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Illustration shows S.P. with cover removed

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4 in. x 5½ in. DOUBLE POLE, IRON CASED

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

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

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<td>6</td>
<td>S111Z*</td>
<td>36/-</td>
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<table>
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<th>Type</th>
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<td>600/800</td>
<td>80 mA</td>
<td>24 H</td>
<td>£3.50</td>
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</table>

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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 such sets, or 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 1916, the set cannot be used or readily repaired. It is quite apparent, therefore, that the Board of Trade will 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 by 'railway companies' road vehicles, either as complementary to rail conveyance or for through-out the country as a whole, the apparatus 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

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 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 the factories should be of a fixed nature, provided or large, and should not take a similar action by arrangement among themselves. Once the arrangement is confirmed, 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 the 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 from shutting up shop 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 radio 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. However, 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 requirements of the industry are available to meet fully 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 civil purposes 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, 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 means for obtaining 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 indicate prices 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,
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 amplifieracks 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 musical point of view. A.R.P. types, on the other hand, are of the crystal type, and perform a task which requires a narrow frequency response. A.R.P. equipment is helpfully and efficiently designed, and a typical installation is shown in Fig. 1. The 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 musical point of view. A.R.P. types, on the other hand, are of the crystal type, and perform a task which requires a narrow frequency response. A.R.P. equipment is helpfully and efficiently designed, and a typical installation is shown in Fig. 1.
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 the 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 grid of the large valves in the output amplifier.

As previously stated, there is nothing to get concerning the valve stages, assuming that 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 board. 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 from the main feed so that the other floors get their programme while the output from an audio-frequency oscillator is injected into the faulty board, 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 loudspeaker, can operate without being seen. These installations are generally in buildings which have a certain amount of dignity to maintain. Town halls, professional institutions, 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 co-operates 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 provide a 500-watt (5 kW) output stage. Units of 20 or 40 watts may be quite sufficient to fulfill 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

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PRACTICAL WIRELESS 245
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 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 0.2 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 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. 2—How automatic bias may be applied in the circuit shown in Fig. 1.

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 made by taking the overall 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.F. 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 overload of 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 twice that of one valve. At the same time, push-pull is extremely useful, due to the fact that...
it is capable of giving better reproduction at 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 a push-pull without the disadvantage of heavy anode-current consumption. In fact, the average consumption is seldom appreciable. The choice of one valve or two (twin pentode) 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 sometimes necessary when tuned to a speaker having a so-called universal matching transformer with a centre tap, since the primary of this will take the place of the secondaries. In building a output circuit used on a Q.P.P. circuit and provided with tapping to give a step-down ratio of about two to one. A tone-correction circuit, again considered as a condenser and resistor in series, is also shown connected between the two anodes of the G.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 B.B.C.'s Pacific Service. This 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.

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 B.B.C. 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 way 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 of the transformer than that due to various forms of parasitic oscillation.

Fig. 5—This skeleton circuit shows the arrangement of a class B amplifier with the necessary drivers. 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.

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 is manned by two commentators and two engineers. The English commentator is Bruce Anderson, of Johannesburg, who, prior to the war, was associated with the radio programmes 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 descriptive phrases. During the war, Mr. Anderson was with the Army in Kenya when he was asked to take up his present position. Johan Lampecht, who is the Afrikaans commentator, was recruited from the Engineering division of the S.A.B.C., having been engineer-in-charge of Pretorius 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 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 the 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 they 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-dot-dash, but dit-dit-dah-dit.

Learning the Sounds

This might sound a little complicated, but if you tune in to 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 what is made in that way is very similar to representing the letters of the code. The sound made in that way is very similar to representing the letters of the code. Learning the sounds people find that they can whistle the sounds but if you tune-in to a good high-rate buzzer in conjunction with a morse dit-dit-dah -dit, it should be regarded as similar to the sound instead of learning the letter A as dot-dash, similarly F is not dot-dot-dot-dash-dot, but sounds, and must be learnt as such. Thus, considering joining one of the Services find a good working knowledge is extremely different procedure, but all would agree in a quick 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 task is less tedious and far more interesting. If you were to ask three or four experienced wireless operators how they 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.

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 dots and dashes is translated into a letter by the subconscious mind. In fact, it 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

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Note of interrogation: dit dah dah dah dit
dot respectively: then learn the “dash” letters, T, M and D; attention can then be turned to “opposites” such as A and N (••••••), U (•••••••) and D (•••••••), B (•••••••) and V (•••••••) and Y (•••••••). 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.

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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. It is unthinkable that the Germans, when they draft any more of their refugees, 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 announcers are as bad as the men, and the moment that most of us hear a woman announcer start announcing that "You all know about such-and-such the Ministrat-of Agricultural," we switch off our sets.

All the Way from "Boatam"

ONE of my readers, rejoicing in the name of Filbert, 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.

Who is the Doyen?

I HAVE received the following note from G. X. G. (Ruley). "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—

Tinny. dingy. tiddly.umpy. funny— with eyes so blue.

I'll hardly. pinky, hokey-jokey. lula.uddle. duddle.

We'll cozy. every. sappy. cozy. Thump. thump. thump.

And moo-go doo-doo, dudum. dudum, dudum. dudum—

hops.

Boo, huh, huh, boop, and lal lo do.

Waggle. waggle. moon.

Cap. grass, cherrybump. bump. bump, lala. lala.

Go-go lula. poppy. lala.

Command. pop. pop. pop. pop. pop. pop. pop.

Where you and I will gumpuspole 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 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 Coo; Love's Melodipeeece; Monley, Monley 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."
MORSE MADE EASY

May, 1941

PRACTICAL WIRELESS

(mo)se 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 spacing unless they have 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 practice sets 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 high-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 the correct components, as shown in Fig. 1. An alternative method of connection is to put them in parallel with the buzzer windings.

As mentioned, it 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 set in at the correct angle, and if not, to a 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, 1-16 in.—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 H.L. type of battery valve in the circuit shown in Fig. 2, where an L.F. transformer is used for grid and anode coupling. The tone 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 oscillator.

Emphasising the Characters

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 the usual length of five 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 dits a minute. This is the method used by 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.
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 loudspeaker. 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 accidents which had gone 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 some point.

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.

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 before in 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 speak 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 gage or heavy flex, so 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 a 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 the type shown in Fig. 2. 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 had been 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. The alterations made are indicated by heavy lines in this diagram.
obtained without the instability. In most cases of this kind it is sufficient to fit a 0.0005-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 a less expensive circuit when the switch 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”

That 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 14 volts and with the control arm at minimum, to avoid overloading the meter). The component was perfectly sound. Then I opened the meter and found it was not connected to the right circuits; the G.B. battery was connected 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 the variable-mu valves. The fault, as explained, was that it was reduced.

A Superhet Fault

An A.C. superhet refused to operate, although the I.F. portion was found O.K. when checked with a groove-pick-up. When the frequency-changer and I.F. amplifier were put out of action by connecting the aerial coil direct to the triode, the second detector fairly good signals were received from the British M.W. transmitters, showing that the second detector was faulty. In the 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 no­dcircuit components were found to be good, however, when their approximate resistance was measured, 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., and over 4.4 (by the meter) at the other valve-holders. The valve was a new 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 socket leads. 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 use in emergency. Previously, only the larger vessels equipped with radio-telegraph and manned by a commercial operator had such facilities. With the increased use 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 Compass

The compass unit consists of a small radio receiver carrying tuning and volume controls on the top. Power is obtained from the radio telephone unit, and the loudspeaker of this unit is employed. A jack is provided on the compass back panel, 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 to these two sets of 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 radio 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 Clarence is 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 type 226 radio-telephone equipment. (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: Beaconfield Conservative Club, Norris Square, Ashton-under-Lyne.

Meetings: Every 1st and 3rd Wednesday at 7.15 p.m.

MAY

The conversion of the club’s receiver from A.C. to D.C. for operation was finally completed at 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.

PRACTICAL WIRELESS

May, 1941

on April 2nd a lecture and demonstration was given at the club-room by Messrs. Robinson (of Casons, Ltd.) and A. J. Aiken, on the subject of "Quartz Crystals." Mr. Aiken dealt with the growth and formation, and Mr. Robinson with the cutting, grading and applications. Appropriate lantern slides were 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, the first meeting, which was held in the premises of the late S. J. Packwood Ltd., in the Craft Room (1st floor), Hope Park School, Park 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 club room is "a work room" with a bench with the building of a power pack for use on various receivers, etc., being available to all youths between the ages of 14-19 who are interested or who wish to become interested in radio. A lecture was given at the club-room in order that short-wave listening can take place. The club room is given free by Mr. A. J. Aiken, and the club meets at only 1d. each meeting attended, there is no entrance fee, and it is not necessary to have any technical knowledge 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. Watson, 10, Rutland Avenue, Thatch Lodge Lane, Whitley, 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 copper at a "car cemetery." These instruments are precision made, and yield a variety of useful gears and parts for the experimenter. The gearing mechanism can be used to give various reduction ratios, the scheme I have adopted being as shown in the sketch.

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 to the "microphone" on another speaker. This 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.

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. Niemons (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 punching 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 colls (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).

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 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 2 in. by 1½ in. 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. Conn (Tamworth).

PRACTICAL WIRELESS

May, 1941

253
A Direct-reading Audio-frequency Analyser
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

WETHER 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 meter, the second frequency being 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. Constructural details appear in the section drawings, Fig. 4, which illustrate the most straightforward manner of mounting the few parts for straightforward wiring.

The instrument is very compact, measuring only 4½ in. long, 4 in. wide and 3 in. 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 50 cycles, the first two graduations on the author’s dial, is approximately three-eighths of an inch, while the 10-ke. line lies only one-sixteenth of an inch from 9 ke. Increasing the diameter 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 3/16-in. dial shown here.

Main settings of the meter are made with the large dial, which controls the large 1,000-ohm 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 a red output jack into which is plugged headphones, valve, voltmeter, or any other good null detector.

The casing shown in the photograph was formed from 1/16-in. aluminium, and given a baked lacquer finish after machining. The bottom is provided with felt mounting foot and protection with a cover.

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 aene 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 voltmeter into the L.P. 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 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. Desired improvement may be achieved by rotating the knob controlling R2 by a small amount.

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Fig. 1.—The finished instrument.
This auxiliary adjustment will in a number of cases 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 moving coil 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 condenser 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:

\[ f = \frac{2πRC}{\Lambda} \]

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 may conveniently be combined in a dual-ganged rheostat, and as a result adjusted simultaneously to balance 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 R3 are sections of a standard dual-ganged volume control, and that the main dial is affixed to the shaft of this part.

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 corresponding 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 1 megohm, and C1 and C2 each a capacitance of 0.0133 microfarad for that very reason.

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 content in the simple system of wave form analysis that is apt to occur to the reader.

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 heat 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, 750, 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...
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 a 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 variable transformer. 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 forming two 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 values corresponding to the dial frequencies is given below for the reader’s convenience.

<table>
<thead>
<tr>
<th>F Cycles per second</th>
<th>R Ohms.</th>
<th>F Cycles per second</th>
<th>R Ohms.</th>
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<tr>
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<td>500,000</td>
<td>250</td>
<td>1,500</td>
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<td>30</td>
<td>412,500</td>
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<tr>
<td>1500</td>
<td>1,417</td>
<td>1,417</td>
<td>250,000</td>
</tr>
</tbody>
</table>

Table of resistance values and dial frequencies.

The point should be emphasized that this table gives the number of values which may be considered to be adequate for the purpose of calibration. 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 a lesser extent upon the ability of the operator to recognize 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 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 evident 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 position of balance, and all the figures made permanent with black India ink. The celluloid cover is placed over the scale and the dial reassembled and replaced on the instrument. If any more frequencies may then be checked to determine if the dial has been replaced properly, any discrepancy being put to the set screw, and rotating the dial lightly 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 Deanne Durbin is "Musetta’s Valse Song" from "La Bohème." A lovely record, one you will play and play. The coupling, Locomond, 03067, is particularly beautiful in every respect, from the quality of Durbin’s voice and the beauty of the melody and the setting of it. Charles Previn’s Orchestra accompanies and provides a particularly beautiful string background to Locomond. The number is Brunswick 03067, 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 cheerful, bright number ‘That’s For Me,’ which gives him an opportunity to display his artistry in singing a rhythmic song. Brunswick 03002.

Have you heard the Ink Spots? This vocal quartet is extremely good. They are rapidly taking their place in the forefront of the record companies and are gaining a more definite minimum signal, and a place in the permanent record section. Their first number, "Stop Pretending," Brunswick 03090, is a delightful rhythm number, the Ink Spots doing it with a particular charm.

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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 "Sergeant Pepper." Brunswick 03091, and Charlie Kunz with a medley of numbers including "Maybe," "Our Love Affair," "Ferryboat Serenade." Brunswick 03017.

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 "Mood," and his orchestra turns in a particularly good number 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 Marie." They are just released on Brunswick 03103 and well worth hearing again. Her treatment of "Ain’t It a Shame about Marie" 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 heard, yet with "If Tears Could Bring You Back," Rex 9910, he is from Wynn supplied. "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 Orches-
Tribbing the possession of receivers by enemy aliens, restriction imposed some months ago, is now to be exempt from the authorities 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 district is to be given by the B.B.C. from 8 to 8.15 a.m. B.S.T. The broadcasts will be given on the short wave G.S.A., 49.39 metres, 6.05 megacycles, and the medium wavelength of 373 metres.

A Unique Verification Card

T is reported that a New Zealand reader of our contemporary, The Australian Radio World, recently received a novel verification test from station KGIB 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

M. R. 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

T 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 will nudge the smoke out. The device can be directed at the smoke from, getting out and spreading around the countryside. Inside a piece of hollow pipe is a 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 wire 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 agglomerate 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 ideas for which they may volunteer are: radio operator, morse slip reader, teleprinter operator, telephone operator, and instrument mechanic.

Servicemen's Postal Course

W E 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. Lyczyn. 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 sea-side 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.

PRACTICAL WIRELESS 257

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

Plymouth Radio Relay Service

T H E Radio Rediffusion Co. at Plymouth has been granted permission to increase its relay rental charge by twopenny a week. Application was originally made for permission to increase the charges from 1s. 6d. to 1s. 8d., but the Works Committee of the Plymouth Council refused.

Radio Gas Mask

T H E 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

A CCORDING 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 percent (approx.).
From Triode to Triode Hexode

The problem of selecting a suitable valve for a particular circuit is not one which need be 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 is quite necessary to overcome 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 understand the meaning of the terms employed. This article, therefore, is intended to explain the general details of those valves most widely used by amateurs, but 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, has only two of these, the cathode and the anode. 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 section, 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 operating 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 the 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 one. 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 cylinder 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 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, that 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. A number of objections may be raised 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 and anode, 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 the modern H.F. screen-grid valve is quite different from its original predecessor, but in actual fact this type would be termed a tetrode. The reason it is called a tetrode is because five grids are used. The first grid is the control-grid, the second grid is the suppressor-grid, and the fifth grid is the screen-grid. These grids are 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). The 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 wire 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, that 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. A number of objections may be raised 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 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

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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.

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 screen 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, decoupling 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 triode being 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.

PRACTICAL WIRELESS

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 phrasing 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, Is., or 1s. 2d. by post from George Newnes, Ltd. (Book Dept.), Tower House, Southamptom Street, London, W.C.2.

A fitting home for every valve!

AMPHENOL


Mr. F. J. Camm (Editor of "Practical Wireless") specifies and uses Celestion-Amphenol valveholders because of their features described below.

Note these features:

STRENGTH! EFFICIENCY!

- Exclusive Celestion-Amphenol Moulded-in Plates ensure maximum strength, rigidity and a high degree of efficiency.

- The sturdy plates keyed into the body cannot rattle loose.

UNIFORM CONTACT! INSULATION!

- Celestion-Amphenol Contacts pressed from specially treated phosphor bronze are engineered to ensure uniform contact on all prongs.

- There will be no "fatigue" even after constant use.

- Exceptional insulation is assured by the special properties of the moulding powder.

CELESTION-AMPHENOL VALVEHOLDERS

Ensure improved electrical qualities.

Will improve the appearance of your receiver.

British made by

CELESTION LIMITED

Engineers,

KINGSTON-UPON-THAMES, SURREY

Works at Kingston-upon-Thames and at Ashtead, Surrey.

Telephone: Kingston 5656-7-B.

THE PRACTICAL WIRELESS ENCYCLOPAEDIA

By F. J. Camm

A complete guide, in alphabetical order, to the construction, operation, repair and principles of every type of wireless receiver. Includes definitions, explanations, formulae and complete instructions on the making and testing of various wireless components. Illustrations include a complete series of circuits for every type of modern receiver.

392 pages. Over 500 illustrations.

Of all Booksellers, 10/6 net, or by post 11/- from George Newnes, Ltd., (Book Dept.), Tower House, Southamptom Street, London, W.C.2.
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 now received. The only trouble caused by the splendid response is that connected with the problem of trying to acknowledge all letters of general interest which cover many pages by the 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 Eisteddfod 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 Sten- torian. 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 can use up to a 25-watt Class B amplifier. This circuit makes use of a Cossor 240B valve.”

For light entertainment, I connect up the gramophone pickup 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 are 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.T. cards here number 112, among them being VRMAY, ZX2EZ, K9QJE, PK3JR, etc. The countries I have heard are 36, 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.

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 homemade 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 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 writing 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, Midlx.

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.
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 City, 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 6,100 mc/s, and they tell me that the TX is in the building of the "Direction Genoral of Electrical Communications," in Guatemala City. Unfortunately, they do not state their callsign. "Guatemala,” in Guatemala Territory, is a good call as it is not so. Fortunately, they do not state their home-service identification, but those very means include a call-sign, their schedule is correct in saying that this is not so, and they include "Guatemala," in Guatemala Territory, is a good call as it is not so.

I have received a letter from WPIT, Pittsburgh, who states that WPIT and its staff have been moved to Boston, and that Mr. Bob, on receiving a QSL from station on 31.34 metres at 10.30 p.m. B.S.T., and giving the signal strength and quality, etc., have been heard regularly 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 program in English and Portuguese—usually R7-8.

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M OST biographies of famous musicians purposely leave their works for the reception 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 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), Bonnagasse, Bonn, on December 16th, 1770. Bonn is situated on the left bank of the Rhine, 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 encouraged to grow, and take root. Bonn itself is on the left bank, where it winds itself between high cliffs, orchards and vineyards, with “the sweet 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 influence of the nobility. The aristocrats and the reigning princes and graces. 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 Kappellmeister 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.

As Beethoven 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 1739 under the Elector Clemens August the Pompos. 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 1237 the Archbishop of Cologne was disposed 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 private persons, only 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—those 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 the German Empire and Treves, and the four lay rulers of the Rheinish Palatinate, Saxony, Brandenburg and Bohemia, joined later by Bavaria and Holland, to whom Beethoven’s fame is due.

Ludwig’s son, Johann, the father of the great composer, was a different kind of man. Although also court musician, and married a young widow, Maria Magdalena Keverich, the daughter of a master cook. As is always the case in these circumstances, it was she who larished the noble home with her musical and attention on the little house in the Bonntagasse, 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 Palatinate] was a most melancholy distance from the Residens, whose old charms have been preserved in a coloured engraving, how humble and even pitiable is the poor home of the Bonner school!” In the court behind the house on the Bonntagasse, not far from the market place, three languages remain; the very small garden, several unassuming trees, one of which has ashbark; and a grass plot on which to-day repose the weather-beaten bust of the Master, who composed on the damp hovel, without light, without air, with only a garret window, under these rough rafters, Ludwig van Beethoven was born on December 16th, 1770. A manner would have been less mean.”

In 1889 the house was purchased by a body of amateurs, and dedicated for ever to Beethoven. 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 administration 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 hungry, and, above all, taught by a cruel master cook, whom he must have been frightened, and whom he not unreasonably disliked! We are told that his father also taught him the violin, and reading, writing and critical studies. 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 mercy was and selfish father thought that by keeping his little son hard at work, he could become a successful prince Van den Eeden succeeded by Neele in 1781, and it is perhaps he who most helped Beethoven with his musical studies, a charming man.

The family is believed to have met a good friend about this time in Mr. Crescener, the English Chargé d’Affaires, who assisted the family with their 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 his father died, and the family, which has come down to us—“Nine Variations on Dresdner’s March in C Minor.” It bears the French inscription, “composées par un Jowen amateur de musique, Van den Eeden, de dix ans, 1783.”

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, Neele 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 a boy so young. But it afforded an invaluable experience and training of which he took the fullest advantage. Neele 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 had deserved some assistance that he might travel. If he goes on as he has begun, he will certainly become a second Mozart.”

Beethoven has been remarkable for his cold, 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.

Outline of Musical History—19
The Life and Work of Beethoven—1
By Our Music Critic, Maurice Reeve
PILOT OWED LIFE TO RADIO

A R.A.F. pilot, describing how a bombing 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 the mother country. 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 factory, the visiting pilot was accompanied by two sergeants, one a wireless operator and the other an air gunner with a newly-conferred D.P.M. Each had been on many bombing raids. They spent the morning and afternoon mending the factory going round the benches. In the lunch hour they each briefly addressed the workers assembled in the factory canteen.

The wireless equipment was explained 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.

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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 we no longer give 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 aware that practical knowledge is of more value than 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. (Earfield).

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 the practical subjects 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. You could quite easily 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 formulae and undertake some calculations involving their application. Pay attention to multi-valve circuits and see that you are familiar with the particular parts 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 100 H.T. supply which will be obtainable on 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 am using a resistor for the coupling. I have tried using R.C. coupling, but I am doubtful about what value of load resistance I should employ, and whether to use a 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. (Earlston).

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.438, 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 no ripple, I am having the trouble of a magnetizing effect due to the residual magnetism of the core, which is keying in my recreation. 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 tell me what is the best thing for me to do?" — T. H. K. (Knockhill).

You are quite right. An ordinary eliminator huge circuits would introduce 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 ratings and to be marked 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 current when it is idling, 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. Thus 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 the A.C. voltage. "Voltage-regulator" units are quite simple components, and do not involve any complicated wiring. Messrs. A. C. Censor, of Highbury Grove, London, N., can supply such items.

Energised Speaker

"I have secured a fine moving-coil loudspeaker of the energised type. Its field resistance is 5,500 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 these results are most unsatisfactory. The volume is poor and I am not longer able to receive many of the stations that I used to hear 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. Are you able to help me solve this puzzle?"

A S you have not stated the type of rectifier used in the receiver or the total current consumption, we can only give you general advice. If you use a 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 would produce such a high voltage drop that the receiver would not receive the correct operating potentials. With a field resistance of 5,500 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 battery to energize the speaker grid, 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-fed amplifier, but my efforts have been unsuccessful, although I seem to remember you publishing such information. What I want is really a midget L.F. amplifier, capable of at least 100 mA’s when no signal is present from P.U. and/or my one-valve (S.W.). I have not room, owing to the way I am trying to arrange my gear, for a unit of normal size. 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 you the output you require. Copies of the issue—at the time of this going to print—can be obtained from these offices post free.

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

L. E. (Newcastle). Traction of the anode current by the lower anode voltage, increase the value of the anode by-pass resistor to remove one or two turns from the re bias winding.

R. H. (Oswestry). The details are too brief. We determined that the name is the same of the transmitter, and therefore can not help in this instance.

N. A. (Burley). All issues relating to the set in question are now out of print. The coil is quite unsuitable for ordinary use. We suggest a 7 H.F. choke. The resonant condenser appears to be out of circuit, for correct operating potentials. You can modify the L.F. transformer yourself.

G. R. (Perak). The scale of the meter can be increased by adding 2,000-turns in series, or three will depend on the internal resistance of the meter and the number of micro-volts you wish to increase. Send postage.

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 18th 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, albania, 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 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 in 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 building up his straight three-valve. he paid a good deal of attention to the reaction circuit, and finally reached the state where the maximum output was produced by the adjustment of the reaction control being quite definite.

re. the normal differential condenser in the reaction control, the condenser being connected across the reaction circuit, as is normally the case, and the moving vanes joined to the detector circuit, 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?

solution to problem no. 418

when hawkings connected the condenser between anode of output valve, he found that signals were not reaching the grid via the coupling transformer, and the condenser by this path. if he obtained signals when he connected the two valves by means of the test condensers.

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. 418, and each have accordingly been forwarded to them : i. a. c. stark, c/o little downstream post office; f. fry, c/o j. hastings, 22, lostock avenue, bewsey, warrington, lances; j. g. beattie, 41, willoughby road, walsley, chester.

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Continued on page ii of this issue
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S.W. 1 - each.

C.W. 1 - each.

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