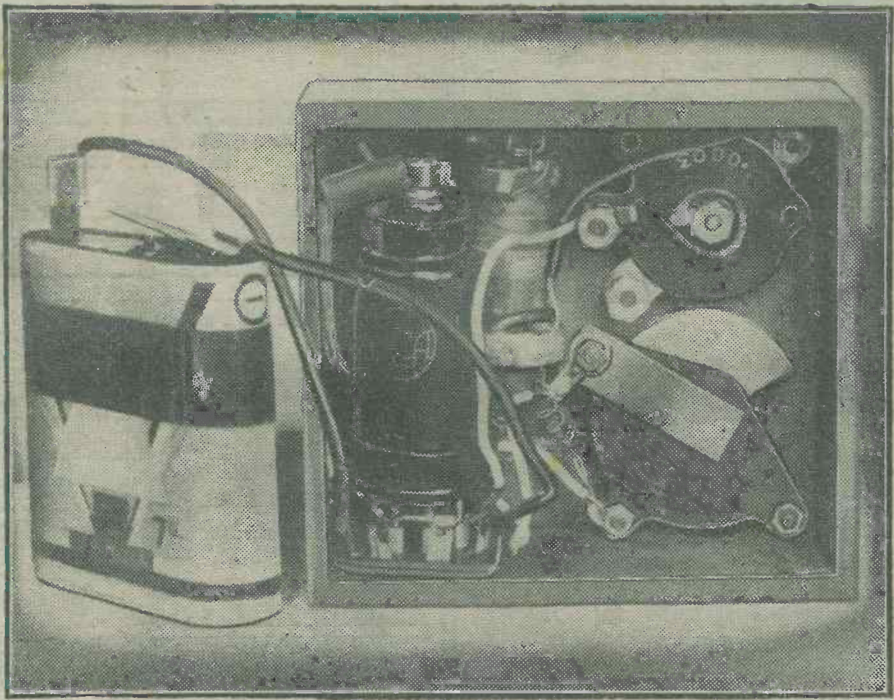
6K7 POCKET RECEIVER

Practical Wireless

9D EVERY MONTH

Vol. 24. No. 504. || Editor: F. J. CAMM || JULY, 1948



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PRINCIPAL CONTENTS

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MAGNETRONS.—U.S. made. Mounted in unit, complete with magnet—spark gap and other electrical and mechanical details. Price £12.10.0. Plus £1 carriage and packing-case.

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It contains amongst other things a strong chassis, 18in. x 6in. x 3½in., fitted with 13 Amphenol type Valve Holders. Among the parts mounted on the chassis are relays, 1 mfd. and 2 mfd. can type condensers. Ceramic variable condensers, small transformers and chokes, grid caps and Pye plugs, etc. Three banks of Mica condensers (approximately 36). Also eight Paxolin panels, 6in. ×2½ in., with feet containing approximately 60 assorted resistors and 25 assorted tubular condensers. **The special bargain price of this unit is only 12/6 plus 3/6 carriage. The supply is limited, so time is precious, don't delay, order immediately.**

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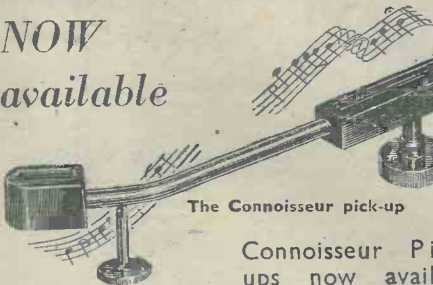

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Practical Wireless

and PRACTICAL TELEVISION

16th YEAR OF ISSUE

EVERY MONTH

VOL. XXIV. No. 504 JULY, 1948

Editor F. J. CAMM

COMMENTS OF THE MONTH BY THE EDITOR

The Tax and Unemployment

LAST month we dealt with the effects of the increase in the purchase tax on radio and television receiver sales, and expressed the view that it would cause unemployment. That, indeed, unhappily has proved to be the case. On the shelves of radio dealers all over the country are 500,000 radio and television receivers for which retailers are unable to find buyers. Our investigations show that manufacturers and retailers place the blame entirely upon the purchase tax for this ruthless destruction of the market.

Worse than this, during the past two months over 6,000 people have been discharged by manufacturers, and at the moment of going to press many more are under notice as factories close and production is cut.

There seems to be a senselessness about the Government's policy. It invited manufacturers to increase production and to export a high percentage of that production. In order to cut down home sales a purchase tax of 33-1/3rd per cent. was imposed, thus forcing manufacturers to export receivers they could not sell in the home market.

The manufacturers loyally responded and many millions of pounds worth of radio receivers, components and valves have been exported under that policy. The Government thought that there was no limit to the pressure it could bring to bear on manufacturers, and no burdens too heavy for the British citizen, and so at the last Budget the purchase tax was doubled. The inevitable result was, as everyone but the Government pundits knew, that sales dropped overnight. Worse than that. The Government has been cutting down its purchases from overseas in the insane belief that we can sell everything to foreign countries and buy nothing from them. Little wonder, therefore, that overseas countries have ceased to buy from us or, alternatively, have imposed restrictive import tariffs which make the export of goods a virtual impossibility unless manufacturers are prepared to allow the Government to raise its dollar credits at the expense of British shareholders.

This quite rightly they are not prepared to do. The overseas market having been considerably diminished due to an unimaginative Government export policy, the trade now finds itself without a home market either, because of the crippling purchase tax. Can the Government wonder, therefore, that manufacturers have cut production and in some cases closed down altogether?

It is true to some extent that the spending boom is ended, and that the incursion of new firms is cutting up the trade. It is also true to some extent that British receivers are so well made that a listener does not buy a new one until the old one has given at least five years' good service.

The fact is that there is no demand to-day for commercial wireless receivers. The only way to save the industry from complete disaster is for the purchase tax to be removed and at once.

Evidently Sir Stafford Cripps is worried about the situation because he has asked the Radio Industry Council to draw up an analysis of the crisis. Shop stewards of one of the largest manufacturers have sent a detailed report to the Ministers of Labour and Supply, the President of the Board of Trade, the Chancellor of the Exchequer, local M.P.s and union officials pointing out that it is time the Government realised that radio is a necessity and asking for an immediate decrease in the purchase tax. The matter has been raised in Parliament. Those interested in Stock Exchange statistics may like to know that the crisis has meant a loss of £7,000,000 in 12 months to investors holding shares in seven of the largest wireless manufacturing companies.

What is happening in the wireless trade is happening in many others, and the time has come when the Government must realise that the public will not continue to countenance taxation on a wartime basis, three years after the victory bells have pealed. The Government has nationalised many industries and denationalised many others. These wrecking tactics cannot be allowed to continue.

The high costs resulting from nationalisation do not encourage the belief that the Government has sufficient experience of business to plan it.

The radio industry is too important to be regarded as a pigeon to be plucked.

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

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

ROUND THE WORLD OF WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ending March 31st, 1948:

Region	*Number*
London Postal	2,096,000
Home Counties	1,465,000
Midland	1,590,000
North Eastern	1,727,000
North Western	1,464,000
South Western	964,000
Welsh and Border	645,000
Total England and Wales	9,951,000
Scotland	1,057,000
Northern Ireland	182,000
GRAND TOTAL	11,190,000

This number includes 45,550 television licences, an increase of 2,050 over the previous month.

Prosecutions in March for operating wireless receiving apparatus without a licence reached the record figure of 637.

Radio Export Record

ACCORDING to latest figures issued by the Radio Industry Council, the value of exports of British radio equipment of all kinds in January last was £1,151,954. The previous highest monthly total was £1,018,000 in December, 1946.

Radio receivers alone accounted for an export value of £457,266. Other export values for the month were:

Components and sound reproducing equipment	£303,182
Transmitters, navigational aids and industrial electronic equipment	£231,128
Valves	£160,378

Twenty-one Years' Service

ANOTHER stage in the history of The Whiteley Electrical Radio Co., Ltd., was recently reached when over 40 employees with 10 years or more service gathered together in the works canteen to pay tribute to Mr. D. James (assistant works manager), who is the first employee to complete 21 years' continuous service. The occasion was marked by a presentation from the directors of a gold watch and chain, which was suitably inscribed. A cheque was also handed to Mrs. James.

Mr. A. H. Whiteley (managing director), in congratulating Mr. James and thanking him for his loyal service, recalled that Mr. James had at various times been associated with practically every department in the works and was held in great regard by every member of the organisation. In expressing his appreciation, Mr. James said that he had been privileged to grow up with the company from the days when it occupied an area of 2,000 square feet and employed just a few people, until to-day, when the factory area was over 100,000 square feet and employs nearly 1,000.

B.I.R.E. Meeting

A LONDON Section meeting was held on May 13th, last, at the London School of Hygiene and Tropical Medicine, at which Mr. I. A. Harris (Associate), read a paper on "The Calculation of Electrode Temperatures in the Radio Valve."

Television Set for Old Folk

AMONG the many gifts at the inauguration of the first of the homes to be opened by Ealing Eventide Homes, Ltd., was a Philco A.1707 television receiver.

This had been presented by Philco and Airmec employees out of surplus funds in the sports and social club.

The home is at "Downhurst," Castlebar Road, Ealing, and is to accommodate 24 elderly ladies who have been chosen out of 250 applicants; it is, incidentally, the first home of its kind in this country to have a television receiver.

R.C.M.F. Council, 1948/49

THE following member firms will serve on the R.C.M.F. Council for the coming year:

Automatic Coil Winder and Elec. Equip. Co., Ltd., W. F. Newell; British Insulated Callender's Cables, Ltd., W. C. Handley; British Moulded Plastics, Ltd. (A), M. J. Nash; British N.S.F. Co., Ltd., S. Wilding Cole; Garrard Engineering and Mfg. Co., Ltd., Hector V. Slade; Hellermann Electric, Ltd. (A), J. Bowthorpe; Morgan Crucible Co., Ltd., E. T. Tregenza; Plessey Co., Ltd., J. A. Smith; Reliance Electrical Wire Co., Ltd., C. H. Davis; Telegraph Condenser Co., Ltd., P. A. Sporing; Telegraph Construction and Mtnce. Co., Ltd., W. F. Randall; Telephone Manufacturing Co., Ltd., W. A. Jackson.

(A) Associate Member.

The following officers have been elected for 1948/49.

Chairman, J. A. Smith; vice-chairman, C. H. Davis; treasurer, Hector V. Slade.

The scene at the presentation to Mr. James at the Whiteley Electrical Radio Company.

Television City

THE U.S.A. radio industry is considering the erection of a "Television City" in New York. It is claimed that the idea would economise in announcers, and the companies would be able to pool resources. It is hoped to include in the "City" a large arena and swimming pool for spectacular sports shows.

P.A. for Turf Club

ONE of the largest installations of public address and paging equipment in the Far East has recently been completed by The General Electric Co., Ltd., at the Turf Club Stadium, in Singapore.

Comprising a three-unit amplifier, single-bay, rack assembly with gramophone player, a three-position control box and a series of microphones and loudspeakers, the installation provides music relay and paging facilities through the grandstand and principal buildings. In addition, a separate amplifier, with its associated microphone and loudspeaker, is provided for paging purposes in the car park. The microphone for this subsidiary installation is located on the pavement outside the main entrance, and is also used by the police for traffic control.

The main control box is normally operated from the assistant secretary's office, as he is the person mainly responsible for the upkeep and general running of the course and buildings, but, if desired, it can also be plugged into a socket adjacent to the main rack assembly or into a similar socket in the secretary's office. Two rows of push buttons, together with their associated pilot lamps and switches control the input and output circuits; this very simple method of control being achieved by means of groups of telephone-type relays.

Suppression of Radio Interference

CONTINUING its campaign for the voluntary suppression of interference with television and short-wave communications the Radio Industry Council held the third of its demonstrations on the fringe of the London television area at Penn, Buckinghamshire. The guests included representatives of the motor-car and sparking plug manufacturers invited by the R.I.C. through the Society of Motor Manufacturers and Traders. Austin, Delco-Remy and Hyatt, Ford, Humber, Jaguar, Rolls-Royce, Scammell, Singer and Vauxhall were represented as well as Lucas, A.-C. Sphinx, Champion, KLG and Lodge. Transport owners were represented by Mr. S. H. Jardine, secretary of the Road Haulage Association, the Hays Wharf Cartage Co. group, which includes Pickfords and Carter Paterson, Thomas Allen, Ltd., and George Neal, Ltd.

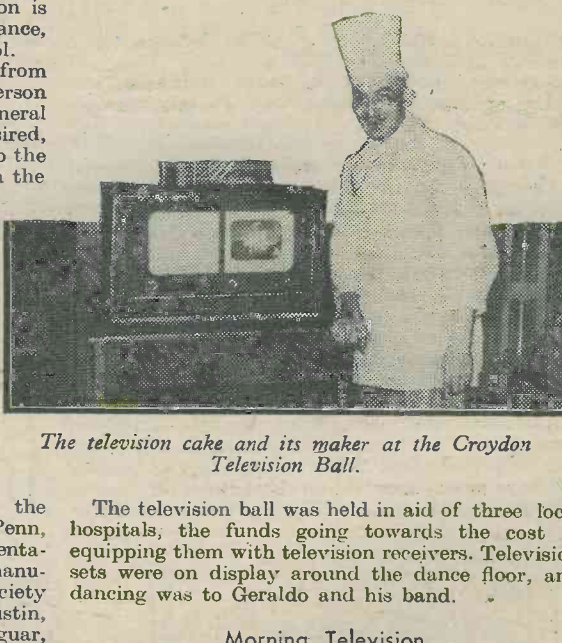
The Hays Wharf group of companies had already agreed in principle to the suppression of its vehicles. The United Dairies Company, which was also represented, is proposing to start suppression. The GPO, which was represented at the demonstration by Colonel A. G. Macdonald, recently announced its intention of suppressing the whole of its 25,000 vehicles throughout the country.

A Piece of Cake!

ONE of the highlights of the television ball held recently by Kennard's, of Croydon, in their restaurant, was an exact replica of a Philips 563A television receiver—made of cake!

Baked by Kennard's chef, Mr. H. C. Axford, to a pre-war recipe the cake was hardly distinguishable from the real thing, so skilful was the decoration. It weighed 140lbs. and was built up in five layers. The loudspeaker fret was carried out in icing, and the walnut effect simulating the polished finish of a real Philips television set was achieved by painting with vegetable dyes. The only items that were not made of cake were the glass tuning dial that projects from the top of the set, the escutcheon on the front, and the photograph placed on the "screen" to represent the television picture.

The item was televised by the B.B.C. Mr. MacDonald Hobley, television compère interviewing the chef on the spot and interrogating him on his labours in the baking of the cake.



The television cake and its maker at the Croydon Television Ball.

The television ball was held in aid of three local hospitals, the funds going towards the cost of equipping them with television receivers. Television sets were on display around the dance floor, and dancing was to Geraldo and his band.

Morning Television

IN response to requests from many viewers, the composite film of television newsreels (this comprises the previous fortnight's newsreels) is now being televised on Saturday mornings instead of Monday mornings. This replaces the demonstration film, which continues to be shown each morning from Monday to Friday inclusive for the benefit of the radio trade.

The change took effect from May 1st.

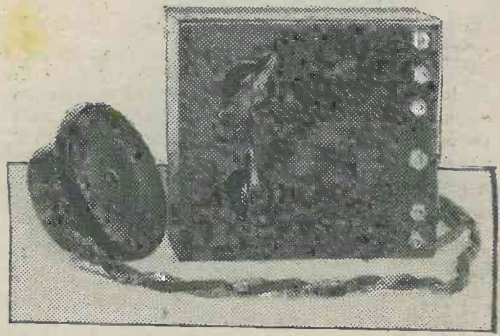
Political P.A.

THE West Bengal Government has prohibited the use of vehicles fitted with loudspeakers except with the written permission of the Commissioner of Police. The order is in force for an indefinite period.

6K7 Pocket Receiver

Details of a Novelty Using Only a 4.5 Volt Battery.

By F. G. RAYER



MANY constructors are interested in the construction of novel types of working receivers, and the very small pocket type of set, although providing only headphone reception, has a wide field of practical use. The receiver to be described, and which is illustrated on our cover this month, utilises a 6K7, which is a pentode of small size which maintains good efficiency with a very low anode voltage. It is easy to obtain and lends itself to the construction of a small pocket set, because a single 4.5 volt dry battery will provide both heater and high-tension currents. The current consumption is about .3 amp., which is about the same as an average 2-valve battery set and not in any way excessive.

Battery replacement is cheap and easy, and the complete receiver, including battery, is only 4in. by 3½in. by 2in. A single earpiece or pair of headphones may be used in conjunction with it. A few feet of thin flex are used as a throw-out aerial, giving ample headphone volume on the more powerful stations. With a longer aerial some foreign stations can be received.

Constructional Details

From the circuit shown in Fig. 1 the few necessary parts can be seen. For tuning and reaction solid dielectric condensers are necessary. The reaction condenser may be either an ordinary type or a differential condenser; a capacity of .0005 μF. is also suitable.

A valveholder with open sockets simplifies construction as it can be mounted in the same way as a baseboard holder. Other types of holder will have to be supported on short stand-off sleeves.

There is room for a tuning coil ¾in. in diameter and several of the small coils available are suitable. Before building the case to the dimensions given check that the condensers and coil can be accommodated and that the valve can be inserted. The battery (a standard 4.5 volt pocket-lamp battery) fits beside the valve, flat against the variable condensers.

In addition to the two control knobs, the positions of which will be seen from Fig. 2, six small terminals are fixed along the front near one edge.

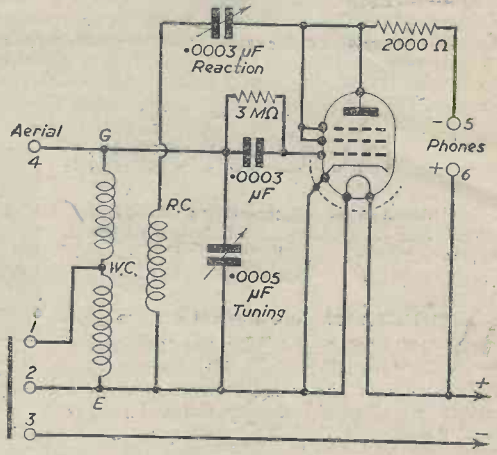


Fig. 1.—Circuit of the pocket receiver.

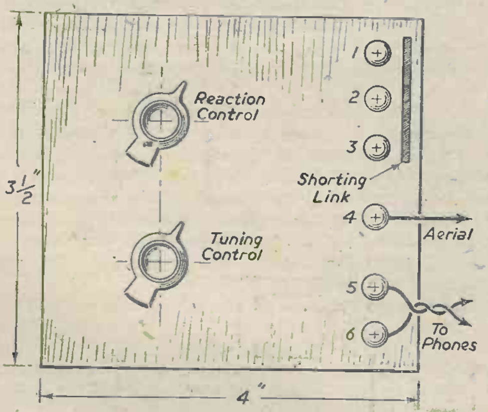


Fig. 2.—Layout of the panel.

Wiring Details

The three upper terminals serve as an on-off and wavechange switch in the simple manner as follows. When it is desired to listen, a connecting link, in the form of a 1in. length of copper wire or anything similar, is placed across the terminals. The set is then switched on for medium-wave operation. If long-wave reception is required, terminals 2 and 3 only are shorted.

It must be noted the valve is indirectly heated. Hence 15 or 20 seconds will elapse before it begins to function after switching on.

Using Phones

All connections are shown in Fig. 3. With phones with low internal capacity the 2,000-ohm resistor can be omitted without affecting results. Note that the valveholder connections shown are for the top of the holder itself, *not* for the

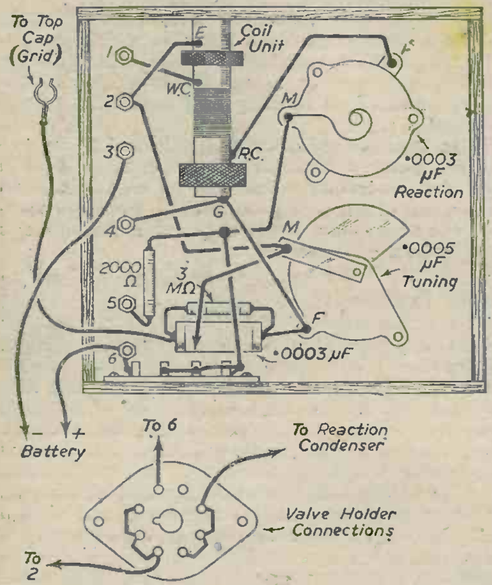


Fig. 3.—Internal arrangement of parts and wiring.

valve pins as viewed from the bottom of the valve.

Flexible leads about 4in. long, ending in clips, are used for battery connections. A piece of cardboard 3¼in. by 2¾in. placed against the condensers prevents any shorting to the battery tags.

With some coils it is possible that insufficient reaction may be obtained, particularly on long waves. If so, the number of turns on the reaction winding may be increased. Local stations will be received without reaction.

If the receiver is required for use in a locality where all that is desired may be received on the medium-wave band, construction may be simplified by using the Wearite "P" type coil, (PA2 or PA7). A fixed condenser could be included in the aerial lead and the primary used for reaction, the tapping and Terminal 1 being then omitted.

It should be unnecessary to point out that the receiver is intended mainly as a novelty, but that even so it is capable of surprising results under certain conditions. If a large outside aerial is employed, some difficulty is bound to be experienced on the grounds of selectivity, and therefore to sharpen up the tuning it may be found desirable to include a small variable condenser (one of the pre-set types will do) between the aerial lead and the aerial socket (No. 4) on the panel.

Recording Technique–2

This Article Outlines the Requirements of a Volume-indicating Device, and Describes in Particular the Use of Copper-oxide Rectifier Meters

By R. KEMSEY-BOURNE

WHEREVER possible the monitor speaker should be fed from its own power output stage, and the input to the monitor amplifier is bridged across the input to the main recording amplifier at a high-impedance point, or suitably transformer-coupled. Obviously the later in the main circuit that the monitor feed-point comes the better; it must be following the tone control or equaliser stages so that any changes to the frequency characteristic obtained by adjustments which are made will appear on the monitor.

The monitor amplifier must be as similar in design and performance to the main recording amplifier as possible, although it is not required to give as much power output. For example, if the main power output stage consists of PX25s in Class A push-pull with transformer phase-splitting, then the monitor might well be PX4s similarly aligned, giving less power but comparable quality. Such a system is shown in Fig. 2. The more nearly similar the main and monitor amplifiers are made, the closer to reality is the impression given by the monitor.

If it is not practicable to build a complete push-pull monitor amplifier, then use a single triode or pentode, always assuming that at the point of bridging there is sufficient voltage swing to give satisfactory monitoring volume. The pentode has the advantage of greater sensitivity, although it will be necessary to fit a tone filter to correct as

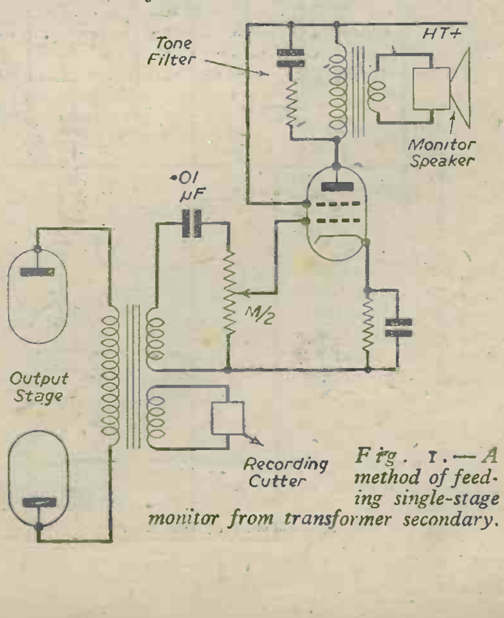


Fig. 1.—A method of feeding single-stage monitor from transformer secondary.

far as possible for the differences between single-ended pentode and push-pull triode (or pentode) outputs ; filters as shown in Figs. 2 and 3 will help.

If more convenient, a single-stage monitor may be fed from a secondary winding on the output transformer, particularly a high-impedance secondary (500-2,000 ohms). Like the circuits of Figs. 2 and 3, the line-up of Fig. 1, operating in Class A, draws no grid current, no power, and thus cannot upset the main output stage or the impedance match between the primary and the secondary feeding the recorder. The monitor as shown may be shunted directly across secondaries having impedances of 500 ohms or greater, and will not affect the recording.

In general practice, audio monitoring of the recorded matter by means of headphones or loudspeaker will be used in conjunction with some form of volume indicator or power-level meter. The recordist thus has both qualitative and quantitative checks on what is fed to the cutter-head. The monitor speaker presents the necessary picture of balance, tone and subject matter at any time, and the volume indicator shows whether too little or too much audio power is being supplied, although it gives no idea of its range and quality.

Types of Indicator

The volume indicator (V.I.) may be one of two general types. It may be a pointer instrument, such as a milliammeter suitably connected, in which case the swing of a needle is followed as showing changes in power level, and this is the most generally used type. Alternatively, it may be a visual device, such as a cathode-ray tube, a "magic eye," or a neon lamp, in which changes in level produce variations in the ordinate of a cathode-ray trace or in the shadow-angle of the "eye," and cause flashing and extinction of the neon tube.

Both types of indicator really show A.C. voltage across a particular load, and, of course, for a given load the power dissipation will be proportional to the square of the voltage across it. Strictly speaking, the square-law holds only for a load that is independent of frequency.

Pointer Instruments

The meter type of V.I. is the most generally applicable, especially for amateur and general professional uses. Any meter must draw a small amount of power from the circuit to which it is coupled, but if the meter is carefully chosen and properly connected this power can be made so small that it may safely be neglected. As we said above, our V.I. is to show A.C. voltage, so that what is required is an A.C. voltmeter sufficiently sensitive to draw virtually no power and with a rapid and even response over as wide an audio-frequency range as possible.

The moving-iron class of meter, although satisfactory for relatively large currents at low frequencies such as 50 cycles, is not sufficiently sensitive for reading small currents at higher frequencies. It usually draws too much current to act as a good voltmeter and has too high a

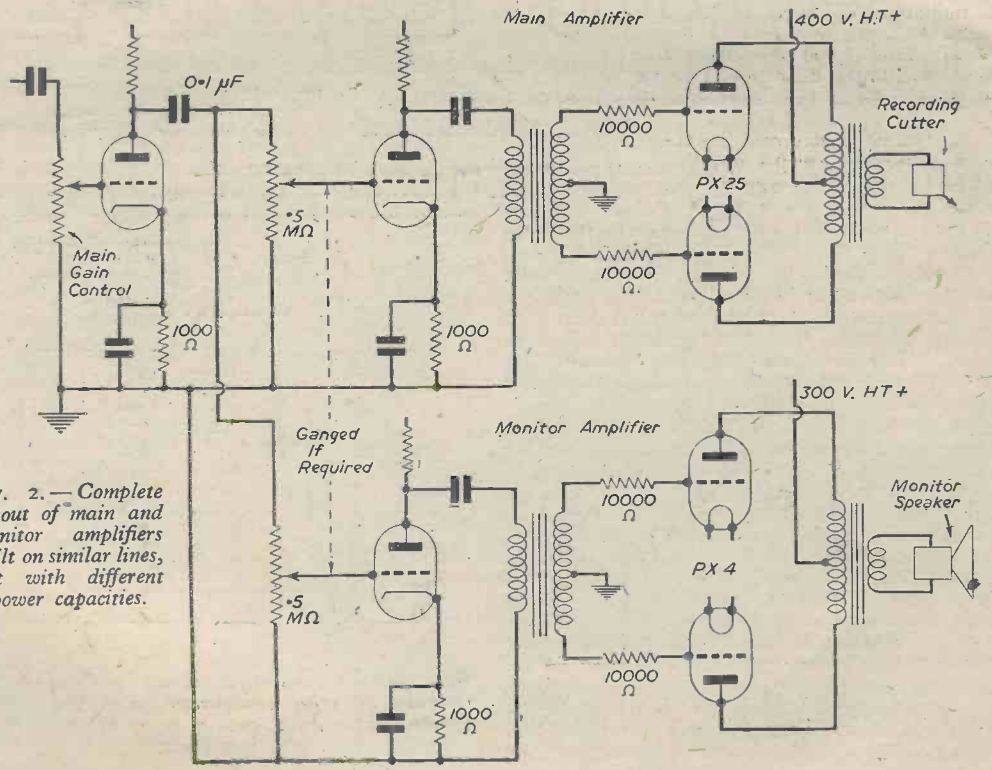


Fig. 2.—Complete layout of main and monitor amplifiers built on similar lines, but with different power capacities.

moment of inertia, so that it is not suitable for direct use as a V.I.

Thermocouple meters have excellent frequency characteristics but are in general insufficiently sensitive, since they also require relatively high currents for operation.

The simplest effective V.I. consists of a low-current moving-coil meter fed through a rectifier of some sort, and connected to the voltage source through an appropriate large resistance. The lower the full-scale D.C. current taken by the meter the better.

Instrument Rectifiers

Fig. 4 shows how a microammeter or milliammeter M is wired to a bridge-connected copper-oxide rectifier B. This type of rectifier is a minute version of the Westinghouse variety used for H.T. and L.T. supplies, and is designed for use with particular meters—500 microamps., 1 milliamp., 5 milliamps., etc. The value of resistance R depends on the voltage range to be covered and the D.C. current taken by the meter for full-scale deflection. The meter itself must draw as little current as possible, down to 100 microamps., and preferably not more than 1 milliamp.; between these limits the value of R will lie between 10,000 and 1,000 ohms for each volt of the full-scale deflection.

There will be some voltage drop in the rectifier bridge itself, so that for a given A.C. voltage range resistance R will have a smaller value than the dropping-resistance would have for the same range of D.C. voltage. For example, to make a 0·1 milliammeter have a full-scale reading of 5 volts A.C., we require a total series resistance of 5,000 ohms (1,000 ohms/volt), but because the bridge contributes some resistance the value of R (Fig. 4) will be of the order of 4,000-4,500 ohms only.

Copper-oxide instrument rectifiers are cheap, and so at present are 0·1 milliammeters and even microammeters. This type of V.I. is recommended, since it is efficient and economic. The Universal Avominor, used on the 5 volt A.C. range, makes an effective indicator across low-impedances such as 15 ohm cutter-heads in spite of the fact that its resistance on this range is only 2,000 ohms; it would be still better if it drew less current. Use the most sensitive meter you can afford.

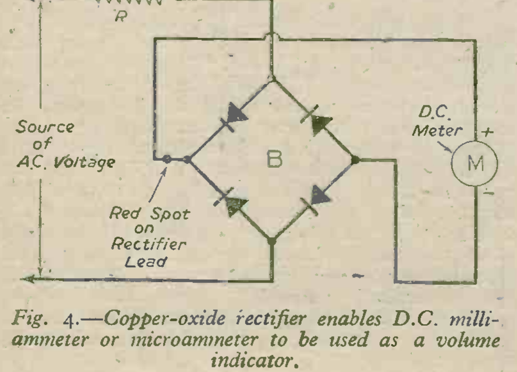


Fig. 4.—Copper-oxide rectifier enables D.C. milliammeter or microammeter to be used as a volume indicator.

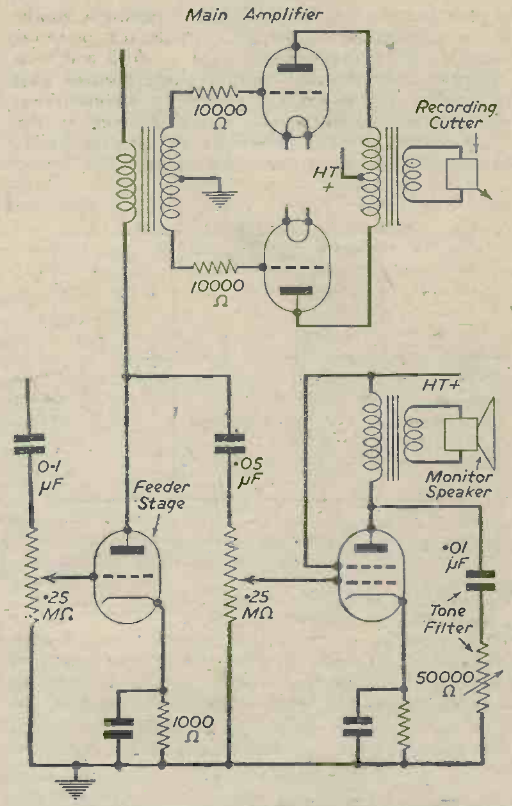


Fig. 3.—Pentode monitor stage fed from main recording amplifier, giving adequate sensitivity for speaker operation.

Properties of Rectifier Meters

Meters with copper-oxide rectification read the average amplitude of the A.C. wave. Overloads will be caused by the peak voltage exceeding the maximum permissible, so that the recordist works

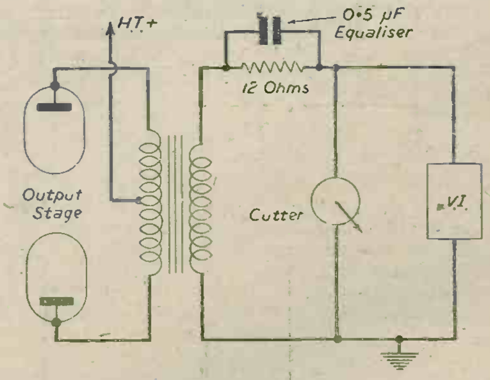


Fig. 5.—V.I. connected across low-impedance recorder, or other transformer-fed device. For 15-ohm cutter, bass equaliser is as shown; range of V.I. is 5 volts.

on past experience, knowing the handling capacity of his apparatus and making allowances as he controls the transmission.

Copper-oxide meters read slightly low at high frequencies. The reading drops by about 1 per cent. for each 1,000 cycles rise in frequency, due to by-passing by the electrostatic capacity of the rectifier. This effect, and the slight variation of

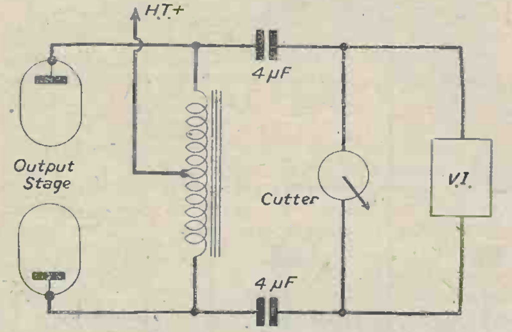


Fig. 6.—V.I. connected across high-impedance recorder, choke-fed via high-voltage paper condensers.

the rectifier's characteristics with temperature, are negligible in everyday practice.

Again, when a meter has been calibrated with sinusoidal A.C., the readings will not hold if harmonics are present. Such considerations as these are neglected, since the V.I. is used rather like a speedometer—to prevent the safe limit being exceeded and warn us when we are cutting it rather fine.

Other Types of Rectifier

Silicon and germanium crystal rectifiers are available for use in meter circuits, but are more used in R.F. than in A.F. circuits, since their frequency response is excellent. They may be used in bridge connection for full-wave rectification, but cost more than the normal instrument type.

Valve rectification will be referred to later; it has the advantage of practically infinite input impedance.

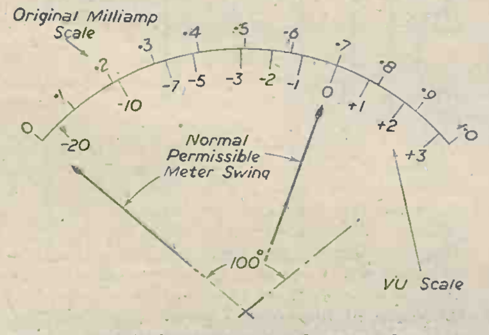


Fig. 8.—Typical appearance of VU-scale, showing angle of swing for the meter needle. Needle should overshoot only rarely.

Connecting the Indicator

The obvious place to wire the V.I. is directly across the cutter-head leads, where it will give most information. The effect on recording performance of a high-resistance meter is not noticeable. Putting an A.C. meter across the primary of the output stage would involve either blocking the flow of D.C. from the H.T. supply or balancing it out.

Figs. 5 and 6 show volume indicators of the type of Fig. 1 connected across low and high

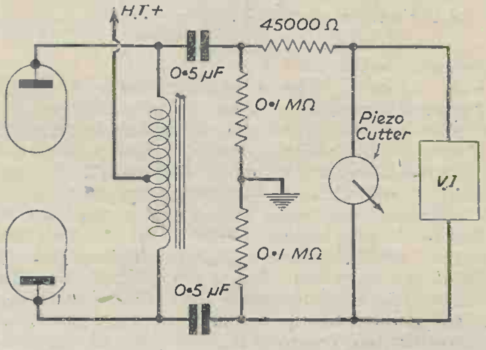


Fig. 7.—Circuit for piezo-electric recorder cutting constant-velocity characteristic, with turnover at 500 cycles. Overall range of V.I. is 150 volts; average peaks should be recorded at about 100 volts level.

impedance recording heads, and Fig. 7 illustrates the method for a piezo-electric cutter. Fig. 5 gives A.C. voltage ranges for cutters of different

Recorder-head impedance (ohms)	4	7.5	15	500	2,000	5,000
A.C. Voltage range of V.I.	3	4	5	35	65	100
Total resistance for 0-1 mA. meter (ohms)	3,000	4,000	5,000	35,000	65,000	100,000
Total resistance for 500 μA meter (ohms)	6,000	8,000	10,000	70,000	130,000	200,000

A.C. voltage ranges for recording heads of different impedances.

impedances from 4 to 5,000 ohms, and the total resistance values for each range. The total resistances tabled include the rectifier.

Using the V.I.

Arrange your meter so that a normal peak voltage for the cutter-head corresponds to 70 per cent. of the full-scale deflection. Then on sustained high-volume levels and on normal peaks keep the meter needle at or just below this deflection. It may, of course, flick past on transients.

Commercial indicators have standard ballistic characteristics, with an input impedance of the order of 7,500 ohms for shunting on 500 or 600 ohm lines. They are basically copper-oxide voltmeters of suitable range. Since a V.I. indicates a mean level over a short period rather than an actual instantaneous power level, it is calibrated not in decibels but in "volume units" (VU), although VU readings correspond with decibel levels above one milliwatt in the case of steady sinusoidal voltages.

ON YOUR WAVELENGTH

By THERMION

The Radio Critic and the Brains Trust

I WAS interested in listening to the Radio Critic recently and to hear his views on the Brains Trust, which coincides with those which I have expressed so often. He thinks, as I do, that each session needs a different group of people, or alternatively that there should be an expert available on almost every subject. I see that Joad has been replaced by Bertrand Russell. I know him to be a clever mathematician, but I do not think that he has the necessary knowledge and experience to deal with the type of questions submitted to the Brains Trust. I write in the presumption that, unlike myself, many people like the Brains Trust. I am all in favour of a properly constituted Brains Trust. I do not like an item foisted on to listeners as a Brains Trust which turns out to be a third-rate music hall act which would get the "bird" even in the remotest districts of this country.

This programme has received undue publicity in view of its very poor show, and I do not accord it any marks, as an examiner, for the replies given to what I consider to be examination questions.

It does not concern me that Joad is no longer in the Brains Trust, nor would it worry me if the remainder of them were changed. If there is a need for a Brains Trust let it be a real Brains Trust and not an exhibition of tergiversatory circumlocution interlarded with an exuberance of verbosity which some of them may find effective in disarming too shrewd a criticism, or in cloaking a lack of knowledge of the subject.

I had a letter from one of my readers Mr. P. J. Rust, of Bournemouth, who thoroughly agrees with my views. He says that in the old days though mistakes were made, the discussions were interesting and informative. Now we are asked to listen to a discussion on the inane question, which produced the expected inane answers, of "What is love at first sight?" Of course, no one could ever be right or wrong on such a question. I wonder if any member of the Brains Trust could give a succinct answer to the question: "What is the square root of minus one?"

I wonder whether the Brains Trust could give a clear answer to the question: "What are the principles of atomic energy?" or "What are the principles of jet propulsion?" or "Why is the sky blue?" or "Why is water wet?" I doubt it very much.

As one who can lay claim to reasonable scientific knowledge, who is an engineer by education and training and a journalist by accident, I have been amazed at the deplorable display of ignorance evinced by the Brains Trust. I can only conclude that those responsible for the programme select questions of the type "What is Love?" so that the Brains Trust can never be right or never wrong. I do not believe that all of the questions which are submitted are of this type. On the face of it it would seem that there is some element of selection about these questions.

As the B.B.C.'s own Radio Critic is so critical of the Brains Trust, I ask the B.B.C. to remodel this programme, or drop it in its present form altogether. I would ask members of the Brains Trust to remember that they are not actors:

> Empty shells from 8 till 10,
> Filled with the wit of other men.

Twenty Questions

Mr. Rust does not agree with me on the subject of "Twenty Questions." He finds it entertaining, and he does not think that the listening public would prefer a different set of "experts," each time. I have put that word "*experts*" in quotation marks deliberately because I do not think that Anona Winn, Jack Train, Richard Dimbleby or any other member of this music hall turn would claim to be experts. It all depends what you mean by "experts" I suppose.

But as the same group of people are expected to be able to divine the answer on a wide variety of topics they would need to have an encyclopædic knowledge and to be omnifarious readers. I do not think any of them would claim to be either. In any case my main objection was that some of them should be asked to "pipe" down a bit and not to regard it as *their own* programme.

Here is another letter, this time from C. Boswell, of Smethwick. He thinks that my article was written to get readers busy with pen and paper! "I do not think the B.B.C. programmes are by any means good, but surely to criticise them in the way you do this month is without reason. 'It gets more than a little boring at the commencement of most objects to hear Anona bobbing up with the first question. I suppose this programme is amusing to children, but I do not think in general that parlour games are suitable for radio. If I am wrong about that, I certainly am right in stating that the listening public would prefer to hear a different set of experts each time.'"

My correspondent does not think that I could be wrong about one thing and right about another! This indicates that his logic is at fault. I know from readers' letters that the majority of them would prefer to hear a different set of voices each time. The "experts" get used to the questionmaster. They do not come strange to the studio. They are able to discern from the twinkle in his eye or the inflection of his voice a point which should count as a question. In any case I reassert that no four people, whether it be Brains Trust or "experts," are qualified week in and week out to give sensible and accurate answers to a wide variety of topics.

Practical P.A. Working—1

In This Introductory Article R. SELBY Discusses the Main Requirements of Public Address Equipment

THE uses of public address equipment up to 1939 were already very wide, but the impetus given by war conditions, when almost every factory was fitted with an installation to provide "Music While You Work," announcements, warnings, etc., and the extensive use of loudspeaker vans for many purposes, has caused the general acceptance of P.A. in some form or another as a *sine qua non* for almost any occasion where people are gathered together even in comparatively small numbers.

The term "Public Address" is not altogether a happy one, embracing as it does anything from a small gramophone amplifier suitable for private parties up to a speech and music installation with an A.F. output of a kilowatt or more, but is now generally accepted, at any rate by technicians.

A large volume could be written on the many technical and practical aspects, but in this series of articles, based on a good many years' experience, the writer hopes to touch upon some of the more important points for the benefit of readers who are interested in the subject.

At the outset it should be made clear to those who are contemplating P.A. from the business angle that it involves a fairly heavy capital expenditure on equipment. It is, as the writer has perforce found by hard experience, possible to effect many economies by means of ingenuity and hard work, but the standard of performance required to-day, now that mere novelty has worn off, is so high that it is useless to attempt it with insufficient loudspeakers, poor quality microphones, or amplifiers having too low an output. Moreover, every P.A. job varies in some way or another, and experience counts for a good deal in obtaining the best results.

There are many ways in which types of P.A. work could be classified, but probably the broad division between indoor and outdoor jobs will suffice. In both cases, of course, the aim is to obtain as faithful reproduction as possible, whether it be speech, live music, or gramophone records, and to make that reproduction clearly audible to every person present, but there are considerable differences in the technique and equipment required. These may be summarised as follows:

Indoor Work

Amplifiers, particularly if for speech only, need not be very large, but must be as distortionless as possible, and may almost invariably be mains operated.

The highest quality microphones obtainable are necessary.

Generally, cabinet or baffle speakers will be required.

Outdoor Work

(With which may also be grouped many factory installations.)

Amplifiers must be of much higher power, often capable of operation from car batteries, but complete freedom from frequency and harmonic distortion is not quite so vital, although naturally desirable.

Microphones. Here again the highest quality is not quite so essential.

Loudspeakers will invariably be of the horn or directional baffle type.

Various accessories such as loudspeaker stands, extra cable, ladders, remote control units, etc., may be required.

It is now proposed to deal with some of these points in some detail.

For the majority of indoor jobs in halls a 15-watt amplifier is sufficient, but it is essential that it have as nearly as possible a straight-line frequency characteristic and that its apparent output impedance be as low as possible. The obvious reason for these requirements is to obtain good quality reproduction. But there is an even more important point. The bugbear of P.A. work, particularly indoors, is acoustic feedback, also known as howling and singing. As the reader probably knows, this is due to the fact that when the amplifier gain exceeds a certain critical point the sound coming from the loudspeakers reaches the microphone with sufficient strength to be picked up and re-amplified, thus quickly building up into a sustained ear-splitting howl. The volume of reproduced sound is thus limited to something below the howling point. This effect is inevitable, but obviously one minimises it by careful positioning of microphone and speakers. If, however, the amplifier, loudspeakers or microphone have any resonances or peaks in their frequency response characteristics, it is clear that the overall amplification of the whole chain is greater at that frequency. Consequently the gain of the amplifier must be reduced sufficiently to prevent howling at this peak frequency, with a consequent unwanted reduction in amplification over the remainder of the audible band. If the peaks can be eliminated by good design, a much greater overall amplification can be obtained before the howling point is reached. It might perhaps be thought that this is rather an academic point, but in the writer's experience it is of vital importance—much more so than the disposition of microphone and speakers. The reason for specifying a low apparent output impedance in the amplifier (obtainable by the use of heavy negative feedback) is to assist in damping loudspeaker resonances, with the same object in view.

A Fallacy

This seems an appropriate point at which to expose a fallacy often put forward by the layman, viz., that a large amplifier will give better results than a small one. As far as indoor situations are concerned, if the microphone is within earshot of the loudspeakers, the volume of sound attainable is always limited by the acoustic feedback factor. Consequently, if, in some given situations, the limit of sound obtained before howling commences is equivalent to, say, 8 watts delivered to the speakers, there is no point in using a 30 watt amplifier. A 10- or 15-watt outfit will do the job equally well with a margin of safety, and will be lighter to handle. As mentioned previously, 15 watts output is sufficient for the majority of indoor work even if gramophone record amplification is required. Naturally, this remark does not apply to installations for factories or Olympia exhibitions.

Continuing to deal with amplifiers, it is hardly necessary to add that reliability is of paramount importance. It is principally a matter of taste (and cash available) whether one builds the amplifiers or buys them ready made. If they are purchased, it is advisable to stick to a reputable make, and to make sure that they are designed to operate with the particular type and make of microphone and pickup which one intends to use. Ex-Government surplus amplifiers need particularly careful investigation on this point. Other points to watch are the degree of convenience (or otherwise) provided for making speaker, microphone, pickup, mains, etc., connections, and convenience of controls, switching and voltage adjustment, also portability, range of output tappings provided, and availability of spare valves.

The same points must also be considered when building one's own equipment, and in addition it must be borne in mind that not only is a good circuit design called for but also the highest quality components and workmanship. Resistors, condensers, etc., must have an ample margin of safety in their ratings, wiring must be sound and well insulated, and components should not be suspended in the wiring. Adequate ventilation is essential. It must be remembered always that P.A. equipment receives much rougher handling during transport and installation than a domestic outfit, and that the consequences of a breakdown are infinitely more serious.

In the next article some practical points in P.A. amplifier design will be dealt with.

Technical Notes—2

Our Contributor "DYNATRON," Discusses Feedback and Transmitter Problems

FOR the following experiment you should procure two coils and condensers which will tune over approximately the same frequency-range, and connect-up to a triode of moderately high amplification factor as in Fig. 4a.

At first, leave everything unscreened. You will have an excellent *oscillator* over most of the tuning range. If the coils are coupled fairly closely, this oscillation can be of a complicated kind, arising from magnetic feedback from anode to grid circuits, together with electrostatic feedback via the valve inter-electrode capacity *Cag*. Different considerations apply to the phase of these two types of feedback, so it is possible you will observe shrieks or whistles suggestive of an audio beat between two different high frequencies.

All right, let us eliminate one form of coupling. Let us keep the coils well apart and enclose them in earthed screening-cans, as indicated by the dotted outlines in 4a. There will now be little or no magnetic feedback.

But oscillation persists almost as well as before? It will have altered in character; probably the shrill whistle will have disappeared, giving a more pure single oscillation which occurs over only part of the tuning-range. Still, there is an unmistakable self-oscillation, as may be observed, for example, by varying the tuning near to a fairly sensitive receiver.

Of course, the cause of self-oscillation is "reaction" between anode and grid circuits—here, via the minute internal capacitance of 5$\mu\mu$F. or so existing between the anode and grid electrodes, exactly as if a small condenser of this value "tied" anode to grid.

As it is an "internal" capacitance, no ordinary measures outside the valve can accomplish much in the way of remedy. To demonstrate what was once done, you might try shunting the anode- and/or grid-tuned circuits with resistances to "damp" them, starting, say, with 250,000 ohms and working downwards until oscillation ceases. You will then have a measure of "stability" all right, but what an H.F. amplifier! It was by no means uncommon to find overall gain improved by *dispensing* with the "H.F. stage."

Balancing-out the Feedback

Then came a real remedy, even though very

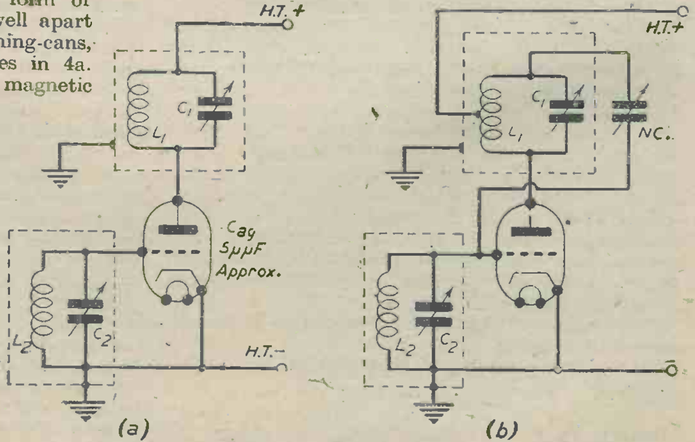


Fig. 4. The "H.F. amplifier," Fig. 3, will make a good T.A.T.G. oscillator, as in (a) : (b) shows a simple method of neutralising.

difficult to set over a wide range of frequencies.

Since the advent of the screening-grid which reduced *Cag* to something like .002 $\mu\mu$F or less, it seems amazing that it took so long to develop what now look like the obvious remedies. Indeed, it took many years to realise fully that the valve inter-electrode capacitance was the culprit, and it was left for Miller, with his complicated equations, to develop the complete generalised theory of the triode network—and, believe me, it is not "simple"!

A capacitance of 5$\mu\mu$F. does seem exceedingly small, but if you work out its A.C. reactance at 1,000 kc/s., you will find it comes to about 32,000 ohms. That is quite a large degree of reactive coupling from anode to grid. At 30 metres (10 Mc/s.), it drops to 3,200 ohms!

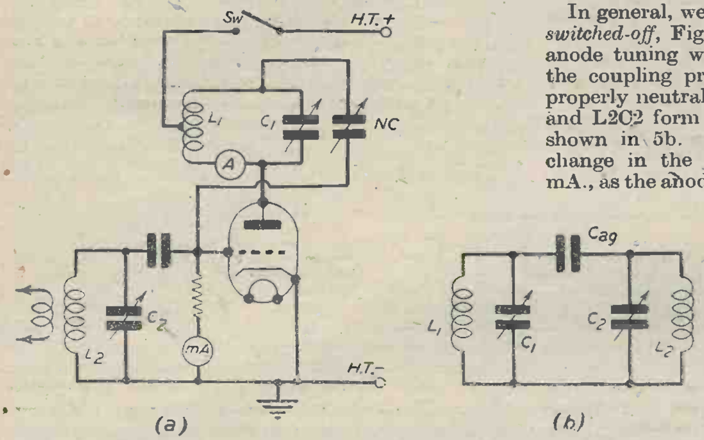


Fig. 5. Discussing methods of neutralising a triode transmitting stage: (b) shows the capacitive coupling between anode- and grid-tuned circuits.

Anyway, if you can get hold of a small single-vane neutralising condenser of about the same order of capacitance as *Cag* (5 $\mu\mu$F.), perhaps you will derive a little amusement trying out the balancing method shown in 4b.

Adjust NC until oscillation ceases at, say, one fixed setting of the condensers. It will probably start again at other settings. It is not difficult to neutralise a transmitting valve working at one fixed frequency; but receivers were a rather different story with a waveband covering M.W. and L.W.

No doubt you have read of the "see-saw" principle used to explain balancing. H.F. voltage gets back to the grid via *Cag*. Because the centre-point of the anode coil is made "earthy," by tapping-down +.H.T., the H.F. voltage feed back from the top end of the coil via NC will be diametrically opposite to that fed back from the anode end via *Cag*. The two voltages will also be exactly equal when the neutralising condenser is adjusted to the right value, hence the resultant feedback will be nil.

"Ancient history," perhaps, but studying important radio principles is always of value.

Interesting Facts About Transmitter Neutralising

Where sufficient power is available in the grid circuit, as in transmitter drives, a direct demonstration of the coupling via *Cag* can be observed in H.F. ammeters, etc.

In a modulated Class C stage it is most important to ensure that no feedback occurs, which, if at 90 deg. to the existing drive, will result in *phase-modulation* on top of the amplitude modulation. There are other complications if a power stage is not properly balanced, such as difficulties in tuning the anode circuit correctly owing to a combination of H.F. output from the valve and "forward feed" via the inter-electrode capacitance.

Short-wave experimenters will be familiar with several methods of "neuting."

In general, we may say that with the H.T. supply *switched-off*, Fig. 5a, any adjustments made to the anode tuning will affect grid-circuit conditions via the coupling provided by *Cag*, if the stage is *not* properly neutralised. The two tuned circuits L1C1 and L2C2 form a capacitively-coupled network as shown in 5b. The usual indication used is a change in the reading of a grid-current meter, mA., as the anode tuning is varied through resonance.

If correctly balanced, any adjustments in the anode circuit (with H.T. *off*) should have no effect whatever on the grid-current.

Another interesting method which involves switching-off the H.T. is shown in 5a. Even though there may be little or no extraneous couplings between L1 and L2, a small reading can be observed in the closed-circuit H.F. ammeter A, due to energy being coupled from the driving source at the grid via *Cag*, i.e., "*forward* feed" through the inter-electrode capacitance.

Often, the closed-circuit ammeter is too insensitive to give any readable indication at the small amount of coupling which exists, and either a more sensitive thermo-ammeter may be inserted, or—what is generally sufficient—a flash-lamp bulb may be connected across two or three turns of the anode coil.

When the anode tuned circuit is adjusted to resonance, the lamp will light to maximum brilliance, then the neutralising condenser is adjusted until the bulb is extinguished. If NC is turned beyond this point, the bulb will come up again, the correct setting being about midway. For more exact balancing, a sensitive thermo-ammeter should be employed.

A "hot" method of neutralising, i.e., with all power supplies, including the H.T., "*on*," makes use of the fact that if, in addition to the normal output of the valve, energy is being supplied via *Cag*, peculiar results will be observed in the anode tuning.

Normally, an H.F. power stage is tuned for *minimum* H.T. feed, and this will coincide with *maximum* current registered by the closed-circuit thermo-ammeter. But if there should be any forward feed to complicate matters, "minimum" and "maximum" indications on these two meters will not coincide—minimum D.C. will occur at a slightly different condenser setting from maximum closed-circuit amperes.

Hence by closely observing the meters in a driven stage, whilst carefully varying the anode tuning over a few degrees, it is easy to test under actual working conditions whether the stage is properly neutralised or not.

Tuning Class C Stages

Reference to what was said above about anode tuning having no effect upon the *grid*-current of a properly neutralised stage, observe carefully that this will be far from true in normal conditions with the H.T. "on."

Even if perfectly neutralised, any change in the anode tuning *will* immediately affect the grid-current. In fact, one good way of tuning a Class C stage is to adjust the anode circuit for *maximum grid-current*—note carefully, not minimum, as for the anode meter.

At a transmitter with which I have been associated, I have had a merry old argument about this, or, rather, whether the grid-current does change if the anode volts are swinging at modulation frequencies—not necessarily implying any observable change in the *mean* grid-current registered by a meter.

We will not go into that now. But why should any alteration in the tuning of the *anode* circuit cause the *grid*-current to change at all, if a stage is properly neutralised? Neutralising implies there is no "coupling" whatever between the two circuits.

No, there is no coupling—magnetic or electrostatic. But the total space current divides between anode and grid, the amounts depending upon the relative + potentials of these electrodes. The grid is driven a certain amount positive, whilst the anode has a certain *minimum voltage* at the instant when peak voltage occurs across the tank load.

The latter will be at a maximum when the tank has maximum impedance, at resonance, hence the volts on the anode will become an absolute minimum, whilst the positive grid potential will cause a few more electrons to be diverted in that direction. Hence "Ig" increases.

Test Instrument Design–6

In Concluding the Series, P. E. TOOKE This Month Discusses Photographic Work With an Oscillograph

ALTHOUGH not in strict keeping with the rest of these articles, it is very useful to have some knowledge of using a camera to record permanently the oscillograms seen on a "scope."

For some work, examining transients, etc., where the speed of the trace is very high, a photographic record is the only means of checking it at leisure.

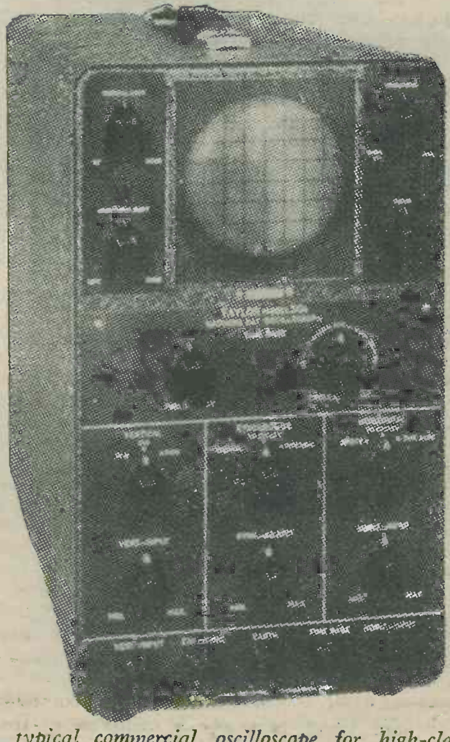
Assuming that you have a 'scope at your disposal, the rest of the apparatus need not be expensive. There are two ways of recording. The first and cheapest is by using the time-base of the 'scope to form the picture and then photographing the tube face. Or, by using the spot alone, to produce the trace vertically and recording by means of a moving film.

Of course, the latter is more expensive, and not all work can be done by either method. Some entail one way, and no other way will do.

For the amateur who just wants to experiment with photographing traces of wave form using the time-base, the least expensive is, of course, the best, so we will start off with this method.

A simple set-up can use the ordinary box camera. If it has a "portrait" lens so much the better; if not you will have to fix it in this way. Purchase a spectacle lens with about a 12in. focal length. The lenses you can buy at the cheap stores are just the thing; you will find that they are marked with a number. This number is their focal length in inches. Mount it over the lens—adhesive tape is ideal, only be sure it does not obstruct the lens in any way. When this is mounted fix the camera firmly in some way in front of the 'scope, with the distance from the screen to the lens equal to the focal length. This should be measured and not left to chance. Also line the camera up so that it is pointing fully at the screen. Do not rely on the viewfinder, as it is not accurate at this short range.

If the 'scope has a blue trace so much the better. A green one will do, however, although it will need a slightly longer exposure.



A typical commercial oscilloscope for high-class work. The Taylor model 30A.

Load the camera in the normal manner with, preferably, orthochromatic film, not panchromatic. Then produce the trace you want to photograph and steady it as much as possible. Focus it as fine as it will go, with the brilliancy a little higher than you would normally have it for visual work. When everything is set and steady just give it a time exposure as quickly as possible; this is about a second's exposure. If your camera has shutter speeds fitted so much the better; if not, you must flick the shutter control up and down with the time knob out. After a few attempts you will be able to get results quite easily and need not worry about not catching a particular trace.

It is much more interesting and better to develop your own film, as then you can control the process to give the contrast you require. Developing is quite cheap and easy. Just a couple of dishes and a packet of developer and fixing salts. Use a "contact" developer and follow instructions on the bottle. There is hardly anything that can go wrong, as you only have an exposed trace in one tone, with no semi-tones to worry about as in a snapshot.

With the method just described results can be obtained which are comparable with the results or output of a commercial camera, and permanent records are invaluable for keeping for future reference.

Now we come to the recording of transients, etc., with a moving film. Unfortunately there are very few short cuts for cheapness in this way of recording. A reliable camera and a motor to turn it are needed. If a commercial one is bought it runs out quite expensive, and unless you are exceptionally handy with tools there is not much hope of constructing one.

If one is not worried too much about expense, a good commercial type of camera should be obtained, such as the Cossor model 427. It is specially designed for use with the Cossor Single or Double Beam Oscilloscope and will take single shots of the screen or continuous moving film records.

For moving film work a motor is needed to turn the shaft which operates the film. The makers state 1/40 h.p. is sufficient, but I have found that a 1/10 h.p. is really needed to cover all speeds. A series of pulleys can be made so that different speeds for different traces are obtainable. With this particular type of camera speeds of up to 20ft. per second are possible. The average speed for normal recording is, however, about 2ft. per second. A paper film or normal 35 mm. negative fits the camera. The paper is cheapest and best, although if more than one copy of the record is wanted, film will have to be used. This runs out very expensive as 25ft. of film costs approximately £2.

Operation is quite simple. The 'scope is focused and the brilliancy set, then the camera mounted and loaded, making sure that the shutter is open, the signal to be recorded is fed into the 'scope, and the camera motor started up. When the desired length of film has run through, the shutter is closed and the motor stopped. The cassette containing the film can be taken out and processed right away if wanted.

The processing of lengths of film is rather too much except for anyone with a proper darkroom. A frame is needed on which to wind the film, and large tanks to take the frame. Processing by a photographic dealer is the best way and the cost is not very high. In the long run it is really the cheapest except for a large firm using the camera all day.

Self-priming Battery

THE Exide self-priming battery was developed during the war, for working with wireless transmitters and receivers for emergency use on ships' lifeboats. Batteries for such duties may be called upon at a moment's notice and they must, therefore, be available for service at all times. Exide self-priming batteries require no maintenance or attention while they are in storage and yet they are capable of supplying current immediately on priming without the necessity for an initial charge.

Each battery consists of a number of individual cells, either cemented together or assembled in a wooden crate, depending on the type of battery. The cells are made up with dry charged plates assembled in a hermetically sealed compartment, with the electrolyte in a separate compartment, and, as the electrolyte is not in contact with the plates, the battery may be stored for long periods without losing its charge.

When the battery is required for use, it is necessary to punch through the seals of the acid compartments, thus giving the electrolyte access to the plates. The battery may then be discharged within a few minutes without any previous initial charge being necessary. Subsequent cycles of discharge and charge may be obtained as required by recharging the battery in the normal manner.

A. F. Measurement Service

A SERVICE has been developed for the purpose of giving comprehensive performance data, in a standardised form, on specimen amplifiers submitted for the duration of the test. At present the service can supply performance data on complete amplifiers as listed, or on the audio-frequency section of radios or radiograms. It is hoped later to extend the service to cover a wider field of A.F. apparatus, including microphones, loudspeakers, pick-ups, and to perform other electro-acoustical measurements.

Form of Results

The data is supplied in a form most suited to its nature, normally in one of three ways, graphically, numerically or photographically, that is, a photograph of an oscillogram.

A short note on the interpretation of the test accompanies each result, also a block diagram of the apparatus used, any formulæ, an accuracy estimation based on all possible determinate and indeterminate errors in accordance with standard laboratory practice, and other information concerning conditions of test. Full details of the service, which, at the moment, is for manufacturers only, may be obtained from A. E. Cawkell, 7, Victory Arcade, The Broadway, Southall.

A.C./D.C. Circuits–2

Dial Light Arrangements, and "Battery-mains" Working are Described This Month

By W. J. DELANEY (G2FMY)

LAST month we discussed the main features of the A.C./D.C. type of receiver and ended by emphasising the necessity for remembering that the chassis and everything connected to it are "live." A point sometimes overlooked in this connection is that although a fixed condenser may be inserted between the chassis and the actual earth connection the aerial tuning coil is connected to the chassis line, and therefore its other end is "live." Consequently, unless a small fixed condenser is included in the aerial lead (between the aerial terminal (or socket) and the tuning circuit) it will be possible to get a shock when plugging in the aerial lead if a metal plug is used.

On the mains side we have already touched upon the mains filters which may be fitted, and small mica condensers are also often fitted to by-pass H.F., but these arrangements are normal filtering schemes and will not be dealt with here.

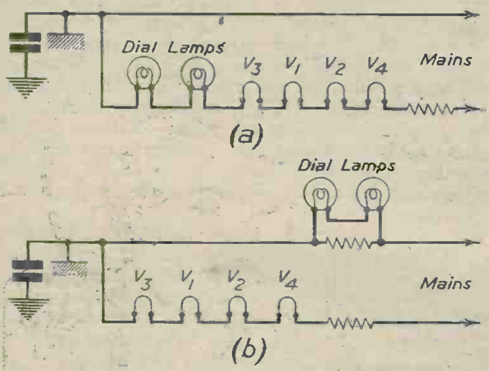


Fig. 5.—Skeleton circuit diagrams showing two main methods of wiring dial lamps in A.C./D.C. receivers.

Dial Lamps

The next point to receive attention is the dial lamp circuit. In many A.C./D.C. sets it will be found that a dial lamp blows the set refuses to function, whereas in other receivers of a similar type the dial lamps can fail and signals still be received. The reason is quite simple and is illustrated in Fig. 5. Here are the two normal methods of wiring, in the first the lamps being in series with the valve filaments, and in the second they are wired in the other mains lead with a shunt to control the voltage across them. It will be obvious that with the first arrangement interruption caused by a broken filament in either valve or dial lamps will break the circuit and the receiver will cease to function. In the other arrangement if either of the lamps blows the valves will still remain alight and the H.T. current will flow through the lamp shunt resistance, permitting the receiver to continue functioning. In the two circuits illustrated two lamps have been shown. In some receivers only one is used, whereas in others there may be up to four lamps, each one illuminating a separate part of the tuning scale. It is obvious that switches may be provided so that any desired lamp may be included in either of these circuits, and the switch may be operated with the wave-change control.

Battery-mains Working

Just before the war some receivers were imported into this country from America which had the then new low-consumption valves for all-dry battery working, but in which provision was made for all-mains working also. This meant that there was no accumulator to worry about, a self-contained L.T.-H.T. dry battery of only about 90 volts being enclosed in the cabinet, and in addition a length of mains lead was also fitted so that the receiver could be plugged into any type of mains socket and the set would operate without disconnecting the batteries. British models were also manufactured on similar lines, and in one well-known British receiver it was unnecessary to operate

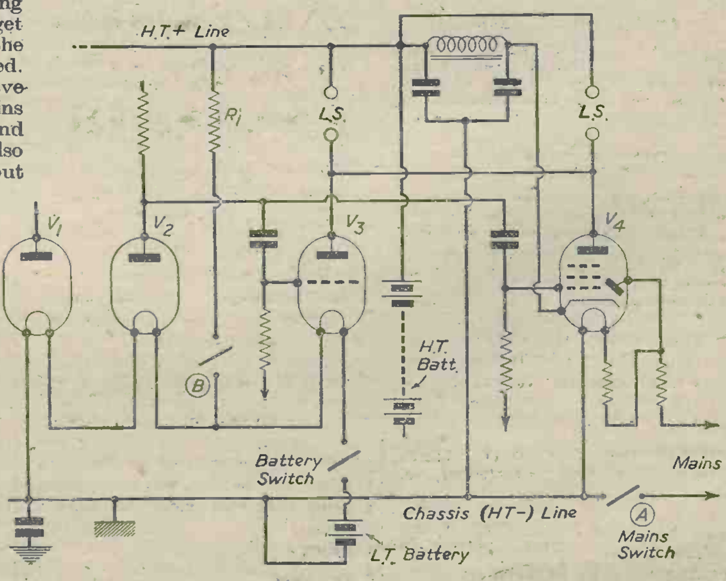


Fig. 6.—One scheme for providing battery or mains working. The filaments of V1, V2 and V3 are not in circuit order.

a switch, the receiver merely being plugged into the mains and automatically switching over to the mains supply when the mains were switched on at the power point. In the event of a mains failure the receiver automatically changed back to the battery supply.

Although these arrangements sound complicated they are really fairly simple and the basic idea is shown in Fig. 6. Here, for simplicity, only a 3-valve receiver has been indicated, and the circuit is in skeleton form. V1, V2 and V3 are the low-consumption all-dry battery valves, whilst V4 is a mains type combined half-wave rectifier and output pentode valve.

It will be seen that the battery valves have their filaments wired in series and in series with the L.T. supply, just as in the case of A.C./D.C. valves. (This means, of course, that instead of a 1.5 volt battery, a 4.5 volt battery would be required for three valves, and so on.) The mains valve is provided with the usual series resistance to control the voltage across the filament and, if required by the particular make of valve used, a series resistance on the H.T. side. The anodes of both V3 and V4 are joined to the loudspeaker and the anode of V2 is joined through the customary coupling condenser to both V3 and V4 control grids. A series resistance is joined between the normal H.T. positive line and a tapping point in the battery-filament line—between V2 and V3. A switch is sometimes included in series with the resistance as shown at (B) and this can be one pole of a normal D.P.D.T. mains switch.

If the mains switch is in the "off" position and the battery switch set to "on," the L.T. supply will be completed through the battery, the valves will light up and the loudspeaker will be operated through V3. V4 in this condition has no effect on the working of the receiver. If, now, the mains switch is set to "on" (and at the same time, of course, the battery switch must be set to "off") the valve V4 will heat up, but the filament circuit for V1, V2 and V3 will be open until V4 has attained its full emission. At this stage normal H.T. will be fed to the H.T. positive line, and as the resistance R1 is in series with the filaments of V1 and V2 across the H.T. supply, current will flow and the filaments of V1 and V2 will pass current. V3, however, has no filament supply and so remains inoperative. When V2 is at working temperature the signals at its anode are fed to V4 which, being now operative, delivers its output to the speaker, and so the receiver is working with the mains supply. The mains and battery switches are generally ganged or form a multi-pole unit, and in the Pilot automatic receiver previously referred to the battery switches are operated by a standard type of relay which closes when the output-rectifier valve attains maximum emission. Failure of the mains supply or mains valve removes the current from the relay which springs back to its original position and thus switches in the battery supplies once more.

The above are the basic details, and there are, of course, as with most receivers, individual refinements introduced to provide smoother supply, easier manufacturing or servicing facilities, etc., but enough has been written to show that the "All-mains" type of receiver is, after all, only a simple modification of standard schemes and well within the capabilities of the average home-constructor.

The Desert Air-mail

RADIO OFFICER WOOD, who holds the P.M.G. Radio Operators Licence No. 5, tells the story of the pioneer days of the earliest British overseas air route—the route between Cairo and Baghdad.

Now B.O.A.C. Regional Signals Officer at Johannesburg, Mr. Wood has been concerned with air radio since he joined the R.A.F. as a boy apprentice in 1918.

Mixed Duties

Radio Officer Wood writes: The Cairo-Basra weekly air-mail service was opened in December, 1926, by Imperial Airways. It was the first British overseas air route and I was proud to be assigned to it so soon after joining the company.

The aircraft, the old three-engined De Havilland *Hercules*, were very reliable and did a grand job, but their biplane construction still had something of the "sticks and string" era about it, while the cruising speed was under 100 m.p.h. Any strong head wind reduced our speed to that of a motor-car, and often we saw the Nairn Transport long distance buses overtaking us, churning up clouds of dust below as they went on their journeys between Baghdad and Damascus.

The aircraft of those days could not fly very high compared with modern standards and were therefore affected by the hot air currents rising from the desert, resulting often in bumpy journeys.

Those were the days of open cockpits and the pilot and myself were exposed to the intense heat, the rain and the fumes from the hot engines. However, our Marconi radio receiver and transmitter, although providing for few of the facilities known nowadays, were reliable for the type of use to which they were put, mainly the passage of weather and routine messages to and from the small number of stations in that part of the world.

But besides our wireless operating duties, there was much else to be done, since we wireless operators were the only crew carried in addition to the Captain.

We were up at the crack of dawn or before, to superintend the freight loading. Then we had to help to start the engines. Our only uniforms were white coats, and if the engine back-fired the coat changed its colour for the trip.

In the air, we had to take petrol, oil temperature and engine revolution readings and switch-over petrol cocks as ordered by the Captain. We were also responsible for working a "Heath Robinson" contraption which indicated to the passengers our position, e.g., "Passing Suez," "Jerusalem," "Dead Sea."

A further duty was to hand round tea or coffee and sandwiches during the flight.

On completion of a round-trip, the Radio Officers had one day stand-off and reported at the airfield the next day to service the radio, while the remainder of the time before the next flight was spent in assisting the engineers to make engine changes or in cleaning plugs. Incidentally, our basic salary was £3 1s. 1d. per week plus 5s. an hour flying pay!

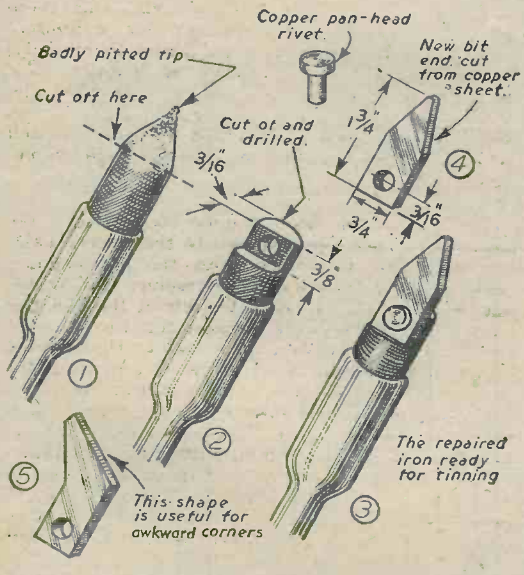
Practical Hints

A Soldering Iron Repair

BITS of soldering irons should last a considerable time providing normal care is taken to avoid overheating and to seeing that they are always properly tinned.

However, after some years of continual use the craftsman may be confronted with a very badly pitted tip, as shown in sketch 1. This is more likely to occur with the ordinary iron than with the electric or gas iron, the heating of which can be more easily controlled.

Separate replacement bits can sometimes be purchased, but a temporary repair can be undertaken quite easily, as shown in the sketch. An extension bit is cut out of sheet copper and riveted to the old bit, the latter being cut down to receive it. A flat is cut out of the old bit as shown at 2, and a hole drilled through both this and the new extension. A small copper pan-headed rivet is used to secure the two meeting faces.



New bits for soldering irons are easily made up as described in the accompanying paragraph.

The finished repair is shown at 3, whilst the extension piece and rivet are shown at 4. The copper sheet should be as thick as possible, up to $^3/_{16}$in. thick, if available, so as to conduct the heat well. The extension bit should be nicely filed and tinned in the normal manner.

If extra copper sheet is available the shape shown at 5 is very suitable for awkward corners, and particularly suitable for radio wiring work.

Such a conversion or repair will not, of course, tackle heavy work, as the heat reaching the tip will be less.

The sizes given will in most cases need modifying according to the particular iron it is required to repair.—R. L. G. (Chelmsford).

THAT DODGE OF YOURS!

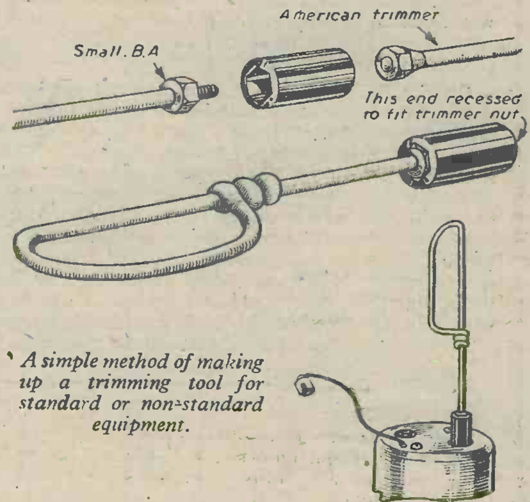
Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay half-a-guinea for every hint published on this page. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be original. Mark envelopes "Practical Hints."

SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page iii of cover.

Handy Trimming Tool

I FOUND it necessary the other day to adjust the trimmers of an American set. Instead of the usual screw the trimmers had an odd shape of nut, so I devised the following tool: From the junk box I got a few large-size banana plugs and removed the metal part. Next, I took one of the nuts from the trimmer and fixed it in a long,



A simple method of making up a trimming tool for standard or non-standard equipment.

threaded rod, and heated it on the fire and burnt an impression on one end of the tube from the plug. I then removed the nut and replaced it with a small B.A. nut which had the same thread. Next, on the other end I burnt another impression, then bent the rod to form a handle. I repeated this on various sizes of nuts from trimmers and other plug tubes and now have a very useful adaptable servicing aid.—E. G. MATHEWS (Llandilo).

High-fidelity

Constructional Details of an Elaborate Unit-con
Amplifier, Using Mainly Surp

By C. W

THIS design was originally commenced with the following points in mind: That the set should give the highest possible quality available for the cost. It should give a good account of itself on (1) voice, (2) organ, or (3) symphony orchestra at good volume, and be capable of receiving London, North and Midland Regions and the Third Programme on the medium-wave band and the Light Programme on the long-wave band.

It was decided that the A.F. output must be 20-25 watts at least, so that the first thing to overload would be the loudspeakers and not the output valves as appears to be normal in many commercial radio sets. Under normal power output it must not be run even near the overload point. This obviously means a high power consumption compared with the normal commercial 60-80 watts consumption, but as electricity at a "flat rate" of ½d. a unit is available, 200-250 watts was fixed as an approximate load.

Distortion

On the R.F. side of set, tuning must not be too sharp, otherwise there will be excessive high-note attenuation. This ruled out high-Q circuits such as used in modern I.F. transformers. These normally cut off at 4-5 kc/s and although I shall be immediately told that variable selectivity I.F.s. are available which can give 15-20 kc/s "top," I still do not feel it is possible to get the same real quality on the superhet as on the "straight" circuit, other objections being excessive hiss and background noise; and as world-wide coverage was not desired a straight set was decided upon.

It was required that it should be possible to sharpen up tuning to some extent if only to reduce an excessively loud heterodyne whistle on occasion.

Another requirement was that sufficient gain should be provided *before* demodulation, so that a really large signal would be available at the detector, i.e., 15-20 volts (To reduce detector distortion and increase $\frac{\text{signal}}{\text{hum}}$ ratio, also so that it would provide for the necessarily quite heavy losses in frequency compensation networks at input of A.F. amplifier.)

A final point: Hum level must be extremely low, inaudible even in pauses of programme and at low volume levels, and yet this must not be at the expense of the low notes.

After consideration of these often conflicting requirements, the circuit diagram shown was evolved.

R.F. Amplifiers and Demodulation

This unit consists of two tuned R.F. stages, an R.C. R.F. stage, and cathode-follower fed twin diodes for A.V.C. and demodulation. Coils used in the set were "salvage" from old-type Cossor 3-valve battery and mains sets. These are in square aluminium cans, approximately 6in. long and 2½in. square, and contain medium- and

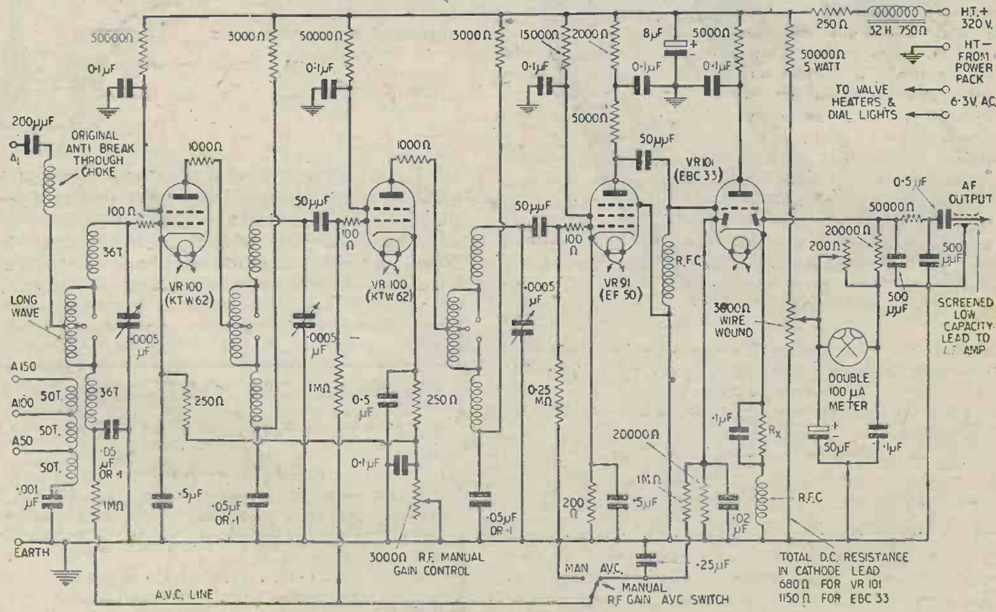


Fig. 1.—Theoretical circuit of the R.F. section.

Radiogram–1

tructed Straight Receiver, Plus Gramophone

Components and Valves.

HAGE

long-wave windings with three wave-change contacts brought out at one end. They are well-made coils with wire leads and usually contain additional components in the way of screen potentiometers, coupling condensers, and grid leaks. One aerial coil and two anode coils are required, and after stripping out additional components and reaction windings from the anode coils it is necessary to add an extra primary to the aerial coil. This consists of 150 turns of 32 enamelled wire tapped at 50 and 100 turns and wound in the space between the long-wave coil (at the end, pile wound) and the side by side medium-wave coil and nearer to the long wave than to the medium wave. This primary resonates at 500-800 metres. On each coil the three contact springs were removed and three wires were substituted and taken out of end slots of can to wave-change switch mounted above. Other leads were taken through other end of coil can, except lead to tuning condenser through side of coil screen, also lead to top cap (grid) of valves.

As will be seen in the circuit diagram, the long-wave winding is connected between the split halves of the medium-wave winding on each coil, and wave changing is effected by shorting together the ends and centre tap of the long-wave coil, i.e., three contacts connected together but not to earth. The three switch sections should be on separate discs, well separated so that each disc is over a coil. As regards the anode coils it will be seen that the lead from the anode goes to the centre tap of long-wave winding and therefore the anode is "tapped down" the coil to the same extent on both ranges, giving in effect a 2 : 1 auto-transformer. It is usual to find that although selectivity with this type of circuit is not as high as with H.F. transformer coupling, gain is usually higher; so high, indeed, with R.F. gain control at maximum that self-oscillation may occur at lower end of medium-wave band. Any tendency to parasitic oscillation is greatly reduced by the 100-ohm grid stoppers in each R.F. stage and the two 1,000-ohm anode stoppers in first two stages. The regeneration occurring at full gain is used to increase selectivity when necessary. It does not increase the gain, as A.V.C. immediately reduces this again to approximately the same level as before. If maximum gain and selectivity are required together for a weak station, then A.V.C. can be switched off and manual control relied on.

For those who find it impossible to obtain coils of the type suggested, alternatives should be easily found, although it will probably be necessary to use R.F. transformer coupling. Alternatively, it is suggested that one aerial and two R.F. transformers of the stripped type now easily available (in sets of two) be secured, and if the gain as R.F. transformer is too low (and selectivity correspondingly high) that the primary winding be ignored and the anode lead taken direct to "grid" end of coil giving "tuned anode" coupling as against tapped tuned anode coupling with the original Cossor coils. The important point with whatever type is used is that sufficient gain should be obtained without "knife edge" selectivity; some of the most efficient types of iron-core coils, for example, should be avoided for this circuit.

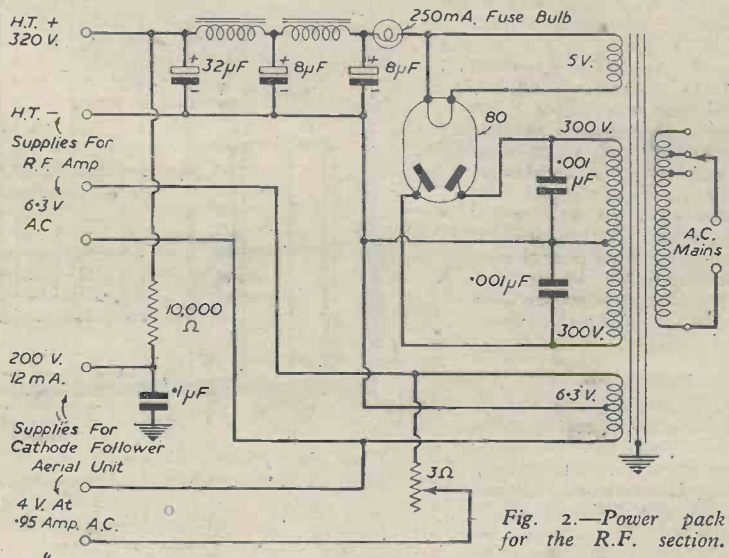


Fig. 2.—Power pack for the R.F. section.

Third R.F. Stage

Further gain is provided by the third untuned R.F. stage. This uses an EF50 (VR91) high-gain V.H.F. pentode with a *low* value of anode load. This stage helps to improve A.V.C. action on first and second stages, compensates to some extent for the normal tendency for tuned stages to be more efficient at the high frequency end of each band; resistance-capacity coupling being naturally *more* efficient at lower frequencies as the impedance of shunting capacities increases. This helps quite a lot with the Third Programme on 583 kc/s.

Any attempt to obtain increased gain by using a higher anode load than 5,000 ohms will not increase stage gain over the whole of M.W. band but may merely cause increased tendency to self-oscillation at point of band where maximum gain is secured.

Theoretical gain with 5,000 ohms load should be $5 \times 6.5 = 32.5$ times (gm of EF50 is 6.3 mA per volt, neglecting stray capacities). The effect of even small stray capacities is seen when it is found that the impedance of even 10$\mu\mu$F is 30,000 ohms at 550 kc/s, 15,900 ohms at 1,000 kc/s and only 10,600 ohms at 1.5 Mc/s. Including average stray capacities, an average of 10-15 times stage gain should be obtained from this stage.

Screen voltage in first, second and third stages is obtained via dropping resistances and not from potential divider, as this has been found to give better stability and smoother A.V.C. action. The third stage is straight, i.e., not vari mu, and its cathode resistance is fixed at 200 ohms. The first and second stages have fixed cathode resistances of 250 ohms, and a variable 3,000 ohms controlling both first and second stages and used as manual gain and selectivity control. First and second cathodes are separately decoupled with 0.5μF condensers. To reduce chance of modulation hum the coupling condensers are kept low (50$\mu\mu$F) and leak of third stage is 250,000 ohms.

Power Pack

To keep stability at a high level and keep hum as low as possible, a small power pack is used to supply R.F. and demodulator section and cathode follower aerial unit only. This consists of an old Philco mains transformer giving about 325-0-325 volts and uses a type 80 rectifier. Smoothing is heavy, three chokes in series, two 25H and one 32H, being used with two 8μF and one 32μF electrolytic condensers, an additional 8μF electrolytic by-pass being used in tuner unit, the voltage available at set end being 250 volts at 70mA. A 250mA fuse bulb is used direct from rectifier valve to first electrolytic and saves possible need to replace rectifier and maybe mains transformer in event of a short or electrolytic condenser failure.

Demodulation and A.V.C.

As large a signal as possible having now been obtained it is applied to the *grid* of the double-diode-triode valve, which has its load in the cathode circuit. This load consists of a good M. and L.W. choke (an old Lewcos is used, although an R.I. Varley has been used and works O.K.). The valve used is a MHLD6, available as a VR101. This valve needs a total cathode resistance of 680 ohms to give it correct bias, so that if D.C. resistance of R.F.C. is not sufficient it must be made up to this value by means of a resistance by-passed by a .1μF condenser.

If no VR101 is available a Mullard EBC33 can be used but needs total cathode resistance of 1,150 ohms. It has however a lower mutual conductance than the VR101. It will be seen that the triode section is used solely as a cathode follower "feeder" for the two diodes, which share the same cathode return circuit and are thus fed with the R.F. voltages appearing there. As the working impedance of cathode follower across its output is given by $\frac{1,000}{gm}$ ohms approximately; if mutual conductance is 3mA per volt, then it will be seen that the output impedance is only 330 ohms. As this is so low compared with the normal impedance of a tuned circuit (which might be 100,000 to 500,000 ohms) it will be obvious that much smaller values of diode load can be used than normally employed (actually 20,000 ohms) and thus greatly reduce high-note attenuation due to R.F. by-pass condensers and stray capacities. It will also be found that 10-15 volts peak A.F. output can be easily obtained from the demodulator section—more than sufficient for

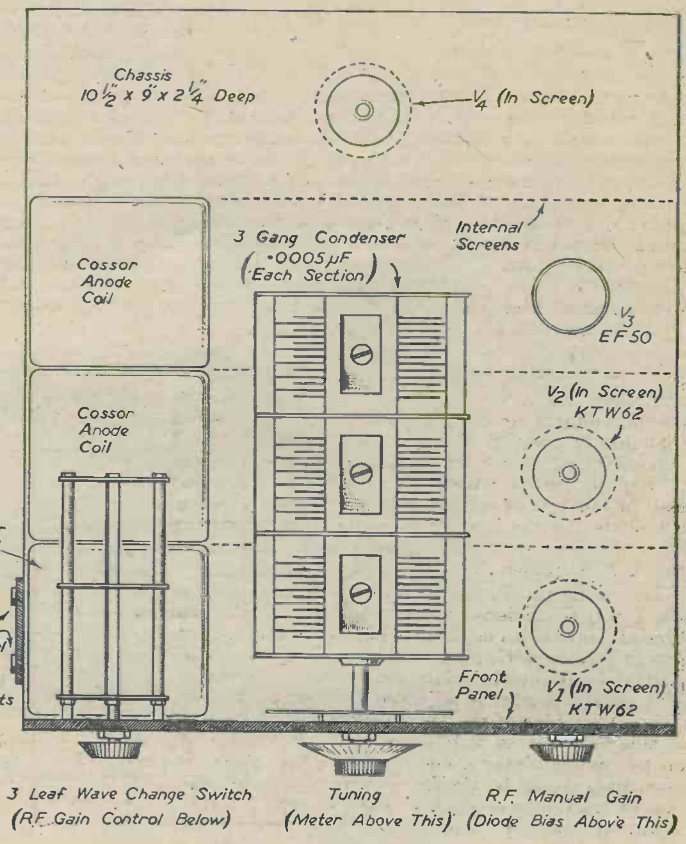


Fig. 3.—Chassis layout.

a normal A.F. amplifier and allowing a large margin for losses in tone control networks. Judged aurally, distortion even with large output appears to be far less than normal diode circuits and about on a par with that obtained from the infinite impedance demodulator without the latter's disadvantage of not giving A.V.C.

The A.V.C. diode (left section in diagram) uses a by-pass of .02 μF, and D.C. voltage is taken to A.V.C. line via 1 megohm resistance and 0.25μF condenser, giving a time constant of .25 sec. This does *not* give response to quick fading (which is rarely heard on M.W.), but also does not cause much attenuation of the very low notes modulating the carrier. A change-over switch is used to connect A.V.C. line to (1) A.V.C., (2) earth (for manual control). This is useful for highest possible quality on strong steady signals and also for "lining up" the tuned circuits.

Demodulation Diode

This is also fed from the cathode circuit and has the same load as A.V.C. diode, i.e., 20,000 ohms. Its R.F. by-pass is reduced to 500$\mu\mu$F only. Although this may seem large compared to the normal value of 100-250$\mu\mu$F it must be remembered that due to the use of a low diode load of 20,000 ohms, 500$\mu\mu$F will have the same by-passing effect to high notes as would 20$\mu\mu$F with the normal load of 500,000 ohms. It is thus possible, by using low diode loading, greatly to increase R.F. filtering efficiency, thereby reducing risk of R.F. leaking into the A.F. amplifier.

The diode return to earth for R.F. and A.F. is via a 0.1μF condenser and to D.C. via a special type of meter to an adjustable point on a 3,000 ohms potentiometer with about 15 volts D.C. across (as part of a potential divider from H.T.+ to earth). This potentiometer is adjusted to the point where the cathode bias of the triode section of the D.D.T. is balanced out so that there is no delay voltage on the demodulator diode. (The A.V.C. diode is, of course, biased to the full extent of the cathode bias of the triode section, giving 2-8 volts "delay" according to the type of D.D.T. used.) The tapping point of the potentiometer is decoupled to earth by a 50μF, 50 volt electrolytic condenser, which also prevents any trace of hum voltage leaking through. The special meter used is a Marconi "left right" D.F. indicator from the R1155 equipment, and are available (in several different makes all equally as good) as ex-government stock at 7s. 6d. to 10s. each. They are beautifully made and consist of two 100μA meters, one zero on left and the other zero on the right and mounted with needles crossed. The movements were used individually in the R1155, but for our purpose are connected as shown in diagram, when D.C. current of the demodulator diode—which is zero biased, and therefore affected by signals of every strength—flows through both sections of the meter and causes both needles to "dip" together, giving a very effective tuning meter. For our purpose it is necessary to remove the case, but the outer metal one may be found a very tight fit. It can usually be gently pushed off, when three small screws will be found holding on the glass front. Remove these carefully and take off front. Now disconnect the internal shunt and series resistances found inside, but leave the movements connected to the same terminals on the back. Paint out the L. and R. yellow letters on the black dial with a little black enamel or, better still, photographer's "dead black." Then replace front and see if both needles "zero" satisfactorily from the adjusters on the front. When O.K. replace screws. I have not found it necessary to replace the outer metal case (intended,

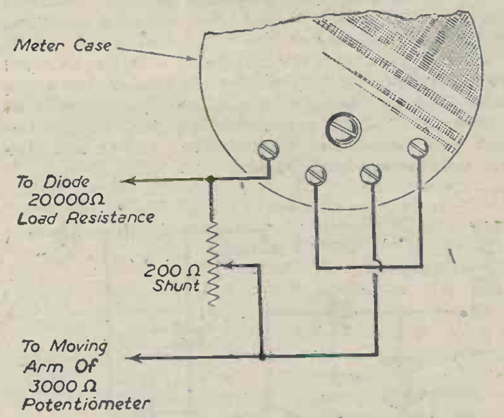


Fig. 4.—Connections to the tuning meter.

I believe, as a magnetic screen). The meter is mounted upside down compared with its usual position. Increase of current from nil causes both needles to swing down, giving a dip when the set is tuned over a station. It will be noted that the use of this tuning meter, while very effective, does not in any way affect the process of demodulation, and there is no alteration in the A.C./D.C. load ratio, causing heavy distortion on deep modulation such as occurs when a "magic eye" is connected to the demodulation diode. The meter is still affected by weak signals, which does not occur with the "magic eye" when (in an effort to avoid the distortion mentioned above) it is connected to the delayed A.V.C. diode.

It will be seen that a variable shunt of 100-200 ohms is connected across the meter and is used to adjust the meter readings to a good value.

The A.F. output from the demodulator diode is taken to A.F. amplifier via a 50,000 ohm resistance and another 500μF condenser, forming an R.F. filter, and then through a 0.5 μF condenser through screened flexible low-capacity coaxial microphone cable via a coaxial plug and socket.

(To be continued.)

A V.H.F. Adapter

A One-valve Mains Unit for Use on Ranges Below 10 Metres

THIS adapter is a single-valve unit and mains-operated. As heater and anode currents are quite small, supplies may be taken from the receiver with which the adapter is used, provided the mains transformer has a 6.3 volt winding. If a 6.3 volt supply is not available a separate small transformer could be used for the heater, the high-tension supply being derived from the receiver in each case. With a wholly independent supply the unit may be used as a one-valver and it will give fair volume on headphones.

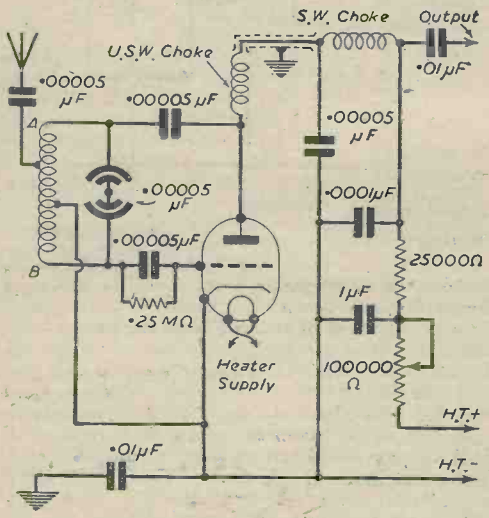


Fig. 1.—Circuit of the Adapter.

The range from about 5 to 7 metres is very suitable for the reception of the television sound broadcasts and is recommended for the initial trial. Due to the layout and circuit used, the unit will operate efficiently on wavelengths below 5 metres, as will be described.

A *short* single-wire aerial is used, and with this the sound transmission has been received at good volume at a hundred miles range. Reception naturally depends upon local conditions as local screening effects may in some cases reduce the effective range of the transmitter considerably. However, the cheapness of the unit makes it worth while where a complete V.H.F. receiver may not be justified. A dipole can be connected to a coupling turn near the tuning coil.

With suitable coils 10 metre amateurs in many parts of the world can be received at good volume, but 5 metre signals are, of course, only reliable over much shorter distances.

The Circuit

From Fig. 1 it will be seen a single tapped coil tuned by a .00005 μF. butterfly condenser is used, with a fixed .00005 μF. condenser for reaction purposes. This gives a very good layout for V.H.F. when used with a triode of the VR135 or CV6 type (where anode and grid connections are brought out to two top caps).

If operation on wavelengths is not required below 4 or 5 metres, an ordinary triode may be used, the base being mounted towards the tuning condenser.

As it is necessary to keep H.F. currents from reaching the output, two chokes are used with by-pass condensers. Oscillation is controlled by adjusting the anode voltage by means of the variable resistance which provides the second panel control.

The earth connection (if used) is isolated by a fixed condenser. This is particularly necessary if the unit is used with an A.C./D.C. receiver. If 'phones are used they should be connected between the terminal marked "Output" and the terminal marked "Earth." High-resistance 'phones (1,000 to 4,000 ohms) should be used.

Constructional Details

The coil, etc., is contained in a metal box 5½in. by 4in. by 2in. This is bolted to an ebonite base 7in. by 8in., to which tags or terminals for H.T. and other connections can be fixed. Fig. 2 will make the layout of the parts clear.

The tuning condenser is mounted so that the rotor spindle is not in contact with the chassis and an insulated coupler is used between the spindle and the reduction drive. If very high frequencies are to be reached, the fixing bolts of each set of fixed plates should not be close to the chassis. Washers may be used to hold the condenser back, or pieces may be cut from the metal upon which the condenser is bolted.

Pieces of flex about ½in. long are soldered between the two .00005 μF. fixed condensers and valve cap connectors so that the valve can be removed. In Fig. 2 the two leads marked "A" each go to the lower fixed plates of the tuning condenser. The coil connections, shown in Fig. 4 on the next page, illustrate this.

All wiring must be secure and long connections should be avoided. In several places tags are used to anchor junctions in the wiring. Take care to connect the anode and grid caps correctly; as the glass bulb is clear the electrode connections can be seen at the top and the pins at the base will come in the position shown in Fig. 3.

For 5-7 metres a choke consisting of 30 turns of 32 S.W.G. wire, in six sections, wound on a glass tube about ⅜in. in diameter, may be used.

Tuning Coil

After winding the coil as shown in Fig. 4, it is soldered directly across the tuning condenser tags. The chassis tapping is taken from the centre of the winding. The aerial tapping should be from ½ to 1 turn towards the anode side of the centre tapping.

By moving the aerial tapping towards the centre of the coil, less damping will be imposed on the circuit, but volume will be reduced. The best position depends upon the aerial used and the particular results desired. For local television sound reception the position shown will usually be satisfactory.

The 16 S.W.G. wire should be wound round some suitable object and the ends bent out straight. The former may then be removed and the coil

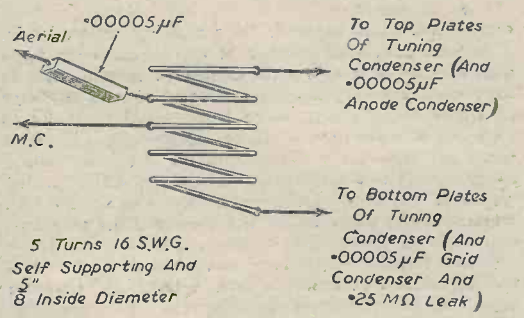


Fig. 4.—Details of the coil and method of connection.

pulled out until there is about 1/10th in. between turns. The tappings are soldered on.

The coil should not be close to the metal screening box. It should also be noted that the L-shaped metal cover, which should eventually be placed over the box and bolted in position, does not come too near the U.S.W. choke or valve. If it does, oscillation will cease when the cover is fitted in position.

this can be done. The H.T. positive lead may be taken to any supply point in the receiver which offers a suitable voltage (about 100 volts). If no suitable point can be found then a resistor may be included in series with this lead and the connection taken to the maximum H.T. line of the receiver.

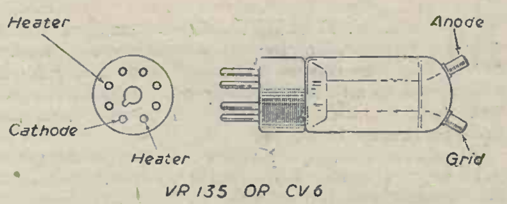


Fig. 3.—Base and cap details of the VR135 or CV6 valve.

A H.T. battery and accumulator can be used for battery operation. It will be found that oscillation can be maintained with only 50 to 60 volts H.T. 'Phones may be used as mentioned.

If the unit is used with an A.C./D.C. receiver it should not be overlooked that the screening box is connected to the H.T. negative line—and consequently to one mains lead.

Coil Details

For 10 metre operation approximately 9 turns will be required on the coil, which should be tapped as with the smaller coil.

(*Continued at foot of next page.*)

Notes on Reception

Though the circuit is not particularly tricky, some care is necessary if best results are to be obtained, as with all V.H.F. apparatus.

Connect up the heater supply and H.T. negative lead. A lead from the output terminal is taken to the grid of the first L.F. stage in the receiver. In some cases, if pick-up sockets are fitted, one of these may be used. If L.F. instability arises (though this is unlikely) the lead may be taken to the grid circuit of the next L.F. stage.

H.T. positive should be connected to some convenient point in the receiver. If the adapter oscillates too violently, as shown by a loud hissing, the H.T. voltage should be reduced or the aerial tapping moved a little away from the centre tap of the coil.

It should be possible to bring the valve into oscillation by turning the control on the adapter, but conditions must be adjusted more or less correctly before

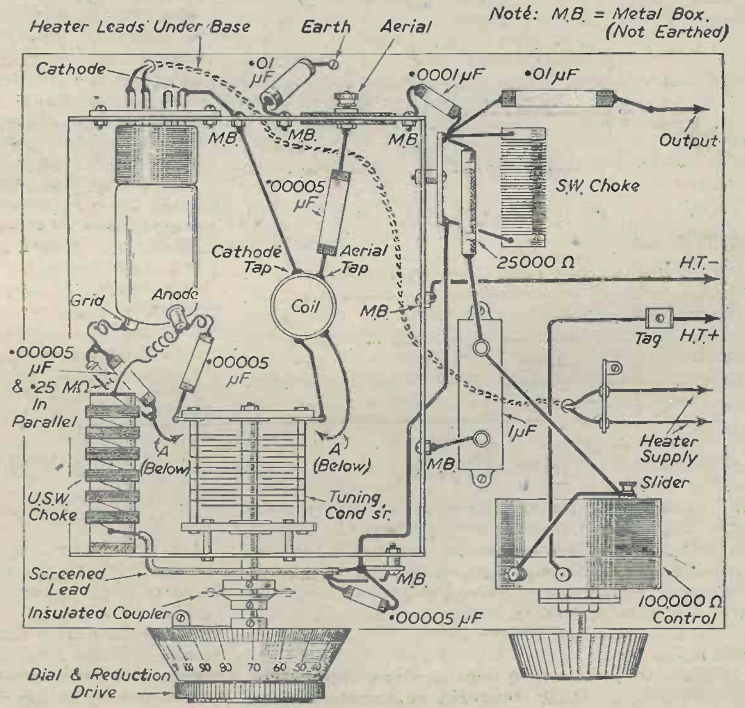


Fig. 2.—Wiring plan of the Adapter. Note the metal screening box which houses the coil, valve, condenser, etc.

A New I.F. Transformer

Preliminary Details of an Indian Invention

MR. S. K. DANDEKAR, of Standard Radio Service, Poona, has, according to a report in the *Radio Times of India*, developed a new type of I.F. transformer and no doubt readers will welcome a brief description of this, and the lines on which it works.

The main feature of these I.F. transformers is to increase the gain considerably, so much so as to eliminate the need of an I.F. amplifying valve, and—this is more important and perhaps difficult to understand—to accomplish detection (usually done by the diode section of a double diode triode valve) without rectification.

It may also be taken for granted that the difference between detection (reference here is to detection effected by the diode section of the double diode triode valve) and rectification is fully understood by readers, though quite often one does come across these two words being used rather loosely, and so inseparable as almost to convey the idea that rectification is indispensable for detection, which, however, is not the case.

These transformers are hereafter mentioned as two-stage first I.F. transformer and two-stage detector I.F. transformer. The gain of the two units and the detecting action of the second unit together completely eliminate the need for an I.F. amplifier valve and also the second detector. When a 50 L6-GT output valve is used, properly matched to an efficient speaker (a normally good—at present available—efficient moving coil type permanent magnet speaker is good enough) the gain of these I.F. transformers also eliminates the need for a low-frequency amplifier stage which is usually provided by the triode portion of the double diode triode valve.

Main Details

Details are given hereunder for the more technically inclined of the readers. Both the I.F. transformers are housed as usual in one metal shield, each cylindrical in shape, the minimum dimensions being 2¼in. diameter and 5in. height. Both the I.F. transformers have three windings, one of which is tapped, thus making seven leads. The first I.F. transformer is an all air core type and one section of the second I.F. transformer is iron core type—pulverised iron—but the number of turns being many more than usual to make it almost a low-frequency choke. Detection is thereby obtained without rectification, so naturally doing away with the conventional diode, crystal or oxide rectifier. Although these are referred to as two I.F. transformers, electrically they constitute one I.F. coil system, since there is no I.F. anplifying valve between the two—the two being coupled by a network of mica condensers and two H.F. chokes; it will be more proper, though, to refer to these as intermediate frequency chokes. The performance of the set incorporating these I.F. transformers is equal to any good make on the market embodying 12A8-GT, 12SK7, 12SQ7, 50L6-GT and 35Z5-GT or similar other types of valves.

3-valve Superhets

It will at once be noticed that this opens a possibility of making three valves all-wave superhets using 12A8-GT, 50L6-GT and 35Z5-GT; or 6A8-GT, 6V6-GT and 5Y3-GT; or similar other selection of valves. Apart from certain radical departures in the I.F. transformer construction and connections, the circuit requires no additional components. The rest of the circuit is about as conventional as that of any five-valve set. The reduction in the number of valves (I.F. amplifier valve and double diode triode valve), components associated with them, circuit simplicity and saving in components cost and assembling cost will be quite considerable.

The author has already wired up an actual model of this three-valve set embodying these I.F. transformers, and the performance has been checked side by side with a standard five-valve set and is not found wanting.

The author shortly hopes to be in a position to publish without prejudice to interests involved, the complete diagram with mechanical details, connections and values of circuit constants.

(*Courtesy Radio Times of India.*)

Safer Flying

AN inexpensive radio communication system for light aircraft was recently seen at the British Industries Fair, Olympia, and demonstrated by the manufacturers, E. K. Cole, Ltd., at Southend Municipal Aerodrome, to the Press representatives of the Ministry of Civil Aviation, key men from flying-clubs, and charter companies and aerodrome operators. For under £100 an owner-pilot can equip his aircraft with a light-weight twin-channel receiver-transmitter with which, at distances up to sixty miles, he can obtain an accurate bearing to his base in cloud, or for night flying.

A V.H.F ADAPTER

(*Cont. from page 291*)

For lower wavelengths less turns can be used, or the diameter of the coil may be reduced. Three turns of slightly larger diameter may be used for reception below 5 metres. The circuit will oscillate with one single turn, tapped half way round, but the limitations of reception upon such frequencies must be kept in mind as there may be no stations operating close enough to be received.

An examination of Fig. 2 will show what components are required.

Frequency Modulated Oscillator

A Unit for Use in Conjunction with the Home-made Oscillograph Described in Our December, 1947 Issue.

By E. D. WARD

WHEN the oscillograph, described in the December, 1947, issue, was designed, it was with the prime object of using it in conjunction with a frequency modulated oscillator for lining up superhets.

This oscillator has been working for some time, and it is very instructive to be able to " see " the I.F. response curves of various receivers.

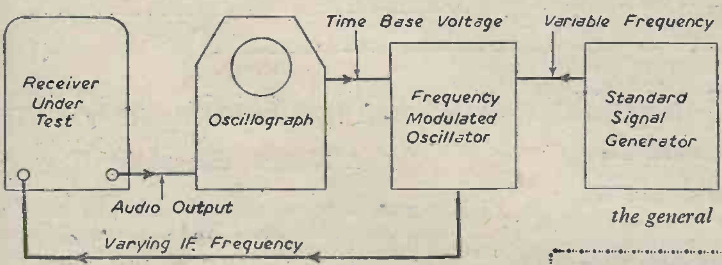


Fig. 1.—Block diagram showing the general layout of the complete assembly.

The Circuit

The oscillator valve V2 is tuned partly by a variable pre-set condenser C6 and partly by the inter-electrode capacity of V1, which utilises the Miller effect. (The input capacity varying with the gain of the valve.) The gain depends on the voltage applied to the grid, and by varying this the total tuning capacity is varied, so we apply the varying voltage from the sweep of the time base to the grid of the Miller valve via a 1 megohm variable resistance. Therefore, V1 sweeps the oscillator valve V2 through a range of frequencies.

The output of the oscillator is fed to the triode portion of a mixer valve (the original model used a 6P8G, but almost any 6 volt triode hexode will do). The hexode portion of the valve is fed from the attenuator network of a standard signal generator (carrier-wave only).

Now suppose you want to line up a receiver with 465 kc/s I.F's; the standard signal generator is set to the fundamental frequency of the oscillator valve (V2), plus 465 kc/s, and at the anode of the mixer valve will be found 465 kc/s varying over a band width of the fundamental frequency of the oscillator valve V2.

Constructional Details

Commence by making the coils L1, L2, L3 and L4 and wire up V1 and V2. When V2 is oscillating V1 must also be in circuit with a bias on the grid equal to half that of the maximum sweep voltage obtained from the oscillograph. Set the frequency of V2 at 4 Mc/s so that when the sweep voltage is applied to the Miller valve V2 will be swept equally either side of 4 Mc/s.

NOTES ON COILS USED IN F.M. OSCILLATOR

All coils are wound on one ¾in. former, starting at the top with :
L2—26 turns of 22 S.W.G. D.C.C. ;
allow a small space and wind :
L1—16 turns of 22 S.W.G. D.C.C. ;
allow a further small space and wind :
L3 and 4—26 turns of 22 S.W.G. D.C.C.

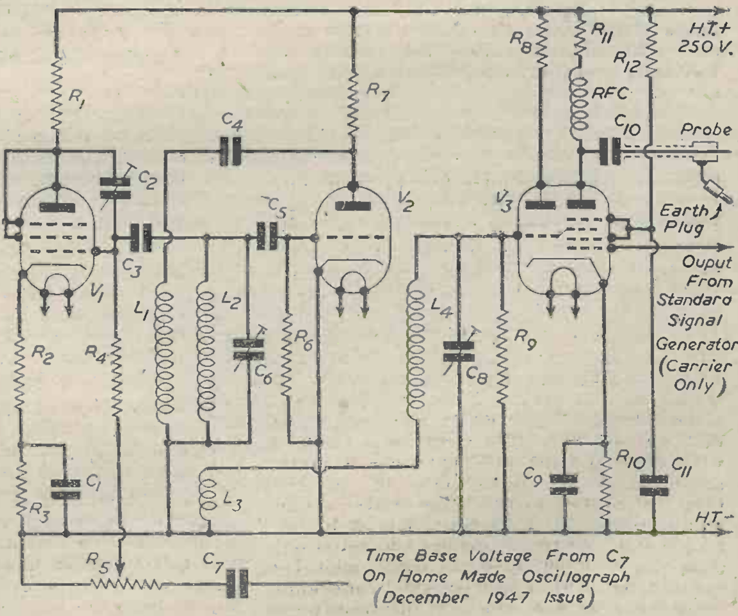


Fig. 2.—Theoretical circuit of the oscillator.

Valve Mounting

The valves may be mounted on an open chassis 9in. by 5in. by 2½in., and this may then be mounted on the side of the signal generator, taking heater and H.T. voltages from a modification therein. The output from the receiver under test is taken from any convenient spot (usually the top end of the volume control) and fed to the amplifier on the oscillograph, and it will be necessary to cut out the internal speaker of the set, first loading the output transformer with a 50 ohm resistance to prevent damage to the output valve.

The internal speaker should be cut out because of the noise this combination makes.

Lining up procedure is exactly the same as for audibility or output meter, only the I.F. response curve can be seen on the screen of the C.R.O.

LIST OF COMPONENTS.

R1 2,500 ohms.	R7 .1 megohm.
R2 150 ohms.	R8 30 K ohms.
R3 450 ohms.	R9 25 K ohms.
R4 ½ megohm.	R10 300 ohms.
R5 1 megohm. var.	R11 25 K ohms.
R6 1 megohm.	R12 40 K ohms.
C1 25 μF	C7 .25 μF.
C2 50 pF.	C8 150 pF.
C3 .0005 μF.	C9 .1 μF.
C4 .0005 μF.	C10 .0025 μF.
C5 25 pF.	C11 .1 μF.
C6 150 pF.	
V1 6K7G.	
V2 6C5G.	
V3 6P8G.	
L1, 2, 3, 4. See Notes on p. 293.	

Suppressors for Car Ignition

Some Hints as to their Efficient Use

THE news that the G.P.O. is fitting suppressors to the ignition systems of its 25,000 vehicles in the London area, in order to prevent interference with television sets, is of considerable interest to motorists, many of whom have fitted them already to prevent interference to their own car radio sets. It is one thing, however, to go to the trouble and expense of fitting suppressors to obtain improved reception on one's own car—it is quite another to do so purely for the benefit of a relatively small number of television viewers.

It may be, indeed, that some motorists will not follow the G.P.O.'s example, and will argue that cars came first and that the manufacturers of television sets must design their sets so that they are not affected by cars! There are about a million cars, goods vehicles and motor cycles in London and the adjacent counties—quite apart from visiting vehicles—and to equip all these with suppressors for the benefit of the few would appear a big task. Television will, of course, spread to the rest of the country eventually.

Those motorists, however, who wish to eliminate the crackle set up in their own car radio sets by their own ignition systems may well be advised to fit suppressors, and for these the following hints, offered by the Lodge plugs company, will be useful. The suppressors should be fitted as near as possible to the actual points where sparking occurs—i.e., at the distributor end of the lead from the coil to distributor, and at the sparking plug end of the plug leads. The suppressors should have a value of from 5,000 to 15,000 ohms, but when they are fitted in both distributor and plug leads the total value of the distributor suppressor and any one plug suppressor should be kept below about 20,000 ohms. If they are of much higher resistance than this, the actual power of the spark may be reduced, with resultant oiling of the plugs, but suppressors of the correct type should have no adverse effect on easy starting or general engine performance.

Two Million Miniature Valves

A Mullard Achievement

THE production of the two-millionth valve at the Mullard factory at Gillingham, Kent, recently, was the subject of a small ceremony which took place when Mr. Kempson-Jones, head of the valve-making department, visited the factory.

He brought with him the actual "two-millionth" valve, which, he said, "has been mounted and brought to Gillingham where it will remain in recognition of the efforts made by everyone, and as a reminder to all in future of the large output obtained from this small but efficient factory."

American Standards

When presenting the valve to Mr. S. Bagust, manager of the factory, Mr. Kempson-Jones said:

"One of the aims when the Gillingham factory started was to reach production speeds from assembly groups comparable to those obtained in the United States on similar types, and I am now pleased to tell you that this has almost been achieved. . . .

"You may think, 'Why must we attempt to obtain U.S.A. speeds?' The reason is that we must export these valves overseas and we have to compete with valves of American manufacture, and therefore we must make our valves as cheap as the Americans. . . .

"As far as Gillingham is concerned, this means, firstly, we must meet the programme so that we can make economical use of the factory and also the equipment and labour at Mitcham. Secondly, it is necessary to maintain the present high level of production per group. Thirdly, to maintain and improve the quality of the assemblies.

"I hope that all of you will be here when the five-millionth assembly is completed."

The Gillingham factory is one of two (the other is at Hove, Sussex) given over to the manufacture of miniature and sub-miniature Mullard valve assemblies.

Underneath the Dipole

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

SHOULD television have a signature tune, with appropriate accompanying picture? The short introductory film has been chopped and changed about as a result of the opinions expressed in "Viewers' Viewpoint" and "Viewers' Vote," and, at the time of writing, seems as if it is going to disappear altogether. I hope it isn't. I agree that the original signature tune film was inclined to be flickery and variable in quality of both picture and sound. Nevertheless, I preferred to carry out final little adjustments of volume and contrast on this, rather than upon the somewhat harsh lettering of the tuning frame which precedes the transmissions. The fault of the B.B.C.'s television signature film lies not in the shots of the aerials, nor in the aerial shots, but in the quality of film transmissions, which still lags behind live television. When tele-cine has been improved a little more, the signature film should be restored, though not necessarily in its original form.

Stage Play Relays

The relaying of plays from theatres, such as has been done from the Intimate Theatre, Palmer's Green, suffers from obvious disadvantages. Apart from the difficulties presented to the technique of both producers and engineers, the laughs, coughs and rustles from the audience tend to distract television viewers. However, regular viewers make allowances for these distractions and derive considerable enjoyment from such relays. One of the most successful transmissions from Palmer's Green was "The Shop at Sly Corner," which kept my family and some friends, at any rate, enthralled for an hour or so, though I can understand new or "stray" viewers getting the wrong idea about television if it happened to be their first viewing. However, I hope that we shall continue to have the privilege of joining the audience of the very small Intimate Theatre, which grows in size from a few hundred on ordinary nights up to a comfortable 100,000 on television nights!

Unesco

I don't think many viewers kept their receivers on for "Unesco," the item which followed "The Shop at Sly Corner." My own home audience melted away before the conclusion of the somewhat pompous introductory speech and I have yet to discover a viewer who survived the latest excursion into documentary television. From the same stable as "Searchlight," it carried with it the same political implications. As an "entertainment" it proved that cinema exhibitors are right in their contention that audiences will not tolerate this kind of stuff unless forced to view it at the point of the machine gun! Fortunately, viewers were able to switch their sets off and escape from "Unesco," which developed into a session of long drawn-out documentary films of the very type the cinemas reject. This is the kind of material which "un-sells" television to prospective viewers.

It is a strange and important thing, the first impact of a television programme upon the would-be purchaser of a television set. The atmosphere of the radio store or a great exhibition is certainly not favourable for an initial viewing, but a radio dealer told me that a trial of a set in the actual home of a prospective customer almost invariably led to a sale. Much depended upon the type of programme viewed during the period the set was "on approval," and he told me that if there was a high proportion of film being televised, or the "A.P." boys were trying out any arty-crafty experiments, then a sale did *not* result. Comedy programmes hold the greatest appeal for new viewers and the Saturday night revues have roped in more television licence holders than anything else. Everyone—the new viewer and the old one, too, is starving for laughs, and the television producers would do well to increase our comedy ration. Who will be the Tommy Handley of television? There are now many comedians (and comediennes), who are thoroughly at home on television, and we simply can't see too much of them. Leslie Henson, Jimmy Edwards, Richard Hearne, Sonnie and Binnie Hale, Hermione Gingold and Claude Hulbert are just a few of the names that occur to me.

Long Distance Viewing

The sign of the dipole is no longer an exceptional sight at distances over fifty miles from the Alexandra Palace. I am surprised at the large number of television aerials which are to be seen above the houses in towns on the south coast, even in situations where hilly ground lies in the direct line between the receivers and the Alexandra Palace. At first, one noted such aerials with great interest; they were conspicuous on account of their elaboration and the height of their masts. In the course of time, these pioneer outposts of television seemed to have gathered around them a brood of new viewers, not quite so ambitious with their aerial arrays, but who seem, none the less, to be obtaining highly satisfactory results with the latest sets. One comes across a perfect little colony of dipoles within a small area, and then may travel many miles before discovering another similar crop. Obviously, the strenuous efforts of the man with the highest aerial has proved the possibilities of television at great distances, but it is strange that subsequent aerials in the same neighbourhoods should be so very much lower and frequently in positions which are obviously exposed to motor car ignition and other forms of interference. Some of the latest sets have their own special circuit arrangements for reducing the effect of such interference, but it must still be there, all the same. You really cannot take too much trouble with your aerial unless you're practically on the doorstep of the "A. P."

Television Tax

Once more the Chancellor of the Exchequer has piled penalties upon the radio trade in general and the prospective television viewer in particular. The vicious increases in purchase tax now makes the cost of television receivers in Britain considerably higher than they are in the United States, where the television craze is just "catching on." Will Britain maintain her lead in television? I think not. The purchase tax will play its part in retarding development and progress here, while in America the competitive efforts of hundreds of television stations and programme sponsors will accelerate the pace. Enterprise and initiative in Britain are discouraged by the practical restrictions imposed in each succeeding budget, and the rhetorical exhortations of the politicians are now exposed in all their hollowness. Perhaps some day we shall cease to be guinea pigs for past students of the London School of Economics and other seats of learning, and gain once more the respect of the world for our commercial and scientific predominance. But, for the time being, things gradually come to a standstill in the radio trade and every other so-called "luxury" industry, with axes, taxes, controls, snoopers, quotas, licences, levies and red tape. It is impossible to comment upon the present trend of the trade without getting hot under the collar! The radio trade in England, in the beginning, was built up by amateurs. Now it is being ruined by another kind of amateur!

Trade Notes

CLIX PRODUCTS

THE sales of Clix radio and television components manufactured and hitherto marketed by British Mechanical Productions, Ltd., are now handled by the General Accessories Co., Ltd., of 21, Bruton Street, London, W.1. The General Accessories Co., Ltd., are the wholly owned subsidiary of British Mechanical Productions, Ltd., and are their selling organisation through whom all Clix products, in future, will be marketed.

BRIMAR VALVE MANUAL

THE new Brimar Valve Manual is now available in sufficient quantities to meet all demands. The manual includes details of nearly two hundred types of valves listed in numerical order throughout, and covering 139 pages.

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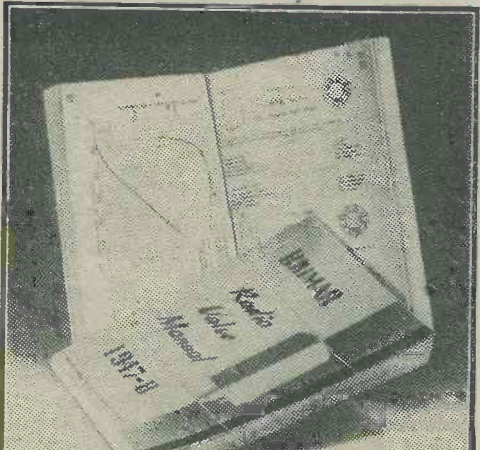

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Programme Pointers

This Month, Our Correspondent, MAURICE REEVE, Discusses the Question of a National Concert Hall

ONE of the saddest, most evocative and most bewildering sights to be seen in war-scarred London to-day is that of poor, blitzed, burnt out Queen's Hall. I passed by it the other day, and I couldn't help but wander up and down Riding House Street into Great Portland Street and back into Regent Street, meditating, reminiscing, and casting my mind and heart back over years of unforgettable memories. Door No. 8 in Riding House Street, Orchestra entrance in Gt. Portland Street; how many times had thousands of us stood outside there to hear the greatness of "London music's golden era"— Padrewski, Bosini, Rosenthal, Chaliapin, Kreisler, Nikisch. Did it not give us riches such as no other London concert hall could match? (Wigmore, originally Bechstein, perfect and also redolent, but too small for the epicurean feasts of Langham Place.) Could the vast spaces and echoes of good Prince Albert's memorial ever hope to vie with it in that intangible quality of atmosphere and mystique which were so part and parcel of Queen's? Wasn't it, also, the birthplace and cradle, nursery, school and realisation of the "Proms," when Proms were Proms, banquets but not orgies, where enough was as good as a feast, and where student and pedagogue rubbed shoulders with, I venture to say, greater camaraderie than they do to-day? In brief, wasn't Queen's Hall perfect of its kind? Acoustics, size, situation. And there it is to-day, six years after its rape, still an empty, burnt-out shell, whilst London music screams out for its replacement.

I do not pretend to know the whys and the wherefores of this tragic cum comic situation. I believe it is Crown property, and I have heard that ten times the rent is now required for the site. Why, I don't know, when the rental of the Oval, Duchy of Cornwall land, remains much as it ever was. Meanwhile, a few bricks are bought and a few programmes are sold annually for the "Henry Wood Memorial Hall Fund," a scheme which, on present lines, cannot hope to bear fruit except in the lives of the youngest of us, and whose projected site in Marylebone Road is likely to be as detrimental to its welfare as the original site in South Kensington would unquestionably have been to the National Theatre.

The lamentable sight of this beautiful ruin which has, for six years, been so melancholy to music lovers, together with the Chancellor of the Exchequer's recent statement on behalf of the Government regarding a National Theatre, raises the question of the practibility, possibility and desirability of a National Concert Hall. The problem is a big one, and, in many ways, bigger than that of the theatre.

Mixed Reception

The announcement concerning the National Theatre was received by the London Press with quite a remarkable degree of disapproving unanimity, at least as far as the financing of it was concerned. The concensus of opinion was very much against the Exchequer—in other words, the taxpayer anywhere and everywhere between John o' Groats and Land's End—standing the racket for something the patrons of which would overwhelmingly consist of Londoners. With no little justice was it also pointed out that, in common fairness, similar theatres should be provided, as well, in the larger provincial centres, Scotland and Wales. And again, by way of a third cold douche on the proposals, it was argued that national funds should not be used for something that only interests a very very small percentage of the taxpayers.

Now, I seem to remember no less a person than Mr. Ernest Newman emphasising the latter point when he opposed similar proposals some years ago regarding opera. If there is any weight in the arguments concerning a National Theatre, they would probably carry still heavier guns if directed against the concert hall project, as probably an even smaller percentage of the population would be concerned.

In using the term "concert hall," I obviously infer a centre of music wherein everything from an opera to a piano solo could be adequately presented.

Opera Only?

What is there in the whole realm of music, other than opera, that could be profitably performed in such a metropolis of the art that cannot be heard every week of the year in existing halls as run under private enterprise? Certainly no such "alibi" as Shakespeare exists for bringing the idea to fruition. Whilst knowing little of what would comprise the repertoire at the National Theatre, other than Shakespeare, the mind certainly reels at the very idea of finding the Tchaikowsky or Rachmaninov concertos popping their heads up for performance at the national music centre! Perhaps it could become the home of the Promenade Concerts, an insitution if ever there was one.

Regarding the arguments against making the majority pay for what only the minority is interested in, I am not so sure this is as fool proof as it may seem at first hearing. I suppose we all belong to a minority of one sort or another. Some of us don't believe in battleships or bombers, whilst others wouldn't give a snap of the finger for all the food subsidies in the land. Many think all art a result of a wasted youth just as much as accomplishments at bridge or cricket are. But the nation as a whole might be not unsuitably defined as an amalgam of minorities, each for all and all for each. A nation without its artistic blood coursing through its veins, freely and unfettered, would be a poor one indeed. Thank heaven England has never been such a one.

It is not enough to spend vast sums on a palace of music for the mere performance of what already exists. The schools and academies are an even greater priority, and the homes of the people and their cultural and artistic environment yet more still. We shall be judged by our ability to continue producing great creative and executive artists, and both the National Theatre and the National Concert Hall should it ever materialise, will probably stand or fall on its stimulating effect, or otherwise, on our artistic impulses as a nation rather than on their ability to produce works of drama and music better than neighbouring theatres and concert halls can. Were we to look down on either from above after a hundred years of functioning, only to see them producing what exists to-day, then I would indeed say they had failed in their chief purpose.

A Practical Proposition

Music is so tremendously, so unalterably cosmopolitan. Its writing and its performance are alike inspired by people from all the corners of the earth. Inasmuch as native drama, even the classics on their own, is more than sufficient to keep a national theatre fully occupied the whole year round, native music is as a mouse to a lion by comparison. I'm afraid the concert hall doesn't seem a practical proposition, short of a school of native opera, though it does seem little short of grotesque that a million pounds of public money can be offered to add one more of a thing of which we already have thirty or forty in London alone, whereas it is seemingly impracticable where there are but two of their kind, neither of which are in any way suitable for the main problem. But, regret it as we may, the very nature of music compared to the drama, other than opera, which makes its multiple and simultaneous presentation in excellent quality so easy and successful, does make the question entirely different from that of the national theatre.

The extinction of the aristocratic millionaire class was certainly the worst possible thing for music.

News from the Clubs

READING AND DISTRICT AMATEUR RADIO SOCIETY

President: Dr. Lemon (G2GL).
Hon. Sec.: Mr. L. Watts (G6WO), 817 Oxford Road, Reading, Berks.

THE first annual general meeting of the above society, under the new rules formulated last autumn, was held on April 3rd. The annual election of officers took place, the only changes being for the position of secretary and treasurer, who did not stand for re-election.

After the elections, Dr. Lemon gave his presidential address on the subject of "The Amateur Licence," with emphasis on the observance or otherwise of the conditions of licence.

Meetings are held at Palmer Hall, West Street, Reading, at 6.30 p.m. on the second and last Saturday of each month.

WIRRALL AMATEUR RADIO SOCIETY

Hon. Sec.: B. O'Brien, G2AMV, 26, Coombe Rd., Irby, Heswall, Cheshire.

THIS society continues its usual activities as reported last month. Prospective members will be welcome and may obtain full particulars from our hon. secretary, address above.

PETERBOROUGH AND DISTRICT RADIO AND SCIENTIFIC SOCIETY

Hon. Sec.: Mr. S. Woodward, 72, Priory Road, Peterborough.

THE society has a membership of 40 and since Christmas has run weekly lectures which have been very well attended. The society now have their own Club House.

At the General Meeting held in April the following officers were elected:

President, D. Crisp; vice-president, Mr. Barber; chairman, R. H. Whitley, vice-chairman, Mr. Smith; secretary, S. Woodward; treasurer, Mr. Frisby; assistant secretary, Mr. Moss; assistant treasurer, Mr. Bennett; technical adviser, C. J. Berridge, M.I.E.E.; communications adviser, F. Wood. All future meetings will be held in the Club House, 61, Padholme Rd.

THE RADIO SOCIETY OF HARROW

Hon. Sec.: J. R. Pikett, 93, Whitmore Road, Harrow, Middlesex.

FORTHCOMING Meetings are: June 15th: Transmitter problems by G4GB, G2TA and G2DD; July 13th: Loudspeaker quality reproduction, by a representative of Messrs. Goodmans (Demonstration).

Mr. Pikett is now Hon. Secretary of the society, Mr. N. J. Hanscomb having moved out of London for business reasons.

BURTON ON TRENT AND DISTRICT RADIO SOCIETY

Hon. Sec.: E. B. Hardy (G3-BSL), Hill Cottage, Dunstall, Nr. Burton on Trent.

MEETINGS are held monthly, usually in the evening on the third Wednesday in the month, at the local Education buildings, Guild Street, Burton. These meetings are advertised in the local press.

The Secretary will be pleased to receive offers of lectures from firms interested, for next winter session.

The society is always on the look-out for new members, and a hearty welcome is always there. Further details can be obtained from the Secretary. The subscription is 5s. a year; 2s. 6d. for Junior members.

THE WEST MIDDLESEX AMATEUR RADIO CLUB

Hon. Sec.: C. Alabaster, 34, Lothian Avenue, Hayes, Middlesex.

THE Annual General Meeting of the above club was held on April 14th, 1948, and new officers and committee were appointed. The address of the new Hon. Secretary appears above.

Enthusiasts interested in any aspect of radio and electronics are cordially invited to join—the club caters for all tastes.

Regular meetings continue to be held from 7.30 to 10.30 p.m. on the second and fourth Wednesdays of every month at the Labour Club Rooms, Uxbridge Road, Southall, Middlesex.

THE TELEVISION SOCIETY (MIDLAND CENTRE)

AS television broadcasting will be extended to the Midlands in the near future, it is essential for all interested in this new science to have a common platform for study, discussion and practical construction. The Television Society, which was founded in 1927, have, therefore, formed a Midland Centre with headquarters in Birmingham. The inaugural meeting was held in April at the University in Birmingham, and the next meetings will take place on every first Wednesday in the month at 7 p.m., and after the summer recess during July and August the new session will begin with a meeting on September 15th at 7 p.m., the others following on every first Wednesday of each month.

Engineers, electrical contractors, and radio dealers alike will find it an advantage to become members of the Television Society, the programme of which caters for the scientist, and engineer, and also for the television salesman and service man. It is also intended to arrange a series of introductory lectures on the subject, and all interested are invited to write to the Lecture Secretary, Dr. W. Summer, F.T.S., M.Inst.E., 169, Maryvale Road, Bournville, Birmingham, 30.

LEEK AND DISTRICT RADIO SOCIETY

A RADIO SOCIETY was recently formed at Leek, and will be known as the "Leek and District Radio Society." The secretary is Mr. W. L. Woodcroft, of 35, The Crescent, Leek, Staffs.

It was formed on April 9th at a meeting called by the new Secretary, and was attended by about 12, after a roll-call of absent would-be members, it was announced that 35 will be on the list for the next meeting.

The members of the nearby S.O.T. Radio Society welcomes this new Radio Club, and as soon as it is ready for lectures, etc., it will co-operate in the exchange of lecturers and ideas, also hopes that field days can be organised between the two clubs.

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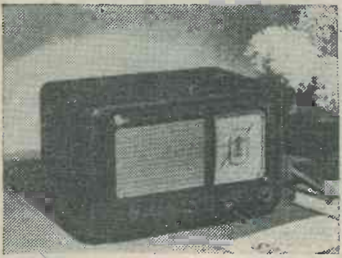

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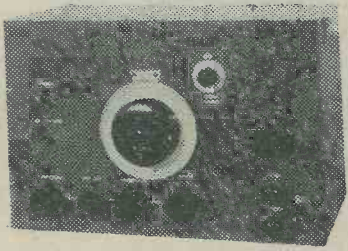

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Review of the Latest Gramophone Records

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Sir Malcolm Sargent conducting, the Liverpool Philharmonic Orchestra give a fine rendering of "Valse Triste" which with "Finlandia" was for many years almost the only example of Sibelius' music known well in Britain. It is, of course, a minor work compared to the massive things that are the composer's real masterpieces, but it is extremely picturesque and its long popularity is fully deserved. On the reverse side is the tune known as "Air on the G String," which comes from the third orchestral suite of the four Bach wrote, whether at Leipzig or at Cothen seems uncertain. Both of these pieces are beautifully handled by Sir Malcolm Sargent on *Columbia DX*1479.

Another record which will receive a ready welcome by music lovers is "The Bartered Bride, Overture," played by the Sadler's Wells Orchestra conducted by Lawrence Collingwood on *Columbia DX*1478. Sadler's Wells has often given us colourful performances of this opera in the course of its admirable productions of famous musical stage works in English, and the Sadler's Wells Orchestra gives a sparkling performance.

Vocal

Like most of the songs of Modeste Moussorgsky, the "Song of the Flea" is strikingly direct and realistic, with a sardonic twist admirably brought out by Oscar Natzka on *Columbia DB*2363. This New Zealand bass has lately distinguished himself at Covent Garden in the part of Sarastro. Natzka has Russian blood in him, and is the first singer from New Zealand to take a principal role at Covent Garden. On the reverse side of this record he sings "Oh, Could I But Express in Song." Natzka is accompanied on the piano in each case by Herbert Greenslade.

Listeners to the B.B.C.'s Third Programme and to "Music in Miniature" know Margaret Ritchie well, and discerning critics have praised her renderings of Schubert especially. The beautiful clarinet obbligato to "The Shepherd on the Rock," which she sings in German on *H.M.V. C*3688, is in the expert hands of Reginald Kell, and Gerald Moore accompanies on the piano.

Isobel Baillie's singing of "The Kingdom—The Sun Goeth Down, Op. 51," on *Columbia DX*1443 once more gives us an instance of the flawless tone and style which have brought her to the highest peak of excellence in oratorio. Musically, Elgar's "The Kingdom" is the equal of the two preceding oratorios, "Gerontius" and "The Apostles." With them it forms a perfect trinity.

Light Music

The Queen's Hall Light Orchestra conducted by Sidney Torch have chosen two pieces from the Maurice Ostrer picture of "Idol of Paris" for their latest recording. The two pieces "Illusion" and "Dedication" are both by that talented composer Mischa Spoliansky, who composed the music for such films as "Sanders of the River," "Wanted for Murder" and "King Solomon's Mines." They are both attractively treated and the composer is at the piano.—*Columbia DX*1458.

"Malaguena"—a piano piece from the suite "Espagnole"—was composed by Ernest Lecuona, one of America's foremost writers of Latin-American music. It is a lively Spanish dance similar in nature to the fandango, and on *H.M.V. B*9637 the melodic and harmonic pecularities of the traditional music have been successfully captured by George Melachrino conducting the Melachrino Orchestra. On the reverse is "Lady of Spain," which has been presented in a variety of musical settings, and it is admirably played by the Melachrino Strings.

Ever since Donald Phillips' "Concerto in Jazz" was first broadcast and recorded by Charles Shadwell's orchestra in 1946, the work has steadily grown in public favour. One of the primary distinctions of "Concerto in Jazz" is that the young composer has evolved a symphonic style embodying some of the main characteristics of jazz music. It has now been recorded by the famous Skyrockets Orchestra specially augmented by a large string section. A particular point of commendation is that the piano passages feature the virtuosity of Pat Dod—*H.M.V. C*3722.

Variety

In "Grandfather's Clock" and "Three Little Fishes" the musical and comedy talents of the highly original Radio Revellers are showpieced with considerable effect on *Columbia FB*3394.

From jazz rhythms to Latin-American themes, every kind of music is skilfully executed by Reginald Dixon, versatile organist of Blackpool's Tower Ballroom. Following his delightful samba version of "Tico Tico," *Columbia FB*3362, Reginald returns to Spanish-American strains with a selection of well-known tangos which should satisfy the most exacting lover of this graceful dance—*Columbia FB*3392.

The combined talents of vocalist Carole Carr and arranger Denny Vaughan are displayed in the latest recording by the Geraldo Orchestra. "Where Flamingos Fly," with lyrics added by Jimmy Kennedy, is given the polished vocal and orchestral treatment that is the hallmark of a Geraldo performance. Ann Carbutt's "Sometimes I Think of Spring," already a favourite over the air, is orchestrated by Denny Vaughan and sung by Carole Carr—*Parlophone F*2290.

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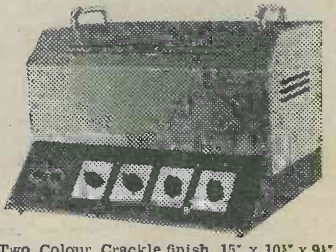

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Open to Discussion

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

German Valve Details

SIR,—I am very pleased to say that my letter in your May issue has already had a large response and that I can be of help to so many who in return are very kind to me. Contrary to public opinion a Scotsman has even offered to send me valve data without asking for something in return. But, of course, I am also willing to help without return offers.

Just a little favour I ask from you: Please draw attention to the fact that ordinary postage to Germany is 3d., and that books, papers, etc., can be sent by book post at the rate of a few pence (I do not know the exact charges).

With the best thanks for your kind attention.—WERNER MAASS (Hamburg).

Anti-static Aerial

SIR,—The article on an anti-static aerial unit in the May issue of PRACTICAL WIRELESS makes me want to mention my own arrangement.

My particular district is a hot-bed of interference on all wavelengths, and after several experiments to get rid of noise I finally used a 6ft. length of aluminium tube as the aerial with a length of television 80 ohm co-ax. as downlead. The curious part of the system is this—the aerial is vertical and the cable inner is connected to the bottom of its length; but the cable outer screen is left floating at both ends, only the inner going to the set aerial terminal. This completely suppresses all noise, which it doesn't do if the outer screen is earthed.

Perhaps some reader can supply the reason why.—S. A. KNIGHT (Wellingborough).

Correspondents Wanted

SIR,—May I take this opportunity of congratulating you on the high standard of your magazine.

I should like to correspond with another amateur of about my age (I'm almost 17) interested in short waves and receiver construction, preferably not too far from my home.—P. M. TALL (132, Wilmslow Rd., Withington, Manchester, 20).

SIR,—I would be pleased to correspond with any reader interested in wireless, who is between 15 and 16 years old. I would prefer a boy living in Lancashire. I am not very keen on short-wave.—J. CLEMENTS (29, Rickhayes, Wincanton, Somerset).

Reader's Thanks

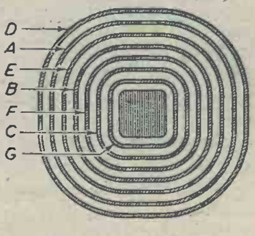
SIR,—Please allow me to tender my sincere thanks to all your readers who readily responded to my letter of December, 1947, in PRACTICAL WIRELESS, by giving me information, circuit diagrams, etc., re connections for set Mk. II B19.

Grateful to friends in Germany and Middle East.—RUFUS ALLEN (Lagos, Nigeria).

Reducing Phase Shift

SIR,—I was very interested in the article on the above subject in your November issue last year and have been trying out the scheme. I used an old transformer I had by me and rewound it, but am doubtful about one point. It was not clear to me from the article just how the separate windings (particularly the feed-back winding) should be arranged on the core, and I should be glad if you could give me any information on this point.—R. STEBBINGS (Harrow).

[*The accompanying illustration will no doubt help to solve the difficulty if studied in conjunction with Fig. 1 in the article in question. Windings A, B and C are the primary, D,E,F and G the secondary windings. In Fig. 2 in the article winding F was used as the feed-back section, the speaker being connected across D, E and G in series.*—ED.]



Amateur Results

SIR,—I am 14 years of age and have been a reader of your excellent magazine for 2½ years now and am very interested in ham radio. My RX is a 1-v-2 battery set using a 35ft. indoor aerial. Here are a few 'phone stations I have logged recently on 14 Mc/s.

C7TY, UA1GB, VO2BP, CN8BV, UA3KAB, VO4Q, LO2JC, UI2CK, VO6X, CO7VP, VE1AX, VS7PS, FA362, VE1BH, ZB2A, FT4AI, VE4IF, ZB1AI, OX3BD, VO2BH, ZC6JL, ZS6JC and nearly 40 Ws.—G. R. KELMAN (Leicester).

Cutting Wanted

SIR,—I have been a regular reader of PRACTICAL WIRELESS for some years now, and I find that I have some pages missing from the January, 1943, issue, owing to the fact that I built the wartime midget A.C.-D.C. receiver which appeared in that particular issue. I removed the pages for reference purposes, and now I am demobilised from the Army I wish to carry out one or two repairs to my receiver and I need the circuit for reference. As all back numbers are out of print, I wonder if any reader can help me with this back number?—D. M. SMITH (69, Painswick Road, Cheltenham, Glos.).

Modified R1116

SIR,—I have been following "Open to Discussion" in PRACTICAL WIRELESS for the past 12 months for any help in converting the R1116 receiver to L.S. output. I have the circuit and full details of components and have converted the set to loudspeaker output, but get serious distortion at normal L.S. volume. I have quite a long experience as an amateur, but simply cannot find where the trouble is, after trying literally everything. Can any reader give me details of successful conversion ?—N. V. FORTNAM (29, Abbotsford Road, Goodmayes, Essex.

Car Radio Problem

SIR,—On two occasions having fitted a dropper resistance in series to enable a 6 v. car radio to be used from a 12 v. battery, I find that I get twice the amount of vibrator noise than if used on a 6 v. battery, and even worse when tuned to a signal. Having tried chokes and condensers in all positions on the feed line, I am still unable to cure the trouble. I might add that if I tap the 12 v. battery at 6 v., and couple it to the output side of the dropper resistance, the noise reverts to normal. I would be glad if anyone can suggest the cause of the trouble, as I do not like the practice of tapping the battery at 6 v. and so put all the load on one half.—J. PERRY (Woking, Surrey).

Television Interference

SIR,—I wonder if any data is forthcoming regarding the various forms of interference on television. I am near an aerodrome and get a fluctuating picture when aircraft fly overhead. I have tried to collect data showing the form the distortion, etc., takes when the plane is in various positions, but unfortunately cannot see the picture and be out in the garden at the same time. The lightning recently also affected the picture, but synchronism was entirely unaffected. Is this due to my circuit, or is it usual ? I should be glad to know whether anyone has yet succeeded in collecting data on the distortion of the received signal under special conditions, and whether the fading caused by aircraft can be overcome.—W. J. COX (Colindale, N.W.9).

Hi-Fi Radiogram

SIR,—I have been experimenting for some time to try to build a high-fidelity radiogram. I have tried various circuits published in your magazine as well as those in other periodicals. Each has had some merit, but has failed to give exactly the results I required. I wonder if you could give a design for a set which would meet my needs—not too dear, although I am prepared to spend a fair amount on it, and if possible, using much of the surplus gear, valves, etc., which are now available.—G. REECE (N.W.5).

[*It is difficult to design a receiver which will meet every need of every individual reader. One will like more top note response than another, and so on. It is just the same with the programmes which are broadcast—it is not possible to please everyone all the time. However, we think the Hi-Fi Radiogram, the construction of which is commenced in this issue, will interest you, as it has a number of separate adjustments for tone, etc., which should enable you to obtain the response curve you require, and it is flexible, using a large quantity of ex-service equipment.*—ED.]

The Amateur Spirit

SIR,—I must write and thank you for your courtesy in publishing my letter, and also to thank the many readers who came to my assistance. I had no idea the amateur fraternity was so widespread and of such friendship. I am unable to devote the time necessary to replying to everyone individually, but take this opportunity of thanking everyone who wrote to me and especially to those who sent cuttings, photos, etc. They have been of the greatest help. I have replied direct to those who enclosed stamped envelopes.—G. BEST (Brecon).

For Dublin Readers

SIR,—May I take up some of your valuable space to make an appeal to Dublin S.W.L.s ? Will any of those living in the South City area interested in forming a club—with the object of pooling information and ideas and the ultimate object of establishing a club S.W. station—get in touch with me at the following address by letter ?—KEVIN MOLAN, (63, W. Mount Street, Dublin, Eire).

Ex-Service Equipment

THE co-operation of readers is sought in helping others out of difficulties regarding items of surplus gear as follows :

M. B. Henville, of Chaplin Road, Wembley, Middx, requires details of the 12- and 6-pin connectors on the front panel of a Power Supply and L.F. Amplifier Unit No. 1, ZA.21531 M.R. Ser. No. 16994, and the possible output of the vibrator section.

W. Marshall, of "Avalon," Finglesham Road, Sholden, nr. Deal, Kent, requires details of receiver and power pack No. 111 Mk. II (3.1-15.5 Mc/s).

B. Blincoe, 11, Adams Road, Compton, Wolverhampton, has a B.50 receiver and is unable to trace what type of valves it uses.

J. F. Paine, of 48, Worton Way, Isleworth, Middx, has a "V.I. 108," of which he requires data.

B. Taylor, 10, High Street, Quarry Bank, Brierley Hill, Staffs, would like help regarding the 3-pin socket on a TR/9H R.A.F. receiver, and would like to hear from any reader who has succeeded in modifying the tuning arrangements.

S. Limming, Hall Cottage, Wainfleet, Lincs, has receiver type 3170A, and would like data which is now no longer available from Air Ministry.

E. McMillan, 8, Waldershaw Road, Forest Hill, S.E.23, wishes to convert radar unit AC/APA-1 into an oscilloscope, but cannot trace out the circuit. Has anyone a copy of this ?

G. E. Cousins, of 3, New Monks Cottages, Upper Brighton Road, Lancing, Sussex, would be grateful to any reader who could supply information concerning receiver type R.1355.

G. Fooks, 31, Percy Road, Yeovil, Somerset, has an 81-B receiver, and requires details of the circuit and plug connections.

L. N. McCord, of 49, Kangaroo Street, Manly, N.S.W., Australia, is unable to obtain in that country details of receiver R.1116 and amplifier A.1134A. He would like to hear from any readers who possess the receiver, with a view to exchanging performance data, aerials, power pack, etc.

A. Milkam, 18, Cornfield Terrace, St. Leonards-on-Sea, Sussex, has receiver 18 Mk. III, but cannot obtain circuit details of battery connections.

K. Evans, 17, Cambridge Street, Hawthorn East, E.3, Victoria, Australia, requires the original circuit of the MCR.1, together with power pack.

G. Ford, of 2, Norrs Road, Stanfields, Tunstall, S-O-T, would like to get into touch with any amateur who has had any experience with ex-Service 6AK5, 9001, 9002 and 9003 valves.

G. Richardson, 36, Renwick Road, Aintree, L'pool, 9, requires information on receiver BC.455.B.

J. Baldwin, The Dingle, Habberley Road, Bewdley, Worcs, would like to contact any readers who are interested in ex-radar equipment and have a circuit of an indicator unit No. 96, Ref. 100B/198, and oscillator unit type 221, Ref. 10VB/6084.

E. Northcott, 60, Harwell Street, Plymouth, Devon, wishes to add an "R" meter to a receiver, R.107, and would like to contact any reader who may have carried out this modification.

L. H. Stevens, 29, Fron Terrace, Rhyl Road, Denbigh, N. Wales, would be grateful for any information concerning the U.S. Army receiver, BC.455.B.

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PRACTICAL WIRELESS. JULY, 1948

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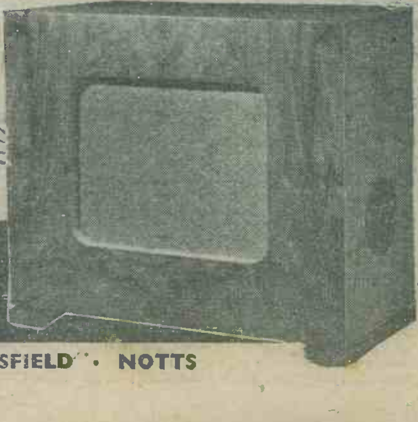

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