MORSE MADE EASY—See page 248

A NEWNES PUBLICATION

Practical Wireless and PRACTICAL TELEVISION

6D.

Edited by F. J. CAMM

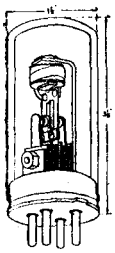
Vol. 17. No. 419.

EVERY MONTH

May, 1941.

ELECTRADIX RADIOS

L.T. Battery-operated Home-made VIBRATOR KITS



To obtain H.T. successfully. Supersede H.T. batteries. The Vibrator converts D.C. to A.C. by vibrating uniformly. Any voltage up to 100 watts obtained by transformers and rectified for radio H.T.

American Vibrators totally enclosed, slightly dented covers. 4-pin non-sync.

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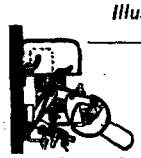
AUTOMATIC CIRCUIT BREAKERS

Magnetically tripped Switches that operate instantaneously

Circuit Breakers operate instantly on an overload. Fireproof construction. Made in single, double, and triple pole. Prices are very low. **Types marked with a star have thermal trip delay.**

SINGLE POLE, HEAVY IRON CASE 250/400 Volts

Illustration shows S.P. with cover removed



Rating	Type	Price
6 amps.	S 11/1G	11/6
6 ,,	S 11/1Z*	13/6
10 ,,	S 11/1G	16/-
15 ,,	S 11/1G	18/-

4 in. x 5¼ in. DOUBLE POLE, IRON CASED

Rating	Type	Price	Rating	Type	Price
1 amp.	S 11/2Z*	18/6	5 amps.	S 11/2Z*	25/6
1½ amps.	S 11/2Z*	19/-	6 ,,	S 11/2Z*	26/-
2 ,,	S 11/2Z*	20/-	6 ,,	S 11/2	23/-
2½ ,,	S 11/2Z*	21/-	10 ,,	S 11/2Z*	32/-
3 ,,	S 11/2Z*	22/-	10 ,,	S 11/2	30/-
4 ,,	S 11/2	22/-	12 ,,	S 11/2Z*	36/-
4 ,,	S 11/2Z*	25/-	15 ,,	S 11/2Z	34/-

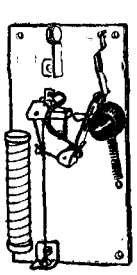
TRIPLE POLE, 3 TRIPS Light Iron Case 300/500 Volt

Rating	Type	Price
800 m/a.	S 11/3Z*	25/-
3 amps.	S 11/3	21/-
3 ,,	S 11/3Z*	24/-
4 ,,	S 11/3	21/-
6 ,,	S 11/3	32/-
10 ,,	S 11/3	38/-
15 ,,	S 11/3Z*	45/-

TRIPLE POLE, 3 TRIPS Heavy Iron Case 300/500 Volt

Rating	Type	Price
500 m/a.	S 11/3Z*	26/-
800 ,,	S 11/3Z*	27/-
1 amp.	S 11/3Z*	24/-
2 amps.	S 11/3Z	22/-
2 ,,	S 11/3Z*	26/-
3 ,,	S 11/3Z*	28/-
4 ,,	S 11/3	23/-
4 ,,	S 11/3Z*	30/-
6 ,,	S 11/3	36/-

2-AMP. THERMO TIME-LAG CIRCUIT BREAKERS



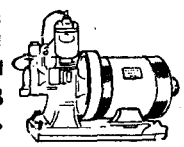
A SPECIAL DESIGN IN AUTO-SWITCHES

with time-lag tripping on 2 to 3 amps. Safety thermo switch with long-break auto overload trip. For back of panel with front indicating knob, compact, 4in. x 2 in. x ½in. deep. Any voltage up to 1,000 v. (as illus. Only) **5/6.** Worth a Guinea.

INDEPENDENT POWER

300 watt Petrol Electric Set, 100 volts, 50/60 cycles, 3 amps. and 30 volts 10 amps. D.C. Portable lightweight, with switch-board, **£32**

PETROL ELECTRIC GENERATING SETS For Lighting and Charging



Half h.p. DIRECT COUPLED, 150 watts D.C., 1,300 r.p.m., 2-stroke water cooled 1-cyl. engine, magneto ignition. On bed plate with 30 volts 5 amps. Dynamo, **£13**

75 Larger Size ½ kW. Petrol Electric Sets, 500 watts, 2-stroke water-cooled 1 h.p. 1-cyl. engine on bedplate, direct-coupled to 50/70 volts 10 amps., D.C. dynamo, magneto ignition, **£17 10s.**

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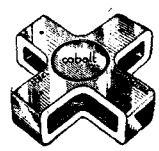
Price only **10/-**

THE ROLLS-ROYCE OF BUZZERS

is the Cambridge-Townsend. Tiny and Shrill. Perfect for Wavemeters, ideal for signals. High note model "T" Diaphragm blade. Platinum Contacts. The smallest Buzzer possible. Price **10/-**

Postage 1/- extra.

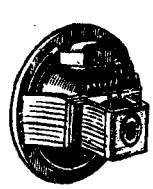
SHEFFIELD SPEAKER MAGNETS FOR MOVING COIL



Powerful New Steel. Four-claw 4½ lbs. 10 watt M.C. Speaker, Permanent Magnets at manufacturers' price. A great opportunity for **5/6**

Postage 1/- extra.

MAINS ENERGISED SPEAKERS



With 6in. damaged cone, **5/-**. Good cone, 6in., 1,200 ohms, **7/6**. Magnavox, 6in. type, **12/6**.

M.C. SPEAKERS, P.M., 7in. cone and transformer, **25/-**; 8in. cone with transformer, **27/6**.

BATTERY ENERGISED SPEAKERS.
K.B., 6volt., 8in. cone, **8/6.**

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Telephone: Central 4611

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Type	Current	Henrys	Res.	Price
C.40/500	40 mA.	20-34 H.	500Ω	6/-
C.60/180	60 ,,	8 H.	180Ω	6/-
C.60/400	60 ,,	25-34 H.	400Ω	8/8
C.60/500	60 ,,	18-30 H.	500Ω	8/8
C.100/400	100 ,,	20-34 H.	400Ω	10/8
C.150/185	150 ,,	20-34 H.	185Ω	15/4
C.200/145	200 ,,	20-34 H.	145Ω	18/-
C.250/120	250 ,,	25 H.	120Ω	20/-

PREMIER 1941 HIGH FIDELITY AMPLIFIER KITS

Each Kit is complete with ready drilled chassis, selected components, specially matched valves and full diagrams and instructions.

	Kit of Parts with Valves	Completely Wired and Tested
4-watt A.C. Amplifier ...	£2 14 0	£3 11 6
4-watt A.C./D.C. ,, ...		£3 17 6
6-watt A.C. ,, ...	£6 16 6	£7 13 6
8-10-watt A.C./D.C. ...		£7 9 0
15-watt A.C. ,, ...	£7 18 9	£9 8 0

Black Crackle Steel Cabinet 17/6 extra.

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Wire-ends. All L.T. Windings Centre-Tapped

SP. 250	250-0-250 v. 60 m.a. 4 v. 1-2 a, 4 v., 2-3 a., 4 v. 2-3 a. ...	13/4
SP. 300	300-0-300 v. 60 m.a., 4 v. 2-3 a, 4 v., 2-3 a., 4 v. 2-3 a. ...	13/4
SP. 301	300-300 v. 150 m.a., 4 v., 2-3 a., 4 v. 2-3 a., 4 v. 1 a., 4 v. 1 a.	17/4
SP. 350A	350-350 v. 100 m.a., 5 v. 2 a. (not C.T.), 6.3 v. 2-3 a. ...	16/-
SP. 350B	350-350 v. 100 m.a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 2-3 a.	16/-
SP. 351	350-350 v. 150 m.a., 4 v. 1-2 a., 4 v. 2-3 a., 4 v. 3-4 a. ...	17/4
SP. 352	350-350 v. 150 m.a., 5 v. 2 a., 6.3 v. 2 a., 6.3 v. 2 a. ...	18/-

Auto Transformers. Step up or down. 100-125 v. to 200, 230 or 250 v. A.C., 60 watts, 11/4; 125 watts, 15/-; 250 watts, 22/-.

L.T. Transformers, all C.T.

4 v. 2-3 a.	11/4	6.3 v. 2-3 a.	11/4
2.5 v. 5 a.	11/4	7.5 v. 3 a.	11/4
5 v. 2-3 a.	11/4	12 v. 3-4 a.	18/-

Push-Pull Driver Transformers 6/6

Universal Output Transformers. 11 Ratios. Single or Push-Pull 6/6

MATCHMAKER UNIVERSAL OUTPUT TRANSFORMERS

Will match any output valves to any speaker impedance.
11 ratios from 13 : 1 to 80 : 1, **5-7** watts, **16/10.** **10-15** watts, **21/10.** **20-30** watts, **36/10.**

ELECTROLYTIC CONDENSERS. Cardboard cases. 500 v. working, 4 mfd. and 8 mfd., **1/9** each. 8+8 **3/6**, 4+4, **2/8**, 8+4, **3/3**, 4+4+1 **3/9**, 4+4+4 **4/3**. 16+8 **4/-**, 16+16, **5/-**, 25 mfd. 25 volt, **1/6**, 50 mfd. 12 volt, **1/6**, 15 mfd. 100 volt, **1/3**. Mansbridge type, 1 mfd. 250 volt, **1/-**, 2 mfd. 250 volt, **1/9**, 4 mfd. 500 volt, **4/8**.

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Premier Morse Practice Key on Bakelite Base and Brass Movement	3/3
General Purpose Morse Key ...	5/10
Bakelite Buzzers	2/-
3 Henry Chokes	7/6
Complete Kit of Parts for Valve Oscillator as described in W.W. "Learning Morse"	25/-

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In response to many requests we have now produced an A.C. version of the popular Premier Short Wave SG3 Kit. Circuit: Pentode H.F. Stage, Pentode Detector, Beam Power Output, and F.W. Rectifier. 200-250 v. A.C. Operation. Built-in Power Pack. Hum-free operation. For use with Phones or P.M. Speaker.

Complete Kit of Parts with drilled chassis, all components. Plug-in Coils covering 13-170 metres, 4 valves and full instructions and circuits.

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Battery Version also available Kit £3 8 0 Extra Coils 9—15, 200—2,000 m. also supplied.

★ *"The Wireless World" said they were* "very much impressed . . . . " ★

See full Test Report, PP. 492-3 December issue. Send for full details.

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Heads will fit any tone-arm 7/6
Premier Pick-up with Volume Control 17/6

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Plessy 8in., 175 ohm field, **7/6**; 10in. B.T.H. 1,600 ohm field, less transformer, **11/6.**

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Westinghouse Rectification complete and ready for use

To Charge :		6 volts at 1 amp.	26/-
2 volts at ½amp.	13/4	12 volts at 1 amp.	28/-
6 volts at ½amp.	22/-	6 volts at 2 amps.	43/6

PREMIER MICROPHONES

Transverse Current Mike. High grade large output unit. Response 45-7,500 cycles. Low hiss level, **23/-.**

Moving Coil Mike. Permanent magnet model requiring no energising. Response 90-5,200 cycles. Output .25 volt average. Excellent reproduction of speech and music. **49/-.**

PREMIER SHORT-WAVE KITS for OVERSEAS NEWS

Incorporating the Premier 3-Band S.W. Coil. 11-86 Metres without coil changing. Each Kit is complete with all components, diagrams and 2-volt valves. 3-Band S.W. 1-Valve Kit, **14/9** 3-Band S.W. 2-Valve Kit, **22/6.**

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Short-Wave Coils. 4- and 6-pin types, 13-26, 22-47, 41-94, 78-170 metres, **2/-** each, with circuit. **Premier** 3-Band S.W. Coil, 11-25, 19-43, 38-86 metres. Suitable any type circuit, **2/11.**

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15 m.mfd. ...	2/4	100 m.mfd. ...	3/-
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40 m.mfd. ...	2/6	250 m.mfd. ...	4/-

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Microphone Transformers. Suitable for all mikes. Tapped primaries. **A, 20** and **40** : 1; **B, 30** and **60** : 1; **C, 50** and **100** : 1 **6/6** each.
Microphone Stands, floor type, telescopic 8" ring, **32/6.**

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EDITED BY F. J. CAMM
Staff: FRANK PRESTON, L. O. SPARKS.

COMMENTS OF THE MONTH

By THE EDITOR

Dispatching Sets by Rail

A GILBERTIAN situation has arisen in connection with the dispatch of wireless sets by rail. Our information is that some of the railway companies are refusing to dispatch radio sets if the valves are included. They are evidently bearing in mind the Order in Council made ten months ago, which restricted the transport of wireless apparatus and prohibited the use of car radio. The railways apparently are unaware that as long ago as last June it was made clear that the Order was not applicable to mains receivers which, of course, are not usable in a motor-car or railway carriage, and are refusing to accept for dispatch complete mains receivers.

Apparently the blame cannot be placed at the door of local stations, for all railway receiving offices have received instructions from their head offices enjoining them to refuse to accept such apparatus for dispatch, as well as copies of printed indemnity forms which those wishing to dispatch wireless sets must fill in.

The form includes a declaration that the set cannot be used or readily adapted for use. One of the clauses reads: "It has been decided that the regulations apply to wireless receiving apparatus conveyed in railway companies' road vehicles, either as complementary to rail conveyance or for throughout road conveyance, if the apparatus is in the vehicle in circumstances in which it can be used or readily adapted for use.

It is quite apparent, therefore, that the railway companies are out of order in requiring that the valves be removed from a mains receiver.

Concentration of Production

AT a recent meeting between the president of the Board of Trade and representatives of the trade press, the Government's new policy for concentration of production was explained. The president made it clear that the policy did not require the formulation of schemes for whole industries or section of industries. Briefly, the scheme is that if several firms in a particular industry are not working to full capacity two or more of them should voluntarily combine to form a nucleus firm, which would manufacture the branded goods of the other and supply them at cost, so releasing labour and machine tools for other essential war-work. Where such firms are unable to agree, the Board of Trade will step in and effect the necessary degree of concentration. Factories so closed down must be kept in readiness to start up again as soon as the war is over, and the Board of Trade will keep a register of such factories and of labour transferred.

There is no reason why a firm with three factories at work on a part-time basis should not arrange to close down one of them, thereby concentrating production in two of them, nor is there any reason why three individual firms, small or large, should not take a similar action by arrangement among themselves. Once the arrangements are confirmed by the Ministry of Labour and the Board of Trade, the firms will qualify immediately for the privileges to be given to nucleus firms. These include the following: The firm will be eligible for inclusion on the list of protected firms. This will result in a lower age of reservation for its workers, and the fact that it is on the list will be taken into consideration in dealing with applications for deferments. The Ministry of Labour will safeguard the labour requirements of these firms in appropriate cases upon the recommendation of the Board of Trade. Government orders will, as far as possible, be given to these firms; the Board of Trade will prevent the factory, so far as possible, from being requisitioned, and help will be given to them to safeguard their supplies of raw materials.

War Demands on the Radio Industry

SINCE the beginning of the war, large demands have been made by the Services on the wireless industry for many kinds of sets, valves and other components. Hitherto it has been possible to meet these demands without any material curtailment of supplies for the home market and for the export trade.

It is inevitable, however, that with the rapid expansion of the Forces these demands will be in ever increasing quantities, and that the radio and valve manufacturing industries, in common with other industries, will be called upon to play an increasing part in the war effort.

Discussions have accordingly taken place between representatives of the industry and the interested Government Departments with a view to ensuring that the resources of the industry are available to the full for the production of radio sets, valves and other components for essential purposes.

It follows that there can no longer be available, except in very limited numbers, components such as valves required for the maintenance of domestic radio sets or new sets to replace those which go out of operation. In order to ensure that this reduction in supplies for home civilian requirements shall be effected on as orderly a basis as possible, the radio set and valve industries have been asked to work to a long term programme, which will mean a severe limitation on the release of such components as valves for the domestic market.

The extent to which such components as valves can be made available for maintenance purposes must, of course, depend in large measure on the requirements of the fighting Services, and the position is likely to vary from time to time.

So far as export is concerned, special arrangements will be made to meet, so far as is possible, the demands for valves for maintenance purposes and in part, at any rate, the demand for new sets.

This position will not, of course, greatly affect constructors. In fact, it will give a fillip to set construction. Our blueprints are in greater demand than ever before, and there are still fair supplies of components available with which to build our receivers. Readers who experience difficulty in obtaining components, however, are finding that a miscellaneous advertisement in this journal soon puts them in touch with other constructors who have the parts for sale at second-hand prices, and we recommend readers who find they are unable to obtain components from their usual source of supply to adopt this course. We are able to inform readers as to parts which are not now obtainable.

We shall publish designs for receivers which can be constructed from materials still obtainable, but it is obvious that they will be of the simpler type in view of the restriction on the supply of certain valves,

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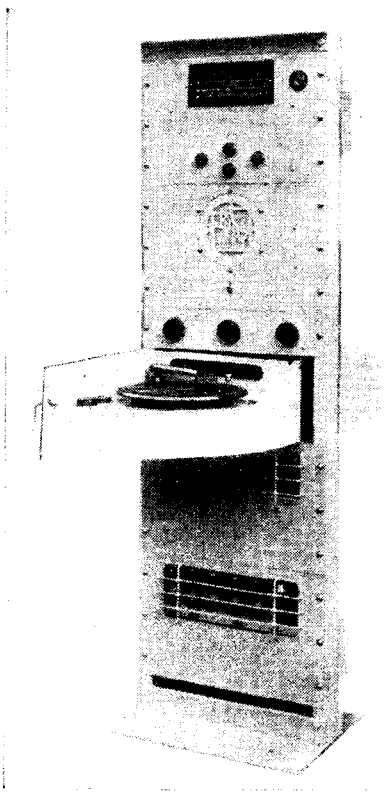
The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, 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.

P.A. EQUIPMENT—1

The Lay-out and Working of P.A. Installations in Factories and Large Buildings.

By "SERVICE"



A Tannoy rack equipment with a 50-watt output stage and including provision for radio or record programmes.

P.A. EQUIPMENT is playing a very important part in the country's war effort, and engineers who can undertake or supervise the installation and maintenance of apparatus in factories, canteens, A.R.P. centres, etc., are doing work of national importance. Factory managers realised even before the war that the provision of light music stimulated operatives, especially those carrying out monotonous, repetitive work, and resulted in increased output and happier workers.

Government advisers have endorsed these findings, and official encouragement to the provision of more and more installations in factories is given in the way of special consideration shown to the manufacturers of P.A. equipment. Permits for the purchasing of the necessary metal, valves and other material are more readily obtained, while the B.B.C. is helping by providing special "Music While You Work" programmes, which not only entertain those factories equipped with P.A. installations, but create a demand for equipment from the workers in those establishments not yet fitted out for the reception and distribution of the programmes.

Now, many radio dealers and radio service engineers do not consider themselves competent to handle the installation or servicing of P.A. equipment. They have probably admired with a certain amount of awe the beautifully finished amplifier acks exhibited at pre-war Radiolympias, and have gazed with rather a thrill at the great 400-watt "bottles" fitted in front of the racks, and protected by shining chromium-plated guard rails. Rows of gleaming knobs marked "Mic. No. 1," "No. 2 Mixer," "No 4 Channel Output," etc., have still further fascinated them, and convinced them that such gear must be very complicated, and very much above their sphere of activities.

Mixer and Fader Panel

It is the purpose of this series of articles to show readers that the wiring of a mixer and fader panel for several inputs is often far less complicated than the wiring of a push-button unit and wave-change switch in a modern receiver; that there is very little fundamental difference between the output stage of a good class radiogramophone and the line amplifier of a rack equipment feeding a hundred loudspeakers; that the running of the distribution wiring network is similar in principle to fixing up a couple of extra loudspeakers in the kitchen and drawing-room after a few simple precautions have been taken, and finally it is proposed to explain how fault finding is often much easier on P.A. installations with their built-in milliammeters and anode circuit inspection arrangements, than is the servicing of an all-wave superhet.

To be confident in the handling of P.A. equipment it is essential that a thorough understanding be had of all the various components, accessories, etc., that go to make up the complete installation, and the present series of articles will take the reader right through the various links in the chain of large and small installations with practical, as well as theoretical, considerations of the type of difficulties that may be encountered at each stage.

Factory Installation

Fig. 1, which forms the basis around which the following articles will be written, is a block diagram of a large factory installation. Two microphones are provided, one of which may be for picking up music from the factory's canteen concerts for distribution to other parts of the establishment. The other microphone may be in the A.R.P. control centre, from which urgent instructions could be put out over the network. This microphone position would probably be fitted with a master switch which would allow the A.R.P. officer to cut off any programme, and go on to the network himself.

The orchestra microphone may be of the moving-coil type, which has a good frequency response with a quiet background, and is a reliable component from a maintenance point of view.

The microphone for announcements would probably be a carbon microphone, which is good for this class of work, as it is rather directional, and, except in expensive types, has a fairly restricted frequency response. Also, it has a higher background noise level, but its low cost and robust construction make it suitable on many occasions where its limitations are of no consequence.

After each microphone will be seen what is termed a pre-amplifier, or microphone amplifier. These are used where long microphone cables are used, such as when the large amplifiers are housed in a central part of the factory remote from the microphone locations.

A record player will next be noticed, and this may comprise a simple arrangement of a turn-table motor and pick-up for playing single records, or it may be an elaborate record-changing mechanism duplicated so that there shall be no long break in the programme when the latter is made up of record selections. The automatic double playing desk also allows the equipment to operate even on a gramophone reproduction for long periods without attention.

The final items with regard to the provision of programme material are the radio receivers. Two are provided, one tuned to the "Home Station" and the other to the "Forces" wavelength. This is to allow for an alternative programme for those loudspeaker positions where provision is made for such a choice of programmes, for example, in private offices, small workshops, etc. Dual-channel operation will be explained in an article later on in this series. If only one channel is available then only one receiver would be required, and the operator would adjust it to the various stations to select a suitable programme. A press-button model would probably be used to simplify this operation.

Now all these sources of programme signals are fed to a mixer panel which is nothing more than what might be termed the "Clapham Junction" of the system. The various inputs may be controlled with regard to their volume, and sometimes their

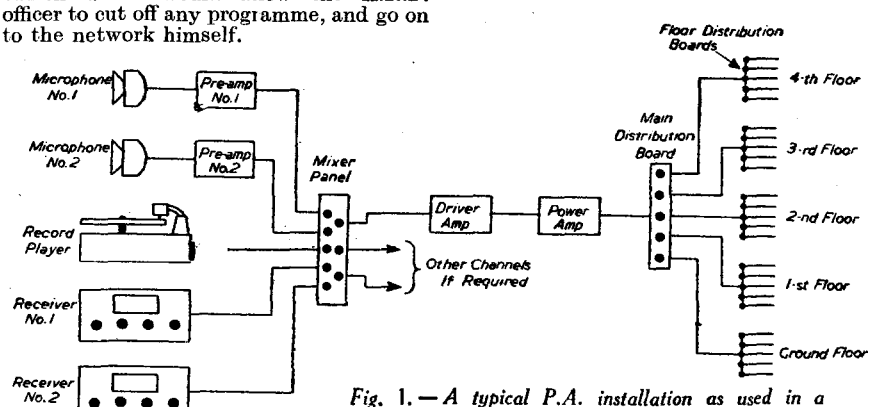


Fig. 1.—A typical P.A. installation as used in a large factory.

tone, and then they are switched to their respective channels.

In addition, the mixer panel may include remote controls to allow the receivers and microphone amplifiers to be switched on where the complete equipment is not on the one rack. For example, the large racks may be in a small room or basement, while the control and mixer panel may be in an office where the system may be under the control of a senior member of the firm. The record-player could also be located at this position, so that the store of records could be kept in a safe place with, possibly, sets of spare valves for the equipment.

Driver Amplifier

The next stage in the system after the mixer panel is the driver amplifier, which gives the signal sufficient amplitude to "swing" the grids of the large valves in the output amplifier.

As previously stated, there is nothing to get concerned about in discussing for the first time microphone amplifiers, drivers (or "swingers" as they are often termed) and power amplifiers. It is merely that a complete amplifying unit with its own power supply and controls is used in the place of each valve in a three-stage, high-grade amplifier. The input valve corresponds to the pre-amplifier, the second valve to the driver amplifier, and the output stage to the power amplifier. If this comparison is kept in mind, no difficulty should be experienced in appreciating the various units of a P.A. installation.

Distribution Boards

The final links are the wiring network and distribution boards. The latter serve the purpose of fuse boxes in lighting systems and enable the wiring to be arranged in convenient circuits which can be quickly isolated if a fault develops on any one of them, which might affect the whole system.

If a dead short occurs, say, on a loudspeaker wiring on the second floor, all the floors may be affected, but by quickly switching each board in and out of circuit the floor on which the fault lies is soon located. This can then be left disconnected from the main feed so that the other floors get their programme while the output from an audio-frequency oscillator is injected into the second-floor distribution board and the trouble located. Fault-finding on networks and other parts of the system will be dealt with more fully in a later article.

The last units in the system are, of course, the loudspeakers. There will be various types to suit the work they have to do. Some locations will demand horn projector loudspeakers to overcome a noisy background, such as would be found in a machine shop. In quiet shops or offices, cabinet loudspeakers would be used with individual volume controls to adjust the reproduction as required for the area served by each loudspeaker.

Concealed Loudspeakers

In many types of installations it is desired that the source of sound, that is, the loudspeakers, should not be visible. These installations are generally in buildings which have a certain amount of dignity to maintain. Town halls, professional institutes, headquarters, churches, etc., do not want loudspeakers spoiling the beauty of their halls and council chambers, and concealed units must be used. If the P.A. engineer can co-operate with the architect of a new building this helps considerably, but where installations are made in existing buildings ingenuity must be exercised in order to give satisfaction. This aspect of P.A. work will not be overlooked in this series.

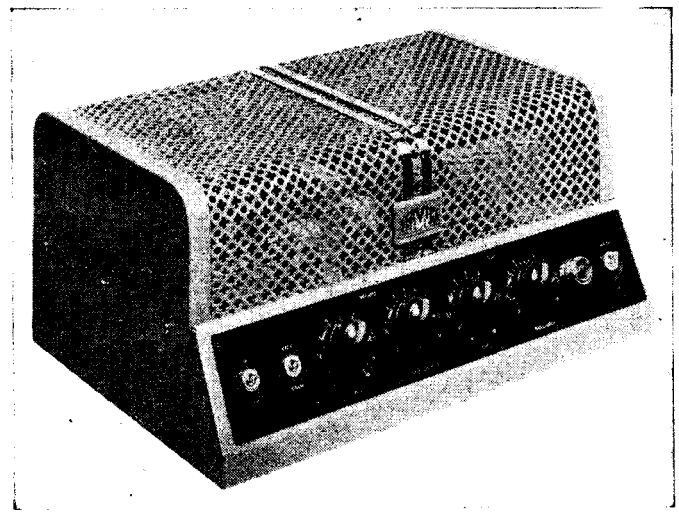
This introductory survey of a typical factory installation serves to indicate the scope of P.A. work. Only in minor details does it differ from installations for blocks of flats, hospitals, and even wireless relay systems. Once the fundamental arrangements and requirements are appreciated, any particular layout may be designed to give the desired results in a certain establishment.

Of course, many installations will not require such an elaborate system as that just described, which might have 500-watt (.5 kW.) output stages. Units of 20 or 40 watts may be quite sufficient to fulfil the needs of small establishments, and all

Deaf Aids

Another interesting branch of P.A. work is that relating to deaf aids; not the small portable types worn or carried by people afflicted with deafness, but the installations often provided in a few rows of seats at cinemas or theatres, or in the pews of churches. These systems, like hospital jobs, use single ear-phones of the lorgnette type for use by ladies, or the more normal style of light headphones, and as these are plugged in and out of circuit as required the supply socket is generally fitted with compensating resistances to maintain a constant load on the amplifier.

All the above points will be dealt with fully in later articles, and notes given concerning maintenance and servicing. The term public address has still remained



The E.M.I. Service P.A. 116 10-watt amplifier with mixer panel incorporated.

controls for volume, tone, mixing, etc., would be mounted on a panel on the amplifier unit itself. Record reproduction could be from a table gramophone with a pick-up attachment to the tone arm, or from one of the cheap little record players sold to the public.

Then, again, portable equipment for use in canteens or at dances, where the equipment must be cleared away after each period of operation, may be all that is required, but to give satisfaction it must be capable of providing sufficient output, and it must be handled correctly while in operation. Varying numbers of people in the room will alter the acoustic properties, and feed-back may be experienced unless the volume control is turned down at the first signs of howling.

to cover all the various types of installations described, although originally it was applied to its earliest function of enabling open-air speakers to address large gatherings. Then the system was used for indoor meetings, and so on to flats, factory and other requirements. Among some groups of the radio profession the terms sound distribution or sound re-inforcement are coming into favour, but the original Public Address title, with its convenient abbreviation of P.A., will die hard, if at all.

Having briefly gone over the field covered by P.A. systems, we will commence to go through the equipment employed stage by stage, and next month's article will deal with the various types of microphones, their uses, and any particular features concerning their installations, cables, etc.

Problems of Amateur Receiver Design—9

Considerations Governing the Design of Simple L.F. Amplifiers for Battery-operated Receivers.

By FRANK PRESTON

THE low-frequency amplifier portion of the receiver is generally regarded as very straightforward. It is, nevertheless, well worth while to consider with a good deal of care the possible alternative arrangements which are available. Dealing first with battery-operated sets, we may look into the possibilities of

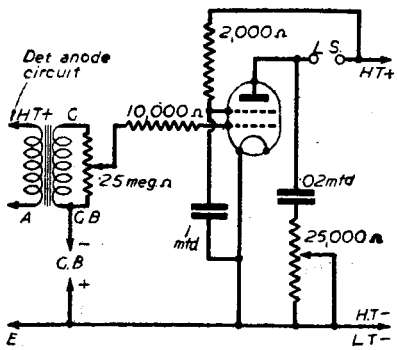


Fig. 1.—The circuit arrangement for an efficient transformer-fed tetrode output circuit suitable for about 500 mW. output.

the most widely used circuits with a view to finding the advantages and disadvantages of each from various points of view.

Audio Output

One of the first questions to be settled is that of the output required. This is essentially limited to something less than two watts unless a high-tension accumulator or a mains unit is to be employed. And if the simplicity of a "single" (as opposed to a push-pull system) output valve is desired, power output is normally cut down to less than 500 milliwatts. By using push-pull, Q.P.P., or Class B, an output of at least double this figure is easily possible.

When using one of these arrangements, however, it is desirable to employ an H.T. battery of "double" capacity and having a low internal resistance; special batteries were available for these conditions, but ordinary high-capacity batteries of reliable make are perfectly satisfactory. If an eliminator is used it should be of a type specially designed for the purpose, since the load varies over wide limits in accordance with the strength of the signals being handled at any moment.

One of the main advantages of using one of the forms of push-pull is that somewhat better quality can generally be obtained. This is not as important as it used to be, however, since the modern tetrode output valves are capable of giving quite good quality output when correctly used, whilst a pentode is fully satisfactory when a simple form of tone compensation is used in its anode circuit. The most important advantage is the comparatively large output with a low H.T. consumption.

The Simplest Circuit

Fig. 1 shows the circuit connections for a transformer-fed output tetrode. This would be used immediately after the detector valve, and with a transformer having a step-up ratio of about one to three. It will be seen that a potentiometer volume control is included in the grid circuit, while there is also a "stopper" resistance to prevent any "stray" H.F. from gaining access to the L.F. valve. Between the anode of the valve and the earth line there is a simple variable tone control in the form of a .02 mfd. fixed condenser and 25,000 ohm. variable resistor. If preferred, this may be replaced by a fixed condenser and fixed resistor with values in the region of .01 mfd. and 10,000 ohms. The precise values are

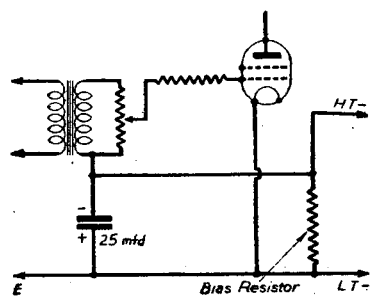


Fig. 2.—How automatic bias may be applied in the circuit shown in Fig. 1.

seldom critical, and the valve makers generally give some indication as to which are most suitable. In any case, the object of the condenser-resistor combination is merely to limit the high-note response and so to make the tone of the output more "natural."

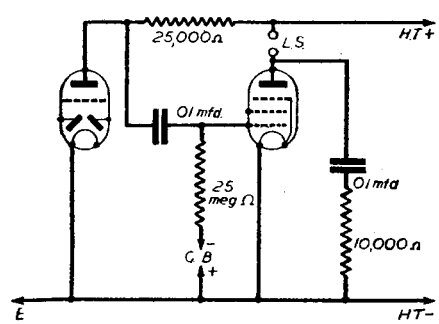


Fig. 3.—Skeleton circuit of an R.C.C. stage following a double-diode-triode. Fixed tone compensation is shown, and the connections given are for battery bias. Auto-bias may generally be used, as in Fig. 2.

It will also be seen in Fig. 1 that decoupling is provided for the screening grid; this is often unnecessary, although generally desirable. If it is not used, the screening grid may be connected directly to a tapping on the H.T. battery. The circuit shown is directly applicable to a pentode valve, in which the additional (suppressor) grid is connected directly to one side of the filament.

Automatic G.B.

Ordinary battery bias is indicated, but it is preferable to employ automatic bias, as indicated in Fig. 2. I do not propose to explain the method of arranging the auto-bias circuit, since that has already been done in this series of articles. The only point which should be stressed is that the calculation of the value of the bias resistor is done by taking into account the total anode current consumed by the set, and not by considering only the anode-current consumption of the output valve. In passing, it may be mentioned that auto bias gives definite advantages in regard to both volume and quality, since it ensures that the valve is always biased correctly regardless of the condition of the H.T. battery.

R.C. Coupling

If the output pentode or triode is used after a double-diode-triode second detector in a superhet it will usually be preferable to employ resistance-capacity coupling, as shown in Fig. 3, since there might otherwise be a chance of overloading the output valve. In such a case the volume control will generally be fitted between the double-diode and triode sections of the valve, as explained last month, so a volume control is not indicated in Fig. 3.

Although a small-power triode valve may be used with connections similar to those shown in Figs. 1 and 3, but without the need for the tone compensator, there is little point in using a triode for such a purpose nowadays. The valve would probably take as much, or more, current as a tetrode whilst giving a lesser degree of amplification and a smaller output. If a triode is to be used—because one is on hand—it should be fed through a good L.F. transformer giving a five-to-one step-up, or along with a preceding L.F. valve, when both may be resistance-capacity fed.

Quiescent Push-Pull

Ordinary or Class A push-pull amplification is not generally desirable for a battery receiver, mainly due to the fact that the anode-current consumption of two valves in push-pull is comparatively high: twice that of one valve. At the same time, push-pull is extremely useful, due to the fact that

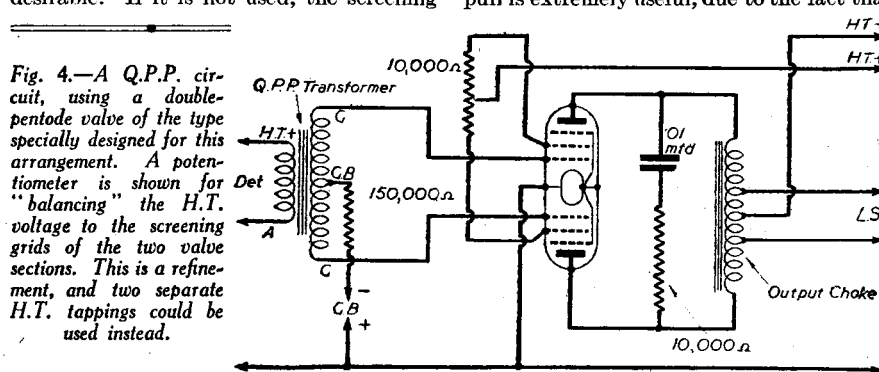


Fig. 4.—A Q.P.P. circuit, using a double-pentode valve of the type specially designed for this arrangement. A potentiometer is shown for "balancing" the H.T. voltage to the screening grids of the two valve sections. This is a refinement, and two separate H.T. tappings could be used instead.

it is capable of giving better reproduction and a greater output than a single valve. It is in this respect that Q.P.P., or quiescent push-pull, is very valuable. This form of amplification possesses almost all the advantages of Class A push-pull without the disadvantage of heavy anode-current consumption. In fact, the *average* consumption is seldom appreciably in excess of that of a single pentode, and may be even less. The "peak" or maximum current consumption, however, on the loudest passages of music, may reach 20 to 30 mA., and that is why a large-capacity, low-internal-resistance H.T. supply is required for successful working.

The circuit of a Q.P.P. amplifier is shown in Fig. 4, where it is assumed that a double (twin pentode) valve is employed. It is, of course, possible to use two separate "economy" pentodes, although the special valve is more convenient and cheaper in initial and replacement costs. The circuit is perfectly straightforward, and a special Q.P.P. transformer should be used. This has a step-up ratio in the region of one to eight, so that a very good over-all amplification is obtained. The G.B. voltage should be about double that used with a single pentode in a single-valve output circuit.

The Output Circuit

It will be seen that an output choke is shown, but this is not required when using a speaker having a so-called universal matching transformer with a centre tap, since the primary of this will take the place of the output choke. Should a choke be used it should be one made for a Q.P.P. circuit and provided with tappings to give a step-down ratio of about two to one. A tone-correction circuit, again comprising a condenser and resistor in series, is also shown connected between the two anodes of the Q.P.P. valve. This is desirable to avoid over emphasis of the higher audio-frequencies, and hence to prevent "shrillness" in the reproduction.

Class B Output

In many respects, Class B amplification is similar to Q.P.P. Actually, both systems are correctly described as Class B, but whereas grid current does not flow in the case of Q.P.P., it does with Class B. Class B is also "power-operated," which means that it must be supplied with power, and not just with a potential fluctuating at audio-frequency. The power is provided by what is known as the driver valve, which is simply a small power triode. This driver is an essential part of the circuit, and therefore Class B calls for the use of one valve more than is necessary with Q.P.P.

A circuit is given in Fig. 5, where the .02-mfd. condenser connected across the secondary of the Class B input transformer should be noted. The purpose of this is to suppress what is sometimes known as "Class B squeal"—a form of high-pitched background noise which resembles that due to various forms of parasitic oscillation.

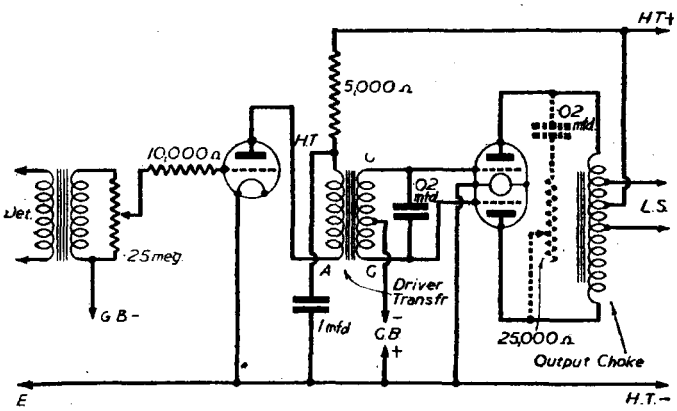


Fig. 5.—This skeleton circuit shows the arrangement of a class B amplifier with the necessary driver valve. G.B. is not necessary with some types of class B valve, in which case the centre tap of the driver transformer is taken to the earth line. The tone control in the output circuit is optional, and is therefore shown in broken lines.

There is also an optional tone-correction circuit between the two anodes, as used in Q.P.P.

Types of Class B Valve

There are two main types of Class B valve, one of which requires a certain amount of G.B. voltage and the other which takes a zero grid bias; in the latter case, the G.B. – lead indicated in Fig. 5 is simply connected to the earth line. Opinion differs as to whether or not it is better to use either of the types referred to, but I am inclined to favour the type requiring a grid bias. There is a further sub-division, since Class B valves are available for outputs of, very approximately, one watt and two watts. The former is the more economical of both L.T. and H.T. current, and is, therefore, to be preferred in the majority of cases when the maximum possible output is not required.

The output choke shown in Fig. 5, may be considered in the same light as that used for Q.P.P. That is, it is not required when using a speaker fitted with a universal matching transformer. If used, it should be of the special Class B type. The driver transformer is quite different from an ordinary push-pull or Q.P.P. transformer; firstly, because it has a ratio to each half-secondary of about unity; secondly, because the secondary must have a D.C. resistance not greater than about 400 ohms. The second requirement is on account of the fluctuating grid current which it has to pass. In the case of both driver transformer and output choke (if used) it is of paramount importance that good-quality components, specially designed for Class B, be employed. Poor transformers have a more profound effect on the output from Class B than they have on that from a single-valve or even a Class A push-pull output stage.

Consideration of L.F. amplifier for mains operated receivers must be left for a later article of this series.

New Commentators for B.B.C.'s Pacific Service

AN experienced, hard-bitten Australian journalist and a distinguished London journalist are now giving regular news commentaries in the B.B.C.'s Pacific Service. The former is P. E. G. Bayley, who has had 17 years' experience of Britain and Europe, and the latter, Cyril Lakin, Assistant Editor of the *Sunday Times*. Mr. Bayley gives his commentaries every Monday and Tuesday and Mr. Lakin on every day except Mondays and Tuesdays.

Born at Geelong, Victoria, in 1881, Percy Bayley, at the age of 15 drifted—his own word—into an office-boy's job on the *Geelong Advertiser*. By the time he was 35 he was relieving editor of the *Advertiser* and subsequently joined the *Melbourne Argus*, on which paper he was Associate Chief Sub-Editor by 1924. He then came to London as Editor of the Australian Press Association, a post which he held for 10 of the most pregnant years of post-war Europe. Locarno, the Naval Conference, the Economic Conference, and many League Assemblies were among the engagements he covered for the Australian Press. For the next five years Percy Bayley was London Manager and Editor of the Australian Associated Press, until doctor's orders forced him into retirement.

First Broadcast from Train

THE first broadcast that Cyril Lakin ever gave was from the back of a train in Regina, Canada. That was about six years ago, when he was one of a party of journalists visiting Vancouver for the 50th anniversary of the founding of that city. Since then he has broadcast more than 150 times.

Listeners to Headline News can visualise him as a grey-haired man in the forties, as quiet and pleasant as his voice. Into his life he has packed a wide range of responsible experience—as don, soldier, administrator, barrister and journalist, as well as broadcaster. When the last war broke out, he promptly left Oxford and joined the South Wales Borderers—he was born in the Vale of Glamorgan—and saw service in France and Salonika. Recalled in 1918, he became Assistant Commissioner of Food at the Ministry of Food. With the coming of peace he was called to the Bar, but soon found the wider field of journalism more alluring. He joined the famous Berry brothers, now Lords Camrose and Kemsley, in 1923, as their Editorial Secretary, and has remained with them ever since—as, among other posts, Assistant Editor of the London *Daily Telegraph*, and Literary Editor of the *Sunday Times*.

S.A.B.C. TO CO-OPERATE WITH B.B.C.

THE South African Broadcasting Corporation has now a mobile recording unit in Kenya and will regularly relay material to the B.B.C. relating to the activities of the South African Forces in South Africa for use in the Home and Overseas programmes. This unit is manned by two commentators and two engineers. The English commentator is Bruce Anderson, of Johannesburg, who, prior to the war, was one of the best known radio producers in the Union. He went to South Africa in 1935 with a theatrical company which was presenting *White Horse Inn*, and later he joined the S.A.B.C. as chief producer at Johannesburg.

His commentaries on various subjects before the war were noted for their smooth flow and aptness of description. Anderson was with the Army in Kenya when he was asked to take up his present position. Johan Lamprecht, who is the Afrikaans commentator, was recruited from the Engineering division of the S.A.B.C., having been engineer-in-charge of Pretoria Station. The two engineering operators responsible for the technical work of the mobile unit are J. Chapman and R. W. Sinclair.

Morse Made Easy

In This Article "The Experimenters" Give Some Helpful Hints and in Doing So Reply to Numerous Questions Which Have Recently Been Put to Them

IT is surprising how many experimenters are now giving their attention to the Morse Code. Most of them have done so many times in the past, but have either been too mentally lazy to master it, or have found that they could not progress beyond the initial stage. Many of these experimenters are anticipating the time when they will join the Services, and are hoping that they will be able to be posted as wireless operators or perhaps as signals

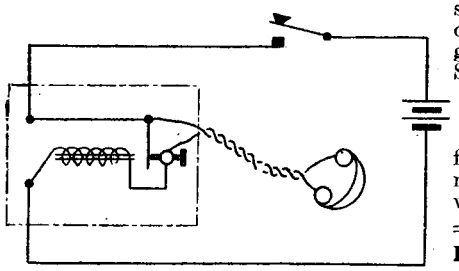


Fig. 1.—An excellent morse practice set using a good high-rate buzzer in conjunction with a morse key and a pair of 'phones.

officers. Provided that the other qualifications are in order, it may not be strictly necessary to have a knowledge of morse in order to be accepted for signals work, but a good working knowledge is extremely helpful in many ways. Those who are not considering joining one of the Services find morse very interesting while amateurs in this country are off the air.

How to Start

The question is one of how to learn morse in a quick and interesting manner. There is no easy way, for whatever method of learning is adopted constant practice and application are essential. But if the correct methods are adopted from the outset the self-appointed task is less tedious and far more interesting. If you were to ask three or four experienced wireless operators how you should proceed to learn the code they would probably each suggest a slightly different procedure, but all would agree that determined practice and constant practice are of paramount importance.

Let us start from the beginning, assuming that the reader does not even know the morse alphabet; [for his benefit, it is reproduced on this page. But remember that it is a waste of time—in fact, it is worse than that, because progress is retarded—to learn the symbols by sight. Morse consists of a series of groups of sounds, and must be learnt as such. Thus, instead of learning the letter A as dot-dash, it should be regarded as similar to the sound made when you say dit-dah, or de-dah. Similarly, F is not dot-dot-dash-dot, but dit-dit-dah-dit.

Learning the Sounds

This might sound a little complicated, but if you tune-in to a morse transmission you will understand our meaning. Some people find that they can whistle the sounds representing the letters of the code. The sound made in that way is very similar to that made by a C.W. transmitter, and this, therefore, forms a convenient method of memorising the sounds. Take a good, deep breath and, with the lips almost closed and applying very little air pressure, try making the sounds through the mouth. If you start in that way you will save a considerable amount of time later in attempting to "translate" the sounds into the printed dots and dashes.

When possible, it is desirable to have some instruction from an experienced operator from the very start, but that generally makes matters more difficult. So it will usually be necessary to learn the alphabet without any assistance. There are various recommended methods of learning the morse alphabet of which the following is typical. Start with the letters made up of dots only, such as E, I, S and H which consist of one, two, three and four dots respectively; then learn the "dash" letters, T, M and O; attention can then be turned to "opposites" such as A (•–) and N (–•), U (••–) and D (–••), B (–•••) and V (•••–), Q (––•–) and Y (–•––), F (••–•) and L (•–••), P (•––•) and X (–••–). Other examples will suggest themselves if the alphabet is examined.

Although some readers may find some grouping of letters helpful, others will not and may find it better to make sure of, say, the first six letters of the alphabet, then the next six, and so on. If that method is adopted, try not to learn the letters in sequence, however, or to have a little practice with words or groups of the letters already learnt. The whole idea is that the letters must be recognised immediately by their sound, and not by their relation to any other letters.

Practice Time

If a half-hour to an hour a day is devoted to obtaining a thorough grasp of the alphabet it should be possible to learn it in less than a week. By that time it should be possible to recognise any letter when sent fairly slowly by another person. At first, however, it will probably be found necessary to think for a second or so before the letter can be written down. It is that thinking period which should gradually be eliminated, so that eventually any correct sequence of dits and dahs is translated into a letter by the subconscious mind. In fact, it

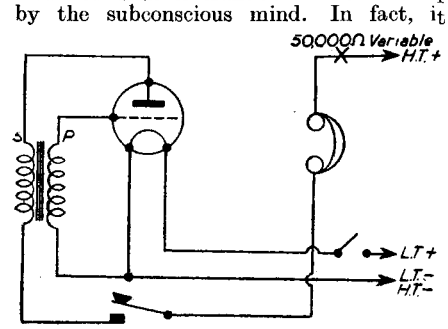


Fig. 2.—If preferred an audio-frequency oscillator, with the circuit shown here, may be used for practice purposes.

should be possible to recognise •– – –, for example, just as easily as the spoken letter J. To do that it becomes necessary to think in terms of the code, just as it is necessary to think in terms of another language when that language is being learnt.

The ideal method of learning morse would probably be to listen to code sent by a *good operator* for a few weeks before ever attempting to send morse yourself. It is seldom that that can be done unless you obtain a set of Morse Instruction gramophone records, or have a friend who can send really well. The reason for this is that the secret of

(Continued on page 250.)

International Morse Code

A	dit dah	•–
B	dah dit dit dit	–•••
C	dah dit dah dit	–•–•
D	dah dit dit	–••
E	dit	•
F	dit dit dah dit	••–•
G	dah dah dit	––•
H	dit dit dit dit	••••
I	dit dit	••
J	dit dah dah dah	•–––
K	dah dit dah	–•–
L	dit dah dit dit	•–••
M	dah dah	––
N	dah dit	–•
O	dah dah dah	–––
P	dit dah dah dit	•––•
Q	dah dah dit dah	––•–
R	dit dah dit	•–•
S	dit dit dit	•••
T	dah	–
U	dit dit dah	••–
V	dit dit dit dah	•••–
W	dit dah dah	•––
X	dah dit dit dah	–••–
Y	dah dit dah dah	–•––
Z	dah dah dit dit	––••

Number Code

1	dit dah dah dah dah	•––––
2	dit dit dah dah dah	••–––
3	dit dit dit dah dah	•••––
4	dit dit dit dit dah	••••–
5	dit dit dit dit dit	•••••
6	dah dit dit dit dit	–••••
7	dah dah dit dit dit	––•••
8	dah dah dah dit dit	–––••
9	dah dah dah dah dit	––––•
0	dah dah dah dah dah	–––––

Note of interrogation	dit dit dah dah dit dit	••––••
Note of exclamation	dah dah dit dit dah dah	––•–––
Apostrophe	dit dah dah dah dah dit	•––––•
Hyphen	dah dit dit dit dit dah	–••••–
Fractional bar	dah dit dit dah dit	–••–•
Brackets	dah dit dah dah dit dah	–•––•–
Inverted commas	dit dah dit dit dah dit	•–••–•
Underline	dit dit dah dah dit dah	••––•–
Preliminary call	dah dit dah dit dah	–•–•–
Break sign	dah dit dit dit dah	–•••–
End of message	dit dah dit dah dit	•–•–•
Error	dit dit dit dit dit dit dit	••••••••

ON YOUR WAVELENGTH

By Thermion

Dance Music

I WAS very pleased indeed to receive a letter from "The Swinging Projectionists" agreeing with my comments on dance music. Like some bold people from the North, however, they omitted to give their names and addresses, but I see that the letter is post-marked Edinburgh, so I hope they will come forward and be recognised. They write to say how much they enjoy my criticisms of dance music, and those who purvey dance music. This is praise indeed from those who claim to be swinging projectionists. They agree that I am in the best position to criticise the matter, and they also agree with my criticisms regarding announcers. They also agree that listeners do not have a chance to say whether they like dance music or not. It is just plugged into them, and so it is presumed to be popular—just about as popular as some of the decisions of Continental Governments who have signed on with the Axis, whilst the people they are supposed to represent are revolting against the decision. All the same, the fact that the swinging projectionists are afraid to sign their names, and to give their addresses, rather puts them in the same class as crooners.

Those German Spies

A. S., of Kidlington, disagrees with me over my recently-expressed views concerning the number of spies who undoubtedly came into this country posing as German-Jewish refugees. He says: "Spies have not come in as refugees, but through some amazing laxity on the part of the authorities, a number of genuine Nazis were admitted into this country shortly before the war." I do not accept this statement. It is unthinkable that the Germans, when they found that Chamberlain was prepared to provide sanctuary for tens of thousands of German-Jewish refugees, did not take advantage of the fact to provide spies with rigged passports. We all sympathise with the genuine German-Jewish refugee, but the fact that some were found with transmitting sets rather proves my point. These refugees were allowed into the country apparently without investigation as to their bona fides.

In Other Words

I DON'T know how many of my readers can remember George Robey's song during the last war when he was appearing in the "Bing Boys." It was entitled "In Other Words," and consisted of stanzas of euphemisms, and long words intended to describe trite sayings, such as "a thick ear." I see that there is now a move by the Government to eschew officialese from official memoranda. That bright house journal, *The Shell Magazine*, says: "We expect shortly to see this extended to the B.B.C., and we look forward to hearing news bulletins in the vernacular. For example, 'Well, chums, here we are again, all merry and bright, and this is your old pal, Lancelot Featherstone (Feathers to you), giving you the low-down on the one-pip-emma news. You will all be pleased to hear that our boys went over and gave Jerry another pasting last night. An Air Ministry communique (di-dah, di-dah) just issued says as how the Rhineland had another basinful last night, and the Ruhr copped another packet. Of course, they potted our 'planes a bit, but they all came home O.K.'" I am evidently not alone in my view that announcers should not be allowed to advertise themselves in the simple task of reading from a sheet of typewritten copy.

To the B.B.C.

ONE of our morning newspapers, under the heading of "Do Drop the B.B.C. Accent," gives the B.B.C. the following advice: "Your broadcasts to America are good, but for goodness' sake cut out what the Americans contemptuously call the 'Oxford accent.' They hate it. They want to hear talks from the men who are actually doing the job, not from professors. They have been 'professed' to death." I concur in these views, and I confess that I do not like to be talked at by professors. Our women announcers are as bad as the men, and the moment that most of us hear a woman announcer start announcing that "You ahh neow ahbout to heah-ah the Ministah-ah of Agricultshaw," we switch off our sets.

All the Way from "Boaton"

ONE of my readers, rejoicing in the name of Fliteroft, and hailing from the salubrious district of Bolton, does not like some of my views on announcers and dance music. One against. I do not withdraw any of them, however. I am tolerant of other people's views and expect them to be tolerant of mine.

Square Pegs in Round Holes

L./CPL. H. airs a grouse which I have received from many skilled readers. Before the war he was an A.A. man with an amateur transmitting licence. He registered for service in the wireless section of the R.A.F., but on being called up found that he had no choice in the matter and that he was being put into a particular branch of the Army, although he had expressed preference for the R.A.F. His work is mostly buzzer stuff, not requiring a great deal of skill to adjust or operate. Like many other readers, he has tried all official ways to get a transfer, without result. I am quite sure that the officials at the Air Ministry do not know of these cases or they would not be making appeals for amateurs to offer their services.

Who is the Doyen?

I HAVE received the following note from G. N. G. (Ruislip). "I thank you for the Superhet Manual which I was very pleased to receive. I shall certainly learn a good deal from it. By the way, I mentioned the fact in my essay that I was 41 years of age. Would it not be interesting to know which reader of PRACTICAL WIRELESS claims to be the oldest wireless amateur?"

How to Become a Radio Star

A MODERN VOCAL
FOR USE OF DANCE BAND CROONERS AND CROONETTES.

You are my—
Rumpty dumpty tiddly umpty funk—with eyes so blue;
I'll hanky-panky, hokey-jokey lulu daddle true;
We'll copsey wopsey upsey dopsy kokum melod-e-e-e,
And moo-moo doo-doo, diddum dadsum, di do memorie-e-e-e.

Refrain:

Bub, bub, bub, bub, and hi de do,
Wiggle waggle moon;
Underneath barrump barramp,
Bub, bub, bububbity coon.
Goo-goo lala popsey,
Pom-pom popsey woo,
Where you and I will gumpasoozle soon!

This has every element for an enormous radio success! It doesn't make sense, which is not popular for "Vocals," but it has R-H-Y-T-H-M—

Any title which suggests itself will do, since the words don't make sense. There is no need for the title to do so either, but the following suggestions may be useful. All are highly unoriginal, and, with slight variations, have been used many times previously: Your Eyes So Blue; Lovesick Coon; Love's Melodeeeee; Wonkey Ponkey Moon; Lalla Palooka Blue, etc., etc.

It is not at all necessary that listeners should be able to tell what it is all about, and in rendering it full use should be made of the back of the throat and nasal passages.

Practice above assiduously, and when you consider yourself quite perfect (which will probably not be long) apply to the B.B.C. for an audition.

Who knows? *It may make you a star in a night!*

There is good reason to suppose that it has taken even less in many instances.—"TORCH."

Our Roll of Merit

Our Readers on Active Service—Fourteenth List.

G. Wilcocks (Gunner, R.A.), Suffolk.
F. Thompson (Pte., R.A.O.C.), Wilts.
D. R. Stubbs (A.C.1, R.A.F.), Newcastle.
C. March (Signalman), York.
F. Spencer (Driver, R.A.), Essex.
E. W. Higgins (Gunner), Northampton.
H. Grimmett (R.A.F.), Berks.
F. C. Critchley (Gunner), S. Wales.
G. Graham (Flt.-Sgt., R.A.F.), Scotland.
L. Pearson (A.C.2, R.A.F.), Salop.
W. Coombe (Pte., R.A.O.C.), Kent.
J. R. Smith (Sgt., R.A.F.), Cumberland.
T. Boyd (L.A.C., R.A.F.), Carlisle.
W. Escott (Rifleman), Swansea.
L. Woodward (Gunner, R.A.), Swansea.

MORSE MADE EASY

(Continued from page 248)

morse is the correct spacing of the dits and dahs, of the letters and of the words. The space between letters should be equal to two dits, and between words, five dits. This sounds very simple, but it will be found that it is difficult to make correct spaces unless the ear has first become accustomed to the rhythm of the various letters.

Making a Practice Set

If you cannot obtain the assistance of a friend and have no gramophone, you will have to do some sending from the beginning. The best method is to make some kind of device with which 'phones can be used, since the mechanical sound from a buzzer is seldom like that produced by a C.W. transmission. The simplest practice set consists of a good-quality high-note buzzer, a small dry battery, a good morse key and a pair of 'phones, wired as shown in Fig. 1. But do note the importance of using good components. A poor buzzer will make a horrible "scratchy" sound and will probably miss some of the dits or "crack" during the dahs. That makes it impossible to recognise the correct sounds. The best buzzers for this purpose make very little mechanical noise, but give a very good, clear note in the 'phones when wired between the buzzer contacts, as shown in Fig. 1. An alternative method of connection is to put them in parallel with the buzzer windings.

If the key is a cheap, shoddy affair it will not work smoothly, and progress will be retarded. There should be no side-shake on the key bar and the base should be substantial or screwed down to an old table or solid wooden board. On a good key it will generally be found that there is adjustment for the width of the contact gap and for the spring tension on the bar. When starting, it will probably be found best to leave the gap fairly wide—say, 1-16in.—and to set the spring so that the tension is near the maximum. As speed is increased the gap and the spring tension is reduced.

A form of valve oscillator can be used in place of the buzzer by using an HL type of battery valve in the circuit shown in Fig. 2, where an L.F. transformer is used for grid and anode coupling. The note produced can be varied by reversing the windings, whilst it may be necessary to reverse the connections to *one* of the windings to make the valve oscillate.

Emphasising the Characters

In sending it is important to keep the speed down until the spacing is fairly good. It will also be found better initially to make the dahs rather too long (that is, more than three times the length of the dits) and to "cut" the dits. This is to give greater emphasis, and to make sure that there is no confusion between the two components. Our opinion is that, when the spacing question has been mastered, the letters should be sent fairly quickly, leaving more than the correct space between letters and between words. In other words, the letters may be sent at a speed corresponding to, say, 10 words a minute, although the actual transmission is at only five or six words a minute. There are some experienced operators who will disagree with this, maintaining that the spacing should be correct (two dits and five dits respectively) regardless of the speed of transmission.

Increasing the Speed

While referring to speed, we might mention that it should be possible to receive at four words a minute straight away after the alphabet has been learnt. After about another month of steady practice the speed should have increased to between eight and ten words a minute. From then onward it is all a matter of constant practice to increase speed. Many people "stick" around this speed, partly because the code is not yet read subconsciously and partly because they cannot write down the letters quickly enough in the spaces between them. It is necessary to acquire the habit of writing "one letter behind"—writing down one letter while the next is being sent. When the speed has increased to between 12 and 15 words a minute it is practically essential to receive whole words at a time, listening to the complete word before writing it. Always have the morse sent slightly too quickly, so that you miss a letter here and there; if the speed is "easy" you will never improve on it.

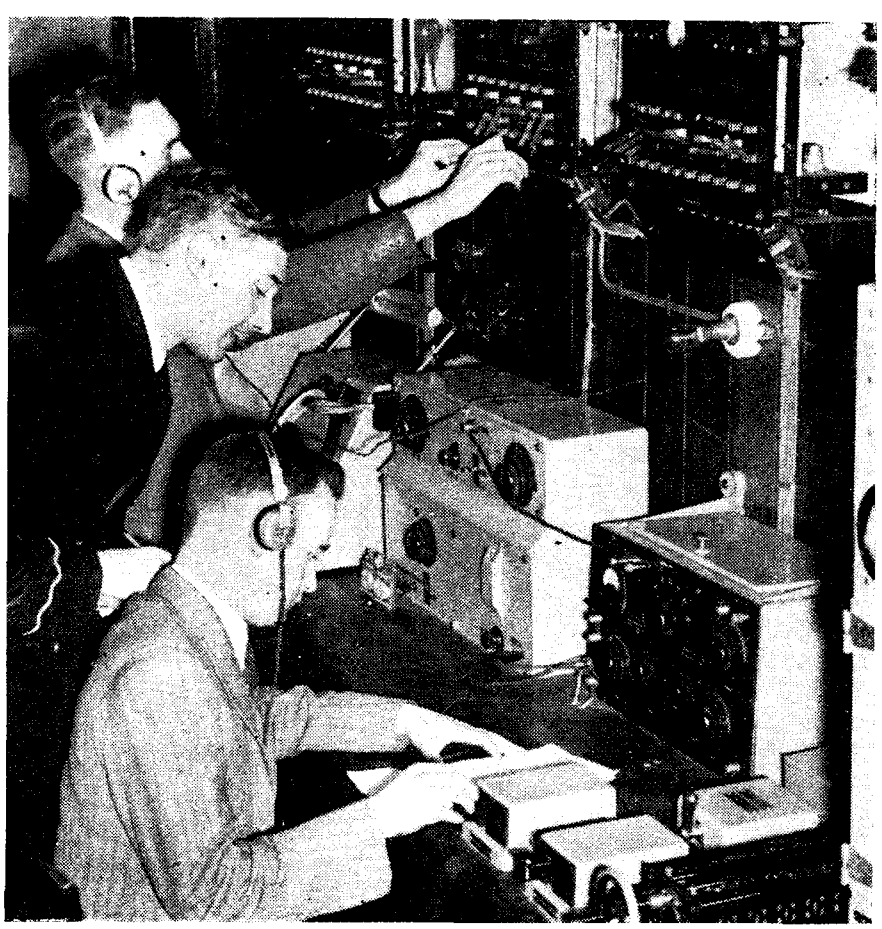
There are scientific methods of teaching the more advanced procedure, one well-known one being the Candler System which is taught through the medium of a correspondence course. When the learner is compelled to work on his own, a system of this kind is extremely valuable, not only because it trains the subconscious mind in a scientific manner and therefore eliminates what might otherwise be a severe nerve strain, but because it prevents the acquisition of wrong methods which may completely prevent the learner from ever reaching a speed in excess of about 12 words a minute. The system can also be applied to the initial learning stage, and certainly reduces the tedium while preventing the formation of bad habits.

Using Broadcasts

Just a word about listening to broadcast morse transmissions. Remember that any messages picked up must not be divulged. Therefore, should you take them down, destroy the written copy immediately the transmission is concluded. Also bear in mind that many transmissions are made in code or cipher; therefore, if you receive groups of five figures, or of four letters and figures combined, etc., they will mean nothing to you although providing excellent practice. Do not, therefore, think that you have made a "hash" of receiving should you get meaningless groups of this kind.

It is customary to send ····- (letters V and E joined together) to indicate that a message is about to be sent, and then to make either ·-·-·- (three A's joined together) or -···- (B and T joined together) to indicate that the message will be sent in plain language or code respectively before the actual transmission begins. To show that the transmission is ended ·-·-· (letters A and R joined together and sent as one) is made.

We are going to repeat our initial advice: constant practice and perseverance are essential to success. Make a habit of practising for at least half-an-hour every day, when you will find that it is by no means as difficult to learn the Morse Code as you thought it was. Once you know the alphabet, have as much receiving practice as you can get; ignore the transmitting side until you can receive. Most people can transmit far more easily than they can receive, but they do it badly if they have not learnt the proper rhythm of the letters.



Showing the extensive equipment used in one of the wireless training colleges.

A Service Engineer's Log

A Further Selection of Notes which will be Found of Practical Aid by Both Experimenters and Other Service Men

THE owner of a well-known battery receiver of the self-contained pattern recently asked me to rectify a fault which had developed suddenly. The trouble was that the set had lost its previous selectivity, while it appeared to be less sensitive; selectivity was so poor that a good deal of interference was experienced even when listening to the Home Service programme, which was normally received at very good strength.

Until a preliminary test had been made it was expected that the reaction circuit, or the anode-feed circuit to the detector valve, was probably at fault. But since the reaction control was operative, and the receiver could be made to oscillate easily enough, it seemed unlikely that the trouble lay in that direction. The next step was to try the effect of replacing the H.F. valve, but that did not make any difference. A rough check of anode currents to the various valves was also unproductive.

Trimmer Adjustment

The effect of adjusting the trimmers on the two-gang tuning condenser was next tried. It was then found that, although the setting of the trimmer in parallel with the condenser tuning the grid circuit of the detector was quite sensitive, adjustment of the other was without effect. It was then fairly clear that the fault was in the aerial-tuning circuit—although the tuning of that circuit is generally comparatively flat. It was considered desirable to make a simple continuity test of the aerial coil, using a grid-bias battery and the loud-speaker. This showed that there was an open circuit whether the wave-change switch was in the long- or medium-wave position. That indicated a break in the medium-wave winding, and it was then soon found that the end lead from this to the grid terminal was broken, apparently as a result of corrosion at the soldered joint. After cutting away the corroded end of the wire and soldering another short length in its place the receiver worked normally again.

The corrosion could have been due to the use of an unsuitable flux when the coil was made originally, or, more probably, due to attack by the "spray" given off by the accumulator each time it was inserted into the cabinet after charging.

Grid "Stopper" Resistors

Another fault which I had to deal with a week or two ago was in a commercial all-wave receiver which had apparently been modified by some "expert" or other after the set had left the factory. It appeared that the previous owner of the set (which had been bought second-hand) had tried to improve reception on short waves by the fairly standard method of inserting a stopper resistor in the grid circuit of the L.F. valve. This valve was transformer fed, and there was an L.F. volume-control potentiometer as shown in Fig. 1. The "stopper"—for preventing the passage of H.F. into the L.F. amplifier—had been inserted at the point shown.

Actually, the fixed resistor was marked 5,000 ohms, while the potentiometer had a value of 250,000 ohms. Thus, although the resistor had been wrongly connected (it should have been at the point marked X in Fig. 1), this should not have caused any serious loss of volume, since its value was so low in relation to that of the volume control. At this point it might be worth while pointing out that when the resistor is in the position shown it is in series with the potentiometer, and thus has the effect of preventing the volume control giving a proper "maximum" even when turned fully anti-clockwise.

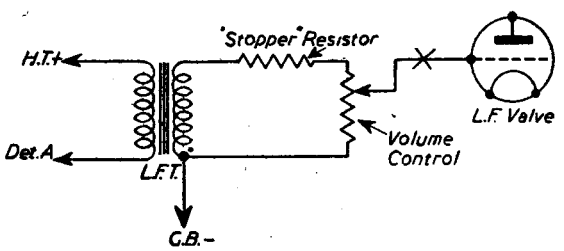


Fig. 1.—A high-resistance "stopper" resistor in the position shown will cut down the maximum volume to a marked degree, due to its being in series with the element of the volume-control potentiometer.

However, when the "stopper" resistor was tested with an ohm-meter it was found that its actual value was well over 100,000 ohms. Consequently, it was cutting down the possible output to a considerable extent. Presumably, the resistor had developed a fault a long time after it had been fitted, and this was why the output from the set had at first been unaffected—at least as far as could be judged by ear.

Had the resistor been put in the correct circuit position, however, it would have had practically no effect on the output in spite of its abnormally high resistance when defective.

Extension Speaker Leads

This brings to mind another difficulty which I was asked to investigate, and which depends upon somewhat similar principles. In this case a commercial set was in use, and provision was made for using an extension speaker. In the set-manufacturers' instructions it was made clear that the speaker should be of the low-resistance type, a value of 7-10 ohms being suggested. But the owner was, in fact, using a speaker of this type, and one which he knew to be in good working order, since he had used it satisfactorily on another set in conjunction with the appropriate step-down output transformer.

The reason for its giving an extremely poor output was at once evident to me, however. The speaker was fed by means of a 15-yard length of very thin flex; this must have had a resistance in the region of 3 ohms over all, and this resistance was in series with the 7-ohm speech coil of the speaker. Thus, of the total output from the set, only about 7/10 was being used to operate the speaker; the remainder was "lost" across the resistance of the wire. When using a low-resistance extension speaker it is essential that the wire used to connect it to the set should be of stout gauge or heavy flex, and that it should be kept as short as possible. By reducing the length to about three yards and using good lighting flex the volume level from the extension speaker was increased to a marked degree.

Incidentally, there are few sets to-day which have provision for a low-resistance speaker, and therefore, a standard type of extension speaker, preferably with built-in matching transformer, should be used.

Superhet Instability

A form of oscillation, more marked on strong signals than on weak, was reported with a superhet of fairly old type. Investigation showed that a new I.F. valve of V.M., H.F. Pen. type had been fitted in place of an S.G. valve which was several years old when replaced. It was not difficult to understand, therefore, that instability was probably due to the far greater degree of amplification provided by the new valve. The trouble would not have occurred, of course, if the replacement valve had been of similar type to the old one, but there was little point in telling the owner of this after he had bought the new valve. Instead, the trouble was easily overcome by applying a bias of three volts negative to the valve, as shown in Fig. 2, and tightening the coupling between the two windings of the preceding I.F. transformer.

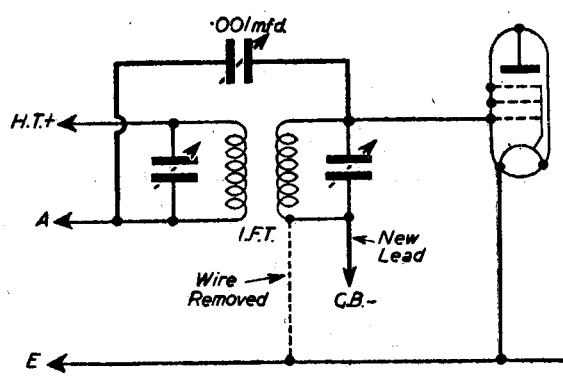


Fig. 2.—I.F. instability resulted from replacing an old S.G. valve by a new V.M. H.F. pentode. Stability was restored by applying a negative bias to the grid of the valve and increasing the degree of coupling between the primary and secondary windings of the preceding I.F. transformer. The alterations made are indicated by heavy lines in this diagram.

If it had been possible, I should have tightened the coupling by the very simple method of moving one of the windings nearer to the other. This was not feasible, since the screening can was rigidly held in position by a couple of rivets. I therefore connected a .001-mfd. pre-set condenser between the high-potential ends of the two windings, as shown in Fig. 2, and adjusted this until the maximum signal strength was

obtained without the instability. In most cases of this kind it is sufficient to fit a .0005-mfd. fixed condenser, but it is worth while to use the pre-set and adjust it carefully.

Converting to Variable-mu

If the owner had agreed, I should have fitted a potentiometer volume control instead of applying a fixed bias to the I.F. valve. This would have been rather more costly, however, due to the need for buying a potentiometer and replacing the on-off switch by one having an extra pole; this is to break the bias circuit when the set is switched off, and so prevent the G.B. battery from running down, through the potentiometer, while the set is out of use.

Volume Control "Reversed"

What seemed to be a peculiar fault was described by the owner of a two-H.F. receiver which was fitted with two variable-mu valves. The fault, as explained, was that the variable-mu control worked "in reverse"; that is, when it was turned toward maximum the volume level was reduced, and vice versa. When the set was put on test I was convinced that the volume control had no effect whatever, and that what the owner described as a reverse action was attributable to a psychological phenomenon, since volume was not increased, he *imagined* that it was reduced.

But whether that was so or not, I checked the potentiometer by means of a milliammeter and dry battery (taking care to start with only 1½ volts and with the contact arm at minimum, to avoid overloading the meter). The component was perfectly sound. Then I kicked myself for being so stupid as not to think of testing the G.B. battery before; two cells were completely "dead," and since they were the two at the nine-volt end of the battery they did not affect the bias to the output valve, which was taken from the 4½-volt tapping.

A Superhet Fault

An A.C. superhet refused to operate, although the L.F. portion was found O.K. when checked with a gramophone pick-up. When the frequency-changer and I.F. amplifier were put out of action by connecting the aerial coil direct to the triode second detector fairly good signals were received from the British M.W. transmitters, showing that the second detector was in order. H.T. current to the anodes of the various valves was next checked, when it was found that the frequency-changer was passing a lower current than it should; the oscillator section of the pentagrid was actually taking only about .2 mA. A new valve was tried, but this did not have the slightest effect. All anode-circuit components were found to be correct when their approximate resistance was measured, so the heater voltage was measured between the valve-holder sockets—with the valve still in place—with a moving-iron meter. It was under three volts for the F.C., against about 4.1 (by the meter) at the other valve-holders.

The cause of the fault proved to be nothing more serious than a faulty connection between the end of the flex used for heater connections and one of the valve-holder sockets. The end was badly frayed and only one strand was touching the socket. And even that was not making very good contact.

With battery sets, a similar fault has often been traced to a run-down accumulator or dirty on-off switch contacts.

A Radio Compass for Small Vessels

A Unit which Enables Radio Bearings to be Taken to Determine a Ship's Position

MARINE radio-telephone equipment is finding wide use in pleasure craft of various types. Although it is employed primarily for ordinary communication with shore, it has great potential value for summoning assistance in emergencies. Previously, only the larger vessels equipped with radio-telegraph and manned by a commercial operator had such facilities. To increase the usefulness of Western Electric marine telephone equipment, the Bell Laboratories recently developed the 50A radio-compass unit. When associated with the telephone equipment, this unit will permit radio bearings to be taken to determine the ship's position.

The radio compass unit made by Western Electric.

The Compass

The compass unit consists of a small metal box carrying tuning and volume controls on the front, and the loop aerial on the top. Power is obtained from the radio telephone unit, and the loudspeaker of this unit is also employed. A jack is provided on the compass unit, however, to permit a headset to be used instead of the loudspeaker if desired. A switch on the telephone set switches these circuits to the regular aerial or to the compass as desired.

The 50A compass unit covers the frequency band from 230 to 350 kc., which includes all of the marine radio beacons maintained by the United States lighthouse service at strategic points on the Atlantic, Pacific, Gulf Coasts, and on the Great Lakes. By taking bearings on two of such stations, a ship's position may be determined regardless of fog or darkness. Also included in the band from 230 to 350 kc. are numerous aircraft beacon stations operated by the Civil Aeronautics Authority.

Simple Operation

On installation, the compass box is permanently fastened in position and the bearing scale on the base of the loop, which is adjustable in position, is set so that the zero gives a direction in line with the keel of the vessel. After a signal has been tuned in, the loop is turned to the position of minimum signal. The reading of the scale then gives the bearing in degrees with respect to the ship's keel. The true bearing of the station may then be determined by the application of the ship's course as obtained from the magnetic compass.

The 50A compass was designed particularly for use with the 227B radio-telephone equipment—a small radio-telephone set, operating on either 6 or 12 volts D.C. and designed primarily for small vessels. Only minor modifications are required, however, to permit it to be used with either the 224 or the 226 types of radio-telephone equipments.—(Bell Laboratories.)

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received by the First Post on the third Monday in each month for publication in the next issue.

ASHTON-UNDER-LYNE AND DISTRICT AMATEUR RADIO SOCIETY

Headquarters: Beaconsfield Conservative Club, Stalybridge Road, Ashton-under-Lyne.

Hon. Sec.: K. Gooding (G3PM), 7, Broadbent Avenue, Ashton-under-Lyne.

Meetings: Wednesdays and Fridays at 8 p.m.

THE conversion of the club's receiver from A.C. to D.C. operation was finally completed at the meeting held on March 5th, and with the aid of a signal generator and associated gear loaned by Mr. W. Taylor the coils were accurately calibrated and the receiver is now in operation.

A number of youths from a local squadron of the A.T.C. have now joined the society, primarily with the object of obtaining additional morse practice and instruction on the basic principles of radio.

On April 2nd a lecture and demonstration was given at the club-room by Messrs. Robinson (of Cossors, Ltd.) and A. J. Aiers, on the subject of "Quartz Crystals." Mr. Aiers dealt with the growth and formation, and Mr. Robinson with the cutting, grinding and applications. Appropriate lantern slides were also shown.

PRESTWICH YOUTH MOVEMENT RADIO CLUB

THE above organisation, which was mentioned in the March issue as a proposed radio club, has now been started and is working well. The club's headquarters is in the Craft Room (1st floor), Hope Park School, Bury New Road, Prestwich, Manchester, and club nights are every Monday, Tuesday and Thursday, commencing at 7.15 p.m. Instructions on the learning, etc., of the morse code are given every evening and lectures are being arranged from time to time. The construction work has begun with the building of a power pack for use on various receivers, etc.

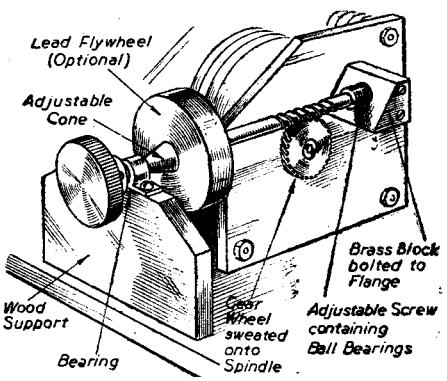
The club is available to all youths between the ages of 14-20 who are interested or who wish to become interested in radio. A receiver is to be installed in the club-room in order that short-wave listening can take place whenever necessary, and the subscription fee is only 1d. at each meeting attended, there is no entrance fee, and it is not necessary to have any technical qualifications to become a member.

All further details can be obtained by calling at the club headquarters on any of the above-mentioned nights, or at the home of the organiser and instructor, Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

Practical Hints

Slow-motion Drive

I HAVE just fitted the following slow-motion drive to an old-type condenser for short-wave work. The driving gear has been made up from parts taken out of a defective car speedometer which I picked up for a few coppers at a "car cemetery." These instruments are precision made, and yield a variety of useful gears and parts for the experimenter. The



A simple slow-motion drive.

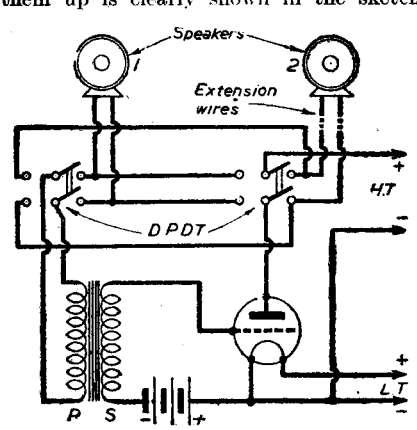
gearing mechanism can be used to give various reduction ratios, the scheme I have adopted being as shown in the sketch. The lead flywheel has been left on the shaft, as this appears to give additional control, and keeps the condenser stable at any given setting. The other end of the condenser shaft is carried through the panel to the tuning dial, the tuning knob being on side of chassis.—L. A. JACKSON (Narborough).

House Telephone Circuit

MOST readers will be familiar with the scheme whereby a loudspeaker is used as a microphone in conjunction with the wireless set. Leads can be run to any part of the house, where one can listen-in to the "microphone" on another speaker.

The snag is that one can only have a one-way conversation, however, and if anything approaching a house-telephone is contemplated, two-way working is essential. By using the scheme shown in the sketch two-way working is possible.

It will be seen that there are two D.P.D.T. switches, and the method of connecting them up is clearly shown in the sketch.



Circuit diagram for a novel house telephone system.

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 £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. 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." DO NOT enclose Queries with your hints.

SPECIAL NOTICE
All hints must be accompanied by the coupon cut from page 268

When both switches are thrown over to the right speaker No. 2 is in the anode circuit of the valve, while speaker No. 1 is the microphone. When both switches are thrown to the left No. 1 is automatically placed in the anode circuit and No. 2 becomes the one that is spoken into.

Only two wires are run to the room with which it is desired to converse, and all switching has to be done by the operator beside the set. This is accomplished in a matter of a second or two, so that something approaching a two-way conversation can take place.—WM. NIMMONS (Belfast).

Plug and Socket Connectors

I HAVE found that the hollow end of an ordinary wander-plug, as used for H.T. battery connections, is very useful as a socket device. The longer type of wander plug (with a grub screw for securing the wire) fits quite well into this socket, as shown in the sketches, Fig. 1. In some makes of plug the hollow end is a little large for a tight fit, but a good connection can be obtained by pinching the two halves of the hollow portion together slightly, by a pair of pliers. This provides a means of connecting two leads to one socket in an H.T. battery, so that either can easily be disconnected when required. The first lead is made into a loop, just large enough to fit around the plug, and the loop is soldered to prevent it becoming frayed out. The loop is tightly secured between the brass collar and the insulating piece of the plug. The second lead is connected to the other plug in the usual manner, which fits into the end of the first plug, as indicated.

If the end of a lead is soldered to the tip of a wander plug, and the joint is bound with insulation tape, then any connection desired—plug, spade terminal or crocodile clip—can be attached to the lead, using the socket provided. To do this, a number of slotted pins are removed from old short-wave coils (any other plug that will fit the socket will do). These slotted pins are soldered to the ends of wander-plugs, spade terminals and crocodile clips, as shown in the sketch, Fig. 2. Any required connector can then be plugged into the end of the lead. I find this device very useful for experimental connections to batteries, accumulators and inside wireless sets, when I often have to change the connector on the end of a lead. I keep a number of lengths of single wire and flex provided with sockets at both ends for experimental connections.—G. ELLIOTT (Gillingham, Kent).

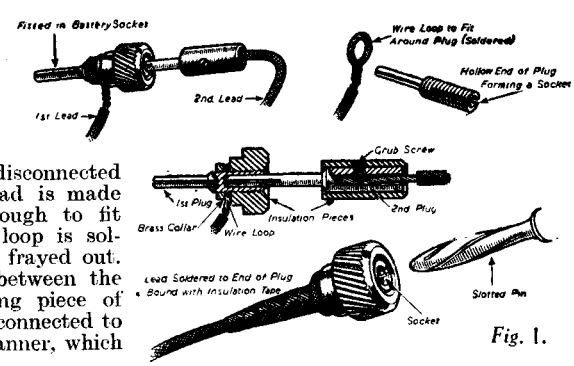


Fig. 1.

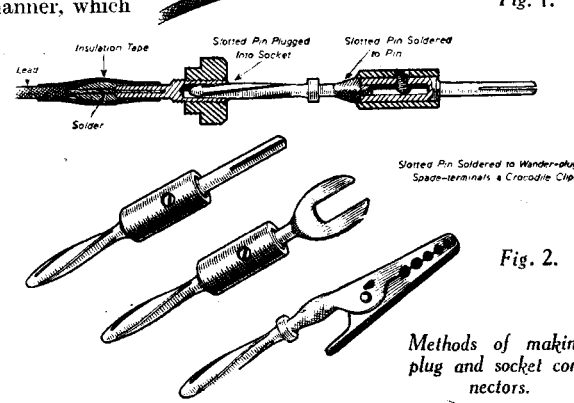
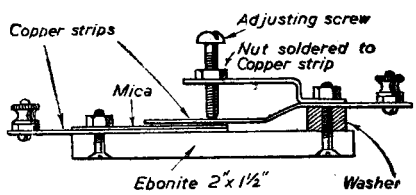


Fig. 2.

Methods of making plug and socket connectors.

Simple Pre-set Condenser

RECENTLY I was making a small short-wave set, and I suddenly discovered I hadn't a pre-set condenser for use in the aerial lead. I therefore devised the pre-set condenser shown in the accompanying sketch. I obtained the



A small pre-set condenser.

copper strips of an old flash-lamp battery of the flat type. The piece of ebonite which is used for the base of the condenser measures 2in. by 1½in. I also obtained the piece of mica out of an old fixed condenser. If the condenser is to be mounted on a metal chassis, or metallised baseboard, it should be fitted on two insulated washers, if not, a short circuit will occur between the two countersunk screws on the bottom of the base. I found that this simple condenser worked quite satisfactorily.—A. G. COBB (Tamworth).

A Direct-reading Audio-frequency Analyser

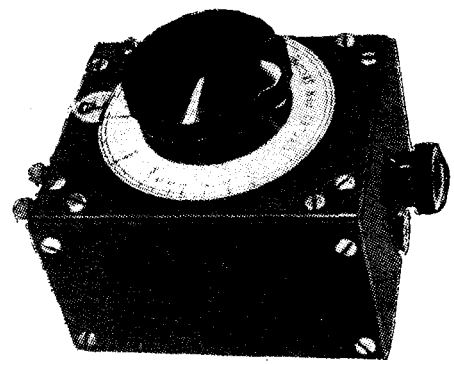


Fig. 1.—The finished instrument.

The Author Describes a Meter, Inexpensive to Build, and Which Has Many Uses in the Service Shop or in the Laboratory

By R. P. TURNER

WHETHER to meet a necessity or only to gratify scientific curiosity, to be able to identify audio-frequencies is a useful advantage. The need arises often in the usual round of radio experience. A technician equipped to perform this operation has no difficulty in setting audio oscillators to desired frequencies, determining frequency drift from the measured pitch of a beat note, adjusting H.F. oscillators to a fraction of a kilocycle, or identifying the tones that serve as indicators in certain laboratory measurements.

Perhaps the most familiar method of establishing the frequency of any sound consists in zero-beating the latter with a beat-frequency audio oscillator and reading the "unknown" frequency from the dial of that instrument. This method is widely used but requires special skill and somewhat costly apparatus. At the same time, it is neither rapid nor foolproof.

At least two instruments which simplify audio-frequency measurement have been marketed in America for some time as laboratory gear. Both types are rapid enough of manipulation to hold down berths on a fast production line if they have to. But they are priced too high for amateurs and servicemen.

The author has duplicated one of these audio-frequency meters on a less expensive scale, and it is described in this article. It is the well-known bridge-type instrument; and while this version will be inexpensive if it is built in accordance with the specifications given here, it is definitely not a toy, and will give a good account of itself. It is only necessary to feed a tone signal of unknown frequency into this device, turn the dial until a null point is located, and then to read the frequency directly in cycles per second on the dial.

Looking at the Meter

The completed audio-frequency meter is shown in Fig. 1; its simple circuit diagram is given in Fig. 2. Constructional details appear in the section drawings, Fig. 4, which illustrate the most convenient manner of mounting the few parts for straightforward wiring.

The instrument is very compact, measuring only 4¾in. long, 4in. wide and 3in. high, and is correspondingly light in weight. Some idea of its small size may be gained by reference to the assembly screws seen in Fig. 1, on the top and sides of the box.

The device covers the useful audio-frequency spectrum—25 to 10,000 cycles per second—in one complete rotation of the frequency dial. There is no range switching. The dial is calibrated to read 37 frequencies directly.

The dial scale is not uniform, as may be seen by reference to Fig. 5, the divisions lying at varying distances from each other and tending to congregate to some extent at the high-frequency end. The separation between 25 and 30 cycles, the first two graduations on the author's dial, is approximately three-eighths of an inch, while the 10-kc. line lies only one-sixteenth of an inch from 9 kc. Increasing the diameter

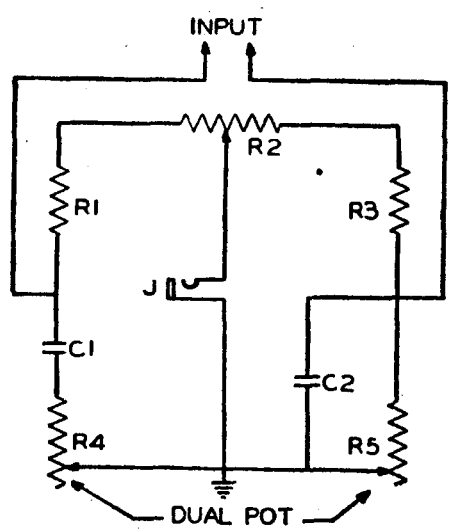


Fig. 2.—Circuit diagram.

of the dial disc will, of course, afford wider separation of the high-frequency points. However, no great difficulty is experienced in setting and reading the 3½in. dial shown here.

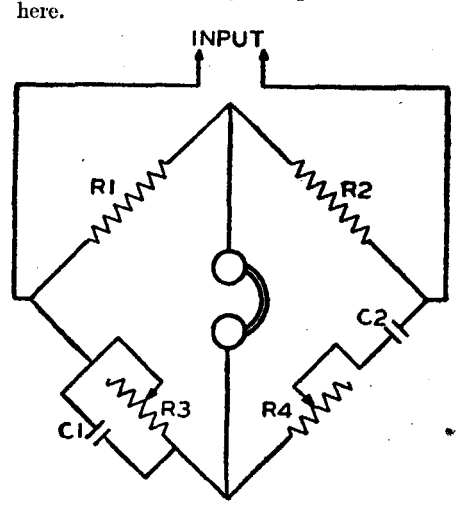


Fig. 3.—Wien's bridge circuit on which the instrument is based. C1, C2—.0133 mfd. mica (made from the following), .01 mfd., .003 mfd., .0003 mfd. All 2% tolerance. R1—2,000 ohms, 1 w. R2—1,000 ohms, linear taper. R3—1,000 ohms, 1 w. R4, R5—Dual 500,000 ohm pot.

Main settings of the meter are made with the large dial, which controls the dual ½-meg. potentiometer, R4-R5 (Fig. 2), while certain auxiliary adjustments are effected with the small knob, visible at the right-hand end of the photograph, which controls the 1,000-ohm potentiometer, R2. The main dial is of the type shown because of its convenient diameter and large finger-grip knob which permits fine adjustments to be made without a vernier. The scale is specially prepared in a manner described later.

Feed-through terminals, used to feed-in the unknown audio signal, project from the left-hand side of the casing (Fig. 1). Directly beneath the small knob on the opposite end of the instrument is seen the output jack into which is plugged headphones, valve, voltmeter, or any other good null detector.

The casing shown in the photograph was formed from 1-16in. aluminium, and given a baked lacquer finish after machining. The bottom is provided with felt mounting feet as a protection against table scratching.

The dial pointer was cut from a small square of plain white celluloid, the index line being scribed in and filled with black marking crayon.

How it is Operated

Operation of the audio-frequency meter is the acme of simplicity; the design reduces adjustments to a minimum. Connect the input terminals of the meter to the output terminals of the frequency generating device (audio oscillator, hummer, driven tuning fork, heterodyne, or the like) and plug in headphones or valve volt-meter into the L.F. meter output jack.

Most generating devices are provided with transformer coupling into the output terminals; but occasionally this will not be the case and a transformer or isolating condensers will have to be interposed between the source and the meter, principally to keep direct currents out of the latter. The type of transformer used is not of great consequence, although the electrostatically-shielded type is highly desirable for this purpose. If coupling condensers are used, they may be 0.1 mfd. tubulars.

Now, advancing from either extreme end, rotate the dial slowly until a null point appears, either as a marked reduction in (or even the elimination of) sound in the headphones, or as a dip of the valve voltmeter reading. At this point the bridge is balanced and the frequency of the unknown signal may be read on the dial.

Null totality will depend upon the amount of harmonic energy present in the audio signal. Large harmonic content acts to broaden the null point, or to make the minimum less convincing. Decided improvement may be achieved by rotating the knob controlling R2 by a small amount.

This auxiliary adjustment will in a number of cases so distinguish the null point that easy recognition of the proper dial reading ensues.

Although headphones may be employed quite successfully with the L.F. meter, a valve voltmeter, or some similar visual indicator with comparable high input impedance will prove much more satisfactory. With any such electronic indicator, the null point is very distinct, and narrow, and the instrument has surprising selectivity. The very low frequency performance, not entirely satisfactory with some types of headphones, is quite gratifying when an electronic indicator is employed. In the absence of a conventional valve voltmeter, the familiar magic-eye valve may be used to considerable advantage.

For Frequency Measuring

The L.F. meter is based upon Wien's bridge (see Fig. 3), a circuit, well known to students of physics and electrical engineering, that has made its appearance in several of the test instruments offered recently to the service trade.

Two of the bridge legs contain resistance only (R1 and R2), while the remaining two are comprised of both resistance and capacitance. In one of these (C1-R3) the resistive and capacitive components are in parallel; in the other (C2-R4) they are in series.

A voltage of unknown frequency is applied to the terminals marked input. Headphones are shown in Fig. 3 as the null detector.

For frequency-measuring work, the ratio arms, R1 and R2, are so proportioned that R2 is twice R1; and the condensers C1 and C2 are made equal in capacitance. R3 and R4 are variable resistors which are adjusted simultaneously so that at any setting the two have identical ohmic values.

Since R3 and R4 have the same value at any setting in their range which balances the bridge for a particular frequency, and since C1 equals C2, and R2 is twice the value of R1, the frequency balanced out may be determined from the equation:

$$f = \frac{1}{2\pi RC}.$$

Where f is in cycles per second, C is in farads, and R is in ohms.

It will be evident that since R3 and R4 are identical at any setting, the two might conveniently be combined in a dual-ganged rheostat, and as a result adjusted simultaneously to balance in the bridge in a labour-saving manner. As a matter of fact, this expedient is used in the meter circuit (Fig. 2) to lend simplicity of operation. Note that R4 and R5 are sections of a standard dual-ganged volume control, and that the main dial is affixed to the shaft of this part.

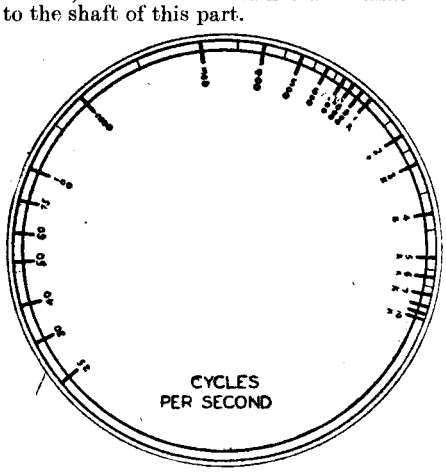


Fig. 5.—Dial calibration.

The auxiliary potentiometer, R2, is included in the circuit to compensate for the lack of exact similarity between R4 and R5 at certain settings, thereby affording a "cleaner" null and correspondingly greater accuracy of reading.

From the Wien bridge equation it may be seen that an appropriate choice of resistance range in the balancing arms and of capacitance values for C1 and C2 will enable complete coverage of the common audio spectrum with one set of components. R4 and R5 in the instrument to which this article is devoted each have a maximum value of ½ megohm, and C1 and C2 each a capacitance of 0.0133 microfarad for that very reason.

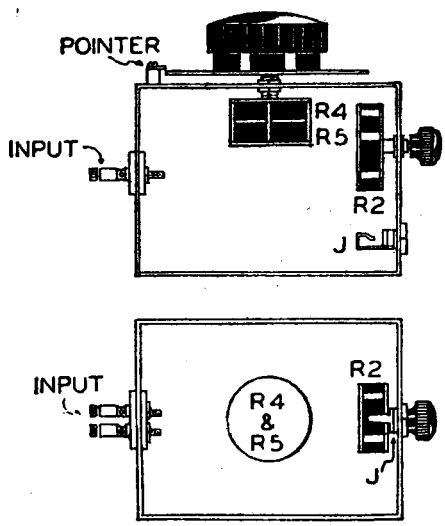


Fig. 4.—Two views showing the general layout of components.

A study of the equation will also reveal that a bridge may be balanced for only one frequency at a time. It follows then that any voltage present in the bridge output circuit to render the null point less distinct is due to some other frequency (or frequencies), particularly to harmonics of the balanced frequency. However, since the bridge offers a different order of attenuation to different harmonics, it is not reliable as an indicator of total harmonic per cent. in the simple system of wave form analysis that is apt to occur to the reader.

Constructional Details

Since the audio-frequency meter is by nature such a simple device, its construction presents no major difficulty. The builder is free to exercise whatever latitude he fancies in the matter of arrangement of the components, since he will encounter none of the annoyances of electrical interaction such as arise in radio-frequency construction.

The sectional views of Fig. 4 show clearly the assembly scheme employed by the author, while Fig. 6 illustrates the method of making a direct-reading dial for the instrument.

In the dial used, the knob is removed by taking out the three machine screws that secure it to the metal disc, and a ring of white Bristol board cut as shown in Fig. 6 to be fitted on the disc. This paper ring is carefully cemented to the dial disc with a thin application of household adhesive, the knob reinstalled, and the calibration points marked later on the paper surface. A ring of thick transparent celluloid is cut to the same size as the Bristol board ring, and after the calibration points have been inked in, the knob is once again removed, and the celluloid ring mounted on the face of the dial, and clamped securely by the knob.

In the interests of shielding, a metal box is recommended for housing the bridge. The author's was made of 1/16in. aluminium, 4¾in. by 4in. by 3in. But it is obvious that the reader may use any small case in his possession. The open-circuit output jack J, (Fig. 2) passed through the case, making contact, and earthing the "bottom" of the bridge.

The insulated input terminals clear the box amply, due to the serrated bosses and stout shoulders.

The 0.0133-mfd. condensers, C1 and C2, are each made up by connecting in parallel one each of 0.01, 0.003, and 0.0003 mfd. Each of these components, which are mica condensers, have a tolerance of 2 per cent.

All parts are mounted firmly and the unit is wired with heavy bus bar to insure rigidity and permanence. Insulated terminal strips of the single and double types are used liberally as tie points to prevent dangling resistors and condensers. Every mounting screw and nut must be driven home firmly, and if the instrument is properly built, they will never need to be unscrewed.

Calibration

After the wiring of the instrument is completed, the main dial is installed less its celluloid cover, and the L.F. meter is ready for calibration. R2 is set at approximately the middle of its range, and, assuming that calibration will be initiated at the low-frequency end of the spectrum, the ganged resistor R4-R5 is set at maximum.

There are two ways to calibrate this instrument. The one followed will depend upon the facilities available to the builder. Either one requires the utmost of care and patience, and should be undertaken only at such time as the operator has the necessary time to devote to the task and the environment necessary for concentration.

The first method, which is by far the most accurate, requires a freshly-calibrated and "preheated" beat frequency audio oscillator to supply the following frequencies: 25, 30, 40, 50, 60, 75, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 800, 900, 1,000, 1,500, 2,000, 2,500, 3,000, 3,500, 4,000, 4,500, 5,000, 5,500, 6,000, 6,500, 7,000, 8,000, 9,000, and 10,000 cycles per second. The

(Continued overleaf.)

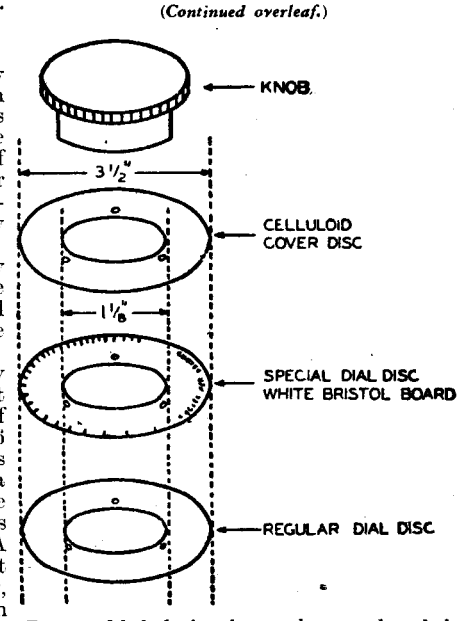


Fig. 6.—Method of making a direct-reading dial.

audio oscillator and a suitable null detector are connected to the meter, and the various frequencies, starting with 25 cycles, successively balanced out, a reference point and number being pencilled lightly on the dial at each null position. For reasons stated earlier, it is strongly recommended that the null detector used in this calibration be a valve voltmeter. The auxiliary resistor, R2, should be adjusted as needed to provide a more definite minimum indication.

The second method consists in setting the dual potentiometer to a series of values which will satisfy the conditions for the above frequencies in the Wien bridge formula, and pencilling reference points on the dial at these settings.

The various values of resistance may be determined by measuring the instantaneous resistance of either R4 or R5, since these two arms are identical, or very nearly so. In order to reduce the arithmetical labour involved in this method of calibration, however, a table of resistance values corresponding to the dial frequencies is given below for the reader's convenience.

F Cycles per second	R Ohms.	F Cycles per second	R Ohms.
25	500,000	800	15,000
30	412,500	900	13,750
40	312,500	1,000	12,500
50	250,000	1,500	8,250
60	200,000	2,000	6,250
75	162,500	2,500	5,000
100	125,000	3,000	4,125
150	82,500	3,500	3,500
200	62,500	4,000	3,125
250	50,000	4,500	2,750
300	42,500	5,000	2,500
350	35,000	5,500	2,250
400	31,250	6,000	2,000
450	27,500	6,500	1,875
500	25,000	7,000	1,750
550	22,500	8,000	1,500
600	20,000	9,000	1,375
650	18,750	10,000	1,250
700	17,500		

Table of resistance values and dial frequencies.

The accuracy of the first method will be dependent largely upon the accuracy with which the audio oscillator itself is calibrated, and its dial set by the operator, and to lesser extent upon the ability of the operator to recognise the exact points of minimum signal. Error due to the last condition is, of course, reduced very materially by the use of a valve voltmeter.

The resistance values given in the table are exact calculated values given more closely than most experimenters can read them with their ohmmeters or bridges, and assume that C1 and C2 are each of exactly 0.0133 microfarads capacitance (which may not be the case). From that it will be apparent that the accuracy of the second method of calibration will depend upon the precision with which the operator can measure resistance and the exactness to which the capacitances of C1 and C2 are known.

After the 37 calibration points have been located by either method and pencilled on the dial, the latter is removed from the potentiometer shaft and the lines and figures made permanent with black India ink. The celluloid cover is placed over the scale and the dial reassembled and replaced on the shaft. One or more frequency points may then be checked to determine if the dial has been replaced properly, any discrepancy being put right by loosening the set screw, and rotating the dial slightly to place the proper graduation opposite the pointer index.—*Radio News.*

Impressions on the Wax

A REVIEW OF THE LATEST GRAMOPHONE RECORDS

A NEW record by Deanna Durbin is "Musetta's Valse Song" from "La Bohème." A lovely record, one you will play and play. The coupling, "Loch Lomond," is perfectly suited to the tender quality of Durbin's voice and she brings something fresh to this grand old song. Charles Previn's Orchestra accompanies and provides a particularly beautiful string background to Loch Lomond. The number is *Brunswick* 03097, and, incidentally, Durbin sings both these in her film "It's a Date." Bing Crosby is the next inevitable choice, and this month he records two numbers from his latest film "Rhythm on the River," sung in that slow Crosby drawl that is so fascinating and so very soothing, and, as a contrast, a bright, cheerful number "That's for Me," which gives him an opportunity to display his artistry at singing a rhythmic song, *Brunswick* 03092.

Have you heard the Ink Spots? This vocal quartet is extremely good. They rarely attempt harmony singing, but devote their attention to simple rendition. Listen to their latest record, "You're Breaking My Heart," *Brunswick* 03095, and if you like this get their recent issue of "Whispering Grass" and "Maybe," *Brunswick* 03075. The coupling on *Brunswick* 03095 is "Stop Pretending," and is a departure from their usual style, being a rhythm number, giving the quartet an opportunity of demonstrating their versatility. There is an excellent piano and guitar chorus in this.

Fine Orchestral Record

AND so to a lovely orchestral record, *Decca F* 7718, "Tales from the Vienna Woods" and "Ständchen," by Mantovani and his Orchestra. These numbers could not have been given to a better orchestra. The rich and mellow quality of the string section is perfection and the light treatment of "Ständchen," particularly the pizzicato effect, is charming. Another very pleasing record is *Decca F* 7725, Tony Martin and Frances Langford singing "Two Dreams Met" and "Our Love Affair"—two superb artists teamed for the first time, and the result is quite up to expectation.

No doubt you have seen the film "Rhythm on the River," if so, you will want to hear Mary Martin sing the two numbers she sang in the film "I Don't Want to Cry Any More" and "Ain't It a Shame about Mame." They are just released on *Brunswick* 03103 and well worth hearing again. Her treatment of "Ain't It a Shame" is a classic and both numbers have an outstanding accompaniment by Victor Young's Orchestra. There are two particularly good vocal records in the Rex lists, one by that popular artist, Les Allen, who sings "Ferryboat Serenade" better than any I have yet heard, with "If Tears Could Bring You Back," *Rex* 9909. The other is Anona Winn singing "And So Do I" and "Good-Night Again" —*Rex* 9911—and she is in grand form. She is accompanied by her "Winners," an excellent little combination.

Dance Records

PERHAPS now you will be in the mood for some dance records and there is a grand collection. Ambrose and his Orchestra has some particularly good ones, notable among them "We Three" and "Down Argentina Way," *Decca F* 7703, the first a lovely new number that will without doubt be a hit, and the second, a rumba, played perfectly. Also there is *Decca F* 7705, "Oh Buddy, I'm in Love," a very cute number with "You're Breaking My Heart All Over Again," a really grand arrangement and an excellent vocal chorus. There is a lovely violin and piano passage in this.

Lew Stone's Band has three records in the new issues, *Decca F* 7707—"The Badge from Your Coat" with "Down Every Street," both with unusual arrangements. Here is another Sergeant-major number that you will hear a lot, "Good Morning, Sergeant-major" and "Bless 'Em All," the favourite song with the Forces, recorded by Lew Stone on *Decca F* 7728. If you want something hot try the Hatchett Swingtette in "Twelfth Street Rag" and "Beat Me, Daddy, Eight to the Bar," *Decca F* 7697. Everybody in this outfit obviously has a grand time at recording sessions. A bright and snappy record. Bob Crosby and his Orchestra record "The Little Man Who Wasn't There" and "Drummer Boy," the number that was featured so brilliantly by Mickey Rooney in "Strike Up the Band." This latter number gives the drummer an opportunity to display his ability. A record with plenty of punch, *Decca F* 7713.

Pianoforte Solos

THERE are two very good piano records this month well worth adding to our record programme. Billy Mayerl playing simply yet rhythmically two popular songs "Blueberry Hill" and "Ferryboat Serenade," *Decca F* 7711, and Charlie Kunz with a medley of numbers including "Maybe," "Our Love Affair," "Ferryboat Serenade," etc., *Decca F* 7717.

From piano to organ is but a short step, and if you like it hot Sidney Torch is your man. He has made a brilliant record entitled "Piping Hot No. 2," which includes such classics as "St. Louis Blues," "Mood Indigo," "Some of these Days" and "Tiger Rag." The recording is good and displays Torch's terrific technique to full advantage—record number is *Decca F* 7721.

Now you probably want some lighter music to conclude your programme. You cannot do better than listen to Ida Haendel. This young violinist has surprised all the critics with her technique, and in the world of classical music is probably the most discussed artist of to-day. All her records have received unmitigated praise from all press critics and there is no doubt that this, her latest record, will be equally well received. She has recorded two lovely solos, "Sarabande and Tambourin" and "Zapateado," a Spanish dance, on *Decca F* 7727, a record that concludes our programme to perfection.

The Mills Brothers have revived two popular tunes for their latest recording on *Brunswick* 03042. The tunes are "Sleepy Time Gal" and "My Gal Sal." Danielle Darrieux, accompanied by Raymond le Grand and his Orchestra, sings "Dans Mon Cœur," the Hungarian melody from the film "Retour à l'aube," and "Je ne sais pas si je l'aime" on *Brunswick* 03036.

ROUND THE WORLD OF WIRELESS

Receivers for Friendly Germans

THE Home Secretary has decided that Germans and Austrians in this country who are regarded by the authorities as reliable, are now to be exempt from the restriction imposed some months ago prohibiting the possession of receivers by enemy aliens.

Talking to Luxemburg

A BROADCAST in the Luxemburg dialect is to be given by the B.B.C. every Sunday in the European service from 8 to 8.15 a.m. B.S.T. The broadcasts will be given on the short wave G.S.A., 49.59 metres, 6.05 megacycles, and the medium wavelength of 373 metres.

A Unique Verification Card

IT is reported that a New Zealand reader of our contemporary, *The Australian Radio World*, recently received a novel verification from station KGIR on a sheet of copper. The station, which operates on 1,370 kc/s, is situated in Butte, Montana, U.S.A., which is the centre of the largest copper mining district in the world.

B.B.C.'s New Home Adviser

MR. A. P. RYAN has been appointed adviser to the B.B.C. on home affairs. He will represent the Ministry of Information, and will put the Government's point of view to the B.B.C. in domestic matters.

Nazi's New Channel Radio

IT is reported that the Germans are using a new station at Calais for their broadcasts in English.

Electrical Tests for R.A.F. Recruits

VOLUNTEERS for entry into the radio and wireless mechanic trades of the R.A.F. are given a set of questions to test their electrical knowledge. The questions were suggested by the Radio Manufacturers' Association Technical Training Committee. They include such points as brief descriptions of voltage, current, resistances and condensers and of the functions of various electrical apparatus. Candidates successfully passing the test, and the other standards for entry into the R.A.F., are entered for special courses of training.

Automatic Radio Control

A NEW system of directional automatic radio control was recently demonstrated in America before Army and Naval officials. Without any more help from the pilot than the depressing of a couple of buttons the 'plane is able to fly in a straight line from point to point. Years of experimenting are behind this new device, which has been developed in Los Angeles by the Harvey Machine Company. This new control consists of two radio receivers. Two radio stations are chosen on the proposed line of flight and each receiving set is tuned to one of these stations. The signals are mixed in the control that operates the automatic pilot so that the 'plane is held in an absolute straight line, regardless of cross winds or other outside conditions. To make this possible, the 'plane will often fly up-wind, or "crab," at an angle to the true course, but the body of the 'plane exactly follows an imaginary "white line" in the sky.

Bombarding Smoke

A STRANGE device which bombards smoke with high-frequency sound waves, thereby causing the smoke to lie down, is being developed by the United States Bureau of Mines, according to the American *Aluminium News-Letter*. One of the units is attached to every chimney and stack to prevent the smoke from getting out and spreading around the countryside. Inside a piece of hollow pipe is a large piece of aluminium which is connected at one end to a loudspeaker and radio set. The radio sets up a magnetic field which causes the aluminium cylinder to vibrate, producing a powerful high-frequency sound which, in turn, creates high-frequency waves. These waves are directed at the smoke and cause the particles in it to coagulate into large lumps of soot, which fall out of the air stream by gravity.

W.A.A.F.'s as Radio Operators

GIRLS of seventeen and a half years may now join the Women's Auxiliary Air Force, and some of the duties for which they may volunteer are: radio operator, morse slip reader, teleprinter operator, telephone operator, and instrument mechanic.

Servicemen's Postal Course

WE are informed that The National Association of Radio Retailers has sponsored a postal course of training for servicemen which has been prepared by Mr. Paul D. Tyers. The course, which has been reduced to a reasonable minimum, and yet covers the essential ground, is available to any radio retailer or his staff at an inclusive fee of £3 3s.

Malaga's Three Short-wave Stations

SOME idea of the importance attached to short-wave broadcasting can be surely found in the fact that Malaga, a little seaside town on the Mediterranean, relying chiefly on the export of wines, fruits and olive oil for its existence, boasts at least three short-wave stations. This is a fine effort for a town with a population of 180,000.

Swiss People's Receiver

A RECENT report from Switzerland states that the Swiss Administration of Posts, Telegraphs and Telephones has ordered the manufacture of a people's receiver which will cost about 128 Swiss francs. It is a four-valve superhet covering the medium-wave band only, and is housed in a small bakelite cabinet. The receiver is designed for an output of 2 watts.

Our illustration shows an A.T.S. officer wiring a receiver—from memory.

Plymouth Radio Relay Service

THE Radio Rediffusion Co. at Plymouth has been granted permission to increase its relay rental charge by twopence a week, Application was originally made for permission to increase the charges from 1s. 6d. to 1s. 9d., but the Works Committee of the Plymouth Council refused.

Radio Gas Mask

THE latest novelty receiver is a gas mask equipped with a short-wave radio telephone having a range of a few hundred yards. It was recently demonstrated to the Ontario Civil Defence Committee.

Listeners in India

ACCORDING to the latest information available the number of licences in India has reached a total of 117,555. This makes the number of listeners in India 3.3 per 10,000 of the population, and is compared to England's three per cent. (approx.).

From Triode to Triode Hexode

This Article Has Been Specially Written to Assist the Beginner to Get a Better Understanding of Modern Valves.

By L. O. SPARKS

THE problem of selecting a suitable valve for a particular circuit is not always easily solved by the amateur designer-constructor. It is quite understandable that some confusion is created, owing to the fact that so many types of valves are available, and that a number of them are suitable for any individual stage or operation. A thorough knowledge of valve characteristics and circuit requirements would eliminate most of the trouble, but as these qualifications are not usually acquired without some reasonable period of active participation in the hobby, they can be ruled out so far as the average beginner is concerned. Another item which tends to aggravate the matter, is the names given to the various types or, perhaps one should say, the failure of the beginner to secure an understanding of the terms employed. This article, therefore, is intended to explain the general details of those valves most widely used by amateurs, but as it will not be possible to deal with technical considerations, it is suggested that reference should be made to the valve data contained in the small booklets published by the valve manufacturers.

Component Parts of a Valve

To be able to follow any explanation about valves, it is essential to have a clear idea of the various component parts used in their construction. These parts are more correctly known as electrodes, and the simplest type of valve, namely, the diode, as its name implies, uses only two electrodes. One of these is the anode and the other the filament or cathode.

When dealing with battery-operated valves, the term filament is invariably used, as in such cases this electrode does actually consist of a very fine wire filament, sometimes coated with a mixture of oxide, which is raised to a certain temperature by means of the current flowing through it when connected to a suitable low-tension battery or accumulator. There are, however, indirectly heated valves which are used in mains-operated circuits. With these, the filament is insulated and passes through a hollow nickel tube of circular or flattened sections, the outside of which is coated with certain alkaline earth oxides. The filament causes the nickel tube to reach and be maintained at the correct operated temperature. Therefore, with this type of valve one usually refers to the filament as the heater, and the nickel tube with its oxide coating as the cathode. The filament, in battery-operated valves, and the cathode in the mains type, both serve the same purpose, namely, that of emitting a stream of electrons. (A flow of electrons in a circuit constitutes an electric current.)

Anode

As the cathode or filament of a valve can be looked upon as the negative electrode, so can the anode be thought of as the positive. The purpose of the anode is to receive or collect the electrons emitted from the filament, and in view of this it usually takes the shape of an open-ended metal tube or rectangular box surrounding the filament and the other electrodes, which will be discussed below. The electron emitted by the filament or cathode has a negative characteristic and is, therefore, attracted to a body having a positive potential. The anode, bearing in mind its purpose of collecting the electrons, has to be maintained in a positive state, and this is achieved by means of some external source—H.T. battery or mains unit—as an examination of circuit diagrams will reveal.

Control Grid

The grid consists of an accurately formed spiral mesh, the gauge or fineness of which depends on the type of valve under consideration. This mesh surrounds the filament like an open-ended tube and is, in turn, surrounded by the anode. The object of the control-grid is, in general, to control the flow of electrons from the filament to the anode, and this is obtained by varying the polarity and potential of the grid with respect to the filament.

A valve using the electrodes described above, i.e., filament or cathode, anode and grid, would be termed a triode or three-electrode valve, and the general arrangement is shown in Fig. 1, together with the normal valve-holder connections.

Screen-grid or Tetrode

Both of these terms are quite common, but every beginner does not know that they mean the same, and are equally applicable to the type of valve mentioned below. There appears to be an unwritten understanding that one usually refers to a screen-grid valve when it is used for H.F. purposes, and a tetrode when an L.F. output valve is being considered. As a point of interest, the correct name is screen-grid tetrode.

As triode denotes the use of three electrodes, the term tetrode tells us that four electrodes are incorporated in the construction of the valve, their arrangement constituting nothing more complicated than a triode plus an additional grid. This fourth electrode acts as a screen, electrostatic—and is located between the control grid and the anode, its object being to prevent uncontrollable feed-back, i.e., reaction, between the output and input circuits of the valve. Speaking in a general sense, it is due to this elimination of feed-back that the modern H.F. screen-grid valve is capable of giving a much higher amplification than its original predecessor, the triode, without the risk of instability. Fig. 2 shows the normal valve holder connections together with the diagrammatic form of indicating an S.G. or tetrode valve. It must be appreciated that a valve of this type designed for use in an H.F. circuit has totally different characteristics—although exactly the same number of electrodes and the same general arrangement—to those used for L.F. work, the latter, as mentioned previously, usually being called tetrodes.

Pentodes

If, for some technical reason which we cannot discuss in this article, it is decided to take a tetrode and add yet another grid, we now have a valve assembly using five electrodes, and for that reason it is called a *pentode*.

Like the tetrodes, pentodes can be designed for H.F. or L.F. work, the essential difference between the two being their characteristics which are governed by the formation of the grids and their spacing. The fifth electrode or additional grid is known as the *suppressor-grid*, and it is fixed in position between the *screening-grid* and the *anode*. The object of the suppressor-grid, which, incidentally, is usually of a coarser mesh and located near the anode, is to remove an objectionable defect in the characteristic of the tetrode caused by some of the electrons coming from the cathode trying to jump or bounce off the anode back to the screening grid. For this reason, the suppressor-grid is invariably connected to earth potential, either internally to the negative side of the filament or the cathode, or by means of an additional connection on the valve base (Fig. 3).

S.G. or Pentode

Some little doubt arises in the minds of many constructors about using a screen-grid or a pentode valve in an H.F. stage. For example, the question is often asked, can an H.F. pentode replace an ordinary S.G. valve? The answer is, yes. From a practical point of view, an H.F. pentode can be looked upon as a superior type of S.G. valve. It can handle a larger input signal without the fear of distortion (due to overloading) being introduced and, because of its improved characteristics, it gives a higher amplification.

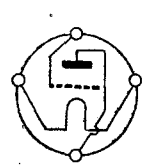


Fig. 1.—A simple triode, the first stage of progress after the diode.

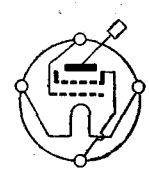


Fig. 2.—By adding another grid (screen) the tetrode or screen-grid valve is formed.

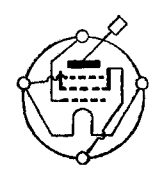


Fig. 3.—To improve matters, an additional grid was added to the tetrode, thus providing us with the pentode.

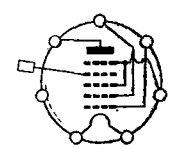


Fig. 4.—This shows how the pentagrid or heptode is formed. This type of valve is primarily intended for frequency-changing in a superhet.

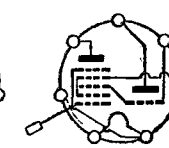


Fig. 5.—Another electrode assembly known as a triode hexode. This is superior to the heptode.

Pentagrid or Heptode

If we continue with the addition of grids until we have *five grids* (plus the usual anode and filament or cathode) we form what is known as a Pentagrid or, if we consider it from the point of number of electrodes, a Heptode. The assembly is arranged to form a screen-grid valve and a triode in the one envelope. It should be noted, however, that two of the five grids are connected together to form the usual screening grid, and another of the grids is

actually used as an anode for the triode section. The order of assembly is as follows: Filament or cathode, triode control grid, triode anode, electrostatic screen, S.G. control grid, screening grid and, finally, S.G. anode. The two sections, i.e., the S.G. and the triode, are coupled together by the common electron stream from the filament. The usual base connections are shown in Fig. 4. This type of valve is primarily designed to act as a frequency changer in a superhet circuit, the S.G. section acting as the first detector and the triode as the local oscillator, the necessary coupling or mixing being obtained in the manner mentioned above.

Triode Hexodes and Triode Heptodes

These are two other types of valve used for frequency-changing, and it should be noted that they are more efficient than the pentagrid or heptode, especially if one is interested in S.W. work.

The triode hexode consists of a mixer section having four grids, and a triode section which has its own anode. The two sections depend on a single cathode which is common to both. The electrode arrangement is: Cathode, control grid, electrostatic screen, oscillator grid (connected internally to the triode grid), screening grid, which is also connected to the electrostatic screen, and finally the mixer anode, and, of course, the triode anode. The conventional diagram, together with base connections, is shown in Fig. 5.

The triode heptode is identical with the triode hexode, with the exception of an *additional grid* incorporated in the mixer section. This extra electrode is connected as a suppressor-grid as described for the pentode.

Valve-holder Connections

Space prevents all types of bases being illustrated, therefore it must be remembered that it is possible to obtain certain types of valve with various bases. For example, an ordinary S.G. valve might have a four- or a seven-pin base. The actual connections are always indicated by the valve maker, but as such information is not always available, it is advisable for every constructor to keep a reference chart by him. In this direction, one could not do better than to make use of the "Radio Engineer's Vest-Pocket Book" (price 3s. 6d.) which, in addition to the comprehensive information covering all types of valve bases, provides a mine of most useful radio data, etc., invaluable to the constructor, experimenter and engineer in a compact and well-indexed pocket book.

WAR DAMAGE—AND YOU

DESPITE the Prime Minister's efforts to get rid of jargon in official publications, and replace it with straightforward English, the War Damage Act contains phraseology which is even puzzling lawyers. If *they* cannot make head or tail of some of it, what chance has the ordinary individual?

The man in the street is asking all sorts of questions about the new Act. To whom does he make contributions? What happens if he does not agree with the value placed on his damaged property—a thorny problem, indeed! Can he obtain an immediate advance on a damaged shop to start elsewhere? Can he claim the contribution to be "expenses" and get tax rebate? What happens if he receives compensation and then suffers further damage?

These are a few of the vital problems affecting many thousands already—but to sift the answers from the mass of long-winded English in the Act is no easy task.

For months, however, a barrister has been working through the Act, section by section, setting down in simple language exactly what the man in the street wants to know, and anticipating his questions and answering them. The result is the publication, on Friday, April 4th, of "War Damage Compensation," an invaluable book for all at the popular price of 1s.

It tells you what you are entitled to, and how to get it without worry. It saves the necessity for obtaining legal advice. Domestic and business property are dealt with comprehensively. It is a book everyone will want for reference. Obtainable at newsagents, bookstalls, and booksellers, 1s., or 1s. 2d. by post from George Newnes, Ltd. (Book Dept.), Tower House, Southampton Street, London, W.C.2.

The British Long-Distance Listeners' Club

IT is not many months ago that we were asking members to show more active interest in the Club, by writing to us and giving us details of their work. Well, we asked for it, so we mustn't complain about the huge mail we now receive. The only trouble caused by the splendid response is that connected with the problem of trying to acknowledge all letters of general interest in the fixed space offered by this page. It can't be done, therefore we do hope that those members who do not see their letter in print will understand the actual position, and realise that their turn will come in future issues. Don't get the impression that we don't want to hear from you. *We do*, but there is just one item we would like to stress. Please make letters shorter and, if possible, let them deal with practical matters, and those items likely to be of interest to all members.

Another Neat Layout

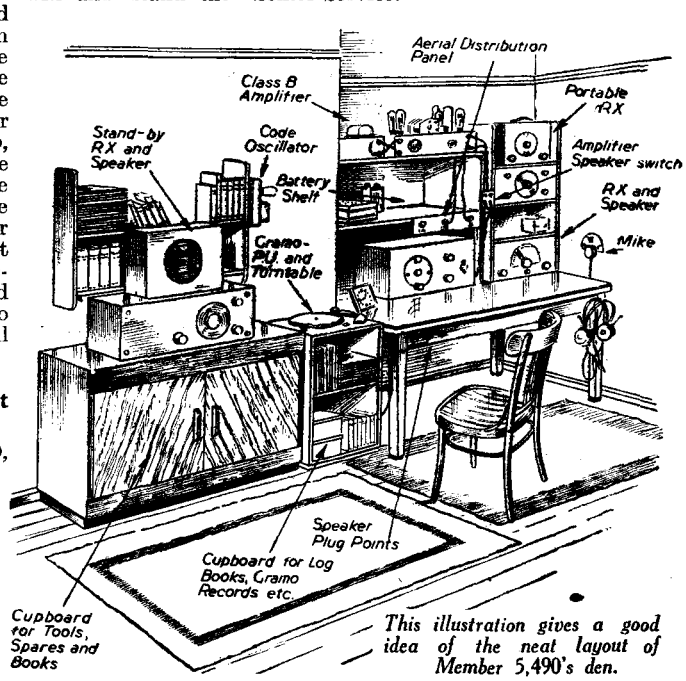
MEMBER 5,490, in Sussex, sends us a drawing showing the layout of his den, and we reproduce it on this page. In his letter he says, "The main RX is an Eddystone All World Two, this being in the bottom of the rack on the right-hand side of the drawing. In the same rack is the speaker, which is a W.B. Midget Stentorian. The stand-by RX and speaker are on the left. This is a home-built 0—v—1 using pentode output, and the speaker is a Stentorian Senior. The b.c. RX is a three-valver, also using pentode output, and it is located in the centre of the drawing. I also have a portable receiver, 0—v—0, which I couple up to a 2½-watt Class B amplifier. This circuit makes use of a Cossor 240B valve.

"For light entertainment, I connect up the gramophone pick-up to the same amplifier, and get an output which is quite sufficient for a fair-sized shack. This L.F. unit is located on top of the centre rack, whilst the gramo. turntable and pick-up are fitted in the top of the book cupboard. I can also do a little home broadcasting by coupling up the mike to the amplifier, and I obtain quite a bit of fun from this arrangement when reception is not too good. The battery supply is located on the second shelf of the centre rack, batteries being used throughout the installation.

"I am waiting my call-up in the Royal Navy as a telegraphist. My normal receiving speed is 32 w.p.m., but I have managed to take down a couple of pages of French at 42 w.p.m. I have gone as far as getting down 53 w.p.m., but unfortunately I was only able to hold this speed for one minute.

"The Q.S.L. cards here number 112, among them being VR6AY, XZ2EZ, K60QE, PK3JR, etc. The countries I have heard are 83, covering all continents."

We must congratulate this member on his morse, as it would seem that he is able to put up a very fine performance, and we wish him every success when he joins the Senior Service.



This illustration gives a good idea of the neat layout of Member 5,490's den.

Portable Receiver

MEMBER 6,823, who is only 13 years of age, sends us details of a handy stand-by b.c. portable receiver he has constructed, and as we feel there might be many who would like to make a similar receiver, we publish his remarks, and also the theoretical diagram of the circuit. "The set," he says, "is the result of my trying to make a straight four mains portable, capable of getting the Home and Forces programmes, plus one or two foreign stations. I wanted to see what kind of a set I could make with the minimum of expenditure, and I can say that I am well satisfied with the results. It is, perhaps, unusual in that no volume control is included in the circuit, the volume being regulated entirely by the reaction. I have not bought more than I found necessary, and it will be seen from the diagram that I have kept the circuit as simple as possible. The coils are home-made and similar to those described in PRACTICAL WIRELESS for the Shelterset Three. The mains transformer is a Wearite RC1, and the valves are Mullard SP4 for the H.F. stage, Mullard 345V for the detector, Mullard Pen. 400 for the output, and their 1W3 as rectifier. The set will receive the Home Service programme at good strength, and the Forces at slightly less volume, this being without any earth connection, and using the mains aerial. When an earth connection is employed, the volume is more than that normally required.

"By way of a query, would it be possible to use the top socket of a three-pin lighting or power point as an earth, and, what is a Westector?"

We assume that the member is referring to the earthing point of the three-pin socket. This normally provides a low-resistance connection to earth, therefore it could be used, but we think it would be more satisfactory, from the point of view of possible interference, etc., to use a separate earth wire. A Westector is the trade name given to a particular type of metal rectifier, which is capable of rectifying radio-frequency signals. In other words, it can be used in place of a crystal detector or even a valve.

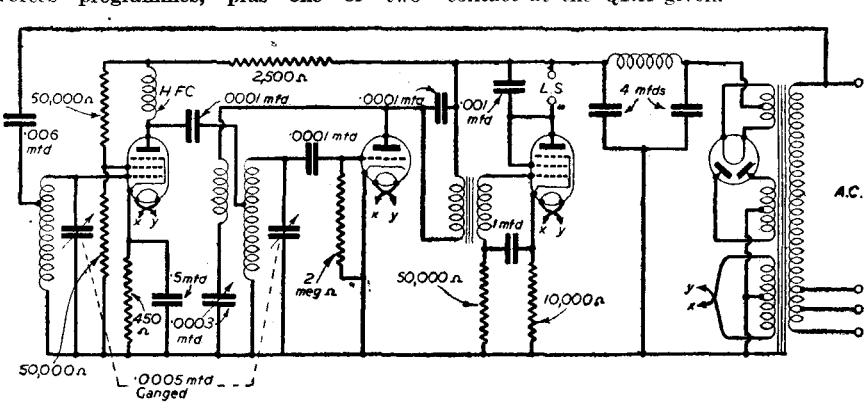
Any Suggestions?

"IS it possible to spare a little space in PRACTICAL WIRELESS for the description of junk-box and experimental sets, as I think this would save us from buying parts and, thereby, helping the country. I should like to get in touch with any reader who is interested in experimental trials, as this forms a large part of my hobby." These are the remarks of Member 6,659, of Enfield, so if anyone wishes to make contact, they should drop a line to 52, Forest Road, Enfield, Middx.

Help Wanted

MEMBER 6,454, of 3, Hilltown, Dundee, Scotland, wants some help. In his letter he states: "I would be much obliged if you could supply a complete list of DX stations operating on medium waves. If any members would care to write to me concerning this form of listening, I would be much obliged and promise to answer all letters."

Well, we cannot supply a list, so if any members can offer assistance, please make contact at the QRA given.



Theoretical circuit diagram of Member 6,823's four-valve main portable.

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).

DX on the Short and Medium Waves

SIR,—It may interest other readers to know that I have just received a QSL from station TG2, located at Guatemala, Central America. I heard the station on June 16th, 1940, and logged it on 48.5 metres. The exact frequency as per their card is 6.190 mc/s, and they tell me that the TX is in the building of the "Direction General of Electrical Communications," in Guatemala City. Unfortunately, they do not state their power, schedule, or antenna system, but I should be pleased to hear from any reader who has verified this station with a view to comparing signal strength and quality, etc., and also anyone interested in M.-W. DX. I, myself, have verified only WJSV, Wash., D.C., and one of the Canadian home-service transmissions, but those veries mean as much to me as all my short-wave QSLs.

With regard to WGEO which you mention, in January's B.L.D.L.C. column, as operating on 48.47 metres, I think Member 6732 is correct in saying that this is not so, according to their QSL WGEO operates on one wavelength only, 31.48 m.; WGEA, however, operates on 139.5, 19.56 and 31.41 m. The other "G.E." station is KGEI (also verified) and operates on 19.56 and 31.48 m. (20,000 w.), and is located at Treasure Island, Golden Gate, International Exposition, San Francisco, California. When they use their Alexanderson directive antennas the effective carrier power is increased to 200,000 watts, their schedule is 12.00-17.00 and 05.00-08.00 G.M.T. on 31.48 m., and 23.30-04.15 G.M.T. on 19.56 m.

Fellow short-wave listeners will be pleased to know that the F.C.C. have now made it compulsory for "W" hams to state their call every 10 minutes, even if they're in the middle of a QSO; this should help short-wave listeners in logging U.S.A. amateurs.—E. J. ROBERTS (London, N.).

Heard on a Two-valver

SIR,—My log for the past three months includes the following stations: VLQ6, VLQ2, TAP, YUB, HVT, SBP, CSW7, FZR, FET22, HA6Q, K4GGH, HET4, and thirty W's. My receiver is a det. and L.F., using a Cossor 210 HF, and Mullard SM2HL. — H. S. THAYER, (Shirehampton).

Identification of S.W. Stations Wanted

SIR,—There are one or two short-wave stations that I regularly pick up, but have so far not identified them. Can any readers help me, please? The first is a station in Havana, Cuba, on about 26.1 metres—does anyone know his call-sign? The other is a station on about 25.2 metres, heard last January 8th at 8.45 p.m. with dance records and announced in English only. At 9 p.m. B.S.T. the station closed with "God Save the King."

Stations CJCX, 49.92 metres, in Sydney, Nova Scotia, and VON9, 50,2 metres, in St. John's, Newfoundland, regularly put in an R6 signal around 10.30 p.m. B.S.T. Station CR7BE, 30.88 metres, is heard very well between 8 and 9 p.m. B.S.T. with programmes in English and Portuguese—usually R7-8.

I have received a letter from WPIT, Pittsburgh, who states that WPIT and its staff have been moved to Boston, and that Mr. Bob Merryman, who previously conducted the English mailbag programme from WPIT in Pittsburgh, has had to discontinue this feature for the time being.

Also, Westinghouse's station WBOS is now on 31.35 metres from 10 p.m. B.S.T. with the "Portuguese Hour," and on 25.26 metres occasionally in the early evenings; I have regularly heard WBOS at R8 and all reception at present is on a 7-valve all-wave superhet.—JOHN PARKIN (Junior), (Hull).

Correspondents Please Note

SIR,—I thank you for inserting my request for a correspondent recently. Unfortunately, it was impossible to reply to all the letters received, but I have kept up a regular correspondence with the writers of the first two letters received. Will other readers who answered my request please note.—S. V. ALLANSON (Calverley, nr. Leeds).

Metal Rectifier as Detector: Correspondents Wanted

SIR,—I recently constructed a simple type of "crystal" stand-by receiver incorporating the new type of Westinghouse high frequency metal rectifier type W.X.1. The results obtained were equal to the most sensitive crystal. As this type of detector requires no adjustment whatever, enthusiasts will appreciate that this development is truly a step in the right direction.

I should be pleased if any young reader who is interested in the formation of a Radio and Television Club in the South Manchester district would communicate with me. In conclusion, may I express my sincere appreciation of PRACTICAL WIRELESS?—J. ROBERTS, 30, Milton Grove, Whalley Range, Manchester.

Radio Brazzaville

SIR,—I expect other readers have heard a French-speaking station on the 25-metre band giving a news bulletin which ends at 9.00 p.m. B.S.T., and giving the call Ici Radio Brazzaville three times.

I have been looking through some American radio magazines, and noticed that the station was entered as being located at Brazzaville, in French Equatorial Africa, the frequency being 11,970 kc/s. I have not been able to find any other details, indeed, no mention at all in any list of short-wave stations. It is a good signal.—P. DICKERSON (Long Stratton).

Comment, Chat and Criticism

Outline of Musical History—19

The Life and Work of Beethoven—1.

By Our Music Critic, Maurice Reeve

MOST biographies of famous musicians purposely leave their works for separate discussion at the end of the volume. In the present series of articles on the "Life of Beethoven," specially designed for young readers, and more especially those amongst them who are more than ordinarily interested in music as a possible vocation, I have incorporated this feature as part of the Master's life story.

Ludwig van Beethoven was born at No. 515 (now No. 20), Bonngasse, Bonn, on December 16th, 1770. Bonn is situated on the River Rhine, in Germany, just below Cologne, and about fifty miles from the German-Belgian frontier. This part of Germany has long been known as one of the most beautiful countrysides in the world. Packed with history, romance and legend to an unusual degree, it is just the kind of land in which a young man of Beethoven's genius would be expected to grow, and take root. Bonn itself is on the left bank, where it winds itself between high cliffs, orchards and vineyards, with "the seven mountains" showing up against the southern sky.

As in most countries in those times, and in none more so than Germany, art flourished under the patronage of the wealthy aristocrats and the reigning princes and grandees.

Family History

Bonn was an electorate, and at the time of Beethoven's birth the Elector was Maximilian Frederick, a small, energetic and pleasant man, very fond of pomp and ceremony, music, the theatre and the ladies. Both Ludwig's father and grandfather were Kappelmeister at the electoral court; that is, director of the Elector's private orchestra and general musical life. His grandfather, particularly, was very respected, and was a highly-gifted musician.

The Van Beethovens came originally from Flanders. We are told that the name "Van Beethoven" means "the beet garden"! Ludwig the elder established himself at Bonn as court musician in 1733 under the Elector Clemens August the Pompous. It was a period of much splendour and artistic activity, and actors and singers from all parts flocked to the little town to seek the princely favour, and Grandfather Beethoven directed almost everything performed there. In addition to the chapel, he was in charge of concerts, plays, balls, banquets, serenades, and all forms of music.

As Beethoven first knew it, Bonn was completely dominated by church influence. In 1257 the Archbishop of Cologne was dispossessed of his privileges, and Bonn became the capital of the Electorate. It was a town without trade or business, and its whole life depended on the little court of the Archbishop-Electors, who were picked from the younger sons of royal houses. They were elected by an ecclesiastical chapter—that is, a body of churchmen appointed for the ruling of the church—their choice having to be confirmed by the Pope and the Emperor of the Holy Roman Empire who, as overlord of the multitude of small states already mentioned, was, in his turn, elected by the ecclesiastical electors of Cologne, Mayence, and Treves, and the four lay rulers of the Rheinish Palatinate, Saxony, Brandenburg and Bohemia, joined later by Bavaria and Hanover. Hence the title of Elector.

Ludwig's son, Johann, the father of the great composer, was a different kind of man. Although also court musician, and his son's first teacher, he was very cruel and domineering, and drank, to the ruin of his family. His wife, Beethoven's mother, was a young widow, Maria Magdalena Kewerich, the daughter of a master cook. As is always the case in these circumstances, it was she who lavished more than one person's care and attention on the little house in the Bonngasse, and all in spite of constant ill health. She had seven children, of whom only three grew up.

Humble Home Life

Many birth-places of the world's great men have been mean and shabby dwellings. Beethoven's was no exception. Herriot, in his *Life and Times of Beethoven*, says: "Within sight of these splendours (the Rheinish landscape), at a respectable distance from the Residenz, whose old charms have been preserved in a coloured engraving, how humble and even pitiable is the poor home of the Beethoven family! In the court behind the house on the Bonngasse, not far from the market place, three landmarks remain; the very small garden, several unassuming trees, one of which has ashy bark; and a grass plot on which to-day reposes the weather-beaten bust of the Master, by Aronson. In this damp hovel, without light, without air, with only a garret window, under these rough rafters, Ludwig van Beethoven was born on the 16th of December, 1770. A manger would have been less mean."

In 1889 the house was purchased by a body of amateurs, and dedicated for ever to Beethoven's memory. Joachim, the famous violinist, was the first president. To-day, it forms a wonderful museum of priceless manuscripts and other treasures, and of even more valuable memories. A constant stream of devout pilgrims pass through it, paying their tribute to the man who gave them, and the world, the most wonderful music yet heard by mortal ears.

When Beethoven reached the age of 19, an event happened which was to profoundly affect him and his mental and spiritual development. In 1789 began the French Revolution, in the course of which Napoleon Bonaparte carried out his great series of conquests. In the course of his victorious campaigns, Bonn, together with the whole of Germany and many other lands, passed under his sway, and a French form of government was imposed on the conquered peoples. The effect that this had on Beethoven's music and personality will be told in its proper place.

Unhappy Childhood

There are few children who really enjoy their practice, at the best of times. The drudgery of scales and exercises and the "going over" of those difficult bits in pieces, when we would rather be out playing games or amusing ourselves in our own way, are trying to all but the most gifted. What must it have been like to young Ludwig? Desperately poor and frequently cold and hungry, and, above all, taught by a cruel and hard father of whom he must have been frightened, and whom he not unnaturally disliked! We are told that his father also taught him the violin, and reading and writing and arithmetic. He went to a poor school for a little Latin. Only the character and will-power of a true genius could have helped him through this terrible childhood.

This mercenary and selfish father thought that by keeping his little son hard at work, he would become a second prodigy like Mozart, and bring him the money which he, the father, was incapable of earning himself. He even went to the length of proclaiming Ludwig to be two years younger than he actually was! It was not until he was 40 that Beethoven, at considerable trouble and cost, finally had the matter of his age settled. Till then, he firmly believed he was born in 1772.

Early Studies

He played at a concert on March 26th, 1778. At the same time, his father's health failed, and he went to Pfeiffer for his studies, and to Van den Eeden, organist to the court chapel. Van den Eeden was succeeded by Neefe in 1781, and it is perhaps he who most helped Beethoven with his musical studies as a child.

The family is believed to have met a good friend about this time in Mr. Cressener, the English Chargé d'Affaires, who assisted them with four hundred florins. He died in 1781, and young Ludwig wrote a funeral cantata, which was performed, but no score of it has ever been found. In the same year he produced the first composition which has come down to us—"Nine Variations on Dressler's March in C Minor." It bears the French inscription, "*composees par un jeune amateur van Beethoven, âgé de dix ans*, 1780."

There is reason to believe that Ludwig toured Holland in the winter of 1781–2, accompanied by his mother, and that, chiefly by playing at private houses, he made some much-needed money. In 1782, Neefe moved to Munster and left Beethoven, aged eleven and a half, as regular deputy at the chapel organ. There was no pay attached to it, and there must have been a good deal of worry and responsibility for one so young. But it afforded him invaluable experience and training, of which he took the fullest advantage. Neefe wrote: "... playing with force and finish, reading well at sight, and, to sum up all, playing the greater part of Bach's *Well Tempered Clavier*, a feat which will be understood by the initiated. This young genius deserves some assistance that he may travel. If he goes on as he has begun, he will certainly become a second Mozart."

Beethoven had a remarkable appearance for a child, short, broad, stooping shoulders, and large head. He must have looked a little oddity at the Electoral Court in his official costume of sea green dress coat, flowered waistcoat, buckled breeches and sword at his side!

B.B.C. HANDBOOK FOR 1941

First Complete Year of War-time Broadcasting Reviewed

PUBLISHED on March 6th, the B.B.C. Handbook for 1941 carries on the tradition of its predecessors in the fullness of its survey of a year's broadcasting activities. With the first complete year of war-time broadcasting as its subject, the handbook has plenty of interesting facts to reveal about the B.B.C., both as a cheerful entertainer in trying conditions and as a "fourth arm" of the national offensive.

The many sections of the handbook are almost all written by men who do the job under review; where the contributors are not actually on the B.B.C. staff they are men of eminence closely connected with broadcasting activities in this country. Mr. Harold Nicolson, M.P., Parliamentary Secretary to the Ministry of Information, for example, contributes an enlightened discussion on broadcast propaganda, and Major Gladstone Murray, General Manager of the Canadian Broadcasting Corporation, tells the story of the successful co-operation between the B.B.C. and the C.B.C. in providing programmes not only for Canada, but for the whole North American continent.

The growth of broadcast news in foreign languages since the beginning of the war is specially stressed. Such broadcasts now go out in 34 languages and occupy 145 hours a week in 78 daily news bulletins. A large staff of experts controls this intricate network of programmes, many of which are doing yeoman service in enemy-occupied Europe.

Other sections of the handbook reveal work done by the B.B.C. "outside itself," that is to say, the great work of Listener Research and that in which, through its Monitoring Service, the B.B.C. becomes for once a listener instead of a broadcaster. It is recorded that some two hundred bulletins in 30 languages are listened to and compiled every day in the daily monitoring report that has proved so useful to the Services and to Government Departments.

Broadcasting at home has its full share of space and the past year's work of B.B.C. departments under war-time conditions is closely reviewed. The price of the handbook is 2s. (2s. 4d. post free) and it may be obtained from the B.B.C. Publications Department, The Grammar School, Scarle Road, Wembley, Middlesex, or from any bookstall.

PILOT OWED LIFE TO RADIO

AN R.A.F. pilot, describing how a bomber crew, when out on a raid, depend on wireless, said: "We are like a very small British colony, and it is good to feel we are in touch with home." He was speaking to the workers in a factory which, before the war, turned out a well-known make of wireless set, but which is now entirely given over to the production of radio equipment for aircraft.

Visits to factories by pilots and other members of aircraft crews arranged by the Ministry of Aircraft Production, are proving of the utmost value in stimulating the workers. Many factory jobs are dull; many, under conditions of mass production, are so remote from the finished article as to seem almost pointless. But now that crews visit factories and factory workers visit R.A.F. stations the workers in the shops meet the flying men. They learn how vital to the R.A.F. is the humblest job in the production of aircraft and of aircraft equipment. At this particular radio factory the visiting pilot was accompanied by two sergeants, one a wireless-operator and the other an air gunner with a newly-conferred D.F.M. Each had been on many bombing raids. They spent the morning and afternoon at the factory going round the benches. In the lunch hour they each briefly addressed the workers assembled in the factory canteen.

The wireless-operator was able to speak technically about radio; the air gunner described raids on Berlin and Milan; and the pilot—a Flying Officer—made it clear that he owed his life to wireless. His aircraft, badly shot about, was obliged to come down in the sea; but an S O S had already been sent out, and after 12 hours in a rubber boat he and his crew were rescued.

Replies to Queries

Theoretical Knowledge

"I have been a keen radio enthusiast for three years, and whilst I seem to have quite a fair knowledge of the subject, I must confess that I have not paid too much attention to the theoretical side of my hobby. I am hoping to secure a position in one of the radio branches of the Services when I join, and I am wondering whether my lack of theoretical knowledge is going to prove detrimental and whether I should make a belated start to become familiar with such matters. I understand that one receives extensive instruction and training on joining?"—P. B. (Earlsfield).

YOU are not alone in this matter. Many amateurs are now regretting that they did not give more time to the study of the theory of radio. Although those accepted for one of the radio branches of the Services receive a thorough training in all matters appertaining to the particular work they will undertake, it must be appreciated that the man who has a reasonable theoretical and practical knowledge stands the best chance of passing the various examinations, securing promotion and passing on to more advanced and, usually, more interesting work. We would certainly advise all who contemplate such activities to commence brushing up their theory. Work right through a good text-book and don't skip the fundamentals. Learn all the more general formulæ and undertake some calculations involving their application. Pay attention to multi-valve circuits and see that you are familiar with the purpose of their individual parts or sections. A very good book to read is the "Radio Training Manual," as advertised elsewhere in this issue.

L.F. Coupling

"I am anxious to build a small three-valve receiver capable of operating from a low H.T. supply, which will be obtained from a mains unit whose output is only 100 volts. I am naturally anxious to get the maximum amplification from the L.F. stage, and as I wish to obtain the best quality of reproduction I fancied using R.C. coupling, but am doubtful about what value of load resistance I shall be able to use, bearing in mind the low H.T. voltage. I believe it is possible to use an L.F. choke in place of the resistance. If this is so, could you give me details of a suitable component?"—R. B. (Earlsdon).

IT is quite permissible to use a well-designed L.F. choke in place of the usual anode resistance, provided that the component has a high inductance value, and a low D.C. resistance. Messrs. A. F. Bulgin, of Abbey Road, Barking, Essex, can supply a suitable model, and we would suggest their L.F.34S, which has an inductance of 100 henries, at 10 mA. Its D.C. resistance is 1,800 ohms, and at the full specified current would only produce a voltage drop of 18 volts.

Eliminators and Class B

"I am using a receiver which has a Class B output stage, and as A.C. mains have recently been installed in my home, I was thinking of using an eliminator to dispense with the dry H.T. battery. The set is most satisfactory, and I do not wish to make any modifications which are likely to impair its efficiency. I mention this, as some little doubt has been raised by a friend of mine, who tells me that it is not satisfactory to use an ordinary eliminator with Class B circuits. He could not explain why, so would you please settle the point for me and tell me what is the best thing for me to do?"—T. H. K. (Knockholt).

YOUR friend is quite right. An ordinary eliminator embodies a certain amount of resistance in its D.C. output circuit(s). This usually takes the form of resistors, plus the D.C. resistance of the smoothing choke. The former are incorporated to reduce the maximum voltage to lower values, i.e., for tapping points, and as the value of these resistors and that of the voltages available at the tapping points depend on the current flowing in the circuits, it is usual for each eliminator to have definite current output ratings, these being fixed by the designer and manufacturer. If, therefore, less or greater current is taken from the unit, the voltages at the various points will rise or decrease above and below the rated values. A Class B output stage consumes very little anode current when it is idle, that is, when no signal is being handled, but, when signals are being reproduced, it will be found that the anode current varies over a very wide range according to the intensity of the signal. On very loud passages, for example, the current might soar up to, say, 30 mA's, decreasing to something in the neighbourhood of ten mA's for a softer passage and, perhaps, right down to five mA's when no signal is coming through. This widely varying current consumption would cause the output voltage of an ordinary eliminator to fluctuate in a most unsatisfactory manner, therefore the eliminator circuit must be modified in design, or one can use what is known as a "voltage regulator" across an ordinary unit, provided it is capable of delivering, say, 30 mA's. These "voltage regulators" are quite simple components, and do not involve any complicated wiring. Messrs. A. C. Cossor, of Highbury Grove, London, N., can supply such items.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

A stamped, addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Energised Speaker

"I have secured a fine moving-coil loudspeaker of the energised type. Its field resistance is 2,500 ohms, and I was under the impression that I could connect it in place of the smoothing choke in my A.C.-operated four-valve receiver. I find, however, that results are most unsatisfactory. The volume is poor and I am no longer able to receive many of the stations which I used to get at good strength. I am at a loss to know what is wrong, as most of the circuits I study of A.C. receivers use exactly the same method. Can you help me?"—C. Y. (Ladywell).

AS you have not stated the type of rectifier used in the receiver or the total current consumption, we can only assume that the rectifier is of the 250 volt, 60 mA type, and that the current consumption is in the neighbourhood of, say, 40 mA's. If this is the case, then it is obvious that the resistance of the speaker field would produce such a high voltage drop that the receiver would not receive the correct operating potentials. With a field resistance of 2,500 ohms and a current of 40 mA's, a voltage drop of 100 volts would result, thus leaving only 150 volts for the circuit. The best thing you can do is to use a separate mains unit to energise the speaker field, or replace the existing rectifier, etc., with one having a higher output.

Midget Amplifier

"I have been trying to find, in back numbers of 'Practical Wireless,' the constructional details of a small battery-operated amplifier, but so far I have been unsuccessful, although I seem to remember you publishing such information. What I want is really a midget L.F. amplifier, capable of giving comfortable L.S. results from P.U. and/or my one-valver (S.W.). I have not room, owing to the way I am trying to arrange my gear, for a unit of normal size; therefore, if you can make any suggestions or put me on to the right issue of 'Practical Wireless,' I shall be very grateful."—P. L. T. (Brighouse).

WE imagine that you have in mind the Midget Two-valve Amplifier we described in our issue for June 10th, 1939. This is a very compact unit, using standard valves, and it is quite capable of giving the output you require. Copies of the issue—at the time of this going to print—can be obtained from these offices price 4d. post free.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

G. C. (Cambridge). A pre-H.F. stage would improve matters. On the higher frequencies a band-spreader is really essential. A.V.C. would not be effective unless two H.F. stages, at least, are employed.

L. S. (Newcastle). If reaction is too fierce, try lower anode voltage, increase the value of the anode by-pass condenser and/or remove one or two turns from the reaction winding.

H. H. (Swanage). The details are too brief. We cannot determine the source of the trouble from the name of the set. Details of the symptoms are essential to guide us.

S. H. (Southampton). No, we have not published a blueprint showing the construction of any apparatus similar to that which you mention. Regret we cannot help in this instance.

M. A. (Bushey). All issues relating to the set in question are now out of print. The coil is quite satisfactory for ordinary broadcast reception.

E. F. (Boscombe). The reaction condenser appears to be at fault. Check detector circuit for correct operating potentials. You can use the L.F. transformer mentioned.

G. B. (Perak). The scale of the meter can be increased by adding shunt resistances. The value of these will depend on the internal resistance of the meter and the number of times you wish to increase scale reading.

The coupon on page 268 must be attached to every query

MORE B.B.C. BROADCASTS TO EUROPE

THE addition to the B.B.C.'s European Service of the morning news bulletin in Turkish, which started on March 2nd, marks a further extension in broadcasts from this country to the continent. The new schedule of transmissions to Europe introduced on February 16th showed great increases in both the length and number of daily broadcasts in European languages. Broadcasts in French are now an hour longer than hitherto, as is also the case with the German transmissions. Half an hour has been added to programmes in Italian. Czechoslovakia, Hungary, Rumania, Spain, Bulgaria, Finland, Denmark, Portugal, Sweden and Norway, are all receiving longer broadcasts than hitherto.

The B.B.C. mobile recording unit has done much recently to bring to listeners in Allied countries right-from-the-spot radio pictures of what their troops and representatives are doing over here. Czech and Belgian Army camps "somewhere in Britain" have been the subject of feature programmes, and recordings have been made of such incidents as the decoration of General Sikorsky by President Benes, and a reception to members of the Allied Forces recently given by the Netherlands Defence Ministry.

The new French programme now being transmitted in the B.B.C. European service at 17.30 G.M.T. each day is packed with variety. News flashes, topical talks, an "American Commentary" in French, songs, music and news of the Free French soldiers in Africa are among its contents.

Prize Problems

PROBLEM No. 419

JOHNSON had spent a lot of time hotting-up his straight three-valver. He paid a good deal of attention to the reaction circuit, and finally reached the state when the maximum sensitivity was being obtained, the adjustment of the reaction control being quite delicate. He used the normal differential condenser control, the condenser being connected across the reaction coil, one side of which was earthed, and the moving vanes joined to the detector anode in the usual manner. One day, however, the set developed the fault of oscillating furiously as soon as the control was turned up. On investigation, the only fault he could find was associated with the coil. What was the fault and why did it cause the trouble mentioned?

Three books will be awarded to the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 419 in the top left-hand corner and be posted to reach this office not later than the first post on Monday, April 14th, 1941.

Solution to Problem No. 418

When Hawkings connected the condenser between anode of detector and grid of output valve, he proved that signals were not reaching the grid via the coupling transfofmer and/or the condenser by the fact that he obtained signals when he connected the two valves by means of the test condenser.

The fact that the signals were distorted and the current consumption high, when he used the test condenser connection, indicated that the grid of the output valve was not receiving its negative bias. He found, therefore, that the trouble was due to a defective secondary winding on the L.F. transformer.

The following three readers successfully solved Problem No. 417, and books have accordingly been forwarded to them: L. A. C. Slark, c/o Little Downham Post Office, Nr. Ely, Cambs.; J. Haseldine, 22, Lostock Avenue, Bewsey, Warrington, Lancs; J. G. Bethell, 41, Willoughby Road, Wallasey, Cheshire.

Practical Wireless BLUEPRINT SERVICE

PRACTICAL WIRELESS CRYSTAL SETS	Date of Issue	No. of Blueprint
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve : Blueprint, 1s.		
The Signet Two (D & LF)	24.9.38	PW76
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	—	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	—	PW62
The Centaur Three (SG, D, P)	—	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 8 (D 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	8.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen)	—	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-valve)	5.6.37	PW40
F. J. Camm's 2-valve Superhet	—	PW52

(Continued on facing page)

These Blueprints are drawn full size.

Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices *which are additional to the cost of the Blueprint.* A dash before the Blueprint Number indicates that the issue is out of print.

Practical Wireless (issues dated prior to June 1st, 1940). 4d. Post Paid
Issues dated June 1st to July 27th, 1940, 5d. Post Paid
(Issues dated September, 1940 and after) 7d. Post Paid
Amateur Wireless ... ... 4d. „ „
Wireless Magazine ... ... 1/4 „ „

The index letters which precede the Blueprint Number indicate the periodical in which the description appears : Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine.*

Send (preferably) a postal order to cover the cost of the blueprint, and the issue (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

SUPERHETS—*continued.*

Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve) ..	—	PW43
D.C. £5 Superhet (Three-valve) ..	—	PW42
Universal £5 Superhet (Three valve)	—	PW44
F. J. Camm's A.C. Superhet 4 ..	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four ..	—	PW73
Four-valve : Double-sided Blueprint, 1s. 6d.		
Push Button 4, Battery Model .. } Push Button 4, A.C. Mains Model }	22.10.38	PW95

SHORT-WAVE SETS. Battery Operated.

One-valve : Blueprint, 1s.		
Simple S.W. One-valver	23.12.39	PW88
Two-valve : Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen) ..	—	PW68

PORTABLES.

Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen) ..	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve : Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86

MISCELLANEOUS.

Blueprint, 1s.		
S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE CRYSTAL SETS.

Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

One-valve : Blueprint, 1s.		
B.B.C. Special One-valver ..	—	AW387
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans) ..	—	AW388
Full-volume Two (SG det, Pen) ..	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
£5 5s. S.G. 3 (SG, D, Trans) ..	—	AW412
Lucerne Ranger (SG, D, Trans) ..	—	AW422
£5 5s. Three : De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans) ..	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen) ..	—	WM393
Minitube Three (SG, D, Trans) ..	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM409
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans) ..	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen).	—	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*Apr.* '36	WM404

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CABINETS

A CABINET for every radio purpose. Surplus cabinets (undrilled) from noted makers. We have hundreds in stock (no catalogues). Send measurements of chassis, etc., and say what kind of cabinet required. Stamp for reply. Inspection invited.
H. L. SMITH AND CO., LTD., 289, Edgware Road, W.2. Tel.: Pad. 5891.

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MOVING COIL rebuilt multi-meters, 5½in. scale. Ranges 0-5, 0-50, 0-250, 0-500 m.a. and 0-10, 0-100, 0-250, 0-500 volts. Only a few left unsold. **50/-** post free.—W. J. Canty and Sons, 94, Braemar Avenue, Sanderstead, Surrey.

LOUDSPEAKER REPAIRS

LOUDSPEAKER repairs, British, American, any make. 24-hour service, moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

MISCELLANEOUS

AUDIO Output at Radio Frequency. Double-detector circuits. Revolutionary Detection theory; system; circuits; practical experiments. 2s. post free.—D'Arcy Ford, Gandy Street, Exeter.

RADIO SOCIETY OF GREAT BRITAIN extends cordial invitation to all keen Amateurs to join. Reduced war-time subscriptions. Send 1s. for current issue "T. & R. Bulletin" and details.—16, Ashridge Gardens, London, N.13.

MORSE EQUIPMENT

FULL range of Transmitting Keys, practice sets and other equipment for Morse training.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: GERrard 2089.

MORSE TRAINING

FREE. "Book of Facts," tells you all about The Candler System of Code training. Courses for Beginners and Operators.—Write: Candler System Co. (LO), 121, Kingsway, London, W.C.2.

NEW LOUDSPEAKERS

3,000 Speakers, P.M. and energised 4in. to 14in., including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

PUBLIC APPOINTMENTS

MINISTRY OF AIRCRAFT PRODUCTION.

EXAMINERS REQUIRED IN THE

(a) GENERAL ENGINEERING,
(b) RADIO-ELECTRICAL,
and (c) INSTRUMENT BRANCHES

OF THE AERONAUTICAL INSPECTION DIRECTORATE.

All candidates must have had good general education, be able to read drawings, understand specifications, use micrometers and other measuring instruments, and have either:

(a) practical experience in an engineering works with, if possible, elementary knowledge of materials testing, or
(b) good knowledge and experience of radio or electrical engineering, or
(c) knowledge of physics and training in light engineering or instrument making and/or optical instruments.

Normal age limits 23-60.

Candidates require to undergo special training in inspection for period not exceeding three months, during which pay will be £3 10s. 0d. weekly plus Civil Service bonus 5s. weekly, plus allowance of £1 5s. 0d. weekly to married men living outside training area.

Salary on satisfactory completion of training £270 per annum for candidates age 24 and over, slight reduction under 24 years.

Overtime payable.

For further particulars and application form, send **postcard only** to:—

Ministry of Labour and National Service,
Box No. 171, Head Post Office,
Small Street, Bristol.

RADIO CHASSIS WANTED

ARMSTRONG COMPANY regret owing to Government requirements various components necessary for servicing Radio receivers are becoming more difficult to obtain and as we are anxious not to disappoint users of our chassis, we are making an appeal to our old customers, who, through joining the Services or for any other reason, have an Armstrong chassis for disposal, to get into communication with us, when we shall be pleased to make a fair cash offer for same.
The Models particularly required are AW125PP, SS10, AW93PP, 3NBP/T, 3NWT, AW38, AW59/T, RF73, RF94, AW104PP, AW3PB, 3WT/PB. These models vary in age up to 4 years, but a few older chassis will be considered. It is not necessary for them to be in working order but it is essential for the majority of the mechanical parts to be in good order, so that they can be made use of for service work.
ARMSTRONG MANUFACTURING COMPANY,
Warlters Road, Holloway, London, N.7.
'Phone: NORth 3213.

RADIO MAP AND GLOBE

WEBB'S Radio Map of the World enables you to locate any station heard. Size 40" by 30" 2 colour heavy Art Paper, 4/6, post 6d. Limited supply on Linen, 10/6, post 6d. WEBB'S Radio Globe—superb 12" full-colour model. Radio prefixes, zones, etc. Heavy oxydised mount. Post paid. 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: GERrard 2089.

READERS' BARGAINS

A.C. ELIMINATORS, as new, 20s.; with trickle charger, 30s.; carriage free.—12, Yewcroft Avenue, Newcastle-on-Tyne, 5.

RECEIVERS AND COMPONENTS

COULPHONE Radio, New Longton, Preston. Prompt personal service. Brand new goods only. Cosmocord Crystal Pickups. Tungsram Valves, British and American types. Guaranteed American Valves, 6/9 to 8/6, including Octal and Bantam types. 8+8 mfd. 500v. electrolytics (4 leads), 4/3. 8 mfd. 500v., 2/6. 50 mfd. 50v., 2/6. Dubilier and Erie 1-watt resistors, all standard values, 5/6 doz. Latest type 10" Rola P.M. speakers with power-pentode transformers, 22/6. 8" Goodmans P.M. speakers with transformer (Model C/810), 17/6. Stamp for 1941 Spring List.

FRED'S RADIO CABIN
75, Newington Butts, S.E.11. 'Phone: Rodney 2180.
THE SPOT FOR KEEN BARGAINS.
MORE MONEY-SAVING BARGAINS FROM THE CABIN. SUPPLIES ARE GETTING DIFFICULT. LAY IN A FEW SPARES WHILE THE GOING'S GOOD.
VOLUME CONTROLS. Previous stocks completely sold out. A new supply now available—rather better quality. We offer these with every confidence; 12 assorted, some with switches various values. Ideal for servicing, etc. Same price as before, although a better line, **3/-** per doz.
MILLGATE 2-speed geared dials in smart brown bakelite moulding. Listed at 3/-. In unopened boxes, brand new, our price, **1/3** each.
BLACK milled knobs, standard ¼" spindle, improves the appearance of your set, **6d.** each.
REMOTE CONTROLS. 12 stud variable speaker volume controls. An unusual line, seldom available. In beautiful rosewood moulded bakelite, complete with knob. Two sockets for plugs and two-pin output. Square shaped. Also round pattern in brown bakelite with large milled knob, on-off and seven positions with engraved markings 1-7. These are brand new from famous relay company. Will suit any type of moving coil speaker—and serve other useful purposes, **1/-** each. Special low price for quantities of 25 or more.
MINIATURE Bayonet bulb holders. Brand new, well made in brass. Wall fixing type to clear, **6d.** each.
T.C.C. BLOCK ELECTROLYTIC CONDENSERS. Salvage stock at real bargain prices. Serve many useful purposes. Assorted, 8+8+2, 24+8+2, 12+8, and many other values. In some cases one section of the block is dead, but these have been cut out. **7/6** doz. (6 supplied for **4/-**). N.B.—A special low price will be quoted for quantities. We offered these last month and they are nearly all gone—only half-a-gross left. First orders secure.
COIL-FORMERS. Brand new stock, 4½" by 1½" at **4d.** each. Also a line of 1" coil-formers in cardboard at **1/6** doz.
ASSORTED COIL-FORMERS. These are ideal for experimenters wishing to build up their own coils, **2/6** per dozen.
TRANSFORMERS. Another useful line for experimenters and handymen. These are burnt-out rejects and if stripped provide perfect laminations. 4" by 3¼" by 1", **1/6** each.
FERRANTI tubular condensers. 1 mfd. 500 volt d.c. test. Absolutely brand new in maker's original wrappings, **6d.** each.
TRIMMERS. We have just one dozen push-button trimmers, seven on strip, to clear, **1/6** each.
MICROPHONE Buttons. Absolutely first quality; no junk; to clear, **2/6** each.
MICA Condensers, small type; assorted; all useful values; ideal for servicemen, **1/6** per dozen.
CONDENSERS. Single-pole mounting, 50 mfd., 12 volt working, **1/-** each.

Continued at top of next column

RECEIVERS AND COMPONENTS

(*Continued from previous column*)

T.C.C. CONDENSERS. .25 mfd., 1,000 volt working; .1 mfd., 1,000 volt working. Special low price to clear remaining stocks, **6d.** each. State value required.
TUBULAR Condensers. Only a few remaining to be cleared. 1 mfd., 350 volt working; first-class condition, **2/6** per doz., or **3d.** each.
PAXOLIN mains panels, 1⅞" deep, 4¼" wide, sockets marked for 10-0-200-220-240 with two adjustable screw terminals. Ideal for amplifiers or any mains work. Brand new, **6d.** each.
ESCUTCHEON Grilles. Smart heavy gauge. Chromium-plated rectangular 3⅞" by 4½" outside. Complete with four fixing holes, **1/-** each.
WIRE-END tubular condensers, .5 mfd. Another good line at the right price. Reduced to clear small remaining stock, **6d.** each.
KNOBS. Black bakelite milled knobs, with ¼" spindle, **2/6** doz. We are nearly sold out of this line, only a few dozen remain.
ORMOND, brand new in original boxes, .0003 mfd. reaction condensers. To clear, **1/3** each.
MAINS CHOKES. Only a few left to clear, 60 m.a., 350 ohms, at special clear-out price of **2/-** each. Also H.F. Filter chokes, twin mains, for smoothing, **1/9** each.
REACTION CONDENSERS. J. B. balanced differentials, .0005 mfd., shop soiled, in original boxes. List price is about 3/6. To clear, **1/6** each.
LIMITED SUPPLY. Burton 6" angle brackets, now unobtainable elsewhere. Solid stamping, polished finish. In boxes, listed 8d. pair. Our price, **6d.** pair.
CRYSTAL and catswhisker in tin box. Bargain line, to clear, **7d.** each. Very useful to experimenters. Also Lucerne permanent crystal detectors, **1/6** each.
TWIN Binocular H.F. Chokes. A very well-made line with wrapped windings. Brand new, **9d.** each or **8/-** dozen.
ORMOND 3ft. push-pull switches. A small quantity to clear, brand new in maker's boxes. Black bakelite, complete with knobs, **6d.** each.
EKCO mains dropping resistances. Total resistance 700 ohms. 3 tappings; 500, 100, and 100 ohms. Only a few remain to be cleared, specially reduced price, **2/6** each. Also a few "Truwind" mains dropping resistances, 2 tappings, 400 ohms. **2/6** each.
DX AERIAL FILTERS. Cut out noise and interference and improve the quality of your reception. Easily fitted in a few seconds, **1/3** each. Also Lincoln Stewart Aerial Eliminator at **1/3** each.
SPEAKER Transformers. Rejects but very useful for their laminations and your own winding. Laminations T and U 2½" x 1½", **6d.** each.
RESISTANCES and **CONDENSERS.** Ex. famous maker. Paxolin strip carrying approximately 8 resistances and 4 condensers; all useful values. Cannot repeat. **1/3** complete.
PLESSEY 3 gang .0005 mfd. Superhet screened variable condenser, 3½" long, 3" wide. A really marvellous line at the ridiculous price of **1/3** each.
VARIABLE Condensers. .0005 mfd. Brand new. Rightly described as a smashing job for the money. Only a small quantity, **2/-** each.
SIX-PIN dual range coils with circuit, **1/9** each.
VALVE BASES, various, 5, 7, and 9 and American type bases, **2/-** dozen lots, special price for quantities.
Postage must be included with all orders.
Regret cannot accept C.O.D. orders.
FRED'S RADIO CABIN FOR BARGAINS,
75, Newington Butts S.E.11. 'Phone: Rodney 2180

GALPINS ELECTRICAL STORES

ELECTRIC LIGHT CHECK METERS, small, late type, well-known makers, in good condition, electrically guaranteed to 200/250 volts 50 cy. 1 phase A.C. mains. 5 amp. type, **6/-**; 10 amp., **7/6**; 20 amp., **9/-** each. Post 1/- on all types.
D.C. ELECTRIC LIGHT CHECK METERS, 200/250 volts, 5 and 10 amps., **4/6** each, post 1/- (in new condition).
PHILIPS HIGH VOLTAGE CONDENSERS. Infd. at 4,000 volts working, **5/6** each, carriage 1/6.
EX R.A.F. GLASS ACCUMULATOR TANKS, 5 x 5 x 8in., new and unused, **3/6** each, post 1/-.
EX R.A.F. SWITCH PANEL, with case (new) fitted 6 small knife switches, leads, cords and cleats, complete in wood case, **2/6** each, post 6d.
D.C. MOTOR BLOWERS, 2in. inlet and outlet. Aluminium body, laminated field, ideal for dug-out ventilation. 100 volt, **25/-.**
HIGH-VOLTAGE TRANSFORMERS, useful for all test work or television. Input 200/240 volts, output 5,000 and 7,000 volts, **7/6** each, post 1/-.
VOLTAGE CHANGING TRANSFORMERS (Auto-Wound), 100/110 to 200/240 v., or vice versa, fully guaranteed, 1,000 watts, **60/-**; 2,500 watts, **110/-.**
DUG-OUT LAMPS, Ex R.A.F., solid brass construction, glass dome, complete with 12-volt bulb (any bulb can be fitted), wall fitting, **3/-** each, post 6d.; Ditto, wing type, as new, **2/6,** post 6d.
DUG-OUT LAMPS, Ex. R.A.F., porthole type, or can be bracket fitted, glass dome, three colour fitting, white, red, or green, solid brass construction, 6in.

(*Continued on page iii of cover*)

FREE ADVICE BUREAU

COUPON

This coupon is available until May 3rd, 1941, and must accompany all Queries and Hints.
PRACTICAL WIRELESS, May, 1941.

RECEIVERS AND COMPONENTS

(Continued from page 268)

dia., complete with bulb; any size bulb can be fitted. Price **5/-**, post 6d.

1 kW. TRANSFORMER, 100 v. input at 100 cycles, output 10,000 volts centre tapped, price **30/-**, carriage forward.

EX R.A.F. AUTOMATIC CHANGING CUT OUTS AND VOLTAGE REGULATORS, to suit any dynamo up to 20 volts at 15 amps., fully adjustable, wiring instructions, complete in metal case. Price **3/6**, post 9d.

DYNAMOS, all shunt wound and fully guaranteed, 50/75 v.-15 a., **25/10/-**, carriage forward.

25-VOLT D.C. MOTOR, maker "Crompton," ½ h.p., ball bearing, in perfect order, **£3** carriage forward.

110-VOLT D.C. MOTOR, totally enclosed, rated at 8 amps., ball bearing, in new condition, make good slow-speed dynamo, **£2 5/-**, carriage forward.

PHILLIPS TRANSFORMERS, 220 v. input, output 2,000-0-2,000 volts, 200 m/a and 2 L.T.s., **40/-**, carriage forward.

¼ H.P. 110 v. D.C. MOTOR, in good working order, **25/-**, carriage forward.

MILLIAMPMETERS, 2in. dia. 0-30 m/a, **20/-**; 2½in. dia. 0-500 m/a, **20/-**.

FLOODLIGHTS, 12in. dia., multi mirror type with 5in. dia. margin spot centre, any bulb can be fitted, **15/-**. Carriage paid.

AERO DYNAMOS, output 12v.-12 amps., new, **15/-** each. Carriage paid.

GALPINS ELECTRICAL STORES,
21, WILLIAM STREET, SLOUGH, BUCKS.
Terms Cash With Order or C.O.D.

BANKRUPT Bargains, GENUINE OFFER. Brand new 1939-40 models, makers' sealed cartons, fully guaranteed at 25 per cent. to 40 per cent. off present prices; also portable midgets. Send 1½d. stamp lists. —Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

SOUTHERN Radio's Wireless Bargains.
Most lines previously advertised still available. New list to be advertised shortly.
Southern Radio, 46, Lisle Street, London, W.C. 'Phone: Gerrard 6653.

VAUXHALL. Rola 8in. P.M. Speakers, with transformers, 14s. 9d. Cosmocord pick-ups with volume control, 11s. and 18s. 9d. Dubilier composition volume controls with switch, 25,000 ohm, 1s. 9d.—Vauxhall Utilities, 163A, Strand, London, W.C.2. Postage extra under 3s.; send 1d. stamp for component list.

PILOT Twin-Miracle, 5-valve A.C./D.C. mains/battery portable superhet. First-class condition. Works tested. New battery, £6 10s. carr. paid.—Rushworth, 6A, High Street, Saffron Walden.

GEE GEE GEE GEE GEE GEE
15, LITTLE NEWPORT STREET, W.C.2.

METAL CHASSIS. Well finished in battleship grey 11in. x 7in. x 2½in., ex famous set-maker in brand new condition. Fitted with seven valveholders. Four 7-pin and two 5-pin. Suitable for all kinds of adaptations. Limited supply. **4/-** each.

AMERICAN & B.V.A. valves. All types in stock, from **4/-** each. Send us your list and we will supply.

SCREENED SLEEVING. A good line of circular metal wrapped sleeving. Unrepeatable, **6d.** a yard.

CELESTION P.M. Speakers. Absolutely brand new, latest type 6in., at special low price, **12/6** each.

A.C. BATTERY CHARGERS. Made by famous maker, ½ amp., **14/6**; 1 amp., **50/-**. 2, 6, and 12 volt.

MAINS DROPPING RESISTANCES. 150 ohm flat metal type, most suitable for midget receivers, **1/-** each. We carry large stock of mains droppers, .2 amp. and .3 amp. tapped. Tell us your requirements.

EX-G.E.C. Speaker transformers. Brand new for pentode output only. Not a junk line, but good-quality stuff in first-class condition, **2/9** each.

SOLDER. Very best quality resincore solder, 50 per cent. tin, 12 gauge, **6d.** a length.

EX-PHILCO new American battery valves. Types: 1A4E, 1B4E, **2/6** each.

VARIABLE CONDENSERS. 3-gang .0005 mfd. A fine job with die-cast frame and solid aluminium vanes, **2/6** each.

PAXOLIN strips with 22 tappings, suitable for resistance strip, brand new, 8½ inches long, **6d.** each.

ASSORTED Paxolin strips with and without terminals, some with sockets. Invaluable to constructors and radio servicemen. Assorted to clear, **2/6** doz.

AMPERITE Line voltage controls. Lamp, complete with base. Eliminates surge from mains and prevents possible damage to receiver. For 100/140 volts, ideal for American midget receivers. Full instructions enclosed, brand new in original boxes. Lamp and base complete, **5/6**.

We hold large stocks of the above items, and will quote extremely low terms for large quantities
Postage extra.

GEE ELECTRIC, 15, LITTLE NEWPORT ST., W.C.2.

CAN Electrolytics, 12 x 16 mfd., 525v Peak. With clip fitting, **3/11** each.
CAN Electrolytics, 8 x 8 mfd. 450v. working. With clip fitting, **3/11** each.
T.C.C. 1 x 1 mfd. paper condenser. 250v. A.C. working. 450, D.C. working, **1/11** each.
T.C.C. 1 mfd. paper condensers. 350v. working, **1/-** each.

RADIO CLEARANCE, LTD.

PLESSEY 4 Waveband Coil Units, with switching, fully screened Pre H.F. stage, 465 kc/s oscillator 13 metres, 2,000 metres, **21/-** each, no diagrams available; I.F. transformers, **2/6** each extra; gang condensers for same, **2/11**.

LISSEN 2v. Battery Pentodes, 4-pin, side terminals, P.T.2A., **4/11** each.

LOW-LOSS Ceramic Valve Holders, Lissen Hi-Q baseboard and chassis, 7-pin, **1/-** each.

LOW-LOSS Short-wave Condensers, variable, ceramic insulation, brass vanes, Lissen Hi-Q, minimum capacity 5 microfarads, 20 mfd., list **5/6** each; our price, **2/6** each.

PUSH-PULL Switch, Lissen 2-point, **4d.** each; 3-point, **6d.** each.

YAXLEY type Switches, 4-pole, 3-way, **9d.** each.

YAXLEY Switches, 4-bank, 2-pole, 4-way, **2/6** each.

YAXLEY Switches, 6-bank, **3/-** each.

YAXLEY Switches, 9-bank, **3/6** each.

ROLA P.M. Speakers, latest model, 7½in. cone, with power and pentode transformer, boxed, **17/6** each.

CLOCK-FACED Dials, 5in. x 5in., with printed scale, 4-wave, **2/6** each.

STRAIGHT-LINE 3-wave-band Dials, **1/11** each.

MAINS Transformers.—Wearite R.C.1 250-0-250v. 80 m.a., 4v. 2.5 amps., 4v. 4 amps., **9/11** each; R.C.4 500-0-500v. 150 m.a., 4v. 2 amps., 4v. 2.5 amps., 4v. 5.6 amps., **21/-** each; R.C.5 100-watt auto-transformers, 100-110v., 200-250v, reversible, **14/11** each; all above transformers 200-250v. tapped primaries.

QUANTITY of Wearite Mains Transformers. New, but with dented covers, R.C.1, **5/6**; R.C.3, **9/6**; R.C.4, **14/6** each. Specification as above.

CHASSIS Mounting Valve Holders, American Octals, **6d.** each.

CHASSIS Mounting Valve Holders, English Clix type, 4-5-7 pin, 3d. each; Celestion valve holders, 5- and 7-pin chassis type, **4d.** each; baseboard type, 5-pin, **2d.** each.

CENTRALAB Volume Controls. Midget type, 2,000, 5,000, 25,000, 50,000, 100,000, 500,000 ohms, less switch, **2/9** each; 1,000, 25,000, with switch, **3/6** each.

SPEAKER Transformers, pentode output, **3/6** each.

PRESS Button Units, size of unit 6in. x 6in. x 2in., complete with 6 press buttons and capacitators, **4/11** each.

PLESSEY Motor Tuning Units, including fractional h.p. A.C. motor for 12v. continual running on 24v., intermittent running and 2-gang 0.0005 condensers, **8/6** each.

12-WAY Push-button Switches, **1/6** each; 11-way push-button switches, **1/6** each; 6-way push-button switches, **1/-** each; 7-way push-button switches, **1/-** each.

DROPPING Resistances, for all purposes, total resistance 535 ohms, 5 taps in steps of 50 ohms, standard for Pye, Lissen, Ever Ready, etc., **3/-** each.

RESISTANCES, 100 ohms, 10 watt, **1/-** each.

10FT. Coils Connecting Wire, glazed, **4d.** each.

PUSH-ON Pilot Lampholders, **3d.** each.

PLESSEY Single-gang 0.0005 Variable Condensers, **1/6** each.

2-GANG 0.0005 Variable Condensers, with Vernier control, **1/11** each.

PERMUABILITY Tuned Press Button Units, **2/6** each.

B.I. Wire-end Bias Electrolytics 50 mfd., 12v. **1/6** each.

TUBULARS, wire-end non-inductive paper condensers, all sizes up to 0.01, **5d.** each; 0.1 **7d.** each.

B.I. 8 mfd. Tubulars, cartons, **2/11** each.

T.C.C. 2 mfd. Electrolytic Condensers, 200v. working, **1/3**.

CONDENSERS, 0.0005 twin, **1/3** each; triple, **1/9** each.

WESTON Meters, 0.50 m.a., and 0.300 m.a., moving coil type, **25/-** each.

ROTHERMEL Senior Crystal Pick-ups, **33/6** each.

SMALL Brown Knobs, **2d.** each.

1LB. REELS 16 and 20 gauge Tinned Copper Wire, **2/6** reel.

5" MIDGET Energised Speakers, 600 ohms Field with Pentode Matching Transformer, **7/6** each.

All orders must include SUFFICIENT POSTAGE TO COVER. Hours of Business: Weekdays, 9-4.30. Saturdays, 9-1 p.m.

PLEASE WRITE YOUR NAME AND ADDRESS IN BLOCK LETTERS.

We cannot undertake to answer enquiries unless full postage included (2½d.).

RADIO CLEARANCE, Ltd., 95, HIGH HOLBORN, LONDON, W.C.1.
'Phone: HOL 4631.

RECEIVERS AND COMPONENTS

LONDON CENTRAL RADIO still supplying the best bargains in Surplus Electrical and Radio Gear. Mostly EX-GOVERNMENT, G.P.O. and SERVICES

SINGLE Earpieces. A good line for experimenters with flexible metal sheathing, chromium-plated. Only a few to clear, **2/6** each.

RESISTANCES. Assorted values and makes, Erie, T.C.C. American, etc. Resistances are in short supply —get a dozen or so while you can. Low price of **1/6** doz.

TAPPED mains resistances. Another good line, for .2 amp. valves. Tapped at 200, 230 and 250 volts. To clear, **4/-** each.

WESTINGHOUSE Rectifiers. The popular type H.T.8. Slightly used, but guaranteed in good condition and working order. Only **3/6** each.

SWITCHES. Heavy duty 3-way 4-pole switches, a good soundly constructed job, will stand up to hard wear, **1/6** each.

B.I. CONDENSERS. Block type oil filled in metal cases with terminals. High quality components, 4 mfd. 450 v. d.c. test, **3/6** each. Also .1 mfd. 1,000 v. d.c. test, **2/6** each and 0.25 mfd. 1,000 v. d.c. test, **2/6** each.

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