valves to be released later in the year will be fitted with the spigotless version of the B.V.A. Standard Base. The introduction of alternative versions of the standard base is the result of varying manufacturing processes and technique, but the primary objective of interchangeability is nevertheless achieved. One standard socket (which must, of course, be designed to accommodate a spigot in any event to ensure interchangeability) will be used for both versions of the B8A base.

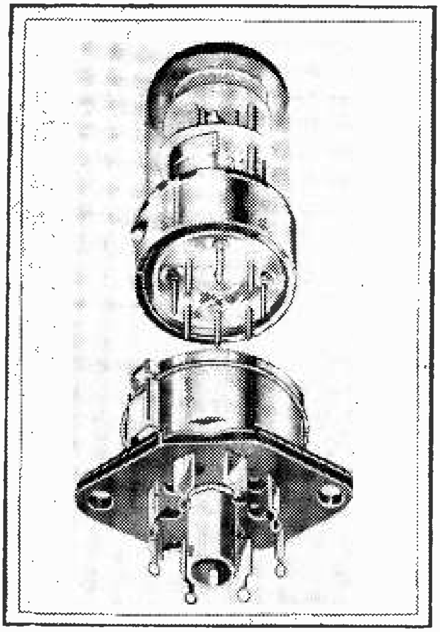
All-glass Valves

The new valves are a logical development of the Mullard all-glass valves (typified by the EF50, which was used in vast quantities during the war for a wide variety of applications). In these valves a flat glass disc, into which are fused rigid metal rods serving both as contact pins and electrode supports, replaces the glass pinch and plastic base. There are no separate leading-in wires with their numerous welded and soldered connections, the length of the lead-in is comparatively short, and the whole assembly is compact and rigid.

Insulation between pins is, of course, much higher than in valves of the "pinch" construction, and as the connections between electrodes and pins are very short, internal capacitances and inductances are greatly reduced. The result is a substantially improved performance at radio frequencies and particularly on short and very short waves.

While retaining all these advantages, the new valves are greatly reduced in size, thus satisfying the demand at home and abroad for small, inexpensive receivers. The new valves are only 22 mm. in diameter, and their length ranges from 66 mm. to 84 mm., according to type. They are fitted with the Standard B8A spigotless base and are used with the one type of socket which is suitable for both B8A versions.

Eight pins are employed and are spaced uniformly around a pitch circle of 11.5 mm. diameter. On account of this uniform spacing of the pins, a locating device is necessary. This takes the form of a small boss on the metal rim of the valve, which fits a corresponding groove in the socket. This is spring loaded and when the valve is pressed home it is effectively secured and cannot work loose or fall out in transit.



One of the new valves with a typical socket. The peripheral locating boss may be seen on the left of the base.

Simple Signal Tracing

Using Simple Equipment for Servicing Receivers.

By E. N. BRADLEY

WHILST signal tracing is becoming a popular method of fault finding in the servicing of radio receivers, the ready-made equipment used for signal tracing is so expensive to buy commercially, and is advertised in so many ways, that the ordinary radio experimenter is often confused as to the methods commonly used and may think that signal tracing gear is beyond his means. It is the purpose of this article, however, to show that signal tracing can be carried out with a minimum of gear, and, moreover, can be of as great value in the home workshop as it has proved to be in the service laboratory.

As might be expected, signal tracing is performed by tracing a signal through the set under test, the quality and amplification of the signal being observed aurally either in headphones or a loudspeaker, or by an indication given by a measuring instrument or visual device such as a Magic Eye. The first necessity, of course, is to supply a signal to the set in question in order that it may be traced, so that in some cases commercial tracing equipment contains a signal generator, but a separate generator may be used quite apart from the tracer. A cheaper and quite suitable signal is, however, provided by the B.B.C.—at least for signal tracing in an ordinary receiver! An ordinary radio signal may be applied to the receiver under test, and this signal, first as an R.F. modulated carrier, then as a modulated I.F. carrier, and finally as an audio output, may be inspected in the various stages as satisfactorily as may a signal from a signal generator. It should be said, however, that an efficient aerial should be used, and the strongest local station tuned.

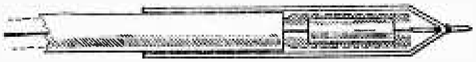


Fig. 1.—Details of the simple signal-tracing prod.

Immediately we see that an all-purpose signal tracer must contain a detector, in order that R.F. and I.F. carriers can pass on their modulated signal to the headphones or other indicator. After detection, too, the signal should be amplified.

The Simplest Method

Before dealing with all-purpose tracers, however, the simplest tracer of any may be mentioned—the headphone set. Where a faulty amplifier or gramophone-player is under test, one giving perhaps a distorted output or no output at all, a pair of headphones connected across each stage in turn—not forgetting the pick-up itself—will show at which point in the circuit the distortion is introduced or the signal lost. Having found this, work can be concentrated on this one stage and the fault found with no waste of time and effort.

Headphones cannot be connected directly across a valve circuit without an isolating condenser, however, to block the flow of DC through their coils, and at the same time a test prod is needed in order that connections to various points can be made rapidly. Accordingly, the isolating condenser—a necessity with any type of tracer—and the contact point are combined in the test prod shown in Fig. 1. Even with a small tracer, where the amplification is limited, it pays to screen the whole of the circuit, whilst in a more comprehensive tracer heavy screening is an absolute essential to prevent feedback over the tracer itself, and screening of the prod must be most carefully arranged. The body of the prod may be formed of a bakelite test prod, with the isolating condenser fitted into the tube, the lead from the condenser to the main tracer being well screened and preferably of coaxial cable. The prod lead must be as short as is conveniently possible, for the prod and lead together will present an added capacitance to any tuned circuit and thus change the tuning to some degree, an unfortunate but unavoidable state of affairs. By keeping the lead short and the prod capacitance small, however, the effect on a tuned circuit is minimised.

The capacity of the condenser built into the prod depends on the type of tracing to be performed, but whatever condenser is used the screening of the lead to the prod must be carried on to include also the condenser, a small piece of copper gauze wrapped round the condenser and connected to the lead screen giving excellent protection. A small condenser must be chosen to fit into the prod, of course, and even so it may be necessary to enlarge the central bore, but this is a simple matter.

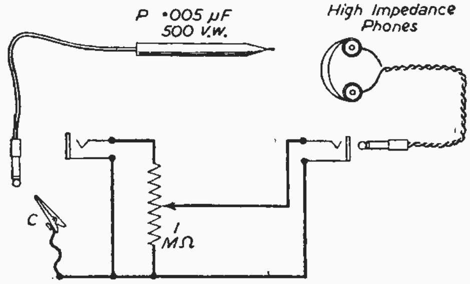


Fig. 2.—A simple audio-frequency tracer.

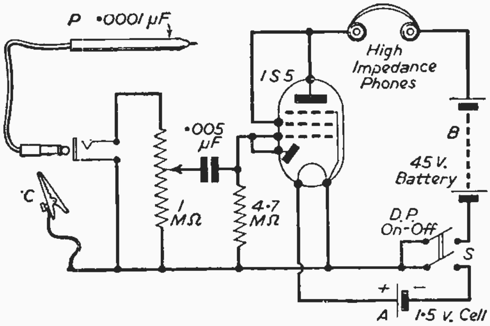


Fig. 3.—This is the circuit of a simple battery-operated tracer for R.F. and A.F.

The prod tip should also be no longer than necessary to give positive contact.

An A.F. Tracer

The prod for the simple tracer shown in Fig. 2 contains a capacitance of 0.005 mfd., since this tracer is designed to deal only with the audio frequencies. It is, indeed, no more than a pair of headphones coupled to the isolating condenser via a volume control. The jacks shown in the diagram are by no means essential, but jack connection is a useful asset with most forms of tracer.

One side of the volume control, via the prod, is connected to the "live" side of the audio stage under test—a valve anode, a grid socket or pin, or a transformer terminal, etc.—whilst the circuit is completed through the clip C, which is connected to the chassis and thus gives an earth connection.

For dealing with R.F. and I.F. signals, however, a valve circuit is necessary, and a small tracer designed and used by the author is shown in Fig. 3. In this circuit one of the useful and efficient 1.4-volt filament valves is used, the 1S5, a type which combines a diode detector with an output pentode. Since less than 1 mA. is drawn from the H.T. battery and only 50 mA.s from the single cell which supplies the filament, the whole circuit with its batteries can be contained in a small metal case.

The prod is fitted with a 0.0001 mfd. condenser, and the volume control is isolated from the valve by a further 0.005 mfd. condenser, but even so the tracer can be used on either audio- or high-frequency signals with adequate signal transference in either case. When the prod is applied to a circuit carrying audio-frequency signals the diode has little effect on the working of the tracer, but when the prod is applied to an R.F. or I.F. circuit the signal is demodulated as in an ordinary diode detector, the audio signal voltages are set up across the high resistance to which both grid and diode are coupled, and thus are amplified and passed on to the headphones.

Power Supplies

A layer built type of H.T. battery is sufficient to provide the tiny H.T. current drain, such a battery being very small and thus fitting into a little space, but three or four grid-bias batteries connected in series to give 27 or 36 volts can be used just as effectively, and will provide a rather cheaper and more easily replaced source of current. The single cell may be of the ordinary small torch type, with connecting leads soldered on to the central brass cap of the positive electrode and the main zinc body of the cell, the soldering operation being carried out as swiftly as possible to prevent heating of the cell's internal elements.

The tracer of Fig. 3 is used in the same manner as that of the previous circuit, the prod being tapped on to the "live" side of the gear under test with the clip C running to the chassis.

Although this type of tracer is capable of excellent work it cannot give an indication when connected to a circuit carrying unmodulated R.F.—for example, it would be difficult to ascertain with such a simple tracer whether or not the oscillator of a superheterodyne receiver were working. To show the presence of an unmodulated carrier, the best indicating device is almost certainly the "Magic Eye" preceded by a detecting and amplifying stage or stages, and such a tracer is shown in Fig. 4.

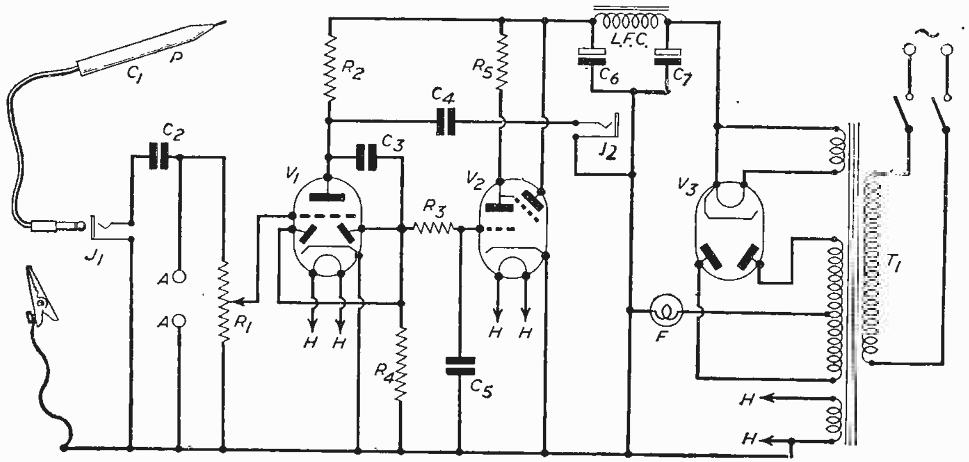


Fig. 4.—Circuit of a multi-purpose, mains-operated signal tracer.

Using a "Magic Eye"

In this circuit modulated R.F. is dealt with by the triode section of V1, which is connected as a grid detector, and since the bias applied to the valve is entirely dependent on the magnitude of the applied signal this detector can also be connected, without any change of circuit, to weak or strong straight audio signals. Whether modulated R.F., I.F. or straight audio is applied to the test prod, therefore, the final result is an audio signal in the headphones together with a fluttering of the shadow in the "Magic Eye." The signal is passed on to the diodes of the double-diode-triode and in consequence a direct current flows through R4, creating a voltage drop dependent on the momentary amplitude of the current and thus on the signal amplitude, so that a fluctuating bias is supplied to the control grid of the "Magic Eye."

The "Eye" therefore, may be used to give a comparison of signal strengths, but its main use is in the detection of unmodulated R.F. Such a signal will give no indication in the headphones, but when the prod is connected to the anode of an oscillating circuit, such as an oscillator in a superheterodyne, the "Eye" will close either partially or completely, giving evidence of a carrier wave which cannot be traced by the use of aural indicators.

The circuit of Fig. 4 may be built using either 4- or 6-volt valves. The latter type will allow the first stage to give rather greater amplification, but there is little to choose in ultimate efficiencies.

COMPONENTS LIST FOR A MULTI-PURPOSE SIGNAL TRACER. Fig. 4.

C1 (prod)—0.0001 mfd., mica.
C2—50 mmfd., silver-mica.
C3—0.0003 mfd., mica.
C4—0.1 mfd., non-inductive, 500 volt working.
C5—0.05 mfd., non-inductive, 350 volt working.
C6—16 mfds., electrolytic, 350 volt working.
C7—8 mfd., electrolytic, 500 volt working.
R1—1 megohm volume control.
R2 (for 4-volt operation)—51,000 ohms, 1 watt.
(For 6-volt operation)—220,000 ohms, ½ watt.
R3—2.2 megohms, ½ watt.
R4—470,000 ohms, ½ watt.
R5—1 megohm, ½ watt.
L.F.C.—20 henrys, 50 mA.
J1—Prod input jack.
J2—Headphone jack.
F—60 mA. fuse bulb with holder.
T1—200-250 volt primary.
250-0-250 v. 50 mA.
4 volt. 2A. 4 volt. 2A.
or 5 volt. 2A. 6 volt 1A.

For 4-volt operation

V1—ACHLDD.
V2—ME41.
V3—UU6.
1 British 7-pin chassis mounting valveholder.
2 Mazda Octal chassis mounting valveholder.

For 6-volt operation.

V1—6SQ7.
V2—Y63.
V3—5Y3.
3 International Octal chassis mounting valveholders.
Chassis, screening case, coaxial cable for prod, etc.
Input sockets, A—A.

For greater convenience in the testing of microphones and pick-ups, this tracer may have an alternative input point, A.A. Equipment connected here feeds directly into the triode.

Using the Tracer

To use a signal tracer to find faults in a receiver, first ascertain that the faulty set may be switched on with safety. If the power pack is in good order, the set is then put into operation and is tuned either to the strongest local station or to the output from a signal generator. Whether the loudspeaker of the receiver gives signals or not depends on the fault—the set may be right out of commission or may be giving distorted results, or intermittent changes in output amplitude, etc. Whatever the fault, commence signal tracing from the aerial input socket back towards the loudspeaker—that is, in the reverse direction to the generally accepted method of receiver inspection by other test means.

If the signal is strong, connecting the tracer to the aerial may bring in the station, together with other strong signals, but the signal should be heard in the tracer 'phones when the prod is applied to the first grid of the set—that is, when the prod and clip C are directly across the first tuned circuit. It may be necessary to "rock" the receiver tuning condenser to correct for the extra capacitance introduced by the tracer, but for the simple tracers described here the input signal must be strong for a good result to be obtained with the tracer connected across the first tuned circuit. Placing the prod on the anode of the frequency changer should certainly bring in the signal, however; if not, check the oscillator for correct working, shown by the "Magic Eye" tracer with ease and certainty. Continue to trace through the stages of the receiver, from grids to anodes. If no output from the set is obtained, the stage will rapidly be found where the signal disappears; if intermittent fluctuations or distortion are present these too will rapidly be traced to their sources. A full exposition of the theory and practice of signal tracing would require far more room than can be given to the subject in these pages, but with the circuits and hints given the experimenter will at least be able to build and operate a simple tracer, for, after all, a little practice is worth a great deal of theory.

Film Producer Uses Frequency Modulation

DURING the last couple of years a new battle has been developing in radio circles in the United States, and it is dividing the "hams" and the listening enthusiasts into two camps.

It is the battle of "A.M." *v* "F.M." It centres around the question whether future broadcasting shall be carried on by the old and trusty method of "amplitude modulation" or whether it shall be replaced by the comparatively new-fangled "frequency modulation."

The trouble is that the whole principle of technique is different, and the adoption of FM in place of AM involves tremendous expense at the transmitting end—practically new stations—and new type receivers at the listening end.

Latest application is in the use of the method of film-production. FM two-way radio communication was utilised for the first time in photographing a train wreck sequence in David O. Selznick's "Duel in the Sun," at Sonora, California.

The film includes a scene in which a railway train is deliberately wrecked on a mountainside, and this called for close co-operation between various points on particularly difficult terrain. Any interference with communication at a crucial moment could have been both dangerous and expensive.

Application was made to the Federal Communications Commission in Washington, and two experimental licences were issued with the call signs KBPI and KBPK for FM operation on 33.54 Mc/s (8.94 metres). The radio side of the operation was supervised by William V. Stancil, a well-known U.S. radio and electronics engineer.

A Quality S.W. Superhet Unit

Variable Selectivity, R.F. and I.F. Regeneration, Cathode Follower Detector Circuit, and an Original A.V.C. System.

By C. SUMMERFORD

THE "straight" short-wave receiver has, since the start of broadcasting below 100 metres, been deservedly popular, especially with the beginner, on account of its simplicity of construction; and doubtless there are few experienced amateurs who at some time have not built one or more of these receivers.

One of the strongest arguments in favour of the "straight" receiver in the past has been that of low noise level or to put it another way, high signal-to-noise ratio.

This is very true, but (and it is a big but) it falls down badly on the question of selectivity because no matter whether the receiver has one, two, three, or more R.F. stages it will still compare unfavourably with a simple superhet in this respect. As to the signal-to-noise ratio of the superhet being inferior to the "straight" receiver, with modern valves and a properly designed circuit this argument no longer holds.

Most modern short-wave superhets have a single R.F. amplifying stage preceding the frequency changer, and as this does not usually give a high enough signal-to-noise ratio, an add-on unit containing at least two more R.F. stages is generally used. The writer does not favour this method because no matter how good a valve may be, it is bound to introduce a certain amount of noise which may quite possibly be out of proportion to the amount of gain obtained at, say, 10 metres.

Thus it will be seen that if two or more R.F. stages are used, the signal-to-noise ratio will be improved but will still be below that obtainable from a "straight" receiver.

This does not, of course, apply if one of the stages has regeneration. In any case, if regeneration is used before the frequency changer the extra valves are, in the writer's opinion, quite unnecessary.

Owing to the fact that the reception of short-wave stations is rather an erratic business, many constructors do not consider it worth while to build receivers for quality reproduction. But surely, no matter how distorted the signal is at the aerial terminal, it is very poor practice to allow it to be further distorted in its passage through the receiver. Besides there are times when scores of stations can be received at really high quality.

Very well then, our desired receiver is beginning to evolve. The points we have made so far are that we need a high signal-to-noise ratio without the need for an additional R.F. unit, and the ability to reproduce at high quality when required.

Two other items needing special attention are variable selectivity and automatic volume control; and these will be dealt with later.

The Circuit

Fig. 1 is the circuit diagram of a superhet unit covering all of the above requirements which has been designed specially for use with "The 10-watt Quality Amplifier" recently described. It is claimed that this has a signal-to-noise ratio at least as good as the T.R.F. receiver. Of the several frequency changers tried in this circuit, the 6K8 proved to be by far the most efficient, and besides being quiet in operation, it is practically non-microphonic. A most important point this last, especially when using the high selectivity position.

Standard "Eddystone" or similar type four-pin coils are used both for the input and oscillator circuits of this valve.

Tuning is carried out by a 150 mmfd. two-gang variable condenser, and in order to reduce the number of controls, mechanical bandspread has been decided upon in preference to the electrical kind.

LIST OF COMPONENTS

- L1. See text.
- L2, 3, 4, 5. Standard Eddystone four-pin coils.
- Ch. 1. Any good quality short-wave choke.
- Ch. 2. Wearite P A.F. coil.
- I.F. 1. Bulgin C51.
- I.F. 2 and 3. Bulgin C50.
- C1, 2, 4, 5, 6, 8, 9, 11, 12, 13. .01 mfd. 350 volt mica.
- C3. .00005 mica.
- C7, C18. .001 mfd. mica.
- C10. .05 mfd. tubular.
- C14. .1 mfd. tubular.
- C15, 16. .0003 mfd. mica.
- C17. .0001 mfd. mica.
- R1, R13. 1,000 ohms ½ watt.
- R2, 5, 8, 10. 5,000 ohms ½ watt.
- R3. .25 megohm ¼ watt.
- R4. 40,000 ohms 1 watt.
- R6. 30,000 ohms 1 watt.
- R7. 350 ohms ½ watt.
- R9. 100,000 ohms ½ watt.
- R11. 90,000 ohms 1 watt.
- R12. 325 ohms ½ watt.
- R14. 500 ohms ½ watt.
- R15. 10,000 ohms ¼ watt.
- R16. 50,000 ohms ½ watt.
- R17. .5 megohm ¼ watt.
- VR1. 10,000 ohms carbon type vol. control.
- VR2. 10,000 ohms wire wound vol. control.
- Sw. 1. Single pole three-way switch.
- Sw. 2. Single pole toggle switch.
- VC1, VC3, VC7. 150 mmfd.
- VC2. 25 mmfd.
- VC4. 25 mmfd., trimmer type.
- VC5. 40 mmfd.
- VC6. 250 mmfd.
- TC1. 20 mmfd., trimmer type.

VALVES

- V1. 6C5.
- V2. 6K8.
- V3. EF39.
- V4. 6C5.
- V5. 6H6.

VC4 is the oscillator trimmer condenser and is a preset of 25 mmfd., while VC2 is the first detector trimmer, and this takes the form of a 25 mmfd. variable which is panel controlled by a slow-motion drive having a reduction ratio of 9 : 1.

Preceding the 6K8 is a 6C5, which serves the dual purpose of reactor and A.V.C. controlled valve.

Several ways of applying regeneration to the input circuit of the 6K8 were tried before the use of a separate valve was decided upon ; and even then capacity control was out of the question on account of the rather large tuning shift that takes place with this form of regeneration at the higher frequencies.

The cathode-controlled system shown in the diagram is quiet in operation, comes up to the oscillation point smoothly, and does not shift the tuning to any appreciable extent.

An inductance (Ch.1) inserted in the cathode return circuit of V1 is shunted by a variable resistance (VR1), a variation of which alters the input resistance of V1. As VR1 is increased, a point is reached, eventually, at which oscillation takes place. This is when the input resistance changes from positive to negative.

Ch.1 can be any good short-wave choke (the writer uses one of the Eddystone skeleton type), and VR1 is a carbon type potentiometer used as a variable resistance. In order that regeneration shall be smooth throughout the range to be covered, a small postage-stamp type trimmer (TC1) is included as shown, to reinforce the grid/cathode capacity of the valve. This will probably have to be slackened off until it is almost completely open, as a capacity of about 5 mmfd. is all that is usually required.

The grid-leak of the 6C5 has its earthy end taken to the A.V.C. line, and a switch (Sw.2) is wired in at the junction of this and the A.V.C. filter so that the A.V.C. may be switched in or out as required.

A minimum bias of about 7 volts is given to the 6C5 by R1, and this is by-passed in the usual way by C2.

Eliminating Deadspots

As there is no R.F. stage to act as buffer between aerial and frequency changer, we must find some other way to eliminate deadspots. This takes the form of a switched, tuned inductance (L1, Sw.1, VC7) inserted between the aerial and primary winding of the input circuit.

L1 consists of 50 turns of 22-gauge D.S.C. wire wound on a 1¼in. former, adjacent turns spaced by the thickness of the wire and tapped at six and 20 turns. The tuning condenser capacity is not critical and can be anything from 100 mmfds. upwards.

Due to the fact that the efficiency of the R.F. circuits is of very great importance in a good short-wave receiver, we have dealt with this at some length ; however, we will now turn our attention to the remainder of the circuit.

Although it is becoming increasingly fashionable to have an intermediate frequency of 1,600 kc/s. such a high I.F. makes tracking of the input and oscillator tuning rather more difficult, especially so in a circuit such as this one when we have "sharp" tuning at the first detector. Furthermore, good selectivity is much more difficult to obtain.

An I.F. of 465 kc/s has therefore been chosen for this receiver. This makes tracking much easier

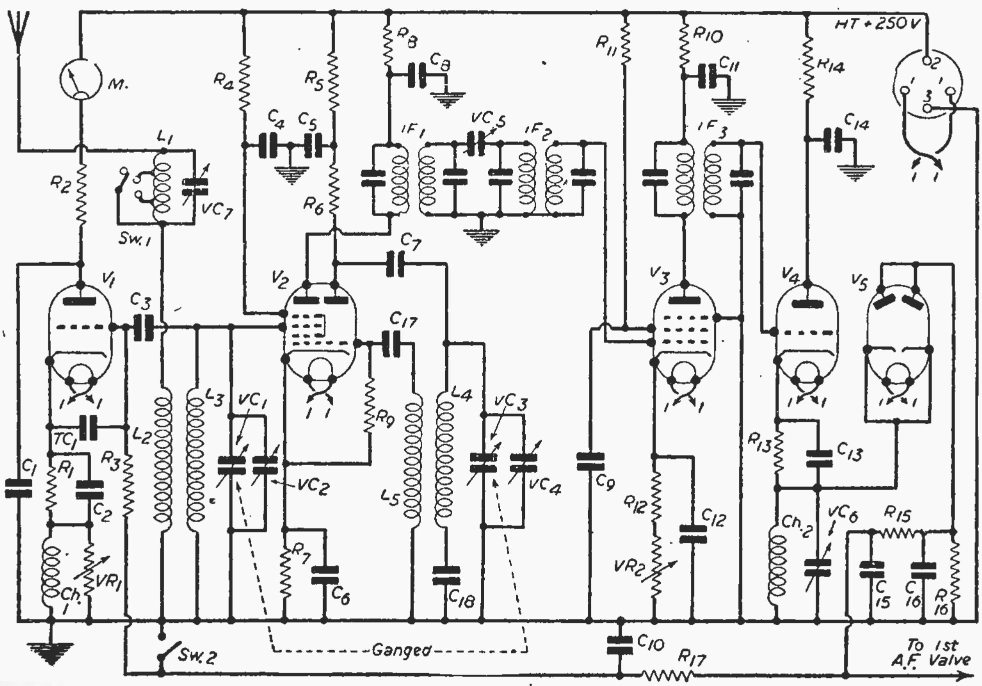


Fig. 1.—Theoretical circuit of the Superhet Unit. The 4-pin plug on the right is for connection to an amplifier—preferably the 10-watt Quality Unit described in these pages recently.

and gives us good selectivity. In order that selectivity may be variable, two I.F. transformers are used between the frequency changer and intermediate frequency amplifier, and these are connected back to back, coupling between them being by a 40 mmfd. variable condenser. A further I.F. transformer couples the EF39 to the 6C5 cathode follower.

All transformers are of the air-cored type made by Bulgin; I.F.1 is Cat. No. C51 and I.F.s 2 and 3 Cat. No. C50.

Some increase in gain could [illegible]s be obtained by using iron-cored I.F. transform[illegible]there is a possibility that the receiver would [illegible] stable. In series with the cathode resistor of the EF39 is a variable resistance of 10,000 ohms which is used as an I.F. gain control.

D.C. Load

One of the biggest problems with the ordinary diode detector is the difficulty of obtaining a reasonable ratio of A.C. load impedance to D.C. load resistance.

With most receivers the D.C. load resistance is kept fairly high and the ratio rarely exceeds 0.7, a figure which means that distortion is bound to be present on deep modulation.

By dropping the D.C. load resistance to 100,000 ohms or less, the handling capabilities are greatly increased. But if this is done the input impedance of the detector drops to rather less than 50,000 ohms and heavily damps the input circuit with consequent reduction of both sensitivity and selectivity. The undistorted output of the I.F. amplifier valve is also reduced.

All of these disadvantages may be overcome by feeding the diode from a cathode follower as shown in the diagram.

The output impedance of this valve measured at Ch. 2 is somewhere around 500 ohms, a value that is so small, relative to the probable detector input impedance, that the latter becomes more or less unimportant.

We can now make the detector load resistance 50,000 ohms without impairing selectivity, and if a value of .5 megohm is chosen for both the A.V.C. filter resistor and the grid-leak of the first A.F. valve, the A.C. to D.C. ratio rises to slightly more than 0.9. The cathode impedance Ch. 2 has an inductance of about 1,000μH and a Wearite type P A.F. coil is quite suitable in this position. If this is shunted, as shown, by a variable condenser (and this should have a maximum capacity of not more than 200 mmfds.) regeneration is obtainable at I.F.

A.V.C. Arrangement

Really good A.V.C. is usually rather difficult to obtain in a receiver of this nature, but in this circuit a somewhat original kind is used which has proved most effective.

Control of the frequency changer and I.F. amplifier was tried at first both by the delayed and non-delayed method, but was discarded for the following reasons: Tuning shift with variation in signal strength, poor control, cross modulation caused by overloading of the frequency changer on strong signals.

Finally, it was decided to apply simple A.V.C. to the grid of the R.F. reactor valve only.

In case there are any readers who think that control of one valve cannot possibly be effective, I would hasten to point out that with this receiver R3 signals produce practically the same aural output as those of a strength of R8, and even R9 plus signals are "held down" to reasonable strength.

The system is very simple really, and all that happens is that the A.V.C. takes the input circuit either up to, or away from, oscillation point as it follows signal variations. Naturally, the more critical the setting of VR1 the more effective will be the A.V.C. By installing a panel-mounted milliammeter between R2 and maximum H.T. we have a combined tuning indicator and "S" meter.

As the circuit stands, excellent regeneration is obtainable from 9 to 80 metres, but if it is desired to extend the range to take in the 160-metre band, a further variable resistance of 50,000 ohms must be wired in series with VR1 and the latter may then be used as a vernier control.

Unmodulated C.W. "fans" doubtless think that, due to the fact that no B.F.O. valve is used, their "pet" signals are not receivable with this unit. However, by fitting a slow-motion control to VC6 we can make V4 gently oscillate and give us a modulated signal of a pitch dependent on the setting of this control.

We now have a simply constructed receiver having the following refinements: A tuned aerial system, variable selectivity, R.F. and I.F. regeneration, efficient A.V.C., B.F.O. without an extra valve, and almost distortionless detection.

Adjustment follows normal superhet practice and calls for little comment; and although a modulated test oscillator is very helpful, especially for aligning the I.F.s, it is not absolutely essential. The oscillator trimming condenser (mounted on VC3) should be set "half in" and the small discrepancies in the ganging can then be "taken up" by panel operated VC2.

Operation

To operate the receiver it is recommended that with VC5 and VR2 at maximum and VC6 and VR1 at minimum settings, the required band should first be located and the ganged condenser tuned to the high frequency end, after which the wave-trap circuit (L1, VC7, Sw.1) should be adjusted for maximum gain.

Tune to a clear space between stations at the H.F. end, increase VR and at the same time slowly swing VC2 until there is almost oscillation, re-tune to bring in the first station in the band and adjust VC2 until a minimum reading is reached on the tuning indicator. Ganging will now "hold" over the entire band.

The settings of VC5, VC6 and VR2 are adjusted to suit the prevailing reception conditions.

Incidentally, the milliammeter tuning indicator can be used for accurately adjusting the I.F.s in the same way as described for the R.F. circuits, i.e., by adjusting for minimum reading.

The DX capabilities of this receiver have been thoroughly tested and in this respect can be said to be really exceptional.

Selectivity is completely adequate, and quality of the production, when using the least selective position and given decent conditions, is excellent.

ON YOUR WAVELENGTH

By THERMION

H. G. Wells and Radio activity

ONE of Mr. H. G. Wells's forecasts has not only been fulfilled, but it is particularly appropriate to the year of his death. I knew him intimately, and the last occasion on which he made a public appearance was at the Roadfarers' Luncheon at which he made a typically Wellsian and witty speech. The forecast to which I refer appeared in his book, first published in 1913, entitled "The World Set Free," and in it he foretold that in 1933 artificial radioactivity would for the first time be produced. It was in 1933 to the very year that Irene Curie and her husband, Professor Joliot, made their joint discovery. Production of radioactive substances was, of course, largely a wartime development of research on the atom. It is because greatly increased supplies of these substances will shortly be available, and because of the danger which attaches to any form of intense radioactivity that the Government is now seeking power to control their distribution. Their main use is, of course, in medicine and research, and it was these two uses which stimulated H. G. Wells's imagination in the latter years of his life.

It is not generally known that H. G. Wells was really a man of science as well as a writer of scientific fiction. As a lad, when he lived in Windsor, and became a draper's assistant to Rogers and Denyer in the High Street, he was extremely interested in the discoveries of Hertz and others who paved the way for the Marconi experiments, leading up to that epoch-making day in 1901 when Marconi transmitted from Poldhu in Cornwall to Newfoundland the first radio signal consisting of three dots. Much has been done since those days. He was greatly interested in radio and a keen listener as well as a critic. As far as I can recollect he did not appear before the microphone. He had not a microphone voice; it was high pitched, although I preferred it to some of the cacophonous voices we hear over the microphone to-day, and particularly in the Brains Trust.

Chatting to him one day in his flat, he told me of the enormous amount of trouble he took to get his scientific facts right. On the question of radio he consulted scientific experts who read through his manuscripts to make quite sure that the fiction did not transcend the bounds of feasibility. I hope these facts emerge when his biographer produces the life story of the greatest writer of our time.

Cheaper Television Coming

ONE of the interesting exhibits at the British Industries Fair were the high-quality, yet cheap, plastic lenses which can be made at a fraction of the cost of glass ones. It is claimed that they are specially suitable for television, and should materially assist in bringing television within the means of all—that is to say, when the country is linked by chains of television transmitters, and the troubles with the coaxial cables have been overcome. These lenses are of the new plastic, and one firm demonstrated their use in television projection. This system, which was originally designed by Schmidt, consists of a large-aperture concave mirror which projects light from a cathode-ray tube. An aspheric corrector plate is employed to correct spherical aberration. The type demonstrated takes a 3¼in. projection cathode-ray tube, and gives a magnification of 7½ times. I have always thought that the large cathode-ray tube was but a passing phase in television development, and that the real answer is the use of a small tube and a system of optical projections. There is no danger of an implosion as there is with a large tube.

The Radio Scientists

SIR EDWARD APPLETON was in witty vein when he replied to the toast of the Radio Scientists at the dinner to commemorate the fiftieth anniversary of the first demonstration of wireless telegraphy. He said that many thought that the gift of wireless was specially vouchsafed to mankind for the primary benefit of the British Empire! In return for such a benefaction it can in justice be said that this country has played a great part in its amazing development. I do not, however, support Sir Edward when he says that the starting-point of this achievement was the work of Marconi. Marconi was a link only, and I object to the tendency of some people to give Marconi proprietorial rights in radio. But for the work of previous experimenters Marconi could not have conducted his own tests. Too little is heard of the work of Sir Ambrose Fleming, who invented the thermionic valve, Dr. Lee De Forest and Edison, who discovered the Edison Effect.

How "Song Hits" Are Made

Tom Trombone, leader of dance band,
Sat down and wrote a letter
To song publishers. Said No, thanks,
For I can do much better.
I'm out to make the most I can,
So kindly get this right,
Unless you care to raise your fee
My boys won't plug your tripe.
But raise your price and we'll respond,
Your song we'll take in hand,
And soon its tune most popular
Will be in all the land.
We'll plug it morning, noon and night,
And listeners educate
To think it really is supreme,
As we so boldly state. . . .
The firm agreed to Tom's demand,
A larger fee was paid,
The song, in spite of tortured ears,
Quite popular (?) was made.
And this is how this game is played,
In spite of B.B.C.,
But then, of course, "None are so blind
As those who will not see."—"TORCH."

Electronic Musical Instruments—1

Practical Experiments in This Interesting Field of Development

By F. C. BLAKE

QUITE a large number of readers have shown considerable interest in recent articles on the electronic organ. In the Novachord the fundamental principle of operation is a master oscillator for each note of the highest octave, followed by a number of frequency dividers for succeeding lower octaves.

This instrument has a special feature which places it in a group separate from the normal electronic organ. This feature is the great

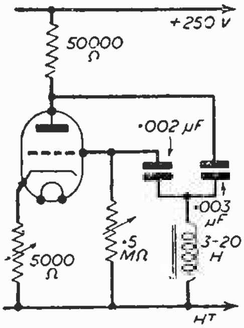


Fig. 1.—Basic form of valve oscillator.

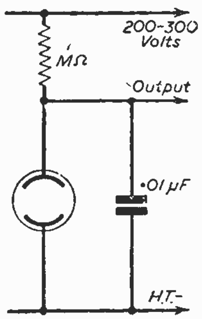


Fig. 2.—Neon relaxation oscillator.

flexibility of control of the sound "envelope," by which means, coupled with tonal variations, effects similar to plucked strings, bowed strings, bell-like chimes, and normal organ sounds may be produced.

To the would-be constructor of an electronic musical instrument I would like to point out that there are several avenues of exploration which are specially suitable for experiments. In this article are described details for the construction of an experimental instrument, utilising the frequency divider system somewhat similar to that used in the Novachord and Solovox. These instruments are manufactured by the makers of the Hammond organ.

The Basic Circuit

Twelve valve oscillators are required operating at the highest octave frequencies, one of which is shown in basic form in Fig. 1.

As far as I know this is a new form of oscillator, which I discovered accidentally whilst experimenting in the laboratory. An ordinary choke or even an L.F. transformer may be used, the inductance, however, should not be too high.

The frequency is adjusted by the size of the condensers, one of which may be preset, or the grid leak may be a variable. The value of the cathode resistor is best found by experiment; it should be just high enough to stabilise oscillation. Too low a value causes a badly distorted waveform, and frequency drift.

We now come to the dividers. Instead of using valves, which, apart from their cost, would need filament supplies, I intend to show how one may use the common or garden neon lamp. These lamps may be obtained from The General Electric Company, of Kingsway, London, and it is very important to note that they must be ordered *without* the usual series resistance. The lamps are described as .5 watt indicator lamps with S.B.C. contacts.

Neons as Oscillators

Probably readers are aware of the fact that neon lamps can be used as relaxation oscillators and sawtooth waveform generators, as shown in Fig. 2.

If a synchronising signal is impressed on the D.C. potential, it is possible to lock the oscillator either to that signal or to a submultiple of it. By taking the output from what I shall term the cathode electrode, only the resultant "divided" frequency is obtained.

Fig. 3 shows circuit of master oscillator and neon dividers for three octaves. The dividers are locked by adjusting the voltage to each neon by means of a potentiometer. The adjustment is fairly critical

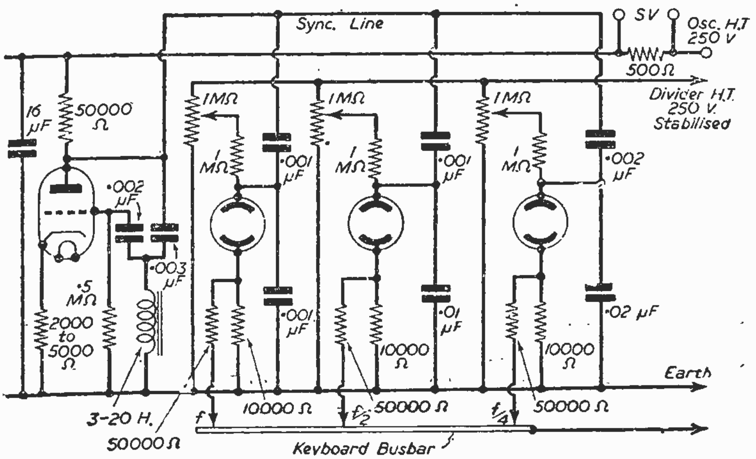


Fig. 3.—Master oscillator and neon dividers for three octaves.

especially when dividing the frequency more than twice. If a large compass instrument is to be built it will be necessary to use 12 amplifier valves boosting the neon outputs, and then, by feeding this series of amplified signals to further dividers, obtaining further tones of f8 and f16.

The locking potentiometers should be set in the centre position of two unstable positions which is found by rocking the control slightly to left and right. Incidentally, I have succeeded in dividing down to $\frac{f}{24}$ that is, when using, say, a 1,000 cycle signal, obtaining an output frequency of 42 cycles approximately. Fig. 4 shows waveforms of neon oscillator and dividers as shown on an oscilloscope.

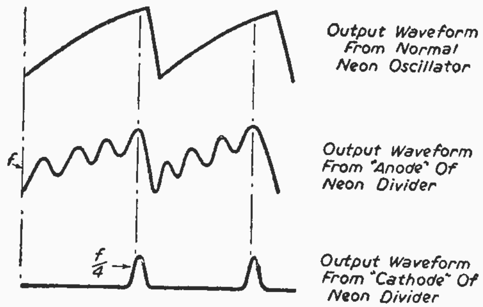


Fig. 4.—Waveforms of neon oscillator and aividers.

So that the output from dividers and master oscillators shall be approximately the same in voltage and harmonic content, it is best to use a neon working at the fundamental frequency, and extract the output from the "cathode," rather than tap the output direct from the master oscillator.

The H.T. supplies to the master oscillators and dividers should be separate, and it is advisable to stabilise the voltage by means of stabilising neons.

It is not necessary to use S.B.C. lampholders for the neons, the simplest method of fixing is to wrap insulating tape round the brass cap to bring its diameter a little larger than the bulb, and fix to chassis or metal coated baseboard by means of a saddle clip. The neons should be screened from any extraneous light, as this would impair the stability, as light falling on the electrodes alters the striking potential.

The Keyboard

The outputs from the dividers are selected by the keyboard, which can be made as described in the April issue, from an old piano or harmonium. One pair of contacts are needed per note, one of which forms the busbar shown in the diagrams.

The contacts, if possible, should make with a wiping action, otherwise trouble may be experienced after a time due to faulty contacts.

If the output from the neons were fed directly into an amplifier, the resultant reedy tones would quickly become monotonous, so that some form of tonal correction is needed. The method usually used in an instrument of this type is shown in Fig. 5 and consists of a series of tuned circuits in series which can be switched in and out or modified at will by means of controls or stop switches.

Should a vibrato stop be required to enhance the tones still further, it can be provided by arranging a simple switching device which makes and breaks S.V. Fig. 3. This causes the master oscillator line voltage to fluctuate, which causes a slight variation in frequency.

A small electric motor operating a cam switch at a speed from 5-10 c/s. is needed, and this can also provide a tremolo stop by arranging another similar cam to switch S.T. Fig. 5. Where component values are not given it should be understood that these are best found by experiment, as they will depend on the inductances used.

With the vibrato stop the periodic frequency variation is transmitted to the dividers, but care should be taken not to have too "heavy" a vibrato, otherwise the dividers would not cope with it.

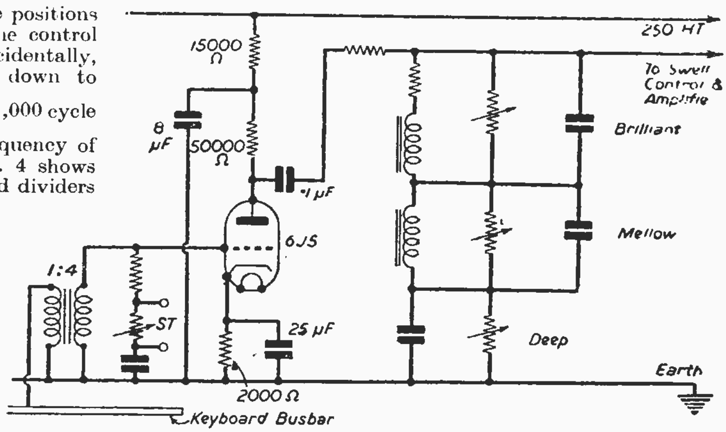


Fig. 5.—Tone correctors in an oscillator stage.

The output from the tone corrector stage is taken via a volume control or swell to the main amplifier. This can be anything from a domestic radio set to a high-power P.A. amplifier.

Another method of generating tones electronically will be described in the next issue.

Notes from the Trade

Philco's New Car Receiver

PHILCO announce a new car radio for 1947, known as Model K.526.

Tested on a number of leading makes of post-war cars, this new Philco has met with all-round approval. Although suppression equipment, consisting of one distributor head suppressor and a condenser on the coil, has been fitted, reports from British motor-car manufacturers give evidence that the suppression equipment could be dispensed with.

The set is priced at £21, plus £4 18s. 3d. purchase tax.

Types: Model K.526T requires a 12-volt battery; Model K.526S requires a 6-volt battery.

W/B Speakers

W/B Stentorian cabinet loudspeakers, in senior and junior models, are now available.

The Senior Model has:

Cabinet: Width, 14⅞in. Height, 12 9/16in. Depth, 7in.

Speaker: 9in. diameter. Diecast chassis. Handling capacity, 7 watts.

Magnet: Flux density, 12,000 lines/sq. cm. Total flux, 47,400 lines.

Price: Type SC (with universal transformer), £5 15s. 6d. Type SX (less universal transformer), £5 2s. 6d.

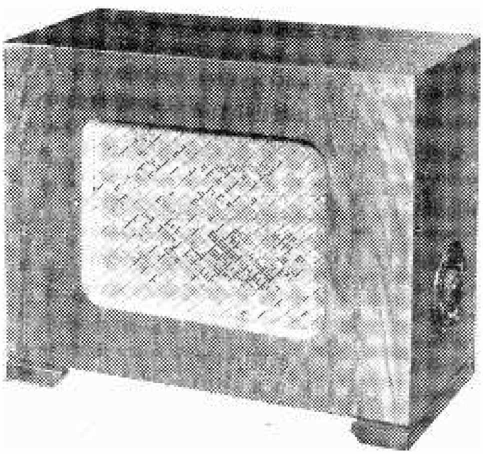
The Junior Model has:

Cabinet: Width, 13½in. Height, 11¼in. Depth, 6⅝in.

Speaker: 8in. diameter. Diecast chassis. Handling capacity, 6 watts.

Magnet: Flux density, 10,000 lines/sq. cm. Total flux, 39,500 lines.

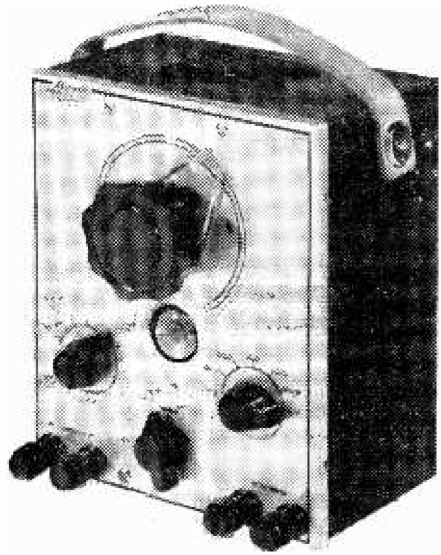
Price: Type JC (with universal transformer), £5. Type JX (less universal transformer), £4 10s. 6d.



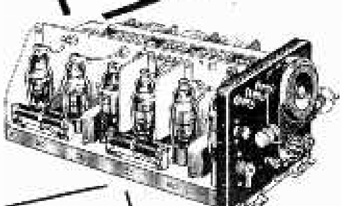
This illustration shows the neat appearance of the new W/B cabinet speakers.

Thrush C.R. Bridge

UTILISING a standard Wheatstone bridge circuit, this Tester enables condensers and resistances to be measured with an accuracy over the major portion of the scale to within two per cent. The instrument is for A.C. mains operation and utilises a two-section neon indicator so that, in addition to normal readings of capacity and resistance, it is also possible to provide a Leakage indicator for capacities rated for operation at 150 volts D.C. and over. Separate terminals are provided for capacity and resistance, and a matching position is provided on the range selector switch so that it is possible to provide an external standard in place of the built-in unit. Then, by placing a standard at one pair of terminals various similar components (including inductances) may be placed at the other pair and values balanced. Ranges are as follows: Capacity 5-5,000 pF: .0005-.5μF and .05-50μF. Resistances, 5-5,000Ω: 500Ω-.5MΩ and 50kΩ-50MΩ. Power Factors up to 60 per cent. may be obtained on a separate control, and this component incorporates the on/off switch for the instrument. The main dial is calibrated from .05 to 50, and our only criticism is that as this follows a log law the higher ranges are rather cramped, but readings are sufficiently accurate for all normal purposes and come within the usual makers' tolerances. The case is finished in black crackle steel and the panel is silvered. The total weight is only 4½ lbs. and the overall size 8in. by 6½in. by 4in. The price is 13½ guineas, and the makers Thrush Radio and Electrical Industries, 1, St. Thomas's Square, E.9.



The Thrush C.R. Bridge. The case is of steel—black crackle finished, the panel is of silvered aluminium, and the leather handle is detachable.



Transmitting Topics

Details of Some Useful but Seldom-used Apparatus for the Amateur.

By W. J. DELANEY (G2FMY)

MANY newcomers to the transmitting field have made certain that they are well equipped with suitable test gear, by which they mean circuit testers, resistance and capacity bridges, wavemeters and so on. But the majority, as judged from correspondence and visits to many new stations, have overlooked quite a number of incidental items which, whilst not regarded by even some "old hands" as necessary, are, nevertheless, invaluable if real experimental work is to be carried out. Chief among these items is the field strength meter. The intelligent use of this piece of apparatus may save evenings of wasted time trying to contact some part of the world which is not covered by the particular aerial in use. Also, if a change has been made in an aerial system, many amateurs simply rely upon reports of their signal strength from different parts in order to get an idea as to the effects of the change. It may take a week or more to collect sufficient data this way to ascertain what the changes have done, whereas all the necessary information (or, at least, the major part of it) may have been ascertained in one evening with a field strength meter.

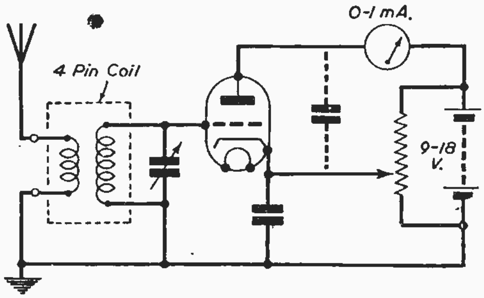


Fig. 1.—Circuit for a simple field strength meter.

Field Strength Meter

The meter is nothing more than a simple valve-voltmeter, consisting of a tuned circuit, valve, sensitive low-reading milliammeter and power supplies (preferably batteries). A single 9 or 18 volt G.B. battery will provide sufficient energy with many types of valve. For best results this equipment should all be housed in a metal box with a short metal rod or length of wire projecting from the lid. This is joined to the tuned circuit, and the biasing supply adjusted to bring the meter reading to zero. Most reliable results are obtained if a length of wire is anchored to the "earth line" of the circuit and to the screening box, and this is provided with a spike which may be dug into the earth so effectively screening the entire assembly. This may be taken to a number of points situated at various bearings around the transmitting site and the readings on the meter noted when the transmitter is keyed. No doubt friendly neighbours would allow access to their gardens for the short time such measurements are necessary, although those who are fortunate enough to be situated in an open country district could take far more readings with less trouble. Such a set of measurements, plotted around the transmitting site, will provide a polar diagram and enable one to see very quickly just what is going out, and what any suggested changes may do, without having to make a long-distance contact. A contact of this kind at a later stage will, of course, enable results to be checked and confirmed.

Surge Impedance Meter

If the transmitter has to be so situated that long feeder lines have to be employed, it may be desirable to carry out tests so that really accurate line matching may take place. This type of measurement has to be made, of course, at radio frequency, so that all that is required is a source of R.F. (at the frequency which will be used), a measuring device such as a valve-voltmeter or equivalent, and a reliable resistance of the variable type capable of covering the required resistance value. As one generally assumes a maximum of about 600 ohms for most amateur feeders, a good resistance with a maximum value of 750 will be suitable and is readily obtained. In place of a valve-voltmeter it is possible to employ an ordinary H.F. metal rectifier and a milliammeter and, to avoid differences and difficulties due to the loading of the device, a loose-coupled input circuit should be used. The source of R.F. can very conveniently be the transmitter itself, coupling the input by the standard link circuit to either the C.O. or buffer stage. A standard double-pole change-over switch on the output side will enable the feeder lines to be substituted by the resistance, and it will be obvious that the method of using this piece of equipment is merely to place the feeders in circuit, energise the meter, note the reading, and substitute the variable resistance. Adjust this to obtain the original meter reading, and the resistance then in circuit is obviously the same as that of the feeders of lines

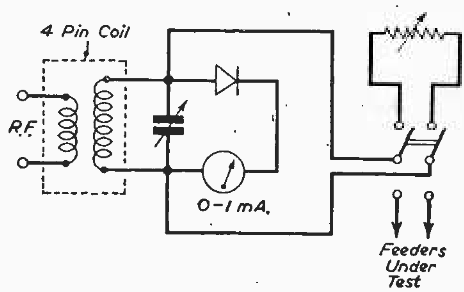


Fig. 2.—A simple impedance meter, suitable for testing feeder lines.

previously tested. If the resistance is not calibrated, its value may be ascertained by means of a standard resistance meter, but it is obviously desirable that the resistance should be provided with an accurately calibrated scale. It should hardly be necessary to point out to amateur transmitters that the resistance must be non-inductive and also capable of dissipating the wattage fed from the transmitter if this is used as the R.F. source.

Modulation Measurements

Many amateurs licensed since the war are now changing over from C.W. to 'phone, and there is wide scope here for pieces of apparatus which will ensure that the transmitted signal will reach a high standard. So far as the modulation circuits are concerned, there is not a very wide range of choice, and the majority of amateurs prefer a good standard amplifier with a hefty push-pull output stage. This can be operated at either Class A or Class AB, although as experience is gained Class C may be preferred. Remember that overloading can be quite a nuisance with a Class A amplifier whilst the same amount of overloading may not prove so troublesome with the other arrangements. As a start, a simple milliammeter in the H.T. lead to the output valve will give a guide as to the loading of the stage. With Class A the needle should remain practically stationary, although slight *upward* kicks can be tolerated. With the other forms of amplification the meter indications are not reliable.

The method of modulation will govern the question as to what type of measurement may next be taken. As there are some rather serious differences, and as changes may be required from time to time, there is little doubt that a really reliable monitor is one of the most satisfactory instruments, although if really serious work is to be carried out a good oscilloscope will be worth its weight in gold. A very satisfactory monitor is the receiver used at the station, provided that it has a reliable R.F. stage and thus removes risk of detector overload. If a change-over switch is used at the aerial, so that when on transmit the receiver has only a very short lead up to the switch, and the R.F. gain is turned

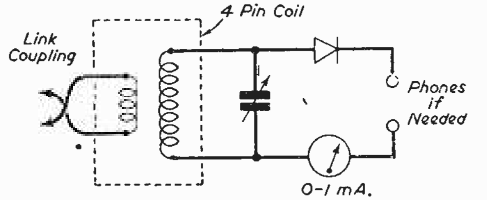


Fig. 3.—A very simple, but effective, monitor circuit.

well back, this will give quite a good indication as to the transmitted quality.

To test the depth of modulation a good valve voltmeter must be used, and the carrier current measured. A steady modulation is then provided, either by a steady whistle into the mike, or by a prolonged "Haaaalo" and the rise in the meter reading noted. The voltmeter must, of course, be inductively coupled to the aerial tank coil or otherwise provided with an induced aerial current, and the coupling so adjusted that overloading or false readings due to too strong an input are avoided.

To avoid over-modulation a simple tuned circuit may be coupled to the transmitter and a diode or metal rectifier connected across the tuned circuit, with a milliammeter in series. This may then be adjusted so that no reading is shown on the meter with normal or full modulation. Over-modulation will result in an upward flick of the meter needle. Such a piece of equipment may also be used to provide audible checks by inserting 'phones in series with the meter.

Secret Receivers in Occupied Territory

DURING the German occupation the Dutch were strictly forbidden to listen to foreign broadcasts, but as long as they were left in possession of their wireless sets, few obeyed the orders. When, however, in 1943, the German authorities enforced their commands by confiscating wireless sets on a large scale, there arose a need everywhere for pocket-size receivers, which could either be hidden away in a small corner or camouflaged in an article of daily use. It was, of course, primarily the task of the Philips concern in Eindhoven to satisfy this demand, and though a normal and organised production was out of the question, personal initiative was not lacking. Soon a lively activity sprang up in small workshops and private rooms and the amateur set-making of earlier days underwent a temporary but intensive revival.

Battery and mains supplies were used for these receivers—mains power being obtained in some cases from cycle lighting dynamos through special transformers.

Official production figures are lacking and no one knows exactly what was achieved, but it is estimated that several thousands and perhaps tens of thousands of these pocket-size receivers were produced in Eindhoven.

Circuit Designs

Preferably "button" or "acorn" valves were used to keep the set as small as possible, and talcum powder tins, books, bed-lamp holders and chocolate boxes were but a few of the devices used to conceal these minute radio sets. The so-called "reflex" circuit was very popular owing to the high sensitivity to be obtained from it with only two of these miniature valves. In this circuit the first serves both as high-frequency and low-frequency amplifier, while the second is used as grid detector with feedback; the low-frequency signal from the anode of this last valve is impressed on the grid of the first valve. In this circuiting system the H.F. and L.F. parts must be carefully separated by filters to avoid self-oscillation.

Another popular circuit combined grid detection and L.F. amplification in a single valve thus making possible a receiver of truly minute proportions. This was the circuit used for the "talcum powder" set.

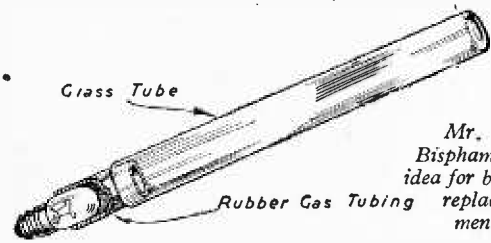
The connecting flex camouflaged by knitted covering was used as a girdle on the mother's dressing gown. The earphone covered in similar fashion was hung in the cot as a baby's rattle. (*Philips Technical Review.*)

Practical Hints

Dial Bulb Fixing

RECENTLY experiencing some difficulty in replacing a dial bulb in an awkward portion of a mains receiver, I used the simple holder as shown below.

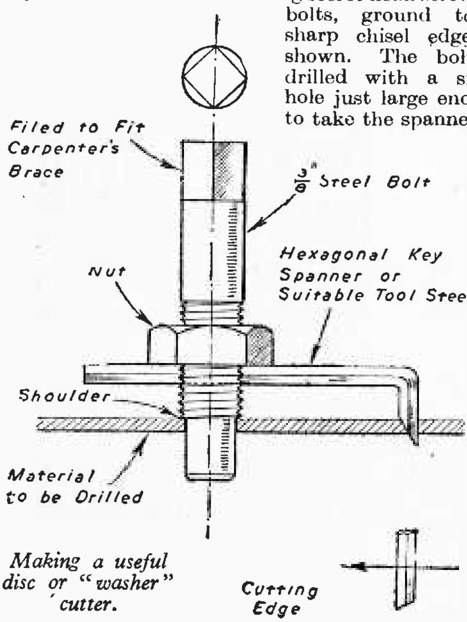
A glass tube, such as those in which malt extract tablets are sold, was fitted with one inch of flexible rubber gas tubing. The tubing was a tight fit in the tube, and was secured with a touch of suitable adhesive. The method of using this device is obvious.—H. BISPHAM (Rossendall, Lancs).



Mr. Bispham's idea for bulb replacement.

Disc Cutter

THE shaft of this drill is cut from a suitable ⅜in. steel bolt filed square at the top end to fit into the chuck of a carpenter's brace. The last ¼in. of the threaded end is filed or turned down to about ¼in. diameter to form a shoulder that will bear on the sheet metal that is being cut. The actual cutter is made out of a right-angled hexagonal key, such as is used for undoing secret head screws or bolts, ground to a sharp chisel edge as shown. The bolt is drilled with a small hole just large enough to take the spanner.



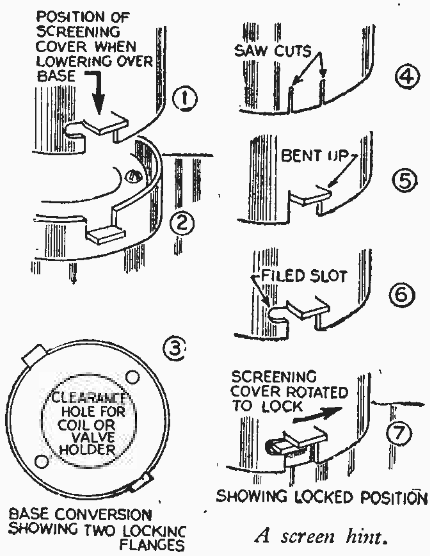
Making a useful disc or "washer" cutter.

To use the cutter mark out the hole to be cut and drill ¼in. hole in the centre. Insert the end of the bolt, adjust the cutting blade to the correct diameter and tighten the hexagonal nut to clamp the blade in position. The hole can now easily be cut by rotating the cutter with a brace.

These cutters are ideal for making valve-holder mounts in metal chassis.—H. W. CUFF (Bournemouth).

A Simple Screening-can Locking Device

NOWADAYS most components are adjusted and matched by the manufacturers and are supplied complete with the necessary screening



A screen hint.

plates or covers often being made into one complete unit. However, the old type of screening-can with its separate base will often come in useful to the experimenter for odd coils, etc. These cans, however, are often fixed to their bases with small set screws, and this presents a snag where quick experimental changing of the component is required.

The idea illustrated allows of such quick changing whilst still retaining good fixture of screening cover to its base.

Briefly, both the base and cover are arranged with small projecting lugs, bent downwards and upwards respectively, whilst those in the cover are provided with short slots to one side. When the cover is placed over the base so that the sets of lugs in each coincide and the cover is rotated slightly, the lugs in the base project into the slots of the cover, thus effectively locking cover to base.—R. L. GRAPER (Chelmsford).

The Three-fou

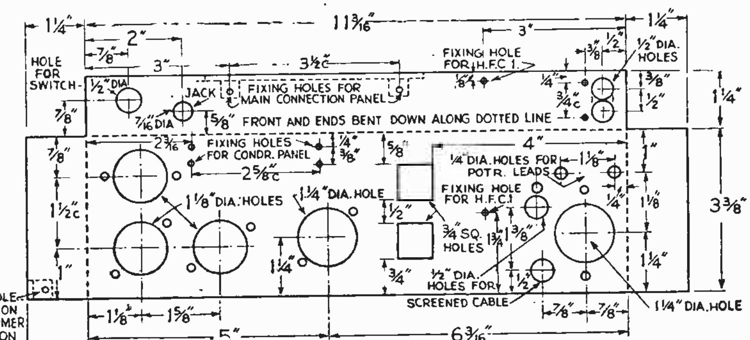
Further Details of a Self-contained Attache-ca:

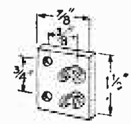
THE wiring diagrams were given in the last issue, from which it will be noted that several of the leads or connections were shown outside the chassis. This was merely to show the wiring as clearly as possible in this rather condensed view. These connections will, of course, be included inside the chassis and will in all cases be much shorter. The four leads going to the transformer unit are, of course, external flex leads from the short connection panel.

The two fixed condensers C10 and C11 shown full at the side, are shown dotted in the positions they occupy in the chassis. This is again for illustrative purposes in order to show the wiring to the valve holders. Similarly, the small high-frequency choke HFC2 (which is a small unscreened one, measuring 1in. diameter × ½in. thick) actually lies flat just above the valve holder for V2, and not end on, as shown. This reaction choke might be home made, if any difficulty is experienced in purchasing one small enough for this position. As a basis to work on, a former might be made from four thin insulating material discs of 1in. diameter, with three inner spacing discs of ¼in. diameter by ⅛in. thick. A small set screw, and nut, passed through the centres of the discs, would complete the former. The three slots could then be almost filled with 38 or 40 s.w.g. enamelled wire. Soldering tags, for the start and end of the winding, should, of course, be securely fitted to the former, so that the choke may be soldered firmly in position. By the way, a low value resistance might be used in place of this H.F. choke, one of about 10,000 ohms being suggested. The condenser C13 coupling V2 to V3, should still remain connected to the top end of this resistance, as when the choke is used.

When commencing the wiring, owing to the somewhat restricted space available, a definite procedure is advised. It is a good plan first to fit the main earth, or chassis wire, which is along the rear, and extends down each end, and the extremities soldered to tags bolted to the chassis. The filament wiring should then be attended to, and this can be conveniently tucked close against the chassis, if good insulating sleeving is used. Then attend to the other valve holder connections, those to the switch, and phone jack. Also, do not forget the connections to the ganged tuning condenser, through the ⅜in. clearance holes in the chassis. All wiring may be done with about 22/24 s.w.g. tinned copper wire, and good quality slip-on sleeving. The main wire from the frame aerial tag to the grid of V1 and shown in Fig. 3 as a black and white hatched one, should be quite stout gauge, about 18 s.w.g. or 20 s.w.g. This wire should also be kept well spaced from other wires, and components.

A good high-frequency choke has been used in the anode of V1, and a good one in this system of coupling the R.F.





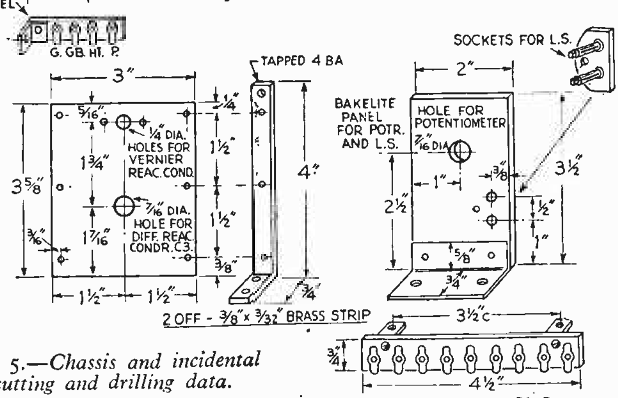
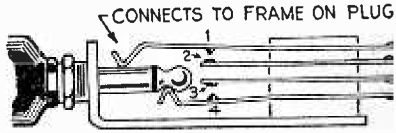


Fig. 5.—Chassis and incidental cutting and drilling data.



CONTACTS 1-2 AND 3-4 MADE OI

Fig. 4.—Details of wiring, fo

· Portable

Receiver Described by R. L. G.

valve to the detector, is most essential. The component used is a Bulgin all-wave choke, type H.F.15, and although an all-wave choke is not essential, its dimensions of 1⅛in. diameter by 2⅛in. long overall will be found to fit nicely into the space available, and the business-like stand-off soldering tags are very convenient. The baseboard fixing disc supplied with this component was not used, the choke being securely strapped to the chassis by means of a band of stoutish gauge aluminium, and two very small nuts and bolts.

All the resistances used are half watt types, and these will be found quite satisfactory and space saving.

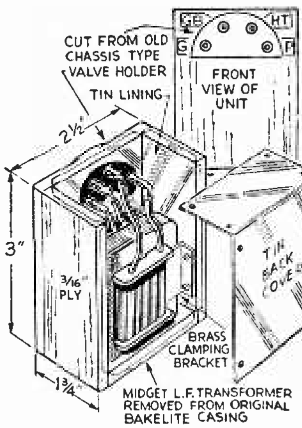


Fig. 6.—Details of the screened transformer unit.

It will be found that the audio end of the receiver is quite compact, and for this reason the valve holder for V3 has been raised above the top of the chassis by two ⅜in.-long collars. This allows condensers C10 and C11 to fit comfortably clear of the wiring beneath. C10, which is the 1mfd. decoupling condenser, might, of course, be mounted above the chassis, but fitting it elsewhere below chassis is not advised, as the right-hand side of the under-chassis should be as clear as possible to give spacing to leads and components carrying R.F. currents. R8, by the way, is a grid-stopper resistance to prevent these R.F. currents straying into the audio section.

It will be seen from Fig. 3 that the screened lead from the anode socket of V4 to one of the loudspeaker sockets is taken along the rear of the chassis, and adjacent to the main earthed or chassis wire. The casing of this screened cable can be conveniently soldered to this wire, and if not of solderable metal, several turns of tinned copper wire may be twisted round it at intermediate positions and the ends soldered to the earth wire.

The decoupling condensers C5, C7 and C9 are all positioned just above the screened cable, and these condensers, as well as C10 and C11, should preferably be of a good paper type. The screened cable, from the anode of V1, to H.F. choke 1, should be of ample diameter to give good clearance from the inside lead, the latter being of moderate gauge. The screened cable used by the author is about ⅜in. diameter. Co-axial cable, would, of course, be ideal for such a position, but might be found a little difficult to bend for so short a distance. The screen covering of this cable should also be suitably earthed to chassis.

SERTION TO CHASSIS
— TO NEG. FILAMENT LEG OF OUTPUT VALVE
UNUSED
O C.11 AND C12
EMOVAL OF PHONE PLUG
he phone jack.

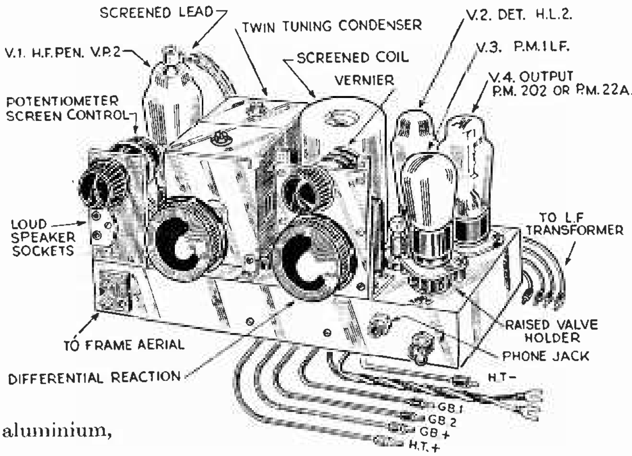


Fig. 8.—The completed receiver with details of leads, controls, valves, etc.

The Switch

The on-off switch operates parallel with the chassis, but this should not be found an inconvenience. The switch used is a mains, double-pole change-over type having six terminals or soldering tags. Only one side is used, however, the two central tags being connected together and go to L.T.— and one side of the fuse-holder. The top outside tag goes to chassis whilst the bottom outside tag goes to R3. As previously mentioned this is to disconnect the resistance network of V1. A normal three-point on-off switch could be used if desired.

The phone jack can be seen to the right of the switch, and that used by the author is an old component, of French manufacture, but no doubt a more modern type will be found to substitute, but see that the jack used "breaks" a pair of contacts on the insertion of the phone plug, in order to switch out the filament of V4. As, in the model shown, the outer contact strip is connected via the plug to the framework of the jack only when this plug is inserted, the chassis connection shown from this contact strip is still necessary, so that the filament of V4 goes to chassis when 1 and 2 come together on withdrawal of the phone plug.

The main connecting panel is located just to the right of the switch and jack, and is bolted to the front face of the chassis just below the level of the top edge. When the wiring of the set has been completed, the necessary short lengths of flex, suitably labelled, are soldered direct to their appropriate tags. A separate projected view of this tagboard is given in Fig. 3, showing these external connecting wires. No flex leads are specified for the eighth and ninth tags, as the former is a spare one, and the latter acts merely as an anchoring tag for R3, and its connecting wire to the three-point switch.

The small connecting panel for the transformer unit is located at the rear of the chassis being secured to the side of the chassis by a simple stout brass bracket and small nut and bolt. This panel is adjacent to the unit when the set is in its case, and the flex connections are thus very short. A short length of flex should be taken from the chassis and soldered to the tin cover of the unit when the portable is finally assembled.

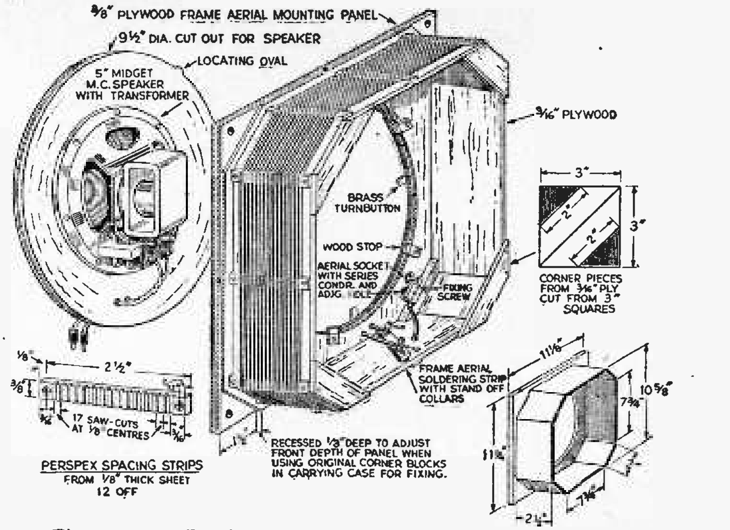


Fig. 7.—Details of the speaker and frame aerial mounting.

Differential Reaction Condenser

There are three connections to this. One set of fixed plates go to reaction winding pin 4, and to H.F.C2. The other set of fixed plates go to the end of the reaction winding only, pin 3, whilst the moving plates are earthed to chassis. The moving plates of the vernier condenser are also earthed, whilst its fixed plates go to differential reaction condenser tag connected to pin 3. Should an anti-clockwise motion of dial be experienced for an increase in reaction, then the connections to the two sets of fixed plates should be reversed. This would then apply to the vernier condenser also. This vernier condenser is a small capacity trimmer type in the region of .00005 mfd. A small one-plate condenser of the solid dialectric type could be used, but a check of centres should be made to see if this will fit.

Screen Control to V1

As previously mentioned, this is obtained by a potentiometer of 20,000 ohms, R2. The moving arm goes to screen and C5. The top end goes to H.T.+ via a 20,000 ohm fixed resistance, and the lower end to a 30,000 ohm fixed resistance, R3. This latter resistance is connected to the three-point switch as previously stressed, and will prevent the small drain on H.T. that would otherwise occur. Should readers have objection to this slight extra consumption, for this method consumes a slight current when in operation, a plain series resistance might be tried, or a plain tapping to H.T. if this is available. The spare tag on the connecting panel might then be used for this extra lead. The potentiometer could then be used for variable-mu grid bias.

As with the reaction control, the correct outer connections should be ascertained for clockwise motion of control, before wiring, otherwise reversal of these connections may be necessary.

The connections to the fixed plates of the ganged tuning condenser are taken to the bottom tags, and adequate clearance holes each measuring ¾in. square have been cut in the chassis for these connections. The moving plates go to chassis, and a short length of wire may go through one of the ¾in. holes to the spindle soldering tag.

A five-pin valve holder has been used for the output valve, and the centre connection is taken to H.T.+. This, of course, only comes into use when using a five-pin output pentode, so need not be omitted or removed when using a four-pin power output valve.

Transformer Unit

For this unit, a simple three-sided box can be made from plywood, and lined with tin for screening purposes. A portion from an old discarded chassis-type valve holder, or a complete four-pin type, can be used for a connecting panel, or just small terminals fitted if preferred. The tin lining inside the front should, however, be well clear of these sockets or terminals. The small "Pip" transformer used was removed from its original bakelite casing and a piece of sheet brass passed through between the laminations and spool, to form a fixing bracket, this being screwed to the side of the box. The original short connections to the windings are soldered to the four sockets, and the front clearly inscribed with the correct connections. Finally, a simple tin cover can be made and screwed to the box with ½in. countersunk brass screws. The unit is seen in Fig. 6.

Frame Aerial and Loudspeaker Panel

Full details of the frame aerial and its former are given in Fig. 7, together with the loudspeaker panel, which fits in the centre of it. Fuller details will be given next month.

On the Amateur Bands

A Monthly Report of Results and Conditions Experienced on the Short Waves.

By "KAYAK"

More 50 M/c DX

ALL existing records for DX on this frequency have been broken. The first two-way contact between North and South America has occurred, and reception of signals from Holland have been reported in South Africa.

The North/South America contact was made by W4IUJ, of West Palm Beach, Florida, and OA4AE, in Lima, Peru, a distance of over 3,000 miles. W4GJO, of Orlando, Florida, also worked OA4AE shortly after. W4IUJ becomes eligible for the Milwaukee Radio Amateurs' Club 50 Mc/s cup offered to the first amateur making two-way contact with another continent from the United States mainland. On the day following these contacts, reception of automatic transmissions from PAUX in Holland was reported by South African stations ZS1P, ZS1T, ZS1AX and ZS1DJ, over a 6,000 mile path, the greatest distance at which V.H.F. signals have ever been heard. DX conditions on this frequency are likely to hold for a few more weeks, especially over north/south paths.

28 Mc/s Band

Conditions on this band have remained good apart from odd days, when fade-outs occurred caused by sun-spot activity. D. L. McLean, Somerset, reports over 100 good DX 'phones heard. His list includes the following: Chilean CE8AB, CE8AG; CX2CO, Uruguay; EL2A, Liberia; HZ1AB, Saudi Arabia; J9ANA, Okinawa; PZ1A, Surinam; XZ2DN, Rangoon; and five "Marine Mobile" stations. He says that South American stations have been heard up to 23.30 G.M.T., a most unusual happening. Mr. McLean mentions much QRM caused by the R.A.F. radar station on 29.7 Mc/s, which spreads all over the band. Other reports of interference from this station come from North America, South Africa, and Okinawa. Remarks overheard from amateurs in these countries indicate that the QRM is severe enough to interfere with DX working. The source of the QRM is less than 50 miles from Mr. McLean's QTH, and as the noise is mostly R9 we understand how difficult he must find conditions.

Dennis Tyler is active on this frequency and informs us of ZC6FP, near Jaffa; J9ANA, Okinawa; Australian VK5XR (a very consistent signal); VP6YB, Barbados; XU6GRL, who is W6GRL, operating from Nanking; and CR4AA, in the Cape Verde Islands.

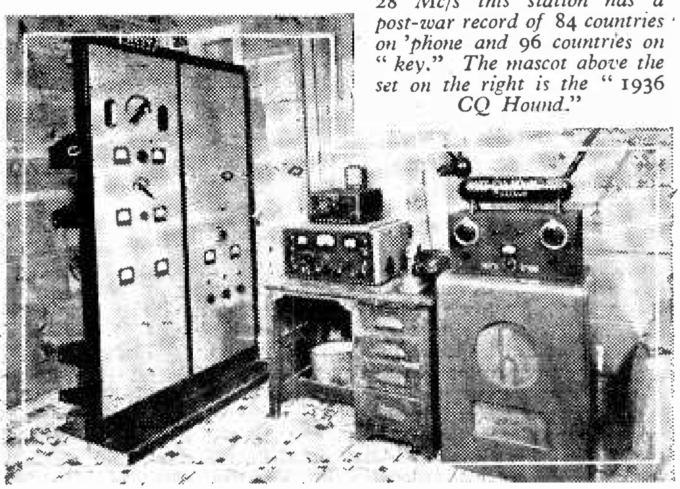
A station mentioned in many reports is OIX7, an experimental broadcasting station belonging to the Finnish Broadcasting Company. D. L. McLean says the station is mostly operated by pre-war OH2NM, with occasional assistance from pre-war OH6NS. OIX7 is making many contacts with amateur stations.

14 Mc/s Band

This band continues just as interesting, with many unusual DX stations reported. On "key" we came across VS6DY, who was working from the s.s. *Anglo African*. Input was given as 10 watts and the transmitting antenna was said to be 25ft. above sea level. No QTH was given apart from address for cards, so we presume the station was operating from Hong Kong, otherwise why the "VS6" prefix? LB90 provided us with a puzzle until he gave information that he was working a portable station in Trondheim, Norway: so that any "LB" calls heard can be taken as portable working from Norway. Other CW stations of interest: OI2KAA, Helsinki, Finland, who is running 700 watts; VS6AA, Hong Kong; VQ8AD, Mauritius; VS7EV, Trincomalee, Ceylon; VP4TX, Trinidad; CT2XA, Azores; VP2AD, Leeward and Windward Islands; OA4U, station of the Magnetic Observatory at Huancayo, Peru; HC1OE, Ecuador; KH6JW, Hawaiian Islands; EA7AV, Madrid; and ZD1KR, Sierra Leone. Two of unknown origin were CZ70 and SS2MB. Any suggestions?

Best R/T stations logged by us were XZ2BA, near Rangoon; KA1AN, Phillipine Island: ZB1AF, Malta; CE3BM, Satiago; Cuban CO7CX; YI6AB, Iraq; XACP, Sardinia; and XU6GRL, Nanking.

'Phones reported by BSWL 804 include CT2AB, Azores; EA9AI, Spanish Morocco; VK4NK,



A fine American amateur station, W8TT at California. With a rotary beam aerial on 14 and 28 Mc/s this station has a post-war record of 84 countries on 'phone and 96 countries on "key." The mascot above the set on the right is the "1936 CQ Hound."

Port Moresby, New Guinea; WNNI, Colorado; KH6GF, Hawaii; VQ6LW, British Somaliland; LI2BO, near Tobruk; and HI2L, Dominican Republic. Receiver used by BSWL 804 is a Sky Champion S20, with one-valve regenerative preselector.

John Brookes, North London, sends along the following 'phones: J9AGP, Okinawa; OQ5AV, Belgian Congo; VE8MQ, Baffin Island; and VP9D, Bermuda. On CW he lists CR7AD, Mozambique; EP1AA, Iran; NY4CM (QTH?); ZP8AC, Paraguay; and LI2BO, El Adem. "Locals" listed RAEM, Moscow. This station is very active on the 14 Mc/s band and the "commercial" call-sign has often puzzled us. However, Mr. Brookes gives the explanation. The call RAEM was originally assigned to the 1938 Russian Polar Expedition. Upon return to the U.S.S.R. the chief operator of the station was granted permission to adopt the call-sign for his own use on the amateur bands.

'Phones listed by Dennis Tyler include FF8FP, French West Africa; LI3BO, El Adem; CP1AP, Bolivia; W4BOW/Iwo Jima; ZP6AC, Paraguay; and CR4AA, Cape Verde. C.W. stations heard include PK6AX, Celebes; I6USA, Asmara; VQ5JTW, Uganda; CR9AN, Macao; LZ1XX, Sofia; YO5WZ, N. Roumania; and PI1L, The Hague.

7 Mc/s Band

DX pickings on this frequency come to those who have the patience to wade through the European QRM. CW stations heard by us around midnight include Cuban CM8GA, CM2CZ and CO6AV; HK4AF, Colombia; CX1DB, Uruguay; XE1GA, Mexico City; and KP4EN, San Juan, Porto Rico. This latter station was as loud as any European! KP4EN uses 1 kw., with a vertical antenna. North American signals are at their best around breakfast time. For signals from Australasia try around 1900 G.M.T. DX stations known to be active on the 7 Mc/s band are ST2AM, Sudan; TF3A, Iceland; KH6AI, Hawaii; ZL4GA, Dunedin; and VU2QY.

Kon-Tiki Expedition

This expedition is scheduled to leave on a 4,000 mile trip by raft across the Pacific Ocean. It is leaving from Ilo, Peru, and will make for the Polynesia group. A 15-watt transmitter is being taken and contacts with amateurs will be made on the 14 and 28 Mc/s bands using call-sign LI2B.

Shorts

New Zealand 'phones are limited on 14 Mc/s to the 14,200-14,300 portion of the band. . . . According to OI2KAF, heard on 14 Mc/s, Finnish amateurs are not yet licensed. OI2KAF is attached to an expedition and is the only officially licensed station in that country. . . . "XA" stations in Greece have now been issued with "SV" call-signs. SV1AH in Athens is the station formerly operated by XAAP, who has now returned to the U.S.A. . . . The Ronne Antarctic Expedition is now established at its base station at Stonington Island, Marguerite Bay, Antarctica. Call-sign is AYZH and known frequencies used for amateur contacts are 12,480 and 8,330 kc/s. . . . The Canadian Broadcasting Corporation recently radiated a coast-to-coast broadcast featuring amateur radio. Principal speaker was Alex Reid, VE2BE, Canadian General Manager of the A.R.R.L. . . . VR6AY, Pitcairn Island, may soon be active again. Reports say that Andrew Young and a New Zealand amateur are busy rebuilding the station ready for amateur activities. . . . At the coming world-telecommunications conference, now being held at Atlantic City, American delegates propose a new amateur band covering the frequency band 2,100-21,500 kc/s. . . . There are now 75,000 licensed amateurs in the United States.

Current DX QTH List

OI2KAA	Box 250, Helsinki, Finland.
OE9AA	R. Richards, A.P.O. S/565, Klagenfurt, Austria, C.M.F.
HZ4DO	P.O. Box 112B, Mekka, Arabia.
VP4TX	52 Mucurapo Road, Port of Spain, Trinidad.
CT2XA	A.P.O. 406, c/o Postmaster, New York.
VS6DY	Radio Operator, *S.S. Anglo African*, c/o Sir Wm. Reardon Smith, 70, Bute Street, Cardiff.
KP4DO	College of Engineering, Mayaguez, Puerto Rico.
LI2JC	R.A.F., El Adem, Near Tobruk, Libya.
I6USA	U.S. Army Radio Station, Eritrea.
HZ1AB	Dharan, Saudi Arabia. J. P. Anderson, A.P.O. 788, c/o Postmaster, New York.
NY4AB	U.S. Navy Base, Guantanamo Bay, Cuba.
SV1AH	Trans-World Airlines, Hasani Airfield, Athens.
VO6K	U.S. Govt. Coastguard Radio Station, Battle Harbour, Labrador. Navy 228, c/o Fleet P.O., New York.
VS9AA	c/o 12, Elder Grove, South Shields, Co. Durham, England.
W2MMO/MM	Matthew Krim, Box 49, 25 South Street, N.Y.C.4, New York.
W3KCG/VP2	Bruce Williams, 155 A.A.C.S. Det., Antigua. A.P.O. 855, c/o Postmaster, Miami, Florida.
ZB1AD	c/o A.P.O, Malta.
VQ3EDD	Box 166, Dar-es-Salaam, Tanganyika.
XE1AC	P.O. Box 9581, Mexico City.

Broadcasting Stations of the World

A MOST valuable booklet is published by Iliffe & Sons, Ltd., which lists long, medium and short-wave broadcasting stations in geographical and wavelength tables. The book is based on information available at November 30th last, and in addition to giving the station names, frequencies, wavelengths and power, a space is provided in which dial readings may be entered. The four sections of the book, which measures 5½in. by 4¼in. are: Long- and Medium-wave European Stations, with Frequencies, Wavelengths and Powers; Geographical List of Long- and Medium-wave European Stations with Frequencies; Short-wave Stations of the World, with Frequencies, Wavelengths, Powers and Call-signs; and Geographical List of Short-wave Stations with Frequencies. The price is 1s. net.

Triode Vectors—3

Concluding Details on the Subject Discussed During the Past Months. By "DYNATRON"

Combined Effect of Grid and Anode

FIG. 5(b) is the circuit under consideration at the moment.

When Eg rises in a positive sense Ia increases in step, a voltage drop V volts will occur across R, whilst the valve anode-to-cathode volts will fall by the same amount, i.e., max. (or R.M.S.) voltage *change* across the valve = Vo = —V.

Hitherto we have used the symbol va in a loose, undefined manner. We simply called it the "voltage across the valve." More precisely, va denotes the *voltage change* (increase or decrease) across the valve *at any instant* in a cycle—small letters are used to represent *instantaneous* values, whilst capitals such as V, Vo denote R.M.S. values, or maximum values V, Vo.

Now, a fundamental point in valve theory is the fact that, if a change Eg volts occurs at the grid, the resulting change, Ia, of anode current will be the same as if the *anode* potential were changed by μEg volts—where μ = the valve *amplification factor*. Stated simply, the grid is *μ times* as effective as the anode in controlling electron flow.

Stated the other way about, a change Va in the anode potential will produce a current change equivalent to a change of Va/μ volts at the grid. If Eg (an applied signal E.M.F.) is varying in a positive sense, then Va in Fig. 5(b) will be decreasing, or varying in a negative sense. Hence, the resulting current change will be that due to an effective electric field at the cathode due to a potential of:

(Eg—Va/μ) volts.

If we bear in mind that Eg and Va must be given appropriate signs, this basic equation may be written in the form:

Ia = Eg + Va/μ,

where Ia denotes the anode current change.

In Fig. 5(b), Va will reach a maximum (in a negative sense) at the instant when Eg is a maximum in a positive sense. In other words, Va will be at its lowest value when Eg is at a maximum in a positive sense. Yet Eg will here determine the maximum value of the anode current, i.e., though the *magnitude* of this maximum will depend on Eg and Va—and therefore upon the anode load—maximum Ia will occur at the *same instant as Eg*; Eg and Ia will remain exactly *in phase*.

When the load is a pure resistance, as shown, maximum electric field drawing electrons to the anode will occur at the same instant as Eg is a maximum—even though Va has some larger value at some other instant. Remember that Va denotes the value of an *alternating* potential at a given *instant*; across the valve, it will reach a maximum positive value at the instant when Eg makes the grid of greatest *negative* potential, since Ia, and the voltage drop IaR in the load, will be a *minimum* at this point.

The normal relations are illustrated by a set of sine curves in Fig. 5(c).

Value of Va/μ

It might be thought that the effect of the anode potential change will in any case be negligible compared with the effect of Eg, because, for one thing, the grid is much nearer to the cathode, and moreover is "μ times" as effective as the anode in controlling electrons.

But don't forget that Va may be nearly μ times as great as Eg, owing to the stage amplification. In fact, a few figures will quickly show that the effect of Va, *at the grid* (or near the cathode), can be of about the same order of magnitude as Eg itself, since in an amplifying stage Va/μ will be nearly equal to Eg.

Thus, suppose μ = 10, whilst at a given instant Eg = 1.0 volt. Then suppose the anode load is such that the stage amplification is about 0.8μ = 8 (a load resistance of four times the valve ra). When Eg varies by 1.0 v., a potential change of 8 × 1.0 = 8 v. will occur at the anode. If Eg is increasing in a positive sense, Va represents a *fall* in the valve voltage of —8 v., i.e., +8 v. more across the resistance *load*.

What will be the effect of this —8 v. in terms of the total electric field produced near the cathode?

The answer is va/μ = —8/10 = —0.8 v. The grid potential has increased by 1.0 v. in a positive sense, but, simultaneously, the electric force exercised by the anode in the vicinity of the cathode has decreased by —0.8 v. The resultant effect of both changes will be equivalent to 1.0 v. — 0.8 v. = 0.2 v.

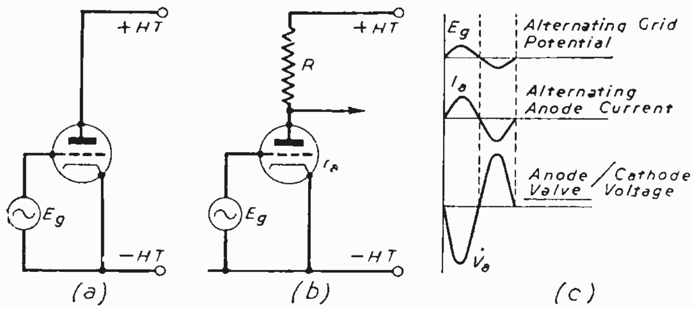


Fig. 5.—Without an anode load (a), the volts on the anode will be constant, and Ia and Eg will be in phase. Also, with load as in (b), there will be no phase-shift between anode currrent and grid potential—the load resistance R simply determines the maximum value of Ia, i.e., the magnitude *of Ia*

So, the total effective potential causing the anode current to increase is only 0.2 v. We could consider as "effective" the whole of the 1.0 v. applied to the grid and say the *dynamic mutual conductance* of the valve, with a resistance of 4ra in series, is only 0.2 mA/V—assuming it was 1 mA/V.

Both statements come to the same thing. But from our present point of view main interest resides in the fact that when the combined effect of grid and anode potentials is taken into account 1.0 v. at the grid is really equivalent to only 0.2 v. Evidently, the effect of Va/μ is very considerable.

Even so, *maximum* electric field near the cathode will occur at the instant Eg is at peak value. Thus if Eg=2 v. peak, Va=8×2=16 v., and Va/μ= 16/10=0.4 v. This will be the greatest possible value under the given conditions, hence Ia reaches maximum at the same instant as Eg—there is no question of a phase difference.

Reactive Load

But Eg and Ia will also get out of phase if the load has *reactance.* This is because Va will not be out of phase with Ia (and Eg) by some angle other than 180 deg. For example, if after allowing for the shunting effect of ra the phase-shift between Ia and the load voltage v is 45 deg., then the anode-to-cathode voltage Va will be out of phase with Eg by an angle of (180 deg.+45 deg.)= 225 deg., assuming inductive reactance. Therefore, Va will be at its minimum not when Eg is at its peak, but 45 deg. later.

Matters are becoming slightly difficult to try to visualise. In Fig. 6 is shown the R.M.S. grid potential as a vector Eg (or it might represent the peak value). Then, let Va/μ be represented by the vector OM, at some angle to Eg greater than 180 deg. The resultant potential drawing electrons across to the anode will be OP Eg.

Note that OP really denotes the resultant electric

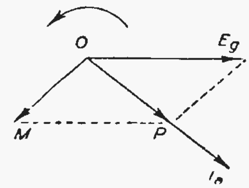


Fig. 6.—With reactive (e.g., inductive) load, the resultant voltage OP drawing electrons to the anode will be de-phased on Eg, and Ia will be in phase with OP—or phase-shifted upon Eg.

field at the cathode due to both potential changes (anode and grid). The important thing to observe is that the alternating anode current Ia *will be in phase with OP,* not with Eg. In this case, the electric force at the cathode will reach its maximum *after* Eg has passed its positive peak, since OP is lagging behind Eg.

The whole vector diagram must be imagined rotating in an anti-clockwise direction about the point O. First, Eg reaches a perpendicular (maximum) position, then, a little later, OP. Ia will reach its peak at the same time as OP, and is therefore lagging on Eg.

I will summarise this part with the aid of values in a later article. Bear in mind that, throughout, we have been considering triodes. As explained earlier, the effect of Va is negligible in a pentode, compared with Eg.

Quality Battery Circuits

Details of Two or Three Receiver Circuits for High Quality Reproduction with Battery Supplies.

By R. V. LUMBARD

It will be realised that the battery receiver is seldom considered by the radio-constructor in search of realistic reproduction. Mains receivers usually take precedence where a high standard of musical fidelity is required. However, the possibilities of a fidelity battery receiver are by no means limited. Improved frequency response and freedom from harmonic distortion can readily compensate for the absence of "shake the room" output which typifies many powerful mains receivers.

The circuits given are chosen as a basis for experiments in fidelity battery receivers. Emphasis has been placed upon quality of reproduction; and not on the sensitivity of the circuits to stations beyond the "local" B.B.C. transmitters.

Fig. 1 is the diagram of a two-valve fidelity headphone receiver. Both valves are of the 2-volt rating, although there is no reason why 1.4 volt valves should not be used. In the latter instance component values may require alteration. V1 should preferably be an H.F. pentode of low impedance. V2 is a normal double-diode-triode. For simplicity only coils of the medium waveband are used. Tuned H.F. anode replaces the usual H.F. transformer coupling between stages. Tuning is by a straight 2-gang .0005 mfd. condenser. If preferred, switches and pre-set condensers tuned to the local stations may be used.

The 'phone transformer is a standard, not midget, inter-valve transformer with a ratio of 1 : 3-1 : 5. Contrary to general procedure, it is connected as a step-down unit. The normal secondary winding is used as primary in this instance, and conducts the 1-1.5 mA. anode current of the D.D.T. Anode current is limited by the application of 1.5 volts negative bias on the valve's grid. Regarding 'phones, those of between 2,000 and 4,000 ohms are quite satisfactory. Low resistance 'phones can be used where a suitable transformer is available.

For Loudspeaker Working

Fig. 2 incorporates a tetrode or pentode output stage for loudspeaker reception. Parts for the H.F. and diode stages remain identical to those used in Fig. 1. A feedback voltage from the output transformer secondary is, however, applied to the "earth" end of the D.D.T. grid resistance. Resistance-capacity coupling precedes the final

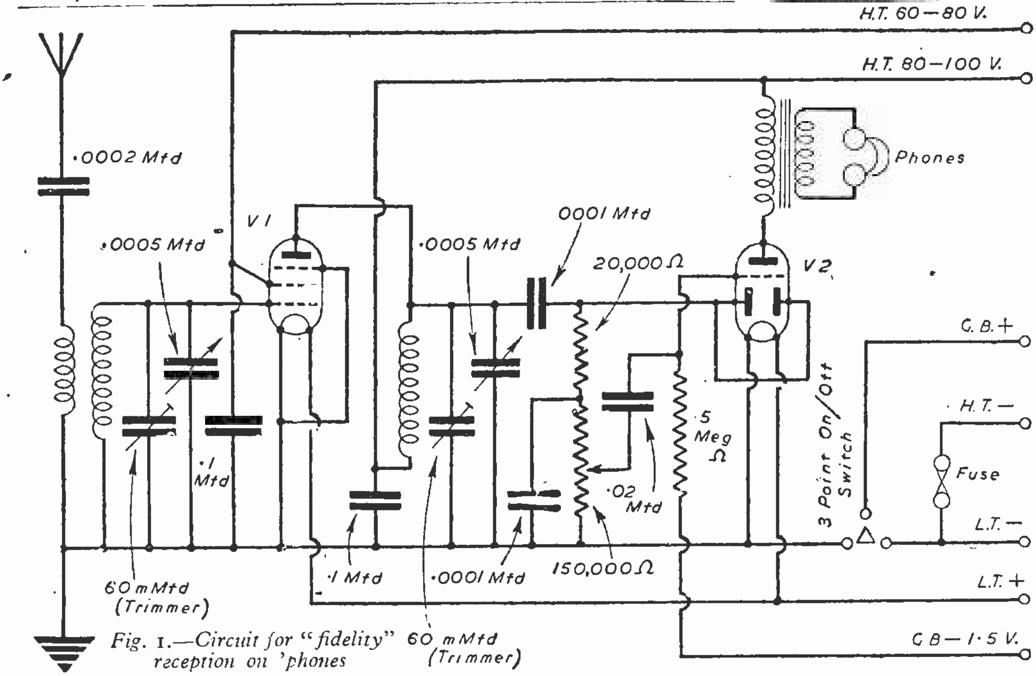


Fig. 1.—Circuit for "fidelity" reception on 'phones

stage. Bias for the output valve will usually be in the region of 2.5-4.5 volts, depending upon the type of valve employed and the H.T. voltage available.

The load impedance of the output valve determines the ratio of output transformer required. For matching purposes, if the ratio is unknown.

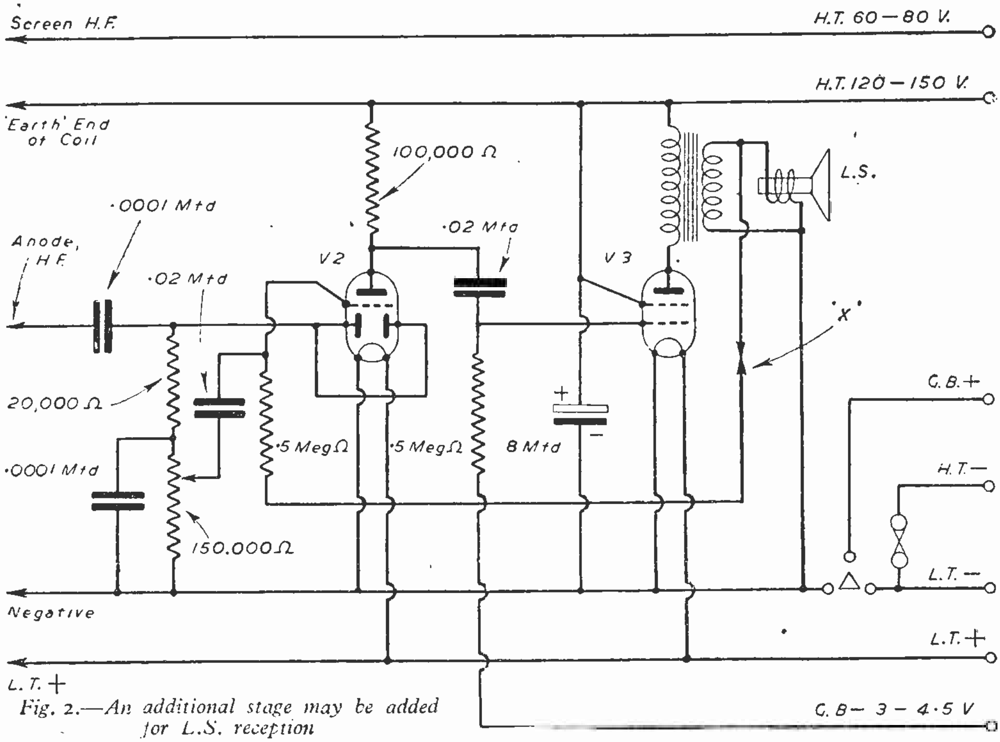


Fig. 2.—An additional stage may be added for L.S. reception

practical tests can be made. To do so disconnect the feedback wire at "X," taking the lead from the .5 megohm grid resistor to the negative line. Then during matching, any improvement or deterioration in quality will become more evident. The feedback lead can be reconnected at "X" when the best ratio is found. When changing leads remember to switch off receiver. Otherwise damage to the output valve is probable.

On connecting the feedback wire there should be a noticeable drop in volume; all objectionable screechiness and distortion of the signal should disappear. Maximum volume, reproduced without audible distortion in speech or music, is to be expected. Any pronounced oscillation or serious distortion indicates that the feedback is not negative but positive. In which instance reverse the leads to the primary of the output transformer. This will correct the phase of the feedback voltage. To ensure most satisfactory feedback a loudspeaker of 2-3 ohms is desirable.

Fig. 3 represents a more ambitious output stage. The same H.F. and D.D.T. circuits are used as for the receiver considered in Fig. 2. But the single output valve is replaced by two tetrodes or pentodes in quiescent push-pull. A parallel fed Q.P.P. inter-valve transformer is also used.

Matched Output Valves

With Q.P.P. the choice of valves is critical. Valves should preferably be of the same newness, and certainly of similar characteristics and type. Slight discrepancies in balancing of a Q.P.P. output stage can often be overcome by adopting slightly different screen voltages for each of the two valves, so bringing both anode currents to a common level.

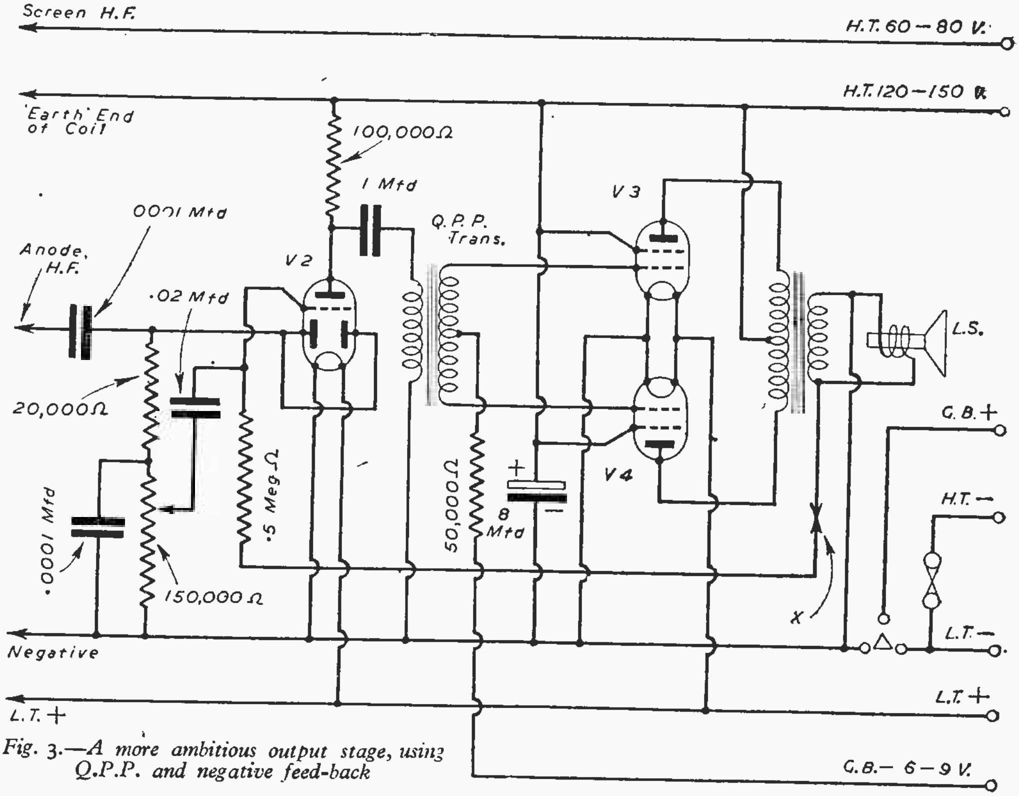


Fig. 3.—A more ambitious output stage, using Q.P.P. and negative feed-back

Output transformer matching can be decided by practical, aural experiments, as with the previous Fig. 2 circuit. Procedure for the correction in feedback phase, if wrong, also follows the lines relating to Fig. 2.

The value of applied bias can be adjusted as required. A higher negative grid bias provides less drain on the high tension battery, but distortion will be more pronounced.

The procedure of mounting the loudspeaker on a baffle is thoroughly recommended, especially where the lowest musical frequencies are to be heard without appreciable attenuation. A 10-12in. speaker is recommended for Fig. 2 and Fig. 3.

A simple and effective baffle can be constructed with stout ¾in. board. A convenient size for mounting in the corner of a room is 3ft. by 2ft. 6ins., the speaker aperture being provided centrally. To minimise high note attenuation, the result of sound reflections from an immediate hard-surfaced wall, it is a good plan loosely to drape the baffle and loudspeaker back with baize or similar material. The front, loudspeaker, baffle aperture is best left clear. Any decorative covering will merely attenuate the high musical frequencies.

Underneath the Dipole

Television Pick-ups and Reflections. By "THE SCANNER"

WHILST most readers of this journal are interested in radio as a hobby, a good many of them combine this interest with an active part in the radio industry. Not all of them pay much attention to the financial columns of the newspapers, where the City Editors currently report "Gramophones and radios dull, and Old Consols 1⅜ lower," a comment which has no connection whatsoever with the top-cut tone control on their wireless receivers. Nevertheless, the technical progress of the British radio industry is closely related to such reports, and the healthier the radio companies' balance sheets are, the more likely it is that the boards of directors will authorise the allocation of more money for research, to the ultimate benefit of us all.

Radio Exports

An encouraging feature of the more recent annual reports of various radio manufacturing companies has been the reference in all of them to the increasing volume of exports. These exports in some instances reach the amazing proportion of more than half of the value of the output of wireless parts, sets and accessories, and, in particular, of complete radio stations and transmitters. In the face of intensive competition from the big American radio companies, our own representatives in many lands have secured contracts of great value. I do not think that any criticism can be directed at the "foreign policy" of our big radio companies, whose foreign salesmen are usually first-class engineers, linguists, diplomats, hosts, spell-binders and high-pressure commercial travellers all rolled into one! Men with strong personalities, plus all these qualities, have been doing this kind of job for years, and are quite unlike the timorous, ill-informed foreign representatives of certain other British industries. Technical excellence is a most important selling point, of course, but it is the "personal" touch which counts in the long run. Some years ago there was intensive competition for large radio transmitting stations in a Balkan country, and the specification and prices of British and American tenders were practically the same. But the scales were turned in favour of the British offer, due to an amazing impromptu music-hall turn given by the British salesman at a party at a cabaret when several members of the Cabinet of that country were present. This salesman, who was also a brilliant engineer, gave satirical imitations, in the course of a song, of the prominent members of the opposition party, much to the delight of the Prime Minister and his friends. After this, the contract was secured without further difficulty!

The Permanent "Nine Days' Wonder"

These exports are, however, largely to "soft currency" countries: getting our radio products into America or other dollar areas is quite a different matter. The power of the big American radio companies and corporations is enormous and covers a wide field of activity. The recording machines of R.C.A. and Western Electric are, for instance, products of their subsidiaries, and the huge royalties remitted annually to America by British film companies for the use of American apparatus and patents must offset a large proportion of the value of our exports. Somebody must have been very much asleep about twenty years ago, when one leading British radio company was actually restrained legally from proceeding with the development of its film recording apparatus through the manœuvres of a big American radio and gramophone company. At that time, I suppose that the British company directors had less foresight, and dismissed the development of the talking picture as a mere nine days' wonder. That decision has cost this country millions. It is a lesson that must be taken to heart when similar decisions have to be made in respect of television. In this field we are ahead of America. Perhaps we might export a few dozen of our latest types of cathode-ray tubes in exchange for dried eggs, nylons or—hush!—American film recording apparatus.

Man-made Static

Encouraged by good results obtained under favourable conditions in their localities, viewers have increased in number at the extreme range of the Alexandra Palace transmission—and even at points normally regarded as being beyond the range. Good results on individual receivers installed at such places as Chichester, Harwich, Bournemouth, Broadstairs, Malvern and Babbacombe have led optimists to try their luck at such distances. Radio dealers are helpful in this matter, and are usually prepared to allow a would-be purchaser to have a try-out free of charge, except, perhaps, for a nominal one to cover the erection of a dipole aerial. Results are dependent largely upon the immediate surroundings, and especially upon the extent of interference by man-made static from cars, diathermy and other electric appliances. There are other man-made interferences which could be reduced: harmonics of 20-metre transmissions from Service and amateur stations, which cause an unpleasant noise just between the sound and vision frequencies. Owing to the flatness of tuning in the average television receiver, this type of interference is sometimes the worst of the lot. The only remedy is to orientate the aerial system until the reflector comes between the dipole and the offending station, even if it means the sacrifice of a little signal strength on the A.P. signal. There are also various commercial short-wave aerials of extreme directional type. I have seen a dipole with three reflectors which has reduced interference successfully, and some keen amateurs have erected weird and wonderful aerial arrays which include a couple of "directors" in front of the dipole, in addition to a reflector behind. Aerial systems of this kind are easier to talk about than to install and maintain. They cover a big area and require a lot of guy and supporting wires and poles. They are also vulnerable to high winds, storm and tempest. On the whole, the simple dipole and reflector takes a lot of beating, and I have myself seen excellent pictures thus received as far away as Babbacombe.

Television Relays

There are a number of towns at the extreme range which are unfortunately placed so far as screening is concerned. Brighton, for instance, is screened by the adjacent South Downs, which effectively cut off the possibility of direct television pick-up in the low-lying parts of the town. Hundreds of potential viewers are lost because of the very low field-strength in such situations. On the hill overlooking Brighton, the results are good. Here is a case where the problem would be solved by making use of the relay system. The television signals would be picked up by a "central" receiver, installed in a high and favourable position. Using Post Office lines, the signal would be sent to subscribers, who would feed the signal through to amplifiers, loudspeakers and cathode-ray tubes. But even in Brighton itself, good reception has been obtained in some parts of the town—usually with the aid of a very high aerial.

Television results are indeed capricious at such distances, and it is always worth "trying your luck" if you are able to persuade a dealer to make a temporary installation.

Television and "Prefabs"

I am interested to note that the broadcast receiving aerial is considered to be an integral part of some of the new prefab bungalows, and is sometimes attached decoratively as part of the design. The aerials usually take the form of a vertical tube, a type of aerial which is becoming increasingly popular for general use. How much pleasanter these are than the unsightly, badly erected aerials one sees in many suburban back gardens. It wouldn't be very much more expensive for the prefab manufacturers to go one step further and incorporate a dipole aerial into the design. The cost would be increased by a very small amount only, and the tenant could use it for his ordinary radio receiver until he decides to purchase a television set. Of course, the "badge" of the dipole might lead the Post Office official "snoopers" to think that a £2 subscription is due. But think of the satisfaction to be derived from the act of pointing out the mistake, and frustrating just one of the army of form-filling officials with which we are now inflicted!

A Simple Lightning Arrester

THIS quickly made lightning arrester was improvised from an old broken-down mains switch. The switch mechanism was first entirely dismantled and the parts discarded, except for the two connecting sockets with their fixing nuts and washers. The two mouldings were both thoroughly cleaned inside.

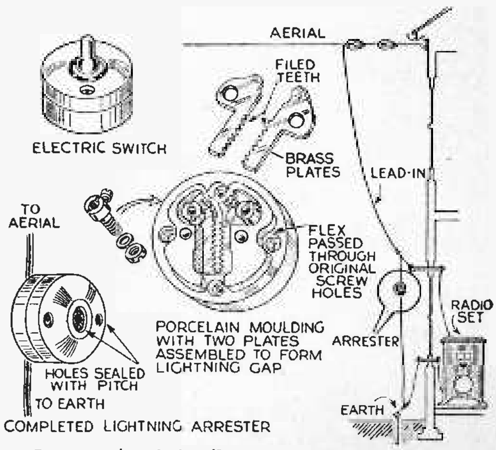
Next, two similar plates were cut from stout gauge sheet brass to fit exactly each side of the recess in the porcelain moulding. On the inner faces of each plate were cut a number of teeth. The plates were cut of such a width as to allow the teeth in each just to clear each other when the plates were assembled in the recess. This clearance between teeth was made to measure approximately 1/32in. Two lengths of single rubber-covered flex were then passed from the base of the moulding through the original fixing holes, and their bared ends secured to the plates by means of the original wire connecting sockets.

The switch cover was then refixed by means of the original set screws, sealing compound from an old H.T. battery being used to seal up the opening formerly occupied by the switch toggle.

Further, the meeting edges of the two halves of the moulding and the set screw holes were treated with sealing compound, spread on by means of a heated knife, to make the assembly quite waterproof.

The completed arrester was then connected directly between aerial and earth by means of the two lengths of flex. The arrester will offer an easy path (across the small air gap between the teeth) to any sudden lightning discharge striking the aerial, whilst the capacity is so minute as not to interfere with the reception. If a lightning-change-over switch is already fixed, outside or inside the house, this need not be dismantled, and may be used in conjunction with the arrester described. The arrester itself works automatically, needs no switching and will need no further attention once fitted.

The most important point, of course, is the construction of the brass plates. They should seat themselves exactly in the recess and no lateral movement should be possible, even without their respective connection sockets tightened up. A few minutes careful filing and shaping will achieve this exact fitting, and it should never be possible for the teeth in the two plates to touch. A thin sheet of mica could, of course, be inserted between the two sets of teeth to make doubly certain.



Constructional details of the lightning arrester described above

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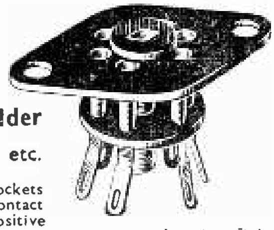

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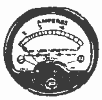

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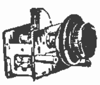

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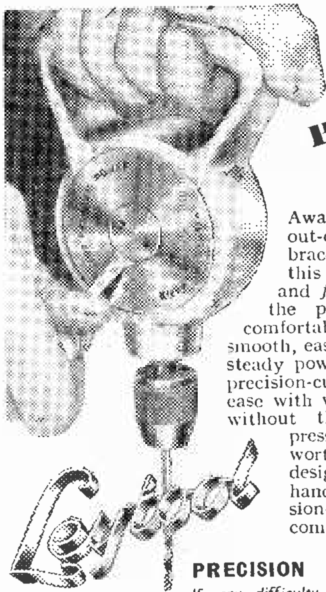

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News from the Clubs

WREKIN AND Y.M.C.A. AMATEUR RADIO SOCIETY
Hon. Sec.: T. L. Stevens, Sunny Cottage, Donnington Wood, Wellington, Shropshire.

THE above society held a further meeting at their H.Q., Y.M.C.A., Wellington, on Thursday, February 27th, when it was decided to amend the name of the society to read as above. The society now has a private room with workshop facilities; each member will be issued with a key giving him access to the room at any time.

Morse code instructions are now under way.

Sub-groups, such as transmitter, receiver, aerials, V.H.F., etc., are being formed.

Negotiations with the G.P.O. for transmitting facilities are now in progress.

Members will now meet on Monday, Thursday and Friday evenings each week, Friday being the evening for the business meeting.

NUNEATON AMATEUR RADIO SOCIETY
Hon. Sec.: B.R.S. 13,684, A. R. Stringer, 6, School Hill, Chapel End, Nuneaton.

A CLUB is now being organised and will be run on similar lines to other clubs around the district. Anyone who is interested in radio communication and short wave enthusiasts are invited to write for full particulars to the secretary.

WIGAN AND DISTRICT AMATEUR RADIO CLUB
Hon. Sec.: H. King, 2, Derby Street, Spring View, Wigan.

THE club is still more active with the granting of its call, viz., G3BPK. The TX has been completed and aerial masts are under construction. The station is licensed for 'phone and C.W. on all bands, but will operate temporarily on 40, 20 and 10. At a later date operation on 80 and 160 is anticipated, and all members are looking forward with enthusiasm to future contests.

CHEADLE (STAFFS) AND DISTRICT AMATEUR RADIO SOCIETY

WITHIN three months this club has made enormous strides. Classes have already started in the following subjects:

Morse, Elementary Theory, Receiver Theory and Design, Transmitter Theory and Design, Aerials, and Workshop Practice and Measurements.

All tutors are qualified wireless officers, and the club now has 13 licences to its credit. This constitutes a record, as the population-ratio of licences in this country is about one in 30,000; Cheadle has one to every 680 people and more coming up.

THE STOURBRIDGE AND DISTRICT RADIO SOCIETY
Hon. Sec.: D. Rock, Flat 1, Block 1, Worcester Road, Summerfield, nr. Kidderminster.

AT the general meeting of the above-named society, held on April 1st, 1947, there was a very good attendance to hear a most interesting lecture, together with demonstration. This was conducted by Mr. C. Young (G2AK), of Birmingham, who erected a portable radio transmitter and receiver working on 5 metres. During the description and explanation of this equipment he demonstrated its operational capabilities by contacting the vice-president, Mr. H. Littley (G2NV), of Stourton, who spoke to the society from his home.

The lecture was in non-technical language, and the members were entertained to the full.

ST. PANCRAS RADIO SOCIETY
Hon. Sec.: H. Brown, 84, Blenheim Gardens, Willesden Green, N.W.2.

ALTHOUGH weather and power cuts have taken a toll of attendance during the past few months, these have now returned to normal and the club is looking forward to a very active period next session.

On Saturday, June 28th, it is hoped to participate in an "Open Day" Exhibition of the Kentish Town Men's Institute where they have their headquarters. It is hoped to demonstrate the activities of the club, and also to let the public see a "ham" at work in his shack. All friends are welcome as are all those interested in wireless.

THE WEST BROMWICH AND DISTRICT RADIO SOCIETY
Hon. Sec.: R. G. Cousens, 38, Collins Road, Wednesbury, Staffs.

THE club now has over 30 members on its books, and meetings continue to be held weekly at the "Gough Arms" Hotel, Jowetts Lane, West Bromwich, at 7.30 p.m.

The subjects of recent talks were:

"5-metre receivers—straight and superhet," by G8NC.

"Simple Transmitters," by G2BJY.

"Measuring Instruments," by Mr. L. Harrison.

"Radio Interference—Its Causes and Cures," by a G.P.O. engineer.

A film show is being arranged for the near future, the previous one being very popular.

Members are taking it in turn to construct the club field day transmitter, for which a transmitting licence has already been granted by the G.P.O.

RADIO SOCIETY OF GREAT BRITAIN (BRIGHTON AND HOVE GROUP)
Town Representative: Lt.-Com. J. R. D. Sainsbury, 80, Lansdowne Place, Hove.

THERE has been a good deal of activity in the area recently—meetings take place on alternate Mondays at the Golden Cross P.H., Western Road, Brighton, commencing at 7.30 p.m. It is known that there is still a small number of members living in the area whose names and addresses are not known to the T.R. Circular letters giving local news and details of meetings are sent out periodically and it is therefore requested that any member who has not so far received such a circular communicate with the T.R. or with any member of the local committee.

At a recent meeting, Mr. Crabtree demonstrated the modern method of lining up a superhet., using a P.M. oscillator and a 'scope. On another occasion, Mr. Geof. Johnson gave an interesting talk on power supplies and mentioned a number of modifications to improve stability. He also gave a useful cascade doubler circuit not generally known.

A radio quiz, organised by Mr. Epton, was the main subject of another meeting. This was a great success and members voted in favour of another at an early date. 3APO excelled in answering questions on international prefixes, many of which fooled other competitors.

So far as future activities are concerned it is not possible to make any announcement. Negotiations are in hand to arrange for demonstrations by manufacturers and talks by well-known people. Something of interest will be laid on for each meeting and members notified in due course.

G5ZQ, having had a long battle with the local Council, has at last obtained permission to erect masts at his QTH. By the time this is in print they should be up and a 150 watt P.A. should be in use.

PROPOSED CHELMSFORD AND DISTRICT CHAPTER, INTERNATIONAL SHORT WAVE LEAGUE

MR. W. C. MILLS, ISWL/G261, of 3, Elm Cottages, Broomfield, Chelmsford, is anxious to form a club in Chelmsford under the above name. The I.S.W.L. will give the club full support. Will all hams and S.W.L.s interested contact Mr. Mills at above address?

Programme Pointers

Further Comments on a Concert Programme Plebiscite. By MAURICE REEVE

GREAT minds sometimes think alike. Just about the time that my last article appeared, I attended a concert at the Albert Hall. What did I find inside the programme? Why, nothing less than a slip of paper on which I was invited to record my ideal concert programme. There were spaces marked a, b, c and d. . . . The concert was the popular orchestral type plus pianoforte concerto, and the question was being asked by the agent.

Now, my idea of a plebiscite would be something much more exhaustive and, consequently, in the long run, much more selective and valuable a guide to programme building than this. I do not set out just to ascertain what sort of entertainment people want on a Sunday afternoon—the particular concert in question was of the Sabbatarian postprandial variety only. I want to know what different types of people want on different days and at different times of the day; also in different halls—or listening in, and even at different prices, or no price at all!

Supposing, for example, the concert agent referred to above collected a thousand plebiscite slips and, after careful analysis, found that that afternoon's particular audience preferred the following programme—or type of programme:

(a) Overture, "Le Carnival Romain" (Berlioz)

(b) Pianoforte Concerto in B flat minor (Tschaikowsky)

(c) Suite, "Casse Noisette" (Tschaikowsky)

(d) Symphony No. 5 in C minor (Beethoven)

and decides to give "the public" what it asks for. A very varied and long concert-going experience tells me that if he mounted that programme at any time or in any place he would get some of the shocks of his life.

Every type of concert produces its own reactions, born very largely of its own traditions and historical associations. If these reactions, or æsthetic demands, are not met, or, what is even worse, if they are outraged in any way, the results are plain to see in diminished and disgruntled audiences. To take an extreme, hypothetical, case. Kodaly's brilliant suite "Hary Janos" as played at the Promenade Concerts, with the zylophonist wearing Hungarian national costume and receiving his own personal ovation, would be hugely frowned upon at one of the classic symphony concerts. Although the work is in the repertory of most orchestras, the zylophonist would be denied his personal glory and would appear as an ordinary member of the orchestra. Conversely, what we pay several shillings to hear at a symphony concert in January may be less acceptable for two shillings standing in the promenade in August.

All this would have to be carefully sorted out. We must be most wary against giving people what they don't want just because we have carelessly offered it to them at the wrong time. The resulting empty seats may only be caused by this and not because they were given something which they didn't want "no how nowhere."

How Many Concerts

How many types of concerts are there? I am, of course, dealing with symphony concerts and not with specialist recitals for solo instruments. Well, the three which obviously draw the largest audiences—whose wishes should first of all be consulted—are, of course, the B.B.C. studio concerts, the Promenade Concerts and the B.B.C. Symphony Concerts, both in the provinces and London. In addition, but the most important from the commercial and "musical well being" point of view, are the series of winter symphony concerts, usually about eight to 10 in number, and dependent almost entirely on box office support. It is these concerts which are now beginning to suffer from the decline in the wartime boom, and whose audiences are rightly tired of the fare they have had dished up to them for so long. I feel that if there is anything we can do to help maintain the patronage they enjoyed during the war years and immediately after we should do it, and if they are losing that patronage through faulty programme building then the obstacle should not be too big to overcome. It is only one of the difficulties. I know. A glutted market is a bigger one

The Promenade Concert programmes may, with some truth, be said not to be in need of interference. The public support they enjoy could be cited as proof. But doesn't that also serve as a cry to the organisers of the less prosperous series? We can almost hear the plea, "Give us the programmes we want and we, too, will buy the seats." It is in the attempt to provide *not* "the public" but the *different* concert going publics that I submit the following questions.

When do you like attending a symphony concert best—time, day, season? This is very important and will give the clue to many of the items voted for).

Your favourite symphonic writer? Your favourite concerto writer? Do you like the one-composer programme? Do you prefer the austerely classical composer such as Bach, Beethoven, Brahms? Do you prefer the more flamboyant type like Tschaikowsky or Dvorak? Do you prefer symphony concerts with or without a concerto? About how many symphony concerts do you attend in a year? How many do you listen-in to in a year? Which forms do you prefer, symphonies, concertos, overtures, suites, operatic scenes and excerpts?

These are the questions which my plebiscite would set out and seek answers to. Naturally, the whole thing would appear more cut and dried, and business like, than it does here. But I do think that, were this properly organised and responded to, a major problem might be solved. And the B.B.C. seems obviously the most suitable authority to suggest it to.

If the Tschaikowsky and Rachmaninow war horses were voted out of programmes as a result, then pianists would have to stifle their annoyance and *amour propre* and get down to it and learn something new for a change.

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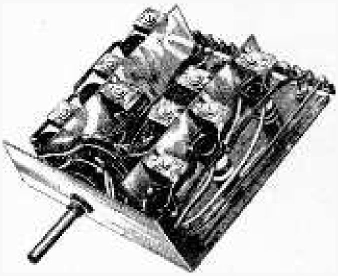

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Impressions on the Wax

Review of the Latest Gramophone Records

AN interesting set of records this month are those by Jean Pougnet (violin), with the Royal Philharmonic Orchestra conducted by Sir Thomas Beecham, Bart. There are three records in the set, five sides of which are devoted to Delius's Concerto for Violin and Orchestra, whilst the sixth side is a recording by the orchestra only of Prelude to "Irmelin," also by Delius.

Although French by birth, Jean Pougnet has received all his training in England from a professor who has taught several other distinguished violinists, and until recently was leader of the London Phillharmonic Orchestra. He possesses twin violins, each worth something in the region of £400. He likes to know that, if anything should happen to one of these instruments, he can rely upon having another closely similar in tone and "feel." The numbers of the records are *H.M.V. DB*6369-71.

The recent death of Manuel de Falla robbed music of a highly original composer, whose genius is especially evident in his ballets and the opera "La Vida Breve." This work won a prize offered for the best national opera when the composer was approaching thirty years old, though, ironically enough, it had to wait eight years for its first performance. The "Danse Espagnole" savours much of Spanish folk music, of which Falla was a keen student. The strong rhythms of the Iberian peasantry, constantly appearing in his stage and other works, give his music a vigour and crispness which comes over very well in an arrangement for violin. Kreisler's translation of the "Danse Espagnole" is cunningly laid out for the instrument, and Ginette Neveu's playing of it on *H.M.V. DA*1865 is superb. The reverse of the record is occupied by "Hora Staccato," a piece by Dinicu, a Roumanian composer not often heard of outside this favourite of solo violinists.

Recording of "Euryanthe"

THE libretto to "Euryanthe" has proved such a handicap to representations of the complete opera that much fine music has remained tucked away on the shelves. The overture, however, has stayed in the concert repertory. It may be said to consist of two vigorous, stirring dramatic sections separated by the weird tomb motif. Most of Weber's overtures are of the type which contain some of the themes of the ensuing opera, and "Euryanthe" is no exception. John Barbirolli is meticulously careful to bring out the details in the scores he conducts, especially in regard to the strings. He began his musical career as a 'cellist, and the string section of the orchestra commands his closest attention. This recording of "Euryanthe," on *H.M.V. C*3560, is magnificently vigorous, clear-cut and dramatic: the ensemble of the Hallé Orchestra will be a delight to all lovers of fine orchestral playing.

When Tchaikovsky turned his attention to the string quartet, the sense of melody that makes his orchestral work so delightful served him in good stead. He made of the slow movement of the Quartet in D, Op. 11, a piece so characteristic of his most melodious style that it has stepped outside the quartet as a whole and is often played independently. Andre Kostelanetz and the Robin Dell Orchestra of Philadelphia should be given a hearing in their attractive new recording of the masterpiece on *Columbia DX*1354. Coupled with it is a well-known number from Tchaikovsky's suite, "The Months"—a delightful Barcarolle.

Vocal Recordings

GWEN CATLEY is one of our most brilliant native sopranos. This month she has chosen an aria which makes heavy demands on the capabilities of any singer. The "Bell Song" from "Lakme" exacts great accuracy of intonation and phrasing, notably in the dazzling bravura passages. Here, Miss Catley gives a really outstanding performance which would convince anyone at one hearing of her very great talent. No wonder she is called the "English Lily Pons." The number of the record is *H.M.V. B*9541.

Both "Lohengrin" and "Tannhauser" are comparatively early works in the Wagner catalogue, and to many listeners the earlier Wagner is more attractive than the Ring dramas and "Parsifal." Joan Hammond's choice this month brings two of the most famous arias from the operas concerned. *H.M.V. C*3562 is a distinguished record for the operatic collection.

It has been the fashion to laugh at many of the songs which held the audiences in Victorian drawing-rooms spellbound, but considered dispassionately these pieces reveal admirable craftsmanship and grateful writing for the voice. "The Holy City" is one of these, and as Gladys Ripley sings it one can feel the reasons for its enormous popularity with our grandparents. During the war years Miss Ripley has steadily risen into the front rank of British singers. Handel's "Largo" is on the reverse of this record—*H.M.V. C*3549.

Variety

SWING enthusiasts will be interested in the news that Columbia have started a new swing music series with world-famous artists. It is intended each month to feature the top swing-bands of the U.S.A. in up-to-date recordings, and so build up a valuable series. Among the stars introduced this month is Gene Krupa and his Orchestra, with a recording of "That Drummer's Band" and "Leave Us Leap," on *Columbia DB*2290.

The rhythm-style section of Parlophone is notable this month for the introduction of Artie Shaw and his New Recording Band. America's popular swing maestro now has two orchestras—one for swing and the other with augmented strings. "Let's Walk" and "The Glider," on *Parlophone R*3027, are by his swing combination, with Shaw himself on the clarinet.

Recordings by popular crooners this month include "September Song" and "Souvenirs," by Frank Sinatra, on *Columbia DB*2286; "The Thrill Is Gone" and "Dixie" by Dinah Shore, on *Columbia DB*2284.

Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Contacts Wanted

SIR,—I have recently completed the five-valve short-wave superhet as described in PRACTICAL WIRELESS (April, 1946, issue), and have had splendid results, although I had to add a 5 : 1 ratio transformer in the output stage to obtain the volume I required. Antenna in use is a 40ft. "end-on" single wire.

If any reader has made this set, I would like to hear from him with regard to type of aerial and valves in use, etc. All letters will be answered.—T. S. LEWIS (19, Cambria Avenue, Ellesmere, Shropshire).

Service Engineers

SIR,—Referring to all the writers in these columns on the above subject, I beg to summarise and to point out to all of them the following points:

1. Good radio-servicing *cannot* be carried out without *all* the best of test-gear, which must be accurate, and I would venture to say that both many of the *shops* and *private* individuals do not possess these.
2. There is only one way to do a job, and that is "*As new*"—be a credit to your profession.
3. *Practical* and *theoretical* training is essential, and it is my opinion that one is *dangerous* without the other.
4. A word about charges. A person who has had a radio repaired is not in the position to say that charges are excessive, because he *does not know* what is entailed in the repair of this set; therefore, to the serviceman—charge what the job is worth, taking into consideration the technical difficulties surmounted and the time involved, plus components. After all, no man in his right mind will work all the time for nothing.
5. It is my opinion that all servicemen should be prepared to study hard and be in possession of a complete set of good test gear or *get out* of the game.—W. F. PULFREY (Chatham).

[*This correspondence is now closed.*—ED.]

Correspondent Wanted

SIR,—I want one or two boys to correspond with me, and perhaps be able to exchange ideas, etc. I'm also an amateur radio operator.—MURRAY SCHAW, R.M.D., Waipawa, H. Bry, New Zealand, Nth Island.

R.A.F. Tx TR/9

SIR,—I would like to correspond with any keen radio amateur conversant with, or in possession of, an ex-R.A.F. transmitter type T/R9.

One of these sets is in my possession, and I desire to acquire as much knowledge as possible relating to the conversion of this set for amateur use.

As it seems impossible to obtain a circuit diagram of this transmitter I should be very grateful if this could have your attention, as I am sure there must be other amateurs as keen as myself who will welcome an exchange of ideas.—J. SAINTHORSE (81, Saltwell Place, Gateshead 8, Co. Durham).

Re Ex-Service Equipment R1155A

SIR,—I would like to answer a few points raised by your correspondent, A. W. Mann (Middlesbrough).

I have had one of these Rxs since September, 1946. I think the results on S.W. stations are very good, and are every bit as good as heard on some types of American commercial communications receivers. My main interests are in the amateurs; nearly all these are received on the L.S.

Here are some amateurs received to date: CE3CK, CN8AB, CO7PX, CO8MB, CX2AX, CX2CO, 9 D2s, 3 EIs, 5 D4s, 4 Fs, 171 Gs (mostly heard on 3.5 Mc/s), GC4LI, 4 GIs, 9 GMs, 11 GWs, 3 HBs, 4 Is, 4 LAs, LU3EQ, LU4HI, LU6AJ, ON4HC, 20 OZs, OX4MJ, 30 PAQs, 2 SMs, SV1AH, TI2OA, TR1P, UA1AB, 4 VEs, VO1I (3.8 Mc/s), VP9F, 120 Ws, 16 XAs, YR5V, YV3AL, ZB1AB.

I have also heard these S.W. broadcast stations on various bands: CNR, TAP, VLA4, VLBC, VLC4, PRL7, FSI, CKNC, CKLO, CHOL, WNRI, SBP, WNRA, HER3, CSW6, Andorra, VONH (5.97 Mc/s), SDB2, KOFA, WWV, OTC5, WOOW, WCBX, WNRE, OTC2, Moscow on all bands.

Tuning is very easy, even on S.W., the S.M. dial being excellent. The noise-level can be very high when receiving weak stations and it is better to use 'phones then.

There is a certain amount of second-channel interference on 14 Mc/s, but this can be cured by using an external pre-selector. The Rx also makes an ideal one for general use, as the medium- and long-wave bands are included in most models. The Rx also works very well with a 10-metre converter and Rx tuned to about 3 Mc/s.

All stations listed were 'phone—no C.W.—as I cannot read morse yet.—W. A. TAYLOR (Newhaven).

Reports Wanted

SIR,—I would be pleased if you would publish my call, and I would also appreciate reports on my transmissions on 40-metre band.—A. C. APPLEBY (G3BKK, Newcastle-on-Tyne, PSE QSL via RSGB).

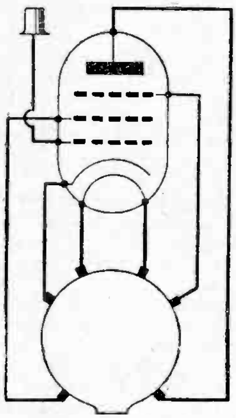
S.130 Stabiliser

SIR,—I would very much like, through your columns, to contact some reader situated similarly to myself (e.g., age about 18 years, fair knowledge radio, *hoping* to enter university next October).

May I take this opportunity of saying how interesting and helpful I find your technical and constructional articles. Finally, you recently described a piece of apparatus containing the Cossor S130 neon stabiliser. If anyone could tell me where these fabulous objects may be obtained, I should be grateful.—J. WILLIS (16, Queen's Road, Alton, Hants).

German Valve Details

SIR,—The following information may assist Mr. G. Somerville (May-June issue) who requires information on a valve RV12P2000. This valve is a German Army valve, and the code used by the German Army is explained below:



The first letter "R" stands for Röhre (valve).

The second letter gives the type of valve:

V = Verstärker (amplifier).
G = Gleichrichter (rectifier).
L = Leistung (power).

The first set of figures gives filament voltage.

The third letter:

P = Pentode.
T = Triode.
D = Diode.

The last set of figures:

For "V" valve = Amplification factor.
For "G" valve = D.C. output current (mA.).
For "L" valve = Power output (watts).

i.e., an RV12P2000 valve is an H.F. pentode with 12.6 volt filament. Actually this valve was very extensively used by all the German services, including Air Force and Navy, and was used for H.F. amplifier, I.F. amplifier, A.F. amplifier, and even as an output valve.

Heater current: 75 mA.
Anode volts: 220 volts.
Screen volts: 140 volts.
Impedance: 1.5 MΩ.
μ: 2,000.

Grid volts are determined by duty to which valve is put. For H.F. circuits: 2 volts.

The connections are as shown in the accompanying diagram.—A. J. THOMPSON (N.17).

[*We wish to take this opportunity of thanking the many hundreds of readers who so kindly submitted data, interesting details and even actual samples of this particular valve. The information has been passed on to Mr. Somerville.*—ED.]

Peculiar Faults

SIR,—Reference your issue for May-June "Open to Discussion," Richard G. Guy's letter and your reply.

I have met this peculiarity on many occasions and it has, as you say, always been in the output transformer, and anyone who is well acquainted with the Marconi CR100 or Naval Type B.28 receiver will have experienced the same "freak."

In these sets, the transformer is mounted on the receiver chassis, and in the earlier models quite good reproduction could be obtained without 'phones or speaker if the L.F. gain was high enough. The only other noise I have met is from the output valve itself, and I believe it would be due to the rattling of the electrodes.—L. W. DODD, G3BIZ (Co. Durham).

Correspondent Wanted

SIR,—I have just been released from the Forces and I am taking radio as my hobby.

I am desirous of corresponding with other readers and enthusiasts in all parts of the globe. I shall be pleased if you will kindly assist me.

I am keenly interested in short-wave receivers, and transmitters, and I should like to exchange ideas, mutual aids, or to be helped by more advanced amateurs and keen experimenters in this field.

I trust you will assist me, and I promise that letters from SWLs will be answered where possible by air mail.—M. I. DADA (24, Volcy Pougnet Street, Port Louis, Mauritius).

Spirituality or Spiritualism?

SIR,—With reference to "Thermion's" remarks in "On Your Wavelength" recently, may I say that I think the word "spirituality" is the one applicable to Christianity, as differing from spiritualism. I am sure "Thermion," as he says himself, or Mr. J. N. Maskelyne, formerly of Maskelyne's Hall of Mystery, could stage a séance.

The writer in the *Psychic News* seems to me to imply that we can act as a sort of "superhet" as regards the inner ultra-violet world, which we can call the "realm of the spirit," and that there are some particularly sensitive individuals better able to do so than others. I do not refer to the insane, D.T.s, or opium smokers, sufferers from liver disorders or indigestion.—M. K. HUGGARD (Co. Dublin).

"The Vector Problem"

SIR,—I have checked the point raised by A. O. Griffiths in your May-June issue, and find that Figs. 1 and 2 on page 157 are correct as they stand. The arrow above each diagram indicates that the vectors are moving in the standard anti-clockwise convention, so Eg is going negative. I suspect that Mr. Griffiths has unwittingly introduced a 180 deg. error in the course of his experiment to demonstrate his "provable fact." In any case, he cannot agree with Fig. 1 and not Fig. 2.—R. S. HATCH (Chorley).

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