PRACTICAL WIRELESS, MAY, 1951

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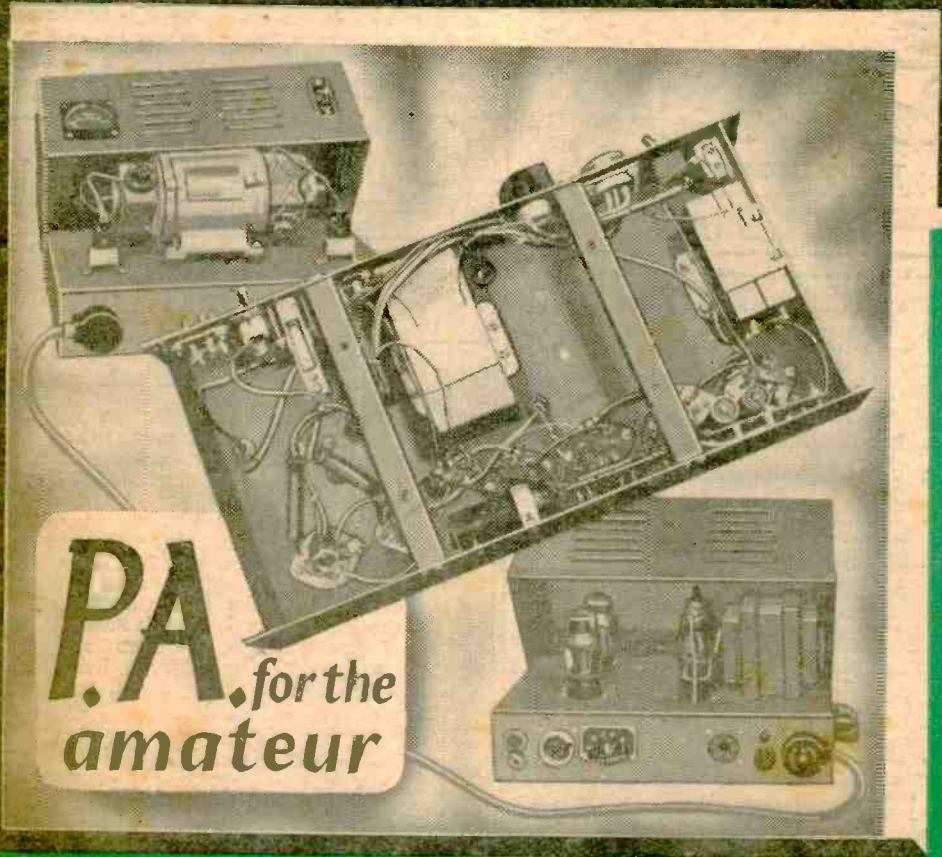
EDITOR:
F. J. CAMM

PRACTICAL WIRELESS



P.A. for the amateur

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Practical Wireless

19th YEAR OF ISSUE

EVERY MONTH.
VOL. XXVII. No. 535. MAY, 1951

Editor F. J. CAMM

COMMENTS OF THE MONTH — BY THE EDITOR

18th National Radio Show

THE 18th National Radio and Television Exhibition will be held this year at Earls Court from August 29th to September 8th. Thus is broken the long association which tied the name of the Radio Show with Olympia. In future we shall refer to this high spot of the Radio and Television Year as the National Radio Show. In many respects Olympia had proved itself to be unequal to the expanding demand of our twin industries. The last Exhibition to be held there was cramped; a much larger number of firms had to be accommodated, with the foreseen result that the gangways were reduced and on the busy days, notably early closing days and Saturdays, it was impossible for visitors to examine the exhibits in comfort.

The more spacious floor space at Earls Court will eliminate this main difficulty, and now that television is developing rapidly a fair proportion of this space will be devoted to special television booths, so that the public can see television programmes on the receivers exhibited.

The first day of the show, namely, August 28th, is to be "Invitation Day" for overseas and other special visitors, and it is expected that Earl Mountbatten will open the Exhibition to the public on August 29th.

The scope of this year's exhibition has been considerably broadened, for every branch of the radio and electronic industry will be represented, and in addition there will be exhibits of gramophones, records and accessories, electro-medical equipment, electronic scientific instruments and test gear, including related products and services, trade exhibits and dealer aids.

Services and Government Departments will be represented by exhibits from the Army, the Royal Air Force, the Board of Trade, the Ministry of Civil Aviation, the Department of Scientific and Industrial Research, and British Railways.

The B.B.C. has promised full co-operation, and visitors will have a much better view this year of the television studio and of the artistes and technical personnel in action.

There will be improved facilities for comparing the various television receivers on exhibits in a 250ft.-long gallery. The control of the distribution of sound and vision will form an exhibit which will be of interest to every technician. There will be glass-walled continuity suites for both radio and television, with the announcers in public view.

We learn that the emphasis in the exhibition will be on export, because invitations to the show have already been distributed widely overseas, and a 28-page booklet entitled "British Radio for the World" has been prepared for overseas circulation only.

The exhibition comes within the Festival of Britain period and visitors who come to Britain in the late summer will also be able to visit the Marine and Engineering Exhibition, and the Flying Display and Exhibition of the Society of British Aircraft Constructors as well as the Motor Show.

The British Institution of Radio Engineers is holding one of the sessions of its 1951 Convention at the National Radio Show.

For the demonstration of radio receivers soundproof enclosures will be provided, a special radio signal being piped to exhibitors requiring it. It will be generated in the control room and will be within the medium-wave coverage of normal broadcast receivers. Only one signal will be transmitted over this network and it will be modulated with good quality speech and music obtained from recordings on magnetic tape, and it will simulate as nearly as possible a typical medium-wave broadcasting station for the demonstration of complete radio receivers.

The technical committee are hoping to provide for the benefit of exhibitors of high-grade low-frequency apparatus, a high-quality audio-signal superimposed on the cable of network carrying the radio programme referred to above. A simple filter will be installed in each demonstration room using the service so that either or both signals can be provided using the same cable run. It is proposed to send out a standard B.B.C. programme taken direct from the B.B.C. over the music lines which will be available in the control room.—F. J. C.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate number of licences issued during the year ended 31st January, 1951.

Region	*Number*
London Postal	2,331,000
Home Counties	1,641,000
Midland	1,736,000
North Eastern	1,896,000
North Western	1,604,000
South Western	1,060,000
Welsh and Border Counties ..	728,000
Total England and Wales ..	10,996,000
Scotland	1,118,000
Northern Ireland	208,000
Grand Total	12,322,000

The above total includes 657,959 licences for television.

New Transmitter for Third Programme

A NEW high-power transmitter and mast radiator are shortly to be put into service at Daventry for the Third Programme. The installation has two of the latest Marconi 100 kW. air-cooled transmitters, with paralleling equipment, to give an output of 200 kW. but, to conform with the Copenhagen Plan, the actual power used will be limited to 150 kW.

This newest design of broadcasting equipment is housed in the oldest surviving B.B.C. transmitting station and now occupies the space where, 25 years ago, the B.B.C. installed their first high-power transmitter for long-wave broadcasting — the famous "old gentleman" of radio, 5XX. This venerable transmitter, which was in service until 1948, was also Marconi engineered, and replaced the historic 5XX which had been used for experimental broadcasting by the Marconi Company from their own works at Chelmsford.

The new installation consists of two complete transmitters of 100 kW. output. They are arranged in line with a special paralleling unit between them, in which the outputs are combined.

Death of Mr. P. C. Bullock

THE B.B.C. announces with regret the death of Mr. P. C. Bullock, A.M.I.Mech.E., A.M.I.E.E. Mr. Bullock joined the Station Design and Installation Department (now Planning and Installation Department) of the B.B.C. in 1931, having previously been with the English Electric Company, and shortly afterwards became head of the power section of this department. In 1944 ill health compelled him to resign this post, but he has since been responsible for the technical negotiation of all agreements for electricity supply for the B.B.C's stations.

E.M.I. and the Festival of Britain

THE Land Travel Exhibition, which forms part of the Festival activities, will feature a display of Amateur Radio Equipment.

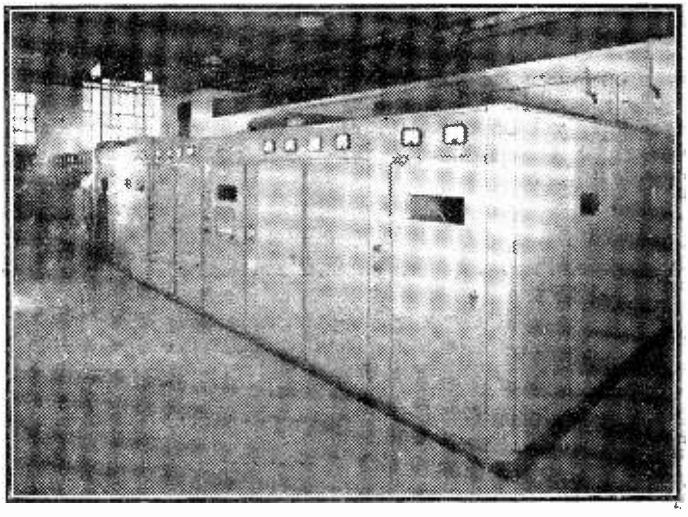
An E.M.I. Absorption Wavemeter has been selected for exhibition in the Amateur Radio Section. This wavemeter employs a germanium crystal rectifier. It operates over the range of 1.6 to 30.0 Mc/s.

Special Magnetic Recorder

A SPECIAL E.M.I. portable magnetic tape recorder is being supplied to the Festival authorities for use in the Dome of Discovery.

The number of enquiries, in many languages, that are expected will necessitate the services of expert translators and technicians.

To enable a query to be "stored" when it is impracticable to give an "on-the-spot" answer, this latest type of professional magnetic-recording apparatus is being used. The enquirer will deliver his questions into the microphone and the recording can then be played back at a suitable time and an answer given.



The two 100 kW. Marconi transmitters at Daventry. The transmitters are worked in parallel to give 200 kW.

The machine will record up to 60 minutes on each 1,200 ft. reel of recording tape and once the queries have been dealt with the recordings can be erased and the tape used again and again.

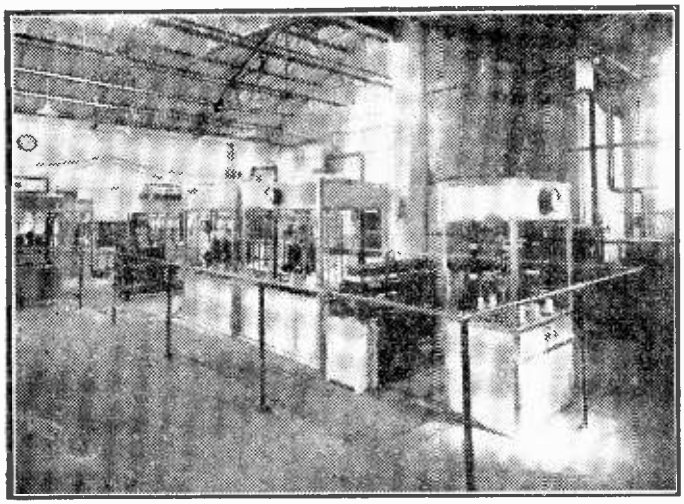
The machine and the Emitape recording medium is being provided by E.M.I. Factories, Ltd., Hayes, Middlesex, England.

Ultrasonics

UNDERWATER sound can be picked up by an entirely new method recently reported to the Acoustical Society of America. When ultrasonic waves strike a wire covered with a porous coating and immersed in water, an alternating potential of the same frequency as the waves is set up within the wire. The kind of metal used in the wire makes no difference, but the effect seems to depend on the kind of porous coating and on the solution with which the wire is covered. The voltage produced is very small, but it can be amplified to useful magnitudes. This discovery, says *Radio Electronics*, may be useful for submarine detection and it will be used for laboratory study of various kinds of underwater effects.

Brain Diagnosis

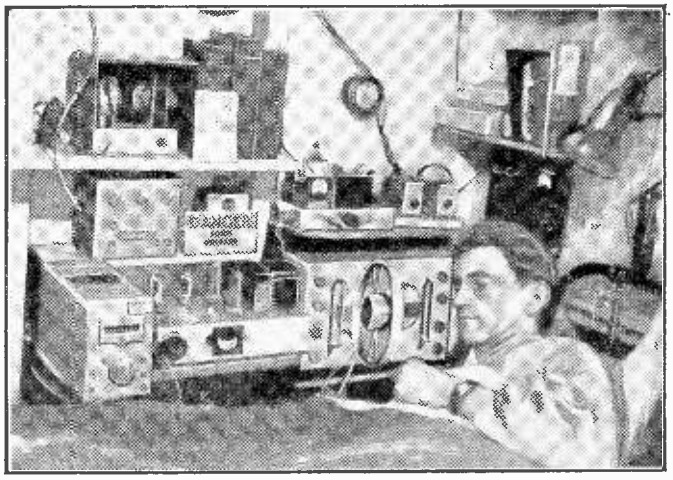
ULTRASONICS are also being used in research into brain disorders. Radiations are passed through the brain and are attenuated through tissues, etc., but remain undisturbed when passed through fluids. As a result a "map" of the brain may be "drawn" to show the presence of fluids, and it is claimed that this is superior to X-ray examinations.



Compare this view of the original 5XX transmitter at Daventry.

The Ham Spirit

FOR five years 24-year-old Len Chastey, of Bridestowe, nr. Okehampton, has lain in his hut at the Cornish Riviera Sanatorium, Roschill, Penzance. As a result of the efforts of the Cornwall Amateur Radio Club he has now obtained a transmitting licence and his "hut" has been well equipped. Now, instead of being cut off from the rest of the world, he is in constant touch with amateurs in all parts. His call is G3GZK and his equipment is rated at 25 watts.



Len Chastey with his finely equipped "shack." See story above.

Oliver Heaviside

IN a lecture recently to the Junior Section of the Cambridge branch of the Institution of Post Officer Engineers, Dr. G. F. C. Searle, F.R.S., described "the man as he was." Dr. Searle is probably now the only surviving scientific man who met Heaviside during his work.

Town Relays

STOKE-ON-TRENT Corporation recently considered the question of town relays of radio and television and it was recommended that offers made by two companies be examined in further detail, and that systems already in operation in two other districts be inspected.

At Dover, the Town Council decided to postpone for a month a proposal to enter into an agreement. In the meantime local traders will have an opportunity of putting forward alternative systems. A similar scheme proposed by traders had been turned down some time ago.

Three Waveband Superhet for the Beginner

A Simple, Inexpensive Superhet Especially Suitable for the Newcomer

By "ELECTRON"

THERE has apparently grown a legend that to build a superhet one must have a wide experience in receiver construction, and in any case, superhet teething troubles are no task for the beginner to tackle. Whilst a superhet is admittedly a more complex unit than a straight of the 0-v-2 variety, and there may occur more involved faults and difficulties, the constructional snags are, in the main, greatly exaggerated. True, the theory of the superhet is more involved (and one is advised to glean at least a working knowledge of this before such a receiver is built), and the initial adjustments more complicated than with a straight receiver; but the problems facing the prospective builder of a superhet are no more than the average constructor can deal with.

All thoughts of point-to-point wiring diagrams must be instantly dismissed. The theoretical circuit diagram and a rough idea of the main component dispositions are all that is necessary, plus common sense and thoughtfulness in the constructional work.

Thus a superhet, even of the simplest type, although not for the real beginner, is well within the capabilities of constructors who have had a priming in various T.R.F. receivers. The receiver about to be described is ideal for enthusiasts who feel they want to progress from the T.R.F. receivers which have been their outlet for constructional work in the past.

The receiver has nothing formidable in its design or construction and can be built very quickly and cheaply. Moreover, it is surprisingly efficient for its size, and will illustrate to hitherto anti-superhet readers that the difficulties often associated with such receivers are largely mythical.

Requirements

When the receiver was designed, the essentials required were that it should be simple, easy to construct, and of reasonably good quality in reproduction. Additionally, coverage on medium and short wavebands was envisaged, and operation on a short indoor aerial was required.

The theoretical circuit will show that medium and short wavebands are included, but many readers, especially those living in the Midlands area, would, no doubt, desire the inclusion of a long waveband for reception of the Droitwich station. This is a simple enough matter, and it only requires the addition of a further set of coils; the wave-change switch mentioned will accommodate the extra ones. For details, see coil data table. Again, if only medium-wave coverage is required, the short-wave range can be completely ignored.

The Circuit

As will be seen from the diagram, five valves are used in the receiver. The first valve operates as frequency changer and local oscillator—it is a 6K8, a triode hexode. Incoming signals (as applied to the hexode grid and selected by the tuning circuit

LIST OF COMPONENTS

Resistors

R1 47,000Ω
R2 47Ω
R3 47,000Ω
R4 47,000Ω
R5 47,000Ω
R6 10,000Ω
R7 350Ω
R8 470,000Ω
R9 47,000Ω
R10 470,000Ω
R11 1 MΩ
R12 47,000Ω
R13 240,000Ω
R14 2,000Ω
R15 1 MΩ
R16 500,000Ω potentiometer
R17 47,000Ω
R18 240Ω
R19 4,700Ω
R20 22,000Ω
R21 47,000Ω

Capacitors

C1/C2
C3 0.1 μF
C4 100 pF silver mica
C5 0.1 μF
C6 0.1 μF
C7 0.1 μF
C8 100 pF silver mica
C9 0.1 μF
C10 0.05 μF
C11 150 μF silver mica
C12 0.1 μF
C13 50 pF silver mica
C14 4.0 μF
C15 100 pF
C16 0.05 μF
C17 25 μF 25v. wkg.
C18 0.005 μF
C19 25 μF, 25v. wkg.
C20 16 μF
C21 16 μF
C22 0.05 μF
C23 0.01 μF, 750v. wkg.

Inductors

L1-3 Aerial coils (see table).
L4-6 Oscillator coils (see table).
L7 Smoothing choke, 60 mA. 10 Henries. (Or field coil of loudspeaker if mains energised type is used.)

Switches

S1, 2, 3, 4, Wavechange switch. 4-pole, 3-way.
S5 Pickup-radio switch. Single pole 2-way.
S6 Tone control selector. Single pole 4-way.
S7 On-off switch, incorporated with R16.

Valves

V1 Frequency changer, 6K8 (or X65, ECH35, etc.).
V2 I.F. Amplifier, 6K7 (or KTW63, EF39, etc.).
V3 Second Detector, 6Q7 (or DH63, EBC33, etc.).
V4 Output, 6V6 (or KT63, EL32, etc.).
V5 Full-wave rectifier, 5Y3 (or U50, etc.).

Transformers

T1 Loudspeaker transformer.
T2 Primary to suit mains. Secondaries: 300-0-300v. at 100 mA, 5v. at 3a. and 6.3v. at 2a.
I.F.T.1, I.F.T.2: I.F. Transformers for 465 kc/s.

L1/C1) are mixed with oscillations created in the triode circuit of the 6K8. These two carriers (the signal received and the local oscillations) will produce a beat note, the frequency of which will be out of the audible range, i.e., supersonic, hence the name of the circuit as supersonic-heterodyne, to give it the full name. It will be seen therefore that, since the I.F. transformers must tune to this beat frequency (or intermediate frequency as it is called) in order to provide sufficient amplification, it is essential that the oscillator coils used must be those designed for the intermediate frequency transformers used. Since the receiver being described uses I.F. transformers of 465 kc/s, then oscillator coils for a 465 kc/s I.F. must be used. Also of some importance is the matter of the oscillator padders; details of these and of oscillator and aerial coil trimmers are given in the coil data tables.

The frequency changer is coupled to the I.F. amplifier, a 6K7, in the orthodox manner, with the earthy end of the I.F. transformer secondary taken to the A.V.C. line. Full A.V.C. is applied to the signal grid and the actual A.V.C. components are of such a value as to be very suitable for the type of fading normally met with in medium-wave reception. Should the receiver be built with the object of using it mainly on the short waveband, then the values of R11 and C9 could be reduced in order to counteract the more rapid fading typical of short-wave reception.

Many of the troubles encountered in superhets are due to badly designed or constructed oscillator stages. In the receiver described, parallel-feed is used, and it is important to install the coils in the correct phase. If the secondary winding is the wrong way round, as likely as not no signals will be received. So, if you cannot get the correct connections for the coils you use, be prepared to change over the secondaries if the necessity arises!

The I.F. amplifier (or first detector as it is sometimes called) is a perfectly straightforward circuit, following normal pattern. The following valve, a 6Q7 double-diode-triode, conforms to standard practice and acts as second detector/A.V.C./1st audio amplifier. The audio side of the 6Q7, i.e., the triode section, is generously decoupled in the anode circuit.

Provision for a pick-up is made, and the switch S5 feeds either the pick-up output or the IF output to the grid of the 6Q7. On pick-up position the coupling capacitor C10 is cut out and automatically mutes the radio side.

The output of V3 is coupled to the output valve, a 6V6, through a 0.05 μF capacitor, and the grid leak of that stage acts as the volume control (R16). A 47,000-ohm resistor is included as a grid stopper.

In place of the more usual fixed-capacitor/variable-resistor, tone-control arrangement, a simple switched circuit is included. This uses the normal fixed capacitor, but the switch (S6) selects various fixed resistors to give three pre-arranged tonal values. Individual constructors may wish to experiment to find values to suit their personal tastes, but the three values given here will cater for most likes. The fourth position, with no resistor in circuit, is specially useful when a lot of bass is required.

Nothing much need be said about the power supply, since this follows normal practice, consisting simply of a 5Y3 full-wave rectifier with standard capacitor-input filter circuit.

Construction

The accompanying layout sketches show the disposition of major components. There is nothing fanciful about the construction, but an attempt was made to place the above chassis components in some semblance of balance. Neatness, providing electrical efficiency is not impaired, always adds to the final pleasure of building radio gear.

Starting from the right-hand bottom corner (front) is the 6K8, followed by the first I.F. transformer and the 6K7. Next to this, along the back, is the second I.F.T., the 6Q7 and the output 6V6. The power supply components have been mounted as far away from the receiver section as

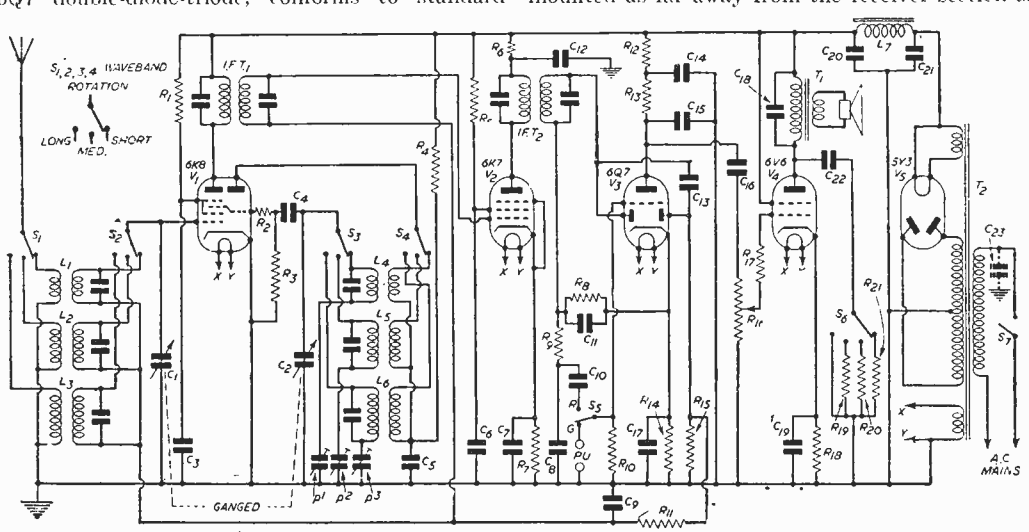


Fig. 1.—Theoretical circuit of the receiver.

practical. No screening was found to be necessary since, with the gain turned fully on, there is no more than the usual very faint hum—hardly audible.

So much for above chassis layout. The below-chassis wiring contains no real snags, and Fig. 3 will show all that one needs to know of the positioning of components. Those not marked should be taken to the nearest appropriate terminal and, in the case of earth return, leads to the nearest position on the earth bus-bars. As far as possible make all earth returns from each stage to a common point. Thus, in the V2 stage, C6, C7, R7 and C12 are all taken to the same point. These common return points are then interconnected by the bus-bars. This procedure is well worth while in the interests of stability, and it prevents receiver earth points being at different potentials throughout the stages.

One hears much about needing an abundance of screened leads in superhet receivers but this is not always strictly necessary. In fact, screening can be overdone because the more screening there is the greater will be the by-pass to earth. Hence the ideal set has just the minimum of screening—and no more. In practice, a certain amount of trial and error is suggested; starting off with only the very obvious leads screened, others being screened if any form of instability or other symptoms appear which suggests insufficient isolation.

Four leads only have been made with screened wire in the original model. They are: (1) From the aerial terminal to the wiper of S1; (2) From the top cap (grid of hexode) of V1 through the chassis; (3) From the rotor of C2 through the chassis to S3; and (4) From the top cap of V3 (grid) through chassis to S5.

No other leads have been screened, since there is no trace of instability, or other annoying symptoms. The valves can be fitted with valve cans (that is, V1, V2 and V3) in order to shield them; in actual fact this was done on the original receiver but they were later removed as an experiment, and since no signs of misbehaviour occurred they were left off.

No leads, apart from the four already mentioned, have been screened, and providing that short and direct wiring is made, that the soldered joints are sound, and that the earth returns are made as previously suggested, there should be no difficulties in getting good initial results from the receiver.

Rigidity is another important point. Components such as resistors, capacitors and so forth, should be taken to "natural" anchor points wherever possible, as in the case of valve-holder tags, I.F.T. terminals and switch connections. Where necessary, insulated anchor tag strips (those with one earthed and two insulated tags are very convenient) should be fitted to provide additional securing points. Only three were found to be necessary and these are shown in their approximate positions in the under-chassis sketch. Even the rawest beginner should have little trouble in wiring-up this receiver, and components will be found to "fall into position" quite easily.

A word on the coils used. These are Wearite "P-" type coils as they fitted into the scheme of things quite nicely. Other similar coils could, of course, be used where desired. The R.F. coils are banked horizontally along the rear of the chassis, next to the wave-change switch; the oscillator coils are banked vertically. It was found quite unnecessary to use coil shields since in the arrangement used the two coils in use for any one given position are far enough apart to prevent any troubles arising. For instance, when on short waves, the two coils in circuit (L1 and L4) are well spaced and are, additionally, in different planes. Similarly, of course, with the other ranges.

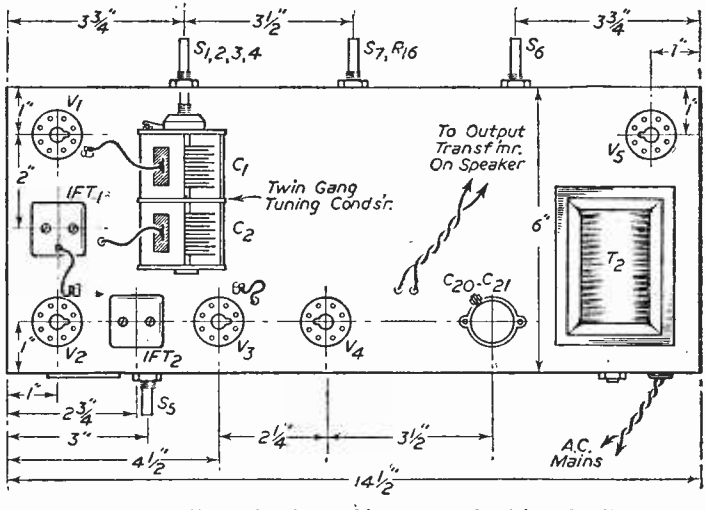


Fig. 2.—Above-chassis marking out and wiring details.

Wiring

The procedure for wiring is largely one of common sense. The layout diagram and the theoretical circuit should be studied closely and the various wiring sequences worked out mentally, with any snags ironed out, before any practical work begins.

COIL TABLES

	AERIAL COILS			OSCILLATOR COILS			
	Ref. No.	Type No.	Trimmer	Ref. No.	Type No.	Trimmer	Padder
Short Wave ..	.. L1	PA3	60 pF	L4	PO3	60pF	5,000pF (P1)
Medium Wave	.. L2	PA2	60 pF	L5	PO2	75pF	450 pF (P2)
Long Wave ..	.. L3	PA1	70 pF	L6	PO1	100 pF	150 pF (P3)

Time spent in working out these details will be well worth while—in fact it is more or less vital. There is, however, one point:—The wiring around the V1 valve-holder should be completed as far as possible before the coils L1, L2 and L3 are fitted into position, otherwise it may be difficult to insert the soldering iron without damaging the coils.

There is nothing outside of normal constructional practice involved, but there are a few points which should be mentioned. In the first place, C23, shown in the under-chassis sketch, was fitted in order to cure some modulation hum which appeared—i.e., a hum which appears only when stations are tuned in—the louder the signal, the greater the hum. Modulation hum is very unpredictable as it usually vanishes when the receiver is plugged into the mains of another house. It can be due to various reasons and likewise there are various cures for the trouble. However, the simplest, and usually most effective, is by the insertion of a capacitor in the position shown. If such a capacitor is installed, the working voltage must be at least 750.

Secondly, the component marked C20/C21. This contains two 16 μF sections—the casing being the negative common. An economy can be effected by using one of the 16+16+25 μF combined capacitors, with the latter section being used for the output bias smoothing (C19).

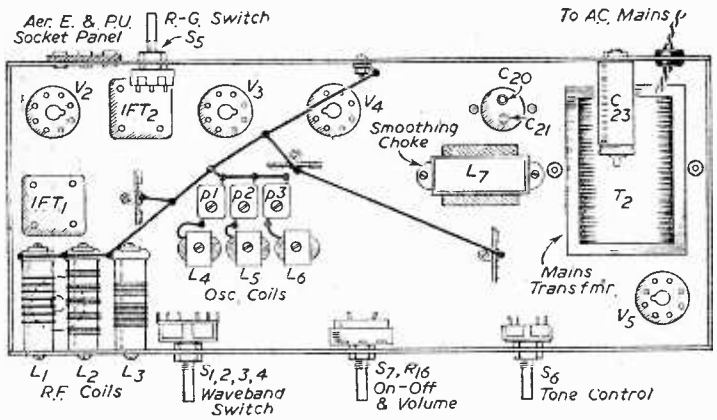


Fig. 3.—Under-chassis layout and wiring details.

In the matter of the twin-tuning gang, the one on hand when the receiver was built had only a single-speed spindle, so a small epicyclic drive was attached to give slow-motion control—so essential if any measure of success is to be attained on the short waveband.

Results

As to results, these have been entirely satisfactory. On medium waves the various European stations provide good, strong signals, and the sensitivity as a whole is good. Quality is also up to standard and will satisfy even the fastidious. The short waveband is well worth while and brings in scores of stations at good, strong entertainment strength, and considering that only a short throw-out aerial of about 4ft. of wire has been used the results are extremely good.

The newcomer to superhets will be pleasantly surprised at the "punch" on the short wavebands. The background level is very low—mains hum for all practical purposes being non-existent and superhet "hiss" being similarly inconspicuous.

In lining up the completed receiver it is, of course, ideal to use a signal generator. However many constructors, especially newcomers, will not have this facility and so a more crude method must be used. It must be remembered that a completed superhet may after the initial switch-on appear to be completely "dead." This is because the trimmers and padders and the I.F.Ts are so far out of alignment. The medium waveband should be tackled first, and the twin gang rotated slowly for any signs of a station. When one has been located it is more than likely very faint, but adjustment of the I.F.T. trimmers will bring the transformers into tune and the station will peak up. Always start at the V3 end and work backwards to the V1 anode winding. When the I.F.Ts have been roughly aligned, the trimmers and padder remain to be dealt with: if a tuning dial is used, the padder (in this case P2) is adjusted until the station received corresponds to its marked position on the dial. Mutual adjustment of trimmers and padder will be necessary for correct "tracking." The trimmer on the aerial coil (L2) is the final adjustment required.

The above is a necessarily brief idea of how to bring the circuits into alignment. If the constructor requires to be specially exact then reference to available textbooks is suggested. Incidentally, one way of getting the receiver roughly in tune is that used by the writer.

Anxious to check the performance in the absence of a test oscillator—for no signals of any description could be heard—the domestic vacuum cleaner was switched on! The I.F.Ts were then trimmed until the noise in the speaker became at its loudest, and a flip of the twin-gang soon produced stations. Often similar interference noises are already laid on, but they can be self produced with any appropriate apparatus—vacuum cleaner, electric razor and so on. In an emergency this is quite a useful dodge!

Before attempting to align the receiver, the normal tests should be made to ensure that no dead shorts are present and that the correct voltages are applied to the various valves.

The short-wave fan could fit bandspreading, and this, in conjunction with a good outdoor aerial, will result in a splendid short-wave performance.

Short-wave Topics

Interesting Information for the Expert and the Beginner

By A. W. MANN

Moving-coil Headphones

MOVING-COIL headphones are very popular nowdays, due in part to the low price of ex-Service types.

Those used until recently by the writer are of the ex-R.A.F., large earpiece type. During the past week, however, I have been testing a pair which are of American manufacture.

At the time of writing there is available in the surplus market a headset adaptor known as type MC385C, high-to-low impedance. This, however, does not accurately match the R.A.F. type headphones to my receiver outputs.

It is designed for use with the American type HS33 and HS38 moving-coil headset.

A pair of HS33 type were purchased at a very reasonable figure from a well-known Liverpool firm, new and unused, the workmanship being of a very high order. Using the 385C matching transformer unit with the R1116A and an unmodified R1155A receiver, the response is exceptionally good. From comments heard on the amateur bands, a well-known G station operator uses the same type headset in conjunction with National H.R.O. The high sensitivity of these 'phones makes them most suitable for DX reception.

QRP Activity

Amateur radio in this country is represented to a considerable extent by comparatively high-power stations on most bands. This rather reduces the chances of QRP transmissions being heard. There are, however, periods of low activity, when the low-power stations can be heard. Under the circumstances QRP operators who fail to raise the station called, or find their repeated CQ calls remain unanswered, would be well advised to put out a general call to short-wave listeners, together with QTH. The results would provide much useful data as to coverage, together with some surprises.

They might be surprised to know just how far away their signals have been heard. The writer would like to compile a comprehensive list of G QRP 'phone stations and full details will be appreciated from those who care to let me have them.

Transmitter Receivers

This brings to mind the fact that there must be a considerable number of battery type ex-Service transmitter-receivers in the hands of experimenters. Some have been purchased with the object of modifying or adapting the receiver section, the transmitter being dismantled for spare parts.

On the other hand, the complete outfit may be stored away until such times as the owner is qualified to obtain an amateur licence. Amongst such apparatus there are, no doubt, quite a number of the ex-R.A.F. TR9 type.

I cannot, however, call to mind hearing any QRP 'phone stations which during a contact mentioned that one of these transmitter-receivers was in use.

There are various models of this transmitter-receiver including the TR9F. This consists of a T1138 transmitter, and a R1139 receiver. The frequency range being 6.6 Mc/s to 4.3 Mc/s. This transmitter was designed for use with the well-known inter-comm. amplifier A1134.

The TR9D included a T1119 transmitter unit and a R1120 receiver. While electromagnetic microphones were used with TR9F and TR9D there were certain modifications in the latter instance, and a A1134 was not used. One form of TR9F, however, was designed for use with carbon granual microphone.

At present the models available are of the TR9H type. The units being a T1396 transmitter and a R1139 receiver. The receiver is a six-valve TRF and incorporates H.F. regeneration. I will further discuss this receiver in the future.

The Amateur Bands

Pirates are to be heard on various bands. It would appear that the abolition of the artificial aerial licence was a retrograde step. In addition to its many other advantages its reintroduction might assist in curbing such misdirected enthusiasm.

Some may disagree with the personal opinion expressed, and in any case consider that the scope for experimental work which this form of licence allowed no longer exists. The increasing interest which is being shown in QRP transmitters is at least sufficient proof.

Simple Receivers

Much can be accomplished with simple receivers. Chassis constructional methods are an assurance to some extent against instability. Constructors, however, who have reverted from plywood to metal panels, should not overlook the fact that the L.T. on-off switch should be insulated from the panel or chassis according to where it is mounted.

Surplus Radio Apparatus

One sometimes sees for sale receivers which have suffered from attempts at modification by those lacking sufficient experience to carry out the work. Such receivers usually find their way into the junk shop.

Before attempting conversions and modifications, it is policy to obtain as much official data, together with theoretical diagrams, etc., as possible

If possible get the receiver working in its original form. Meanwhile, study the necessary modification data, or work out your own, so that you not only have a clear understanding as to what you are going to do but, in addition, how to do it.

It is a sound idea to redraw the basic circuit, and include the modifications. This takes time, but often saves hours of wasted effort.

Modern Superhet Tuning Unit–2

A Receiver Unit for Use with the Amplifier Described in our July, 1949, Issue

By R. HINDLE

THE connections to the ganged condenser are so made intentionally because it fits in better with the construction, and it is quite harmless so long as the leads are screened (as they would be in any case). Short pieces of coaxial cable are used, earthed by screws fitted in the condenser main frame, taking care not to distort the plates of the component. Note that the I.F. transformer between the frequency changer and the I.F. amplifier is the one with the pigtail, which lead should be cut as short as possible, allowing for connection to the grid cap.

Screened leads (again, coaxial cable) are used for leads carrying the audio signal between panels to avoid hum pick-up. This part of the circuit is vulnerable, and even a short, unscreened lead may introduce hum. Coupling condensers on the chassis, C36 and C37, are metal-cased, with the casing earthed, and open leads are limited to a fraction of an inch.

A thin, twin plastic flex is run from the heater pins of V5 to the two dial lampholders provided, and a five-core cable through the larger hole in the back of the chassis brings in the heater and H.T. voltages and mains control leads. A coaxial socket is provided for the pick-up connection, and another provides the aerial and earth connection. Coaxial cable is quite suitable for the latter purpose and is much neater than separate cables.

Two drive cords, fitted in the conventional manner, are used for the Osmor dial. One drives the condenser from the tuning spindle and provides the reduction ratio of the drive. The other drives the dial from the condenser spindle, using the two drums of equal size provided by the makers of the dial.

Alignment

In view of the recent shifting downwards of the B.B.C. wavelengths, it is important to keep all stray capacities low whilst wiring so that the necessary sweep is obtained. There is no difficulty in ensuring this with the layout given. A glass dial marked with the revised station positions is available and is now supplied with the assembly.

After carefully checking the constructional work, connect the chassis to the amplifier chassis by means of the five-core cable and the coaxial cable, and switch on. It is necessary, for best results, to ensure first that the I.F. circuits are correctly tuned to 465 kc/s, and if at all possible this should be done with a signal generator. If this cannot be done, however, these circuits should be left until later.

Check that the dial pointer sweeps exactly over the 180 degrees of the dial and short out the A.V.C. condenser until the aligning is completed (C44). Switch to medium waves and, with the aerial connected, it should be possible to tune-in a signal without any adjustment of the trimmers. If nothing can be tuned-in, and no faults can be found, it may be that the I.F. circuits are too far out of tune (if a signal generator has not been used), and these should be given a preliminary adjustment, listening for the rustling noise that indicates approach to tune.

When signals have been received, proceed as follows. Screw all trimmers (*not* coil cores) full in, and then slacken half a turn. Remove the top cap connections normally on V1 and V2, and connect the lead normally on V1 and V2 instead: the other is left disconnected. This eliminates the R.F. stage, and only the pack underneath the chassis will need adjusting. Set the dial to a station in the middle of the range that is normally well received and identifiable with certainty, and tune it in with the medium-wave oscillator coil core to maximum. This coil is the one between the trimmer banks. Now finally trim the I.F. transformers if these have not

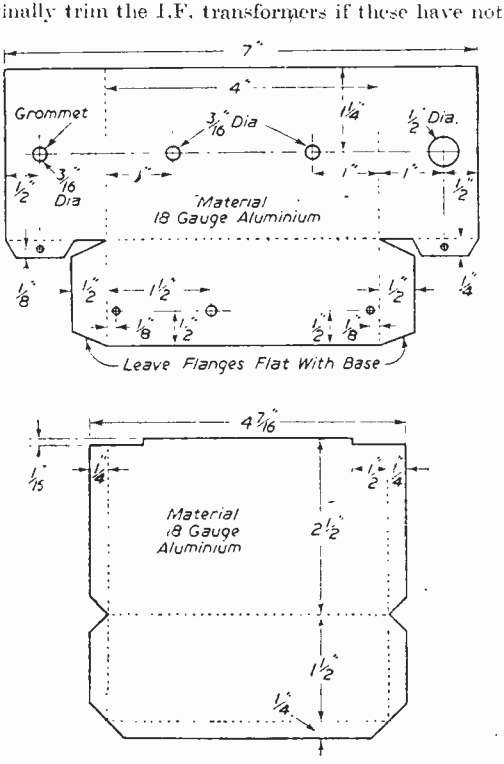


Fig. 5.—At the top (a) is the chassis layout and cutting plan, and at the bottom (b) the remainder of the box.

previously been set up with a signal generator; if they have, let well alone! Then set the dial to the position of the medium-wave Light programme as marked on the dial, and tune the signal to maximum with the oscillator trimmer, leaving the core alone. The third step is to set the dial to the North Regional position and then to adjust the oscillator core for maximum for this station. Now alternate on Light and North Regional transmissions, adjusting only the trimmer on the former and only the core on the latter, until satisfied that no further adjustment is required on either. Then, on the same two tuning points, using the same method with the aerial core and trimmer, bring this circuit into line. Finally, check the adjustments, using weak transmissions near to the two previously used.

Where the location of the constructor provides a very strong signal from any of the transmissions required for the adjustments they should be reduced in strength by working only with a short aerial. Later, when the main aerial is connected, the aerial circuit can be finally adjusted on weak transmissions at about the same frequency.

On long waves set the dial at 1,500 metres and tune in the Light programme on the oscillator core. Then, using any signals at the upper and lower part of the range whose frequency can be recognised, adjust the core and trimmer alternately, as before.

It is not so easy to find identifiable signals on the short waves and it will be better not to adjust the cores at all unless quite certain what is required. They will not be very far out and the aerial trimmer can be adjusted to resonance at the lower end of the range. If, however, a signal generator is available, a procedure similar to that described for medium waves will ensure best results.

The various trimmers and coils can be identified from the literature supplied with the coil units. If a calibrated signal generator is used for the adjustments the procedure is as described above, except that the following frequencies are substituted for the stations previously specified:

Long Waves	1,800 metres		166.7 kc/s Core
do.	1,000	do.	300 kc/s Trimmer
Medium Waves	450	do.	666.7 kc/s Core
do.	250	do.	1,200 kc/s Trimmer
Short Waves	45	do.	6.67 Mc/s Core
do.	20	do.	15 Mc/s Trimmer

When the above adjustments are completed restore the grid top caps to their normal positions and, on the same transmissions or generator signals as before, adjust cores and trimmers respectively of aerial and R.F. stages, but leaving the oscillator section alone. Finally, check these two stages on weak signals at about the same position on the dial, or, with signal generator, by reducing the signal to the minimum readable intensity.

Tone Control Unit

The separate tone control unit is built up on an aluminium chassis cut and drilled as in Fig. 5a and bent (markings inwards) to form four sides of a box. The two narrow flanges are bent up first. These are bolted to the base with countersunk bolts. The ½in. flanges are not bent; they are intended for screwing the chassis to the cabinet.

The other piece of aluminium Fig. 5b is bent to form the other two sides of the box with all the flanges bent at right-angles with the markings inwards. This should then fit snugly to the first part with the flanges inside the chassis walls. It will be necessary to round off corners with a file to ensure a good fit. Eventually, when wiring and testing is complete, the two parts should be screwed together with small, self-threading screws.

Looking into the chassis part as it stands on the bench, the hole on the left side wall is fitted with a grommet to take a piece of coaxial snugly. The 1 megohm potentiometer R28 is mounted in the adjacent hole in the front; the 100 K. potentiometer R26 goes to the right. A coaxial socket for the input is fitted in the right-hand side wall. A two-way fixing tag is screwed to the hole in the base at 1½in. from the left-hand side, the screw being countersunk.

Fix C40, R29 from the earthy ends of the controls to the earth tag. Join the two potentiometer moving arms together and to the unearthed soldering tag and then wire in rigidly C41 and C42. From the input coaxial socket wire C39, R27 to the upper ends of their respective controls. Finally, feed a length of coaxial cable through the hole and solder to the two tags of the tag board.

New Valve Voltmeter

A NEW valve voltmeter for use on D.C. and on A.C. over a frequency range of 50 c/s. to 150 Mc/s. is announced by the General Electric Co., Ltd. The instrument is mains operated (230 or 115 volts, 50 c/s.); has ranges of 1.5, 5, 15, 50 and 150 volts R.M.S. and D.C.; and costs £61 12s. 0d.

Principle of Operation

In the case of A.C. measurements, the voltage to be measured is applied to a diode valve rectifier which has a high load resistance so that the input capacitor is charged to a negative voltage almost equal to the peak of the applied voltage. This voltage is passed through a D.C. amplifier which has a degenerative action, and so eliminates errors due to changes in valve characteristics. The amplifier is connected in a bridge circuit and the out-of-balance current indicates the voltage under test.

The detecting diode valve is contained in the portable probe and is connected to the set by a flexible cable. This enables the diode valve to be taken direct to the point at which the voltage is to be measured, which reduces errors normally caused by long leads. Special arrangements are taken to maintain input impedance as high as possible at high frequencies.

For D.C. measurements the unknown voltage is connected directly to the D.C. amplifier and, as the bridge circuit is highly degenerative, a very high input resistance is obtained when making these measurements.

A particularly interesting feature of the circuit of the instrument is that when the zero is set on the lowest range it will hold good for all the other ranges.

On your Wavelength

by THERMION

Isle of Wight and Television

THE inclusion of the Isle of Wight in the map issued in connection with the Beveridge Report, showing the locations of present and proposed television stations, has brought me a number of letters asking whether this presages the erection of a transmitting station on that delectable spot.

One newspaper, more noted for its sensational style than for its accuracy, boldly asserted a week or two ago that this was to be the case. I have the highest authority for stating that an I.W. television station is not contemplated at the present time. It is possible that the island will be served by one of the stations on the mainland.

Discless Gramophones

I WROTE in last month's issue a note concerning the discless gramophone marketed some years ago, but which enjoyed a very short commercial life, and made use of a photo-electric cell and a celluloid sound track, by means of which one could have a record which played continuously, the duration of play being limited only by the length of the celluloid strip which somewhat resembled the sound track of a talking film.

Mr. P. W. Feesey, of Raynes Park, writes to say that the company which marketed it was the British Ozaphane Co., which had the enterprise to market a domestic instrument in this country. It was housed in a conventional radiogram cabinet round about the year 1936, and they had as their slogan "Music on a beam of light," and Sir Malcolm Sargent recorded several orchestral works on films for them, and half-hour reels of dance music were also produced.

Such a development is inevitable, but I think it will be many years before the standard system changes.

L.P.R.

THIS reader tells me that after brief experience in long-playing records he finds them remarkably satisfactory; although there are some reasons, he says, for criticism of it, there are many others to justify, as I have already pointed out, the continued use of the present standard 78 r.p.m. records. He considers the introduction of a third speed such as 45 r.p.m. would be a folly; 33⅓ (why not an integral number?) and 78 records between them cater adequately for all disc recording.

He comments that we do not, in our feature entitled "Impressions on the Wax," review Decca records. The answer is a simple one; they do not send them in!

Of course, the question of gramophone needle and record wear depends very much upon the user and the type of pick-up, as well as the quality of the needle. I have some records at home which are over thirty years old and do not exhibit very many signs of wear or deterioration of musical quality after all those years of fairly frequent playing. I agree with my correspondent when he says that the two most important features in avoiding record wear are lateral freedom of movement of the stylus and lightness of the pick-up head. One such head is the Acos G.P. 20. A sapphire stylus operates satisfactorily with this pick-up.

Summing up the argument, therefore, we are all agreed that a device requiring no needle would be ideal, that sound-on-film fidelity is not equal to present-day disc recording, and that we shall have to be satisfied with present discs for many years to come, not because of technical difficulties, but purely because of economic conditions.

Growth of Clubs

IN the early 'twenties wireless clubs sprang up in almost every street, and they performed a very useful function in mutual aid when technical difficulties arose, as they often did. They began to fade away in the middle 'thirties until in 1939 there were only a couple of dozen spread throughout the country. The advent of television has given a fresh impetus to the club movement, for not only are television clubs being formed, but also combined radio and television clubs.

This journal and its companion journal *Practical Television* have already appealed to the B.B.C. to issue special experimental programmes for television experimenters. They did this many years ago in connection with radio, and I see no reason why it should not be done with the new science. In fact, there are even more reasons why it should be done.

There are many uncharted problems in connection with TV which cannot be solved by the engineers of Alexandra Palace alone, not because they lack the necessary technical skill, but because they cannot be all over the country at the same time.

Such an experimental programme would mean that every time it was radiated some of the best brains in the country would be checking up and reporting to the B.B.C.

I have no doubt that the R.S.G.B., and some of the more important of the television clubs will support this plea.

Club Lectures

I OFTEN receive requests to lecture to clubs. Too often I am compelled to decline the invitation because insufficient time is given to me. I am always delighted to give a lecture, but in view of my other commitments I must have at least three months' notice. As the lecture season has now practically ended and will not commence until October, I suggest that club secretaries plan their next season's programme now and make arrangements for speakers accordingly.

Although I was unable to be present in person at one club meeting, I was able to record a lecture on wire so that the members could hear my voice. The recorder I am operating at present is the Wirek, made by Boosey and Hawkes. The spools contain enough wire for over one hour's recording.

Type R25 Conversion

How to Convert this ex-Service Unit into an Efficient Communications Receiver

By T. S. WHITE

THE Receiver Type 25, part of the ex-R.A.F. Transmitter-Receiver TR1196 is still readily available on the surplus market at an exceptionally modest price. Details of its conversion to a broadcast receiver have already appeared in these pages. The R25 unit however, contains much of the circuitry of a very efficient receiver of the Communications type, and this article describes a method of conversion with a minimum amount of alteration to the existing wiring, and utilising as many of the existing components as possible. The additional components required are the ganged tuning condenser, coils, one I.F. transformer and a few smaller items usually found in the experimenter's "spares box." One valve only (an output pentode) is required in addition to the six valves contained in the receiver unit.

Circuit Description

One of the EF36 (VR56) valves is utilised in the R.F. stage. No A.V.C. is applied, but the gain is controlled by a variable resistance in the cathode circuit. The existing EK32 (VR57) valve is retained in the mixer stage, followed by two stages of I.F. amplification, both using EF 39 (VR53) valves. A double diode-triode EBC33 (VR55) is used as detector and first audio valve and also provides AVC which is applied to the two I.F. amplifiers. Any small pentode such as the 6V6 or EL32 may be used in the output stage. The Beat frequency oscillator uses the remaining EF36 (VR56). The complete circuit is shown in Fig. 1.

Chasis Layout

After removing the existing tuned circuits from the chassis, it will be seen that there is very little space in which to place the necessary ganged tuning condenser, coils and wavechange switch. The top cover to the unit is therefore pressed into service and is bolted to the chassis as shown in Fig. 2. The

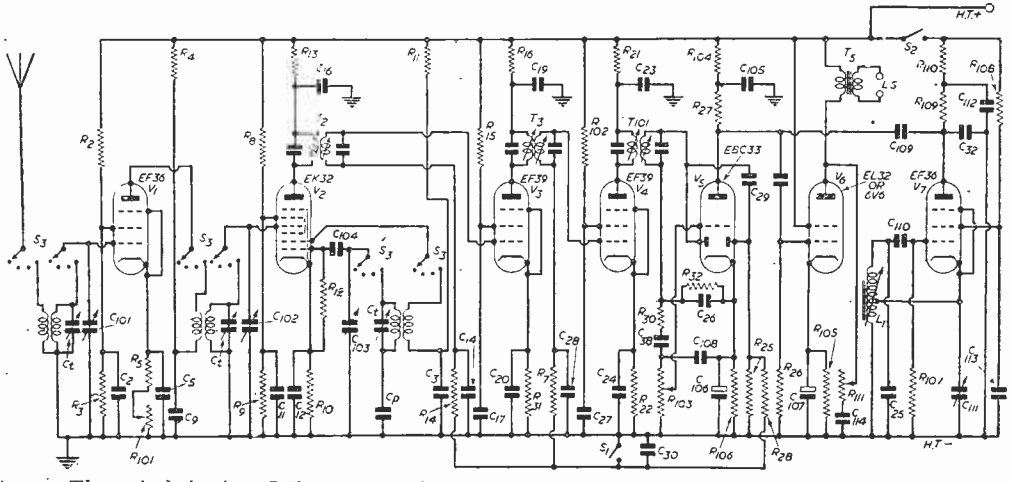


Fig. 1.—Theoretical circuit. Coil connections for Band 4 only shown. Resistors R2-R32, Condensers C2-C.38 I.F. transformers T2 and T3, and coil L1 are as used in R25 unit.

ADDITIONAL PARTS REQUIRED

I.F. transformer T101—460 kc's.
Aerial, H.F. and oscillator coils.
12 50pF pre-set condensers. W/C switch (S3)
2 S.P.S.T. toggle switches.

CONDENSERS

C101, 102, 103	—300-350pF. (ganged) variable.
C104, C110	—100 pF.
C105	—8 μF.
C106, C107	—25 μF. 25 v.
C108	—200 pF.
C109	—2 pF.
C111	—25 pF. variable.
C112	—.001 μF.
C113, C114	—.05 μF.

RESISTORS

R101	—5,000Ω Pot.
R102, R107, R108	—50,000Ω ¼ watt.
R103	—.5 MΩ Pot.
R104	—40,000Ω 1 watt.
R105	—470Ω 1 watt.
R106	—2,500Ω 1 watt.
R109	—1,000Ω.
R110	—10,000Ω.
R111	—10,000Ω Pot.

hinged lid on the chassis cover is removed and a piece of mica substituted to hold the oscillator padder condensers.

On the receiver unit chassis the Jones type plug is removed, L.T.+ and H.T.+ from the I.F. section being transferred to pin 7 of V1, and the H.T.+ side of R2 (100,000 Ω) respectively. A diagram showing the position of these components will be found pasted to the bottom plate of the unit. Condensers C35, C36 and C37, transformers T4 and T5, potentiometers R18 and R23 and coil L1 are also removed.

Transformer T5 may be used as the output transformer if headphone reception only is required. The additional I.F. transformer is mounted as shown in Fig. 2. The lead from the first I.F. transformer to the top grid-cap of V4 should be removed and the second I.F. transformer modified by removing the yellow lead from pin 5 of the EBC33 valveholder and taking this lead to the top grid-cap of V4. The additional wiring required to conform with the circuit diagram Fig. 1 can now be carried out.

The Tuned Circuits

The author wound coils on 1in. paxolin formers to cover the frequency range of 30 Mc/s to 600 Kc/s (10-500 metres). Several manufacturers are able to supply coils to cover this frequency range with a ganged .0003 or .00035 μF. condenser at reasonable prices, and therefore no details of the coils are given. Winding all the necessary coils is a long and tedious task and is not to be recommended. The values of the oscillation padder condensers have not been given as coil manufacturers will specify optimum values. The wave-change switch is a four-position Yaxley type consisting of three two-pole wafers mounted inside the chassis cover as shown in Fig. 2. Complete screening of the coils is unnecessary if the layout shown is adopted.

The Beat Frequency Oscillator

The coil L1 taken from the receiver unit is utilised in this circuit and the cathode tap is obtained by unwinding approximately one-third of the coil, fixing the tap, and rewinding. Note that the tapping point is nearest the earthy end of the coil. The leads to the top grid-cap of the valve, to the diode signal anode and to the B.F.O. pitch control should be screened, and a screen placed round all the B.F.O. components to prevent injection of beat frequency voltage into the early stages of the I.F. amplifier.

Power Supply

The requirements of the power supply are 200-250 volts at 70-80 mA for H.T. and 6.3 volts at 1.5 A. for L.T. An octal valveholder on the rear of the chassis cover is used to connect the supply to the receiver.

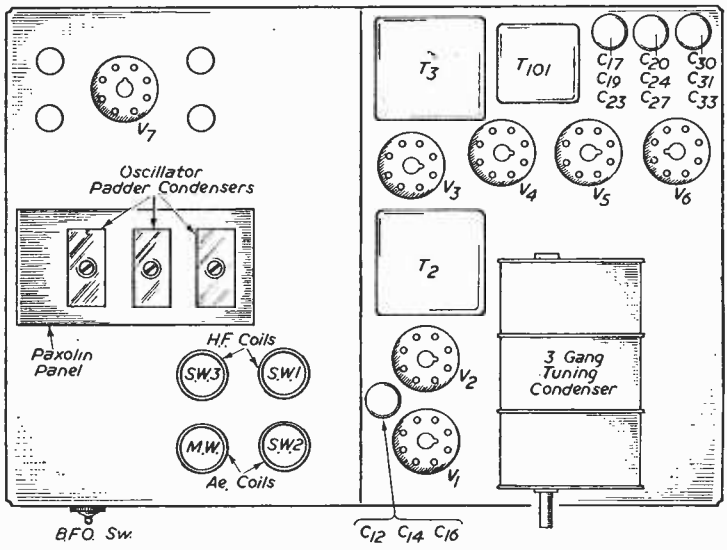


Fig. 2 (a).—Top of chassis layout.

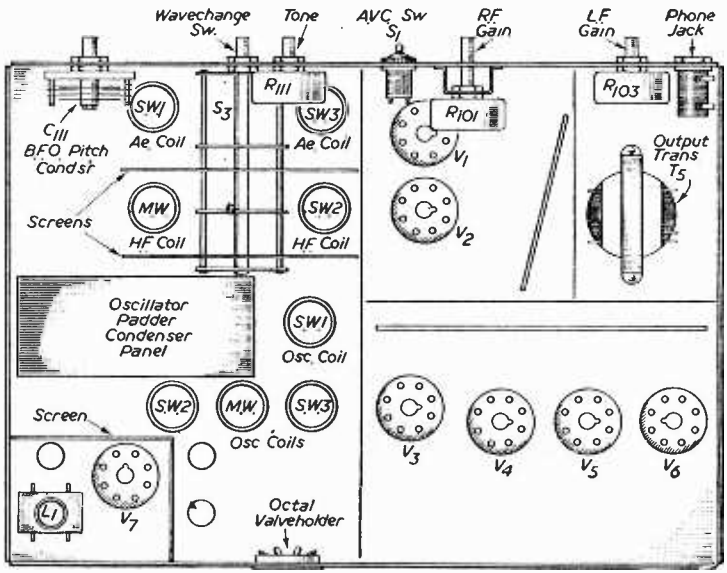


Fig. 2 (b).—Under chassis layout.

General

A slow-motion drive giving a reduction of at least 50-1 is recommended for use as the main tuning control. Fig. 3 gives the position of the controls. It will be seen that the space left by the removal of the Jones type plug must be covered to enable the R.F. gain control to be fitted. We must point out that we are unable to answer queries or give instructions for using alternative models of the R.25 or for making other modifications. We are, of course, always pleased to deal with problems arising directly from the details given, in constructional articles such as this, but must remind readers that a stamped-addressed envelope must be enclosed if a postal reply is required.

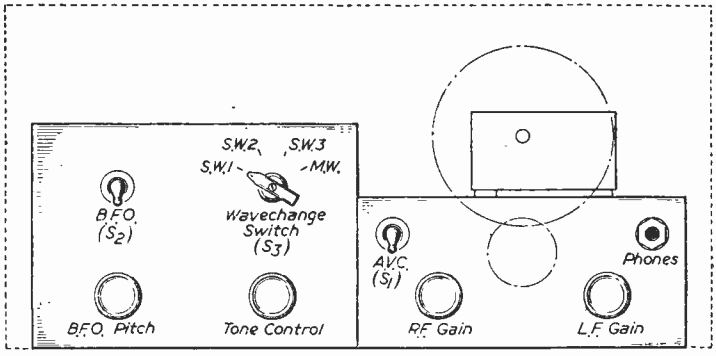


Fig. 3.—Panel layout.

Improved Crystal Receivers

Using the Germanium Crystals, and an Interesting Experimental Push-pull Circuit

By W. J. DELANEY (G2FMY)

ON several occasions recently young readers have asked whether it is possible to obtain improved signals in a crystal receiver by connecting two crystals in parallel. It is quite understandable that a beginner should reason that an increased output should be obtained if each detector gives a certain signal and these are combined before passing to the headphones, but unfortunately all that does happen is that the incoming signal is split between the two crystals, and thus each only handles half of the signal so that the combination, after detection, is only approximately the same as that given by one. There is quite a lot in this problem, however, and it will be shown later in this article that two crystals can be used to give an increased signal, and, in fact, a small crystal set can be built to operate a small loudspeaker provided that you are near enough to a powerful station. Before dealing with this, however, it should be pointed out that the crystal set should not be despised. Apart from the fact that the young newcomer to radio should start off on a crystal set in order better to understand some of the principles involved, there is a real field for this type of receiver: For bedside listening for the younger generation, at school, camp or other places where a battery or mains receiver would be inconvenient, and even for the old folk who want a little private listening to avoid interference with others.

Germanium Rectifier

The days of the catswhisker are, of course, over. There is no need to fiddle with delicate adjustments which are upset by the slightest vibration. Even the so-called pre-set detector is now superseded by the germanium type of permanent detector perfected during the war and now available in various types as a war-surplus item. Naturally new types are of improved design and may be preferred by those who can afford them. For experimental use, however, the surplus items will be found very useful and in most cases give a much better signal than the ordinary crystal detector. The signal is, of course, very weak with the simple crystal receiver, owing to the fact that there is no amplification, and therefore every care must be taken to avoid losses and to develop the maximum signal voltage across the tuning circuit. Fig. 1 shows the basic crystal receiver the coil being tuned by a standard variable condenser of .0003 or .0005 μF and the small condenser across the phones being of .001 μF. It will be noted that the aerial is coupled to the main coil through a smaller coil, and it is here that considerable time may be spent in experiment. The main coil is "damped" by the load of the crystal and here also improvements may be carried out by reducing the damping effect. Fig. 2 shows how this may be carried out by tapping the crystal down the coil. The young experimenter has, therefore, two interesting fields for work, and the following are some suggestions of the lines

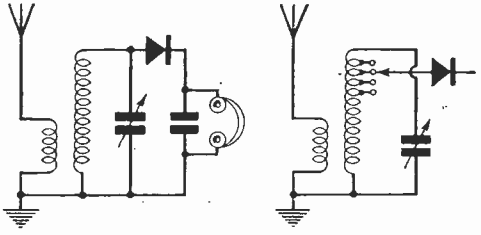


Fig. 1 (left).—A simple receiver circuit, and Fig. 2 (right).—An improved tuning coil.

upon which he may work. Firstly a single coil may be wound and arrangements made for connecting the aeria and the crystal to various points.

Coil Design

The simplest way of doing this is to use ordinary enamel-covered wire for the coil and to support the coil firmly so that a strip of brass may be fixed to the same board in such a manner that it can pivot on one end and the other end run across the coil.

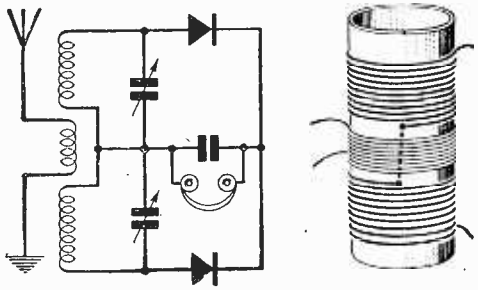
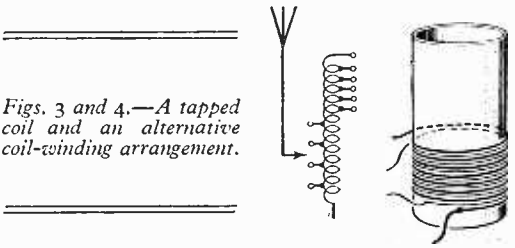


Fig. 5 (left).—A push-pull crystal circuit, and Fig. 6 (right)—Coil-winding details.

A punch mark in the brass where it touches the turns of wire, if run backwards and forwards several times over the coil, will scrape off the insulation and make contact with the bare wire. One such strip may be used for the crystal connection, and another for the aerial, and these may then be adjusted over very wide limits. Alternatively, loops may be made in the wire when it is wound on, and these may be used as connecting points, or they may be connected to multi-point selector switches. It will be found that the crystal connection will show a definite improvement at a certain position, any movement above or below that position reducing the signal strength. On the aerial side it is usually a matter of compromising between the loudest signal and the most selective point. If there is only one powerful station near you, then you can probably connect the aerial direct to the "top" of the coil. In London, however, where the Light and Home are both received very loudly, such a connection would result in both stations being heard together and therefore the aerial tapping point will have to be down near the earth end, thereby obtaining selectivity, but at the expense of signal strength or sensitivity. The tightness of the aerial coupling will also affect the selectivity and experiments may be made by interwinding a thin wire in between the lower turns of the other coil, or by winding the aerial coupling coil over thin strips of wood or other insulators stuck across the bottom end of the main coil. The size of the former on which the coil is wound will also affect results and also the number of turns of wire which are needed. The best idea is to try out various coil formers from, say, 1in. up to 3in. in diameter, and if you cut off about 40ft. of wire—about 24 gauge is most suitable—you can wind all of this on any size of former and it will cover roughly the Medium waveband. If you find in your particular locality that your station is received too near the ends of the tuning adjustment, take off or put on turns to suit. If the condenser is nearly wide open, then you need to take off some turns, whereas if it is practically closed, then you need more wire on.

Push-pull Circuit

Those readers who understand the A.C. type of receiver will know that the mains transformer secondary is wound to give double the required voltage, and each end of the winding is taken to one side of a half-wave rectifier. In this way, as the A.C. voltage changes its direction each half cycle there is always a rectifier waiting for it, and each half therefore works in turn. The same idea is seen in the ordinary push-pull output stage found in high-power amplifiers, and it may be applied to the crystal receiver as shown in Fig. 5. It will be seen here that there are two circuits each feeding a rectifier and the centre point is neutral. Two separate tuning condensers will have to be used, or a two-gang condenser may be employed if the trimmers are working satisfactorily. The coil is made up as shown in Fig. 6, the centre of the main coil being opened to allow the aerial or primary coil to be wound in between the two halves. Only about ¼in. to ½in. need be allowed, and again the number of turns for the aerial coil will have to be found by experiment to suit the particular locality. This is a very interesting circuit and will be found very good for giving improved signal strength at places where only a weak signal is normally received. A good aerial is needed, as it does not seem to react very favourably with very weak signals. In the London area, however, both the Light and Home programmes may be heard on a 2in. P.M. loudspeaker with an outdoor aerial, and it will be found a very interesting circuit for the experimenter.



Figs. 3 and 4.—A tapped coil and an alternative coil-winding arrangement.

V.H.F. at the Festival

THE lighthouse on the Shot Tower at the Festival will be switched on and off by V.H.F. Radio over a distance of approximately 3 miles.

The transmitter will be installed at Chance Brothers' London office with a four element Yagi directional serial providing a horizontal polarization, mounted on the roof of the building. The transmitter will be operated from the A.C. mains supply requiring 100 watts for operation when transmitting with a power output of 5 watts.

A total of six valves are employed in the transmitter which comprises a crystal-controlled oscillator followed by three multiplication stages, power amplifier and modulator stages.

The receiver is mounted in the lighthouse lantern with a four element Yagi aerial mounted on the outside balcony of the Shot Tower. The receiver is operated from the A.C. mains supply requiring 120 watts for operation and with crystal controlled frequency.

Simple Extension Speaker and Inter-communication System

A Domestic Aid and Experimental Set-up

By R. V. HARDY

THE usefulness of the extension loudspeaker is now generally recognised, and in many homes an additional speaker is installed in the "other room." However, comparatively few people appear to take advantage of the excellent microphone characteristics of the moving-coil extension speaker, by arranging inter-communication between the various rooms in the house. Perhaps this is partly due to the somewhat complicated designs which are sometimes published, and the mistaken idea that the system will be difficult to install.

The circuit shown on the right is extremely simple, very efficient and requires few components, while the advantages it affords are numerous. Normally, the speakers relay the radio programmes in the usual manner, but by turning a switch the extension speaker becomes a microphone and the user is able to carry on a conversation with the occupants of other rooms. This is useful for talking between the dining-room and kitchen, or the workshop and house. The system is also extremely effective for relaying amateur concerts and plays to other rooms in the same way that radio plays are produced, and has the great advantage that the actors can read their parts direct from a script. This facility is much appreciated by the younger members of the family.

If desired, the extension speaker may be placed near baby's cot, and will give audible warning should the youngster wake and commence crying. Mother can then switch over her speaker and say a few comforting words, which will often save a tiresome journey upstairs. When this service is required, a slight alteration in the positioning of the controlling switch is indicated, and will be dealt with later.

Circuit

The diagram shows the connections necessary for two-way communication between the radio set and one extension speaker. Any number of additional speakers may be connected in parallel, provided due regard is paid to matching them to the set. Normally, one or two extensions will not materially affect results.

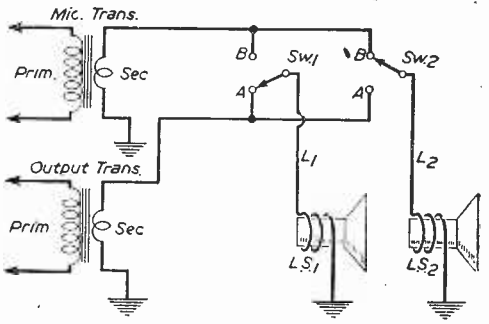
The output transformer is that which is incorporated in the radio set. Disconnect the secondary from the speaker speech coil, earth one side and connect the other side to contacts A on switches SW.1 and SW.2. Switch SW.1 is mounted on or near the radio set, while SW.2 controls the extension loudspeaker. One side of the speech coil of the internal speaker is earthed and the other side taken to the centre, or moving contacts, of switch SW.1. Earth one side of the speech coil of the extension speaker and take the other side to the centre contacts of switch SW.2.

Mic.-trans. is an ordinary output transformer with the high-impedance primary connected to the pick-up terminals of the radio set, and one side of the low-impedance secondary earthed, the other side being connected to the contacts B of the single-pole double-throw switches SW.1 and SW.2.

It will be observed that, apart from the earth connections, only two leads connect the loud-speakers; these may consist of twin bell wire. If a convenient earth is not available, a third wire will have to be used and the earth connections taken to this.

In many radio sets the pick-up terminals are permanently in circuit, but where this is not the case, the radio-gram. switch will have to be shorted out, when speech will be heard through the radio programmes. When conversations are required the set should be detuned, or the aerial unplugged.

Operation is simple. With both switches in the A position, normal radio is heard in both speakers. By turning either switch to the B position, the



Circuit of the arrangement suggested by Mr. Hardy.

associated speaker can be used as a microphone, the switch being returned to position A when an answer is required.

When the extension speaker is installed near a child's cot, it is better to have the controlling switch placed by the side of the internal speaker switch and the lead L2 run to the speaker. The mother will then be able to switch the speaker over at the radio set.

British Radio Components Show

Preliminary Details of This Year's Exhibition of Spare Parts

THE eighth annual private exhibition of British radio and electronic components, to be held by the Radio and Electronic Component Manufacturers' Federation at Grosvenor House, London, from April 10th to 12th, gives every sign of being as successful as the 1950 exhibition, which was attended by over 20,000 visitors from 21 countries.

Over 100 firms have arranged to take part in the exhibition, which has been carefully arranged to give an improved layout of the stands and better provision for the comfort of visitors.

The important contribution made by the industry to Britain's defence programme is borne out by the display of special components and apparatus made to conform to Service requirements. Valves are again included in the exhibition.

The following components and apparatus are being shown for the first time.

A complete list of Exhibitors and Stand Numbers will be found on page 214

Capacitors

New moulded casings, giving complete protection against moisture, have been developed by A. H. Hunt Ltd. (Stand 20), and by the Telegraph Condenser Co. (Stand 44). These new types of sealing have been applied to ceramic, tubular foil, and silvered mica capitators, and a complete range is available.

The Telegraph Condenser Co. have also improved their "Plastapack" plastic film capacitors, which are particularly suitable for use in electronic counting circuits and computors.

Notable this year is an entirely new and completely satisfactory method of sealing ceramic, stacked foil, and silvered mica condensers. Each condenser is mounted in a moulded casing which is then filled with a specially developed plastic immersion sealing ("Plimoseal"). This method enables the 100 per cent. humidity, 100 deg. C. requirements of "Category A" Ministry specifications to be met.

Electrolytic Condensers

The comprehensive range of wet and dry electrolytics of all-aluminium construction will be on view and is sure to be of interest to manufacturers, engineers and traders alike. Also distinctive types of single, dual, and triple section "Lectropacks" in standard or twist prong mounting, together with Micropacks and the miniature Picopacks, all with the guarantee associated with T.C.C. standards of quality ensuring a long and trouble-free life.

Resistors

The high-stability carbon resistors introduced last year by Painton & Co. (Stand 62) have been improved in the higher ohmic values to give greater stability, and are now available up to 1.0 megohms in half-watt rating. A new type of compact audio-frequency fader resistor is now being made.

An outstanding new development of the British Electrical Resistance Co. (Stand 59) is a hermetically-sealed potentiometer particularly intended for use in severe atmospheric conditions and in corrosive atmospheres. This is rated at 5 watts with resistances up to 50,000 ohms, and conforms to Service standards.

A sealed potentiometer of the midget type (Code GS) has also been developed by the Morganite Resistor Co. (Stand 54), who are noted for their range of very small diameter variable resistors.

Erie Resistor Ltd. (Stand 24) have produced the first fully-insulated grade I resistor of high-stability cracked carbon, suitable for operation under tropical or other severe conditions. It is made in three ratings: $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ watt, and in the usual range of values from 10 ohms to 3 megohms.

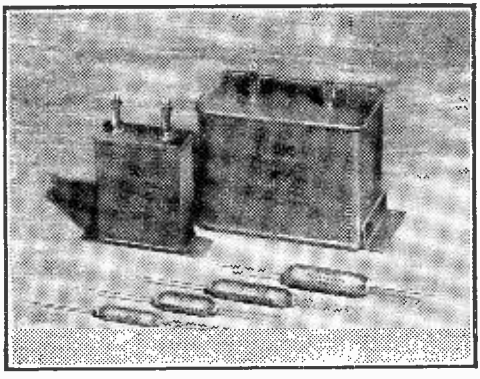
Other Components

A. F. Bulgin (Stand 21) are introducing a new range of control knobs suitable for high-quality radio cabinets, together with small lever and dial knobs for special apparatus.

A new mains voltage signal lamp for panel fitting uses a standard 15-watt sign lamp in an all-insulated holder behind a moulded glass lens.

A new vibration-proof combined screw and lock-washer is marketed by Guest, Keen and Nettlefold (Stand 106), in which the washer cannot become detached from the screw, but is nevertheless free to operate effectively.

(*Continued on page 215*)



The new T.C.C. components which are being shown for the first time. The large items are the new Plastapack condensers in high values, whilst the small items are low values in the same form.

LIST OF EXHIBITORS AND STAND NUMBERS

Exhibitor	Stand No.
A.B. Metal Products, Limited	36
Acoustic Products, Limited	56
Advance Components, Limited	73
Antiference, Limited	68
Associated Iliffe Press, Limited	112
Associated Technical Manufacturers, Limited	74
Automatic Coil Winder and Electrical Equipment Co., Ltd.	86
Belling and Lee, Limited	12
Bird, Sydney S., and Sons, Limited	8
Birmingham Sound Reproducers, Limited	66
Bray, Geo., and Co., Limited	111
British Electric Resistance Co., Limited	59
British Insulated Callenders Cables, Limited	57
British Mechanical Productions, Limited	27
British Moulded Plastics, Limited	88
British N.S.F. Co., Limited	61
British Rola, Limited	48
Bulgin, A. F., and Co., Limited	21
Bullers, Limited	75
Carr Fastener Co., Limited	60
Clarke, H., and Co. (Manchester), Limited	105
Colvern, Limited	51
Cosmocord, Limited	71
Daly (Condensers), Limited	81
Dawe Instruments, Limited	49
Decca Record Co., Limited	94
De La Rue, Thomas, and Co., Limited (Plastics Div.)	96
Diamond 'H' Switches, Limited	3
Dubilier Condenser Co. (1925), Limited	29
Du Bois Co., Limited	2
Duratube and Wire, Limited	40
Edison Swan Electric Co., Limited	38
Egen Electric, Limited	26
Electro Acoustic Industries, Limited	58
Electrothermal Engineering Co., Limited	102
English Electric Co., Limited	95
Enthoven, H. J., and Sons, Limited	47
Erie Resistor, Limited	24
Ever Ready Co. (Great Britain), Limited	82
Ferranti, Limited	9
Fine Wires, Limited	108
Garrard Engineering and Manufacturing Co., Limited	69
General Electric Co., Limited	93
Goodmans Industries, Limited	18
Guest, Keen and Nettlefold (Midlands), Limited	106
Hallam, Sleigh and Cheston, Limited	104
Hellermann Electric, Limited	42
Hunt, A. H., Limited	20
Igranic Electric Co., Limited	72
Imhof, Alfred, Limited	89
Jackson Bros. (London), Limited	37
London Electric Wire Co. and Smiths, Limited	76
London Electrical Manufacturing Co., Limited	39
Long and Hambly, Limited	16
Magnetic and Electrical Alloys, Limited	33
Marconi Instruments, Limited	97
McMurdo Instrument Co., Limited	70
Measuring Instruments, Limited	109
Micanite and Insulators, Limited	41
Morgan Bros. (Publishers), Limited	85
Morganite Resistors, Limited	54
Mullard Electronic Products, Limited (Components)	31
Mullard Electronic Products, Limited (Valves)	101
Multicore Solders, Limited	17
Murex, Limited	100
Mycalex Co., Limited	83
Oliver Pell Control, Limited	25
Painton and Co., Limited	62
Parmeko, Limited	32
Partridge Transformers, Limited	55
Permanent Magnet Association	84
Plessey Co., Limited	64
Plessey International, Limited	65
Pye, Limited	107
Reliance Electrical Wire Co., Limited	22
Reslosound, Limited	23
Salford Electrical Instruments, Limited	35
Sangamo Weston, Limited	87
Scharf, Erwin, Limited	52
Scott, Geo. L., and Co., Limited	103
Simmonds Aerocessories, Limited	30
Stability Radio Components, Limited	78
Standard Telephones and Cables, Limited (Components)	10
Standard Telephones and Cables, Limited (Valves)	7
Static Condenser Co., Limited	77
Steatite and Porcelain Products, Limited	28
Suflex, Limited	6
Supply, Ministry of	92
Symons, H. D., and Co., Limited	110
Taylor Electrical Instruments, Limited	1
Taylor Tunnicliffe (Refractories), Limited	5
Telegraph Condenser Co., Limited	44
Telegraph Construction and Maintenance Co., Limited	50
Telephone Manufacturing Co., Limited	45
Thermo Plastics, Limited	14
Truvox Engineering Co., Limited	19
Tucker, Geo., Eyelet, Limited	4
Vitavox, Limited	43
Walter Instruments, Limited	80
Walter, J. and H., Limited	79
Wego Condenser Co., Limited	34
Welwyn Electrical Laboratories, Limited	11
Westinghouse Brake and Signal Co., Limited	13
Weymouth Radio Manufacturing Co., Limited	46
Wingrove and Rogers, Limited	53
Wireless Telephone Co., Limited	63
Woden Transformers, Limited	67
Wright and Weaire, Limited	15

(*Continued from page 213*)

Test Instruments

Taylor Electrical Instruments Ltd. (Stand 1) are exhibiting three new models in their range of test instruments. Types 72A and 77A are universal test meters in the moulded cases with overload protection. The design of the meters was undertaken by a firm of industrial designers, and the result is a pleasing and efficient appearance. Type 88A is a larger type of test meter in a wooden case with a single linear scale for all ranges.

An interesting exhibit is the quartz crystal activity test set manufactured by Salford Electrical Instruments Ltd. (Stand 35). which in addition to measuring the activity of crystals can also measure the dynamic resistance of parallel-tuned circuits, giving a direct indication.

Dawe Instruments Ltd. (Stand 49), whose range of test equipment is well known, are showing a new high-speed level recorder (Type 1406), which provides a means of rapidly recording response characteristics with an accurate logarithmic scale. This is particularly suitable for amplifier testing. Another new instrument is the peak strain gauge for determining the maximum strain imposed on mechanical structures.

Other Items of Interest

A new type of magnetic high-fidelity pick-up —the "Minuette"—is shown for the first time by the Edison Swan Electric Co. (Stand 38).

The Telegraph Construction & Maintenance Co. (Stand 50) manufacture a new type of air-spaced coaxial cable, having a helical membrane applied edge-on to the conductor. This construction is robust and results in an effective dielectric constant of 1.08. The cable is particularly suitable for wide-band transmission. Other new developments include "Permendur"—a special alloy with the highest known magnetic induction (24,000 lines), and a nickel-copper alloy substitute LM.326.

The production of zirconium on a commercial scale has recently been attained by Murex Ltd. (Stand 100), and it is now available in rod, sheet or wire form. It has a high melting point and excellent corrosion resistance, and is particularly suitable as an alternative for tantalum or molybdenum in certain applications.

The main features of the G.E.C. exhibit will be Osram valves and other electronic devices. In the valve field will be a complete range of miniature valves for battery-operated A.C. and D.C./A.C. receivers. Outstanding in this group of valves is the X79 triode-hexode frequency changer for A.C. use; the X17 heptode frequency changer, which gives excellent short-wave performance with a wide range of battery voltages. For D.C./A.C. uses the X109 triode hexode is also very good on the short wavelengths.

High-slope output pentodes are represented by the N78 (for A.C.) and the N108 (for D.C./A.C.), both with a conductance of 10 mA/v.

A number of special types of valves will be shown and there will be a particularly strong exhibit of voltage and current stabilizers, including some of the "Stabilivolt" type.

CANBERRA—ATLANTIC CROSSING

THE English Electric Canberra which set up the fastest time for a transatlantic crossing, on February 21st, 1951, was fitted with a radio installation designed to meet the very special requirements of this unique aircraft.

To ensure that the Canberra's fighter-like performance and manœuvrability are not impaired by the usual protruberances associated with aircraft wireless aerials, the suppressed direction-finding loop recently designed by Marconi engineers was employed, and the radiator for the high-power communications transmitter was a special type of buried antennæ, designed by the Royal Aircraft Establishment in conjunction with the Marconi Company.

A.D. 106/108

The radio equipment carried by the Canberra on this flight consisted of the A.D.107 high-power transmitter, the A.D.108 receiver and the A.D.7092A automatic radio compass. All this equipment, which was originally designed for the aircraft of the British Air Lines Corporations using normal types of aerials, gave a performance under the exacting conditions of high altitude, high-speed flight, which enabled the aircraft to remain in perfect communication when 1,500 miles out over the Atlantic. The use of the suppressed D.F. loop in no way reduces the ranges at which good bearings can be taken, and on this flight the navigator of the Canberra was obtaining navigational aid from the radio compass when the aircraft was 500 miles from the Newfoundland coast.

T1154 and R1155

The Marconi Company is proud of its association with this great flight and especially as this is the first occasion on which the Royal Air Force have used the successors of the famous T1154/R1155 equipment which, introduced by Marconi's in 1939, became standard equipment for every type of British bomber and flying boat used during the War. The T1154/R1155 is still the standard equipment for the British heavy aircraft used by the R.A.F., and it is gratifying that the performance of the new equipment installed in the Canberra should have followed in the great tradition.

Books Received

RADIO LABORATORY HANDBOOK.
By M. G. Scroggie, B.Sc. M.I.E.E. 430 pp., 216 illustrations. Published by Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1. Price 15s.

THE RADIO LISTENERS' WEEK-END BOOK.
By John Pringle. 288 pp., illustrated. Published by Odhams Press Ltd., Long Acre, London, W.C.2. Price 9s. 6d.

TELEVISION RECEIVING EQUIPMENT.
Third Edition. By W. T. Cocking, M.I.E.E. 374 pp., illustrated. Published by Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1. Price 18s.

OXFORD JUNIOR ENCYCLOPÆDIA.
(Vol. IV—Communications.) 495 pp. Published by Oxford University Press. Price 30s.

P.A. for the

Description of a Complete Universal Unit f

By S. A. DEI

THE object of this article is to provide the constructor with some practical ideas on the subject of Public Address, and it is therefore proposed to discuss points which arose from the construction of apparatus now in regular use by the author.

Cost has been kept to a minimum consistent with reliability, and advantage has been taken, where possible, of the ex-W.D. surplus readily available.

In view of the fact that the outfit was liable to transportation to various halls in the district, the probability of encountering either A.C. or D.C. mains supply was real. Therefore it was obvious that the amplifier must be designed on "universal" principles if it was to be suitable.

Probably the main disadvantage is that in common with most universal designs, under certain supply conditions the chassis may be "live." Reasonable care on the part of the operator must therefore be taken to ensure correct polarity of the mains plug when on A.C. If D.C. supply is used, the amplifier will not function unless polarity is correct, automatically rendering chassis safe.

Design

With the universal arrangement, the A.C. mains transformer is eliminated thus considerably reducing expenditure. This in turn means that the H.T. is limited by the value of the mains supply voltage, which if designing a high-power outfit would be a considerable disadvantage. However, 10 or 15 watts of audio is readily available with a 230 volt supply and this is more than sufficient for use in the average hall likely to be encountered. Also, the cost of a loudspeaker large enough to handle powers in excess of this figure would mean an expenditure not proportional to the results obtained.

It was considered an advantage to construct a pre-amplifier as a separate unit for two reasons. One, because it is only required when a microphone in addition to record reproduction is wanted. Two, in the interests of efficiency it is wise to keep this high-gain sensitive unit quite separate from the main amplifier, and thorough screening is also highly desirable.

The circuits are quite straightforward and no originality is claimed, except perhaps in their application, and through the article emphasis is on the practical rather than theoretical.

The Main Amplifier

The function of VC1 in Fig. 1 is to provide a control for setting the level at which it is desired to operate the amplifier. Individual

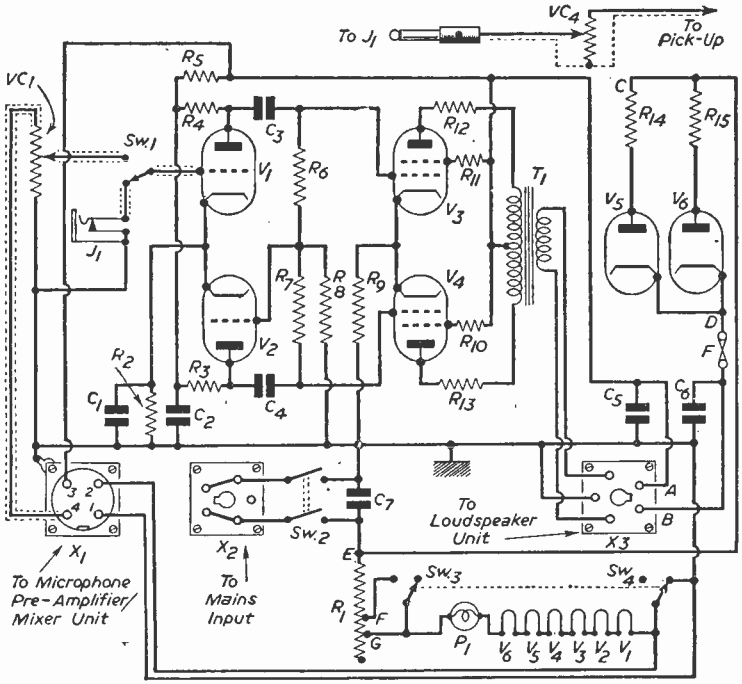


Fig. 1.—Circuit of the main amplifier section.

LIST OF COMPONENTS
A.C./D.C. AMPLIFIER.

Resistances. All ½ watt rating unless otherwise stated.
R1—.3 A. mains dropper with fixing feet and variable tap.
R2—1.5 kΩ.
R3, R4—100 KΩ.
R5—10 KΩ.
R6, R7, R8—250 KΩ.
R9—125Ω 5 watt.
R10, R11—100Ω.
R12, R13—100Ω 1 watt.
R14, R15—100Ω 3 watt.

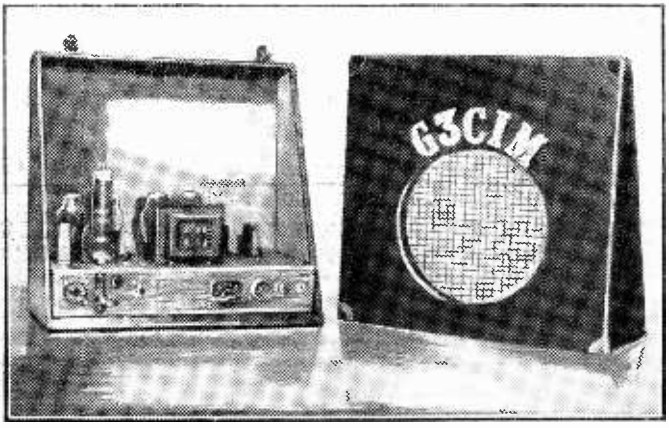
Capacitors.
C1—25 μF. 25 v.w. Elec.
C2—8 μF. 350 v.w. Elec.
C3, C4—.1 μF. 350 v.w. Tub.
C5, C6—16-16 μF. 500 v.w. Elec.
C7—.1 μF. 500 v.w. Mica.

Valves.
V1, V2—6J5/G/GT.
V3, V4—KT.33.C.
V5, V6—U31.
VC1—.5MΩ potentiometer.
VC4—.5MΩ potentiometer (on turntable unit).
F—250 mA. fuse and holder.
J1—Closed circuit jack (and two plugs).
P1—6v. .3A. pilot lamp and holder.
6 International octal valve holders.
T1—Output transformer 40 : 1 (Premier "Match-maker," MO.15).
SW1—S.P.D.T. toggle.
SW2—D.P.S.T. toggle.
SW3/SW4—D.P.D.T. toggle.
X1, X2, X3—Connectors (see text).
Sheet metal for chassis (20 s.w.g. Alclad or similar.)
Paxolin and solder tags for component board.
Sleeving, connecting wire, screws, nuts, grommets, knob, scale, screened wire, etc.

Amateur

all Public Address Requirements

NEY



microphone and gramophone gain controls are incorporated in the pre-amplifier unit.

It will be observed that when SW1 is down, i.e. grid drive being supplied via J1 from a gramophone pick-up source, there appears to be no method of volume control, and likewise no grid leak for V1. The reason for this is that control of audio level is desirous from the point where the operator's attention is most required—at the gramophone turntable. This method of control is shown at the bottom of Fig. 1 and VC4 is mounted in the turntable case.

Two U31's are used in parallel for V5 and V6 for the reason that current consumption of the amplifier exceeds the rating of one valve. It is wise to include the surge limiting resistors R14 and R15 to safeguard these valves in the event of a fault developing.

If it is intended that the amplifier is to be used solely on D.C. mains, then V5 and V6 need not be incorporated, the point marked C on Fig. 1 being connected directly to D. It is important, however, that in the event of this being done, the dropping resistor R1 be adjusted to compensate for the exclusion of the two 26-volt filaments.

To calculate value of R1, assume SW3/SW4 in position shown (i.e., filaments of pre-amplifier not in circuit). The value of EG in ohms will be that which will drop the mains voltage to a value equal to the sum total of the filament voltages of V1, V2, V3, V4, V5, V6 and P1.

V1, V2 and P1	are 6.3 v. each	=	18.9 v.
V3 V4	are 25.0 v. ,,	=	50.0 v.
V5 V6	are 26.0 v. ,,	=	52.0 v.
Total		=	120.9 v. say 121v.

Therefore, the required voltage drop across EG

LIST OF COMPONENTS
PRE-AMPLIFIER/MIXER

Resistances. All ½ watt rating unless otherwise stated.

R16—250KΩ.
R17, R20—50 KΩ.
R18, R21, R22—100 KΩ.
R19—2.5 KΩ.
R23—1.5 kΩ.
R24, R25—.5 MΩ.

Capacitors.
C8, C9—.5 μF. 350 v.w. Tub.
C10, C13—25 μF. 25 v.w. Elec.
C11—.01 μF. 350 v.w. Tub.
C12—8 μF. 350 v.w. Elec.
C14—.05 μF. 350 v.w. Tub.

Valves.
V7—6J7/GT.
V8—6SL7 (see text).
VC2—.5 MΩ potentiometer (small).
VC3—.5 MΩ potentiometer (small).
J2, J3—Closed circuit jacks.
P2—6.3 v. .3A. pilot lamp and holder.
T2—Microphone input matching transformer.
2 International octal valve holders.
1 valve cap.
SW5—D.P.S.T. toggle.
X4—Connector (see text).
Sheet metal for box (20 s.w.g. Alclad or similar).
Paxolin and solder tags for component board.
Sleeving, connecting wire, screws, nuts, grommets, 2 scales, 2 knobs, screened wire, etc.

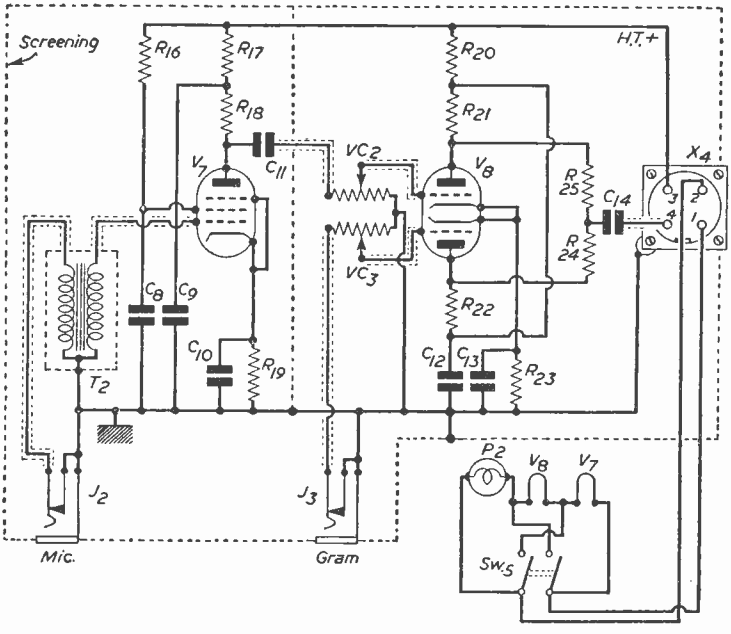


Fig. 2.—Circuit of the pre-amplifier/mixer unit.

will be the mains supply voltage minus 121 v. Assuming the former to be 230 v., this will be 230–121=109 v. The value of EG in ohms will be $R = \frac{E}{I}$ where I is filament current, i.e., .3 A. Therefore, $R = \frac{109}{.3}$ ohms = 363.3Ω. Now if the pre-amplifier is put into circuit, SW3/SW4 is

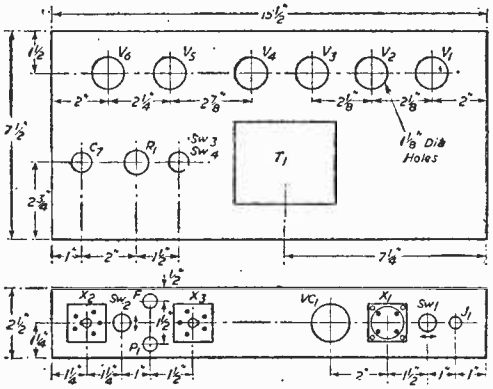


Fig. 4.—Cutting and drilling details of the chassis.

thrown. SW4 opening up the heater line and SW3 short-circuiting part of R1 to allow more voltage to be available. The value of EG in ohms being calculated as follows: Additional voltage required = V7, V8 and P2 = 6.3 v. each = 18.9 v. total.

$$EG = R = \frac{18.9}{.3} = 63\Omega.$$

It is necessary that some method be used to link up the various units of the outfit, and probably the constructor has ideas of his own on this subject. On reference to Fig. 1, three connectors are shown marked X1, X2, X3. Their function is as follows.

X1 serves to make the necessary connection between the pre-amplifier and the main amplifier. Pins 1 and 2 are filament supply, Pin 3 H.T., Pin 4 grid input (use screened lead) and the chassis line is via the metal screw connector and "breeze" connecting cable. X2 connects amplifier to mains supply.

X3 connects audio output to loudspeaker; also H.T. to loudspeaker energising.

These connectors are clearly shown in the photographs and were obtained from radio surplus shops. X1 is a "breeze" connector. X2 and X3 were taken from a stripped ex A.M. I.F.F. unit.

It is, of course, not necessary that the constructor should use exactly the same method as that described, and provided the method used has the same function, all will be well. The main point to remember is that the grid lead between Pin 4 and the pre-amplifier must be screened, and the screening connected to chassis at each end.

One disadvantage of the mains-energised loudspeaker is that a fair quantity of multicore cable is needed, so if the constructor wishes to utilise a P.M. type, it will be necessary to connect an L.F. smoothing choke between points A and B in Fig. 1, to replace the energising coil on the speaker. This should be in the region of 15 Henrys with as low a resistance as possible, and in any case not more than 500Ω.

The author used an R.G.D. 10in. energised type, mainly because a quantity of suitable cable was available. Any good quality P.M. 10in. will be suitable.

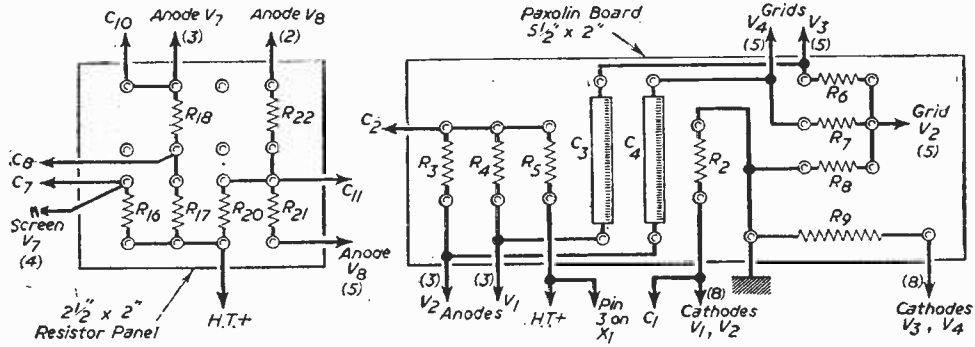
For the sake of neatness the constructor is strongly advised to make up a component board as shown in Fig. 3(b). First obtain a strip of paxolin 5½in. x 2in. and lay the components on the board, then with a pencil mark the position where solder tags are required. It is simplicity itself to drill the 4BA clearance size holes, insert the tags and punch over. The board can then be wired up on the bench with comfort, and fitted in the chassis with ease.

Chassis

Little need be said on the metal work. The author made up the chassis with the aid of a bench vice, mallet, length of angle iron, block of wood and a small square. Figs. 4 and 5 provide all the necessary data for the construction of a chassis similar to the author's. Aluminium was not used because in the view of the author it is difficult to work with. Its inherent softness causes it to "tear" when using cutting tools.

Pre-amplifier/Mixer Unit

The intention when building this compact little unit, was to be able to use it in conjunction with an amplifier having a 6 volt filament supply, and the universal amplifier just described. Some means was therefore needed whereby the valve filaments could be quickly connected in series or parallel.



Figs. 3 (a) and (b).—Details of the component mounting boards.

S.W.5 in Fig. 2 carried out this operation simply and efficiently. It consists of a small bakelite toggle switch purchased together with all the other switches, from the radio surplus dealer.

With the switch open as shown, the filaments are connected in series for use with the universal amplifier.

With it closed, the filaments are connected in parallel for use with a 6 volt supply.

Possibly, a 6SN7 would be an ideal valve for V8 from the point of view of characteristics, particularly when used with a 6 volt filament supply. Unfortunately, however, it is unsuitable for series connection, due to its high heater current (.6 A) and therefore a compromise has to be made if it is desired to utilise the pre-amplifier with the two kinds of filament supply.

The 6SL7 has a .3 A filament and the base connections are the same as for the 6SN7 and can be substituted without complication.

It should be noted that the 6SL7 is a high μ valve, and the stage gain is slightly more than is necessary, but its performance proved quite satisfactory and it was therefore permanently substituted.

It will be observed that X4 is a "breeze" connector and is identical to X1 used on the main amplifier, shown in Fig. 1 and described in the text earlier.

As with the main amplifier, it is desirable to make up a component tag board before assembly, as in this instance particularly there is not a great deal of space available for wielding a soldering iron inside the box. Reference to Fig. 3 (a) will show the component layout.

Further reference to Fig. 2 shows the microphone transformer T2. This should be small physically and preferably have a mu-metal cast case. It is usual for the microphone manufacturer to supply a correct matching transformer for use with his product, and it is wise to inquire about this when making the purchase.

Mixing control is provided by VC2 and VC3, and the combined signal passed via C.14 to the main amplifier for further amplification.

Figs. 5 and 6 provide all the necessary information on the metal work, and the photograph gives a general view of the complete unit.

The Carrying Case

As can be observed from the photograph on page 217, the carrying case is built in two halves, these are connected together by the hinges, and two case catches. The hinges are the type which allow the two halves of the case to separate.

It is not proposed to describe the carpentry. The author, recognising his limitations in this direction, enlisted the help of a cabinet-maker friend, and satisfied himself with the covering operation and generally finishing off.

In view of the fact that there is a considerable area to cover, it is advisable to use carpenter's glue, as this is economical and more convenient to use.

The method of covering depends to a great extent upon the amount, and shape of the artificial leather cloth available, but a good plan is to cut two big squares first, and cover the front and back, glueing over the edges about an inch flange all round. Next cover the ends with pieces cut to the correct size.

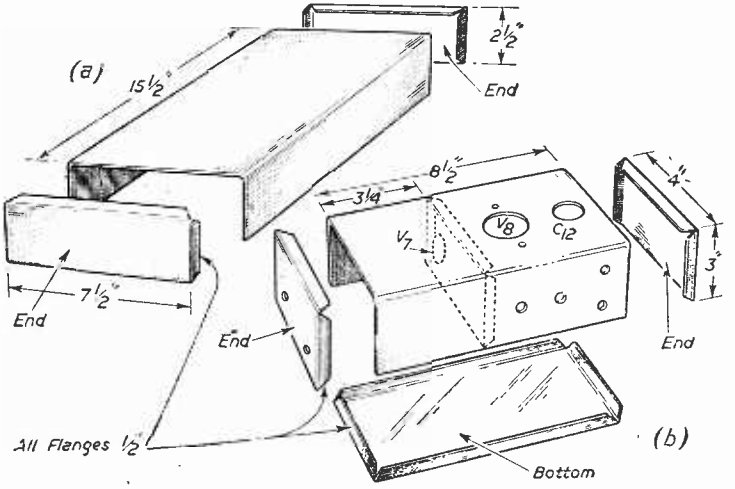


Fig. 5.—Chassis construction details.

The loudspeaker hole should then be cut out, leaving sufficient at the edge to cut star fashion and glue inside the rim. A strip of rexine ½in. wide should then be glued right round the inside of the rim.

Purchase, and fit, the corner protectors and the rubber feet.

(To be continued.)

For the Transmitter

2-metre P.A. Efficiency

How to Obtain More Efficiency in your Transmitter at V.H.F.

By C. ELLIOTT

MANY amateurs are using the 832 or 832A twin tetrode power amplifier tube for the P.A. stage in their transmitters on 2 metres. The 832 is specially designed for V.H.F. work up to 250 Mc/s, and is readily obtained from government surplus sources at a reasonable price, so is consequently very popular. The power input generally has to be limited to about 36 watts and the corresponding R.F. output is given by the manufacturers as 26 watts, under the correct operating conditions. The actual power supplied to the aerial system, however, will depend on the efficiency of the P.A. tank circuit and of the method of coupling to the aerial, and, consequently, in many cases nothing like the 26 watts finds its way into the aerial system.

Another source of inefficiency frequently lies in the system of modulation. Many experimenters have found that the 832 is a difficult valve to modulate by the usual plate-and-screen system. Whether this is due to difficulties of matching the valve to the modulator load or lack of driving power to the P.A. or other causes is not clear. A carrier with a low percentage of modulation is of little use on 2 metres for long distance communication, where the average signal strength at the receiving end is very low. One hundred per cent. modulation with plenty of sideband power is required under these conditions to give a solid reasonable signal. Many carriers have been received from time to time at S4 to 5, but have been unreadable on 'phone, due to being only about 70 per cent. modulated. It is the object of this article to show how one can obtain the maximum R.F. output from the P.A. stage and how the stage can be fully modulated without the use of the expensive plate-and-screen system.

The P.A. Tank Circuit

Of the possible types of circuit which can be used, the type frequently employed, consisting of the well-known centre-tapped coil and condenser combination, is the least efficient. See Fig. 1. The tank coil of, say, 2 turns of 12 s.w.g. wire is about 1¼in. diameter and 1¼in. long, split in the centre to accommodate the aerial coupling coil. When the tuning condenser is adjusted to resonance, the capacity employed is about 4pF for each section. The plate-to-cathode capacity for each section of the 832 is 3.8pF, increasing the total capacity to 7.8pF, and if we include stray capacities in the circuit the total is probably about 10pF on each section of the tuned circuit. Now, the tuned circuit has its own losses, and the power dissipated in this way is subtracted from the total available R.F. power, so that the highest output efficiency can only be obtained by making these losses negligible. It can be shown that greater efficiency can be obtained by making the ratio L/C high, up to a certain value. This limiting valve is set by various requirements, such as the need for a "flywheel" effect in the tuned circuit, the minimisation of harmonics, and the prevention of distortion during 'phone operation. In the case of an 832 working

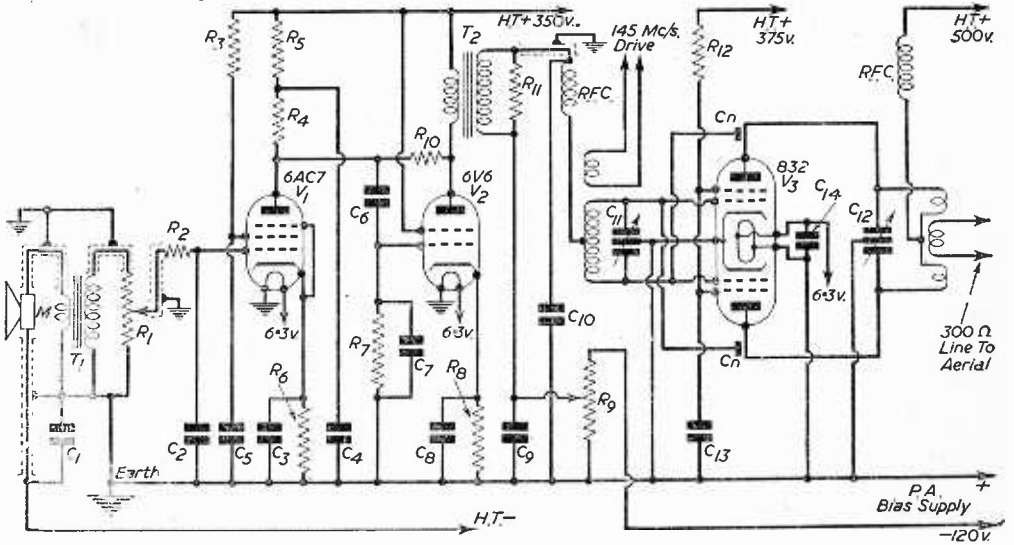


Fig. 3.—Modulator and P.A. stage of grid-and-screen modulated transmitter. Although shown theoretically as coils, the coiled lines feed is actually 'linear.'

at 500 volts on the anodes and passing 70 mA the optimum capacity for each side of the split stator condenser works out at about 3.5pF for 2-metre operation. This figure will be the total capacity required, including anode-to-cathode capacity and stray capacities, but, as we have already noted, the anode-to-cathode capacity itself is 3.8pF, which together with strays probably gives a total of 6pF.

Thus, on 2 metres it is not possible to attain the best L/C ratio, but by practically eliminating a tuning capacity in the tank circuit it is possible to attain a much higher value than that given by a normal tuned circuit. The obvious solution is to use ¼-wave lines for the tank circuit, which are tuned either by a shorting bar and resonate with the anode-cathode capacity exact or by a very small condenser with a swing of 1 or 2pF. Tuning for resonance is rather difficult with a shorting bar, so it was decided to tune by means of a small 4 x 4pF split stator condenser, the capacity in use at the resonance point being only about 0.5pF per section. In linear tank circuits the coupling to the aerial is liable to be less efficient and there may be some loss of R.F. by direct radiation from the lines. It was decided to make use of a circuit which combines the advantages of the tuned coil and linear tank circuit, namely, coiled lines. Coiled lines take up no more space than a conventional coil, while the normal lines take up rather

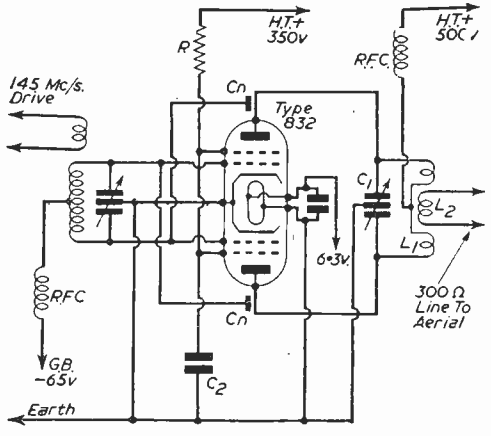


Fig. 1.—An 832 P.A. stage with normal tank circuit.

a lot of room on the chassis (they are generally about 14in. long on 2 metres), and, furthermore, there is less direct radiation from the coiled lines, due to their compact construction, and they should give more R.F. to the aerial circuit.

LIST OF COMPONENTS FOR FIG. 1.

C1—15 x 15 pF. split stator.
C2—500 pF. mica (R.F. bypass).
Cn—Very small neutralising capacity (see Fig. 2).
R—20,000 ohms.
L1—2 turns 1¾in. diam., 1¼in. long, 12 S.W.G.
L2—2 turns 1in. diam., ½in. long, 14 S.W.G.

Construction

The actual construction of the lines is shown in Fig. 2. 14in. of 12 s.w.g. wire are taken for their construction and the exact centre of the length is found. The wire is then folded into a hairpin shape, with a straight section in the centre about 0.6in. long. The two ends are then wound around a

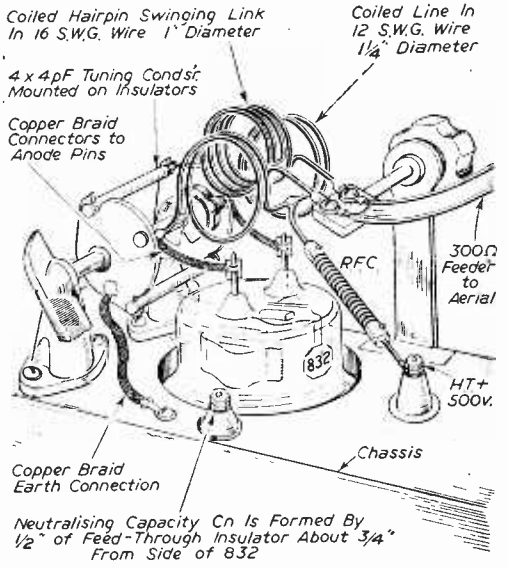


Fig. 2.—Coiled-lines tank circuit.

suitable former to give a coil about 1¼in. in diameter, winding away from the centre. It can be seen that each half of the winding is in the opposite sense to the other, so that the whole does not form a single inductance, but behaves simply as a normal ¼-wave line. In order to couple the tank circuit to the aerial it is not possible to use a coupling coil of one or two turns, as each half of the tank circuit will induce opposite voltages in the coil and no transference of energy will occur. In the only example of the coiled line which the author has seen the aerial was directly tapped on to the lines via blocking condensers, but this method is not so suitable for making the fine adjustments necessary for optimum coupling and also is not regarded with favour by the Post Office! The best coupling system, as shown in Fig. 3, consists of another coiled line, wound in the same manner as the tank coil and mounted as a swinging link. It is formed with 16 s.w.g. wire by winding on a suitable former to give a coil diameter of about 1in., and each half of the winding contains two turns.

In operation the tank circuit is tuned to resonance by the condenser in the usual manner, and the increased efficiency is immediately apparent, for in the unloaded condition the anode current at resonance will dip to about 25 mA. With the normal tuned circuit of Fig. 1, the resonance dip is about 35-40 mA. The link can then be swung in to give optimum coupling by watching for maximum feeder current or maximum reading on a remote field-strength meter. The loading at 500 v. can

be 70 mA., if one wishes to keep within the manufacturers' specifications, but there is no reason why the input should not be increased to 40 watts (80 mA.), as with the high efficiency of the tank circuit and coupling arrangements this input should be well within the anode dissipation of the 832. Even 50 watts input is just within the capabilities of the tube, the R.F. output then being 36 watts, giving 14 watts to be dissipated at the anodes (rated at 15 watts). This is for C.W. operation, of course. When swinging in the coupling link practically no retuning of the tank circuit should be required if there are no standing waves on the feeders. There is a perceptible resonance dip even when the P.A. is correctly loaded when using coiled lines, but no such dip is noticeable in a normal tank circuit on 145 Mc/s.

The Modulation System

It must be admitted that this modulation system, to be described, was tried out in the first place as a rapid method of getting going on 'phone without the time and expense required for providing a high-level modulator with an output of 20-30 watts, as needed for plate-and-screen modulation. Evidence from other amateurs has shown, however, that the application of 20-30 watts of audio to a 40-watt carrier does not necessarily give 100 per cent. modulation with an 832, but with this particular modified grid-modulation system, 100 per cent. modulation with good communication quality can easily be obtained. The principles of grid modulation have been adhered to on the whole, but the difference lies in the screen circuit of the 832, where the dropping resistor has not been by-passed for audio-frequency, thus enabling the screen voltage to swing up and down as modulation is applied to the grid. (Refer to Fig. 3.) The system is therefore grid-and-screen modulation.

To commence at the modulator end of the circuit, a carbon microphone is used with a 1 : 50 ratio transformer to feed a 6AC7 in a high-amplification circuit. The whole of the modulator current is taken through the carbon microphone in order to energise it without the use of a battery. As the modulator works Class A, there are no current fluctuations and so no undesirable effects. Stability is ensured by means of the high-capacity by-pass condenser C1. R2 is a stopper resistor and C2 and C7 are R.F. by-pass condensers, all to ensure that no R.F. enters the modulator circuit. Screened wiring is indicated in Fig. 3 at points where it is important that no R.F. currents should be picked up. The 6V6 output valve works at a fairly high bias, produced by a 1,000-ohm cathode resistor, and this is mainly to reduce the anode current, as the full output is not required. It is also important not to saturate the core of the modulation transformer T2 by excessive current. The transformer used by the author was a small 1 : 3 type, originally designed for directly-fed amplifier stages in receivers, and it handles 25 mA on the primary quite easily.

As for normal grid modulation, it is desirable to use a very low-impedance valve for the modulator (e.g., a triode), for the load on the modulator varies over the A.F. cycle as the rectified grid current of the modulated amplifier changes. However, perfectly satisfactory results are obtained with a 6V6, by using negative feed-back via R10 to reduce the anode impedance and swamping the transformer secondary by a load resistor R11. The grid-bias supply should have a very low resistance, to prevent variations in the grid current from opposing the modulation voltages. The potentiometer R9 only offers about 3,000 ohms resistance when correctly set, and this seems to cause no difficulty. The load on the driving stage varies with modulation and a linear modulation characteristic may not be obtained if the R.F. voltage from the driver varies with load. It is sometimes recommended that the driver should supply several times the required driving power, the excess being dissipated by a load resistor across the circuit, the load variations thus being reduced in proportion to the total load. However, on 145 Mc/s the dynamic impedance of circuits is very low and they are, in effect, already loaded, and it was found that no trouble was experienced. Note that C13, in the screen circuit of the 832, has a capacity of only 500 pF and is a by-pass for R.F. currents only. The supply voltage to the screen was chosen to give roughly the correct audio load of 15,000-20,000 ohms without exceeding the working voltage of 250 volts.

LIST OF COMPONENTS FOR FIG. 3

C1—50 μF, 12v.	R1—500 kΩ pot.
C2—100 pF, mica.	R2—10 kΩ.
C3—25 μF, 12v.	R3—500 kΩ
C4—8 μF, 350v.	R4—50 kΩ.
C5—0.5 μF.	R5—10 kΩ.
C6—0.05 μF.	R6—250 Ω.
C7—100 pF, mica.	R7—250 kΩ.
C8—50 μF, 50v.	R8—1,000 Ω, 1 watt.
C9—2 μF, 200v.	R9—5,000 Ω, 5 watt.
C10—500 pF, mica.	R10—500 kΩ.
C11—15 x 15 pF, split stator.	R11—25 kΩ, 1 watt.
C12—4 x 4 pF, split stator.	R12—15 to 20 kΩ, 3 watt.
C13—500 pF, mica.	
Cn—See Fig. 2.	
C14—500 pF, mica.	

All resistances ½ watt unless otherwise stated.
M—Carbon microphone.
T1—1 : 50 microphone transformer.
T2—1 : 3 modulation transformer.
V1—6AC7, V2—6V6, V3—832.

Setting Up the Circuit for Operation

Adjust the potentiometer R9 to give about 90 volts bias on the 832 and apply drive to the grid circuit so as to give about 80 mA when the P.A. is fully loaded. Swing the link in to give optimum loading, as indicated by feeder current or a remote signal strength meter, and make a final adjustment to the tuning of the tank circuit for maximum output. Now increase the coupling a little so that the observed R.F. output drops, and apply modulation, using R1 as a volume-control. There should be about a 10 per cent. increase in the reading of the feeder current or signal strength meter, and the P.A. anode current should kick upwards to 95 to 100 mA on modulation peaks. If downward modulation is encountered, then coupling to the antenna should be increased. It is possible to modulate successfully at lower values of grid-bias by suitably adjusting the drive, but 90 volts is about the best figure, and very low bias with low drive will again result in downward modulation. The most important adjustment

(*Continued at foot of page* 224.)

Simple Resistance Meter

A New Idea for the Experimenter

By J. S. KENDALL

THIS unit, which is the very essence of simplicity and can be made for a matter of coppers, presents a means of measuring resistance which is very efficient for a range of a few hundred ohms down to about 1/10. The parts in the main can be found in the junk box.

The parts required are:

One rotary switch with up to five positions.
One double-pole double-throw toggle switch.
A selection of close tolerance resistors of suitable rating.
One suitable dry battery (a three-cell torch battery is quite good).

The principle of the instrument is that with a constant current the voltage drop along a resistor is directly proportional to the value of the resistor.

The circuit is shown on the right. The object of the 5-ohm resistor is to limit the current flow to a safe value when checking very low resistances. The meter used with the unit can be almost any radio meter that has a resistance of at least ten times the value of the standard or the resistance being measured whichever is the greater. If the meter resistance is too low the current drain gives inaccurate measurement. Suitable values for the resistances are 1 ohm, 3 ohms, 10 ohms, 30 ohms and 100 ohms. Quite a number of ex-W.D. units have 10-ohm resistors in the form of anode stoppers. If possible gold-tipped resistors should be used.

The 1- and 3-ohm resistors are not readily obtainable but can be made to a fair degree of accuracy by comparing with the 10-ohm standard.

Using the Meter

The method of use is simple. First switch the voltmeter across the unknown resistor and adjust the range switch so that the voltage reading is as near as possible to half the battery voltage, then throw the toggle switch so that the voltmeter is across the standard resistance. The actual resistance of the unknown is expressed in the formula $R? = \frac{Rs\ (V1)}{V2}$ where R? is the unknown, V1 the voltage across the unknown, V2 the voltage across the standard resistance and Rs the standard resistance. It will be seen that as long as the meter scale is linear the actual voltage need not be expressed as such and can be expressed in "degrees." This allows the use of a cheap moving-coil meter of low current drain if the user prefers a built-in meter.

An example of the calculation with the unit would then be:

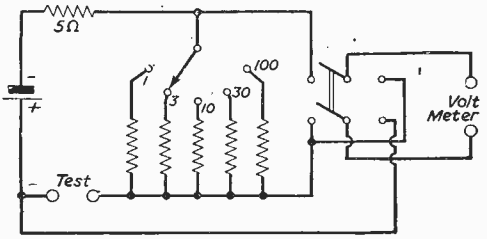
V1 equals 4.7Ω.
V2 ,, 2.8Ω.
Rs ,, 3Ω.

Then applying the formula $R? = \frac{Rs\ (V1)}{V2}$

$R? = \frac{3 \times 4.7}{2.8} = 5$. Remember it is not possible to make measurements to a greater accuracy than the standards being used. If, then, ordinary untipped resistors are used the accuracy cannot be better than one part in five, but if gold-tipped resistors are used the accuracy will be about one part in twenty. The inaccuracies also grow as the readings increase in difference, i.e., at the top and bottom of the range.

A few of the uses of the instrument are:

To measure contact resistance of a wave-change switch. For this measurement the battery voltage should not be more than 1.5 or the voltage will overcome the barrier layer effect of the dirt and oxide on the switch. Shunt resistors for meters can



Circuit of the arrangement described here.

be measured with it and the resistance of earth connections on chassis. The latter gives some surprising readings and as high-resistance earths are one of the greatest causes of instability it is worth the trouble in making the meter if only to check these.

2-metre P.A. Efficiency

(*Continued from page 222.*)

is that of the aerial coupling, which is why a swinging link coil is specified. The coupling should not be increased any more than that required for good upward modulation, as this will result in lower R.F. output and increased anode dissipation.

It can be seen that, using the circuits described, the 832 will work at 40 watts input, 100 per cent. modulated. No overheating has been observed and the circuit has been successfully in use for some time. Reports show that the upward surge of the P.A. current and R.F. currents do not indicate over-modulation with this circuit. The carrier does not become broken, but the signal appears to have increased punch and penetration over a plate-modulated transmitter. It is not certain exactly how the circuit works, but the effects described could be explained by an increase in average carrier level during modulation, with an accompanying increase in power radiated in the sidebands. The results would thus have some resemblance to those produced by the "super-modulation" systems recently described. These systems also make use of grid modulation, but employ a separate valve to generate the increased carrier level on modulation.

Designing Your Own Receiver—7

Advice and Guidance for the Beginner

By STANLEY BRASIER

Ohm-meter

THE remaining essential instrument which the amateur should possess is the ohm-meter, and here again our old friend the 0–1 milliammeter forms the basis of the instrument.

The principle on which the ohm-meter functions was shown in Fig. 8. The values of voltage and resistance are arranged so that when the X terminals are short-circuited, the variable resistor can be adjusted so that the full scale current of 1 mA is registered. Thereafter, if the short-circuit is removed and replaced by a resistor having a value between certain limits, a current dependent upon this value will be registered. From Ohm's Law it is then possible to calculate the value of the resistor. In general, the range of values which can be determined is dependent upon the basic current range of the meter, but for general work the 0-1 mA type enables resistors from approximately 200 to 200,000Ω to bo measured, especially if a long scale is available. In order to obviate the necessity of calculation every time an unknown resistor is measured it is usual to calibrate the scale, and perhaps the easiest and less tedious of all methods is by the application of known values. For this type of ohm-meter is not usually so accurate that it can discriminate between percentage tolerances of resistors normally used in receiver work, and since these are the type of resistors checked, there is no point in aiming at an accuracy which is any higher. But here again, if another ohm-meter can be borrowed for checking purposes, so much the better, and it is only necessary to connect in turn as many different values as are required to the X terminals and mark the points on the scale. This subject, however, will also be dealt with later.

Other Instruments

During all our checks on receiver performance we relied on the fluctuating programme signal for the input, and upon our aural interpretation of the output from the loudspeaker. Although, as we have seen, this system is fairly satisfactory it is usual to use instruments which will give an indication of improvement, or otherwise, to a finer degree. These consist of what is known as an oscillator, to feed a signal into the receiver, and an output meter, which gives visual indication of the final results obtained.

The Oscillator

A test oscillator may consist of an extremely complicated piece of apparatus where specific H.F. *measurements* are required, but in the case of the amateur—and especially the beginner—all that is needed is a small signal of *constant intensity* which can be fed into a receiver under test. This may consist of a simple single valve circuit which is so adjusted that the valve is in a state of continuous oscillation (similar to an oscillating one-valve receiver) and this signal, which will be at high frequency, is applied to the receiver. Even this, however, will not be strictly audible at the output of the receiver, but the sound will be similar to that which is heard when a local station is radiating without a programme. The "programme" in the oscillator consists of a signal from another valve which, oscillating at low frequency, is superimposed on the H.F. signal, and produces an audible note which is heard in the loudspeaker of the receiver. The wavelength of the oscillator signal must, of course, be identical with that of the receiver and under these conditions will provide a steady unfluctuating signal, the advantage of which will be appreciated when testing.

As a guide towards the construction of a simple oscillator for testing and trimming purposes, Fig. 9 shows a suggested circuit. It should be made up in a metal box and if miniature low-consumption triodes are used the whole instrument could be very compact. If only the medium and long waveband

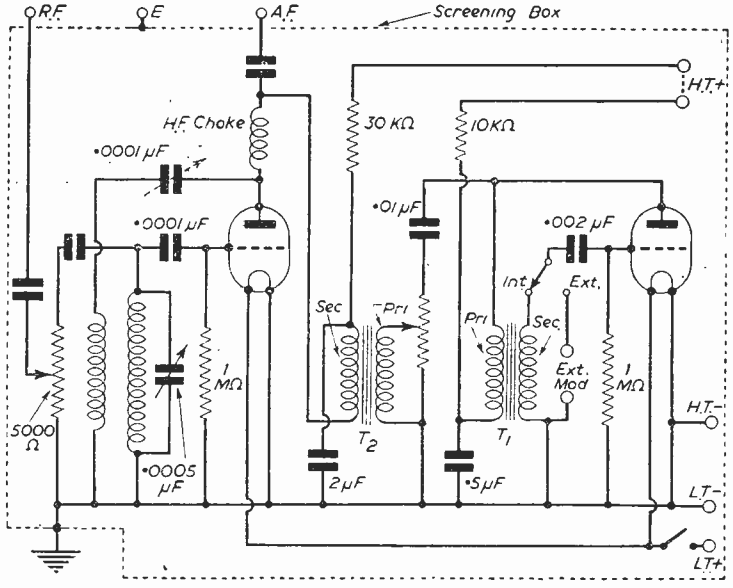


Fig. 9.—Suggested circuit for a modulated oscillator. T1 and T2 are midget L.F. transformers. H.T. may consist of a few grid-bias batteries.

are required the coil may consist of any good quality dual-range type. The tuning condenser should have a value of .0005 μF approximately and the "reaction" condenser should be of a value that just permits of continuous oscillation. The pitch of the modulation note will be dependent upon the type of transformers used but may, to some extent, be varied by a small condenser connected across T1. Output is controlled by the potentiometer and should feed into a screened lead via an artificial aerial. This can conveniently be made up in a small tin box.

Output Meter

Coming now to the output end of the receiver it is usual to record the amplified signal from the oscillator by means of an output meter. Such an instrument gives visual indication and is connected in place of the loudspeaker. The eye is more sensitive to perception of movement than is the ear to differences of sound and thus finer adjustments to the receiver are usually made possible.

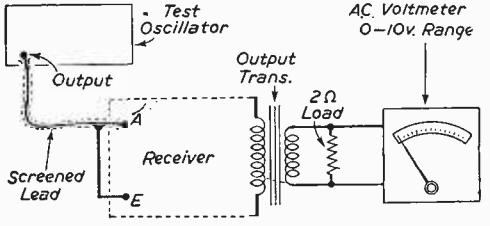


Fig. 10.—Showing how the A.C. voltmeter may be connected for use as an output meter.

To record the output signals from a receiver it is necessary to use an instrument that will respond to an alternating current, therefore the A.C. voltmeter previously referred to will be entirely suited to the purpose. The meter is connected to the secondary of the output transformer but the resistance (or rather, inpedance) of the loudspeaker must be represented by an artificial load in the form of a resistor, which is also connected across the output meter. The lowest range of the meter is used and it should be noted that the instrument in no way gives any specific quantitive indication—it merely records *differences* in output —and for this purpose it is most convenient. For connection see Fig. 10.

Thermo-ammeter

Another instrument which is available at low cost in the form of Government surplus is the thermo-ammeter, and because it is responsive to alternating current, such meters are extremely useful. The type reading 0-350 milliamps is applicable to checking the current of 0.2 Amps. and 0.3 A.C./D.C. valve heaters and many other A.C. measurements. It can also be used in place of the A.C. voltmeter as an output meter. In this case the resistor should be joined in *series* with the thermo-ammeter. It is necessary to warn the amateur that this type of instrument is very susceptible to breakdown if the full-scale current is exceeded or if there is an initial "surge" at the moment of switching on. For this reason it is sound practice to fit the meter with a shorting switch which may be "opened" when circuit conditions have assumed normal proportions.

There are many more instruments useful to experimenters such as the valve voltmeter, beat-frequency oscillator, oscilloscope, etc., but these may be acquired if, or when, such interests develop. The instruments described, however, if used intelligently, will provide the amateur with much knowledge with regard to the development and testing of receivers.

The Final Effect

Although the appearance of a completed receiver or test instrument makes not the slightest difference to the performance it is well to cultivate an artistic sense towards construction. For surely it is better to have apparatus that looks well in addition to working efficiently. This attitude also reflects to the unseen parts of the chassis work, as it should, and one soon finds that attention is paid to every single detail in connections, wiring, etc., and altogether a great pride can be taken in one's mechanical work.

The object of this last section in the series is to show how the appearance of instruments made at home can be constructed to almost professional standards, by the use of certain materials and methods.

These are mostly concerned with the panel arrangements but, first let us consider for a moment the question of suitable cases to house the instruments. The easiest way, of course, is to use an ex-Government case if such is available in convenient size. Very often only a "finish" is required to make them look like new. For home construction 16 gauge aluminium is very suitable and the main body of the case may be made up by bending to size. But a better method, and one which enables nice sharp corners to be obtained, is to use L-section angle strip, also of aluminium. This is available from advertisers and may be cut to form the foundation supports. For, in addition to providing the case with much greater strength, the method obviates the necessity of making short angle bends along a length of metal—a procedure which is not easy, without special presses, if a good symmetrical appearance is to be presented.

Finishing

For finishing there are now quite a variety of brushing cellulose materials on the market which, when applied, are indistinguishable from the sprayed method and have sufficient "body" for one coat to suffice. This type of cellulose is likely to "run," however, and for this reason it is advisable to work on one horizontal surface at a time. If the case is made up in sections as above, it may easily be dissembled for finishing.

(To be continued)

Programme Pointers

This Month MAURICE REEVE Deals with Some More Recent Programmes

THE relief and thankfulness with which I learned that "Music Hall" and "Variety Bandbox" were no longer going to inflict upon us their witless wit and their horrible noises alias music, were slightly tempered by the subsequent news that the former programme's title was going to be bequeathed to an "entirely new type of show," whilst the latter, title, show and all, was to be restored in the summer.

When we see "Music Hall" in our future programmes it will be difficult to remember—at first, at any rate—that it is not the same collection of nitwittery, half-baked oafery and cacophonous jargonry which has inflicted itself upon us for countless Saturday evenings in the past. I cannot think why the whole works, title and all, are not cast as far away as it is possible to cast anything. For years now the radio critics, almost with one voice, have written of B.B.C. variety, including some of the regular weekly shows of the "Keep Smiling" type, in such terms of sweeping condemnation that something ought to have been done about it a very long time ago. There simply are not enough Music Hall variety turns of sufficiently high quality to fill a quarter of the many hours which are allotted to variety on the air. Further, there is no liaison between programmes to avoid the sickening repetition of topical jokes such as we had about groundnuts and Sir Stafford Cripps, and as we are now getting about the coal shortage. The best of them are not frightfully funny, but their plugging is inexcusable. And last, but by no means least, is the "dead head" studio audience, for which no defence can be found in any quarter.

No: critics must just keep pegging away at these points, knowing they are right and hoping that some day something will be done about them.

Saturday Night Theatre

"Dear Octopus," Dodie Smith's colourful comedy of family life, was notable for being "Saturday Night Theatre's" four hundredth production. Although this large total includes some repetitions, it is a fine achievement by all concerned. We should all be grateful. Gladys Young's appearance in the New Year's Honours was not only thoroughly merited but was, I presume, proof that we do all appreciate hers and the others efforts.

"Travellers' Joy," that enormously successful skit on the topical problem of our currency troubles when travelling abroad—considerably eased since the play was written—came over well, with the ever charming Yvonne Arnaud in her most attractively loquacious mood. The other characters, and the play generally, lost a little of the sparkle and gaiety it had at the Criterion through not being visual.

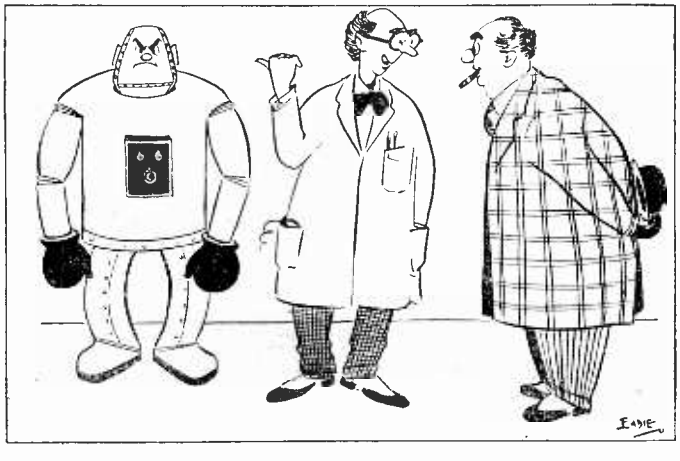
The two plays I liked most during the past few weeks were "Monsieur Lamberthier," by Louis Verneuil, with Marius Goring, Lucie Mannheim and John Buchelle; and "Such Men Are Dangerous," adapted by Ashley Dukes from "The Patriot" of Alfred Neumann, with, amongst others, Henry Oscar, Phyllis Neilson-Terry, Brian Powley, Keneth Kent and Lewis Stringer.

"Monsieur Lamberthier" is a typical French plot of love, jealousy and intrigue, such as only our Gallic friends seem able to convincingly contrive. Miss Mannheim seemed quite terrific as the wife with a secret, and her succession of cajoleries and swindles of her poor wretched husband left us almost as bewildered and exhausted as the poor man himself.

"Such Men Are Dangerous" is a powerful presentation of the plot of the Chancellor and others to murder the infamous and lunatic Czar Paul of Russia, and to place his son Alexander—the Alexander of Tilsit fame and to whom Napoleon showed his heels when retreating from Moscow—on the throne in his stead. I well remember the magnificent silent film, "The Patriot," with the late Emil Jannings, Adolphe Menjou and Pola Negri.

Ibsen's masterpiece, "The Doll's House," came to us on the "Third." I only have room to say that Marjorie Westbury was very effective as Nora Helmer, the "little song-bird" of Torvald Helmer, who, after enduring a particularly cruel piece of tyranny, not only leaves her gilded cage—her "doll's house"—to fight her own way in the world, but who thereby set the whole feminine

PROFESSOR BOFFIN



"And here, Mr. Solomons, is the answer to the American heavy-weight problem."

world afire to do the same. One of the great women's dramatic rôles.

Verdi

The Verdi half-centenary celebrations received due recognition, and, for the most part, there were good performances. Verdi was one of the great masters of music, and in the course of his artistic development, covering an exceptionally long life, he must have passed through more phases than even Wagner. "Falstaff" differs from "Traviata" even more then "Parsifal" does from "Rienzi."

"Afghan Adventure," the record of a year spent at the British Legation in Kabul, in 1924, by Muriel Miller, wife of a member of the Legation staff of that time, was a pleasant enough narrative, but far too long. There was neither material nor excitement sufficient to occupy a whole hour on a Sunday evening.

Quiz

Quiz programmes continue to hold their popularity, though some of the more juvenile ones seem a little redundant outside of Children's Hour. It is fascinating to follow the adult mind searching for a piece of information by often devious and tortuous ways, more especially when the listener thinks he has come across it down a more direct path.

"The Wonderful Year" sickened me. Is it remotely possible that 2051 will be describing 1951 in similar terms? I doubt very much whether there was anything at all special about 1851 other than the exhibition. And does an exhibition, by and of itself, make a year "wonderful"? I'm afraid the opening sentences about the blue sky, the sunshine and—above all—God's blessing, rather prejudiced me against the whole thing. Is God blessing our present efforts at assembling specimens of our genius and handiwork on the south bank? Perhaps it is a little too early to tell; perhaps we shan't know till 2051.

The current Sunday evening serial, "The Mayor of Casterbridge," seems as good as any that have gone before. A great story is doubtless the chief contributory factor.

News from the Clubs

THE GRAFTON RADIO SOCIETY (G3AFT)

Hon. Sec.: W. H. C. Jennings (G2AHB), Grafton School, Eburne Road, Holloway, London, N.7 (one minute from the Nag's Head).

MEETINGS continue every Monday, Wednesday and Friday at 8 p.m., and the morse classes (beginners to advanced) continue to progress excellently. A. Appleby and F. L. Rogers both successfully passed the G.P.I. examination and are now G3HMS and G3HGX respectively. A lecture and demonstration entitled "Radio Control of Model Aircraft," by courtesy of Messrs. Ilford Electrical Company, will be held on Friday, April 13th, at 8 p.m., by F. C. Judd, Esq. (G2BCX), and W. Taylor, Esq. Refreshments will be provided free of charge and visitors are cordially invited to this special show. In order to facilitate catering arrangements, visitors are requested to send the hon. secretary a postcard advising their attendance.

CRAY VALLEY RADIO TRANSMITTING CLUB

General Secretary: A. Swindon (G3ANK), 135, Station Road, Sidcup, Kent.

MEETINGS of the C.V.R.T.C. are held on the fourth Tuesday of each month at the Station Hotel, Sidcup, at 7.30 p.m.

CLIFTON AMATEUR RADIO SOCIETY (G3GHN)

Hon. Sec.: W. A. Martin (G3FVG), 21, Brixton Hill, Brixton, S.W.2.

THIS society meets every Friday evening at 8 at 225, New Cross Road, New Cross.

The club station is now licensed for 'phone and is active on 80 and 160 metres.

Club membership stands at 50, with 19 licences.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec.: K. J. Grimes (G3AVF), 3, Clarendon Park, Tor Vale, Torquay.

THE Field Day Rules and other F.D. matters were discussed at the February meeting.

At the March meeting (the 17th) judging took place of the entries for the club's contests. Trophies will be awarded at the A.G.M. in April.

Technical films and demonstrations are on the programme of future events.

Visitors to Torquay interested in radio are invited to attend. The meetings of the society are held on the third Saturday of each month at the Y.M.C.A., Castle Road, commencing at 7.30 p.m.

NEWARK AND DISTRICT AMATEUR RADIO SOCIETY

Secretary: John R. Clayton, 160, Wolset Road, Newark, Notts.

THE club has been invited to take part in the Newark "Festival of Britain Exhibition" to be held for one week during July next.

GILLINGHAM TELECOMMUNICATIONS SOCIETY

Secretary: C. E. Pellatt (G2FAQ), 101, Boundary Road, Chatham, Kent.

AT the society's second A.G.M. on March 6th, the following officers were elected: Chairman, Mr. A. Walker; Treasurer, Mr. C. W. Booth, M.B.E. (G3GSP); Secretary, Mr. C. E. Pellatt (G2FAQ). Meetings are held at the Medway Technical College, Gardiner Street, Gillingham, on alternate Tuesdays at 7.30 p.m. Newcomers will be very welcome. The society's transmitter, G3GTS, is licensed for 'phone and the full 150 watts. Members will be operating the Medway Area "A" station during N.F.D. on June 2-3. All R3GB members will be welcome at the site. The call sign will be G2CM/P.

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: R. T. Parsons, 14, Carlyle Avenue, Brighton, 7.

A VERY full programme of instructive lectures and demonstrations has been arranged: in fact, time for informal "ragchew" evenings seems very limited at present!

Several new members have come along, and those intending are asked to contact the Hon. Sec. Meetings are held every Tuesday evening at the "Eagle Inn," Gloucester Road, Brighton. Programme includes further Mullard film strip lectures and a promise of a repeat and more advanced demonstration on tape recording by G5ZQ.

COVENTRY AMATEUR RADIO SOCIETY

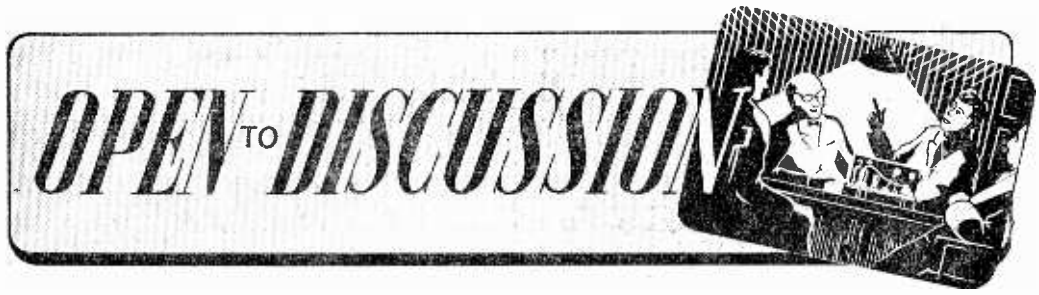
ON February 12th a colour and sound film show upon plastics was put on by G2BFT and proved an absorbing subject. The manufacture of laminated plastics for radio and electrical use was covered, and G2BFT answered his many questioners with the authority his many years in the industry have given him.

A most interesting event took place on February 26th, when the lecture on super modulation by G3RF took the form of a two-way contact between G3RF using his super-mod. rig at home and the society members with the club transmitter G2ASF. The conclusions reached by G3RF as the result of many weeks' experimenting provided members with a clear exposition of this much-argued system of modulation.

Members of other local clubs joined a large gathering on March 12th to see a demonstration of radio-controlled models given by members of the International Amateur Model Constructors Society. The ingenuity shown in the adaption of single-tube QRP transmitters and receivers and the degree of control obtained over the moving models impressed the audience greatly.

NEW CLUB FOR MANCHESTER

IT has been decided to form a radio club in the Cheetham Hill district of Manchester, and any reader interested in becoming a member should write as soon as possible to either Mr. H. B. Knowles, 36, Oak Road, Crumpsall, Manchester, 8, or J. C. Henderson, 47, Maple Street, Cheetham, Manchester, 8.



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).

Training Service Engineers

SIR,—Referring to D. F. C. Smyth's letter in the January issue of PRACTICAL WIRELESS. I was very surprised by the writer's statements regarding service engineers' wages, although he claims to have been associated with the radio industry since 1932. I should like to point out to Mr. Smyth that there are qualified bodies to represent the radio and television service engineer. During December, 1949, an agreement was arranged indicating amongst other things the *minimum* wages for a "qualified radio and television engineer." It should, therefore, interest your writer to know that the *minimum* rate for a fully-qualified radio service engineer is £6 12s. 6d., and for a television engineer of the same standing, £6 17s. 6d. per week. It should be noted that these rates are "rock bottom," and in practice enlarged upon. It also appears as though your writer is rather hazy about the term he uses, "competent radio engineer." The term *fully qualified* in reference to the above agreement indicates that the engineer holds the "A" certificate of the "Radio Service Trade Register." Before this certificate is issued the engineer must have passed the "R.T.E.B." radio examination or equivalent, which in itself is very comprehensive, and, further, before he is able to sit for the examination he must be able to satisfy the examination board that he has been gainfully employed in the industry for at least five years. In order to qualify for the television certificate the engineer must pass either the R.T.E.B. television examination or a manufacturer's course. I can guarantee that Mr. Smyth will be able to ask for much more than £5 10s. when he can satisfy the above conditions. I should like to add that it is the aim of the G.R.S.E. to "stamp out" for ever these self-named "radio engineers"—these in the trade are known as "quacks" and are they who have given the trade such a bad name in the past. —GORDON J. KING (Oxford).

[*This correspondent has missed the whole point. Not all employers recognise minimum rates, nor do they belong to Federations signatory to the agreement and are not therefore tied by it. Even service engineers sometimes work under rate!*—ED.

SIR,—From the point of view of an enthusiast from the earliest days of wireless, when you had to understand Morse to enjoy the hobby, and when the V24 was the valve of the day for H.F. work, I found this correspondence very interesting.

When the hobby palled and I sold my equipment (I bitterly regret this sale, and will tell you why), I acquired a radiogram by a world-famous maker which gave excellent service for a long time, but when trouble eventuated I called in the firm of local experts, complete with letters after their names, etc., and when these "qualified servicemen" had returned the set with a bill for 35s. and a new on/off switch wired in parallel with the original, I found the condition of the set absolutely unaltered, and sent it back again. With its return once more and another bill for 10s. the set was still quite useless, but as I was due to move to another town I could not do much about it. In Hove the qualified dealer charged me for a new frequency changer and a few other items, which added up to two bills totalling £3 10s. 0d.

I moved to my present address, although in the meantime I had laid the set up pending finding someone who really was a good serviceman, and for nearly twelve months was without it.

Then the largest firm of electrical and radio dealers, and, incidentally, the agents for the makers of my set were called in, and they were reluctant even to look at anything which was more than three years old. I eventually got them to have the set in for inspection and they said it was not too bad, and after *five* deliveries to me and return to the "shop" they said that the set was now as good as it would ever be. The distortion was terrible, the H.F. side grossly mis-aligned, and the needlecup had been brutally dug out of the polished wood panel with a screwdriver, and was ringed with marks radiating in all directions. I called in the chief of the service department to inspect this damage and to hear the set and comment on its poor performance; he said he would make inquiries, but I have heard nothing further, although I have received a bill for £4 10s. 0d.

For Mr. Harrison's benefit I would say that this set has never been handled by a dabbler, never by anyone but the three "experts" in three separate towns. An amateur would not have done worse; he would very likely have done a much better job and charged me less. The set concerned is straightforward and no super-compact article.

The trouble with this set was that it needed the dust blown out, a new volume control, *and nothing else*, and I have had to pay £10 to the "experts." The radio service business is a racket. Charges of 30s. for unsoldered connections, or the replacement of 6d. components are commonplace. The string of letters after the "service engineer's" name is a mumbo jumbo which involves a cloak

for inefficiency, and a desire for a closed shop in radio.

The device described by Mr. Harrison, where invoices are endorsed: "Cost increased due to inexpert attention" is presumably designed to discourage the employment of free-lance servicemen by set owners. If the radio trade itself were not full to overflowing with people with little or no radio knowledge, although possibly with a sufficiency of capital to run a shop, there might be an excuse for the sneers at the "dabbler." My experiences tell me that there is probably a large slice of truth in the contentions of Bernard F. Appleton and others.—G. H. GUNTER (Eastbourne).

Resistance and Ohms Law

SIR,—With reference to my letter on page 138 in the March issue, I should like to point out that the printers have mistaken the symbol ρ (rho). As printed it does not make sense. The eleventh line from the bottom of the first column should, therefore, read: "Even if we calculate the value of R, we still have to use ρ, the value of which. . . ."—SIMPLETON (S.W.1).

A Small Oscilloscope

SIR,—I have constructed the small oscilloscope recently described in your magazine.

The result was most satisfactory and, except for one or two small details, the construction was comparatively easy.

One of the biggest snags was interference by the magnetic field of the mains trans.

This field affected the spot when at rest, and to effect a remedy I had to move the tube forward about 2 to 3in.

To support the tube I had to fit an extension tube; this, however, does not affect the appearance of the set.

The wiring is formed and laced and the grid leads are screened and earthed.—ALAN CRONIN (Belvedere).

Programme Pointers, etc.

SIR,—I have just been reading Mr. Maurice Reeve's attack on "The Life of Leslie Stuart," a programme that I enjoyed very much. This is his second attack on the pre-First World War composers. (The first occurred some months ago.) This time Lionel Monckton, Leslie Stuart, etc., are the victims; who knows, Sir Arthur Sullivan may be next! The music alone of the "Arcadians" makes it an evergreen.

The music by English composers of the period 1870-1914 is far away ahead of the music of the past 35 years. I am referring, of course, to musical comedy and light opera.

Although not a B.B.C. subscriber, I would love to hear a series of programmes of the works of Sir Arthur Sullivan.—G. BYRNE (Eire).

Heater Supplies

SIR,—I think, perhaps, that a word of warning should be added to "Electron's" article in the March issue concerning heater supplies. It is an attractive proposition to use the odd tappings when an appropriate secondary winding is not available, but the matter is fraught with pitfalls for the inexperienced.

For instance, when using the circuit shown in Fig. 1 of the article for a rectifier and the live mains lead is connected to the 220v. tapping, the full mains voltage, very nearly, appears across the heater/cathode insulation with the usual form of circuit because the reservoir condenser between cathode and earth has negligible impedance to mains frequency. This is not quite what the valve makers recommend for most of their valves. Another point to note is that the rectifier heater cannot be tied to the rectifier cathode, as is common practice in A.C. sets or the H.T. line will be connected direct to the mains, nor can it be tied to earth because, if the live mains lead should then be connected to the 220v. tapping, there would be an almost dead short across the mains. The heater would necessarily, therefore, be left floating, as shown in Fig. 1.

The method of splitting the 200v. tapping loop, as shown in Fig. 2, is not without danger either. These wires are generally enamelled and lie in contact with each other for some inches. Now if the mains live lead is connected to the 200v. tap, i.e., to one end made by breaking the loop, the mains voltage will appear across the two adjacent wires insulated only by the enamel.

Due regard to these points should be paid if these circuits are used, and the circuit decided upon should be carefully checked to ensure that the D.C. voltage between heater and cathode is not higher than that quoted as maximum by the makers. For instance, if the circuit of Fig. 2 is used for a rectifier and the heater is earthed as shown, the full H.T. appears across the heater/cathode insulation; if, to avoid this, the heater is tied to cathode the H.T. voltage appears across the two severed ends of the 200v. tapping loop, plus the peak mains voltage on one half cycle if the live lead of the mains is connected to the other wire of the loop.

A point arises in connection with Fig. 3. It will probably be desirable to connect the earth direct to the most vulnerable valve heater, i.e., the detector of a receiver or the first valve of an amplifier if such is fed from the arrangement.

I would suggest that the auto-transformer arrangement shown in Fig. 4 would be far better in all cases, and it would not be difficult to extend its construction to permit the operation of valves of any standard heater arrangement from the 4v. or 6.3v. winding usually available.—R. HINDLE (Wallasey).

Two-band Aerial

SIR,—In the April issue your correspondent, Mr. O. J. Russell, credits WØWO with the development of this off-centre fed antenna using a 300 ohm line.

I have been using it with success since I read a reference to the system in QST shortly after the bands were reopened.

Therein G81G was mentioned, although no claim for originality was made for his use of the idea. However, he does considerably pre-date WØWO. —CHAS. MCCARTHY (E16G) (Cork).

Impressions on the Wax

Review of the Latest Gramophone Records

THE recording of "Giselle" by the Royal Opera House Orchestra, Covent Garden, conducted by Robert Irving, who shared in the Sadler's Wells Company's phenomenal American success, will give immense pleasure to the large audience of ballet-goers who follow the company. The music is played here as for the Sadler's Wells' staging of "Giselle," and comprises scenes from Act I. Its composer, Adolphe Adam, was considered a leading figure in the spheres of ballet and "opera-comique" during his mid-nineteenth-century reign of popularity. Now his work survives only in the one ballet, "Giselle." Automatic couplings only are supplied on *H.M.V. C*7834-5.

Of the many waltzes that Josef Strauss gave to the world, undoubtedly the "Music of the Spheres" is one of his masterpieces. This recording of it by the Vienna Philharmonic Orchestra, conducted by Karl Bohm, on *H.M.V. C*4070, comes from the city that gave the waltz its greatest impetus.

The overture to Nicolai's opera, "The Merry Wives of Windsor," has been heard many times, but the recording by the London Philharmonic Orchestra, conducted by Sir Adrian Boult, on *H.M.V. DB*21223, seems to gain for it additional attractions.

Dvorak's "Symphony No. 4 in G," sometimes known as the "English Symphony" for the slim reason that it was published in this country, has been admirably recorded by Bruno Walter conducting the Philharmonic Symphony Orchestra of New York on *Columbia LX*1365-8. In the fourth symphony Dvorak wrote music of a more arresting colour and effect than the majority of orchestral composers.

*Columbia LX*1360 presents a splendid version of the wedding celebrations, included in the introduction to Act III of Wagner's "Lohengrin." It has been recorded by the Vienna Philharmonic Orchestra conducted by Herbert Von Karajan, and the Vienna State Opera Chorus. The "Bridal Chorus" never fails to impress one as an outstanding example of the composer's skill.

Vocal

It seems particularly fitting that Gigli should provide us with a version of Cottrau's famous "Santa Lucia" with all the advantage of modern recording. He sings it in Neapolitan on *H.M.V. DA*1963. On the reverse is a song in Italian, worthy companion to its more familiar neighbour, and ample material for Gigli's voice.

Another Italian tenor is introduced on *Columbia LX*1364. The excerpt he sings from Donizetti's opera, "La Favorita," is the aria, "Spirto Gentil," (Spirit so Fair) from Act IV. It is regarded as a test of a tenor's skill, and Poggi's interpretation does him great credit. On the reverse is the aria, "M'appari tutt' amor," which is one of the gems of Flotow's "Marta."

The two songs chosen by Webster Booth for his latest recording come into the category of ballads. "May the Good Lord" is the signing-off song of one of America's biggest weekly radio programmes, "The Big Show." The coupling, "No More," is Jack Popplewell's adaptation of Sebastian Yradier's "La Paloma." The number of the record is *H.M.V. B*10035. The accompaniment is by Sidney Torch and his Orchestra.

The H.M.V. series of recordings from the Glyndebourne production of Mozart's delightful ensemble opera, "Cosi fan Tutte." On one side is a trio and on the other a soprano solo from Act I. *H.M.V. DB*21118 is the third in the series by the Glyndebourne Opera Company.

Variety

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Two of the songs from the musical, "Kiss Me Kate," which recently had its opening night in London, have been chosen by Dinah Shore for her recording on *Columbia DB*2820. They are "Always True to You in my Fashion" and "So in Love." This popular singer was recently voted America's favourite woman vocalist in a nationwide survey carried out by the A.I.P.O.

Recently, Donald Peers recorded for the first time with The Merry Macs, the celebrated American vocal team. In his latest recording on *H.M.V. B*10039 he is again joined by them for unusual renderings of the "Tennessee Waltz" and "My Heart Cries for You."

Dance Music

Geraldo's new titles couple a waltz revival, "If," with Eve Boswell singing the refrain, and a one-step, "Ferryboat Inn," in which the Geraldtones group is heard. This is on *Parlophone F*2453. Other popular recordings by dance-bands include "The Roving Kind" and "I do, do, do Like You," by Sid Phillips and his Band, on *H.M.V. BD*1269; "My Heart Cries for You" and "Tennessee Waltz," by Joe Loss and his Orchestra, on *H.M.V. BD*6087; and "So in Love" and "Can't Seem to Laugh Any More," by Victor Silvester and his Ballroom Orchestra, on *Columbia FB*3598.

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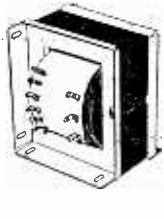

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