Practical Wireless

and

PRACTICAL TELEVISION

EVERY WEDNESDAY


EDITED BY
F. J. CAMM

ROUND THE WORLD OF WIRELESS

Radio at Christmas

The radio normally fulfills its function as a provider of music and other entertainment during the year, but at Christmas-time it is generally called into use to give fuller play to its possibilities. Many amateurs carry out a little home broadcasting at this time of the year, although for the remainder of the time, this aspect of radio is overlooked. The addition of a microphone may, however, lead to new developments, either for room-to-room communication or for other "telephone" purposes. The old idea of enabling one to hear a baby in a distant room, without having to switch off the wireless to listen, is well known, but there are many other interesting applications which will appeal to the individual after reading the article on home broadcasting in this issue. Gramophone reproduction is receiving more attention, but there are still many listeners who are content with the playing of discs with a simple pick-up added to the set. The use of contacts to reproduce and other special circuits are not so popular as they should be, but those who have tried them can vouch for their effectiveness in improving record reproduction.

Chess by Radio

Two teams, Sydney and England, in one programme, recently played chess by communicating the moves over a radio link. Each team played in two groups of four at different stations. The match ended in a tie at 4–4, persons having the white pieces being successful at all eight boards. This match will probably be the last for some time, as amateur stations have now been taken off the air.

Sets for the Navy

It has now been announced that following the suggestion for supplying the troops with radio apparatus for entertainment purposes, it has been decided to make similar presentations to the men of the Navy. The receivers probably be of the all-wave type so that full use of the short-wave transmissions may be made.

Rumanian S. W. Station

Experimental broadcasts are being made by the new Rumanian short-wave station on the 21500 and 20400 metre bands and also by the station at Kisenew. The power is given as 20kW and the wavelength as 212.6 metres.

Physical Jerks

As already announced, next Monday will see the commencement of an experimental series of physical exercises, to be broadcast for ten minutes, starting at 7.35 a.m. each weekday. On Monday, Wednesday and Friday, a male instructor will direct the exercises for men, while Tuesday, Thursday and Saturday will be given over to women listeners with a woman instructor at the microphone. At the moment the exercises are designed for listeners under 40 years of age, though if the experiment proves popular it is possible that the over-forties will be catered for later on. The exercises will specially designed for listeners with little space in their homes, and if exposure equipment will be necessary.

'Phone Books in Broadcast

Telephone, books, numbering into the hundreds, each consisting of 500 pages, are used in setting the name of the telephone subscriber who gets the lucky 'phone call during Horace Heid's 'Pot o' Gold' programme each Tuesday evening over WLI and NBC. In examining 'phone books from all over the country, it was found that some have 12 pages and some have 200. So it was decided, in order to be completely fair, to bind all the books into volumes of 500 pages each.

Thus, when the selector chooses Book 47, it may mean that that volume will contain telephone books of a half-dozen small towns. When Heid selects Book 108, it may contain only half the pages of the Cleveland telephone directory, while the other half is included in another volume bearing another number.

Frank J. Drennan, the woodworker of Andover, Mass., who was presented with $1,000 on Christmas Eve, regularised. It was he was advised by Western Union that the money was waiting for him about five minutes after Ben Gruver talked to him on the 'phone during the programme. Heid's 'Pot o' Gold' is heard at 8.30 p.m., E.S.T., Tuesday, over the NBC Red Network.

Burbleton Comes Back

If one wished to know what the England outside London was thinking and doing any time during the last two or three years, one could not have done better than pay a radio visit to Burbleton, that mythical North-country township whose local bigwigs discussed their affairs with such engaging frankness. In pre-war North Region language, Burbleton had a very big following and many people will be pleased to hear that it is coming back to the programme. It makes its first war-time appearance on December 1st, and all the old well-known characters will be heard debating, in true Burbleton style, the problems of A.R.P. in their town. T. Thompson, the Lancashire author, is responsible for the script.
A Pocket Portable

Construcional Details of a Midget One-valver, which
Will be Found Particularly Useful for A.R.P. Work

The completed pocket portable ready for the batteries.

THE midget receiver about to be described was made in a cigar box measuring only 6in. by 3in. by 1 1/2in.; a box which holds twenty-five cigars is of suitable size. Although small, the receiver works well, bringing in the Home Service transmissions at good strength on the 'phones on a piece of wire 10ft. long as aerial. The set does not work on the long-wave band, as the coil was not wound for this.

The "Pocket Portable" actually has the necessary 2-volt accumulator of the jellyfished type fitted in the cigar box, and the complete set will quite easily go into any coat pocket and so, with a pair of head-
leave a reasonable length of wire for connecting up; this is the grid winding. Leaving a space of 6in. from the start of the grid winding, and using the same gauge of wire, and winding in the same direction, wind on enough wire to fill a space of 3in., thus completing the reaction coil. A little shellac varnish painted over the windings keeps them taut and firmly in place. For details of the coil see Fig. 1.

Assembling the Parts

To make the receiver, first drill two holes, one above the other, the diameter of a banana plug socket, in the left-hand side of the cigar box, about 3in. from the back, and mount two red sockets. To one connect one side of the .0001 series aerial condenser. Now, having wound the coil, place it lengthways in the bottom left-hand corner of the box, as close to the back as possible, and adder the input wire of the grid coil to the other side of the .0001 aerial condenser. Continue with this grid coil wire and solder to the other banana socket. Fasten the coil in place, and secure with a very small screw through the Paxolin former to the bottom of the box. This can easily be accomplished by inserting the screw at an angle. Screw down at both ends, and it is as well to note that, owing to the thinness of the wood, all screws will protrude through and in consequence will need filing flat.

Next, take the rubberholder and screw this as close as possible to the coil, allowing for the width of the glass bulb.

phones, one has a complete receiver which is easily carried about.

Winding the Coil

The coil is made on a Paxolin former 3in. long by 1 1/2in. diameter. About the middle of this former, wind on a sufficient number of turns of 28 d.c.e. wire (closely wound) to fill up 1 1/2in., not forgetting to

The .0005 mfd. tuning and reaction condensers are now fixed into place, on the front of the box, and knobs attached. Connect the grid of the valveholder to one side of the .0003 grid condenser, and the other side of this condenser to the coil and condenser. Join a piece of fine wire from the moving vanes of the tuning condenser to the moving vanes of the reaction condenser, and allow sufficient length to reach to the right-hand side of the box, to be joined later to earth, the fixed vanes of the latter being now connected to the reaction winding of the coil. The other side of the reaction coil is joined to the plate or anode terminal of the valveholder. A fine wire, insulated with sleeving, now joins the same anode terminal to one side of the H.F. choke. Solder the other side of the choke to the terminal marked A (see Fig. 3) and to one side of the .001 fixed condenser, the terminal C being joined to the other side of this condenser, and by a piece of thin rubber-covered wire to the socket (red) next to the "phone" jack. Now solder the grid-leak to the grid of the valveholder, joining the other side of the leak to one of the filament terminals, and by means of some thin rubber-covered wire connect it to the terminal marked B on the "phone" jack. The remaining jack terminal D has now a piece of rubber-covered wire soldered to it—about 4in.

Fig. 1.—Winding details and connections for the coil.

Fig. 2 (Left)
Circuit diagram.

Fig. 3.—Wiring diagram of this compact little portable.
Home Recording

Further Notes on the Production of Gramophone Records and Play-back

In the absence of alternative broadcast programmes, many listeners are now turning to their gramophone section, and there is obviously an increasing interest both in the playing of records and in their production. In the latter connection it must be remembered that much can be done to improve the reproduction by the use of special circuits, such as the contrast expander, whilst in the recording of music there is a most interesting field of experiment. It is possible to make discs at home which are absolutely indistinguishable from the commercial product—in fact, some amateurs have claimed that they have obtained better reproduction from home-made discs. But if care is not exercised, both in the selection of materials and in the processing, the results are absolutely worthless. It is useless to expect to get a good record with the aid of a cheap old-fashioned pick-up, a worn-out steel needle, and an aluminium disc. Similarly, it is just as much a waste of time to obtain a most expensive tracking gear, high-quality cutting head and diamond cutter and to connect it to an inferior three-valve battery set with cheap inter-valve transformers. But by striking a compromise between these extremes, it is amazing what can be done.

The Amplifier

First of all, the amplifier or radio unit which feeds the cutting head should be capable of reasonable quality and a comfortable output. There is essentially a background of noise from the record when played back and therefore the sound track should be sufficiently great to obscure that background. Furthermore, to accommodate peaks in the volume the output stage should be of adequate power-handling capacity. Generally speaking, not less than 2 watts should be considered in this connection, and 5 to 10 watts will be even better. If a microphone is being used for the recording process this should be of a good type having a quiet background—not the cheap and noisy carbon type. What is probably more important is that there should be no audible hum in the amplifier—a point which is of the greatest importance in A.G. operated amplifiers and equipment. Some reliable apparatus should be employed to guide the cutting-head across the disc, and whilst it is possible to link up a standard pick-up traversing a 12 inch commercial record, whereby making this carry the cutter, as shown in Fig. 1, it will probably be found with an aluminium disc that the cutter digging into the disc will exercise such friction that the needle in the standard disc will jump and spoil the track. Where expense is to be considered the Feigh mechanism described in our issue dated November 18th will be found quite satisfactory. If much recording is to be done and really high-quality results are aimed at, then an elaborate tracker such as the V.G. should be obtained. The motor and turntable should be of reliable design capable of exercising a really steady torque without vibration or speed variation. The commercial models of complete home-recording gear generally incorporate a very heavy steel turntable to provide a flywheel effect.

Cutting Head and Needle

A really good pick-up capable of handling the input from the amplifier should be used, or one of the special recording heads specially obtained. This should be mounted to track correctly, and in conjunction with it you can use a worn steel needle, a sapphire or a diamond cutter. The latter are expensive, but are definitely worth the money. If the steel needle is used it should be run through on an ordinary gramophone record first and then inserted in the cutting head so that the slightly worn surface offers its cutting edge to the disc. For this purpose a magnifying glass will have to be used when inserting the needle. The sapphire needle will cost from 7s. 6d. to 12s. 6d. Aluminium discs must be replayed by fibre or similar needles, as steel ones will only cut up the recorded track. On the other hand the special discs may be replayed with steel needles after processing, this latter usually consisting merely of wiping over the disc with some special fluid, one acting as a hardening medium and the other as a polish. They may, of course, be played back instantly after recording and without processing, but in that case a fibre or other "soft" needle should be employed.

Connecting the Cutting Head

The cutting head should be led from a filter circuit in the output stage of the amplifier to avoid direct current flowing through it. Fig. 2 shows a circuit for a single output valve, whilst in a push-pull stage two fixed condensers as in Fig. 3 will offer sufficient protection whilst permitting the passage of the signal currents.

Many houses are not provided with readily accessible power points, or other places where the wireless set or other low-consumption electrical apparatus may be easily connected. Some listeners overcome this difficulty by fitting two-way adaptors to a standard lighting point, and in this connection a really good connector with some form of separate switching is no doubt the best way of overcoming the difficulty. In the Octa range of components will be found several adaptors of this type, some with self-contained switches and others with a form of extension switch which is cord or button operated. In its simplest form this adaptor consists of a straight-through connector with a branch, the former being controlled by the switch. Thus, if any electrical apparatus is connected to the branch it may be controlled from the normal wall switch, and a light fitted to the trunk connector, as it is called, may then be switched off, if not required, by means of the switch on the adaptor. This is a square-section push device in the small model, and it costs £1. 10s. A similar model, but with both trunk and branch controlled by separate push-switches, costs 2s. 3d. To avoid the necessity of reaching up to the lamp-holder to switch off, these adaptors are available with a double cord, provided with ains, or a twisted flex with pear switch at the end. The first model has a cord 15in. long, and the price is 2s. 6d. A patent form of spring anchorage is used to prevent the cords from whipping and also holds them well clear of the adaptor so as to avoid fouling or damage to the lamp. The other model is known as the "Either-lite," and the switch action enables either connector to be switched on, either switched off, or both off. This model costs 5s. 3d., and the cord is 7ft. long. These particular adaptors should not be confused with the cheap models on the market, as they are all provided with screwed shade carriers at the trunk end, and thus a shade may be mounted round the lamp in the ordinary way, the adaptor being above it and more or less out of sight.
The Drawing-room Play

The Microphone and Pick-up are Always in Great Demand at Christmas, and they can be Utilised to the Full in a Home-produced Radio Play — By L. O. SPARKS

With the popularity of the microphone amongst constructors, and the natural desire of most owners to emulate the B.B.C. studio results, the opportunity afforded at Christmas to entertain one's friends with a real radio play is a chance too good to be missed. Fortunately, providing one has a good receiver or, better still, an L.F. amplifier having a reasonable output to amplify the microphone currents, the production of a play is not, as might appear at first sight, a costly matter. Unlike amateur theatrical affairs, scenery or lighting effects are required, while, as regards a suitable cast for the actors, there is, invariably, plenty of volunteers most anxious to try their talent in front of a microphone.

To ensure the complete success of such a venture, it will be appreciated that one person must undertake the rôle of producer, whose job it is to see that everything goes according to plan or script and arrange the presentation of the play in the most striking and natural manner. This does not mean, however, that everything connected with the production must be governed by one man's ideas; there is the technical side of the matter, such as the amplifier, the number and placing of the microphones. Then there is the question of effects, while the selection of suitable music and its production can easily form another person's part. The timing of the individual parts and the mixing of the various microphones, if more than one is used, together with prompting, can easily form a very full-time occupation for, say, the producer during the actual performance.

Requirements

The first thing to secure is, of course, a suitable play, and the time devoted to this matter can go a very long way towards making or mars the splendid effort. One must remember, that a radio play depends entirely on words, music and effects. The various scenes have to be portrayed by sound alone; the atmosphere has to be created in the listeners' mind by a skilful blending of spoken words, sound effects and, possibly, music; therefore, too much consideration cannot be given to the material forming the foundation and structure of the play.

It is not advisable to commence operations by attempting something far beyond the capabilities of one's equipment. In other words, remember the apparatus available when discussing the selection of the play. As regards the play, it is possible that the producer or someone interested in the project can write one himself. On the other hand, it is often possible to utilise a section of a short story and adapt it to existing requirements. Finally, several very fine plays have been published in past Christmas issues of this journal; therefore, if your volumes are not complete, there is still time to order from our Back Number Department.

Effects

These have to be introduced to just the right extent. Too little will leave the production wanting in atmosphere, but too much will, like too much seasoning, completely spoil the dish. The right amount will depend on the producer's skill, plus, of course, the close co-operation of the effects men.

The sound of wind can usually be produced by keeping the mouth fairly close to the microphone and going through the process of whistling through the teeth. But don't let it develop into a full whistle. A little practice will soon enable all the actors to produce varying intensities of sound from a gentle breeze to a full-blown gale to be produced at will.

The swish and crash of the sea need be nothing more than two pieces of very fine sandpaper rubbed together, two or three handfuls of sand in a large tin or on a stiff sheet of brown paper. It will soon be found that various movements will create very natural effects.

The crackle or roar of flames can be produced by crushing paper plus the wind effect, quite close to the mike, while a matchbox or a piece of wood slowly crushed can sound very much like a most sickening smash.

The clatter of horses' hoofs needs a couple of empty coconut shells lightly beaten on a plain or cloth-covered board, according to the ground they are supposed to be covering. The noise of chains, footsteps, shots and the clash of arms must always be most carefully rehearsed, otherwise there is the great danger of them being reproduced in such proportions to the rest of the sound as to make them obviously unreal and even ludicrous.

Mikes and Amplifier

The technical man must be fully familiar with the capabilities and peculiarities of his equipment. All precautions must be taken to prevent any trace of feed-back which might cause microphones how. For this reason alone, it is always best to have a separate room for the studio, thus leaving the audience in a room on their own with a suitable loudspeaker.

The L.F. side of the set or the amplifier should have an output of, say, two to three watts, although this will depend on the size of the room housing the audience and the number in attendance.

If more than one microphone is being used, a simple mixer of the type shown in Fig. 1 is absolutely essential, and change-over switches can be wired to bring others into circuit when and if desired.

For musical interludes, it is really best to use suitable passages of pre-selected records, using, of course, a good pick-up to reproduce them via the set or amplifier. When required, the P.U. can be brought into circuit in place of one of the microphones by quite simple switching as shown in Fig. 2, but if a separate set can be used for P.U. work only, this greatly improves matters and gives the operator wider scope.

The connections for the normal type of P.U. are given in Fig. 3, and it should be realised that far less amplification will be required for this component than the microphone.
THE "THREE-TWO" RECEIVER

An Economical Two-valve Receiver Utilising a Multi-electrode Valve to Provide the Results Usually Only Obtained by a Three-valver

By W. J. DELANEY

When considering problems of economy in the building of a receiver, there are very few things which may be done, apart from the acquisition of components of low cost. Inferior parts, however, will result in inferior results, and therefore it is false economy to obtain such parts. There is a scheme, however, which has been introduced before in these pages, namely, the use of multi-valves in positions other than those for which they are intended. By adopting this scheme, economy may be effected, although owing to the slightly increased cost of such a valve the saving is not considerable. When, however, one considers the associated components which are saved, plus the saving in space and consequent use of a smaller chassis, and the I.T. current, there is at least some small advantage in such a scheme. The receiver to be described is a battery version of a mains set which was built for experimental use, but, unfortunately, the full advantages of the mains set cannot be obtained, and the mains set can only be built with American valves. In the original model a triode-pentode was used in the dual function of H.F. amplifier and detector, whilst a dual triode was used as first I.F. and output-stage. The ordinary battery Class B will not, unfortunately, operate as the two-stage valve, and therefore it is necessary to use a single type of valve. This still permits us, however, to build a two-valve, which acts exactly in the same manner as a normal three, providing H.F. detector and output-stage in a compact form. It is necessary here, however, to point out that the specified dual-valve must be used, as this has a completely separate pentode and triode section, whereas the majority, if not all remaining valves of this type, have the grid of the triode section joined to the pentode section.

The Circuit

Standard parts are otherwise used throughout the receiver, and a small chassis only 8in. by 6in. is simple to accommodate them. A Varley standard two-gang coil unit is employed which provides an H.F. transformer input, with a similar inter-valve section, plus reaction. A two-gang condenser with standard slow-motion drive is employed, and the remaining few parts are wired between various points beneath the chassis. To obtain maximum sensitivity under all conditions, a separate By-lead is provided for the screen voltage of the H.F. pentode, whilst for volume control purposes the L.F. input is controlled by a potentiometer. The triode section of the first valve is perfectly normal, and all other circuit details may be seen from the theoretical diagram below. It will be noted that the triode anode is fed from the maximum H.T. line by using a decoupling resistance. The values of decoupler and coupling resistance have been chosen to provide smooth reaction with stability and avoid the use of a further battery lead. To keep down the number of panel controls the on/off switch is mounted on the rear of the coil unit and is operated by the normal wave-change switch which is provided on this particular unit. Note that a special slotted dolly switch must be used for this purpose, the correct Bulgin type number is 8.5. The receiver is perfectly stable, and handles just like a standard three-valver.

Construcational Data

The chassis requires only two holes for the valveholders, plus two small strips on the rear panel for aerial and speaker. Clear ance holes or slots may be left for the latter, whilst for the valveholders the holes must be 1\frac{1}{8}in. for the 9-pin and 1\frac{1}{4}in. for the 8-pin. Small holes for the connecting leads from the coils are needed, and these may be \(\frac{3}{16}\)in. in diameter. Two component-mouting brackets are screwed on the underside of the chassis to accommodate the reaction condenser and volume control, and these brackets should be set just beyond the edge of the chassis so that the lock-nuts of the one-hole fixing bush will clear the panel which is used with the set. It will be noted, by the way, that the condenser has been mounted off centre on the chassis to enable the size of this to be kept to a minimum, and, therefore, when placing the chassis in a cabinet, or using a panel, this may be either centred to permit batteries or speaker to be placed at the side, or a larger panel may be used and the panel centred on this.

Adjusting the Receiver

The receiver must be ganged before maximum results are obtained, and for this purpose the condenser should be adjusted to the North Regional or Scottish Regional setting on the calibrated dial so that the
Homo Service transmission may be heard. At first the signals may not be received exactly at these settings and the tuning control should, therefore, be adjusted on either side of the point (according to the part of the country in which you live), until some signal is heard. Reaction should be advanced slightly during this process. As soon as the station is located the trimmer on the section of the condenser nearest to the panel should be adjusted whilst the tuning control is manipulated to keep the signal audible. In this way the tuning setting may be brought to read correctly the wavelength of the received station. Next, the trimmer on the remaining section should be adjusted and as volume increases the reaction control should be set back until reaction is absent. If then the volume is too great, the L.F. volume control should be adjusted. Keep signals as weak as possible, whilst making these preliminary adjustments, and when once set they will require no further touching. There is a wide range of cabinets from which to choose and advertising in our pages, and a receiver of this type will make a very neat and compact assembly for general use. It was not thought desirable to include short-waves, although there is no reason why, if short-waves are particularly required, a three-band coil assembly could not be used, but the receiver has not been tried out with this particular arrangement.

**LIST OF COMPONENTS FOR THE "THREE-TWO" RECEIVER**

- One "Bar Type" 2-gang condenser (Polar)
- One micro-horizontal drive (Polar)
- One 2-gang coil unit, type BP.114 (Varley)
- One 400 mfd. Compax reaction condenser (Polar)
- One screened standard H.F. choke, type H.F.9 (Bulgin)
- One 4-point slotted dolly switch, type S.139 (Bulgin)
- One 3,000 ohm 1-watt resistor (Dubilier)
- One 10,000 ohm 1-watt resistor (Dubilier)
- One 40,000 ohm 1-watt resistor (Dubilier)
- One 2 megohm 10-watt resistor (Dubilier)
- Two 2,000 mfd. fixed condensers, type 635 (Dubilier)
- One 0.1 mfd. fixed condenser, type 4602/S (Dubilier)
- Three 1 mfd. fixed condensers, type 4603/S (Dubilier)
- One 1 megohm volume control, type VC.65 (Bulgin)
- One 2-pole chassis type valveholder, type X.112 (Clix)
- One 2-pole chassis type valveholder, type X.112 (Clix)
- One 2-socket strip, A.E. (Clix)
- One 2-socket strip, L.S. (Clix)
- One two-car connector, type R.426 (Clix)
- Two component-mounting brackets (Peto-Scott)
- One Metaphor chassis, MIN, made with six runners (Peto-Scott)
- One TP.22 triode-pentode valve (Mazda)
- One Pent.22 output pentode valve (Mazda)
- Connecting wire, insulated cabling, screws, etc.

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**THE WIRELESS CONSTRUCTOR'S ENCYCLOPAEDIA**


Wireless Construction, Terms, and Definitions explained and illustrated in concise, clear language.

From all Booksellers, or by post 5/6 from George Newnes, Ltd., Tower House, W. N. Angleton Street, Strand, London, W.C.2.
Christmas, 1939

FATALISTS will point the tragic finger at the last two digits of this year of grace—39, three thirteens! The first three figures added together make thirteen, and the last two and the first added together make thirteen. I am not a numerologist, and I do not think that numbers have the slightest effect on what we prefer to term luck, which is always of two sorts, good and bad. But there it is. In 1939 we are engaged in a war of major proportions. It is certain that we shall emerge victorious and, let us hope, soon. The year has witnessed the confiscation of amateur transmitting sets, but it has also seen the immense power for good as well as for propaganda which can be made of the broadcast word in time of war.

Wireless had not been introduced in the last war. I am, of course, speaking of wireless telephony, for field telephone sets were in use during the 1914-1918 war. It seems a profound tragedy that the motto of the B.B.C., "Nation Shall Speak Peace Unto Nation," has borne such poor fruit. It is no fault of theirs. Foreign countries have used the power of the ether to fan the flames of hate, and in war similar methods must be adopted finally by all. You must agree with me, however, that the British propaganda is clean, careful, and calculated. It is free from bias and hate. The limitation of programmatic variety is one of the inevitabilities of war. It does help to cheer us with a form of cheer absent in the last. This issue goes out to countries, save the belligerents, all over the world, and to many of my message of cordial goodwill will reach them round about the 25th of December. Because of this, readers in this country will receive it some weeks ahead. I hope that they will not doubt its sincerity, because it must be uttered at a time divorced from the atmosphere of goodwill which steals over the world during the joybell period. I know that many will feel a sense of incongruity this Christmas, but it is not for us to debate these things. We are all experiencing hardships and difficulties, and journals and journalists are not an exception to the rule. I do, however, want to express to all readers wherever they may be sincere greetings for the merriest Christmas possible under the circumstances. Between now and the 25th a shower of Christmas cards will arrive from loyal readers the world over. In advance, I thank them in the spirit of reciprocity which makes Christmas what it is.

Lincoln Did Not Say It

MAJOR-GENERAL SIR ERNEST SWINTON was speaking over the wireless the other night on war matters. I was not in the least interested in his talk, but I pricked up my ears when I heard him quote that famous phrase: "You can fool some of the people all of the time, and all of the people some of the time; but you cannot fool all of the people all of the time." The meticulous B.B.C. should have vetoed that part of Swinton's speech with a little more care, for Abraham Lincoln did not originate that phrase. It is true that he used it in a speech at Clifton, Illinois, on September 8th, 1858. Spofford denied that Lincoln invented it. There are some who think that P. T. Barnum did so. I deny that too, for Pliny and La Rochefoucauld made similar remarks years before. The earliest to use it as far as I have been able to trace in the form in which Lincoln quoted it is Josh Billings. Just as well to have these matters right.

Newspaper Scoops

THE word "News," they say, is compounded of the initial letters of the four points of the compass—North, East, West and South. In these days of small newspapers and restrictions, the lot of the reporter is particularly unhappy, for although in peace time the scoop still lives, in war-time there is no such thing—for the Ministry of Information sees to that.

It has become increasingly difficult in recent years for the quickest mind to keep ahead of the speed of communications. Radio has eliminated the last few moments of delay. But the real scoop is still a thrill, and in the splendid Christmas Number of the "Strand Magazine" you will find the story of the most notable newspaper scoops of recent years, specially written by that world-famous journalist, Douglas Reed, who wrote "Insanity Fair" and "Disgrace Abounding."

In spite of war-time conditions this fine issue of "The Strand" lives up to its great tradition. In common with all other magazines it must be ordered from newsagent or bookstall.

Letters to Foreign Countries

A TOPICAL reminder concerning the new regulations governing the dispatch of letters to foreign countries. Under present conditions no printed publications, postage or revenue stamps, plans or photos, maps or similar diagrams, may be sent to the following countries: Baltic States, Belgium, China, Denmark, Greece, Holland, Hungary, Italy, Japan, Luxembourg, Norway, Poland, Portugal, Roumania, Spain, Sweden, Switzerland, Siam, Turkey, U.S.S.R., Vatican City or Yugoslavia. These regulations do not apply to letters, but the sender's address must be written on the back of the envelope, and the words "Written in English" printed. Communications will be opened.

J. H. Thomas Resigns

M Y personal regrets that genial J. H. Thomas has resigned his position as Managing Director of A. C. Cossor, Ltd. Mr. Thomas was Chairman of the Radio Manufacturers Association, but I learn that he has tendered his resignation and this will be considered at the R.M.A. Council Meeting on December 15th. Col. G. D. Ozanne, the Vice-Chairman, has also tendered his resignation. The new Managing Director of A. C. Cossor, Ltd., is Sir Louis Sterling, who was formerly Managing Director of E.M.I. He resigned on May 20th.
LOOSE CONNECTIONS

The Importance of Avoiding a Noisy Mainly Dependent Upon the Efficiency Background is of Connections

The writer, a Service Engineer belonging to a company whose name is a household word, has recently been amusing himself by reading a number of books on service work published both here and in America, also sundry articles appearing in these countries, and gives below a number of faults which, although not uncommon, have been rarely, if ever, mentioned.

Stupid Mains Plugs

A common cause of spluttering in commercially-built receivers is such a stupid one that the engineer never bothers to mention it, and the amateur usually thinks of it last. This is the actual connection between the mains cord and the mains plug. The average mains plug is peculiarly unsuitable for this purpose, having the usual Grooved hole in which the end of the flex is inserted, which in turn is intended to be gripped by a screw of absurd dimensions, which may, with luck, grip as many as half of the metal strands. This connection very often becomes loose due to one or more strands working out from under the screw, leaving the rest of the bunch a sloppy fit. In the absence of an intelligently designed plug, the best remedy is to bend the strands together so that the screw can be made to grip them without them spreading unduly. Where the cover permits of it, it is a good idea to bare about 1½ in. and take the strands through the hole, round the outside, and back through the hole again. Obviously the screw should not be tightened to the point where the flex is cut, but it should be tight enough to prevent any possibility of swaying, which sets up most disagreeable interference.

Plugs and Sockets

There is an increasing tendency for manufacturers to terminate the aerial and earth connections of the set with sockets, and to generously provide two particularly nasty little plugs intended for the earth and aerial leads. At least one manufacturer recommends 7½2 copper wire for the earth " which should continue unbroken to the actual receiver," but thoughtfully provides a plug in which only three strands will pass through the hole provided for that purpose. These plugs are in themselves satisfactory, but many of them have a common failing. The wire is intended to be held in place by the metal plug portion which is screwed up against it. Often when screwed right home it will not properly grip a piece of wire of reasonable gauge, and while the wire is clean, all is well, but when the wire oxidizes, nasty scraping noises are heard in the speaker if the leads sways. Trouble of this nature is peculiarly awkward to find, as if the lead is taken and shaken from side to side at an angle that is at all acute, it may bring the wire into perfectly good contact. It should not be necessary to add that such manufacturers are getting trouble to lower H.F. resistance of their tuned circuit, and it is intolerable that resistance should be set up in the signal plug, which necessarily happens unless the plug grips the wire tight enough to prevent oxidization.

The Elusive Gas Pipe

Many listeners are obliged to use a water pipe "earth" which, at best, must have a fairly high resistance. Along this resistance there is a potential drop, consequently if any metal comes in contact with the pipe throughout its length, which is in turn connected to earth, it will cause some sort of noise to be set up in the speaker. Many years ago a case was investigated where a set made the most alarming noises when a motor-bus went by. This was due to a water-pipe "earth" which had a gas pipe momentarily when the motor-bus caused it to vibrate. Such a trouble as this is not difficult to find, as the water pipe is visible throughout its length, but, unfortunately, this is rarely the case. To a lesser extent the same trouble can apply where the water pipe touches some other earthed object at a point above (possibly several stories above) where the earth lead from the set is connected.

Ancient Wall Sockets

Wall sockets that have been left undisturbed for a term of years often make very bad connection with the supply wires, due to damp, verdigris, and any of the other troubles which can attack a wall plug not protected by a box at the back. Such a state of affairs often gives rise to a minute arc between the wire and terminal, which in turn can produce a most appalling racket in a sensitive wireless set of the superhet class. The remedy is obvious, and it is sufficient, therefore, to draw attention to it. It will be appreciated that an ordinary A.C. voltmeter is not likely to reveal the trouble, the obvious pointer being whether the set works satisfactorily when plugged into some other socket. The same trouble would, of course, appear with a broken wire, but this usually solves itself, as the broken ends of electric light cable very soon move apart so that a complete break occurs.

A Screw Loose!

The reprehensible habit of neglecting "earth" a mains set is getting more and more common. Admittedly in nine cases out of ten reception is not improved, but it is unquestionably desirable from the safety aspect. An ungeared chassis brings quite a few lesser troubles in its wake, an example will serve to indicate them. Some chasses are fixed in their cabinets by four nuts and bolts. In due course the base of the cabinet warps, and a nut and bolt which were previously under tension become loose and rattle on the chassis. If the chassis is earthed, this does not matter in the slightest. If it is not earthed, it will still not matter in 99 cases out of 100, but in the odd case it will faithfully record its movements on the loudspeaker by a peculiar scraping noise, which can be imitated by scraping the aerial lead gently with a piece of metal. The trouble, of course, occurs in those receivers which are inclined to be on the verge of instability when the earth is removed, and it is more likely to occur with sets one or two years old, rather than with those of this season, which, taking them all round, are extraordinarily stable.

Declining Selectivity

The selectivity of some receivers is liable to decline gently, until a point is reached where its owner wakes up to the fact that, whereas it used to be possible to get this station free from that station, it has become impossible. Go to the local dealer and he will tell you that it is valves, which is a wise diagnosis, as it is almost, but not quite certain, to be correct. Assuming that the set is not out of gas, all components are O.K., and there are no loose connections, the "not quite" element will be resistance in the actual switch contact. Recently a troublesome switch was carefully measured for its resistance, and revealed the astonishing figure of 300 ohms, rather more than 25 per cent. of the H.F. resistance of a good grid coil at 400 metres. The trouble was that the wiper blades which formed one half of the switch contact had become tired, had lost the springiness they enjoyed in their youth, and touched the rotor portion of the switch so gently that a piece of tissue paper could be slipped between them without being crumpled.
The Extension Speaker

Technical and Practical Aspects of Remote Listening Points

It has always seemed very probable that the great vogue at one time enjoyed by the portable and transportable sets is due to the fact that these sets offered the advantage of "radio anywhere in the house."

That they have to some degree gone out of favour does not, we believe, indicate that this feature is no longer appreciated; rather is it the natural result of the introduction of fixed-location sets possessed of desirable attributes absent from the earlier form of portable.

In short, it appears that radio users have sacrificed the special convenience of being able to take the programme into any part of the house in favour of the good points of the modern "stationary" set. That the former convenience can be regained with the aid of extension loudspeakers does not seem to be very widely realised by listeners.

Here we intend to deal with the technical and practical aspects of that question so that readers may discover how easily the matter may be arranged.

The first consideration must naturally be given to the question of how many rooms are to be served, and whether more than one point is likely to be in use at once. In the majority of cases it will most probably be decided that it will suffice to provide extension of at the most two additional listening points, and that only one of these will be working at a time.

Such a circumstance it is only necessary to acquire one extra loudspeaker, so that the business is both simple and inexpensive; the single loudspeaker can be moved into the room in which it is desired to listen—and the wiring itself is easily installed.

Wiring the House

Insulated staples such as may be obtained from almost any electrician can be used for securing the leads in position; it is a good plan to drive each staple nearly but not quite home, then apply a steady pull to the free end of the wire and give the staple a final sharp tap with the hammer. In this way the leads are kept taut and neat.

Probably the best route for the leads will be found along the lower edge of the skirting board, as close to the floor as possible. If reasonable care is taken the result will not be at all unsightly, indeed, it will be almost invisible if one takes a small brush and touches up both lead and staples with paint to match the colour of the skirting board.

Wiring System

The system of wiring should be such as to place all the loudspeakers in parallel, the series system of connection is only suitable in certain special cases. Actually, neither method is ideal in theory unless special arrangements are made as to the output circuits of the receiver, but the practical aspect of the question would result in the inevitable slight degree of mismatching hardly justifies the complication involved. Practical considerations of the cable transformers and loudspeaker wiring is overall an extra connecting transformer to feed the extension systems as a whole; individual matching of the separate speakers is sufficient.

A convenient method of connecting the loudspeakers to the various terminal points is very desirable unless one is prepared to fit each instrument as a permanent and allow it to work at all times. This is not wanted in most cases, so it becomes essential to provide some means of silencing the unwanted instruments.

If this takes the form of some sort of plug and socket connection scheme, any particular loudspeaker can be put out of action by the simple expedient of withdrawing the appropriate plug. At the same time, it is then made an easy matter to transfer the instrument from room to room as required and one can reduce the total number of reproducers needed.

Quite simple and inexpensive connections will serve the purpose, the miniature type of two-pin plug available from electrical stores being as good as anything so far as actual efficiency is concerned. Those who are prepared to spend a few extra pence to obtain a good appearance and perhaps greater reliability would do well to obtain details of the Bulgin system of wall jacks.

Assuming that some such arrangement of plug and socket connection is used, the extension line system can be kept permanently connected up to the output terminals of the receiver; plugging in a loudspeaker at any one of the distant points then brings the programme into the line concerned.

The alternative method is to connect the extra reproducers permanently to their respective extension points and use some form of switching system at the receiver to bring the required extension into circuit when needed.

The output arrangements of the receiver must be given some little consideration, especially if it is to be used for a long time. No form of output filter or transformer is the only positive protection, and it should always be provided.

(Continued on page 249)
The Trophy 8

Review of the Peto-Scott Communications Receiver

In this receiver we have a good illustration of the incorporation of all those features which are essential when reliable short-wave long-distance reception is desired. Apart from those factors which are common to the communications type of receiver (B.F.O., A.V.C., etc.), the makers have gone even to the extent of "mixing" the valves. The desirability of reducing valve noise and background noise needs no emphasis, and in this connection it has been found, as we have explained before in these pages, that the majority of such noise is introduced in the first, or signal H.F. stage. Special valves have, however, been introduced to reduce this noise factor, and a typical instance is the Mullard EP8. In the Trophy 8, therefore, the makers have included this particular valve, leaving the remaining stages fitted with American 0 type valves and the results are fully justified. The frequency-changer is a 6TH6G, with a 6K7G L.F. amplifier, a 647G 2nd detector, A.V.C. and L.F. amplifier and a 6P6 output pentode. The usual B.F.O. stage and separate R.F. oscillator are provided, and the mains section includes a full-wave rectifier. The entire receiver is built into a black-enameled finished cabinet, but the speaker has been omitted and is obtainable in a similar style of cabinet with chromium decoration.

Controls
There are ten "controls" on the cabinet front, four of these being switches and jacks subsidiary to the main functions of the receiver. Phones, for instance, may be plugged to the jack, thereby cutting out the speaker and including them in the output circuit, fed through a standard filter. The switches are a "send-receive" on/off switch, B.F.O. on/off and A.V.C. on/off, whilst the remaining controls cover tuning, band-switching, H.F. gain, L.F. gain, tone, and B.F.O. pitch control. There are five bands, covering from 7 to 650 metres and the band switch and the tuning dial are calibrated in kilocycles and megacycles (43 m.c. to 545 k.c.) continuous.

The receiver has been tested by us on various aerials and gave a very good account of itself under varying conditions. The efficiency of the R.F. stage is very marked in contrast with other receivers of similar design employing a standard valve. All of the controls function in a smooth and effective manner, the judicious use of the H.F. and L.F. gain controls acting effectively in controlling background noise and interference where the latter is experienced. A.V.C. works well and is fully effective under all normal fading conditions, although as is usual with this particular type of circuit, high-speed fading naturally results in a variation in the signal strength. Each waveband has a separate portion of the dial for calibration purposes, so that no difficulty is experienced in tuning any desired station. The price of this receiver is £13 17s. 3d., whilst the speaker is 46s. 3d. extra. Hire-purchase terms are, of course, available at the usual Peto-Scott convenient rates.

The Trophy Six

In the review of this receiver in our issue dated November 28th the price was given as 94 guineas. Owing to increased costs of materials since the war, the price of this receiver has been increased. The present price is, therefore, £10 10s. 6d.

NTS. 3-valver

The illustration below shows an interesting chassis form of three-valve set which may be obtained for £3 10s. 6d., including valves. This tunes from 14 to 2,000 metres, in four bands, and is available also in a mains form at £3 10s. 6d. In this case, however, the range is slightly narrower, covering from 18 to 2,000 metres. For the medium and long-wave bands the coils are of the screened type, whilst the short-wave coil is situated beneath the chassis and is unenclosed. The receiver is complete with self-contained switching and incorporates a full vision (clock-face) tuning dial with separate scales for each range. There are three main controls: tuning, reaction and combined on/off and volume control, with a central 4-position wave-band selector. The receiver is assembled on a metal chassis, finished in grey celluloid and a gang condenser is used for tuning. The medium- and long-wave coils are separated, as may be seen from the illustration and there is no trace of interaction or instability due to coupling between stray wiring, etc. There is a fuse bulb fitted, and the battery supply is in the form of a multi-cable, rendering the receiver ideal for installation in a small cabinet of the type types of aerial and gives a very good account of itself, being both selective and very sensitive. On quite a small indoor aerial a very wide selection of stations was received, and the quality given by the output stage, even with 100 volts, was fully up to the normal standard of a battery receiver of this type. The battery cords are colour-coded and the valves provided are of the Hitave type. The suppliers are New Times Sales Co. Ltd., 66 (Pr.W.11), Ludgate Hill, London, E.C.4.
A Simple Capacity Bridge

The accompanying diagrams show a capacity bridge which can easily be made up from spare parts. It consists of a 10,000-ohm potentiometer placed across an L.F. source, one terminal of a pair of earphones is connected to the sliding contact.

A simple but efficient capacity bridge.

The other terminal of the headphones is connected to the junction of the known and unknown condensers which are connected in series, also across the L.F. source. The L.F. current is obtained from a buzzer, a connection being made to each side of the trembler contacts.

To use the bridge, connect the unknown condenser to the appropriate terminals, switch on the buzzer, and adjust the potentiometer until a position is found where the strength of the note is at a minimum. The scale can be calibrated from standard condensers, or the capacity of the unknown component can be calculated from the following formula:

Capacity of \( C \) = \( \frac{B}{A \times C} \)

- K. C. King (Bromley).

Reducing Mains Hum

It is interesting to note that 50 cycle mains hum can generally be reduced fairly considerably by inserting a fixed condenser somewhere in the loudspeaker circuit. When using an output transformer the condenser can be connected between one secondary terminal and the loudspeaker; a capacity of 0.5 mfd. or so will generally prove just about right. If the speaker is fed through a choke-capacity filter it is only necessary to reduce the capacity of the filter condenser to a value similar to that referred to above. The idea in both instances is to provide a comparatively difficult path to the very low frequencies without restricting the passage of any others. This can be done quite easily by the methods suggested, and if care is taken in choosing the optimum condenser capacity, the quality of reproduction will certainly suffer at all.—P. F. (Mill Hill).

Marking Leads Passing Through Chassis Grommets

It is often difficult to trace leads which connect underside to top-side chassis wiring when two or more are passed via rubber grommets inserted in the intervening chassis. By adopting a simple method of colour-coding and a suitable well-known constructional toy, and some odds and ends.

A steel rod is soldered to one end of a length of brake cable as shown. At the other end some insulating tape is wound round to the diameter of the spindle of the condenser or potentiometer.

From some thin brass two collars and a tube are made as shown. The sketch illustrates the method of fixing the brake cable to the condenser or potentiometer spindle. The steel rod passes through the panel through a bush wheel which keeps the rod in a horizontal position. In use the control was found to be free from noticeable backlash, and is perfectly stable.—L. Kellog (Hendon)

WIRELESS TRANSMISSION FOR AMATEURS

Edited by F. J. CAMM

Explaining how to Learn the Morse Code: Applying for a Licence: Building and Operating a Transmitter. Illustrated by Many Practical Diagrams.

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Deciding on the Output Stage

With the advent of tetrodes, and the wide variation of sensitivity required in the output stage, selection of the many available types of systems has become increasingly complicated. The battery user may select a triode, a tetrode, a pentode, or one of the quiescent output systems, namely, the quiescent push-pull or class "B" output. The other hand, he may choose a triode, tetrode, pentode, bottom bend push-pull, usually referred to as class "C", or normally biased push-pull, usually referred to as class "A", or one of the fancy output arrangements (low-loading, etc.). Certain secondary complications arise, inasmuch as class "A" or class "C" push-pull could make use of triodes, tetrodes or pentodes. It is therefore highly desirable to clear up the output question and to indicate which type of output is appropriate for any set of conditions. It is desirable, but not essential, that the output stage should have high sensitivity. It is exceedingly important that this distortion be introduced, i.e., the output valve must amplify irregularly of frequency. It is equally unnecessary that the output stage accommodate the highest instantaneous peak voltage, it is essential that occasional overloading will not be unduly noticeable to the listener. This latter is unquestionably a compromise, but for the battery user there is no reasonable alternative. For convenience, each type of output is dealt with separately, commencing with those which are applicable to either mains or battery working.

Triode Output

Triode output has the unquestionable advantage of simplicity. It will work with anode load grossly unsuited to its needs with little noticeable distortion, and when overloaded on transients to the extent of 50 per cent., the resulting distortion is noticeable only to the chosen few. Its principal disadvantage of poor efficiency, the output delivered being only about 10-20 per cent. of the power consumed, and this disadvantage is well known to the battery user. Anode consumption of, say, 10 milliamperes will seldom more than a 150 milliwatt output. Another disadvantage is lack of sensitivity, but this can, of course, be overcome by providing adequate gain in the preceding stages.

Pentodes

When the pentode was introduced some years ago it was greatly misunderstood, a disadvantage under which it labours even in these enlightened days. There are still many people who calmly remove a triode and substitute a pentode and hope, with unmerited optimism, for good results. It is stated above that the triode is tolerant of an incorrect anode load; it is equally true to say that the pentode is very intolerant. So intolerant, in fact, that it practically precludes the use of a moving-iron speaker, while almost every moving-coil speaker needs to be shunted by a resistance and condenser in series in order to check the tendency for its impedance to roll off at the higher frequencies. The great advantage of the pentode is its high efficiency, being of the order of 40 per cent., or more than double that of the triode valve. In the case of the higher impedances battery pentodes, colloquially known as "economy pentodes," it has the additional advantage of not requiring a large plate supply. In battery receivers where high sensitivity and reasonable output is required, it is a more useful choice where one or other of the quiescent systems cannot be used. Mains pentodes, however, are not necessarily more sensitive than mains triodes; in fact, in one well-known valve maker's range it is possible to find a pentode and a triode with approximately similar output, the triode having less sensitivity than the pentode. The pentode will usually be chosen in a mains set where large output is required, and the use of an adequate triode is restricted either by the H.T. current available or cost.

The Output Tetrode

The tetrode follows logically from the pentode, and differs from it only in that it has a suppressor grid. The absence of this electrode necessarily results in the anode being further away from all other electrodes, and possessing, therefore, less capacity to "earth." The difference between a pentode and tetrode of equivalent characteristics is simply that when the latter valve is used the grid current will be more noticeable than in a pentode triode, but, in fact, in one well-known valve maker's range it is possible to find a pentode and a triode with approximately similar output, the triode having less sensitivity than the pentode. The pentode will usually be chosen in a mains set where large output is required, and the use of an adequate triode is restricted either by the H.T. current available or cost. Another disadvantage is lack of sensitivity, but this can, of course, be overcome by providing adequate gain in the preceding stages.

Battery—Class "B" Output

From the point of view of efficiency, i.e., speech output, against battery consumption, the class "B" valve is still unchallenged. With suitable precautions, a carefully chosen loudspeaker armature is really good, but it has the serious disadvantage of poor sensitivity, as the average class "B" valve with driver requires several times the input power of a quiescent push-pull pentode. Under average conditions, however, really good quality is more easily obtained with class "B" output than with a pentode push-pull.

Pentode Quiescent Push-pull

As already intimated above, the quiescent push-pull output stage possesses commendable high sensitivity, and of course, the smallest quiescent push-pull pentode that a most excellent local station receiver may be made of is 2-15. It is built simply by a double-diode detector, and finally a quiescent pentode, although for Continental reception the double-diode would, of course, be substituted by a double-diode triode. It has, however, a slightly smaller speech output for a given H.T. consumption, and is also intolerant of incorrect anode load, but quite excellent reproduction is obtainable provided a good loudspeaker armature is used, with relatively small impedance, and both halves of the speaker primary are shunted by suitable condensers. The correct impedance and sufficient shunting capacity are recommended by the maker of each individual type of valve.

Summing-up

After reading the above notes, the reader will almost certainly come to the inevitable conclusion that there is a great deal of truth in the old saying "one cannot have one's cake and eat it." Economy, sensitivity and quality do not go hand-in-hand. For example, push-pull triodes give the best quality, and are the most wasteful, whereas the more economical output arrangements do not give such good quality. The modern commercially built receiver often makes use of pentode or tetrode output, but the shortcomings of these valves are somewhat mitigated by the use of specially designed loudspeakers, and the control of the response curve by the careful design of preceding stages. The writer admits having been a little harsh in his criticism of the various output systems, but considers that by exaggerating the disadvantages of the different valves the reader will be more readily able to compare them and appreciate the advantages.

P. R.
Television as a War Weapon

As might be expected, it is the Americans who are forecasting that television is to be the most powerful weapon which this present war will bring quickly to a stage of perfection. Their imaginative minds have been given full play, with the result that, although a long way behind this country in actual service technique, inventors are filing patents for devices that are claimed to be of immense value both in attack and defence. It is always dangerous to prophesy, and no doubt many of the prognostications savour rather of that apt expression "that the wish is father to the thought," but taking a broad technical view of the whole situation, it seems very likely that just as radio made its most spectacular progress in the last war, so television may be called upon to fulfil a similar function. A recent paragraph in these columns drew attention to the possibility of televising direct from aircraft to ground stations, and now it is claimed in America that designs have been registered for equipment, both receiving and transmitting, that is small and light enough to satisfy the limited space available in airplanes. Ordinary short-wave radio has proved of inestimable value for maintaining communication between general army headquarters and units in the front line, and it is now suggested that maps, operational plans and ordnance could be sent via low-powered directional television transmitters from unit to unit, using a process of scrambled signalling in order to ensure secrecy. It is said that this would be preferable to any drawings, etc., being committed to paper as these might fall into enemy hands, whereas a radio vision signal which can be interpreted only by those who know the code would provide no damaging record, as it is only transitory.

Other Devices

A NOTHER television patent for which high hopes are claimed proposes to send a televised picture of an airport to a pilot who is lost in a fog, or who happens to be flying over a strange country. This proposal has been made many times before, but in this case the scheme is to make a small light, moving to scale across the televised picture, show the pilot the exact height and position of his machine in relation to the airport. Even with a picture definition of 180 lines, it was proved some years ago by special transmissions from the Crystal Palace that a detailed map comes over with very remarkable clarity, especially when a reasonably sized cathode-ray tube is used in the receiver and direct viewing is employed.

Ray-sensitive Spectacles

A CHICAGO inventor has produced special spectacles which he claims are designed to be sensitive to the infra-red rays. By their use a pilot is said to be able to get clear vision through clouds and fog to the ground below, while fog observation by the machine itself, these glasses, are worn, will enable airplane engines to be seen above, since it is also claimed that when heated they radiate infra-red rays. Yet another example of the ingenuity of inventors is furnished by the story that experiments are now being conducted with television torpedoes. These machines are said to be relatively cheap and simple to manufacture, and some addition in their quota of bombs, a television transmitter. This sends back pictures to the base station, and the course of the torpedo is adjusted according to the information obtained in this way, using radio remote control. The timing for the release of the bombs is undertaken as a result of the same information. The idea may not prove so fantastic as at first thought, for although these machines could be very vulnerable to anti-aircraft fire, or the work of fighter squadrons, they could be sent in mass flight formation to their objectives, and man power would be saved. Pilots take a long time to train to a high pitch of skill, and pilotless equipment is, therefore, a possibility to be reckoned with, especially as it is stated that the Zeiss Optical Works are co-operating in this work. In any case, American experts are studying the possibilities, and more may be heard at a later date.

Film Scanning

The American engineers are continuing their researches towards finding the best form of film scanning unit. Attention is not confined to the actual form to be taken by the television camera, that is whether of the storage tube or image dissector type, or a combination of both with or without secondary emission multipliers, but attention is also being given to the best type of film projector which can be employed. Opinion is necessarily divided, but many experts now feel inclined to place their faith in the continuous projector, as opposed to the ordinary type which operates on the Maltese Cross principle. By coming to this decision they are reverting to the machine in use several years ago, and also following in the steps of the B.B.C., who effected certain important changes in their film equipment at the beginning of this year. With this type of projector the film is never jerked through the gate in a series of movements, but moves forward continuously. This form of machine was used for television purposes several years ago in America, and the appearance can be gauged by referring to Fig. 1. At the rear is the arc lamp or projection lamp housing while to the left can be seen the film spool chambers; the lower one being the main feed chamber and the upper the "take up" box. In the centre of the main body is housed the heavy mirror combination which is motor driven, and upon whose careful alignment depends the principle of this "jerkyless" film projector.

Ingenious Operation

For does matter at what speed this machine is operated, the film pictures always give the effect of continuous movement, and the scheme will be understood better by referring to Fig. 2. Driven round on an inclined axis is a large drum near the periphery of which is mounted a series of flat mirrors. By means of two fixed mirrors and the drum mirrors, the beam of light from the lamp housing is reflected four times, and at the same time passes through the film negative as it moves continuously through the gate. Although the film is moving, the individual pictures of each frame are projected on to succeeding mirrors, and due to the mirror movement the frame picture emerging from

(Continued on page 249)
Making Receiver Cabinet's

Cabinet Construction is an Interesting "Sideline" as a Change from Set Building and Experimenting, and Provides an Excellent Means of Occupying Spare Time on "Black-Out" Evenings

By FRANK PRESTON

I do not propose to describe any one cabinet, because style and dimensions must be decided by the individual in accordance with requirements. Instead, general constructional details will be given. Experienced woodworkers might decide to tackle a comparatively simple piece of construction, bearing in mind that a well-made rectangular box looks, and is, impressively superior to an ornate and "showy" cabinet which is badly made and probably lacking in rigidity.

General Procedure

No matter what the shape, provided that it is a simple one, the general method of procedure is the same. The first step is to make a rectangular frame consisting of the two upright sides, the top and the bottom. After that, a front panel can be fixed with nails or screws, and a back made which can easily be removed. As an alternative, it might in some instances be preferable to fix the back, leaving the front open so that a choice, with its own metal or plywood front panel, can be slid into position. It is desirable, in any event, to make either the back or front a fixture, because this will stiffen the assembly to a marked degree.

In the first place, a rough drawing should be made of the proposed cabinet, and this should be carefully and accurately dimensioned according to the set, speaker and possible batteries which it will have to accommodate. The four parts mentioned above will call for prior attention, and should be bought in one length. In estimating the length, bear in mind that the upright sides will probably overlap the bottom and top, and that not less than 2in. of waste should be allowed for sawing and final trimming and smoothing.

Suitable Timber

The wood, which should be well seasoned, can be bought ready planed, for it is not worth the amateur's while to spend time in planing rough timber. As to the choice of wood, one of the best for the amateur is Japanese oak; it is softer than English oak, is easier to work and less liable to splitting. Another is satin walnut, but the easiest wood of all to work is canary or American whitewood. This will have to be stained to match existing furniture, since it is yellowish in its natural form.

Do not use wood less than 3/4in. thick, bearing in mind that the thickness is always stated as that of the unplained timber. It will be about 1/4in. after planing. If the cabinet measures more than about 20in. in length or height it is better to use 1in. or 1 1/2in. stuff. Also bear in mind that if the cabinet has to be, say, 8in. deep, the wood must be cut from a board which is initially wider than this, again to allow for planing.

Corner Joining

After the planned wood has been obtained it is necessary to decide on the form of joining to be used at the corners, since upon this depends the method of setting out. A professional woodworker would tell you that one of the various forms of dovetailing is necessary for the strongest corner jointing. But this method of construction is beyond the ability of the average constructor, who will generally find it better to use either butt or corner-halving. In butt jointing, the ends of two pieces of wood must be made perfectly square so that they will fit closely against the other two. It is standard practice to allow the uprights to "run through," as shown in Fig. 1. The board should be marked out with the lengths of the top, bottom and sides, but a full 3/4in. should be allowed between all pieces; this is for the saw kerf or groove. In the case of the uprights, allow an extra 3/4in. at each end; this will project when the case is first assembled, and the projections will be planed down flush with the outer surfaces.

Halved Joints

It would appear that butt jointing would be the easiest type to deal with, but that is not necessarily the case, since it is far more difficult than at first appears to square the ends of a board. It is, of course, absolutely important that the end should be square to both the face and the edge of the board. Because of this difficulty it is often better to use corner halving, as shown in Fig. 2. In this case it is better to allow the top and bottom boards to "run through," whilst the uprights should be made shorter than the total height of the cabinet by the thickness of the timber. Also remember that the "tongue" of the top and bottom boards must overlap the face of the sides by 3/4in. to 1in. so that the sides can later be cleaned down.

Making the Rebutes

The method of forming the rebates across the ends of the top and bottom members is to square lines round the ends of the boards, the lines being the thickness of the wood apart; and the outer one being at least 3/4in. from the rough, sawn end. Then either gauge or rule a line across the end and a short distance down the two edges, half-way across the wood. Next hold the board in a vice and, with a stiff back saw, cut across the end with the saw at an angle to the wood, as shown in Fig. 3. Saw down to the shoulder line on the side nearer to you, and then turn the wood round and repeat at the other edge. Finally, hold the wood vertical and run the saw across just to the depth of the shoulder line. In doing this the saw kerf or groove should be just inside the waste part of the wood. The rebate is completed by sawing across the face of the wood, to remove the small strip.

Form all four corners in this way, taking care that the rebates at both ends of each are on the same side! Then hold the two pairs of corresponding members together and make sure that they are identical; if not they must be trimmed. When they are right, drill a few small holes—for nails—through the tongues of the rebates.

Final Assembly

To assemble, lightly coat the ends of the uprights with thin, hot glue—one at a time. Hold an upright in the vice, press the adjoining piece closely against it and drive in the nails. Actually, it is best to use 1 1/2in. panel pins, which are thin, round nails with small heads. Carry out this assembly work as quickly as possible so that the frame can be made square before the glue sets. To make it square, check the two diagonals shown in Fig. 4, with a lath. When equal, the lath can be lightly nailed across one diagonal to keep the frame true.

(Continued on page 244)
New FAST FLYER!  
... But for  
ALL-WORLD NEWS  
Short-Wave Radio Thrills  
and B.B.C. Listening  

TROPHY annihilates distance

GET A TROPHY NOW... Enjoy the thrills of all-world radio listening... TROPHY range is unlimited... In the comfort of your own home, hear—on speaker or 'phones—the amazing variety of broadcasts on the air day and night. On any other set but a TROPHY it is impossible to hear them all. You've always wanted a TROPHY, get yours now, prices may rise.

TROPHY 6

The design and specification of this 6-valve A.C. communications receiver ensures for the user reliable reception of the world's transmissions. Wave-range 6.5 to 545 metres continuous, using switched coil unit. Electrical band-spread and other refinements, including switched A.V.C. and R.F.O., pitch control. Built-in moving-coil speaker and provision for alternate use of 'phones. For use with ordinary aerial or doublet type. Housed in pleasing cabinet measuring 19ins. x 10ins. x 9ins. deep. Fully tested and ready for immediate use on 250/250 A.C. 6/100 cycles supplied. Fully Guaranteed. Terms available.

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RADIO ROYAL installs TROPHY 8's

Europe's largest Press listening post and other official centres too, depend on their TROPHY for listening to world-wide short-wave and B.B.C. broadcasts. See paragraph about your TROPHY. Go to your Dealer or write or call on Peto-Scott immediately. Whatever model you choose you will quickly understand why TROPHY takes first place as the set for thrilling and enjoyable radio listening.

TROPHY 8

The super 6-valve A.C. model of the TROPHY range. Here is a receiver for comfortable listening to the world's War news—flashes and important bulletins always to be heard in English in addition to interesting topical discussions, entertaining programmes and usual B.B.C. transmissions. Wave-range 5 to 255 metres. Solo-control band-spread, R.F. on all bands. Switched Beat Frequency Oscillator and A.V.C. Designed for use with separate P.M. speaker (for peacetime output). Connections for alternate use of phones. For single-wire or doublet aerial. Complete in Cabinet size 16½ins. x 9½ins. x 10½ins. deep. Fully tested, for operation on 250/250 or A.C. supplies. Fully Guaranteed. Easy Terms available.

PRICE £13.17.3

SPEAKER Ei.. sensitivity P.M. unit in cabinet to match. 4613

TROPHY 3

This amazingly sensitive receiver—available in battery and A.C. versions—is unapproachable by any other radio in the same class for reception on 6.2 to 550 metres (continuous). Employing single plug-in self-locating coils, at low cost, the TROPHY 3 gives dependable reception from every corner of the earth. Speaker is built-in with provision for phones. Complete in cabinet as illustrated and supplied with coils for 12 to 52 metres. Ready for use. Fully Guaranteed. Terms available.

A.C. MODEL Ready for immediate operation on A.C. 200/200. £6:18:9

BATTERY (Excluding battery). Fully tested and ready to play. If required, 5 additional coils for complete coverage, 6.2 to 550 metres, R.F. extra.

CALLERS, All TROPHY Models should be bought from dealers listed below. Or call in for Lists.

POST ORDERS. Immediate delivery on receipt of order. Orders to be sent to TROPHY Radios, 77 (P W) City Road, London, E.C.1. Tel. Cittadell 3073. 41, High Holborn, W.C.1. Tel. Holborn 3248

ARMSTRONG

Regret to announce that on and after December 6th a compulsory increase in all prices of chassis contained in our current catalogue will be 5c per cent. Readers of "Practical Wireless" will appreciate this very small increase does not represent fully the cost of raw materials and manufacturing costs.

In accordance with our policy of fair trading we have made no increase in the prices of our chassis during the first three months of the war.

MODEL SS10

This 5-valve, High Fidelity Radiogram chassis, direct coupled push-pull output capable of handling 8 watts, and gives good quality reproduction on both radio and gramophone, for an economical price of £6 2s. 6d. 5% war increase.

Armstrong Push-pull Speaker to match AW3 chassis, £1 1s. 6d. Plus 5% war increase.

We suggest Model AW25 combined with matched speaker at £1 1s. 6d. plus 5% war increase, complete, represents the most outstanding value on the market today.

MODEL AW3P.

This 5-valve (including Cathode Ray) all-valve Radiogram chassis giving 8 watts output, complete with min. moving coil speaker. Cash £7 16s. 6d. Plus 5% war increase.

MODEL AW3PS.

15-valve (including Cathode Ray) all-valve Radiogram chassis giving 6 watts output, complete with min. moving coil speaker. Cash £11 17s. 6d. Plus 5% war increase.

Illustrated Art Catalogue on request. All chassis sent on 7 days' approval.

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WARLERS ROAD, HOLLOWAY, LONDON, N.7.
(Adjoining Holloway Arcade)

*Phone NORTH 3215

PRACTICAL WIRELESS

December 2nd 1939

THAT TIME CONSTANT

When dealing with the performance of high-quality amplifiers and circuits in which every careful attention has to be given to such factors as phase and amplitude distortion, the expression "time constant" nearly always occurs. The meaning of this is somewhat obscure to some readers, but in general terms it is a measure of the rapidity of growth or decay time in different circuits. For example, if a condenser is required to discharge through a resistance in a certain time, then part of the circuit would be said to have a poor time constant. The expression finds application in two types of circuit, namely, that containing inductance and resistance, and that in which capacity and resistance are embodied. The theoretical conception of what is actually happening in either type of circuit involves a knowledge of mathematics which the reader is not in the present instance in assimilating. On the other hand, it is quite common knowledge that if any form of inductance is present in a circuit, then on closing that circuit the current takes a relatively small fraction of time to build up to its steady-state value, whereas with resistance only present the time taken is zero. The same thing applies to condenser circuits, which includes a circuit for the condenser to take time to reach its charged condition. The time constant in such a circuit is very simple, however, for with inductance and resistance present the expression is merely R where L is in henries and R in ohms. The general deduction from this is that in a circuit of given resistance the rate of growth or decay of current is directly proportional to the inductance of the circuit, while if it is desired to increase this rate then the resistance should be increased. The time in seconds given by substituting figures of circuit inductance and resistance for the fraction 1/2 is the time taken for the current to rise to two-thirds of its final value. In the case of a circuit containing a condenser and resistance, then the time constant is the same in farns and R in ohms. If the time that should elapse before the current reaches twothirds of its final value is required, then either or both C and R must have their values cut down and similar reasoning applies to the circuit containing a discharge. This is particularly important in valve theory, where for various forms of coupling the amplifier charges has to leak away as a flow of electrons through a resistance. Not only have the values for these quantities to be considered in the light of frequency response in the amplifier, but the time constant has its degree of importance and circuit values may have to be adjusted in order to satisfy the conditions of design.

D. M. W. (Wick). The field could be used as you suggest—if fact, that is one of the main features of its design. In some cases a 3,000-foot field could, but the 2,000 or 2,500-foot distance is more general. W. S. F. (Belfast). Microphone, Ltd., 4, Charterhouse Buildings, E.C.I. J. H. (Windsor). We regret that we are unable to supply details in the absence of further information regarding your proposition.

J. N. S. (Edinburgh). The trouble may be due to the speaker itself, or the amplifier or circuit employed.

J. F. (Leamington Spa). Owing to changing prices we suggest you write to Messrs. Peter-Scott for a quotation.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is out of general interest.

J. A. B. (Bradley Cross). The set was described in a recent issue of the journal which is no longer on the market. We cannot supply blueprints or other details.

J. B. P. (Bristol). A converter could be used, but probably your previous set did not employ H.F. amplification and this may be necessary for the conversion to succeed in the case of a square wave output. M. F. (Leamington Spa). Owing to changing prices we suggest you write to Messrs. Peter-Scott for a quotation.

*Phone NORTH 3215
Get back that P-U-N-C-H in your Set!

With the D.C.

AVO MINOR

This precision built moving-coil D.C. instrument, with 13 ranges covering 0-120 ma, 0-600 volts, and 0-3 megohms, provides adequate testing facilities for checking valve performance, batteries and power units, etc. It reduces troubleshooting to its simplest terms. In case, with instruction booklet, leads, interchangeable testing prods and crocodile clips.

CURRENT

0-6 ma 0-12 v 0-240 v
0-30 ma 0-12 v 0-300 v
0-120 ma 0-150 v 0-600 v

RESISTANCE

0-10,000 ohms 0-1,200,000 ohms
0-60,000 0-3 megohms

Write for full description and details.

RADIO SERVICING SIMPLIFIED 6th Edition

This valuable text-book, written in the light of the latest radio knowledge, covers the whole routine of testing modern radio receivers. Clearly explains causes of faults in receiving and amplifying apparatus; describes all tests in detail. Shows how to use radio testing instruments. 150 pages. Numerous diagrams and graphs.

Seal Proprietors & Manufacturers:


PRACTICAL WIRELESS

December 2nd, 1939

L.R.S

CARRY ON THE GOOD WORK OF SUPPLYING QUALITY RADIO EQUIPMENT

ARMSTRONG CHASSIS

MODEL SS.10 "SUPER-HOT BRIGHT" 6-valve High-Fidelity Radio-gram chassis. All valves incorporating 2 independent circuits, dual tuned, with separate push-pull output, capable of handling a broadband wave. Excellent Stereophonic results. A.C. and D.C. balanced push-pull output. Full specifications on request.

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Impossible thought! So what could be a more suitable gift than a "Stentorian" to bring the radio to an extra room? Your family will appreciate it—and you will too!

Fit a new

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SAFEWAYS ADAPTORS
You can use your Radio and other electrical appliances in any room and secure their full benefit throughout your home by fitting a SAFEWAYS Adaptor in your existing lamp-holder.

To nullify the depressing effects of the "Black-out" fit a SAFEWAYS adaptor with a low-wattage lamp in the branch outlet and the usual lamp in the other. You can then enjoy normal lighting knowing that, should it be necessary, dimmed lighting can be switched on at a moment's notice.

This particular arrangement can also be used as a nightlight for children or infirm relatives. It is merely one of many ways in which SAFEWAYS can increase the convenience of your electrical installation — quickly, cheaply and safely.

ASK YOUR DEALER FOR "SAFEWAYS"

Single Switch, 1/10; Double Switch, 2/3; Cord Control 2/6 each.

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Moaned Smith "Our old super-bulb is on its last legs, darling pet."

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Ask to see the FLUXITE SMALL-SPACE SOLDERING SET — complete with full instructions, 7s. 6d. Write for Free Book on the art of "safety" soldering and ask for Leaflet on CASE-HARDENING, SETTING and TEMPERING TOOLS with FLUXITE.

TO CYCLISTS! Your sports will NOT be hampered by the super-bulb. FLUXITE'S safety soldering set makes a simple job of fixing new bulbs.

THE FLUXITE GUN is always ready to use — FLUXITE on the soldering job instantly.

little pressure places the right quantity on the right spot and one cheerful blow fixes everything. Price 1s., or filled 2s.

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FLUXITE IT SIMPLIFIES ALL SOLDERING

FLUXITE LTD. (Dept. W.F.) DRAGON WORKS, BERMONDSEY STREET, S.E.1.

A Well-equipped Den

SIR — I enclose a photograph of part of my den which may be of interest to readers. My set is a 5-valve superhet with A.V.C. and push-pull output (P.S.4). There is also a 2-valve short-wave converter coupled to it, covering 9-160 metres, with 4-pin plug-in coils. All are home-con- structed and work off A.C./230 mains. The speaker is Magnavox 66, and tele- phones for DX. Aerial is an inverted-L, 30ft. high, 40ft. long, screened by houses and pointing to South America. I also use a piezo-electric pick-up and electric motor.

I would like to exchange QSL cards with anybody at home or abroad, and any reader of this journal is welcome to come down and have a chat at above address.

—RALPH ROOSENBERG, Wellington Avenue, Smithdown Road, Liverpool.

Home Recording: Public Address Work

SIR — Having read several letters in your past two or three issues on home-recording 1, too, would be interested in a few articles on this subject. I also suggest an article or two on home broadcasting and general public-address work, including a few circuits of high-quality amplifiers. Wishing your excellent paper all the best and continued success in its new form. — L. W. Ritchie (Bournmouth).

[A new article on Home Broadcasting appears in the present issue, and articles on Public Address work were published in the issues for December 17th, 1938, and July 4th, 1936. These issues are obtainable from our Publishing Dept., price 6d. each, post paid.—Ed.]

A Multi-valve Short-wave for Overseas

SIR — Being a regular reader of your paper for over 10 years, I do feel my duty to drop you a line from time to time. I must, therefore, congratulate you on the new appearance of your paper, which is most attractive.

While looking back on the old and new copies of PRACTICAL WIRELESS, I have noticed the lack of a description of a 2-, 3-, or 4-valve short-wave receiver running from A.C. mains 230 volts, covering the bands of 7, 14 and 28 m/c, and I shall be glad if such a description can be given in the near future. American metal valves of the latest types will be the most suitable.

The set should be simple to build and operate with the minimum of controls, and for headphones reception; band spread tuning will be essential.

I submit herewith my log of 14 and 28 m/c stations received on my "Halli- crafter's Sky Champion," with the aid of a 3ft. double aerial which is only 10 metres above ground and is sited north-west to south-east. I've logged these stations in the period of 1.10.39 till 1.11.39.

W6PEM, C6IA, V696ES, H8RC, W6QN, W6QX, YV1AF, HE:ZU, TO7SH, X13, J5CW, TV4AP, HJ1, YEY4AA, KEFKE, OQ6AB, W5HRD, W6USA, K9AF, NYIAE, K5AM, KAIIL, ZE1JS.

Last cards here are from FK31Z VE507 for 14 m/c, phone and a card from PY4DA for a 7 m/c, phone "hook-up." — RUBEN SOLOSOV, Jerusalem, Palestine.

Radio Atlhone

SIR — I wish to report that Radio Atlhone is testing on the 31-metre band, although officially listed as only operating on 16.82 metres.

A corner of Mr. Ralph Ragerman's Den.

I have to-day received verification of reception on this new frequency and included is a schedule which might be useful to other readers, so I give it here. For the next few weeks Atlhone will be operating on 16.82 metres from 12.30 to 15.30, and from 14.00 to 15.00 hrs. G.M.T. every day, and also transmissions will take place on the new wavelength of 31.27 metres at the following times: 17.30 to 17.45 and 22.00 to 23.00 hrs. G.M.T. — R. T. PARRS (Brighton).

A Militiaman's Appreciation

SIR — I am a militiaman, and have been in barracks since the beginning of the war. I have PRACTICAL WIRELESS sent to me from home each week, and it arrives on Saturday in time for the week-end. It seems to be about my only connection with the life I lived before the war. Although I am now unable to indulge in any practical work, I still find pleasure in reading the experiments and work of others.

Of course, everywhere work on radio and television must be seriously hampered by the withdrawal of all transmission licences. We can only make the best of it, and look forward to the time when we may return to our life as it was before the war.
I would say that it amounts to a national duty to continue publication of such periodicals as Practical Wireless and also Practical Mechanics, both of which keep the "ham," wherever they may be, in touch with their hobbies although they are unable to get to them. I trust that Practical Wireless will continue to appear for a good many years to come, and I am sure that it will never lack readers as long as it continues to publish articles of universal appeal to radio amateurs as it does at present.—John B. Dore (Somewhere in England).

The A.R.P. One-valve
Sir,—Just a line to let you know that I have built myself the "A.R.P. One-valve," and that I am more than satisfied with it. In the evenings it takes me all over Europe, stations coming in loudly on headphones at every movement of the tuning dial. I want to thank you for putting such a good item set before your readers. In fact, it is the finest set I ever handled.

I am going one better, and starting on the "Rapid Two."—W. B. Stevens (Newcastle-on-Tyne).

Exchanging S.W.L. Cards
Sir,—I should be glad to exchange my S.W.L. card with any "hams" and all who desire it.

I enclose a few of my best "catches" on the 20 m. band. They include XE2FC, 2Z2, ZDAR, RSL, N4G, OZE (17 30), K6GY, VS7RA, K90G, and PK4K.—Harry Rosewell, 22, Dale Ave., Longdon, nr. Preston, Lancs.

Purr Problems

PROBLEM No. 376

J.A.R.T.V. had a space marine transformer with two 4-volt 1-amp. units on it, and he decided to use the space transformer to supply the heater of the new valve. To obtain the 6 volts necessary he joined the two 4-volt windings in series and took a lead from the center tap of one winding, thereby obtaining 6 volts (4 + 2). The result did not come up to expectations, although there should have been an improvement in the performance of the set. What was wrong?

Three books will be awarded for the first three correct answers submitted. Entries should be addressed to The Editor, Practical Wireless, George Kewley, Ltd., Tower House, Southampont Street, Strand, London, W.C. Envelopes must be marked Problem No. 376 in the top left-hand corner and must be posted to reach this address not later than the first post on Monday, December 4th, 1939.

Solution to Problem No. 375

When Roberts connected the one transformer he was satisfied with the different markings, and misunderstanding these he had mixed primary and secondary wires, connecting one primary and one secondary terminal in each circuit. This obviously prevented signals being obtained.

The following three readers successfully solved Problems Nos. 372 and 373, and books have accordingly been forwarded to them:

T. W. Welsh, 80, Tyndall Road, Leicester.
W. G. H. Robinson, Furze House, Catter, Cumberland.
L. C. Tabor, 52, Newbury Road, Kington, Hereford.

NEWNES' TELEVISION AND SHORT-WAVE HANDBOOK

By post from: GEORGE NEWNES, LTD., TOWER HOUSE, SOUTHAMPTON STREET, STRAND, LONDON, W.C.2.

PRACTICAL WIRELESS

December 2nd, 1939

PRACTICAL WIRELESS
Extension Coupler

"I am building a short-wave experimental receiver, but wish for a long extension cord for the tuning condenser. Unfortunately I wish to mount this on a sub-panel and find it difficult to line it up exactly so that the control will be in line. The usual extension rod, therefore, is rather tight and the slow-motion drive slips. Is it possible to get a long flexible coupler, similar to the small discs with crossed arms as in the Edystone range?" — R. T. (N.W.O.)

The Coupler is an extension shaft flexible coupler in the Bulgin range, type E.H.12 or E.H.14. The former has a 1½-in. length of rod between the two flexible discs, and the latter has a 2½-in. rod. If these are not sufficiently long you will have to make your own by obtaining two of the standard flexible couplings and wire them together to the end of a length of ebonite rod.

Choke Coupling

"I should be glad if you would let me know what is meant by choke coupling. I am familiar with normal transformer and R.C. coupling, but have not yet met this new arrangement. I do not remember seeing any set in your pages employing it." — A. G. (Waldstone).

The choke coupling is exactly the same as resistance-capacity coupling, the full term being, in fact, choke-capacity coupling. The difference is that in place of a resistance in the anode circuit, the load is effected by means of a good L.F. choke. The inductance should be high and the main advantage is that it provides a lower D.C. resistance and thus the valve may be permitted to receive more high-tension voltage. There was one form of choke coupling in which the grid leak also was replaced by a choke, and for this purpose the secondary winding of a burnt-out transformer may conveniently be used.

Aerial Insulation

"Is there any need to go to the expense of fitting the elaborate chain of insulators on an aerial? I am using just one insulator at each end and a friend has told me that if I put a good chain of insulators I shall get better foreign-station reception. Your advice in this connection will be appreciated." — F. R. T. (Cambridge)

One good insulator may be better than a chain of inferior insulators badly arranged. If the quality of the small insulators is taken for granted, then those are connected together with wire, then there may be a leakage path through which the effects of the insulators. If a good quality insulator with a long leakage path is employed, however, it may provide all the insulation that is necessary for reception purposes. In any case it is a good plan to lower the aerial periodically and thoroughly clean the insulators and connecting links, removing the deposit of soot (carbon) which accumulates on them in the course of time.

Battery Charging

"When charging two accumulators of different rating, must the current rate be limited to the rate of the smallest accumulator, or is the fact of the two batteries being in series sufficient to act as a regulator?" — N. D. F. (Selby)

With the ordinary home-charging methods the current should be limited to that of the cell having the lowest charging curve. There are, however, several methods of charging, i.e., constant current, constant potential, etc. We assume that your two batteries are of the same voltage, and therefore you should connect them so that the current flowing will not exceed that recommended for the smaller model. An ammeter is therefore essential in this case.

Extension Speaker

"I have tried an extension speaker on my set but it is very weak. It also seems to cut down the volume on the set itself, when both speakers are in circuit. Is it necessary to cut off the built-in speaker when using an extension?" — S. E. (Weston-super-Mare)

In cases both speakers may be operated together, but the problem is to the volume thereby obtained will depend upon the circuit. In some cases an extension speaker has to be of high resistance, and in others of low resistance, and it is therefore essential to use the right type of speaker with your set. The maker's instructions should therefore be followed in this respect. We would imagine from your remarks that your set is designed for a high resistance speaker and you are using a low resistance model, thereby short-circuiting the output circuit. See the article in this issue on extension speakers.

The coupon on page 252 must be attached to every query.


**D.C. ELIMINATORS AND L.T. CHARGERS**

EVEN in the best regulated offices, slips occur from time to time, and in these days with A.R.P. work and blackouts the regret that we omitted to get into our issue dated November 11th last in the article on Eliminators. Here, the method of calculating one part of the bleeder resistance value was incorrectly stated. Statically, the value given by the contributor was correct. Unfortunately, however, when such a bleeder resistance is in use there will be a current load to the lower part of the total resistance, and this will lead to an incorrect value, if the method of calculation which was given is adopted. Therefore, the method of calculation should be as follows: First, settle upon an arbitrary current which may be "bled" from the total H.T. and this should be a small fraction of the total current, say 10 per cent., as already explained. Resistance R1 in the diagram published in the issue in question has to pass this initial current when connected to a working receiver and we require 60 volts at the first tapping and a third resistance. Therefore, 60 volts at the initial current, which we took as 2 mA will give a value of 30,000 ohms. The next resistance, R2, is calculated exactly as mentioned in the article, namely, the current of the valve which is fed from the 60 volt point, plus the bleeder resistance, gives a total current of 4 mA in the example and as 20 volts have to be dropped across that resistance the value is 25,000 ohms as mentioned. Thus it will be seen that all the calculations in the example are quite correct, with the exception of the first section, R1.

THE EXTENSION SPEAKER

The great majority of reputable commercial sets are quite safe in this respect, and if they are provided with terminals for an external loudspeaker, all that is necessary is to connect up the extension leads thereto.

When no such terminals are provided the matter calls for a little care to ensure safety (that is, immunity from risk of shock to anyone handling the extension apparatus). Probably the simplest method is to proceed as follows: connect one lead of the extension pair to one side of the built-in loudspeaker transformer primary through a condenser of 2 microfarads. Connect the other lead of the extension line to the remaining side of the internal output transformer primary, also through a large fixed condenser. To avoid breaking into or otherwise interfering with the wiring of the set, the connections from the condensers may take the form of short pieces of flex ending in crocodile clips; these can be attached to the required points inside the receiver without disturbing anything.

Connecting Up

In the case of a home-built set, of course, it may be that no such precautions will be necessary; if the instrument already incorporates an output filter the extension line can be connected straight to the loudspeaker terminals of the receiver.

Many of the later commercial sets fitted with terminals for extra loudspeakers give what is called a low-impedance output. With these the ordinary type of step-down transformer often found fitted to extension loudspeakers is not required.

We will conclude our consideration of the practical and technical side of the question by adding a reminder that our earlier suggestion of twin bell wires for the extension material applies only to lines actually inside the house; for a lead down the garden, some form of insulated lead should be provided; metal-braided wire is recommended.

**PRACTICAL TELEVISION**

(Continued from page 241)

the main projection lens at the top of the emulsion above the sprockets. The magnification of the mirrors one to the other is set to allow this to take place, and the scheme of the picture chamber is a familiar one, and forms the basis of several pieces of scientific equipment. The actual change from one frame to the other takes place by ensuring that the succeeding frame picture is correctly focused on to the following mirror at the very instant the previous frame is about to disappear from view. By merging the changes in this way the optical expression given to the eye is one of discontinuous movement and is, therefore, ideally suited to use with a disc scanner (as seen in Fig. 1), a storage tube or image dissector tube. The number of pictures per second is governed by the motor drive, and can be made to suit any transmission standard, whilst the synchronising signals may be injected just where required, for the whole scheme of scanning is really independent of the film motion provided by the projector unit itself. Furthermore, a smooth change over from film to studio scenes and vice versa is possible with any special adaptations, as is the ease with the intermittent projector.

The only important defect which has so far been noticed with this apparatus is the possibility of frame flicker, even when the frames per second are at least 50. This is caused by alternate frames of the film reflected from the drum being of unequal brightness, due to the mirrors getting out of alignment one to the other. This is really corresponding to a daily check of angularity, although the task calls for great skill because of the very small angles involved.

**PERSONAL PARAGRAPHS**

H. J. Barton-Chapple, a member of our technical staff, and a regular contributor to these pages, has been granted a commission in the R.A.F. Volunteer Reserve.

Alan R. Barnett, for nearly ten years East Midlands representative for Ekco, has severed his connection with the company.

G. W. Godfrey has given up his position as general manager of the home television sales section of Baird Television, Ltd.

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**PRACTICAL WIRELESS**

**LATEST PATENT NEWS**

Group Abridgements can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.3, either sheet by sheet or as issued per subscription of 5s. per Group Volume or in bound volumes price £1 each.

Abstracts Published

**ADJUSTING WIRELESS APPARATUS.**—Cole, Ltd., E. K. (12011), H. G. No. 500305.

In a remote-control device for a wireless receiver, wherein the tuning element is driven through a flexible shaft from a shaft 2 (Fig. 1) actuated by the tuning knob is 3. The wheel 4 is released to mesh again with wheel 3.

**NEW PATENTS**

Three particulars of New Patents of interest to readers have been selected from the Official Journal of Patents and are published by permission of the Controller of H.M. Stationery Office. Abstracts of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.3, price 1s. weakly (annual subscription, £2 10s.)


2909.—General Electric Co., Ltd., and Alden, G. H.—High-frequency amplifiers including thermonic valves. November 7th.


2908.—Hazelton Corporation.—Automatic control system for television receivers. November 4th.


2908.—Mullard Radio Valve Co., Ltd.—Cathode-ray tubes. November 4th.


**A POCKET PORTABLE**

(Continued from page 230)

this socket. Also, with a piece of rubber-covered wire, connect the remaining remaining terminals to the black and red wire and a piece of rubber-covered wire, connect the remaining remaining terminals to the black and red wire and a piece of rubber-covered wire, connect the remaining remaining terminals to the black and red wire and a piece of rubber-covered wire, connect the remaining...
Classified Advertisements

Advertisements are accepted for these columns at the rate of 2d. per word. Words in black face and/or capitals are charged double this rate (minimum charge 2/- per paragraph). By special arrangement, words in black face and/or capitals may be charged 4/- per line. All advertisements must be typewritten.

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5. - Small traders' parcel of components, comprising 40 tubes, 50 resistors, 30 electrolytics, 20 valveholders, etc., etc., value 5/-; 2/- per parcel.
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PRACTICAL WIRELESS, 2/12/39

Positon of Condensers

ORDINARY paper, tubular or mica condensers may be mounted in any position, but some care is necessary when using electrolytic condensers. The wet type of condenser of this variety must be mounted in a vertical position, or at least so that the vent holes are uppermost. When using these components, therefore, look for mounting instructions on the case, as it is generally indicated whether or not they must be mounted in a certain position.

Gramophone Working

THE majority of listeners who use the gramophone section regularly will appreciate that a light so directed that it illuminates the edge of the turntable is a valuable accessory, as it ensures that the needle is correctly placed and also avoids damage to the record. Special small turntable illuminating lamps are available, but an error may be effected by examining that these are switched off when the 'gramophone lid is closed down. On most lids a self-supporting or similar stay is fitted, and usually two contacts may be mounted on this in such a manner that when the lid is lifted the light is in circuit and when the lid is lowered it is open-circuited.

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ROUND THE WORLD OF WIRELESS

Short-wave Receivers

The design of short-wave apparatus tends itself better to the experimenter than that of ordinary broadcast equipment, and although circuits must, more or less, be standardised, there are many refinements which may be incorporated and which will provide scope for experiment. The ideal short-wave receiver is, of course, the communications type of superhet, but it is possible to build a simpler type of receiver and yet still retain many of the features of this special type of superhet. We have already described in these pages various special short-wave receivers, and in this issue we give yet another specialised design, including five valves. Reception is, of course, the main stand-by of the "straight" receiver, and the more effective that this part of the circuit may be made, the better will be the results. Specialisation has, therefore, been paid to this part of the Short-Wave Set, and they are many other features in design which will appeal to the experimenter who requires something different from the ordinary straight three or similar type of set for battery operation on the short waves.

"People's Set" for Troops

The authorities have approached some of the larger radio firms with a view to obtaining a design of radio receiver for use by the troops. Something on the lines of the "People's Set" is indicated, providing simplicity of operation and reliable results.

Elizabeth Cowell as Broadcast Announcer

The B.B.C. announces that Elizabeth Cowell, the former television announcer, has returned to broadcasting, by arrangement with the Air Ministry, as a woman announcer in the Home Service programmes. She is to specialise in announcing variety broadcasts.

Miss Cowell joined the B.B.C. as a television announcer in May, 1936, and since then has faced the microphone and television camera on more than a thousand occasions, at Alexandra Palace, on the stage at St. George's Hall, at Radio-lympia and in television outside broadcasts. She has also produced television programmes, specialising in presentations of ballet, which is one of her principal interests. Miss Cowell speaks French and German. Before she joined the B.B.C. she had had considerable experience in dress design and display.

Children's Hour Adventure Story

ELISABETH KYLE is well known as a writer for Children's Hour, particularly in the adaptations she has made of folk tales. Now she has made a thoroughly topical play which will be broadcast on December 9th. It opens with Robin and Jean travelling to Glasgow in a train during a black-out. In an old curiosity shop they meet a mysterious stranger and take part in an adventure concerning a parrot, a musical box and the model of a Chinese temple carried out of priceless jade. The play, which is called "The Key to No. 10," will be produced by Christine Ov.
PRACTICAL WIRELESS

December 9th, 1939

**DX on Medium Waves**

A Simple Explanation of the Requirements of a Circuit for Long-distance Reception on the M.W. Band, with Brief Details of Such a Circuit

By FRANK PRESTON

POINTING out that the average amateur nowadays thinks of DX reception only in terms of short waves, a very keen experimenter recently asked me for a circuit suitable for a sensitive receiver for medium-wave reception. At first the request struck me as being in some way funny, but after further consideration and after discussing it with other experimenters, I realised that there was a good deal in it.

My querist pointed out that he had been building long-distance sets for a number of years and remarked of the "Selectone," which I described in PRACTICAL WIRELESS seven years ago. This was a Det-I.F.-Power type of receiver with a number of features which were unusual at the time. It gave good reception of American medium-wave stations, not only on my own aerial but in the hands of a large number of readers. A suggestion was therefore made that an up-to-date version of this set should prove very popular. But I had to disagree with this, despite the fact that at least one reader has received three or four "Yakus" on it within the last few weeks.

"Straight" Circuit Not Suitable

Unfortunately, a set of this type, however well designed and made, is not sufficiently selective for present conditions. The very nature of the simple type of "straight" circuit makes it unsuitable for 1940 DX. By designing a "straight" set with at least two H.F. stages—and possibly a band-pass filter into the bargain—sufficiently sharp tuning might be obtained; but only at the expense of a certain delicacy of operation and initial trimming. And even if an exceptionally high degree of selectivity were combined with marked sensitivity, I should not favour a circuit of that type. The reason is that the requirements can be met in a simpler and less expensive manner by using the superhet. Regardless of the adverse reactions of many "old hands" to the superhet, there is no doubt that it does present the most convenient method of combining every feature that is most valuable for medium-wave DX work. When "simplicity" and "cheapness" are the prime need, a very good argument can be made out in favour of the "straight" circuit. For any other purpose the "straight" cannot easily be defended, however much fondness the pre-1930 experimenter has for it.

A Superhet

This leads us to a brief consideration of the kind of superhet circuit best suited to the needs of the M.W.-DX "fan." Personally, I doubt whether I should build a set for long-distance reception of the so-called broadcast bands only. Since a short-wave band can be added at practically no extra cost, and with only a sacrifice of efficiency on the 200 to 2,000 metre range, there does not seem to be any very good reason for not including it. Even if it is used only rarely, it provides an interesting diversion.

A skeleton circuit is given on this page which shows the general arrangement which may be followed in building a receiver of the type in question. It should be made perfectly clear that the circuit is not complete in every detail, and that it is given rather for the guidance of the experimenter than as a circuit which would appeal to the average constructor. That is why no constructional details will be given, for it is assumed that anyone who proposed to make a receiver round it would have sufficient knowledge and experience to work out his own practical details. There are on the market various makes of coils that could be used, whilst the other components are of standard type. Most readers have their own favourites in the way of valves, and certain resistor values are essentially dependent upon the particular valves employed. The values are generally given in the literature available from the valve manufacturers.

Valve Sequence

It will be seen that there is a preliminary H.F. stage, followed by a pentagrid frequency-changer (there is no particular reason why a triode-pentode or triode-hexode should not be used if preferred), a single I.F. stage and an H.F. pentode second detector. An I.F. amplifier would be used in most cases, but this can be of any standard type. Since there are two tuned stages prior to the frequency-changer it is quite unnecessary to use a band-pass filter, especially since ample selectivity control can be provided in the first I.F. circuit. Experience generally shows that a preliminary H.F. amplifier is better than a second I.F. stage, since a certain minimum signal input to the frequency-changer is essential for efficient operation; this is an important point when DX is the first need.

A three-pole tuning condenser is required, and the type of this depends upon the oscillator coil employed. My preference nowadays, but it has at least two advantages for the purpose under consideration. In the first place it permits the second-detector to operate at maximum efficiency, and in the second it allows that valve to be used in an oscillating condition for the reception of C.W. transmissions. It might be argued that a beat-frequency oscillator would provide a better means of obtaining C.W. reception, but we are concerning ourselves not only with efficiency, but also with reasonable simplicity.

Of course, reaction control must have some slight effect on the tuning of the second I.F. transformer, but this is negligible at 465 kc/s provided that trimming is carried out when the reaction condenser is set to a position just below the oscillation point. Additionally, the differential reaction condenser counteracts to a large extent the changes in circuit capacity brought about by reaction condenser adjustment.

(Continued on page 265)
The "THREE-TWO" RECEIVER

THRE only details which were not given concerning this receiver last week were the drilling dimensions for the panel lay-out. As the receiver must be provided with a panel, or mounted in a cabinet, which will have to be drilled, we give on this page a dimensioned lay-out of the front of the receiver, from which the desired drilling may be accomplished. The holes for the various spindles should, of course, be merely clearance holes, so that the control knobs will cover them. So much for the actual construction. A simple three-valve combination of this kind, however, is remarkably amenable to circuit changes, and much can be done to "hot-up" such a circuit so that each stage gives its maximum performance. For instance, the screen-grid of the H.F. stage is provided with a fly-lead for insertion in the H.T. battery. The usual voltage for such a point is round about 80 volts. When, however, this is raised or lowered, the H.F. valve acts in a different manner, and in some cases the stage may prove unstable if it is raised or lowered above a certain point. This, then, is the first point where experiment may be carried out to provide an efficient H.F. stage.

Instability

Initial experiments should be carried out with the lead inserted into the socket nearest the 80-volt mark, and it is preferable for this type of receiver to obtain one of the H.T. batteries which has a large number of intermediate voltage sockets. Some, of course, only have sockets at every 15 volts, whilst others are tapped at every 6 volts or so. When a signal has been received and the receiver is found to be operating properly, move this screen voltage lead up and down the battery and note the variation in performance. It will be found that there is a point where sensitivity is at maximum and the set is perfectly stable. No bias is applied to the valve, and, therefore, gain is at maximum with consequent risk of instability if the lay-out is badly carried out. When, however, the screen voltage has been properly set for the valve in use the receiver will be perfectly stable and gain will be adequate. If it is desired then, to avoid the necessity of using the extra fly-lead, or a different type of H.T. battery is to be used, where the appropriate tapping point is not available, the screen may be fed from a potentiometer across the H.T. supply, the two parts of such a potentiometer being provided by two fixed resistors having values which will ensure the correct voltage being applied. Alternatively, a simple series resistance may be joined between the screen-grid and the H.T. line feeding the output valve, with a 1 mfd. fixed condenser between the screen-grid and earth. To ascertain the correct value of this resistance a milliammeter should be inserted between the fly-lead and the socket on the H.T. battery which has been found most suitable, and the current reading noted. The value of the resistance may then be calculated by subtracting the voltage which is being used from the total of the H.T. battery and dividing this by the current in milliamps. The answer will give the value of the resistance in thousands of ohms, and a 1-watt component will be ample for the position.

Detector Stage

In the detector section or detector stage of a similar circuit it is also possible to improve the performance of modification of certain component values. The grid leak is probably the most critical in this respect, changes in its value affecting not only the sensitivity of the stage, but also the smoothness and efficiency of the reaction circuit. Try values from 1 megohms (10,000 ohms) up to 5 megohms, and note the difference in sensitivity on a weak station, and also the way the reaction control behaves. With some values the reaction will go in with a "plip" long

LIST OF COMPONENTS FOR THE "THREE-TWO" RECEIVER.

One "Bar Type" 2-gang condenser (Polar).
One micro-horizontal drive (Polar).
One 2-gang coil unit, type BF/14 (Varley).
One 1910 3 mfd. Grid condenser (Polar).
One screened standard H.F. choke, type H.F.9 (Bulgin).
One 8-point slotted dolly switch, type S.139 (Bulgin).
One 3,000 ohm 1-watt resistor (Dahleret).
One 10,000 ohm 1-watt resistor (Dahleret).
One 45,000 ohm 1-watt resistor (Dahleret).
One 250,000 ohm 1-watt resistor (Dahleret).
Two 2001 mfd. fixed condensers, type 655 (Dahleret).
One 10 mfd. fixed condensers, type 46025 (Dahleret).
Three 1 mfd. fixed condensers, type 46035 (Dahleret).
One 1 megohm volume control, type 5G (Pawlence).
One 9-pin chassis type valvholder, type X.112 (Clix).
One 9-pin chassis type valvholder, type X.112 (Clix).
Two two-socket strips, A.B. (Clix).
One two-socket strip, L.S. (Clix).
One top cap connector, type 8425 (Clix).
Two component mounting brackets (Peto-Scott).
One Neepholer chassis, 6in. by 6in. with 3m. runners (Peto-Scott).
One TP-22 triode-pentode valve (Mazda).
One Pen 320 output pentode valve (Mazda).
One 5m. screened valve, insulated slewing, screen, etc.

Drilling dimensions for panel or cabinet front for this receiver.
An A.C. Operated Trickle-charger

A Handy Piece of Equipment for Keeping L.T. Accumulators Used for Radio, or Emergency Lighting Work, in a Fully Charged Condition — By L. O. SPARKS

The problem of recharging low-tension storage cells forms one of the little, but always present, disadvantages associated with battery-operated apparatus. However careful one might be in keeping a check on the discharge rate and period of an accumulator, there comes a time when the supply unexpectedly becomes exhausted, and for some unknown reason this so often happens when it is least convenient. During normal times, this failure of the L.T. supply to a radio receiver could be sufficiently annoying, but during the present conditions, when one does not wish to lose some special broadcast item, the necessity of preventing such occurrences becomes vitally important. The same consideration must now, of course, be given to accumulators which are being so widely used for emergency lighting work, and for portable and stand-by A.R.F. shelter listening points.

It is not always convenient for constructors to make use of some of the well-organised charging services now so well established in most areas, while others who have A.C. mains available naturally feel that they would like their installation to be as independent as possible from outside assistance.

For the benefit of the latter, details are given below of L.T. chargers suitable for most domestic requirements.

Technical Considerations

When dealing with an alternating current supply, it becomes essential to provide some means of converting or rectifying the available current to that suitable for charging purposes, usually, reasonably pure direct current.

For this purpose, various types of rectifiers can be used, but so far as most requirements are concerned, the choice can be restricted to two, the valve and the metal rectifier. For amateur purposes, the latter is, undoubtedly, the most simple and economical, therefore it is that type which will be dealt with in this article.

Three fundamental circuits recommended by the makers of the Westinghouse metal rectifier are shown in Fig. 1, where it will be seen that the essential requirements are a mains transformer, a rectifier, and a limiting resistance.

The construction of the mains transformer will depend on the voltage of the mains supply and the type of rectifier employed, i.e., the L.T. charging output required, which, in turn, will be governed by the number of two volt cells to be charged at any one operation.

The limiting resistance, although a rather insignificant item, is very important as it is incorporated in the circuit as a safety-device.

The resistance of an accumulator is very low, and it must be appreciated that the current limiting factors of the charging circuit are the resistance of the cell and the difference between the applied voltage and that of the accumulator. If, therefore, any fluctuations exist in the applied voltage, these will be capable of creating fluctuations of a much greater magnitude in the charging current. As each type of rectifier has definite current limitations, and, of course, the same applies to the secondary winding of the mains transformer, it will be realised from the above that unless means are provided to prevent or swamp such current fluctuations, serious harm might be caused to these components. In view of this, the resistance should never be omitted from the practical circuit.

Controlling the Output

When metal rectifiers are used which have an output suitable for the charging of more than one accumulator at a time, both the tapped secondary and a tapped secondary winding or a relay variable resistance. The first method is recommended by us in preference to the latter.

There is an exception to this rule, however, and that is when a centre-tapped secondary winding or rectifier is used which require a centre-tapped secondary winding, which is shown in Fig. 1.

Design

For ordinary radio requirements, quite a small charging current will be suitable, as it is usual to bring the charger into operation only a sufficient number of hours each day, or every other day according to individual demands, to replace, as it were, the current consumed by the receiver during its period of operation. This process is known as trickle charging, and the required apparatus is less costly than that which would have a greater output and which, consequently, would take a lesser time to charge a given cell.

A small panel is advisable, to carry the mains on-off switch and the output terminals or sockets and, with the larger chargers, a suitable ammeter to enable a visual indication to be obtained of the output or charging current. The circuit shown in Fig. 2 (upper half) makes use of the Westinghouse metal rectifier type L.T.7, which is ideal for all normal 2-volt cell trickle-charging. The mains transformer secondary is centre-tapped to give plus 4 volts A.C., while the fixed resistance must have a value of 2.5 ohms. The charging current is 0.5 amps. The arrangement in the lower half of Fig. 2 has a greater output and is suitable for charging from 1 to 3 two-volt cells at a current of 1 ampere. The rectifier is the type L.T.4. The limiting resistance must have a value of 1.75 ohms.

With the tapped secondary feeding the output control, the secondary A.C. voltages will be 7.5 volts, 9 volts and 11 volts for one, two or three 2-volt cells, respectively. If, however, a variable resistance is used as the control, the secondary voltage must be 11 volts and the following resistance values provided: 5.25 ohms, 3.25 ohms and 1.75 ohms for one, two or three 2-volt cells as before.
December 9th, 1939

PRACTICAL WIRELESS

257

ON YOUR WAVELENGTH

By Thermion

I have often wondered why it is that a few educated people are not retained in some parts of the British Isles to teach them English pronunciation and grammar.

"Incognito—by Request"

The pundits of the B.B.C. picture, might in many cases, acquire beacons, tributes or mai'

Genei the Acts No. 15th. and Engineer-in-Chief, otherwise may acquire, buy, sell,

pin, purchase, let, hire, supply, dispose of, acquire, or distribute wireless transmitters, whether for telegraphy, telephony, or television, or for use as navigational beacons, or landing beacons, or otherwise for the purpose of indicating position or direction or the remote control of machinery. Nor may they sell, purchase, let, hire, supply, dispose of, acquire or distribute high-frequency inductors, spark coils, quenched and rotary spark gaps, high-frequency equipment, being equipment which generates or uses high-frequency current at frequencies greater than 10,000 cycles per second, and having a maximum output exceeding 10 watts and including equipment intended for use in connection with furnaces and mechanical devices, unless the transmitter is capable of an anode dissipation exceeding 10 watts is illegal. Similarly, piezo-electric quartz plates or piezo-electric tournaline plates, cut to oscillate at any specified frequency, are banned.

The transmitter seems to be in a bad time.

Overseas Correspondent Wanted

Arthur C. H. Walters, who is the 2DMT, and who resides at 18, North Street, Bedminster, Bristol, 3, wants to communicate with one of the fans overseas., He cheerfully says that although an undertaker by trade, his outlook on life is not morbid. He is prepared to swap letters and manuscripts equally as well as an occasional book or novel.

Another Myth

A Correspondent whose initials and address I refuse to disclose lest some of my fans in the district tear him limb from limb. He says that the best English is spoken in Dublin, and Inverness, and that this is South Africa, searching for gold and diamonds. He posted the manuscript and drawings to us, but Hasler, knowing the epoch-making inventions of Mr. Belfry, and realising that if we published them the war would be over, sent them to the bottom of the ocean in a ship specially chartered to convey the manuscript to us.

Readers on Active Service

I continue to receive a large number of letters from readers called to the colours but who are helping us to carry on by remaining readers. Where possible I have been able to put them in touch with one another. I hope that every reader called up or otherwise departed from his home will keep me posted of his change of address. It may happen that another reader will be moved to the same district and thus I can put them in touch with one another so that they can meet for pow-wows.

Readers' Change of Address Column

I am happy to comply with a request made that I include a regular column of readers' changes of address. Where these addresses relate to the Army, I am, of course, unable to publish them, but I can include the reader's name and district and offer to forward letters. Readers who wish to keep in touch with one another are offered the facilities of this column.

"Wandering Willie's Tale"

One of the finest short stories in literature, which could also be classed as one of the best ten yarns in the world, is "Wandering Willie's Tale," which is none the worse for having been written by the roguish Sir Walter Scott. It has been adapted into dramatic form by the B.B.C. Talks Department, and it will be produced by John Gough on December 8th. The eerie adventures which Wandering Willie, the blind fielder, happened upon at the Castle of Redgaunt make a gripping tab in dramatic form. Scott's own dialogue has been used mainly throughout, and wherever new dialogue has had to be written, the narrative has been closely followed by the adapter, who has made a study of the dialogue of the time. Because in the original the story is told by Wandering Willie himself, this does away with the need for an anonymous narrator, as the linking passages between the various scenes can be told by the central character.

PRACTICAL MECHANICS HANDBOOK

By F. J. CAMM.

400 pages, 6/6 or 6/6 by post from

GEORGE NEWNES, LTD.,
Tower House, Southampton Street, Strand, W.C.2.
A Virile Outlook

WITH television transmissions in this country a thing of the past, and apparently a hope for the very distant future, according to the dictates of war, the British public, quite naturally, are apt to overlook what is happening in those neutral countries who are free to apply their scientific knowledge in peaceful channels. The continent of America, however, has not only grasped the advantage of the situation in which they have been placed, and seem determined to overhaul the standards of the continent established in television. They have made it clear that while the dissemination of pictorial information and a variety of entertainment are the prime factors associated with their steadily growing home service, the future of television is bound up in many directions which even the most courageous scientist would hesitate to prognosticate. Recent events have proved conclusively to the American that one must not think of television only in terms of home entertainment. Television in a cinema was becoming an established fact in Britain, and installations in these places of popular entertainment was proceeding at a pace dependent only on the speed with which the television projection receivers could be built. Demonstrations of these large screen pictures in New York have convinced those who saw them that they are entirely free from flicker, and have a degree of definition governed only by the quality of the transmission itself. In other words, the electrical and optical characteristics of the electronic apparatus employed was fully capable of dealing adequately with any transmission which this equipment was called upon to handle. As a result of this aspect of television's development, events of national importance, whether they have a bearing on the political, commercial, or sporting life of the community, can be participated in at the instant they happen, although separated by miles from the place at which they occur. Mass entertainment in this form, as distinct from the fireside atmosphere provided by scenes in the home, will always be part of the make-up of the average person's life, and by lifting big-screen television from the realm of conjecture to practical realisation television has destroyed the limitations of human vision, and by harnessing sound and vision together opened up a panorama of events which can be seen without any time delay which characterises a recorded version. In the United States, the whole industry realises that it is, at the moment, only on the threshold of a virgin field and looks forward to improvements in education as a result of big-screen installations in all schools, so that the specialist can address a class of students numbered in thousands, instead of being confined to the four walls of the classroom.

It is in that telecasting will find divers applications in commercial communication, the telephone, navigation on land, sea and air, so as to still further reduce the risk of travel which at present is hidebound by nature's idiosyncrasies from the point of view of weather. These items alone are sufficient to convince the fertile brains of that country that television will provide material for an all-embracing industry. It will not be a case of subordinating old industries to the requirements of the new, but of necessity there must be a reassessment of values, and the establishment of a spirit of co-operation so that all may benefit. This is not a case of a scientific miracle occurring overnight, but rather the gradual culmination of a series of discoveries in the field of electronic engineering, all of which have played their part in assisting in the progress of what is technically termed 'the art of instantaneously producing at a distance a visible image of an actual, or recorded scene, by means of an electrical system of communication.'

Visual D.F. Working

The versatility of the cathode-ray tube is exemplified once more by its application to many forms of direction-finding schemes where it is desired to secure the correct bearing of a signal. Many difficulties have to be contended with, however, and any out-of-balance must be counteracted. One very promising method uses the usual pair of crossed frame aerials set at distances to each other, and feeds the signals through to the two pairs of plates of an electrostatically operated cathode-ray tube. In the path from aerial to C.R. tube, however, is interposed two amplifiers and two pairs of reversing switches. These last named are for the purpose of compensating for any out-of-balance of the actual operating characteristics of the amplifiers. Normally a single narrow ellipse would give the impression of focusing on the calibrated fluorescent screen, but by synchronously operating the reversing switches so that the frame aerial signals pass through each amplifier in turn, any difference in the working characteristics is portrayed by the existence of two narrow ellipses. By taking the mean angle between these two patterns the exact bearing is logged.

Compact Relay Transmitters

For both commercial and military purposes, efforts are being directed in many quarters to the perfection of equipment which will serve as efficient relay transmitters when working on very low wavelengths of the order of a few metres. This in many cases is being supplemented by the development of micro-wave apparatus using carrier frequencies well above 300 megacycles. These transmitters have to be very compact, readily transportable, and possess a low power consumption when employed for field purposes, in order to maintain satisfactory lines of communication between units which may be separated by distances up to 20 miles. A very important point in connection with this apparatus is that it adds materially to the secrecy of the information radiated, since the propagated beams are directional, and distinct from the more common forms of broadcast signals. The actual designs vary in certain respects according to the particular purpose for which the relay of signals is required, but as a basis it is generally found that the main unit comprises a high stability master oscillator working at a frequency dependent on the prime carrier frequency. For example, in the case of a 120-megacycle relay transmitter the oscillator would probably work at 20 megacycles and be followed by a combined separator and low-stage gain amplifier. The third harmonic of the oscillator would be extracted, and after the separator, is doubled to the final working frequency of 120 megacycles before being handled by the output stage. Depending on the form of intelligence it is required to relay from point to point, so the degree of modulation response would be adjusted. The aerial used with this form of equipment often comprises a broadband array with reflectors, and by careful design a sharp beam is secured which can give a power gain up to a figure of 25. As an actual example of the simple nature of the micro-wave relay apparatus of low power, reference can be made to the accompanying Illustration. The original form of vertical antenna is mounted on a per- pendicular rod carried on the top of a rigid tripod. Part of the valve equipment is also accommodated on the rear of the tripod with considerable support, with batteries under the tripod.
Choosing a Loudspeaker
When to Use Permanent Magnet or Mains Energised Speaker Unit, and How to Get the Best from Them.

There are two principal types of moving-coil loudspeaker, known as permanent magnet (P.M.), and energised. Actually, as most readers now know, both depend upon the use of a magnet, for it is within the field of this that the moving coil—attached to the cone—moves. The audio-current output from the receiver is fed into the speech coil, as it is called, and produces a fluctuating magnetic field round the coil. As the coil is close to a powerful magnet system, the fluctuating magnetic field acts on the fixed field, thus causing the speech coil, and hence the cone, to vibrate.

That is a very sketchy outline indeed, but it should suffice to clarify the statements that will be made later. It should not be hard to appreciate that the effect on the speaker cone must be more pronounced if the audio currents passed through the speech coil are increased in intensity. That simply means that a greater receiver output provides increased signal strength—there is nothing obscure about that. A point that might not be quite as obvious is that the intensity of the steady magnetic field acting on the speech coil also has a considerable effect on the loudness of reproduction. This means that a greater output can be obtained from a given input to the speaker if the strength of the magnet is increased. Actually, it is not just the strength of the magnet that is important but the effect of the magnet on the speech coil. And the effect is proportional to the magnet strength and also to the distance between the magnet and the coil, the closer the two can be placed, the greater is the effect of the magnet on the coil.

Kinds of Magnet
A permanent magnet is a magnetised piece of alloy-steel, whereas an electro-magnet consists of a piece of soft iron, or special iron alloy, which does not itself "hold" or retain any magnetic properties, but which can be magnetised temporarily by passing an electric current through a length of wire coiled round it. See Figs. 1 and 2.

In practice, a fair amount of electrical energy is required to energise or magnetise an electro-magnet of the type used for a loudspeaker. An average minimum figure for a smallish speaker is 5 watts, but 7 to 10 watts is desirable. When the moving-coil speaker was first developed, it was generally accepted that an energised or electro-magnet speaker was more sensitive than one of the permanent magnet type, because the field strength could be made so much greater. This idea is still held by some, but it is rapidly becoming less and less true. The reason is that a considerable amount of research work has been carried out in connection with the production of highly efficient permanent magnets, with the result that it has been possible to make them in such a manner that a tremendously strong field strength can be obtained. Incidentally, the makers of the W.B. "Stentorian" speakers have been pioneers in this field, and are now making even public address and auditorium types of P.M. speaker.

Energising Current
A source of electrical energy is, of course, required to operate an electro-magnet speaker, and that would appear to be a disadvantage. It is, when dealing with a battery set or even with a mains set fed by a power supply unit capable of giving just the correct voltages and currents for H.T. and L.T. But in many instances, the power unit can provide rather more power than is actually needed by the receiver. In that case, the surplus can well be employed to energise the speaker. Moreover, it can be used very economically, because the magnet winding—referred to as the field coil—can be used as a very effective H.T. smoothing choke. Thus, the normal smoothing choke is not required. That means a saving in the cost of components; additionally, an energised speaker can generally be made rather more cheaply than a P.M. speaker of similar power-handling capacity.

But there are several points which have to be considered before a final choice can be made. The first is concerning the

![A Roda permanent magnet speaker.](Image)

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**Fig. 1.—Main details of a permanent magnet speaker.**

**Fig. 2.—Sectional diagram showing the construction of an energised speaker.** Compare with Fig. 1.

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**A Horn loudspeaker intended for Public Address work.**

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**Fig. 3.—How a speaker field winding can be energised in an A.C. receiver.**

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**Fig. 4.—In this example the energising wattage available would be inadequate, and a P.M. speaker should be used.**
CHOOSING A LOUDSPEAKER
(Continued from previous page)

amount of energising power that can be spared. As mentioned above, a small moving-coil speaker needs at least 5 watts for energising; a larger speaker to handle an audio output of, say, 6 watts needs something like 10 watts minimum; whilst a public address speaker to deal with an audio output of 20 watts needs not less than 15 watts, and should have about 30 watts for maximum efficiency.

Some Practical Examples

Fig. 3 shows a skeleton circuit, where a 2,500 ohm energised speaker field is used for smoothing the H.T. supply in an A.C. receiver. It is assumed that the output from the rectifier is 350 volts at not less than 50 mA, and that a voltage of about 225 is required for H.T. purposes. In this case, 50 mA is passed through the field winding, which then produces a voltage drop of 125 volts (Ohm's Law—voltage drop equals current times resistance). The wattage dissipation of the field is therefore 125 multiplied by 50/1,000 (voltage times current in amp), which is 6.25 watts. That would just be sufficient for a small speaker, and efficiency would be about as high as when using a P.M. model.

But now look at Fig. 4. The circuit arrangement is the same but the output from the rectifier is 250 volts, 60 mA. whereas the receiver valves require not less than 200 volts, 30 mA for efficient working. By using Ohm's Law again, we find that the field should have a resistance of about 1,100 ohms to give the necessary voltage drop of 90, when passing a current of 30 mA. In these conditions the dissipation of the field winding would be about 1.1 watts. In the first place, the required field resistance is non-standard, so it would be necessary to use a speaker with either a 1,600 ohm or a 2,000 ohm field; in the second place, however, the energising wattage would be entirely inadequate. In conse-

quence, a permanent magnet speaker would be a practical essential in these conditions. Smoothing would then be performed by either a 1,500 ohm smoothing choke, or by means of another standard 30 henry choke of lower resistance in series with a fixed resistor to bring the resistance up to the required value.

Parallel Field Connections

Now let us look at Fig. 5. In this case, the voltage output from the rectifier is only slightly too high for the set, but the current is much greater than is necessary. We could very well make use of a 6,500 ohm energised speaker (the resistance generally used for direct connection to D.C. mains). By connecting this field winding across the H.T. output from the rectifier, we can "absorb" a current of nearly 40 mA, so that the required 50 mA is still left for feeding the valves. Although the field winding in this instance does provide a certain smoothing effect it is not sufficient for this purpose. A normal 200 ohm choke is therefore connected in series with the positive supply lead.

This method of connecting a speaker field is not unusual, but it is very convenient to use in an example such as this. Additionally, it has the advantage of acting as a "load" on the rectifier when the set is first switched on; this is most valuable when the values of the indirectly heated type and the rectifier is a directly heated one, or a metal-oxide pattern. It is often recommended, when using this form of connection, or when feeding the field directly from a D.C. mains supply, that a neon lamp be connected in parallel with the field to prevent back E.M.F. due to the inducance of the winding. From the various figures on the diagram, it will be seen that the speaker field receives 10 watts energising power, which is adequate for speakers of medium size.

"Free" Bias

Another method of using a speaker field for energising is shown in Fig. 6, where the winding is in series with the negative H.T. lead. The H.T. voltage required is nearly 400 at 100 mA, and the rectifier provides 500 volts at 100 mA. We could thus use a standard 1,250 ohm field coil, which would produce a voltage drop of slightly more than 120 volts when passing 100 mA (1/10 amp). The voltage drop can, however, be used for biasing the output valve, by connecting the grid-return lead to the negative side of the winding, as shown. In the example taken the G.B. voltage would be 120—works. The grid-return in many cases it would be possible to choose a field winding more appropriate to the G.B. needed.

Even in our example, however, the correct value of bias could be obtained by connecting a 50,000 ohm potentiometer across the field: the field, therefore, would approach the grid-return lead to the slider of this; the connections are shown in broken lines. It will be seen that an 8 mfd. electrolytic bypass condenser is used in conjunction with the bias-voltage supply system.

In the Heater Circuit

We will take just one more example of the use of an energised speaker. This is with a D.C. receiver having indirectly heated 16-volt valves, as indicated in Fig. 7. In this instance the field winding is used to drop the voltage applied to the heaters from the D.C. mains supply. As 170 volts has to be dropped, the current being 35 mA, a resistance of approximately 700 ohms is required. This is a standard field coil resistance in some makes of energised speaker, so it could be used very conveniently. If an increased voltage drop were needed, a small fixed or tapped resistance could be connected in series with the field winding. There is not much advantage in this method of using an energised speaker for the heaters, but it is mentioned as a matter of interest.

From the points that have been raised it will be appreciated that both types of speaker have certain advantages. Both have their adherents, and both have been brought to a high degree of efficiency. At the same time, it is quite evident that more care is needed in designing a set for use with an energised speaker. For this reason the P.M. pattern is specified for the majority of PRACTICAL WIRELESS receivers, and it is most favoured by the constructor. Additionally, of course, it is more adaptable for use with a variety of different receivers.

PRACTICAL WIRELESS
SERVICE MANUAL

Edited by F. J. CAMM.

From all Booksellers 5/- net, or by post 5/- direct from the publishers, George Newnes, Ltd. (Book Depot), Tower House, Southampton Street, Strand, London, W.C.2.

Fig. 6.—Diagram showing how "free" bias is obtained by inserting the field winding in the negative H.T. line.

Fig. 7.—For D.C. sets only. Speaker field in the heater circuit. Few speakers could take the 38 watts indicated without overheating, but the values can be modified to overcome this difficulty by using a field of lower resistance in series with a resistor.
Practical Hints

An Aerial for an Air-raid Shelter

On constructing one of your A.R.P. sets for use in my Anderson type shelter, I was puzzled as to what type of aerial to use. I finally decided to use a short, vertical type aerial, which, besides being easily made, does not hinder any placing of earth on top of the shelter.

I took the barrel of a cycle pump and placed it as shown in the sketch. I then placed a 4ft. length of tin iron rod inside the pump barrel and held it in position with wet sand. The iron rod was a portion of a child's diased cot. The lead-in was led through the small hole in the pump barrel, and both ends were sealed with sealing-wax. There is no loss to earth, as the pump barrel is celluloid covered.

A novel aerial arrangement for an air-raid shelter.

Kenneth Brown (Gorton, Manchester).

A Motor-driven Coil-winder.

Desiring an adaptable motor drive for coil winding and light buffing, I decided to commission the electric motor fitted to the household sewing machine. The motor is so fitted to the sewing-machine that it is a simple matter to remove it without in any way upsetting the mechanism.

It occurred to me that if I constructed some form of temporary chassis mount in which could be incorporated permanently a suitable belt drive, it would be a matter of a few moments to transfer the motor from chassis to sewing-machine or vice versa, as desired.

The accompanying illustration shows the procedure I adopted, using a strong oak mounting chassis.

One interesting feature of this arrangement arises in the methods by which I should mount the motor, since it will be seen that due to the channelled mounting arm method of fitment, brought about by the design of the sewing-machine, a similar principle had to be adopted, this proving in the long run to be both rigid and conveniently simple in use.

To take a certain amount of strain off the mounting strips S, I fitted a wood block so that the arm could rest in a groove, as depicted.

The driving band is kept in tension by an idle which forms part of the motor-assembly, and this band drives a home-made pulley, details of which are given in the insert. The only slight modification necessary as far as the sewing-machine is concerned, is the fitment of a suitable mains plug which would fit both the chassis and sewing-machine socket, the sockets on the chassis being series connected to a toggle switch of Bulgin pattern, with the mains supply lead connecting through a noise suppressor unit also of Bulgin pattern; this latter fitment is not shown in the illustration, but as with Loudspeaker Switchboard

A simple loudspeaker switchboard showing connections.

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An Experimental Heterodyne Filter

Constructional Details of a Useful Unit for the Short-wave Enthusiast

Short-wave communication receivers using a crystal filter have an exceedingly high degree of selectivity; nevertheless, when two stations are heterodyning each other with an audible beat note, reception of either becomes impossible from a readability point of view. For this reason a heterodyne filter has recently been introduced in America (now being manufactured commercially) that will attenuate a single audio-frequency only. Having carried out some experiments with this type of filter, plus some additional modifications, it is thought that this piece of apparatus should be of considerable use to short-wave listeners generally.

The many uses to which such a filter can be put will immediately be apparent. Apart from removing the heterodyne note from interfering stations, it can also be applied to a super-regenerative receiver to cancel the quench note, and will also attenuate the loud hiss in the super-sensitive band of frequencies. For short-wave listening, an interfering modulated C.W. station in the broadcast short-wave bands can be completely eliminated.

To those who are not already acquainted with this type of filter, a few words of explanation are necessary. First it must be pointed out that it does reject a single audio-frequency completely, and not merely attenuate a band of frequencies as with a normal high or low pass filter.

The circuit is derived from the type of bridge circuit used for audio-frequency measurement. This is shown in Fig. 1. An unknown audio frequency is applied to arms A and B, R2 and R3 are then adjusted until the note in the headphones is cancelled out; when a balance is established. The unknown frequency is then found from the formula \[ f = \frac{2 \times f_c}{R_2 + R_3} \] provided that \( R \) divided by \( R_1 \) equals 2, and that \( R_2 \) and \( R_3 \), and \( C \) and \( C_1 \) are equal.

Working Filter Circuit

Turning to the working filter circuit of Fig. 2, it will be seen from the circuit values that the above conditions have been complied with. The frequency range over which the filter will work is mainly governed by the value of \( C \) and \( C_1 \). The value shown covers the most useful band in the top part of the audio scale. The two variable resistances will, of course, be potentiometers, using the slider and one side only.

One method of connecting the filter to the output of a small receiver is shown in Fig. 3. A 1:1 transformer may be used in the anode circuit of the valve which feeds the input of the filter, the output being taken to a pair of headphones. This arrangement can be applied to a standard short-wave receiver or to a two-valve super-regenerative ultra-short-wave set. In the latter case, \( R_2 \) and \( R_3 \) may be permanently set for eliminating the quench note. The few components needed may be mounted direct on to the front panel of the receiver or, alternatively, on a small sub-panel, as

Fig. 1—Original bridge circuit.

Fig. 2—Circuit values for the heterodyne filter, shown in the practical wiring diagram, Fig. 4.

Accurate Components Necessary

It is necessary to mention that the components used should be of a reliable make, so that the circuit values will be accurately matched. Manufacturers' tolerances are perfectly acceptable, however, and will not mar the working of the filter circuit. Where the circuit is used for measurement work, extreme precision is required for both the component values, and for establishing balance. Since only the effect of the bridge is made use of some latitude is allowable. However, the more accurate the components used the less will be the drop in gain which must inevitably accompany such a device. Therefore, it is advantageous to make use of a little more amplification when the filter is used.

It will be seen that both input and output of the circuit can be connected across transformers, and by using two transformers in this way the filter may be connected between two L.F. amplifying valves of a multi-stage receiver. This method may be regarded as a trifle clumsy, and will not be looked upon with favour by those who dislike audio transformers from the quality point of view.

Accordingly, a circuit was tested out using \( R_1 \) and \( R_2 \) directly in the anode of a valve, as in Fig. 5. It will be seen that a 1 microfarad condenser is inserted between \( R_1 \) and the junction of \( R_3 \) and \( C_1 \). The condenser did not affect the working of the bridge in any way apart from requiring small readjustment from \( R_2 \) and \( R_3 \). Also \( R_1 \) and \( R_2 \) have values of 100,000 and 50,000 ohms respectively. This circuit arrangement should be used in the early stages of a multi-valve receiver.

Operating Notes

Regarding the operation of the filter it might be noted that \( R_2 \) and \( R_3 \) will be quite sharp in tuning out the unwanted heterodyne note. When a signal is tuned in on the receiver accompanied by a heterodyne, first \( R_2 \) and then \( R_3 \) should be rotated until (as will happen in each case) the heterodyne diminishes in strength. Finally both potentiometers must be adjusted until the heterodyne completely disappears. With the elimination of one audible frequency, some distortion must of course take place, though this is not so important on the short waves, and also distortion will be at a minimum where the filter is tuned to the top part of the scale, hence the values shown. Where it is desired to remove frequencies in the lower part of the range, larger condensers must be used at \( C \) and \( C_1 \). \( R_2 \) and \( R_3 \) may also be increased up to a value of 50,000 ohms, in which case a wider band of frequencies is covered.
Auto Grid-bias Circuits

This Article Explains Why Certain Modifications are Introduced Into Simple Auto-bias Circuits in Order to Ensure Better Working, with Special Reference to Mains Apparatus

When an electric current passes through a resistance, a difference of potential, or voltage drop, is produced across the ends of this resistance, and this offers a simple way of providing negative grid bias to receiving valves without using a separate grid battery. The principle will be understood readily by reference to Fig. 1, which shows the essentials of the grid and anode circuits of a typical output valve, such as an indirectly-heated pentode. Certain components necessary for a practical auto-bias circuit have been purposely omitted for the sake of simplicity, but these are given later in the article.

Brief Explanation

Examining this diagram, it will be observed that the main circuit through which the anode current flows commences at the H.T. plus terminal, through the primary of the speaker transformer to the anode of the valve, through the valve to the cathode, and from the cathode back to the H.T. minus terminal via the resistance "R," usually called the bias resistance. The grid of the valve is connected to the H.T. minus line through the transformer secondary (in the case of a resistance-capacity coupled valve the grid would be connected to H.T. minus via the grid leak, so in both cases the grid is at the same potential as H.T. minus). Assuming that the anode current of the output valve is 30 milliamperes, and that the bias resistance "R" is of 500 ohms, a simple application of Ohm's Law shows that the voltage drop across "R" is 15 volts, or .03 X 500 or 15 volts. This means that the potential of the cathode of the valve is 15 volts positive with respect to the H.T. minus line, which is exactly the same as saying that the H.T. minus line is 15 volts negative with respect to the cathode. And since the grid is at the same potential as the H.T. minus line, it can be said that the grid is 15 volts negative with respect to the cathode, that is, it receives 15 volts negative bias.

If the theoretical circuits of a number of receivers are examined, it will be noticed that the actual connections employed are far more complex than the simple circuit shown in Fig. 1, while there appear to be several different ways in which the bias circuit can be arranged. The reasons are that the diagram shown in Fig. 1, is only fundamental, and needs a certain amount of modification to meet practical conditions, and that different types of valves need somewhat different types of circuit, although all are basically identical.

One Case

In describing these different circuits, we will deal first with indirectly-heated mains valves, since these are the most commonly used to-day. Fig. 2 shows the basic circuit of a typical receiver in which auto-bias is applied to four indirectly-heated valves—the screen grid (or screened cathode) H.F. amplifier, detector, a low-frequency amplifying stage, and an output pentode. The complete circuit through the valve, i.e., the anode current circuit, is drawn in thick line, and the auxiliary components associated with the auto-bias arrangements are drawn in thinner lines. It will be noticed that the essential arrangement, i.e., the inclusion of a bias resistance between the cathode and H.T. minus line is common to each valve. The questions which naturally arise are: why will not the simple arrangement shown in Fig. 1 serve in practice? and, if any modification is necessary, should there be any difference in the circuits adopted for the different valves?

The answer to the first question is that all these additional refinements are required in order to prevent the bias arrangement from transferring from the anode circuit to the grid circuit any alternating fluctuations such as audio-frequency or high-frequency signals, hum voltages, and so on, which would undoubtedly result in re-amplified hum and either low-frequency or high-frequency oscillation. In other words, these additions are a form of de-coupling to obviate back-coupling.

Feed-back

Consider first the current flowing in the bias resistance in Fig. 1. This will consist of a direct current equal to the mean anode current of the valve and bearing an audio-frequency modulation. Possibly there may be also a certain amount of hum ripples in the anode current—the "residual hum" of the receiver. Now, as the circuit applied to the grid will also be negligible. The reasons for adopting different methods of bias decoupling in different valves will be apparent from a study of the conditions under which different types of valves work. Considering first the high-frequency valve, it will be clear that the
AUTO GRID-BIAS CIRCUITS

(Continued from previous page)

angle current fluctuations are of radio frequency, in the main and, in fact, entirely if care has been taken in the layout to
and, if the ordinary decoupling circuits are efficient. It
will therefore be sufficient to by-pass the bias resistance with a comparatively
small condenser which will have a
directly in parallel with the bias
resistance but between the top end of the bias
resistance and the lower end of
the L.F. transformer secondary.
A moment's study of this arrangement will show that in effect the shunt circuit in
parallel with the bias resistance consists
of the condenser and decoupling resistance in series. Owing to the high impedance
of this combination, only a small proportion
of the total A.C. component of anode
current will flow in the arm "re," thus
avoiding serious bias attenuation, while
circuit, r and c act exactly in the same way as the
decoupling resistance and condenser so commonly

![Diagram of auto grid-bias circuit]

used in the anode circuits of valves;
or the smoothing choke and condenser in
an H.T. unit, namely, that the condenser
offers a much smaller impedance to the
A.C. component than the resistance so
that the A.C. voltage drop occurs mainly
across the resistance, giving an almost
perfectly smoothdc voltage at the grid
of the valve.

Fig. 4.—An alternative to the centre-tapped filament transformer is a potentiometer.

To-day, the decoupling system just
described is seldom necessary because
manufacturers have now produced low-
voltage electrolytic condensers of very high
capacity and therefore of correspondingly
low reactive impedance, and these may be
connected simply in shunt to the bias
resistance as indicated in the case of the
output valve in Fig. 2. Capacitors of 12,
25, and even 50 or 60 mfd. are available, and
those do away entirely with the need for
complicated decoupling devices.

Now consider the case of directly
heated output valves, which are still used
to some extent in broadcast receivers and
are, indeed, essential where really big
outputs are required. In such valves the
filament itself is the cathode, and is,
moreover, fed with raw A.C. It is therefore
not possible to take the bias resistance from one side of the filament to H.T. minus,
as by doing a considerable amount of A.C. hum would be introduced. What is
done, therefore, is to connect the bias resistance between the mid-point or centre-
tap of the filament transformer and the
H.T. minus line as shown in Fig. 3, by-
passing it in the usual way by a condenser of
large capacity. If the transformer has
been centre-tapped accurately no hum will be
introduced, but it is a difficult matter
to tap out at the exact electrical centre
of a winding. If the accuracy of the
centre tap is in doubt when hum is experi-
cenced, the usual plan is to connect a poten-
tiometer of fairly low resistance across the
filament winding and, disregarding the
centre tap, connect the bias resistance to
the slider of the potentiometer, which
should then be adjusted so that hum is
reduced to a minimum (Fig. 3).

It should be noted that this arrangement
not only renders the filament of the output
valve at a potential above H.T. minus
equal to the bias of the output valve, but
makes the heaters of any other valves
feel from the same L.T. winding also positive
with respect to H.T. minus by the same
amount. Normally, this should make no
difference to the working of the set, but
in the case of a large output triode, where
the bias voltage may be anything between
30 and 100 it will be safer to use an
independent L.T. winding directly from the
output valve and another for the indirectly-
heated valves.

LIGHT MUSIC BROADCASTS

VARIOUS criticisms have appeared
concerning the alleged disappearance
of light orchestral music from the B.B.C.
programmes. Actually listeners are hearing a
high percentage of the light orchestras
which were popular before the war. Under
the Defence Regulations, however, the
activities of the B.B.C. are curbed in certain
departments and this does not apply to the
engagement of light orchestras.

Already the studio programmes have
included Murtoni and his Tipica Orches-
ta; Fred Hartley and the Novelty Sextet,
with Brian Lawrence; and among those
booked for early inclusion are Troise and his
Mandollas, with Percy Manche; the
Richard Cran Orchestra; Falkman and
his Apoche Band, with Amelia Magri;
Wynford Reynolds and his Orchestra;
A. J. Powell and his Banjo Octet; Harry
Davidson and his Orchestra; the Palladium
Orchestra; Camplin and his Sales Orches-
ta; and the Alphas.

Recent outside broadcasts have brought
listeners performances by the Hotel Victo-
ria Orchestra and the Lewisham Hip-
podrome Orchestra, and have taken them to
the Chiswick Empire to hear Harry Fryer
and his Orchestra; to Kilburn for Alfred
van Dam and his State Orchestra; to the
Stadium to hear Arthur Laing and his
Orchestra have been heard; and to
Caridges for music by Geiger and his
Orchestra. In the near future listeners will
hear Tom Jenkins and his Band at the
Grand Hotel, Eastbourne.

ON THE DRAWING-BORD

When designing a new receiver, much preparatory work should be carried out on the drawing-
board. Some indication of the extent of such work in the factory may be gained from the
above illustration which shows the drawing-office at the Ecko works. About 200 blueprints
are made out for each set which is designed.
PRACTICAL WIRELESS

RADIO CLUBS & SOCIETIES

DX ON MEDIUM WAVES
(Continued from page 254)

There is one more feature of the circuit given with this call for explanation. This is in the method of obtaining delayed A.V.C. When a double-diode is used for second detector in a conventional circuit, A.V.C. can be obtained in a simple manner, but with a pentode detector some alteration in methods is required. The W X 900 may be connected across the detector (in series with a fixed condenser, of course) provides the required rectified A.V.C. voltage, whilst a voltage from a tapped 450 volt battery separate from the normal G.B. battery. A potentiometer is also used for variable-mains voltage control. This system works well in practice, and the delay voltage prevents the sensitivity of the detector being seriously reduced. A sufficiently strong signal is being handled for a sacrifice in sensitivity to be permissible.

Reasonable Cost

A set designed around this circuit need not be expensive if use is made of separate screened coils of the type intended for direct bolting to a metal chassis. Four-range coils can be bought for about 10s. 6d. each, whilst high-gain P.F. transformers with tertiary winding will cost about 6s. 6d. each. Thus, the total cost of coils will be under 4s. If 1s. is allowed for the three-gang condenser, a similar amount for a dual-range slow-motion drive of the type with an accurately calibrated circular scale, and 1s. for a wave-change switch assembly, it will be seen that the total cost of the most immediate works out at about £4 guineas. A cheaper tuning device could be used, but it does not pay to "economise" unduly in buying this important component. Using average valves and 120 volts (maximum) H.T. the current consumption will be in the region of 7 m.A., which is within the range of the type intended for use with H.T. battery. Even when a small power pentode is added to the set the current consumption can be kept down to under 12 mA, and this can be obtained economically from a so-called double-capacity battery. The difference in current is really the total H.T. consumption of the set, with L.P. amplifier, could be kept well below 10 m.A.

Chassis' BEST SELLERS!
Amazing Bargain Replacement Radios

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With All Valves
Tested 69/6

All-Wave

Full test, 6/6. B.A.R.A. Fully tested. Simulated mains and mains with 5,000 metres. Powerful 4, B.C. circuits, with Driver and Bass 2, Amplifiers, driving valves and 12 special transformers.

BARGAIN 79/6

Fully Tested 4-Valve Radiogram Chassis
REPLACEMENT CHASSIS to be used for output and sound. Employs powerful Excelsior G.B. Battery circuits with powerful output. Wave-range: 200 to 3,000 metres. B.A.R.A. constructors. Output: 4 WATTS NET. Price: 25s. 6d. with all valves. Limited stock. Complete with all parts, and man's kit of payments of £1. 17s. 6d.

SPECIAL OFFER! Brand New Fully Guaranteed All-wave Battery 3 Bands £1 12s. 6d. (All bands tested and guaranteed, 12 months' subscription free, and three months' free tuning). Terms 3s. 6d. down and 12 equal monthly payments of 2s. 6d.

FREE VALVES! 50 foot wire 8 KIT

All-Mains 5v. R/Cram

Chassis £5:19:6
WattValve 3 bands, one pair of 9 m.B.T. tubes, 2 tube carrier, with middles, Pentodes, and Periodic output circuit. Powerful P.T.R. transformer, 12 special transformers. S.G.3. Complete special with 12s. 6d. worth of valves and fits broadcast. Special offer with 10 valves. Above kit with complete set of 15 m.B.T. tubes, 10,000 metres, loudspeaker, 100 watts output, £6. 15s. 6d. Terms 30s. down and 10 monthly payments of £1.

NEW TIMES SALES CO.
56 (P/W15), LUGGATE HILL, LONDON, E.C.15

In order to keep the members together in the mean-while, it has been decided to make a provisional meeting on Sunday 2 p.m., in addition to the usual meetings, at which members can come to meet and discuss the present situation.

BRISTOL EXPERIMENTAL RADIO CLUB
Headquarters: 21, King's Corridor, Old Market Street, Bristol, 1.
Publicity Manager: D. F. James (SDIC), 60, Robertson Road, Actonville, Bristol, 5.

Meetings: Alternate Tuesdays, at 7.30 p.m.

FULL meeting of the above club held on Tuesday, December 5th, was the last before the Christmas Holidays. It is anticipated that meetings will be resumed on Tuesday, January 10th, 1940.

Most members have now settled down to radio experimenting under war conditions. Arrangements are being made to demonstrate several telemark-con-structed Public Address Amplifiers at the first meeting of the New Year. More practical details as to who are now a regular feature at all meetings.

PRACTICAL WIRELESS

Radio Reports should not exceed 200 words in length and should be received First Post each Monday for publication in the following week's issue. www.practicewireless.com
THE SHORT WAVE 5

Preliminary Circuit and Constructional Details of a New Short-wave Receiver — By W. R. HOBBS

This three-quarter rear view of the receiver shows the comprehensive screening which has been adopted.

It is most desirable and, in fact, necessary, when more serious DX work is intended, to incorporate in the design of the receiver, means for varying certain of the circuit constants at will, so that selectivity and sensitivity may be adjusted more closely relative to reaction and stage gain. In this design, the writer has endeavoured to provide for such considerations without excessively increasing the cost, at the same time providing a sequence of manual control which should be readily grasped after a little practice.

Apart from the extra expense which would be entailed in the housing of the set in an elaborate cabinet, and although a somewhat smaller or more compact component lay-out could have been adopted, this would only detract from the original purpose of an accessible chassis, the use of which could combine the pleasure of both listening and experimenting.

Studying the theoretical diagram given in Fig. 1, it will be seen that, basically, quite a conventional scheme is employed, the principal features being the use of screened grid injection in place of the more customary anode feed, and the advantage of variable-mu characteristics in the detector stage.

In this way, the correct setting of the screen-grid potentiometers will provide both exact operating conditions for the valves and a method of determining the most sensitive setting consistent with reaction and the type of signal being received whether this be 'phone or C.W.

On the higher frequency bands, that is, using the 9 to 14 and 12 to 26-metre coils, this form of "balancing" provides a stable means for getting the most sensitive state of reaction in the detector stage, whilst for the lower frequency bands, and with careful adjustment of the variable-mu

gain control, exceedingly smooth reaction is obtainable.

Before dealing with a typical operating sequence, it will familiarise the scheme if the component lay-out

the little gain provided by this untuned stage, the valve V1 is mounted in such a way that short wiring results, with, therefore, the removal of various causes for losses and interferences.

The horizontal mounting of the valve in this manner results in not only a conveniently short serial connection, but also isolates electrostatically the remainder of the connections from the detector stage. Thus we have the valve base mounted behind the intermediate aluminium screen and in the section utilised for the next H.F. stage, which employs a high-frequency control, and it is useful to note here that no interaction takes place between V1 and V2, primarily owing to the ample distance and the wiring lay-out.

The Detector Stage

V2 wiring is quite ordinary, but a screen-grid potentiometer is used so that, as will be explained later, a dual form of reaction control furnishing maximum sensitivity is obtainable by the combined adjustment of these two controls.

Ganging accurately with this type of circuit used principally for the short-wave bands, would at first seem impractical in view of the possible causes for attenuation, instability, and the usual circuit losses; and the writer feels that it should be noted here that the consistency in the operation of the original model in this respect can be obtained mainly to the high point also enjoyed in the design of the Eddystone condensers, whilst, of course, bearing in mind the slight but appreciable advantage obtained by the balancing of fine band-spaying condenser which it was deemed advisable to incorporate for the higher frequency bands.

This balancing condenser is provided solely to counteract any small stray capacities, whilst at the same time proving very desirable as a fine bandsplier when used with the reduction drive as depicted.

The feed to the primary or aperiodic winding of the detector coil is taken directly from the anode of V2 through the medium of two ceramic condensers, one a fixed condenser of 110 m.mfd., the other a 50-m.mfd. trimmer type, these

Fig. 1.—Theoretical circuit diagram of the Short-Wave Five.
PRACTICAL WIRELESS

THE SHORT-WAVE FIVE

(Continued from previous page)

condensers, as will be noticed, being connected in parallel.

In this manner, a third of the capacity coupling to the coil is adjustable, so that both the detector and coil adjustment can be made at certain frequencies if desired, although for average purposes after a little experiment a suitable manceuvre can be carried out, whether the receiver be in or out of a cabinet, whilst it would appear that both the reaction potentiometer and the L.F. volume control R11 were so mounted in the interests of comfortble adjustment, this is by no means so, since it will be noticed that the coupling between the detector and the first L.F. valve V4 is suitably carried out with a minimum of wiring in the employment of a Hivac PX250 S.W. valve, which employs a top-cap grid return.

FiIter feed transformer coupling is used between the L.F. valves, this being interrupyed by a 'phone jack so that with or without the loud-speaker in circuit, more critical tuning can be accomplished.

LIST OF COMPONENTS FOR THE SHORT-WAVE FIVE

RESISTORS

One 4,000 ohm; watt. Erie Resistor Co.
One 2,500 ohm; watt. Erie Resistor Co.
One 1,000 ohm; watt. Erie Resistor Co.
Two 400,000 ohm; watt. Erie Resistor Co.
Two 500,000 ohm (without switch), type M. Erie Resistor Co.
Two 500,000 ohm (without switch), type M. Erie Resistor Co.

CONDENSERS (Fixed and Pre-Set)

One .0002 mfd., type CM5, A. F. Bulgin and Co., Ltd.
Two .001 mfd., type CM4, A. F. Bulgin and Co., Ltd.
Two .001 mfd., type PC01, A. F. Bulgin and Co., Ltd.
One .01 mfd., type PC01, A. F. Bulgin and Co., Ltd.
One .05 mfd., type PC02, A. F. Bulgin and Co., Ltd.
One .05 mfd., type EC4 (electrolytic). A. F. Bulgin and Co., Ltd.
Two .1 mfd., type RD41, 6-50 mfd. British Mechanical Productions, Ltd. (Ciba).

CONDENSERS (Variable)

Three 270 mfd., with two parallel (as close as possible). Strachan and Co., Ltd. (Eddymore).
One 12 mfd., type 12132 fitted as a coil condenser, Strachan and Co., Ltd. (Eddymore).

REDUCTION DRIVE

One type E.R.D. Radiometer—G5N1 (Birmingham), Limited.

VALVE AND COIL HOLDERS

Three 4-pin, type 906. Stratton and Co., Ltd.
One 4-pin, type 907. Stratton and Co., Ltd.
One 5-pin, type K147, British Mechanical Productions, Ltd. (Ciba).
One 4-pin, type X105. British Mechanical Productions, Ltd. (Ciba).
One 4-pin, type X106 (ammon). British Mechanical Productions, Ltd. (Ciba).

CHOKES (H.F.)

Five, type 100I (E.W.). Stratton and Co., Ltd. (Eddymore).

CHOKES (L.F.)

One type L F 16. A. F. Bulgin and Co., Ltd.

TRANSFORMERS

One 4-turn, type T100I. A. F. Bulgin and Co., Ltd.

SWITCHES

One type S10G. A. F. Bulgin and Co., Ltd.

BRACKETS

Four, type H9. A. F. Bulgin and Co., Ltd.

CONDENSER CRADLE

One, type 1114. Stratton and Co., Ltd.

KNOBS AND DIALS

One precision (slow-motion dial), type 1,085 (Hivac).
One, type K16. A. F. Bulgin and Co., Ltd.
One, type 1035, (deriving back with knob, dial and cursor). Stratton and Co., Ltd.
Two, 1006-R, ONOM, instruments knobs. Stratton and Co., Ltd.

JACKS AND PLUGS

One, type P172 (single-circuit jack). Messers. Lieven.
One, type P172 (closed-circuit jack). Messers. Lieven.

Two type PH4; jack plugs. A. F. Bulgin and Co., Ltd.

COILS

Five of 6-pin, type 932. Stratton and Co., Ltd.

INSULATING PILLARS

Two, type S.M. (British). Radiometer—G5N1 (Birmingham), Ltd.

PLUG AND SPADE TERMINALS

Six, type MP1A, engraved, H.T.—H.T.—P.

Two, type RM1, engraved, red and black.

VALVES

One type SE230, 2W, Hive, Ltd.
One type PX230, 2W, Hive Ltd., of type VP215, 4-pin. Hive Ltd.
One type HP215, 7-pin. Hive Ltd.
One type 2230, 2-pin. Hive Ltd.

PHONES

S. G. Brown, Ltd. Type A.

LOUDSPEAKER

W.B. Stratton Junior.

CHASSIS

Complete chassis. Petro-Street, Ltd.

MISCELLANEOUS

Wood screws (round head) (to 1½ in. length). Writing: A. F. Bulgin and Co., Ltd.
Screened felt, W.S. H. Ltd. A. F. Bulgin and Co., Ltd.
Screws. A. F. Bulgin and Co., Ltd.
Flex. A. F. Bulgin and Co., Ltd.

FLEXIBLE CONNECTIONS

Two, type F.C. Radiometer—G5N1 (Birmingham), Ltd.

ELECTRAX CHARGERS

You must keep your battery charged at all times. A battery charger is fitted to your receiver. The battery charger will charge the battery all day if kept on a light switch. Whenever the battery is on charge, the voltage should not be over 13.5 volts. If the voltage is too high, it may be damaged. The battery charger has a built-in thermostat for protection against overcharging.

SHELTER CHARGERS, with automatic switch-over mechanism.

A.R.B. ACCUMULATORS for 200 watt. These are of a storage type. The battery charger can be connected to the accumulator without any trouble. The accumulator can be charged from the battery charger or from any other source.

A.R.B. SHELTER Ventilation and Air Conditioning. The battery charger is fitted with a ventilation system to keep the battery cool. The system is self-starting and requires no attention.

ELECTRAX ELECTRIC FIVE. A.C. 193, 290 to 490. The electric charger has a control panel which can be used for charging different types of batteries, including lead-acid batteries.

WAR EQUIPMENT FOR SERVICE PERSONNEL

DOUBLE HEADDRESS, with rubber band, for use on field. Price: £1.25. Obtainable from all radio shops.

FIELD TELEGRAPH YOKE. Only 4s. 6d. Obtainable from all radio shops.

HEADPHONE CORD, 2.5 m., with 4-pin plug. Only 5s. 6d. Obtainable from all radio shops.

DIXIMPESTA VEST POCKET TESTER. A versatile tool for testing radio equipment. Price: £1.50. Obtainable from all radio shops.

ELLIOT BATTERY TESTER. Only 10s. 6d. Obtainable from all radio shops.

LINESMEN'S DETECTOR, O. & I. Galve, in leather case. Only 7s. 6d. Obtainable from all radio shops.

HORSEH-BRASED CASED GALVE, with leather case. Only 15s. Obtainable from all radio shops.

FIELD TAPES, with brass or leather case. Only 1s. 3d. Obtainable from all radio shops.

LISTENING MICROPHONE, steel-clip Electroacoustic. Use with any equipment. Only 10s. Obtainable from all radio shops.

WIRELESS FUSE, 5s. 6d. ONLY. Available from all radio shops.

BULLO, G.P.O. Type tweaker Claridge Dust Shell, with个性, 1/2 oz. 6d. Obtainable from all radio shops.

MORSE CODE TRANSMITTERS, 10/6, per line. Available from all radio shops.

ELECTRIC IMMERSION HEATERS. Save fuel and cost. Only 10s. Obtainable from all radio shops.

OF GREAT INTEREST IN DARK WARS EVENINGS.

LOW COST, Multiple Places, 6/6. Available from all radio shops.

ACOUSTIC RECORDERS, low cost. Available from all radio shops.

MUSIC, acoustic sets, complete outfits in cardboard box. Available from all radio shops.

A.R.E. PETROL ELECTRIC RADIO. Available from all radio shops.

FOR LIGHTING AND CHARGING PURPOSES.

A 500 watt, single cri, 12 volt water cooled pump. Provides ample lighting and charging power. Available from all radio shops.

A 150 watt, 3-pin plug, 12 volt battery charger. Available from all radio shops.

A 150 volt, 3-pin plug, 12 volt battery charger. Available from all radio shops.

ELECTRAX RADIOS

216, Upper Thames Street, London, E.C.4
Comment, Chat, and Criticism

I POINTED out in my recent article on Gramophone Records that after accepting the modern miracle of electrical recording, with all its perfection of detail and lifelike representation of a great work of music down to the smallest detail, as a matter of course and an ever recurring certainty, the most vital factor making for the perfect record was the reproduction of the recording artist's personality. The ability to do this on a wax or composition disc, to such a degree of fidelity that, having once heard a powerful personality play a given work, we can at once recognize him as the maker of the record, is, to me, an absolutely achieving ambition. It is something romantic and fascinating, as well as scientifically marvelous, in one's ability to "pick up" a performance of a great composition by, say, Caruso, Paderewski or Kiesler, and take it with you to play at a friend's house, as I must imagine for one moment. You or I, with these men in our pockets as it were, playing them there, here and everywhere. And all for six shillings a time.

The B.B.C. announcers say, "There are a few seconds, so I'll play you a record of . . ." Christopher Stone goes revects of gramophone records (and probably gets as much for doing so as most of the flesh-and-blood artists). It's all most extraordinary and, in some ways, all wrong. But, like port wine or oivane, we must either bottle it if we want to enjoy it, or else visit Portugal or the Black Sea and get the real thing.

Individuality

That this question of individuality is one that welds to fully alive to would have been to be borne out by the large numbers of recordings one can nowadays get of most of the famous compositions. In fact, it is frequently almost entirely a question of "who do we prefer to play such and such a work," rather than what work do we prefer. With most of the masterpieces we have a choice of five or six recordings, as well as with hundreds of pianoforte and violin solos and songs, which are arranged before us performed by innumerable artists. With songs it is not quite so remarkable as the various voices, as well as the innumerable types of accompaniments, they can be set to, to make a large variety of recordings almost a commercially successful certainty. But to store half a dozen different pianists playing the same Chopin study, and half a dozen orchestras and conductors, the same Beethoven Symphony had to be ranked and proven wise.

Cortot

As I said in the same article, few artists have succeeded in imparting their own individual style on to the disc to such a degree as the great French pianist. There must be something very vibrant in his playing which records very easily, like the tones of the instrument itself. For, apart from the usual faithful reproduction of those tones, Cortot's records are just like bottles of essence, preserving something vital and necessary. They kill two birds with one stone—they not only preserve a mechanically perfect production of a great piece of music, but they preserve a great performance of it as well. So many recordings succeed in the first of these accomplishments, but not so many in the latter.

Cortot's recordings of the Schumann Concerto, the César Franck, Symphonic Variations, and innumerable Chopin pieces, have long been famous. Also of chamber music, notably Beethoven's Archduke Trio, Bach's Brandenburg in D and the Franck Piano Quintet. He is unquestionably the most beautiful Schumann player among all the pianists, and his distillation of romance into the music of that most ineradicable of romantics has made a perfect recording of "Scenes from Childhood." If you haven't heard Cortot play "Traumerei," then secure a record of this gem at the first opportunity. He has also just recorded a wonderful and characteristic performance of Chopin's second Concerto—the last bouquet from Chopin's beautiful garden—which I recently heard on the Editor's machine at his residence.

Toscanini

Another superb record I heard on the same occasion was the one and only Toscanini—this time in charge of the National Broadcasting Corporation of America's Orchestral—in the one and only fifth Symphony. This sounds somewhat in the manner of an alliance of two perfect souls, and so it is. Toscanini sold Queen's Hall out last summer, for seven concerts in three weeks, within forty-eight hours. And the balcony was ten shillings a time! On those records you can lick the great little man under your arm and go with him where you will. He is there to the very life. A Beethoven Symphony under Toscanini's baton is probably the greatest achievement in the executive work of music. He has long been recognised as a maestro with the lastone, and one of the chief reasons is said to be because he adheres more faithfully to the commandments of the composer, as these are recorded on his scores in the form of directions for performance, than any other conductor. This if Beethoven says that he wants such and such a movement to be played at so many metronome beats to the bar, or such and such a melody to be phrased as he has marked it—then Toscanini says, in effect, "that's good enough for me." So let's be impartial. It's on my part to suggest that I know better than Beethoven how his music should go! As Toscanini is also that rare bird which can infuse his own personality into his readings without having to override the composer's wishes in the manner, if not unnaturally so, of course. That we get from him something as near perfection as well may be. The chief features of this beautiful record are the unfailing lucidity of the recording, which impels us through the work almost against our own consciousness; and the intensely terrible speed of the last movement. None of those sentimental accessories with which so many conductors unwarrantedly adorn this most famous of symphonies with, but the authentic Beethoven granite; a stern, unrelenting struggle with the elemental forces.

Playing Speed

This question of speed enters into a large number of recordings. It seems to be the fashion to drag things, to spin them out and to sentimentalise over them, especially, of course, when there is a melody, and more especially a lovely melody. It's all in wrong. Firstly, it is not good expression—surely one of the most misunderstood words in the language—and also it robs the work of its sparkle and vitality. There is nothing worse than to let music drag and hang fire. I noticed this the other day on hearing Kreisler's own recording of the beautiful "Caprice Viennais." I had not heard him play it for some time, and the first thing that was born in on me was how many players, notably those who have arranged the work for various combinations of salon orchestras, have overfounded it with excessive and unwanted sentiment, robbing it of all its Viennese gaiety and charm. Kreisler should know, surely.

London and New York. On December 9th they will hear for the first time of the Hebrew songs which, in the arrangements of their conductor, have become so famous.

"To the Public Danger"

THERE is added point in these days of black-out and higher road fatalities to this play which was written by Patrick Hamilton for broadcasting. "To the Public Danger" was broadcast in the early part of this year and has been brought up to date specially for the revival on December 7th. Listeners will recall that the play deals with the criminality of reckless motoring without regard for the safety of the lives of other people on the road.

PROGRAMME NOTES

Glasgow Orpheus Choir

S O far as a choir can be regarded as the creation of one man, Glasgow Orpheus Choir is the product of its conductor, Sir Hugh Robertson. They will come to a B.B.C. studio on December 9th to give a concert of the music which they sing better than any other combination. The Orpheus Choir was built up by Sir Hugh Robertson from the Glasgow Tynecastle House Choir, until their fame extended across the Empire. There are twenty-three choirs varying in size between tiny Scots village halls to the largest halls of
Double-detector Circuits

SIR,—With reference to the letter from Mr. Long, in your issue dated November 25th, I beg to state that I have forwarded to your correspondent the information he requires on the subject of the crystal set.

As double-detector circuits appear to have created an interest, it would be appreciated if a few readers who have built up either the double-crystal detector circuit or the valve double-detector would report the results they have obtained. I have not tried it on the short waves; but the reader does so.

By the way, the reaction to detector 2 in the published circuit should preferably be taken to L.T. negative.—D'AVCY Ford (Exeter).

A Prizewinner's Thanks

SIR,—I thank you for the book, "Wireless Transmission for Amateurs," which you awarded me in connection with the Prize Competition.

I have recently turned my attention to the transmitting side of wireless, but unfortunately, the present restrictions on the issue of licences, etc., have confined any study to theory, rather than practice. My prize becomes all the more useful for that reason.

I have "dabbled" in wireless for the last 10 years, and have taken Practical Wireless almost from the first issue. The greater amount of my wireless knowledge has been obtained from the many interesting articles in Practical Wireless, and from the careful perusal of your Wireless Constructor's Encyclopaedia, which has been an invaluable help to me.—WM. G. H. ROBINSON (Cleator).

The S.W. "Ranger"

SIR,—Many thanks for your foolproof 6-v, Short-wave Ranger described in Practical Wireless of March 11th, 1939. For range and signal strength it's a great DX'r, once the coil is set. I received DJA (Br.), TAP, Ankara (RT7), Addis-Abeba (RT7), Rome (RT8), Buenos Aires (RGP), WSIE (RT9); WNBI (RT8); and many unidentified stations. I find the 31 m. (9-6 units) band the liveliest at present. I use headphones only for DX work.—F. W. McGEER (London, W.).

Exchange S.W.L. Cards

SIR,—I should like to exchange my cards with any other S.W.L. I will also QSL 100 per cent. I should also like to correspond with any short-wave fan in U.S.A. or Canada.—D. SMITH, 16, Cowel Lane, Hillingdon, Middlesex.

S.W. Logs: Correspondents Wanted

SIR,—I have been a regular reader of your excellent paper for several years, and should like to make a suggestion. During the time I have taken the paper I have seen very few of what I call "full" logs, that is to say, listing frequency exactly, and stating the time the station was received, and also QSA + B or RST so that others may compare results with them. I should like to see published more logs something like that of R. I. Coigier in the issue for October 9th, 1939 (+ RST). I do not include a similar log of my own as I have been QRT for some weeks, and do not think readers would be interested in such "ancient" logs.

I should like to get in touch with any SWL. AA or full ticket, "ham," in any part of the world (except British Isles) with the view to exchanging 7 m.c/s and 14 m.c/s logs, also logs of BC stations. I am particularly interested in correspondence with Iceland, Azores, Canaries, Bermudas, West Indies, Pacific and South Sea Islands, East Indies, and South America, but don't let my choice discourage other correspondents elsewhere from writing. I shall answer any log or request for further information received; I greatly enjoy the present form of PRACTICAL WIRELESS and wish it every success. On 191.75 kHz, K6PE, San Diego (Hockering, East Dereham, Norfolk, England).

The Kestrel S.W. Four

SIR,—Thank you very much for your advice I asked for recently, concerning the Kestrel. The trouble was a simple one—a broken G.C. lead. Readers may be interested in the following log heard over Derby, November 9th to 19th. Aerial, 30ft. inverted L facing N-S.

On 16, 19, 25 and 31-metre bands, WNBI, WGEA, WSLR, WPIT and WCAM. On 19 and 25-metre bands, LRU and XGOY heard faintly.

Solution to Problem No. 376

When Kestrel connected the microphones in series he should have made a test with an A.C. meter to ensure that the windings were so connected that they were in phase. If this is not done the voltages will not be additive and in his test, 12 plus 12, the result may be in phase, thus failing to provide 6 volts. The valve was, therefore, under-rated.

Solution to Problem No. 377

When Jacots connected the microphones in series, he should have made a test with an A.C. meter to ensure that the windings were so connected that they were in phase. If this is not done the voltages will not be additive and in his test, 12 plus 12, the result may be in phase, thus failing to provide 6 volts. The valve was, therefore, under-rated.

The following three readers successfully solved Problem No. 375 and looks have accordingly been forwarded to them: H. KAY, 36, St. Margaret Street, Dorking, Surrey. R. J. BARRETT, 3, Woodland View, High Tron, Nr. Stourbridge. J. P. COOK, c/o 20, Salt Hill Way, Slough, Bucks.

The well-known Europeans, such as Zeesen, Rome and Daenverty, come in fine, and I have also heard EAQ and TAP and a station announcing itself as Belgrade. On November 12th the 20-metre amateur band seemed alive, but I was unable to identify anything on the speaker, and as my 'phones are damaged I unfortunately had to let this pass.

I think this is a very fine set, and when conditions are good the Americans come over very well indeed on the speaker. I shall endeavour to let you have a more comprehensive log at a later date.

Would the Kestrel tune down to about 10 metres satisfactorily, as I have heard that the amateur band on this wavelength is active?—E. ANDREWS (Brighton).

[Although not primarily designed for tuning down to 10 metres, it may be well worth while to try, if available coils are used.—Ed.]

Correspondents Wanted

SIR,—I wish to get in touch with any young reader who is interested in short wave—medium wave receiving. Please write to R. O. L. EDMONDS (188, Kingsley Road, Hounslow, Middlesex).—R. O. L. EDMONDS.

SIR,—I shall be glad to get in touch with any reader of this journal residing in this district and interested in short-wave work.—GORDON RICHARDS (16, Elizabeth Street, Holmwood, Nr. Oxted, 374).

[We were interested in the photograph of your den, but unfortunately it was not sufficiently clear for reproduction purposes.—Ed.]

THE "THREE-TWO" RECEIVER

(Continued from page 255)

PETERS made up a three-valve battery set, with a pass-band transformer, and with a three-gang and three-gang convector. Instead of using a metal chassis as specified in the description of the receiver, he effected an economy by using a wooden chasuis, joining the Diamond circuit to earth instead of to an existing bolt on the chassis. When he tried out the receiver he failed to obtain any results, although attention seemed to function correctly and sounds of some kind could be heard in the speaker. What was wrong? These books will be awarded for the first three correct solutions received. Notices should be addressed to The Editor, PRACTICAL WIRELESS, 1-3, Lensfield Place, Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 377 in the top left-hand corner and must be posted to reach the editor not later than the first post on Monday, December 11th, 1939.

Aerial Sensitivity

One final point concerns the aerial input. There is no H.F. control on this receiver, and there is thus, under certain conditions, risk of distortion in the H.F. and detector stages due to too great an input voltage. In this case, of course, some form of limit must be imposed on the incoming signal, and this is most conveniently carried out by a series-serial convector. Such a component may be any type of variable or semi-variable convector having a maximum capacity of .0003 mfd. or .0005 mfd. It is merely joined between the aerial lead-in and the aerial socket on the receiver, and at first glance it may appear to be a definite Advantage. Slight re-tuning will generally enable the signal to be kept free from distortion.
Practical Wireless

BLUEPRINT SERVICE

Table: Practical Wireless

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW1</td>
<td>Universal Hall-Mark (I.F. Pen, D), Push-Pen</td>
</tr>
<tr>
<td>PW2</td>
<td>All-Wave Corona Four (I.F. Pen, D)</td>
</tr>
<tr>
<td>PW3</td>
<td>Universal Corona Four (I.F. Pen, D)</td>
</tr>
</tbody>
</table>

SUPERHETS

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW1</td>
<td>3S Superhet (Two-valve)</td>
</tr>
<tr>
<td>PW2</td>
<td>4S Superhet (Three-valve)</td>
</tr>
<tr>
<td>PW3</td>
<td>5S Superhet (Four-valve)</td>
</tr>
</tbody>
</table>

Mains Sets

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>PW1</td>
<td>1S, 2S, 3S, 4S Superhet (Three-valve)</td>
</tr>
<tr>
<td>PW2</td>
<td>1S, 2S, 3S, 4S Superhet (Three-valve)</td>
</tr>
<tr>
<td>PW3</td>
<td>Universal 5S Superhet (Three-valve)</td>
</tr>
</tbody>
</table>

Four-valve: Double-sided Blueprint, 1st, 2nd, 3rd, and 4th |

SOUTH-WAVE SETS (Battery Operated)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>PW1</td>
<td>Simple S.W. One-valve</td>
</tr>
<tr>
<td>PW2</td>
<td>Two-valve: Blueprint, 1st, 2nd, and 3rd</td>
</tr>
<tr>
<td>PW3</td>
<td>Three-valve: Blueprint, 1st, 2nd, and 3rd</td>
</tr>
</tbody>
</table>

MISCELLANEOUS

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>PW1</td>
<td>S.W. Converter-Adapter (1 valve)</td>
</tr>
</tbody>
</table>

Supplementary: Universal and Wireless Magazine CRYSTAL SETS

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW1</td>
<td>Two-valve: Blueprint, 1st, 2nd, and 3rd</td>
</tr>
<tr>
<td>PW2</td>
<td>Three-valve: Blueprint, 1st, 2nd, and 3rd</td>
</tr>
<tr>
<td>PW3</td>
<td>Four-valve: Blueprint, 1st, 2nd, and 3rd</td>
</tr>
<tr>
<td>PW4</td>
<td>Five-valve: Blueprint, 1st, 2nd, and 3rd</td>
</tr>
</tbody>
</table>

December 9th, 1939

These blueprints are drawn full size. Copies of supplementary instructions and descriptive sections of these sets can be had in some cases on approval at the following prices, which are based on the following prices, which are based on the face of the blueprint. A dash before the Blueprint number indicates that the set is in course of development. Port Poids: Amateur Wireless, Wireless Magazine. The Index letters which precede the Blueprint number indicate the stage in which the description appears: T.P. refers to PRACTICAL WIRELESS, A.W. to Amateur Wireless, W.M. to WIRELESS, and W.G. to WIRELESS, Great Britain. Start (probably) a postal order to cover the cost of sending this blueprint and the shipping charges will be prepaid. PRACTICAL WIRELESS, Gainsborough Street, Strand, W.C.2.
Gramophone Motor Hum

"I have a radiogram which gives rather pronounced hum, and I attribute this to the motor. Do you advise earthing this, or is there any risk of a mains short-circuit from so doing?" - L. E. (N.W.7.)

A LARGE number of electric gramophone motors are provided with an earthing terminal, and where the motor forms part of a complete gramophone unit the mounting brackets may be used with advantage, thereby earthing the motor. You may find, however, that the hum is not removed by this method of earthing as the windings in the brush-changer may intersect with windings in the motor, thereby introducing hum, and the turntable itself may not act as a sufficient screen. In these cases probably the only effective scheme is to use a pick-up which is provided with a special hum-reducing coil.

Battery Superhet

"Could you let me know when you last published constructional details of a 3- or 4-volt battery superhet? If you have not done one, perhaps you could say if you intend publishing one in the near future." - R. G. B. (Tonbridge).

We have published both a 3-valve and a 4-valve superhet for battery operation. A blueprint of the 3-valve is still available, No. PW40, and the constructional details will be found in the issue dated 5.6.37. These are reprinted, as the original issue is out of print. The 4-valve is, unfortunately, out of print, but if you have the book number you will find the constructional data for the 4-valve in our issue dated 16.11.35.

Coil-winding Machines

"Have you at any time published details of the winding machine suitable for transformer windings, or whether there is a book which gives details?" - A. T. L. (W.C.1.)

FOR simple transformer purposes you only need a neat bobbin made from papered or similar material, and this may be mounted on a spindle carried in an ordinary twist drill, the number of revolutions for one turn of the handle being found, and then it is not difficult to wind the desired number of turns. An effective coil-winding machine was, however, described in our issue dated 23.10.27, and you may wish to make up an instrument of this type, which will also be found valuable for making tuning coils. This machine is provided with a turns counter and is quite simple to make up.

Sound Detector

"I wish to make up a sound detector to pick up the air-raid warnings and amplify them inside the house. How can I do this? Is it possible to place a microphone outside the house and connect it to a loudspeaker inside? Or do you have a diagram which would show me how to do this?" - C. R. D. (New Eltham).

Its simplest form such a detector could be made by placing a microphone feeding a loudspeaker in any room. However, there are several things to be borne in mind. Firstly, the microphone must be protected from the weather. Secondly, the amplifier will have to be switched on all the time in order that it will be operative when a warning is sounded. Thirdly, there will be the constant sounds from the

PRACTICAL WIRELESS

Cabinet Rattle

"I am troubled with a peculiar form of distortion which nothing seems to cure. It takes the form of a kind of buzz on certain notes, and although I have very carefully examined the speaker and have tried various circuit ideas it is still there. I cannot notice the trouble on weak or strong signals. This leads me to suspect the speaker, but as this is fairly new and has not been overloaded by any means, I am rather at a loss to account for the trouble. I wonder if you can help me?" - M. C. I. (Hastings).

This trouble may not be in the set or speaker. A very common cause of such a buzz is found to be due to the cabinet design and manufacture. In some cases the air chambers provided round the speaker will resonate at certain frequencies and the increased amplification so afforded might result in some case in the room resonating at the increased volume. If, however, it can definitely be traced that the sound comes from the cabinet then all round and you may find that there is a looseness in the plywood laminations which is causing the trouble. A cabinet pin driven through the cabinet at the points indicated and riveted over on the inside should prevent movement of the wood and so reduce or cut out the buzz.

REPLIES IN BRIEF

The following replies to queries are given in abridged form either because of space limitations, or our rules, or because the point raised is not of general interest.

A. D. (Liverpool). We do not know of any particular company name as mentioned in your letter, and regret that we cannot complete your circuit diagram as it is too schematized.

J. B. S. (Saxmundham). Write to H. F. R., Ltd., Herland Street, Tottenham Court Road, London, W.C.1. A single-stage test in the amplifier itself may indicate the trouble.

W. W. (Aberington). We recommend our book "Transmission for Amateurs." We would remind you, however, that transmitting activities are restricted during the war, and a licence will not be issued.


J. M. (Gloucester). We would suggest you communicate directly with the manufacturer, who may be able to send you a replacement. Address "Electrolux, London, W.2." to obtain a reference.

J. E. Y. (Reading). We think it would be very difficult to make a satisfactory composite of the two mentioned and advise you to obtain a ready-made article.

H. A. (Longsha). We cannot give connections without a type number, as the firm in question makes a great number of different types of coil from time to time.

E. E. R. (South Norwood). The valve in question should work quite satisfactorily.

E. H. (Sheffield). This is merely a standard component, having primary and secondary windings. Any standard coil, even if it includes a reaction winding, may be used, ignoring the reaction section. You will find many of the coils in this book in operation, using this type of transformer are essential in conjunction with any of them. The selection is necessary for wavelength changing.

M. K. (Brynsieg, Wigan). So far as we can trace the coil is no longer on the market.

D. H. A. (Lates). There is nothing wrong with the aeter, and the connections are perfectly standard. You are correct, of course, that the parallel with the supply is measured, and in series it indicates the power flowing.

The coupon on page 272 must be attached to every query.
L.R.S
(of 11, Oat Lane)
Intend carrying on the good work of supplying Quality Radio Equipment.

Important TROPHY announcement

to those PRACTICAL WIRELESS readers who, for some reason or another, have not yet ordered their TROPHIES—please turn to last week’s issue of this journal and study the important TROPHY announcement. TROPHY Radios have been recommended more than any others for all-world listening and represent the best value obtainable. Order Now at present low prices. TROPHY models from £6 16s. Terms available.

PETO-SCOTT LTD.,
West End. 41, High Holborn, W.C.I.

FREE ADVANCE BUREAU COUPON
This coupon is available until December 18th, 1939, and must accompany all Queries and Orders.

Notes from the Bench
Another Soldering Hint

WHEN fine soldering work is being carried out, the quick application of solder is one of the main essentials, but this cannot be done if the iron will only carry a very small layer of solder. A good 'head' of molten solder is essential, but this will not adhere to the iron if the temperature is wrong and if the iron is not clean. This latter point is the one which concerns us at the moment, and a bit which may be new to many is that the desired cleanliness and requirements for making the iron solder the may be obtained by rubbing the hot iron on a block of sal-ammoniac, or dipping it quickly in one of the prepared soldering fluids. Some amateurs prefer the cheaper and more readily tanned's solder into the powder in small quantities so that the desired cleaning and timing is carried out at one operation.

Wooden Chassis

Owing to increased costs of metal, chasiss may prove more economical when made from wood, but there is no need to use very heavy plywood for this purpose if certain points are kept in mind. The top, for instance, may not be thicker than 1/2 in. provided it carries certain flat components, such as coil units, whereby the amount of flat metal forming the base unit act as a stiffener to add strength to the chassis. This must not be overdone, but additional supporting strips may be placed beneath heavy components should the top be found to exceed excessive weight.

Pick-up Chatter

With many types of magnetic pick-up it is often possible to hear the reproduction of a record, during loud passages, through the excessive vibration of the armature, and as this can become very annoying, it is always advisable to take simple precautions to eliminate this as much as possible.

A stout lid should always be provided to cover the turntable and pick-up when they are in use, and to prevent it acting as a sound-box, the interior of the lid and its edges should be covered with thick felt.

MORSE EQUIPMENT


LOUDSPEAKER CONVERSATIONS

PARLEES Triple Cone Conversions Will Immensely Improve the Reproduction of your Wireless Speaker. Enables you to bring your speaker right up to date at a cost of only a few shillings; free descriptive leaflet from the Pioneer Manufacturers of Moving Coil Speakers since 1898, i.e. Burhett Radio, 76, Snares Rd. South Croydon.
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FULL OF HELPFUL INFORMATION . . .

- Technical information and valve operating data.
- Useful Tables of Pin connections.
- Comparative valve Tables.
- Many useful hints for Experimenters.
- 12 Pages of Circuit diagrams.

In fact, everything you need to know about valve characteristics and working conditions.

In these times of emergency, valve replacements will be required in many receivers. The comparative table shown in the Osram Valve Guide will enable you to select the equivalent OSRAM VALVES.

Write for your copy of the OSRAM VALVE GUIDE (sent post free) to the Osram Valve Technical Dept. of:

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2
Receiver Overhauls

ALTHOUGH receiver faults are not ever-recurring, there are many occasions when a listener feels that remedial action might be improved by an overhaul. Cycles, ears, and other working apparatus have to be overhauled periodically, and most wireless receivers pay for a similar overhaul. At such times it may also pay to make modifications to a circuit which has been in use for some time, and without making drastic changes it may be possible to make appreciable improvements in the results with little expense and with a minimum of trouble. The question of straight-through overhaul or clean-up is more simple, but there are many points which have to be considered mind.

An examination of terminal or screwed connections; soldered joints which may have worked loose; dust between moving parts and similar details are probably familiar to every listener, but in view of the many different points which can receive attention at such an overhaul we give in this issue two or three articles on the subject. After a perusal of these it may be found that you can substantially improve your receiver’s performance, but remember always to be discriminative in the changes which you introduce.

A Stimulus to Sales

DEALERS throughout the country should find business greatly stimulated by the extensive advertising campaign which has just been inaugurated by The General Electric Co., Ltd., in connection with the marketing of two of its current receivers. This advertising campaign is scheduled to cover a period of several weeks, and the media is a comprehensive one, embracing London national newspapers and a large number of others circulating in all parts of England, Scotland and Wales, Northern Ireland and Eire.

This means that literally millions of people will have their attention directed to these 5-valve, 3-waveband, receivers, for the advertisements are of imposing dimensions and occupy prominent spaces, while they tell a convincing story in a concise and attractive way.

Light Music

OUTSIDE bands and light orchestras are being heard in increasing numbers in the broadcast programmes. In Christmas week, for instance, at least a dozen combinations which were well known to listeners before the war have been booked, and they include Harry Engleman’s Quintet, Falkman and his Apache Band, Orchestra Raymonde, Troie and his Mandoliers, Mantovani and his Typica Orchestra, Ernese and his Quintet, and Sydney Baynes and his Orchestra.

Many Regional musical combinations are also being engaged so that, within the limits of the single Home Service programme, every effort is being made to give lovers of light music a representative choice of names.

The Christmas Cuckoo

"THE Christmas Cuckoo" is a play which has been written by Eliza C. Keely Smith, author of the story in the book by Frances Browne entitled "Granny’s Wonderful Chair," will be broadcast on Christmas Eve. It tells the story of two poor cobbler who once upon a time found a cuckoo sale in a hollow tree trunk when they were cutting their Yule log. They were kind to the bird and in return for their hospitality it promises them gifts when they came back in spring—a leaf from the Golden Tree worth a great price and a leaf from the Merry Tree which keeps folk jolly all the year round. One of the cobbler thought that these gifts would make everything go well for the brothers but it was not quite so simple as that. The play will tell about the luck that the leaves brought them.

"Macbeth, King of Scotland"

ODFREY TEARLE is to play the lead in a special production, "Macbeth, King of Scotland," on December 22nd. This is the first time that a drama production has been broadcast on this scale since the beginning of the war. Arranged by Bernard Freeman, and produced by Val Gielgud, this Shakespearean production is a special adaptation which deals in sequence with the stories showing the deterioration of the character of Macbeth.

"The Magic Shirt"

HOW a misfortune can be turned into a potential advantage whenever he grows old, and J. E. Devineh uses it to advantage in a play called "The Magic Shirt" to be broadcast on December 21st. Lord Wallaby, an elderly statesman, is reaching the peak of his career, thanks to Lady Wallaby, who is described as "the artiste of Lord Wallaby’s career," but a burglar and a chapter from "The Arabian Nights" bring a sudden and astonishing dilemma which does not require police or publicity, and Lady Wallaby finds a problem which she cannot tackle.

The part of Lord Wallaby will be played by Bruce Winston, and that of his manservant, Bosun, by Kenneth Bottom and "The Magic Shirt" will be produced by W. Farquharson Small.
THE IDEAL RECEPTOR
A Discussion of the Features which Constitute an Ideal Broadcast Receiver

By W. J. DELANEY

If you ask the average listener what, in his opinion, constitutes the ideal receiver you will receive a different answer from practically every one. To some, a three-valve receiver with an output of less than 1 watt surface whilst others will listen to nothing less than an 8-valve with push-pull output rated at 12 watts or more. It is thus obvious that in general principles there is no such thing as an ideal receiver, each listener having his own ideas as to what constitutes the ideal. There are, however, many features which can be found common to each one and it is possible to arrive at a compromise basis as to the points which should be embodied in a general type of receiver. For instance, the majority of listeners must have provision for gramophone record reproduction in the receiver whilst a choice of stations must also be provided. The highest possible quality construction, low cost, long life, and upkeep are also essentials which everyone aims at.

There is, however, one point which is not often stressed and which has not, so far as I am aware, received attention from designers, although perhaps some individual listeners may have thought of the idea, or even included it in their own homemade apparatus. I refer to the separate performances of the radio and the gramophone side of a set.

Quality First

In the majority of receivers the pick-up is connected into the detector or one of the L.F. grid circuits, the connection generally being made permanently and opened or broken by means of a simple radio-gram switch. For normal purposes this serves very well. But when a little thought is given to the matter it is obvious that radio and records require different treatment. Those readers who have made up the Contrast Expander which I described on May 6th last will have appreciated how much better gramophone records sound when they are played through such an amplifier. But, unfortunately, this type of unit is not satisfactory with radio, owing mainly to the different characteristics of the signal. It will be remembered that a gramophone record is mechanically recorded—that is, in a "sound" sense. Although electrical equipment is used to convey the sounds to the disc there are limitations imposed on the method of recording the sound which make it necessary to reduce the contrast and also to limit the volume and amplitude balance is very incorrect. Again, those readers who built up either of the tone-control units described in the issue dated February 11th last will have experienced the effects which are obtainable when bass or treble or both are amplified or reduced. From this point of view, however, there is a snag to be avoided. If a radio set is properly designed, without a straight-line L.F. amplifier is included, there should be no need for a tone control. If, for personal preference, one prefers organ music, for instance, to be deep toned, there is no objection to a top-note cut-off control. If the cabinet or room in which the receiver is housed gives undue prominence to the lower frequencies, there is similarly no objection to a low-note cut-off to improve the effective brilliancy of speech and music. On the other hand the ideal receiver should be such that the effects which are obtainable in a gramophone record can be applied to radio broadcasts, or vice versa.

Tone Control

A tone control should, as its name implies, control the tone of reproduction, but in most cases the component which bears this name merely reduces the higher frequencies, and thereby gives a more balanced effect to the output, although musically the factory when receiving distant stations, owing to background noises or heterodyne whirlies. From this, therefore, one will assume that quality, as such, is only obtainable from a "local" station, and, therefore, a broad range of tone control designed for quality should have a minimum of H.F. amplification, sufficient to lead the detector stage satisfactorily, and a really good L.F. section.

Separate Gram. Section

To enable the same set to be used for records, however, a separate amplifier would be desirable, preferably incorporating the contrast expander arrangement, and the switch for radio-gram. Switching should cut out entirely the radio section of such a set and bring into circuit the special record amplifier. One or two commercial receivers have, in fact, attempted to incorporate such a device, but, as mentioned in the early paragraphs of this article, a complete home radio-gram set has not, so far as I remember, been built on such lines. Economy is undoubtedly the main feature of such a receiver, but by the use of special multi-section valves, initial expense could be kept down to a minimum, whilst upkeep should not be out of the ordinary, with suitable choice of valves. If the output section of the radio equipment were designed on a more reliable basis, it should be added to the gramophone amplifier section and still further reduce expense, and a suggested scheme is indicated in Fig. 3. It will be seen that the change from radio to gram is made in the L.F. section, and the pick-up is permanently in circuit. By making use of multi-switches, such as the small Bulgin components, operated by a single rod, the H.T. to the separate sections, or the L.F. or both, could also be cut out as desired so that the total drain would be constant from the mains supply. To obtain the desired high output and good quality such a receiver would have to be mains operated, and the A.C. mains user is in the best position in this respect owing to the high H.T. which he can obtain from a suitably designed mains unit.

Fig. 3—Schematic diagram of the arrangement of the ideal set.
Modifying Old Receivers

Simple Modifications for Old Receivers Now Being Used as Stand-by Sets

By L. O. Sparks

A part from the vast number of constructors who are, by now, well-established readers of Practical Wireless, fresh recruits to this sphere of radio activity are rolling up in surprising numbers and the majority of them are old-timers returning, once again, to their hobby of several years ago.

This sudden interest on their part is due, according to the many letters received, to their desire to make a stand-by receiver or bring into service one of their earlier efforts which had been put on the shelf when they deserted the ranks, so to speak, and went over to a commercial product. Their skill and knowledge has, of course, become a little rusty, with the result that they now are not too sure how to carry out some of the desirable modifications necessary to bring the sets in question up to date. The general difficulties seem to be those mentioned below.

Fitting Modern Valves

With many of the older circuits, it is not always an easy matter to substitute modern valves for those originally specified, owing to the fact that the valve of to-day has a much higher efficiency than its earlier counterpart. There is, of course, also the question of the original valveholders being unsuitable for certain types of modern valves and this, in turn, may necessitate alterations to the layout of the components.

The chief danger, due to increased efficiency, lies in the H.F. and output stages. For example, a modern G.O. or H.F. pentode might introduce signs of instability, due to the characteristics of the H.F. coupling and the existing operating conditions governed by the circuit design, being unsuited for use with a valve of high gain. Similarly, if two stages of L.F. amplification are employed, trouble would, no doubt, be experienced if a modern steep-slope L.F. pentode was inserted in the output stage, especially if a power valve had been used in the first place.

Providing screened coils are incorporated in the circuit and that it is possible to adjust the screen and anode voltages of the H.F. valve, it is usually possible to overcome any initial troubles which a modern H.F. valve might introduce, but to avoid any unnecessary alteration to the layout, it is always advisable to select a valve having the same type of base. If one wishes to be on the safe side, the valve manufacturers will gladly suggest the nearest equivalent in their present-day products.

Variable-mu Control

The use of a variable-mu type of H.F. valve allows a very satisfactory form of volume-control to be obtained and, at the same time, helps to remove any trace of distortion due to the reception of a very powerful local signal. The modifications for this refinement are quite simple, as Fig. 1 indicates.

The diagram at the left shows the normal circuit of a "straight" H.F. screened-grid valve, such as those used in the earlier sets. It will be noted that the aerial coil is connected between the grid terminal and earth. With a variable-mu valve, it is necessary to apply a variable negative bias to the grid of the H.F. valve, and this is done in the manner shown by the circuit on the right of Fig. 1.

The earth end of the coil is disconnected from the earth line and taken to the moving arm of a potentiometer having a value of 50,000 ohms, and one side of a .01-mfd. fixed condenser, the other side of which is taken to earth. Across the potentiometer is connected a 8-volt grid-bias battery which has its positive socket also connected to the common negative earth line. This connection should be broken, either by means of a switch or by removing the plug, when the set is not in use, to prevent unnecessary drain on the G.B. battery.

Output Pentodes

The pentode was not so widely popular a few years ago as it is to-day, therefore power or super-power valves were invariably employed. These could handle, within reason, the input from two stages of L.F. amplification which so often formed an essential part of many designs. To-day, however, a modern pentode, with its high gain, will give greater output for a much smaller input, so when replacing the output valve of a receiver of a few years old, it is necessary to remember this fact, otherwise severe distortion will be introduced. The question of matching the loudspeaker also enters into the question. If the original speaker is to hand, then it would be advisable to use a pentode, as this would necessitate the use of a suitable output transformer to secure satisfactory matching between valve and speaker.

A modification worth while, with an output using two stages of L.F. amplification and a power valve and, of course, providing a modern pentode is to be used, is to dispense with one L.F. stage and insert a pentode in the output. Failing this, a simple volume-control should be inserted across the second L.F. stage so that the input to the output pentode can be controlled, thus preventing overloading.

If modern valves have to be fitted in a set with two L.F. stages coupled together by means of L.F. transformers, much better results will be obtained by replacing the second transformer with a resistance-capacity coupling as shown in Fig. 2, which also indicates how the volume can be controlled with such an arrangement. Another item which must not be overlooked when a modern pentode is used, is the tone or load-corrector in its anode circuit. This takes the form of a resistance, having a value of, say, 15,000 ohms, connected in series with a condenser of .01-mfd., and joined across the L.S. terminals or between the anode and earth.

Selectivity

Some of the older types of coils were designed to secure greatest sensitivity and, due to the conditions then existing, the question of selectivity did not receive a great deal of consideration. Apart from the addition of a stage of tuned H.F. amplification or the insertion of a 4000-mfd. variable condenser in circuits with the aerial lead-in, there is very little that can be done. The most satisfactory course is to fit modern coils.
Notes on Servicing
In This Article Some of the Snags in Radio Service Work are Briefly Explained

The Avo Test Meter, which has several separate ranges, easily selected by rotary switches.

Many of the more experienced service engineers having been called up, it is likely that greater responsibilities will fall on those of lesser experience. As most of these people no doubt realise, there are many snags and pitfalls in radio service work which may be encountered from day to day. An outline of some of these difficulties may, therefore, be of value to service engineers of short experience.

Locating Faults
We will commence with the case of the receiver which is known to be absolutely silent. It is unwise to switch on such a set with the supply connected without first making a rough test for an H.T. short-circuit, as additional components may be damaged by so doing. A quick resistance test between the heater socket of the rectifier valve and chassis, on a mains receiver, will show if such a fault exists. This precaution may save further damage to the mains transformer, L.S. field, rectifier valve, and other components if, for instance, a reservoir or H.T. smoothing condenser has developed an internal short-circuit. When switching on a set for test, a danger sign to look for is a glowing auxiliary grid where the output valve is a pentode. Here is an almost infallible warning of a break in the anode supply to this valve, such as an open-circuited output transformer primary. The overheating could, of course, be avoided altogether on test, by making a continuity test between the H.T. supply and pentode anode, before switching on the set. Once a fault has been located, particularly in the event of burnt-out components, it is wise to search for a possible breakdown of some other component as a cause, or result of the trouble. An intelligent use of the volt-millivoltmeter will give much useful information on the working condition of the receiver under test. It is, of course, essential to use a high-resistance volt-millivoltmeter for tests where high series resistance is encountered in the circuit under test, otherwise the consumption of the meter may seriously affect the reading obtained. A case in point is the taking of voltage readings at the screen grid of an H.F. valve which receives its supply via a resistor of high value.

Anode Voltage
In certain cases an abnormally high voltage at the anode of the output valve, together with low current consumption, can be puzzling. The routine check of components usually associated with these symptoms may reveal no fault. An open-circuited smoothing condenser may be the culprit in such cases. It may cause inaudible oscillation which results in weak or "no sign." When replacing defective resistors, care should be taken to fit components of ample current-carrying capacity. Occasionally, it may be found that the makers of the receiver in question have cut things rather fine, and it may be advisable to replace with a resistor giving a greater factor of safety. This point should be looked for, particularly where an H.T. potentiometer network is used to feed the screening grids of H.F. valves. Any associated decoupling condensers should, of course, be checked for leakage when a resistor breaks down. It should be remembered that a high-resistance leak may not show when testing with the usual ohmmeter using a single cell. It is necessary in such cases to test at a higher voltage, say 200 volts or so. However, care must be taken not to apply a much larger voltage to the component under test than it is designed to work at. Noisy volume controls are common troubles, though there are pitfalls here for the inexperienced engineer. It is possible for noise and intermittent signals to be produced on turning the volume control while this component is in perfect working order. Where a coupling condenser is used between the volume control rotor and the grid of the L.F. or output valve, for instance, an intermittent contact in the condenser may cause noise or intermitted signals when the volume control is operated. It may be found possible to clear intermittent faults by disturbing valves or components. In many cases this will be an unwise procedure, as the fault may not reappear for a considerable period. If at all possible, some means should be found to locate the fault first. A signal generator will be of great assistance for this purpose. It can be used to inject signals stage by stage in a process of elimination. An output meter will give a better indication than the ear in locating such faults.

Faulty Soldered Joints
Dry or imperfect soldered joints can cause numerous troubles. It is possible for a joint, which appears to be O.K. when tested with an ohmmeter, to offer a high impedance at H.F. A case in point was a fault which appeared in an A.C. Radiogram handled by the writer recently. The instrument was a new one, having been in operation only a few weeks when a fault occurred. The customer reported that signals would fade or suffer a sudden decrease or increase in volume at intervals. A number of service calls were made but the fault did not appear. The set was, therefore, brought into the workshop. A signal generator was connected to the aerial socket and an output meter to the L.S. sockets. The set ran perfectly for some days when the meter showed a decrease in output. The generator

(Continued on page 290.)

The Dixon Ohmmeter, and two of the separate plug-in accessories.
ON YOUR WAVELENGTH

A Suggestion for Small Clubs

SECRETARIES of some of the smaller and more recently formed clubs tell me that they are finding difficulty in carrying on. Their members are being called to the colours, and new recruits do not come along in sufficient numbers to fill the gaps. They ask me what they should do. The answer is that they should endeavour to carry on. There are no rules which will apply to every case, for the number of members, the district, as well as the sphere of interest fostered, affect the problem. Clubs must, however, carry on. They owe that to those who have joined the colours. The latter will not feel particularly pleased if they return to civilian life and find that those they left behind were not able to defend their small portion of the home front. In some cases, however, I know that the difficulties are very real, and for this reason I make the suggestion that they should endeavour to get some of the larger clubs to absorb them. Some of the old clubs are, too, finding it difficult to keep membership up to strength, and they might be willing to take in some of the smaller clubs, of course with the proviso that when the war is over they will revert to a separate identity. It will be nearly impossible to get the members together again if they are allowed to disband, or if there is no organisation at home which will act as a link.

From an Active Server

BEARING on this matter is a letter from L. Frank, XG4NLL, who is now stationed at Cosham, Hants. He expresses pleasure that PRACTICAL WIRELESS is continuing to act as the link between constructors. He says it joins his past and his present life. The Liverpool and District Short-wave Club, of which he was hon. sec., started a promising career, but it has been closed for the duration of the war. He would be delighted to hear from readers, or from any of his club colleagues. Any letters sent to me will be forwarded.

Some John Hilton Nonsense

A FEW evenings ago John Hilton gave a talk in which he uttered some remarks which can only be defined as wrong. Here is one of them: "If you are asked to pay higher prices walk away and put your money in National War Savings." I do not know how he thinks that people who cannot pay for hire-purchase transactions are able to buy savings certificates. I suggest that B.B.C. speakers confine their remarks to subjects they know something about. I am yet to learn that Hilton's experience entitled him to speak on business matters, and I would further remind him that textbook economics may be useful playthings, but an ounce of practical experience of them is worth the whole lot of profitorial tripe uttered in a didactic I-know-all-about-it-take-it-or-leave-it attitude. There are those in the radio trade who know far more about these matters than John Hilton. He should confine his remarks to subjects on which he is enabled to speak with authority. I also suggest to the B.B.C. that they should not permit speakers, however distinguished, to talk on subjects they obviously can know little about. It offends the ears of those who know as much as there is to know about the subject.

New P.O. Regulations

SOME drastic new regulations are now in force regarding the sale, purchase or even acquisition of various pieces of apparatus which are common to high-quality receiving apparatus, as well as standard transmitting equipment. The full details of these regulations, so far as they affect the dealer and listener, are given on another page in this issue, and one point which is probably of the greatest interest is that relating to valves having an anode dissipation of 10 watts or more. Such valves are commonly used in output stages of high-quality broadcast receivers and public-address equipment. The regulation also prohibits the use of remote-control apparatus such as might be used for the radio control of boats, aeroplanes or other working models. Great care is, therefore, necessary in considering the making of wireless apparatus now, and any experiments which you might wish to carry out should bear these new regulations in mind. Fuller details of the new regulations may be obtained from H.M. Stationery Office.

Torch Batteries

I LEARN of a dealer in Dumfrieshire who is adopting the trick I have previously referred to of making torch batteries out of high-tension batteries. He breaks up a 6s. H.T. battery and offers to alter the customers' torches to take two of the cells by soldering on a tin extension. The customer, of course, pays the cost of the alteration. He sells these 3-volt conversions at 4d. and the 4½ volt batteries at 6d. Thus, in this form he is able to make 13s. 4d. out of a high-tension battery. This is quite apart from the fact that high-tension batteries are unsuitable for a quarter to half an ampere discharge. Battery manufacturers can have the address of this person if they wish. His name has been sent on to me by Mr. W. M., of Dumfrieshire.
IN discussing nationality in music a few weeks ago I drew attention to the various harmonic and rhythmic 'colourings' and 'effects' which go towards making the music of one nation so different from that of any other. The characteristic ornaments that occur in all Spanish melodies, and the use of the melodic minor in such a lot of Russian music—all these things, I explained, had come down to us from the days of the troubadours, and the folk-singers of days gone by, and were now as much a part of musical language in their respective countries as were the various idioms and characteristics of their speech.

This week I would like to emphasize that this is something quite separate and apart from any particular composer's individuality. What really happens is this. A musical idiom is evolved from the common stock of musical speech of a people in the same way that Yorkshire folk say, "Art council," or "O.K., too's?" Why do they say it? How did they ever get to talk with those accents, and to use those idioms? When did we acquire them? Well, doubtless the philologists tell us in their massive tomes and treatises just as the mathematicians tell us where the Squandri got their grisly language and turned it into music in the indigenous and personal idiom of the composer. Even in his later works, if it is true that he had a personal idiom, it is not merely a matter of the composer's idiom but of the composer's acquired idiom, which would be stamped with the characteristics of the composer's country. But not all the composers are nationalists in the strict sense. But the new Czech culture was inevitably bound up with the spirit of the common people, from whose racial consciousness it had sprung. And I must quote again from Mr. Birley's last sentence. "When we have heard Smetana's Symphonic Poem to the river, when the songs of the people mingle with the light of the dawn and they are concrete things.

Mr. Birley emphasises very graphically the power that music has for expressing the nationalistic feeling at the same time as it can paint a picture or tell a story. It is also a lucid and succinct confirmation of my remarks on the origins of nationalism in music. And this dual accomplishment is manifested in a work like Smetana's Vltava in a way that makes it an admirable example for illustrating this article. By the way, this work, and the even better-known opera to the opera, "The Bartered Bride," will be familiar to Promenade and other Symphony Concert listeners. In writing a work which merely consisted of rapid runs and arpeggios on the strings and the harp, which the most naive listener could tell was meant to describe water, plus the suggestion of a shiny bank and a spawning trout, Smetana might not have done any more than a hundred composers have done when writing of "The Thames on a Sunny Afternoon," or "Niagara's Rushing Cascade." But it is the employment of national harmonies and rhythms which tell us that, first of all, the piece is of Czech origin, and secondly, that it is a picture of a Czech river that we are looking at. Thirdly, Smetana's individual treatment of music's language tells us that it is Smetana who has written the work, and not Dvorak or Bartok. And, lastly, his statement that the picture is of the River Vltava, and not of any other Czech river, must be accepted as binding by the listener.

Critical Listening

If all these factors are considered, and their implications obeyed, whenever music is listened to, then there is absolutely no reason why either the meaning of the work should escape us or that it should interest us. But don't ever listen to even the most insignificant work without a set purpose. Ascertain the composer's intentions as to what he set out to do. We owe it to him, and we owe it to ourselves. After all, it is true that we do before we start to read the most trifling piece of writing, or before we look at the smallest painting, or they are "concrete things."

So with the abstract language of music, added concentration and preliminary inquiry are necessary. And what a reward will such an effort give us! What thrills, what delights and what sensations are ours if we just take that little trouble before sitting down to listen.
Overhauling the Receiver
Some Seasonable Hints on Checking Through the Receiver and on Improving Selectivity - - - By FRANK PRESTON

Fig. 1. — A simple method of connecting the aerial tuner to a band-pass filter.

simple tests show these to be desirable—but the receiver should be removed from its cabinet and given a good clean. The more accessible parts can now be cleaned with a duster, whilst a feather brush or pastry brush is suitable for cleaning many of the other parts. Once the dust has been loosened it can be removed with a vacuum cleaner. When this is of the cylindrical type the best result can generally be obtained by first connecting the pipe line so that an outward draught is produced. Then the tube can be changed and the remaining dust sucked up. For doing this it is usually found best to fit the small brush to the pipe line.

Clean Tuning Condensers
Variable condensers should be cleaned, and to do this it is in some instances necessary to remove the cover plate. With older types in which the vanes are fairly widely spaced, or in a simple type of "straight" set, an excellent method is to run a pipe cleaner between the vanes. This will be still more effective if the cleaner is first dipped in carbon tetrachloride or one of the preparatory cleaning fluids normally intended for fabrics. "Open" the moving and fixed vanes and clean each set separately. Incidentally, the same cleaner dipped in carbon tetrachloride (about three parts a small bottleful from most chemists) is excellent for cleaning switch contacts, terminals, valve and coil pins or other rubbing contacts.

Test the Wiring
When wiring has been done by clamping the looped ends under terminal heads, run round those with a small pair of pliers and see that all are tight. Where there is appreciable slackness, remove the terminal nut and clean the contact face of this and also the looped end of wire. This can be done by scraping with a knife blade or by rubbing with very fine glasspaper; emery cloth is not very suitable, because the fine particles can, in some conditions, form a high-resistance leakage path.

If connections are soldered, look carefully for "dry" joints. These can be detected by the solder being in a dirty blob, instead of its having run smoothly, and also by pulling fairly hard on the wires. If the joint is too weak, in which case it might cause a high-resistance connection, thoroughly clean the parts, apply a trace of Fluxite and re-solder. Do not forget to see that all terminals are tight in the components to which they are attached. In some cases it will be necessary to disconnect and remove the component to tighten any loose terminals.

Self-contained Battery Sets
When checking through a battery set, the batteries for which are housed in the cabinet with the set, bear in mind that the fine spray given off by the accumulator when freshly charged has a tendency to corrode insulation and wires near it. Pay especial attention to coil windings and flexible leads. While carrying out the inspection see that all screens and screening cans are tight and making good earth contact. This applies especially to built-up screening boxes.

If a suitable meter is available it is desirable to test the L.T. and H.T. voltages actually applied to the valve holders, whilst the voltage of the G.B. battery might be measured. Too low a voltage will show whether a battery is in need of attention, or that there is a bad connection in the battery circuit. In the latter case, the on-off switch might be at fault. Any switch—on-off or wave-change—can easily be tested by short-circuiting it; should this have any effect it will be obvious that the contact through it is inefficient.

Check the Valves
A valve which is no longer efficient might be the cause of a marked deterioration in the set or of reduced selectivity. Accurate tests cannot be carried out by the average constructor, but many first-class radio dealers are now equipped with an instrument which shows on a marked scale the "goodness of the valve: the reading is generally in milliamperes, and it indicates the mutual conductance of the other hand, should any valve be suspected and there is no convenient method of making a test, most dealers will arrange for a new valve, or one known to be in good condition, to be tried as a replacement.

Adding Band-pass
While carrying out the examination it might be desired to improve the receiver, either by adding another amplifying stage or by modifying the tuning arrangements to obtain greater selectivity. Full details of both H.F. and L.F. amplifiers have been given in these pages before, and back numbers of the articles in question are in most cases still available if required. The question of selectivity would not appear to be of great importance now that there is only one R.B.C. "home" programme, but as many readers have discovered of late, interference with the two frequencies employed by the R.B.C. is not uncommon on certain evenings. When a single-circuit aerial tuner is used in a Det.-L.F. receiver it might be desirable to change this for a band-pass filter. This can generally be done by replacing the existing single condenser by one of the two-gang type and fitting another coil identical with that already used. Sometimes a second single condenser can be attached to the present one by means of a coupler.

(Continued on page 390)
Of the Atlantic by the methods which the authorities have employed will prove of inestimable value when reviewing the future of British television. Not only single sideband working but also negative modulation as distinct from positive modulation will call for careful attention in order to see whether the claims for interference reduction are justified for the former modulation scheme. If a serious view is taken of the present situation, it is possible that good may come out of evil, and the work of America may stand in good stead.

Frequency Modulation

Conjointly with the views expressed in the previous paragraph must be studied this new problem of frequency modulation as distinct from amplitude modulation, for this has loomed into great prominence as a result of the work of Armstrong in the United States. It must not be imagined that frequency modulation is entirely a new aspect of radio, for its benefits on the radio telegraphy side have long been recognised. For example, it is an established principle that a carrier wave which is rich in sidebands is of definite advantage from the point of view of reducing fading for telegraphic services. There are three main advantages which can be cited for frequency modulation over the older methods in this connection. In the first place, by a suitable choice of the depth and frequency of the modulation a greater proportion of the energy can be transferred to the sidebands. Following on this at the same time, the total sideband spread, and in consequence the interference with neighbouring channels, is reduced very considerably. Finally, there is no reduction in the aerial power, whereas with an interrupted continuous wave, such as would be used for Morse telegraphy transmission, the power is always half or less, depending on the waveform of the modulation. For broadcast television, Armstrong has been demonstrating in America in no uncertain manner that his scheme embraces all the advantages known previously for wireless telegraphy. Whether this same argument will still hold for the ultra-high modulation frequency which is inseparable from modern high-definition television pictures has yet to be investigated.

A corner of a cathode-ray tube research laboratory, showing the special equipment employed for some of the work.
Practical Hints

A Condenser Improvement

To prevent increasing the minimum capacity of one section of a ganged condenser in my receiver, I hit upon the idea of making up a rather novel movement which simply alters the physical setting of the body of the condenser but leaves the moving vanes stationary. In the accompanying sketches the details of the scheme are clearly outlined, and from these it will be seen that I have made good use of a rubber door-stop for the separate control.

This door-stop is rigidly fitted with a threaded 3-16in. diameter brass shaft which passes through a bush in the front panel and terminates in a 3in. diameter control knob.

This rubber "drive" presses firmly on the edge of a shaped brass operating arm, which is soldered to the brass clamping nut on the condenser bush. The small chonite roller engages in a recess filed in the arm and located at the maximum setting of the condenser.

The diagram shows the method of assembly, the bush type fixing nut normally supplied with this particular type of condenser being the principal feature in the fitting. It will be apparent that the ultimate smoothness in the movement will depend entirely on the careful choice of thickness in the operating arm, washer, and bracket or panel mount.—G. F. Davia (St. Albans).

Insulated Coupling Brackets

Recently when mounting a variable condenser on a rather thin aluminium screen, it occurred to me that whilst the extension rod fitted between the condenser and the front panel afforded some degree of rigidity, the screen and front panel were not sufficiently earthed for a receiver which I expected to operate down to 11 metres.

Due to the particular design of chassis, and in view of the fact that the extension rods were, of course, insulated, the rather large screen would quite possibly introduce noises apart from the movement noises of the old types of variable condensers employed. I therefore devised a number of "coupling" brackets which could be used also for various other purposes apart from that intended.

Inductance Tapping

To make a tapping on a S.W. coil a crocodile clip is usually employed, but as this only grips half the wire a sound joint is not ensured. A remedy is shown in the accompanying sketches. By cutting a slot in the former about 1in. wide, as at A, a tapping can be made by a crocodile clip from the inside, which will then grip firmly.

If a more permanent and neater job is required, holes, as at B, can be drilled before winding, and tappings soldered on through the former.—K. A. Shone (Wrexham).

A Single Drive for Two Components

Recently I found it necessary to include two condenser drives in one, so I devised the following idea. A rod about 8in. long was fitted (as shown) underneath the chassis. A 2in. diameter wheel (A) was fitted and this contacted with a wheel (B) of 1in. diameter. This drove another wheel (C), which was fitted to the spindle of the reaction condenser. Mounted 1in. farther back was another wheel (D), which drove another smaller wheel fitted to the spindle of the volume control.

The components and wheels were mounted on brackets secured to the top of the chassis. To operate reaction, leave the control as shown in diagram; for volume, push in until A engages with D.—M. C. Campbell (Romford).

SPECIAL NOTICE

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

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1.10-0 for the best hint submitted, and for every other items published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southwark Street, Strand, W.C.2. Put your name and address on every item. Please note that every motion sent in must be original. Must envelopes "Practical Hints" DO NOT enclose Queries with your hints.

A method of tapping S.W. coils.

Some of these I made insulated by using a bakelite strip in place of a commencing brass strip as used in the ordinary type illustrated. It will be seen that the insulated types can be used in instances where the moving vanes of the condenser are in

"THE CYCLIST"

3d. Every Wednesday
To provide adequate screening, however, the H.F. sections only are mounted on a thin gauge aluminium sheet (20 S.W.G.), a similar gauge being used for the intermediate screen.

The front panel is of 18 S.W.G., and as this would prove too flexible if used in the more conventional way, owing to the rather large proportions, it is bent round the sides of the chassis.

The L.F. stages are treated almost as a separate amplifier, being, as will be seen, mounted directly on the wooden part of the chassis and well away from the rest of the H.F. stages.

On studying the wiring diagrams, it will be apparent that to facilitate wiring between the front panel and the screen, the front panel may be very simply removed after a trial assembly by just loosening the extension rod (grub screws and reduction drive), the dial fields being left assembled excepting for the screened grid potentiometers, 'phone jack and switch.

Figs. 1, 4 and 5 give the constructional details for the chassis, screen and panel, but it will be noticed that owing to the design of the chassis and the use of baseboard mounting components, a somewhat different form of diagram from the standard practice of this journal has been made, this illustrating only the essential centres and incidental measurements for the principal components, as it was anticipated that little difficulty is offered by the layout.

The full detail in the diagrams the screw holes for fixing this plate to the wooden chassis are not given as in the case of component fixing holes, it
FIVE
F-WAVE
eetails and Full Operating Notes on the Receiver — By W. R. HOBBS

will be apparent that to prevent this thin aluminium "riding" up at the corners after fixing the components, at least three screws should be provided along each edge.

Another point which may not be clear is the method of mounting the horizontal valve VI, the centre line for which is depicted in this diagram. Actually the low-loss baseboard type valve-holder for this position is first of all fitted to a simple metal bracket of proportions which are not critical and which may fall in with the constructor's own requirements, but the method adopted by the writer comprised an aluminium bracket which in turn is reinforced with a block of wood, as is clearly defined in the wiring diagram given in Fig. 2.

The six-pin coil holder is supported on thin insulating pillars, and it may be found preferable in the original design, to remove the existing pillar terminal stems, and fix directly to the coil-holder by substituting long 6 B.A. screws.

The 7-pin valve-holder for the H.P.215 valve (V2) is similarly supported on two midget insulating pillars, which in turn are secured to two home-made aluminium brackets screwed to the chassis.

There is, however, ample room for a modification to be made here if the constructor does not wish to go to this trouble, and this is in the use of a four-pin type pentode with another low-loss type valve-holder as used for V1 and the detector.

The intermediate screen should be fitted with fixing flanges towards the front panel, this resulting in the "cut-out" for the valve VI being located on the left of the chassis, and so the edge of the fixture will fall along the fixing line shown. The cut-out in the centre of the screen is carried right through the fixing flanges,

UNDER-CHASSIS WIRING DIAGRAM

This method providing an easy means for determining the screen's relationship to the location of the ganged condenser cradle to prevent the flexible coupling fouling the edges of the cut-out.

This condenser cradle method of mounting is very clean, consisting simply of a brass condenser cradle of the three-gang pattern with the end ganging bracket removed, mounted on two large insulating stand-off pillars. Unfortunately, there is no space here to detail this more fully, but the assembly will prove quite straightforward when the components are to hand.

There is just one consideration to be made with regard to the front panel diagram, Fig. 1, and this should be made in conjunction with the under-chassis wiring diagram, Fig. 3.

To earth the front panel effectively — and this is most important — the fixing screws located in the side portions in the wiring diagram should not be of the wood-working type, as these pass through both panel and the side runners of the chassis, being finally secured with nuts.

(Continued overleaf)

Three-quarter front view showing the separate screens.

Drilling details of the front panel.

components for this be found on page 292.
THE SHORT-WAVE FIVE
(Continued from previous page)

Wiring

Wiring should only be attempted when one is fully satisfied that the various controls are working without any trace of binding, a condition which could quite soon arise in badly aligning the reduction drives. While on the subject of the reduction drives, there is a point concerning the epicyclic drive used for the bandsetter or balancing condenser C12. It will be seen, on referring to Fig. 2, that three lock-nuts are used on a 6 B.A. bolt in such a way that one secures the bolt to the panel, whilst the other two act as "distance" lock-nuts, clamping the small fixing lug of the drive very securely.

All pillar connections should be carried out by removing the terminal screws and soldering wires directly and neatly to the heads. Again, to take full advantage of the low-loss characteristics of the coil and valveholders used in the H.F. stages, soldering should be employed, not terminal connection. See that the electrolytic condensers have correct polarity as indicated in the wiring diagrams.

Testing the Receiver

Having satisfied oneself that wiring is correct, the serial, earth and speaker connections can be made, but the valves and coils remain until the ganged condenser moving vanes have been physically set to as close a ganging as the constructor finds possible, finally adjusting all dials to read correctly and the vernier in very careful adjustment of the tuning dial, set to 0.

Any errors in ganging will be automatically counteracted as tuning is carried out by adjusting the bandgreeder or balancing condenser.

The screen-grid potentiometer for V1 (R3) should be set at the most sensitive point, which is determined by tuning-in roughly any reasonably weak station, but to commence operation a mid-scale setting will suffice.

The immediately important consideration is to get the detector stage steady and with a preliminary degree of smooth reaction, this state of reaction being finally adjusted to maximum intensity of the signal gain through the first stages.

The screen-grid potentiometer in the reaction circuit will therefore have to be considered next, and this is R3. Approximately just over half-scale will serve to determine the state of reaction in relation to the gain-control and variable-nu control R14.

Now it will more than likely be that the reaction will be fierce, so the potentiometer R14 should be adjusted by increasing in an anti-clockwise direction, reducing screen voltage by turning the control R5 back (anti-clockwise).

Now adjust the potentiometer which governs the bias on the primary coil of the detector tuning coil, this is R4.

Finally, the combined adjustment of the reaction condenser with R5, followed by the combined re-adjustment of the two potentiometers R4 and R5 should bring the desired signal in at maximum gain.

The full sequence is not by any means as involved as would appear, and a little experiment will soon clarify the relationship of each control, making it possible for a different sequence to be adopted consistent with the essential principles outlined.

For C.W. signals it will be found possible to modulate the note without "wobbling" or any trace of drift, simply by re-adjustment of, say, R4. It is, however, important that the frequent re-adjustment of the variable-nu gain-control, in conjunction with the screen-grid injection control R3, be carried out to obtain the exceedingly smooth reaction which is possible with this receiver, with particularly stable adjustment on the higher frequency bands.

NEW SMALL PROJECTION TUBES

In the big screen electronic television equipment for cinema, the manufacturer and installation of which ended abruptly with the declaration of war, two forms of cathode-ray tube were employed. One used an opaque screen accommodated in a large glass vessel approximately 16ins. in diameter, so that the picture could be lens-projected directly from the front surface of the fluorescent screen on to the remote viewing screen, while the other was of a more conventional character, and allowed the picture built up on one side of the tube's screen to be projected right through the material, and binned, on to the separate viewing screen. The advantage of the former over the latter idea was the material increase in light due partly to the fact that no loss of brilliance was entailed by passing the picture through the granular structure of the fluorescent powder and the material used to bind this to the inner glass wall of the tube. For this reason steps have been taken to produce smaller counterparts of the opaque screen-tube, and material success seems to have crowned the efforts of the engineers responsible for the work. The anode voltage employed is of the order of 20 to 25 kilowatts and to save employing an expensive projection lens, attention has been turned to making a less structured screen of the reflecting type for viewing purposes. Neglecting for the moment the obvious advantages accruing for home viewing in those countries where a television service is still possible, these tubes and remote viewing screens can be used for a variety of scientific purposes, in lieu of the more conventional and lower voltage operated tubes which with most readers are familiar. A compact assembly is possible, brilliance is of a high order, with the minimum trace of the moving spot within the screen area; and there is no doubt that their use will extend, especially if the required gain and voltage can be reduced to economical limits and so reduce the size and cost of auxiliary equipment.
IMPORTANT P.O. RADIO REGULATIONS

It is now illegal to sell or even possess certain apparatus, under the Emergency Powers (Defence) Act, 1939.

THE Postmaster-General has issued three orders under the Emergency Powers (Defence) Act, 1939, the first and third of which came into effect on November 25th and the second on December 12th. One particular part of the regulations issued is of great interest to dealers and listeners and is as follows:

REGULATION OF USE OF WIRELESS TRANSMITTERS.

The Postmaster-General, in the exercise of the powers conferred on him by Regulation 8 of the Defence Regulations, 1939, hereby orders that on and after the 25th day of November, 1939, no person shall, except under a licence or permit granted by the Postmaster-General, engage in wireless transmission for communicating by wireless telegraphy, wireless telephony, or wireless television; or as a navigational beacon or landing beacon or otherwise for the purpose of indicating position or direction; or for the purpose of the remote control of machinery.

This order shall not apply in relation to any apparatus used in accordance with the terms of a licence in force under the Wireless Telegraphy Acts, 1904 to 1926, authorising the use of the apparatus for transmission.

Applications for licences or permits shall be made to the Engineer-in-Chief of the Post Office, stating full particulars of the apparatus in which it is to be used, and the name, address and occupation of the person or company that wishes to use it.

Possession of Wireless Transmitters

The Postmaster-General, in the exercise of the powers conferred on him by Regulation 8 of the Defence Regulations, 1939, hereby orders that on and after the 12th day of December, 1939, no person shall, except under the authority of a written permit granted by the Postmaster-General for the purpose, have in his possession or under his control (1) any wireless transmitter which is designed or used for communicating by wireless telegraphy, wireless telephony, or wireless television; or as a navigational beacon or landing beacon or otherwise for the purpose of indicating position or direction; or for the purpose of the remote control of machinery, (2) or wireless apparatus components capable of being assembled to form such a wireless transmitter, or (3) any wireless receiving apparatus which is designed to be used as a wireless transmitter or which can be adopted for the purpose of being used as a wireless transmitter by the operation of a switch or by the changing of screwed or plug connections.

This order shall not apply in relation to any apparatus in respect of which there is in force a licence under the Wireless Telegraphy Acts, 1904 to 1926, authorising the use of the apparatus for transmission.

Applications for permits should be made to the Engineer-in-Chief of the Post Office, stating full particulars of the apparatus or article concerned, the purpose for which it is required, and the name, address and occupation of the person or company in whose possession or under whose control the apparatus or article is to be retained.

Control of Wireless Transmitters and Certain Other Electrical Apparatus

The Postmaster-General, in the exercise of the powers conferred on him by Regulation 55 of the Defence Regulations, 1939, hereby orders that on and after the 25th day of November, 1939, no person shall, except under the authority of a permit granted by the Postmaster-General for the purpose, sell, purchase, let, hire, supply, dispose of, acquire or distribute any of the undermentioned articles:

(a) Wireless transmitters which are designed to be used or are capable of being used for communicating by wireless telegraphy, wireless telephony, or wireless television; or as navigational beacons, or landing beacons, or otherwise for the purpose of indicating position or direction; or for the purpose of the remote control of machinery.

(b) The following articles intended for use as parts of wireless transmitters, namely, high frequency inductors, spark coils, quenched and rotary spark gaps.

(c) Any wireless receiving apparatus which is designed to be used also as a wireless transmitter, which can be adapted for the purpose of being used as a wireless transmitter by the operation of a switch or by the changing of screwed or plug connections.

(d) Line carrier telegraph equipment or line carrier telephone equipment.

(e) High-frequency equipment (being equipment which generates or uses high-frequency current at frequencies greater than 10,000 cycles per second and having a maximum output exceeding 10 watts) including such equipment intended for use in connection with furnaces and medical apparatus.

(f) Electronic valves capable of an anode dissipation exceeding 10 watts.

(g) Piezo electrical quartz plates or piezo electric tourmaline plates cut to oscillate at any desired frequency.

Applications for permits should be made to the Engineer-in-Chief of the Post Office, on forms obtainable at any Head Post Office or from the Engineer-in-Chief, stating full particulars of the article concerned, the purpose for which it is required and the name, address and occupation of the person or company who wishes to obtain it and of the person or company from whom it would be obtained.

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December 16th, 1939
EDDYSTONE E.R.A.7 CHASSIS

The listener who is only familiar with the standard type of commercial "beach" receiver would be very surprised if he could inspect the special Eddystone 4-band chassis receiver, known as the E.R.A.7. In place of the usual bent or pressed metal chassis and thin screening boxes for coils, this receiver is built on a die-cast aluminium alloy chassis, and the various screening compartments are also of one-piece die-castings. Apart from this, massive screening is employed for certain of the valve top-cap leads, in one case a length of thick copper tubing being employed, and in another case heavy screened cable which remains almost rigid. Further evidence of the care which has been expended in obtaining a stable receiver is evidenced in the various earth bonding which have been employed, and this extends even to the separate parts of the slow-motion control, which are linked to avoid any risk of noise or trouble due to slight differences in potential which might arise.

The receiver is a 7-valve superhet, designed for A.C. mains operation, and incorporates a separate oscillator valve to eliminate frequency drift; A.Y.C. and a "Magic Eye" tuning indicator. The special intermediate-frequency stage is enclosed in a die-cast box, as is the case of the coils, and air-dielectric trimmers are fitted and positively locked so that the frequency is constantly maintained. There is an H.F. stage, and this is in use on all bands.

The Circuit

The main essential features of the circuit are thus all that one could desire in a standard broadcast receiver—that is, without going into the communications type of set, but this receiver performs exactly the same as this specialised type of receiver, except for the lack of a B.F.O. section. Selectivity is taken care of by the nine tuned circuits, and the stability is such that it was found possible during our tests of the chassis to pick up an American station about midday, and to hold it, although a hand was laid closely across the ganged tuning condenser. The sensitivity is also very high, an input of no more tuning control and this incorporates a gear-driven slow-motion device of the automatic two-speed type, wherein rotation of the control in the opposite direction operates the slow-motion drive. The output stage is rated at 5 watts and the speaker handles the maximum output easily, and the response curve is remarkably flat.

The Tuning Scale

The scale is of novel design, being in the form of a cylinder 1½ in. in diameter and 8½ in. in length, which is a rack and pinion device operated from the waveband selector, and the pointer is in the form of a thin wire carried on a runner and driven by a fine cord. The separate scales for each band, which are from 13 to 33 metres, 31 to 85, 200 to 555, and 900 to 2,100 metres, are marked in wavelengths and have station-name indications on every scale. The amateur bands are separately marked on the short-wave ranges and in addition carry a number of additional markings to simplify tuning of the amateurs.

The tuning indicator is mounted on a separate small unit which also carries two dial lights, and this unit has to be bolted to the cabinet or panel front. It is one of the best receivers which has so far been tested by us, excelling in range and quality of reproduction, even under most adverse conditions. Out of curiosity we tried the set with a very short indoor aerial in an all-steel building where normally results are very poor. Even so, however, we were able to hold an American broadcast signal during the middle of the day at entertain-ment standard strength. The chassis is supplied ready tested with valves and speaker and the price is £22 1s. 0d.
Simplified Multi-waveband Switching

A Circuit Incorporating a Coupling-coil Feedback Arrangement for Short-wave Reception

In designing an all-wave receiver, an important problem to be solved is how to reduce the number of switching contacts to a minimum, it being obvious that the more contacts there are the greater is the chance of faults developing and the complexity of wiring increasing. The problem is usually not difficult, where the local oscillator circuit of a superheterodyne receiver is concerned, because of the necessity of maintaining the strength of oscillations constant throughout each waveband, and of providing suitable tracking circuits. The Telefunken Company has solved the problem in one way by using a Colpitts circuit on the longer wavebands and a coupling-coil feedback arrangement on the shorter waveband.

In Fig. 1 is shown only the oscillator circuit of the superhet receiver, which may be connected in any desired manner to the mixer stage. The resistance W4 and condenser C1 generate the grid-bias voltage, which matches itself automatically to the instantaneous oscillator amplitude. In order to obtain a sufficient voltage swing, it is necessary to increase the resistance W4 from the previously usual value of 50,000 ohms up to 150,000 ohms. In order that the time constant of the combination W4, C1 should not be too great, and thus encourage relaxation oscillations in the S.W. range, the capacity C1 is reduced from about 100 mmfd. to 25 mmfd. The resistance W3 serves to guard against a rise of the oscillator voltage at the lower end of the S.W. range, when reduction of the grid A.C. voltage rises, due to voltage division between the grid-cathode capacity and the resistance W3.

Short-wave Working

On short waves only, the switch S1 is closed, so that the lower end of the S.W. coil K is connected direct to earth. A further tracking condenser C1 may be introduced which is, however, not essential on S.W. reception, since the percentage frequency difference between oscillator and signal frequencies is very small, and adequate ganging is achieved even without this condenser.

Those parts of the circuit of Fig. 1 which are operative on S.W. reception are illustrated in Fig. 2, in which, however, the circuit elements W3, W4 and C1 are omitted for the sake of simplicity. It will be seen that an inductive feedback occurs between the feedback coil RF and the grid circuit coil K. The circuit elements M, W, L and C2 of Fig. 1 are in parallel with the condenser C3 in the S.W. setting, and are, therefore, in effect inoperative and not shown in Fig. 2.

Medium-wave Reception

On medium-wave reception the switch S1 in Fig. 1 is open and S2 closed. That part of the circuit of Fig. 1 which is operative on medium-wave reception is shown in Fig. 3. In contradistinction to Fig. 2, the feedback is done here by means of a Colpitts circuit. The S.W. feedback coil RF acts effectively as a conductive connection on medium waves. Therefore, on medium waves, the long-wave additional coil L in Fig. 1 and the auxiliary tracking-condenser C2 are effectively direct-circuited by the switch S2. The parallel capacity C, which serves to increase the initial capacity of long waves, is in effect similarly in parallel with the capacity C3. By closing the switch S2, the danger of excitation on a short wave is also avoided at the same time, without the expense of a separate switch, since the S.W. anode H.F. current is by-passed via the switch S2 and the capacity C to the feedback coil RF. This would also be the case if the capacity C and hence the losses increase. The same resistance W1 serves the same purpose on long-wave reception.

Long-wave Working

When both the switches S1 and S2 in Fig. 1 are open, the circuit is ready for long-wave reception. As against medium-wave reception, not only the additional coil L, but also the condenser C2 comes into operation, the latter being provided to make the tracking capacity smaller than on medium-wave reception. The series circuit of C2 and C3 is then operative as tracking capacity. The condenser C3 is, however, only brought in to the feedback by means of capacitative voltage division, as otherwise the feedback would be too strong. In this way the circuit is further simplified, since a separate switch contact for switching over the upper end of W2 to the upper end of C2 becomes unnecessary. The danger of excitation on a short wave can, if necessary, be eliminated by connecting the parallel capacity e not directly parallel to the coil L but with its lower end to earth, as shown in Fig. 1. In the long-wave setting, not only does the feedback coil RF operate as feedback for a short wave, but there is also the feedback voltage arising across the condenser C3, since if the capacity e were not connected as above, the low-potential end of the coil K would be connected via the capacity b and the capacity c with the junction of C2 and C3 for a short wave. By means of the separate connection of the capacity r, however, the low-potential end of the coil K is for short waves connected via the capacities b and c to earth, avoiding C3. The capacity c (about 70 mmfd.)) must be large compared with the self-capacity of C.

The connection of the capacity c has no effect on the oscillator generation of the long waves, since for the long waves the oscillating circuit is operative, consisting effectively of the capacity C with the parallel connected series circuit a, b and c, together with the coils K, M and L, and the tracking condensers C2 and C3. It may also be observed that the capacities a, b and c need not be adjustable as shown.
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The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessary for publications).

Exchanging S.W.L. Cards: A Good S.W. Log

SIR,—I would be very pleased to exchange my S.W.L. card with any other S.W.L. card held in the British Isles or overseas. I QSL 100 per cent.

I also append my log of the stations heard during the last month on a home-built four-valve receiver run off a mains eliminator, and used in conjunction with a horizontal end-on antenna 65ft. long and 30ft. high, directed S.E.

C.W. (5.6 mc.): W1FK1, Fone: W4EOK.


Fone (14 mc.): EA7BA, K4FKC, PK10G, PK5W1, W4DZ, HCM, C.W.: K8AB, K5JAP, K4ESB, ECV, LIZID, QJ4SM, PJ2DY, HT, PJ3VBJ, TA1AA, AR, FX, VOY1, W9CQ, W3GP, PB1, YC7AV, KAMY.

Fone (28 mc.): W4NCD, JU, LO, W2AOD, JLV, KXY, QF, W3CMO, DL3, W6AWSA, EJ3, AAO, PPR, RL, RUL, TOU, W9KDB, TOZ.

Also I have heard broadcast stations: W4JA, 25.35 mc., W5OJ, 25.35 mc., KC7, 25.35 mc., W2CBX, 25 mc.-band; XEWX, Mexico City, on 31.85 mc.; TOWA, Guadalacama City, on 39.85 mc.; VLR, Melbourne, Australia, on 31.32 mc.; and TAP, Ankara, Turkey, on 31.70 mc.

S. H. W. cards I have been receiving lately have been VK2ME, VLR, WCB, W2HN, XS6J, and VSZAK.


SIR,—I have been a reader of your excellent paper for about a year now and would like to exchange my S.W.L. card with anybody at home or abroad. All cards will get a prompt reply. -— Donald Nasby, 41 Town Terrace, Leeds Road, Huddersfield, Yorkshire.

Correspondents Wanted

SIR,—I would like to get in touch with any young reader of your journal aged about 14 or 15 who is willing to correspond with me at the address given below. I have been reading your paper for the last eighteen months, and have gained almost all my knowledge of wireless from it. — J. A. Bladon, Middleton A, Christ's Hospital, Hurnham, Sussex.

SIR,—I have been a reader of your excellent paper for some time now and I have gained practically all my radio knowledge from it. I am fifteen years old and I am very interested in learning the Morse code, and I wondered if any reader living in my district would be kind enough to teach me. I should also like a correspondent about my own age interested in short-wave work. In closing, may I wish every success to your fine paper. — D. G.

Shepherd, 82, Brantwood Road, Tottemham, London, N.17.

From a Blind "Reader"

SIR,—I feel I must write and tell you how much I appreciate the new PRACTICAL WIRELESS. I have been a reader for quite a long time, and have followed all the articles on short-wave radio. I have twenty-nine cards from sixteen different countries. I would like to mention that I am a blind listener and wish to exchange my S.W.L. card with any other S.W.L. in any part of the world. I will QSL 100 per cent. Also, I would like to correspond with a listener in any part of the world.— Thomas J. HorsOX, 8, Moorbridge Cottages, Bestwood Colliery, Notts.

Countries

SIR,—I am a regular reader of your splendid radio paper and am interested in short-wave work. My equipment consists of two receivers, the Hallicrafter’s Sky Chief, and a ten-valve Ferguson (13 to 70 metres). The serial is an inverted L, 80 ft. long, 30 ft. high, direction N, S. with lead-in at the south end. I am a member of the B.L.D.L.C. and the B.S.W.L. and I hold the B.S.W.L. "H.A.C." certificate (S.W. broadcasting bands). I have qualified for the V.B.E. but have not yet applied. I listen on the S.W. broadcasting bands and have heard seventy-seven countries, thirty-five being verified. QSLs amount to fifty. I think your paper is excellent, but I should like to see the return of the "Leaves from a Short-Wave Log".—V. Smitheman (Birmingham).

Price Problems

Problem No. 378

Barclay & Co. are makers of transformers which had two 4-volt 1 amp. windings in addition to the H.T. winding. He wished to make up a set in which he needed 4 vols. 2 amps. for the inductors and desired to use the transformers by connecting the two 4-volt windings in parallel to obtain the desired direct current of 4 volts. He did this but he switched on in the transformer connected to 240 volts and the current was at once switched off. What would you do? Three books will be awarded for the first correct solution. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newsam, Ltd., Tower House, Southamp ton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 378. It is the top left-hand corner and must be posted to reach this office not later than the first post, Monday, December 19th, 1939.

Solution to Problem No. 377

Peters failed to note that the morse condenser has to be earthed in order to obtain a complete circuit from the moving vanes of the condenser to the coil. A metal chassis permits this to be done, but on a wooden chassis, there is no earth terminal on the morse condenser, he overlooked this fact.

The following three readers successfully solved Problem No. 376, and books have accordingly been forwarded to them:

R. Butterfield, 12, Broadway Road, Radiford, Coventry, R. Dr. Dunn, 30, Suffolk Road, Ponders End, Eithfield, Middlesex, C. W. Smith, High Street, St舳ley, Warwickshire.

A.F. Transformer

This component has a primary inductance of 50-80 H., and gives excellent and level quality reproduction.

With a generous nickel alloy core, and with low self-capacity for high amplification.

No. L.F.12. 6/6 each.

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If you have not yet had a reference copy of our catalogue No. 162, showing full range of components, please send at once, mentioning this paper.

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These clamped and shrouded choke need no introduction; all have monolithic metallic windings, and are unequalled for efficiency, reliability, and value. Inductance accurate to ±15 per cent. Insulation 114 V. With 6in. leads and finished in matt grey.

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IT SIMPLIFIES ALL SOLDERING

PRACTICAL WIRELESS
December 16th, 1939

OVERHAULING THE RECEIVER
(Continued from page 279)

One method is shown diagrammatically in Fig. 1, where it will be seen that "top-capacity" hand-wound coupling is used, a .0001 mfd. differential condenser being employed for coupling purposes. By varying the capacitance of the condenser the degree of selectivity can be modified to suit prevailing conditions. Although usual coil connections are parallel, these are dependent upon the particular type of coil in use.

Re-trimming
When there are two or more tuned circuits in the receiver, selectivity can be restored to maximum by rotating the trimmer should this prove necessary. In most cases, only very minute adjustments will be necessary unless a new valve has been fitted in an H.F., I.F. or detector holder, or unless the wiring has been altered since trimming was carried out initially. If the receiver covers short as well as medium and long waves, it might well be found that re-adjustment of the S.W. trimmer is required by improved reception. Great accuracy of trimming is essential on short waves, and the small changes of capacity which occur while the

such troubles as instability or even "no signs. It may be found that instability occurs at one end of the wave band only, and much good time may be lost in looking for faults which do not exist outside the valve.

Variable Selectivity
When dealing with a superhet, it will generally be found best to set the aerial trimmers first, and then to deal with those for the primary and secondary of the first I.F. transformer, and finally the primary and secondary of the second I.F.'s in that order. Selectivity can often be increased to a fair extent by moving the primary and secondary windings about .01 turns further apart. After this has been done the trimming should receive attention. Sometimes it is better to move the windings still further apart and to provide a variable-selectivity control. One method is by putting a winding of about 30 turns of fine wire between the primary and secondary, and wiring a 5,000 ohm variable resistor across this. Another method is to connect a .0001 mfd. pre-set condenser between the "grid" and "grid" terminals of the transformer (see Fig. 2). Selectivity can then be varied by adjusting the condenser; increasing capacity reduces selectivity. As a complete alternative to either of the above suggestions it might be thought worth while to replace the first, or both, I.F. transformer by a new one of the variable-selectivity type.

To Cyclists! Your wheels should not be too round and must be true, so that with ease, your ride will be a pleasant one.

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Neutralising.

"I have been looking through some old books and in the course of reading found reference with circuit to a neutralyze receiver. I am not very familiar with theoretical circuits and enclosed the cutting and should be glad of some further details as to the value of the condenser marked NC and the valve." — L. G. R. Blackburn.

The type of circuit referred to was used for H.F. amplification in the days prior to the introduction of the screen-grid valve. When the anode circuit is taken to the same frequency as the grid one, they are out of phase due to feedback via the inter-electrode capacity of the valve. This prevents maximum amplification and the H.F. stage and it is avoided by fitting the condenser marked NC in the diagram between anode and grid instead of in the plate circuit, the inter-electrode capacity here being more in phase with the plate circuit, and thus furnishing a similar capacity to that of the valve and thus a very small component has to be used. Special condensers were made for this purpose and are still obtainable from Jackson Bros. The S.G. valve, however, overcomes this difficulty and in addition gives greater amplification and better stability.

Screened Leads.

"I have built a set which unfortunately is not very efficient and, in trying to buck things up I have made a number of modifications. I have screened the H.F. section, with a partition round the entire section screened the anode lead and generally carried out the wiring in the best possible manner. I enclose a sketch of the set and have indicated working voltages and all other data. I wonder if you could assist me in setting this set stable so that it would be worth using." — F. W. S. (Chelmsford).

The circuit, in most respects, quite satisfactory. I think you will find that the trouble is entirely due to the long reaction lead running from the detector anode across the chassis to the reaction condenser. If you screen this lead and earth the screening, we think you will find that the set will be quite stable and will experience no further trouble with it.

Coupling Coils.

"When making coils I am a little in the dark about the method of winding which is adopted in various makes. In some cases the wire is in separate sections wound in simple form; in some the windings are on top of each other, and in yet other coils the wire is coiled to form formers. Is there any particular rule which has to be followed in this particular connection?" — H. F. (Falta)."

The aim in winding coils where there is a primary and secondary is to obtain maximum inductive coupling between those windings with minimum capacity coupling. There are several ways of obtaining this desired end. If separate coils are wound and placed side by side (that is, end to end) there will be maximum inductive coupling between them (if they are wound in the correct sense) and minimum capacity. The same end may be obtained by winding the primary over the secondary, using some form of spacer and winding the primary at a slight angle.

Aerial Static Charge.

"When I adjusted my series aerial condenser the other day I got a shock from it. I thought there may be some mains leakage from the set, but a careful inspection showed that there was not. I made a number of tests and finally found that when the a.c. leads to the receiver in question I did get a shock, and I have since been unable to obtain one. Can you explain this?" — W. D. C. (Teddington).

RULES.

We wish to draw the reader's attention to the fact that the queries submitted is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our previous issues, and of any readers' queries.

1. Supply circuit diagrams of complete multi-valve receivers.
2. Suggest alterations or modifications of receivers described in our publications.
3. Suggest alternations or modifications to current receivers.
4. Answer queries over the telephone.
5. Queries cannot be dealt with in full. All sketches and drawings which are sent to us should be in the same rude throughout.
6. Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.


The effect was no doubt due to a static charge which had collected on the aerial side of the condenser in question. If a good air-dielectric condenser is used this may accumulate quite a large charge during stormy weather, and it may often be seen to discharge with an appreciable flash. A solid-dielectric condenser often likewise leads to a sufficient prevent this trouble, however, and there is no need to worry about it except in very stormy weather, when it is desirable to short-circuit the condenser or fit a proper spark-gap in the aerial circuit.

Stepping Down Mains Voltage.

"I have an American A.C.-D.C. set which is provided with a 110-volt input. My mains are A.C., but 220 volts, and I have been told that I can use the set if I put a transformer between the mains and the set. If this is so, could you tell me what type of transformer I need and where I can get one. If this is not the case, how can I work the set from these mains?" — M. V. (Long Eson).

A transformer is needed, and in this case a two-winding transformer is needed.

These are made now by several firms. They are wound to carry the necessary high mains current, and their size would be dependent upon the input current, and the former is a standard high-voltage receiver to be used.

The coupon on page iii of cover must be attached to every query.

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WIRELESS PRAC TICALS
December 16th, 1939

If this meeting is well attended the Society will be able to hold meetings in Manchester from time to time during the war, and will at all these meetings discuss public matters concerning difficulty in obtaining radio apparatus, etc. The members will also discuss the equipment at this first meeting are: Lack of information on short-wave radio now reported to be unable to publish and current of radio publications, etc. 2 Suspension of television service (a representative of a firm of television manufacturers may give a short talk concerning this matter, apart from the discussion); 3. Qualified amateur radio transmitting apparatus; 4. Production of radio receiving apparatus, particularly in the short-wave range; and 5. Are regular radio meetings of this or a similar type be held in Manchester? Readers are reminded that they do not have to be very technically-minded to attend these meetings, as they are being made to try out all persons interested in radio. The attenders will decide whether these meetings will be continued or not.

# Workshop Calculations, Tables, and Formulae

By F. J. CAMM

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January

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**ROUND THE WORLD OF WIRELESS**

**Pocket Receivers**

Many ingenious designs have been given from time to time for small receivers suitable for carrying in a pocket. In some cases these have been merely "designs," as the results have failed to show any practical value. One of the latest, however, is being so enthusiastically welcomed that it has been given the name of "design," and the receiver has been actually put into production.

Their saving account balance, as an act and not as individuals, now is about $8,150. In order to avoid the temptation of having it handy to draw out, the money is sent each week to a local bank. The cost of sending is $10 cents, and each week a different member of the troops pays this amount. The treasurer and each pay day they hand over to the bank $7.50 without a whimper.

By arrangement with the bank, no money can be withdrawn from the account without the signature of at least four members of the group. Their total is $25,000. "When we reach this we'll probably up to $50,000," Rinchart said. "At any rate, we're not going to leave radio broke."

**Broadcasting at Christmas**

The first war-time Christmas programmes will be as far as possible, free from the horrors of war and will be broadcast later in the afternoon. The evening includes a Santa Claus Party, a Maturity Play, and Midnight Mass from Downside Abbey.

Christmas morning will begin with Christmas Greetings—"A selection of songs and stories, verses and records," "opened" by Lionel Gamlin and Leslie Teronno. Later, listeners will hear a Carol Chain made up of contributions from different parts of the country. It is possible that at nine o'clock the Sistine Choir from the Vatican may be heard, and the morning will also include a St. Hilary play for Christmas morning, Carols by the B.B.C. Singers, and a Religious Service from the Chapel Royal.

An Empire programme is in preparation for Christmas afternoon. This will be followed by Parlor Games, a Christmas Party for evacuated children, and another for the British troops abroad, a P. G. Wodehouse play—"The Crime at Castle Blandings"—and dance music and cabarets from Newquay, London and Harrogate.
Constructors' Problems

In spite of the hundreds of letters which are dealt with each week by our Query Service department, it is surprising to note how they can be classified under distinctive headings. A careful examination of the records compiled by this department reveals that there are certain problems common to most readers and that these, in turn, can be ranged in order of popularity with surprising regularity. As these details prove that certain facts or formulae are not such general knowledge as one would like to think, in view of the wide range of articles which have appeared in past issues, some of the queries are given in this article, although, for reasons of space, it is obviously not possible to deal with all of them in one issue. It is hoped, by adopting this procedure, that many readers will find the solution to their problem and that they will be saved time and postage.

Speaker Matching

Not that the use of extension speakers has become quite common, and the fact that most commercial receivers are provided with sockets for the easy connection of an external speaker, many readers are asking for details concerning suitable ratios for output matching transformers to enable them to use an existing speaker or to purchase one of the correct type.

The formula itself is quite simple, namely,

\[ N = \sqrt{\frac{R_T}{R_S}} \]

where \( N \) is the turns ratio of the transformer, \( R_T \) the optimum load resistance of the valve concerned, and \( R_S \) the impedance or resistance of the speaker. The value \( R_T \) can be ascertained from the valve maker's leaflet; similarly, the impedance of the speaker is usually quoted by its maker, so that the unknown value \( N \) can be calculated with little difficulty.

If a speaker is not already provided with its own matching or output transformer, then the resistance of the speaker coil, or, in the case of the moving-iron models of a few years ago, that of the speaker bobbins will have to be taken.

Meter Shunt Resistances

The desire to convert an existing single scale reading meter into one of the multi-scale type is very common but, so the post bag reveals, the method of calculating the values of the required shunts, necessary with amm or milliamm meters, is not too well known. It is quite simple and not difficult to remember, whilst its application should not cause anyone any perplexity.

It is,

\[ R_{shunt} = \frac{R_{meter}}{N-1} \]

where the resistance of the meter winding is that specified by its maker and \( N \) represents the number of times the full scale deflection is to be increased. For example, if the meter has a normal full scale reading of, say, 5 mA and it is desired to fit shunts to allow it to read 50 mA at full scale, then \( N \) equals 10 and \( (N-1) \) naturally becomes 9.

Stage Gain

When designing and constructing L.F. amplifiers, much trouble and dissatisfaction of unnecessary valves will be avoided. The Query Service figures show that these facts are now being more widely appreciated, therefore the formula is given below.

\[ \text{Stage Gain} = \frac{R_{l}}{R_T + R_a} \]

where \( R_{l} \) is the anode load and \( R_a \) the impedance of the valve and \( \mu \) its amplification factor, the last two values being those given by the valve data sheet for the valve concerned. With L.F. transformers the ratio of the winding must be taken into account, in addition to the amplification factor of the valve, and \( R_{l} \) then becomes the dynamic resistance of the primary winding. With a resistance coupled L.F. stage, \( R_{l} \) would, of course, represent the value of the anode resistance.

Standard Resistance Colour Code

Although these details have been published many times they are given in these pages once again, and we would suggest that they are copied out on a stout piece of cardboard and placed in a spot handy to the constructor's bench, thus avoiding much waste of time during experimental work.

<table>
<thead>
<tr>
<th>Figure</th>
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<tbody>
<tr>
<td>0</td>
<td>Black</td>
<td>5</td>
<td>Green</td>
</tr>
<tr>
<td>1</td>
<td>Brown</td>
<td>6</td>
<td>Blue</td>
</tr>
<tr>
<td>2</td>
<td>Red</td>
<td>7</td>
<td>Violet</td>
</tr>
<tr>
<td>3</td>
<td>Orange</td>
<td>8</td>
<td>Grey</td>
</tr>
<tr>
<td>4</td>
<td>Yellow</td>
<td>9</td>
<td>White</td>
</tr>
</tbody>
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The chief thing to remember when applying this code is the following order of reading the colours, as it will be found that each resistance carries three indicating colours or markings. These are Body, Tip and Dot. The body will be a certain colour according to its value, but one end or tip of it might be marked with another colour while on the body will be found a dot of another colour. They must be read in the order given, and an example is given to make this quite clear. A resistance having a grey body with a black tip and a red dot would indicate 8, 0, 00 or, written correctly, 8,000.

Frame Aerials

The actual windings necessary for a frame aerial for use on the ordinary broadcast wavebands, i.e., medium and long waves, depends so much on the size of the frame, the spacing of the windings and other details, that it is not possible for the Query Service to calculate the exact number of turns required for each individual application, especially when very brief information is provided, as so often is the case, of the circuit under construction. To enable, therefore, the constructor to have a basis for the start of his experiments, it should be noted that for the medium waves, approximately 75 feet of wire will be required, while for the long wave section, 130 to 150 will be necessary. If the frame is of the type incorporating its own reaction winding, then 40 to 50 feet is suggested for this, but experiments must be made to determine the most satisfactory number of turns in each case.

The medium-wave section should be wound with, say, 24 S.W.G. enamelled or D.C.C. wire and its turns should be approximately \( \frac{1}{10} \) of an inch apart. The long wave and wave reaction can be wound with much finer wire, for example 35 S.W.G. and the turns should be close together.

PATENTS AND TRADE MARKS

Any of our readers requiring information and advice respecting Patents, Trade Marks or Designs, should apply to Messrs. Rayner and Co., 1 New Broad Street, London, E.C.2, or to Messrs. P. & D. Smith, Southampton Buildings, London, W.C.1, who will give free advice to readers mentioning this paper.
Valve Economy

Novel Valve Arrangements Which May Be Tried in Order to Reduce the Total Number of Valves.

We have already explained in these pages how various economies may be effected in general receiver design, and in one instance have indicated how a multi-electrode valve may be used in an unorthodox way in order to save initial valve expense and to reduce the size and number of components in a receiver. (See the "Three-Two," receiver in our issue dated Dec. 2nd last.) This idea wishes to go farther can strap two diodes for use as a rectifier or even use two of these particular valves in a straight circuit, making use of some diodes for A.V.C., some for rectification and others for quenching or other special purposes. However, the type of valve which is undoubtedly the most interesting from an experimental point of view is the A.C. double-triode. There are two types of this valve available of utilising a dual type of valve may, however, be applied in other directions and similar economies effected. In the article in question it was mentioned that tests had been conducted with a double-triode valve for L.F. and output stages, but these valves are not available in battery types. The standard Class B valve has characteristics such that it will not permit one section to be used as a straight output triode, although such section may be used as a triode. The reason is that the majority operate with no grid bias and thus their handling capacity is low. A low-gain two-stage amplifier could, however, be made up with such a valve, although it is probable that the resultant output would not exceed that given by a good L.F. valve. The total H.T. current would be less, although the L.T. current would be similar to the two valves each taking 1 amp compared with the 2 amps or more of the Class B valve).

Double Triodes

In the main types, however, there are several valve designs which lend themselves admirably to special uses, and the double-diode-triodes or double-diode pentodes need not be employed in superhet receivers. The use of the diodes for good-quality signals in a straight set should not be overlooked, and the experimenter who

Fig. 1.—The circuit of the Three-two receiver using a triode-pentode.

on the market, one having a single cathode for both sections, and the other having two separate cathodes. Although of American origin, they are available in certain English valves based on the original, although it appears that at the moment only one English firm makes the two-cathode pattern. This separation of the cathodes enables the valve to be used in circuits which are not possible with the single cathode type. Connections and theoretical data are given in Fig. 2.

Fig. 2.—Theoretical diagrams of the 6N7G and 6C8G valves and under-expander view of pin connections.

Push-pull

A very good instance of the effective use of the double-triode, single-cathode type, is in a quality L.F. amplifier wherein one section is employed for L.F. amplification, and the second as a phase inverter. The circuit is given in Fig. 3. It will be seen that the signals, either from a radio section or from a pick-up, are fed into one triode section, and the output is taken through the standard resistance-capacity circuit to one of a pair of output valves arranged for push-pull working. At the same time the signal is also fed to the second section of the double-triode, and the output from this section feeds the second of the push-pull valves. This arrangement has certain features which make it preferable to the more usual scheme of taking the output from cathode and anode of a single valve, and better balancing is possible. The advantage of this particular circuit is, of course, in the saving of space over two separate valves, the saving of one valve-holder and a slight economy in both H.T. and L.T., due to the particular valve characteristics.

Grid and anode of a triode valve may, of course, be strapped to permit the valve to function as a diode or rectifier, and this enables various circuits to be tried out.

(Continued on page 306)
An Optical Equivalent

Principles which have been firmly established in the field of normal optics are freely borrowed and adapted to meet any special conditions which arise in electronic work. This is particularly the case with one of the ordinary types of cathode-ray tubes where it is found necessary to make the electron stream undergo focusing, refraction or reflection. An interesting application of this has just been made known, and has for its major feature the reduction of spherical aberration. In the usual form of cathode-ray tube the cathode and accelerating anode assembly are mounted at one end of the tube with its filament serving as the other. In this special tube this assembly is located about the middle point of the glass envelope. The stream of electrons emitted from the cathode immediately comes under the influence of a positive field of force which accelerates the electrons towards a negatively-biased electrode positioned at one end of the tube. Before reaching this electrode, however, the stream must, of course, come under the influence of an equipotential surface which exists between the positive and negative fields. This surface acts on the electrons in the same way as a mirror does to a beam of light; that is, reflects them back towards the remote end of the tube. The stream is then made to accelerate towards a fluorescent screen at the remote end by the action of a high-potential additional electrode which brings about a strong focusing action, so that the impact of the stream on the fluorescent screen is evidenced by a sharp, clear-cut, tiny area of light. In addition to the reduction of spherical aberration the total length of the tube is cut down very materially, and this is a very important point for certain uses of the tube, particularly television. The tube housing is reduced in size, and yet normal forms of modulation and spot movement under the influence of a time-base generator can be undertaken.

Oscillographic Uses

The cathode-ray tube is becoming an indispensable item of equipment for the multitudinous oscillographic uses to which the device can be applied. No high-class serviceman's equipment is really complete without an oscillograph, while in the laboratory its use has become as common as that of an ammeter and voltmeter. To study the behaviour of circuits and record the changes which occur when alterations are made is of importance to designers, and the accompanying illustrations show, in the corner of a research laboratory whose bench equipment lends support to these remarks. In addition to the oscillographs which must be recorded when accumulating experimental data, visual observation of wave-forms on the screen of the cathode-ray tube provides invaluable help in showing what is actually happening in that part of the apparatus to which the electrodes are connected. A recent paper, presented at the Institute of Electrical Engineers, showed a new application of the cathode-ray tube for measurements in a network analyser. Under ordinary circumstances the calculations involved in the operation and design of modern electrical distribution systems very often present such intricate mathematical equations that their solution by ordinary analytical means becomes practically impossible. As an alternative, therefore, a miniature network, comprising generators, reactors, resistors and other circuit components, is set up to have an equivalent electrical characteristic to the distribution system undergoing investigation. It is here that the cathode-ray tube shows its value; becoming of such importance, for the nature of the current and voltage distributions can be observed, their phase relationships checked, magnitudes can be measured, and, furthermore, there is the additional advantage that severe overload conditions can be determined without damage to the equipment. Transient phenomena in networks is becoming of increasing importance, and when photographic methods are used in conjunction with the cathode-ray traces on the fluorescent screen, proper records can be made in a manner which only hours of laborious calculations and drawings would reveal to those undertaking the investigations.

Shelf Life

Many home constructors of television sets, as well as purchasers of complete sets, are wondering if their equipment will in any way deteriorate as a result of the enforced shelf life brought about by the cessation of television transmissions. From Alexandra Palace, as readers know, apparatus which lies idle for any period of time must inevitably accumulate dust, and with the self-imposed restrictions of lighting and heating it is probable that the stereoview set is accommodated in a room which is seldom used. If this should be the case, it is better to move the set to a room where heat is available, and so remove any possibility of damage arising from temperature differences. If the television set is combined with an all-wave radio which does daily service for listening-in, then all is well, for the local heating from the valves and power pack will ensure that the set's interior in no way suffers. An occasional removal of the back, and the careful use of the suction nozzle of a vacuum cleaner by the radio expert of the household is a wise precaution, and with the very high winds which seem to abound at this time of the year it is as well not to neglect the aerial system. As many installations are a dipole with or without reflector, supported as high as possible above the roof top by a mast, it is a good idea to examine carefully the support fixtures to ensure that they are successfully withstanding the ravages brought about by inclement weather. If there is any movement of the mast in a lateral direction within its bracket suppor, this will cause damage to the pole and should be remedied by wedging straight away. Also, see that the feeder cable is free from defect and not swaying in the wind or fracture will result. Any exposed soldered joints should be cleaned and tared up.
The End of the Year
I AM necessarily writing this ahead of Christmas, but the message will reach you round about Christmas Eve if we can rely upon the railways to do their stuff and deliver promptly. I mention this point because some readers are complaining that nowadays they are not able to obtain copies with the same meticulous promptitude as hitherto. There are a number of reasons for this. There are restricted train services and restricted collection and delivery services, due to the blackout. We ask for the indulgence of our readers in these difficult times, and if the one and only weekly wireless journal fails to arrive on the Wednesday morning, readers must not presume that we have shut up shop and departed for some unknown destination in the country. The editorial offices of the journal have not been evacuated to the country. Here we are, right in the danger zone defying Hitler to do his worst. I refuse to evacuate my office, unless at some future time a bomb neutralizes my sanctum. Even this, however, will not prevent us, like Burgomaster Max in the last war, from publishing our journal.

Anyway, festive greetings and all that.

The Club Dinners
FOR my sins it is part of my job to visit the annual forfearch of clubs around the festive board, for even your energetic Editor has not yet discovered any means of being in two places at the same time. I am, therefore, his unworthy deputy, and one of the hosts which I have to propose, or to which I have to respond, includes the visitors and the Press—gentlemen of the Press, if you please. I do not know why journalists should be referred to as gentlemen, for the definition of a gentleman is one who does not work for his living, or one who would not willingly hurt the feelings of another. The former definition certainly does not apply to me, and I gather from my correspondence that the latter does not either. But, still, here we are at the end of another milestone in the history of the world, and I do want for the nonce to drop the role of splenetic critic, and to extend the hand of comradeship to all my readers. Most of them understand my gibes, and accept them in the spirit of friendly badinage. Some, however, get quite hot under the collar, and add to the gaiety of my life by scrawling a bitter letter to me disagreeing with my views on this, that or the other. There is substance here for a New Year's resolution on the part of these readers. However, it is pleasant to hear the flattering things which are said at club dinners about the Press. It is realised that it is the Press which keeps the movement together. An industry or a hobby gets the press it deserves, and it is the wireless constructor who has made the wireless press what it is—the first reader to send me a rude answer to this is sacked!

The Past Year
I have, indeed, been a momentous year, one of alarms and excursions, finally culminating in the declaration of war towards the end of Radiolympia. The cloud of doubt ruined the best show of the lot, and caused it to close down before it had run the usual course of its life. The radio trade has had a bad time, although there are signs, judging from the re-introduction of hire-purchase, that it is reviving. Amateur wireless transmitters have had their licences cancelled and their transmitting sets confiscated. The Baird Company has suffered a knock-out blow, for the television transmissions have ceased for the duration of the war. Journals, too, have had their difficulties, but we are encouraged by the continued interest shown in radio construction, as evidenced by our net sales, to continue. This, in spite of rising costs and the inevitable problems which a war brings to journals of this character. We are on the threshold of a new year. We can but hope that another Radio Show will take place in 1940, which means that the war will be over soon.

Midget Receivers
I HAVE received the following interesting letter from A. C., of Rossendale, Lancs: 
"From time to time various concerns have produced portable receivers of reasonably small dimensions—one or two sets were really in the 'pocket' class—but for some reason really little attention has been paid to the design of a midget battery receiver.

"In the United States, of course, there is a great business in the sale of A.C.-D.C. midget sets at about 30s. to 45s., and it is difficult to understand why our British manufacturers have never been able to cater for the low-price market.

"I suggest that there is a real need for a pocket portable at present, when so many thousands of people are taking part in some form of National Service. Broadcast programmes are popular with both British and French troops. As one report from Paris states:

"Music has not been, as in 1914, the first victim of the war. The first opening roar of the cannon scattered the startled muses. To-day, music goes with the soldiers to the battlefield. Thanks to the radio, the artistic life of a nation is no longer stilled by the clash of arms. Above the military trains, the convoys of supply, the transmission of the wave trains is uninterrupted. They travel, invisible in the air, to ensure the intellectual replenishment of the peoples... The receiving sets can carry to the very edge of the battlefield the comforting, cheering voices of artists who formerly could only occasionally reach the units behind the lines... Just as one sends the soldiers at the front packages filled with good things, so art in its most familiar form gives us defenders a moment's diversion.

"These gifts will certainly be much welcome, but even the smallest commercial portable provides loudspeaker reception and is too big to be 'taken everywhere.

"Is it impossible to design a low-priced pocket receiver, strong enough to withstand normal use, operating from dry batteries for H.T. and L.T., and providing reception on small headphones?"

By Thermion

December 23rd, 1939

PRACTICAL WIRELESS 297

ON YOUR WAVELENGTH

[Image of a radio wave]

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Comment, Chat and Criticism

THERE are few spheres of life into which music, in some form or other, does not enter. Nor is there a function or a celebration in which it does not have its allotted place. Whether it be a King's coronation or the Maypole dance, the gathering in of the harvest, or the celebration of marriage nuptials; each and all call on music to play an important role. So with Christmas approaching, it may not be unseasonable if we consider the part it plays in the great annual festival of hope and faith.

It would be as impossible to talk about Christmas music without introducing a reference to its great twin event, Easter, as it would be to write about winter without mentioning summer. Not by way of critical comparison, but simply because it seems inevitable that we should. We all know that Christmas is a festival of rejoicing, whilst Easter is one of mourning. Consequently, the music for the two occasions is naturally of a vastly different character. But that is not the half of it. I think that much more than meets the eye is the religious nature and significance of the two rites govern the character of the music used in each. What is the first thing that strikes us about their music, when looked at in retrospect, as it were, and quite without prejudice or favour? Simply this, which is of profound significance. Christmas is a festival of rejoicing. It is the great carrier of the year, it has the widest possible ramifications from turkey to crackers, and mistletoe to mince pie. Everything is spontaneous, natural and free and unreserved. We do as we darned well please. And we do it because we want to do it, unlike Easter, when we do things rather more because we've got to do them.

The festival is completely informal and spontaneous—in spite of certain preparations and formalities, much more so than Easter. The result of all this on the musical side of the celebrations is inevitable.

The Christmas is consequently stamped with an informality and a spontaneity which are wholly lacking at Easter. Not only does the religious side of the ceremony lack the formal great masterpieces that Bach and Handel gave to the spring occasion, but the very joyousness of the season sets the whole people music making as part of their merrymaking. Which leads me to the core and root of all Christmas music—the Carol.

Carols

What would Christmas be without the carols? No matter how atrocious the vocal effort and regardless of the venality of some of the youngurchins who make sport of the occasion, and are quite oblivious of the true meaning of their chants, what would Christmas be without those "Noels" and "Whil's He'z Shepe'rs Watch, and croaked through the letter box? What if we were not summoned from our fireside to cheer our inner person with the numerous knick-knack? Not quite the same surely. Celebrants in hotels or restaurants must surely miss a vital part of the season through missing three young carols, who have been a part of the English winter mythology for ages out of reckoning. Carols (the word Carol is derived from the French generic name Noel) have had a long and chequered history. They first came into use in the church service when Latin ceased to be the language universally understood and spoken—presumably at the time of the rise of our modern national dialect. St. Francis of Assisi is said to have designed the first examples to stimulate greater enthusiasm in church services than the long Latin sequels would generate.

Classification

Ricketts divides English carols into groups according to their subject matter. The earliest dealt with the Nativity, the Incarnation and the Annunciation. Then came the Shepherd and the Epiphany groups followed by those of Christmastide, the Waesol and the Boar's Head. Although most of the best carols have come from the Continent, there are many English carols by Byrd, Gibbons, Lawes, and other masters of Elizabethan and Stuart English music. The "First Nowell" is only a portion of a long harangue, and its constant repetition gets very monotonous. "God Rest You Merry, Gentlemen," is a subdued tune, which was used to various political motives in the eighteenth century. "Remember O' Thou Man" (1611) is also a very good one. A very early one is "The Bear's Head in Hand Have I" (1621), and it is sung every Christmas in front of Queen's College, Oxford.

A large number of folk-song carols are based on mystery plays and pageants, notably the "Cherry Tree" carols, the "Carol of the Crows," "Joseph was an Old Man," "Dives and Lazarus," and "Three Ships," etc. English carols have suffered strange vicissitudes. They began as popular songs of great beauty, and up to the time of the Reformation—a time of Catholic piety such as we see to-day in any Roman Catholic country—the Virgin and Child was the favourite theme. Henry the Eighth's arbitrary rule in the sixteenth century caused the suppression and lasting effects on the temper of the country, caused a loss of joy and spontaneity to them—they became dour and formal. The Puritans, however, disapproved them altogether, whilst even the Restoration had little effect. But they came back to some favour about 1700 and were more or less stabilised as a hymn for church performance—this being the final test of their quality. "While Shepherds Watched" would be typical of the form which they permanently assumed from then onwards. Perhaps the most beautiful carols are to be found in the lullaby and cradle song categories, the palm going to those originally written in Germany, owing to the stilted and didactic dimitives in that language. There are many collections and an extensive bibliography. Much research has evidently been given to the subject.

Amateur Talent

Carols, however, are surely at their best when, to a Christmas card setting of frost, Mr. Harold Pinter, of the WLW staff, artist, woke up one morning recently in tears, after a dream that her brother, a German citizen, had been drafted into the army at home and wounded in action. Early this week she received a letter from Germany. It said that her brother had been discharged from army service and several days after hostilities began was wounded.

Our Music Critic, Maurice Renee, Discusses Carols and the Festive Season

PRACTICAL WIRELESS
December 23rd, 1939

PROGRAMME NOTES

Professor Galore

C UY WARRACK has chosen some of the music he most loves for the concert which he will conduct on December 23rd. Moreover, it has all been composed by members of the Strauss family. It begins with the overture, "Fanny Elssler the Dancer," by Johann Strauss (son) and followed by Old Viennese Dances, by Oscar Strauss; the Gavotte, "Where old ladies collect in bands or choirs and goes out on its joyful ways singing, with sincerity and skill, for the benefit of deserving charity and to the pleasure of those inside and around their fire. A knock on the door may get politely answered and the request for charity generously responded to, but a glass of port and a mince pie are not infrequently the carollers' reward. Also, we seldom get this news, London, nowadays. It is many years since I can remember seeing it—fourteen miles from Charing Cross. I hope the custom has survived in the country—we can ill spare to shed many more of these pages of Old England's story. But what chances would there songsters have on our modern arterial roads, and in the crowded areas of suburbia? Tip and run is the order of the day there, and unavailingly so, I'm afraid. King's College, Cambridge, have provided us in recent years with by far the best carol singing, and it has been among the best radio items on Christmas Day for many seasons. I cannot say if we are to enjoy these famous choristers again this year—probably not. But keep a look out for new programmes for them, and if you haven't heard them before, don't miss them. If you have, then I know you'll be switching on.

Dream Come True

T HIS story gave uncomfortable feelings to the people who heard it: Mrs. Rudolph Pinter, wife of the WLW staff artist, woke up one morning recently in tears, after a dream that her brother, a German citizen, had been drafted into the army at home and wounded in action. Early this week she received a letter from Germany. It said that her brother had been discharged from army service and several days after hostilities began was wounded.
A 2½-watt Battery-operated Amplifier

Owing to Previous Copies Being Now Sold Out, the Following Details are Reprinted by Request

WING to amplifiers being so often associated with high-power outputs, it has become common to think of them as being essentially mains operated; therefore, in view of this and the number of requests received for a battery-operated outfit, the unit mentioned above has been designed. To the many readers who have made such requests and who may require something different from that given below, we would draw their attention to the latest edition of "Sixty Tested Wireless Circuits," wherein will be found much valuable information, together with complete circuits, concerning amplifiers and their design.

The first consideration with any battery-operated apparatus is current consumption. The second, at least as far as amplifiers are concerned, is the output obtainable. Bearing in mind the fact that these two requirements are very closely related to each other, and that dry H.T. batteries are likely to be the source of anode current supply, limits to suit both factors had to be selected, and it soon becomes apparent that it is absurd to think of a 4.5-watt output, as so many constructors would desire.

If one can eliminate the question of dry H.T. batteries by, say, using large-capacity H.T. accumulators or, for example, a Milos Unit, then the output can be raised considerably, but even so, one cannot soar to the large outputs obtainable from some of the mains-operated "power" amplifiers.

So many pick-up enthusiasts appear to have the impression that unless an amplifier can deliver, say, 6 watts of undistorted output, it is not worth considering for record reproduction. Well, I suppose it is a matter of personal taste, but hearing in mind that one is usually concerned with using the equipment in a room of average size, I would suggest that much power is out of all proportion.

From the reproduction point of view, by which I mean judging purely, I maintain that an output system capable of handling 2 watts is more pleasing, when it is fully loaded, than a 5 or 8-watt outfit with the volume turned down to the same output. However, whatever the pros and cons of the two pentodes, P.P.225's, arranged in quiescent push-pull, the coupling being provided by a Varley Q.P.P. transformer and D.P.36 which is parallel fed to allow the utmost inductance to be obtained from the primary winding to ensure a good bass response.

The normal output of one P.P.225 with 153 volts on the anode and auxiliary grid, and with its grid biased 12 volts negative, is 1,000 milliwatts, or 1 watt; therefore, with two in the above output circuit, it is safe to estimate that at least 2½ watts will be obtained, provided the anode and bias voltages are correctly adjusted.

The current consumption of the L.L.2, with 135 volts on its anode, is approximately 3 mAs, while each P.P.225, under normal working conditions, will draw as much as 18 mA in the anode circuit and 2 mA in the auxiliary-grid circuit. These figures at first sight seem rather drastic for battery operation, but one must not overlook the fact that with Q.P.P. output the two P.P.225's are so heavily biased that their standing current becomes very low and large current surges only take place during the handling of powerful passages in the input signal.

It is impossible to go into the why's and wherefores of Q.P.P. operation in this article, but it will suffice to say that the whole secret of satisfactory output and distortion-free reproduction is the correct adjustment of the grid bias with relation to the actual anode potentials.

The output from a normal pick-up will provide adequate input for the output valves as the L.L.2 has a fairly high magnification factor, while the coupling transformer has a ratio of 1:9. So far as microphones are concerned, a lot depends on the type and their actual efficiency, and with a high sensitivity model a satisfactory output will be obtained; but with others having a lower output, such as high quality transverse current and moving-coil types, it will be advisable to provide a simple "head" amplifier in the form of, say, a good straight H.F. pentode resistance-capacity coupled to the L.L.2.

Two variable controls are provided to allow two inputs to be controlled and "mixed" before being fed into the grid circuit of the L.L.2, thus allowing two pick-ups or one pick-up and a "mike" to be used, according to individual requirements.

This item is always very handy as it increases the uses of the amplifier considerably, apart from giving the operator greater scope so far as results or effects are concerned.

The third control R3 is a combined

(Continued overleaf)

Fig. 1.—Theoretical circuit of the 2½-watt battery amplifier.

Fig. 2.—Panel layout and drilling diagram.

TONE CONTROL AND ON/OFF SW.
A 2|WATT BATTERY OPERATED AMPLIFIER. (Continued from previous page)

 Potterometer and switch, the potentiometer section being used as a tone control, while the switch is wired to one of the batteries. It will be noted that the tone control is really a low-note booster or high-note cut-off, but the values have been selected to provide a most satisfactory variation in the tonal response, and it will be found very useful for the elimination of resonant surface vibrations or feedback. It must be appreciated, when considering this arrangement, that the natural characteristics of the amplifier are on the high side, so any additional provision of a high-note booster is not required; in fact, it would be detrimental.

Layout

It will be seen from the illustrations that a small simple chassis has been used to hold all components, as this allows a clean top deck to be obtained and facilitates wiring. It will be quite an easy matter to build a compact cabinet round the chassis, if a more professional appearance is required, to make a cover to fit into the top of the chassis out of sheet perforated zinc.

The transformer is placed so that the grid leads to the two output valves are short and direct, the resistance Rs being included to prevent, in conjunction with the two fixed condensers Cs between each anode and the negative line, parasitic oscillations which are sometimes generated in symmetrical push-pull circuits.

The anode circuit of the L.L.2 is decoupled by means of a resistance and a condenser to eliminate any possible instability through battery coupling, but the anodes of the P.P.229's receive their H.T. via the output transformer. No output transformer is included in the amplifier as the majority of modern moving-coil speakers are fitted with a multi-ratio transformer which usually allows satisfactory matching to be secured.

Particular attention must be given to the connecting wires associated with the two input controls. As these potentiometers are in direct contact with the input grid, it is essential to cover all connecting wires with metalised braidings.

"FOR SERVICE READERS."

Readers who have relations or friends in H.M. Forces will be thanked if they draw attention to our famous contemporary "TIT-BITS" and its device "FOR SERVICE READERS." This page, conducted by "Nobby," who is the Service-man's Champion, is already famous. Nobby, offer of expert help is extended to A.R.P. workers and all engaged upon Service for the State. Apart from this feature "TIT-BITS" readers of the brightest of all home weeklies and is the ideal paper to send "him" in the next parcel.

WIRING DIAGRAMS

TELEVISION IN AMERICA

Those nations free from the rigours of war and able to maintain their television services, that is to say, the U.S.A. and Italy primarily, have apparently been studying very carefully the nature of the productions which fortunate viewers within range of the Alexandra Palace signals were able to enjoy in pre-war days. From information which has become available from various sources it has appeared very clear that the authorities charged with providing entertainment through the medium of television, and this applies particularly to America, have begun to recognise that it is far better to make a really honest use of the conventions which the restrictions of television make apparent, than to make fruitless attempts to disguise those limitations by a rather lavish copy of what occurs in either the film studio or on the stage. The producers who are tackling this important problem have come to the very sensible conclusion that it is preferable to exploit fully their own analytical selection of the visual clues which the new medium is undoubtedly placing at their disposal. It has always been recognised in the entertainment world that the films have the special advantage of post-editing, but there is no reason why this factor cannot be offset by paying very careful attention to individual lighting for each item of the production in conjunction with correct continuity movement. A clear lead is established over any film record by the vitality of the television transmission, for there is the knowledge that the event is happening while being watched, and did not occur some months previously in the form of a haphazard scenes which the editor has restored to a story with the events in chronological order. In America it has already become apparent that the probationary period of programme production is likely to be a short one, and although large talent resources will be acquired, has become an incentive and not a deterrent.
A Pick-up Lifting Device

The action of removing and replacing a pick-up on a gramophone record has always struck me as being bad for the tracking, and as I frequently experiment in practising this very function, I decided that in the interests of my records I would construct some form of lifting device which would provide a further advantage in protecting a piezo head which I use. After weighing the pros and cons of various schemes, I hit upon the idea of using a camera release and ratchet movement along the lines indicated in the sketches.

This camera shutter release is very positive in action, and by adjusting the relationship of the ratchet teeth to the push of the release pin, I very seldom have to make any adjustments. The diagrammatical representation shows the essentials of the completed assembly, the inset illustration clearly defining the function of the hinged record lifting strip.

-A. J. GRIFFITH (Leicester).

Turntable Illumination

A PROPOS the article in a recent issue of P. W. regarding turntable lighting, I thought that the following idea is used by me for the past few weeks would be of interest to other readers.

I had by me an old shaving stick case, made of a composition similar to bakelite, of which the cap screwed into the body.

I cut a hole in the cap large enough to take a miniature batten holder, as supplied by a popular stores, and then drilled the flange of this cap, and also drilled corresponding holes in the base of the batten holder, this allowing small bolts to be inserted and screwed up tightly to hold the assembly rigid.

Next, I cut a window in the body of the case in such a position as to allow light from the miniature bulb (15 watts) to project.

When completed, I gave the whole assembly a coat of brown bakelite enamel, and when this had dried hard I wired the lamp to a small press switch for inclusion on the motor board of my radio graph.

W. CHURCH (West Wickham).

A Calibrated Scribing Tool

AS I do a good deal of home constructional work, I thought it would be well worth my while if I made a calibrated scribing tool having inch and fractional markings. As a steel rule offered considerable difficulties, so far as drilling was concerned, I decided to go to a little trouble in carefully scoring a brass strip down to 1/64 of an inch.

After slightly shaping one end after marking and scraping the scale—the scoring being carried over one edge, as will be noticed in the accompanying drawing—I then drilled a small hole into which would finally be fitted the brass fluted needle holder. To observe the necessary degree of accuracy, I made sure that the centre of the hole corresponded to the exact centre of the zero inch mark.

Two 18 gauge brass guides, one screwed to the wooden handle, the other free to move up and down the scale and handle, were soon made, and the finished job proved interesting to make and practical in use.—R. C. WENDRIP (Hanworth).

Bandspread Adjustment

THE problem of finding exact settings for a band-set condenser, which, to be fully effective, should be varied in steps, was overcome by me in the following manner. I took a standard small-capacity condenser and mounted this on the chassis not on the panel. An old three-inch tuning dial of ebonite was then cut as shown in the accompanying illustration. If desired, of course, a disc could be cut from sheet ebonite about 1/24 thick to the desired size. A small spring stop device was next cut as shown in the separate illustration, and this was screwed to the chassis on the under side so that it engaged in the notches cut in the edge of the disc. The position of the condenser and the size of the disc are shown so that a small section of the disc will protrude through a slot cut in the front panel. This portion of the disc is then engraved, and enables the condenser to be adjusted by the thumb and exact settings repeated.—T. HELM (Romford).

SPECIAL NOTICE

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

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay 1s.10d. for the best hint submitted, and for every other item published on this page we will pay half-a-crown. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newsom, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notice sent in must be original. Mark envelopes "Practical Hints." DO NOT enclose Queries with your hints.
The design of pocket-receivers can cover many novel features, but generally speaking the true pocket set is only possible when Miclad valves and special parts are employed. Even so, the accommodation of suitable batteries then brings the total dimensions rather beyond anything but a large coat pocket or similar receptacle. If, however, the batteries can be separately accommodated then quite reasonable pocket-sets may be made up, even using standard parts. We recently described a one-valve built into a cigar box, and in an endeavour to see just what could be done with this type of box we carried out one or two experiments, and an interesting two-valve circuit was included in these as illustrated on our cover and described in this article. Standard parts were to be used and a selection of standard cigar boxes was obtained. These varied considerably in shape, but a very useful size was that used for 2½'s, and this measured 5in. by 3½in. by 1½in. deep. This just enables two valves to be accommodated comfortably in standard baseboard-mounting valveholders at each end of the box, with sufficient room between them to take a small transformer and the two variable condensers.

The question of a coil was solved by using the Bulgin Miclad coil, and this was bolted to the top of the box—the relative positions of these parts all being indicated in the cover illustration.

Battery Problems

This, therefore, only leaves the problem of the batteries, and one easy way of overcoming this is to have a similar box in which may be placed a small jelly-type accumulator for L.T., with three or four G.B. batteries connected in series for H.T.

If the receiver is just required as a novelty, then standard batteries could be used in the ordinary way. Leads for the batteries are brought out from the case through a suitable hole, and two-socket strips are mounted on each side for aerial and earth and for 'phones. The cigar-box wood is generally of cedar, and although very thin is easy to cut, and when cleaned down will take a very good polish or may be left in its natural state. The labels are generally well fixed, but a damp cloth pressed on them will enable them to be cleaned off without warping the wood. Do not use too much water, and do not use coarse sandpaper to clean down as this will scratch the soft wood and spoil the surface. Be careful not to damage the cloth hinge, as this is also attached with glue and will not stand up to misuse. When cleaned, drill the two holes in the front (which is actually the bottom of the box in question), using a twist drill to avoid tearing the wood. At the sides drill accommodating holes for the socket strips and then attach valveholders, coil, transformer, and socket strips with short bolts. The wood is too thin to permit of satisfactory screening, if desired, valveholders may be wired up—from the filament point of view, before attachment. Although it is possible to get at the various terminals if the position which we adopted is followed this is shown in the illustration below. Wiring may be carried out with insulated solid wire, or ordinary flex, and is quite a simple matter.

Wavechange Switching

To avoid the fitting of a wavechange switch, the continued operation of which might result in splitting the thin wood of the box, we adopted a crocodile-clip method of wavechanging. A short length of wire is attached to the earth connection on the coil and the clip is attached to the earthed terminal of the tuning condenser when long waves are being received. This is merely to keep the clip from springing loose and perhaps introducing a short circuit or other trouble. When medium waves are required the clip is attached to connection point No. 2 on the coil. The numbers, incidentally, will be found stamped into the coil-former close to the small eyelets. If the small coloured leads on the coil are not long enough, or you desire to preserve uniformity in the wiring, you can unsolder them and attach separate leads. The fixed condensers and grid-leak are joined to the appropriate terminals and the normal wire ends may be used. If you make use of standard mica condensers with terminals, short leads may be attached to them.

The battery leads should, of course, be long enough to reach to the battery box, or position in which the batteries are to be kept. An on-off switch has been omitted for the same reason as the wavechange switch, and the set is switched off merely by disconnecting the L.T. negative lead from the accumulator. Alternatively, a suitable switch may be mounted on a small strip of ebonite, with a strip of metal attached to one terminal of the switch and drilled to accommodate the terminal on the accumulator. The lead is then attached to the remaining switch terminal and thus on-off switching may be carried out in the usual way. If you are interested in making a more comprehensive job of the receiver then automatic bias may be provided by including a suitable resistance with by-pass condenser in the H.T. negative lead in the usual way. This will entail the fitting of an anchoring screw so that the lead may be attached and the secondary of the transformer connected to the H.T. negative lead. Any type of aerial may be used, depending upon the results desired. If selectivity is an important point in your locality, use a small aerial. This may be a length of flex in the form of a throw-out aerial, about 4ft. 20in. being adequate. If a full-size outdoor aerial is connected to the set then selectivity will naturally be rather poor and a series-serial (Continued on page 212).
Loudspeaker
Improvements

How to Obtain Increased Volume and Better Reproduction by Using a Wall-mounted Baffle.

Constructional Details are Given in This Article

By FRANK PRESTON

A s most readers are fully aware, speaker reproduction can generally be improved by transferring the unit from the comparatively small receiver cabinet to a good-sized baffle board. It is not as widely known that by this means it is possible to obtain a greater useful volume of reproduction from a given input. In very many instances an improvement in the speaker mounting will give results as good as those to be obtained by adding an additional amplifying valve.

The Blocks

The blocks of wood used for mounting can be made from planed timber measuring about 2 in. by 1 in., by about 4 in. long. They are best made from a single length because this simplifies the work of making the bevel or chamfer. To mark out for this measure in. (or the thickness of the wood) from the corner at each end and draw a line down one face as also shown in Fig. 2. The corner can then be planeed off. Bore a couple of 1/8 in. holes in each of the four pieces and countersink these for the screw heads. By holding the blocks in place against the wall the positions of the screw holes can be transferred by pushing screws through the holes or by means of a bradawl.

At the eight points marked the wall should be drilled to receive Rawlplugs of the correct size for 1/2 in. screws. As an alternative, slots can be made in the wall by means of a wall drill or narrow cold chisel; wedges about 3 in. long, by 1/2 in. thick at their wider end can then be made and driven into the wall. The wedges should be only slightly tapered.

For example, if they are 1 in. long they should taper from 1/2 in. to 1/4 in. After this has been plugged in, either of the methods the wooden blocks should be firmly attached. It is worth mentioning that if plugging tools are not available it is generally possible to provide a sufficiently secure fixing by driving in three 2 in. nails. These should be placed in the form of an "anchor" and should be sloped downward slightly. It should be understood that this is not an "anchor" method, but one that will obtain a secure hold only when the plaster is hard and of good quality.

To fit the baffle board it is necessary only to bore a hole about 1 in. from each corner and in the centre of each edge, countersink the holes and mount with screws about 1 in. long. A better appearance can be obtained by using so-called fancy screws, the heads of which are drilled and tapped to receive a short parallel-sided screw with a decorative head.

The Baffle Board

In choosing the wood for the baffle it is obvious that the plywood should be faced with a wood which matches the furniture in the room—often oak or mahogany. If this is not possible use first-class alder plywood, which can be well rubbed down and later stained and polished. For a baffle up to 3 ft square, 9 mm. (about 1/2 in.) plywood is suitable, but for larger sizes it is better to employ seven- or nine-ply, which is between 5 in. and 7 in. in thickness. In the first place, the baffle should be planeed perfectly square, and then the two upright edges may be bevelled. After that, the frit or hole should be made in the centre. Actually, it is better and easier to make a simple hole rather than to do any fretting. Since the speaker unit will probably be mounted on a small and separate board, the hole can be of any shape, but either circular or square will usually be preferred. This is cut out after finding the centre by drawing two diagonals.

Decoration

Whether the hole is to be round or circular it will be cut out with a keyhole or pad saw, as shown in Fig. 3. A rim hole should be made inside the marked-out line in the case of a circle, or four such holes should be made just within the corners for a rectangular hole. After sawing, the edge

Fig. 3.—The box in the centre of the board may be cut with a pad or keyhole saw. The board should be held firmly whilst sawing.

Fig. 2.—The edges of both the baffle board and the mounting blocks are bevelled as shown here.

Fig. 1.—How the baffle may be arranged in the corner of the room.

During the past few years it has, unfortunately, become customary to build the speaker into the set, instead of using it as a separate unit. This might be a convenience but it is not conducive to high efficiency. One of the best speaker arrangements consists of a large shallow, open box, standing on end, with the speaker unit mounted in the centre of the front; this should be heavily and rigidly built to ensure complete absence of vibration. An objection to this form of construction is that the speaker becomes cumbersome. Another is that in many cases it is not possible—because of its size and weight—to place it in the most satisfactory position in the room.

Large Baffle Area

A better method, which is generally applicable, is to use a large baffle, which is mounted in a corner of the room between the two walls. The baffle board should consist of stout plywood and should be mounted with its centre at a height of about 4 ft. It has sometimes been suggested that the speaker baffle of this type may be suspended with cords from the picture rail. This is seldom good practice unless the complete assembly is very heavy and rigid and, preferably, built as an enclosed box of triangular section. My preference is for a baffle board about 3 ft. 6 in. square firmly fixed to the wall.

One sound method of mounting is by screwing four wooden blocks to the walls, and screwing in the board to these. The blocks should be shaped and arranged as shown in Fig. 1, where it will be seen that they are not of rectangular section but have one edge bevelled so that it makes an angle of 45 degrees with the wall. The simplest method of finding the correct position of the blocks is to bevel the two upright edges of the baffle, as shown in Fig. 2, and then holding the baffle in the corner and at the correct height so that its position can lightly be marked on the wall with a pencil.

A

Baffle Board

Mounting Blocks

ANGLE OF CORNER OF ROOM

Fig. 1.—How the baffle may be arranged in the corner of the room.
of the hole can be smoothed with a rasp and wood file, and finally with glass-paper. Should some form of decoration be desired, this can easily be arranged by fitting strips of half-round moulding parallel to the edge of the board with, perhaps, a stamped wooden ornament at each corner of the decorative square. To fit these decorations, make holes near each end of the strips and about every 6 in. in the length with a fine archimedean drill. Apply a very light coat of thin hot glue to the beading, press it into place after marking out its position, and then fix it by driving in 6 in. panel pins; drive these nearly to the level of the beading and then slightly sink them with a pin punch.

A piece of silk should be fitted over the back of the hole, and this is best bought ready mounted in a cardboard frame. By buying the silk in this form the difficult job of making it uniformly taut and free from lines is avoided.

The speaker unit will probably be mounted on a small board, and this can be screwed on to the back of the baffle. In many cases reproduction may be improved, however, by spacing this board from 6 in. to 9 in. from the baffle by inserting felt, rubber or wooden packings, as shown in Fig. 4. This spacing tends to improve bass reproduction, and it is worth while to experiment with different spacings.

Speaker Connections
Where convenient, it is best to have the speaker fairly near to the set. But if it must be some distance away use goot-quality flex for the connection, especially in the case of a mains set. When using a speaker with separate output transformer it is better to fix the transformer to the baffle so that the secondary leads (which are connected to the very-low-resistance speech coil) are as short as possible. A few ohms resistance in the leads to the primary winding is seldom of any importance.

If the speaker is an energized moving coil use stout valансeual rubber twin cable for the connections to the field winding, since these carry the full H.T. voltage. It is also generally desirable to keep the leads to the anode of the output valve a short distance away from the field connections so that it cannot pick up any hum from the unsheathed current passing to the field. As an alternative, use twisted triple cable.

A Better Arrangement
Although the construction is slightly more difficult, and the appearance less pleasing, it is often better to place the baffle with its centre about 6 ft. high and to make it slope downward. This can be done by cutting the baffle so that it is, say, 4 ft. wide at the top and 6 ft. at the bottom; in cutting out draw a centre line and measure half the length from this to make the board symmetrical. The same results for the construction mentioned above, although the angles will not be perfectly correct.

Remote Control for Television Cameras

CONSIdERATIONS of space often make it difficult to accommodate a large television camera and an operator at a point from which a scene has to be viewed. This difficulty can be overcome by arranging for the camera to move under the control of a view-finder observing the scene from a remote position at which an operator can be stationed.

The accompanying illustration, Fig. 1, shows an arrangement of this kind. It will be noted that the two mutually perpendicular motions of the camera mounted in the gimbals framework are conveyed to a remote view-finder 3 by means of flexible cables or shafts 4 and 5. At the view-finder the flexible shafts control the positions of the two independent cross wires 6 and 7, which are within the field of view through the eyepiece 8, at their point of intersection indicating the centre of the field of view of the camera. Alternatively, the flexible shafts may control the direction of the whole view-finder in which a rectangular framework would indicate the field of view for the lens being used.

A View-finder Improvement
An improvement upon the viewfinder is shown in Fig. 2 in which the cross wires are accommodated in a subsidiary optical system 1 and superimposed upon the scene visible through the aperture 2 by means of a half-silvered mirror 3. The advantage of this arrangement is that a lens 4 may be included so that both cross wires and object would appear in focus simultaneously.

Although cross wires have been shown, it is preferable that illuminated slots with a black background should be used in practice, so that the auxiliary optical system will not reduce the contrast of the scene being viewed. Further, as an alternative to two intersecting lines, a gimbals mechanism may be devised which is controlled by the flexible shafts, and which carries a flag (such as a circle of wire) covering the centre of the scene being transmitted.

In the converse arrangement, handles would be attached to the ends of the flexible shafts at the view-finder, and their manipulation would control both movement of the camera and position of cross wires.

It is obvious that instead of the flexible shafts, alternative methods of comminuting the movement of the camera may be employed. These methods include Bowden wire mechanisms or an electrical follower arrangement.

PRACTICAL WIRELESS ENCYCLOPAEDIA

By F. J. CAMM
(EDITOR OF "PRACTICAL WIRELESS")

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A REVIEW OF THE LATEST GRAMOPHONE RECORDS

Parlophone

PATRIOTIC songs, old and new, are linked together on Parlophone F 2718. It is a recording by Oscar Natcke, New Zealand's great bass singer, who sings "Land of Hope and Glory" and "There'll Always be an England." Tauber revives one of his old favourites, "You Are My Heart's Delight," on Parlophone F 20467. He couples it with an equally popular song, "Vienna, City of My Dreams." He has also made another revival which we come to an over-medley and "Songs My Mother Taught Me" on Parlophone F 20468.

Silvester

You should learn "Songs on Stick" featuring A. Handley of Parlophone on F 11428, and the Symphony Orchestra have recorded "Slavonic Dance, No. 8" and "Slavonic Dance, No. 8" on Parlophone F 11429.

Variety

L. E. H. Hutchinson ("Hutch") sings a popular song of the moment, "Lord of the Air" on Parlophone F 1589. He couples it with a hill-billy song, "Ridin' Home." This artist also sings "This Heart of Mine" and "Later On" on Parlophone F 1570. Ronald Franklin and Tommy Handley pop up again as Muzzogalloo and Winterbottom on Parlophone F 1564. There are plenty of laughs in their version of "Good Luck (and the Same to You)" which has been adapted from the march Colonel Bogey," and "We Must All Stick Together." Song medleys are always popular at parties, especially at this time of the year, and a number are featured in the Parlophone list. First we have two descriptive song medleys—"Somewhere in France" on Parlophone F 1580, a two-part record featuring "Siegfried Line," "Run, Rabbit Run," "There'll Always be an England," "Adolf," "Hamblinco Relays," and "We'd Me Latch," and "The Fisgine Singer" on Parlophone F 1590, introducing "Love's Old Sweet Song." "In an Old-fashioned Town," "Where My Caravan Has Rested," "Little Grey Home in the West," "Roses of Yesterday," and "When You Come Home." Patricia Rosser-Bourbon plays piano-medley on Parlophone F 1584 called "Songs to Sing—and Listen To." From a picture postcard series by H. Robinson Cleaver, playing at the organ of the Granada, Welling. It is excellent. Cleaver Miss No. 2 introduces popular songs of the moment—Parlophone F 1585. Finally, we have The Kerbside Serenade styled by the Granada Hits Medley" on Parlophone F 1588.

If you wish to spring a surprise on your friends this Christmas by tap-dancing, then you should learn to dance the Victor Silvester Way. Parlophone are issuing four 10in. records, complete in an album, with booklet giving details and instructions.

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LATEST PATENT NEWS

Abstracts Published.

INDICATING - APPARATUS. - Telefunken Ges. Fur Drahtlose Telegraphie. No. 506469. A dial and pointer indicator, particularly for a radio receiver, comprises a source of radiant energy, emitting a high proportion of waves towards the violet end of the spectrum, for illuminating the dial or the pointer either of which are coated with luminous material, for example a composition having a radium content or a phosphorescent paint. Thus, the whole dial may be coated with phosphorescent paint and then coated, for example, blackened, to leave luminous scale indicia exposed, or a glass scale to be illuminated from behind may be formed by casting the back thereof with black material except at the scale indicia and then coating the whole back surface with phosphorescent paint. A glow discharge tube with a luminous blue gas is preferably used as the source of radiant energy.

INDICATING DIALS AND SCALES; ILLUMINATING. - Hausermann Vereinigte Fabriken Chemiker Graeven Und Metallwaren Ges. No. 507556. An edge-lit scale for watches, clocks, measuring apparatus, etc., is lit from one edge only and comprises a front transparent plate, bearing the matter to be illuminated, spaced approximately 1/2 a millim from a dark background plate to which it is secured peripherally by a raised edging or border. As applied to a tuning scale for a wireless receiver, a front transparent plate A of glass, mica or synthetic material (see accompanying illustration) has the scale indicia.D, E, printed on its front or rear surface and is secured to the back-plate B of glass, metal, synthetic material, etc., by a raised border C, for example, of Chatterton's compound. The back-plate of glass, is rendered opaque or translucent except along strips F lying behind the wave-band scales E through which a luminous tuning spot or pointer moving behind the rear plate may be seen. The several wave-band scales E and F of station names D may be differently coloured.

NEW PATENTS

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Latest Patent Application


Specifications Published.


514681.—Cohn, B., B., and Shackle, A.—Means for adjusting rotatable control spindles in wireless apparatus. (Cognate Application, 16813/38.)

514861.—Philco Radio and Television Corporation. — Wireless receiving circuits.

514083.—Telefunken Ges. Fur Drahtlose Telegraphie. — Aerial systems.

514995.—General Electric Co., Ltd., and Hunter, S. G.—Driving means for the tuning-indicators of wireless receivers.

514071.—Baird Television, Ltd., and Nuttall, T. C.—Television and like systems.

514389.—Telefunken Ges. Fur Drahtlose Telegraphie. — Reduction of interference in electric signal transmission systems. (Addition to 467283.)

514590.—Fersch Akt. Ges.—Television transmitting-apparatus.

514545.—Baird Television, Ltd., and Nuttall, T. C.—Television and like systems.

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December 23rd, 1939

VALVE ECONOMY

(Continued from page 295)

No doubt various circuits will suggest themselves to the experimenter, but one idea which has been proved effective is to use the valve as amplifier and rectifier in a contrast expander circuit to take the place of two separate valves. Here the double-cathode type is most suitable, and, in fact, is essential for stability and correct working. The signal is fed into the first triode section which is treated as a separate valve, having the usual 1 bias resistor in the cathode lead. The second section has grid and anode strapped to enable it to act as a rectifier and the load resistance is then included in the cathode of this particular section. The output is then applied to a variable-nil valve to which the input is also fed, and thus the desired combination for effective contrast expansion is obtained. The arrangement is shown, in skeleton form, in Fig. 4, exact values of components depending upon the particular valves which are employed.

PRACTICAL WIRELESS

Two-channel Mixer

One final circuit will suffice to show how these dual valves may be usefully employed. For home broadcast performances, or even for small public-address equipment, it is desirable to employ an input mixing circuit so that two pick-ups or a pick-up or mine may be used. In the usual way this is accomplished by connecting a volume control across each component and feeding the grid of a single valve. A more effective circuit is shown in Fig. 5, however, and in this the dual-triode is again employed. It will be seen that the output from one instrument is taken one of the grids and the output from the other instrument to the second grid, the resultant output component present at the two anodes then being fed to the output coupling condenser through the usual load resistances and decouplers. With the type 6N7 valve the voltage gain from each grid is approximately 9, and thus it will be seen that this is a very effective circuit to employ on the input side as compared with the more usual single triode arrangement.

There are certain characteristics present in some of the dual-triode valves which render them very suitable for use as single triodes, for which purpose the two grids and the two anodes are strapped together. For instance, in a powerful amplifier it may be desired to employ Class C or Class AB operation for which reason good drive is required. Such an input could be obtained by the use of a 6L6 valve, but equally suited to, but connected as a single triode. In that case the bias resistor would be omitted and the valve would be regarded as a straightforward low-impedance triode.
THIS receiver has proved extremely popular, but all copies of the original issue are now out of print. The details are, therefore, reprinted. The receiver is shown in its simplest form, and the blueprint which is available for it shows only the bare necessities. In this condition, however, the receiver may be relied upon to furnish a most comprehensive log and under all normal conditions some really good DX work may be accomplished with it. After it has been in use for some time, however, it will be found that various little improvements may be added and these are described in this article, so that those who wish to build the set in a more advanced form may do so.

The circuit selected is the simplest reacting detector arrangement, rather than a special circuit utilising an S.G. or H.F. pentode valve. Although home-made coils may be used, a standard 6-pin plug-in coil is specified, but the constructor may build for himself a set of such coils, taking for his data the details given in our issue dated July 24th, 1927, or that which will be found in our hand-book, "Code, Chokes and Transformers." It should be noted that a 4-pin coil is not recommended, although it can be used. The reason is that the aerial has a marked effect on the performance of the receiver, and a 6-pin coil permits of a loose coupled aerial arrangement being employed, with the result that the damping effect of the aerial is removed. A condenser may, of course, be connected between the aerial and the grid winding (thus omitting the aerial coupling coil), but the effect is not so good as when the coupling coil is employed.

The Circuit

Reaction is obtained by means of a standard reaction condenser and winding on the coil, and a capacity of .0005 mfd. or .0003 mfd. should be employed. In most cases the larger value will be found of most use. A normal tubular or mica fixed condenser is connected in the grid circuit with a fixed grid-leak of 3 megohms, but again, this value may be modified and up to 5 megohms employed. The choke is most important and although it is possible to make a very efficient component at home, it is recommended that a really reliable commercial article be selected. This will avoid difficulties due to "dead spots," erratic reactions, etc.

A simple baseboard form of construction is used, as there are only a few components and a chassis is not called for. A good quality coil-holder should be used, and although a metal panel connections should preferably be soldered. The tuning condenser specified has a maximum capacity of .0016 mfd., but if desired you may use temporarily .0005 mfd. standard condenser with a .0005 mfd. fixed condenser in series with it. A .00025 mfd. condenser may, of course, be used, but will give rather more difficult tuning due to the wider wave-range covered with that capacity. A set of coils may be bought or made and with these the receiver may be used to cover all wavelengths from 9 to 10 metres up to 2,000. It is not advisable to try to use a set of this type to tune below 10 metres, and therefore, if it is desired to listen on wavelengths below 10 metres an ultra-short-wave set should be made up.

Fig. 1.—Theoretical circuit diagram of the simple one-valver.

Refinements

The receiver is provided by means of a 66-volt battery and the voltage should be adjusted to give a smooth reaction control. By way of refinements the first improvement would be the fitting of a bandspreading condenser. This should consist of a small variable condenser having a maximum capacity of about 30 mfd., and it may be mounted on the panel quite close to the tuning condenser. It is wired in parallel with that condenser, that is, the fixed and the moving vanes of each condenser are connected together, as shown in Fig. 2. When this addition is made tuning will be very much simpler. The main tuning condenser is simply advanced about one degree at a time, and at each setting the smaller condenser is turned throughout its range, thus spreading out the waveband which each adjustment of the main condenser covers. Good slow-motion dial will be found of the utmost value in a set of this nature, as they enable the small motion of the condenser to be made and many stations which would otherwise be missed may thereby be heard. This

Fig. 2.—Diagram showing how the bandspreader condenser is joined to the main tuning condenser.

Fig. 3.—How a 4-pin tuning coil may be used. (Continued on next page.)
SHORT-WAVE SECTION

(Continued from previous page)

will be especially noticeable where two or more stations are found very close together on the main tuning condenser. A slight movement of this, and the band spreading condenser will enable quite a large movement to be made with the dial to separate these stations and overlap will be avoided.

Coil Ranges

In the Ed dystone range there are 9 coils of the 6-pin type which may be used, and to enable the constructor to obtain some idea of the ranges covered the following are the type numbers and the bands which are covered with a .00016 mfd. condenser:

- 6BB 9-14 6P 150-325
- 6LB 12-25 60 290-510
- 6Y 22-47 6BR 490-1,000
- 6R 41-94 *60Y 1,000-2,000
- 6W 76-170

If a .00025 mfd. condenser is used, or if the .0005 condenser scheme is adopted, the tuning range will be slightly greater than the above figures, and this will obviously be accompanied by the tuning difficulty already mentioned. It is desirable in a short-wave set to provide as small a tuning band-width as possible, so that difficulties in tuning due to the close proximity of different stations are removed. Another important point regarding tuning concerns the minimum wavelength to which each coil may be tuned. This is dependent upon the minimum capacity of the tuning condenser and an inferior condenser will obviously tune to a higher minimum wavelength.

WIRING DIAGRAM OF THE SIMPLE ONE-VALVER

... (Diagram of the wiring diagram)

NEWS FROM THE TRADE

Varley Dry Accumulators

We recently reviewed a new type of dry accumulator produced by Varley and we are now informed that this special unit is available in a wide range of sizes. These embrace various capacities from 21 A.H. to 40 A.H. types and the smallest model is suitable for use in a torch, the actual cell measuring 2¼ in. in height and 1½ in. in diameter. This particular cell costs 2s. 6d. and it weighs 8½ ozs. Full details of the complete range may be obtained from Messrs. Varley Dry Accumulators, Ltd., at By-Pazes Road, Darting.

Taylor Electrical Instruments, Ltd.

We are informed that Taylor Electrical Instruments will continue to produce their full range of instruments during the war, and that any of this, and the position of most models is quite satisfactory, and other types are at present in production, and delivery will be available shortly. At the moment no price increases have been announced. Additional new factory space has been taken at Slough for the express purpose of manufacturing a large and comprehensive range of precision moving-coil meters, full details of which will be released when they become available.

BOOKS RECEIVED

Modern Armaments. By Professor A. M. Low. Published by The Scientific Book Club. 274 pages. Price 2s. 6d. to members.

Everyone interested in armaments will find a mine of information on the subject in this new book by Professor A. M. Low, who is an acknowledged authority on all types of modern armaments. The subject matter is dealt with in a simple and popular manner, and is readily understandable to the ordinary reader. The book is divided into seventeen chapters covering, amongst other subjects, Explosives; Small Arms; Artillery; Chemical Warfare; Warships; Mines and Torpedoes; Tanks; In the Air and Parachutes. Amongst a host of other details the reader is told about the secret of manufacture of big guns; how machine guns and other automatic guns and rifles work; all about explosives and ammunition; how guns and incendiary bombs are made; the development and manufacture of tanks and armoured cars; all about battleships and aircraft carriers the mass production of aeroplanes; and how that wonderful apparatus, the predictor, works. There are also interesting chapters on the adaptation of weapons to peace-time use, such as the employment of gas for destroying rats and other vermin. This book which is illustrated with several fine photographic reproductions, can be recommended to all well-informed persons who are anxious to keep up to date with the latest scientific developments in connection with armaments, and to learn how some of the modern instruments of warfare may be turned to good use in peace-time occupations.

Practical Electrician's Pocket Book

The forty-second edition of this handy book has just been published and a new section of particular importance has been included on "Lifts and Their Maintenance." Dr. A. F. M. Fleming, Director of Research, Metropolitan-Vickers Electric, and past president of the I.E.E., contributes a brilliant technical summary of the industry's progress during the year. In his preface, the Editor mentions that the "Pocket Book" widened its appeal during the Great War and suggests that it will again prove of yet greater value under present conditions.
The "Simplest Short-waver"

Sir,—After about three years of short-wave listening I am writing to let you know how pleased I am that I built the one-valve receiver, the "Simplest Short-waver." It certainly is a fine receiver, and I can recommend it to anyone wishing to begin short-wave listening with a small outlay. I certainly was pleased to receive VU2QQ's 'phone with an 0·9 v. version of it, and a long wire aerial. In stating this I must point out that the arrangement is difficult to receive here owing to the direction of the aerial.

To encourage other listeners who wish to build a low-priced receiver from junk, I am enclosing a list of 14 m.c.s. DX heard here on an 0·7 v. receiver; built with the exception of the coil former, entirely of B.C. parts with lathe-inlaid, and containing most of the features of the "Simplest Short-waver." The aerial in use is a 38 ft. one, 8 ft. high, and 9·8 SW.

All continents have been received, and all stations are heard on 'phone.

They include: VX4XJ, VSTRA, ZC6BO, VE7ZZ2, VE6IC, VQ2FQ, VO4A, W1, W2, W3, W4, W7BV0, W8, W9, HBN, VP0MR, VP0L, VP2NS, QO8XJ, PY2, PY3, PY4, PY7, YV1, YV5, CE3AT, SU1, SU3IR, O1NAF, CN88, VQ4, VQ2HC, ZS2X, ZS0CW, PF4AL, PA3, PA8. Western European includes OT2AB, YR5IC and PB, SV1(3), SP1(2), LY(2), ES6D, OK1SV, OH2OL and ZB1LA.

I am hoping your fine paper will continue to keep the spirit of amateur radio alive throughout the war.—R. TAYLOR (Birmingham).

A DX Log from Purley

Sir,—I append my DX log of stations heard during the week, in the hope that it may interest other readers.

10 metre amateur band: W1, 2, 3, 4, 5, 6 (13 W5's heard in ten minutes one evening).

11 metres: W2XJJ, W2XQQ (New York); W6XPD (St. Louis); W8XNU (Cincinnati); W8XLI (Superior) and W6XZA (Washtenaw).

13 metres: W6RA, WCBB, WBPL.

16 metres: W6EC, WCBB, WPLT, W6UW (ex-W1XAR), TGWA, JZI.

20 metre amateur band: W1, 2, 3, 4, 5, 6, 8, 9, Z2D.

21 metres: SUZ.

22 metres: W6PT, WCBB, W6UL, HPSI.

27·20 metres: V6K (Sydney commercial station), FMN.

29 metres: VUD3, CXA8, HJ4CAG, LRA1, W6GOE, W6RCA, WBOS.

48-9 metres: W6NM, WCBB, W6JM (ex-W6XLA), W6CW (ex-W6XCI), CFCJ, HJ3CAX (very well heard now), HPSI.

61 metres: VUD2.

I am in need of an S.W.L. correspondent in Great Britain or abroad.—T. B. WILLIAMSON, 3, Highland Road, Purley, Surrey.

Exchanging S.W.L. Cards

Sir,—I have been short-wave listener, and collect S.W.L. cards. I would therefore like to exchange my card with any full-ticket, A.A. or S.W. listener.—WILLIAM J. ORME, 1, Waterbeach Road, Slough, Bucks.

Sir,—Several months ago I wrote to your paper and asked for correspondents, and as a result of the publication of my letter I received seven letters in three days, and five more a few days later. I have now six regular correspondents who have all been of great help to me in my experimenting.

I wish to apologise to those whose letters I could not reply to owing to the cost, and so I had to keep a regular correspondence with only the first few that I received.

I now have QSL's from TFJ, ZRO, OLR5A, W2XY, PY3EN, V50CC, and have sent reports to various other stations. I would like to swap my S.W.L. card with readers living in Africa, India, or South America.—M. PARKS (Norlands, Middletoncave, Malton, Yorks).

Sir,—I shall be pleased to exchange my S.W.L. card for that of any "Full" A.A. or S.W.L. anywhere in the world, and will endeavour to reply to each card per return.

Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents, nor must he be held responsible for the name and address of the sender (not necessarily for publication).

December 23rd, 1939

PRACTICAL WIRELESS

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I would also like to bring to the notice of readers of Practical Wireless that my friend, Ken Graves, 296, Hollins Road, Oldham, and I are running a QSL Exchange Service, and any readers who are interested, and will write to either of us, will be given a hearty welcome. This Service is to keep the "Ham Fires Burning" until pre-war conditions are with us again.

In conclusion, I would like to say I greatly appreciate your paper, so "carry on, Practical Wireless."—FRANK CLEMENTS, 11, Lynydart Avenue, Great Lever, Bolton.

Religious Broadcast Services

Sir,—I wish to express my thanks to Thomson for his remarks in the issue of Practical Wireless of November 18th, when he states that: "Just about the time when I am able to listen-in each evening there is usually some mournful music or a religious service." The number of the services on week-days is increasing, and it would seem that this religious work is being delegated by the clergy to the B.R.C. If there is such a demand for sermons and hymns singing, why do not the clergy open their churches on week-days, and give those enthusiasts a chance of queuing up for admission? A well-known local paper told us recently that these additional week-day services were for the benefit of the aged and infirm, but considering that they take place as late as 10.30 p.m., it is probable that such pious wish would be resting.—A. DUNNOLY (Newcastle-on-Tyne).

Stability

The ideal receiver should be absolutely stable on all wavebands, and this end can only be obtained by effective screening, rigid leads and proper wiring. It is seldom possible to build a receiver of high sensitivity which is absolutely stable, and short waves in such a manner that when tuned to a very distant station an ear-drawn plate may be inserted at any part of the receiver without affecting tuning in the slightest. This end can be obtained, however, if the above points are attended to, and "noise" leads, such as those to the top caps of valves, are anchored or passed through rigid screening tubing.

Directional Aerials

When using directional aerials for receive distant reception, a card pass or similar direction indicator is a valuable addition to enable the exact direction in which the aerial is pointing to be determined. If such an indicator, in conjunction with a world map, is employed, it will be found that some interference is obtained from the point of view of the "bending" of radio signals due to some peculiar ground contours in the vicinity. Obviously such experiments are of great interest, and the higher frequencies.
**Practical Wireless**

**BLUEPRINT SERVICE**

**PRACTICAL WIRELESS**

<table>
<thead>
<tr>
<th>No. of</th>
<th>Universal Hall-Mark (HP Pen, D, Push-Pull)</th>
<th>P841</th>
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<tr>
<td></td>
<td>A.C. All-Wave Corona Four</td>
<td>P821</td>
</tr>
</tbody>
</table>

**SUPERHERBS**

- **Battery Sets:** Blueprints, 6s. each.
- **Two-valve:** Blueprints, 5s. each.
- **Four-valve:** Blueprints, 6s. each.

**Mains Sets:** Blueprints.

**SHORT-WAVE SETS:** Battery Operated.

**PORTABLES:**

- **Portable:** Blueprints, 1s. each.
- **Four-valve:** Blueprints, 1s. each.

**Miscellaneous:**

- **Blueprint, 1s:**
- **SW Converter-Adapter (1 valve):** P848A

**WIRELESS AND WIRELESS MAGAZINE**

**CRYSTAL SETS.**

- **Twofold:** Crystal Sets.
- **1934 Crystal Set:** P834
- **1940 Crystal Set:** P844

**MAIN OPERATED.**

- **Two-valve, 6s. each:**
  - A.C. Two (D Pen, Pen)
  - A.C. D.C. Two (D, Pen)
  - A.C. D.C. Two (D, Pen)
  - A.C. D.C. Two (D, Pen)

- **Three-valve, 6s. each:**
  - A.C. Two (D Pen, D, Push-Pull)
  - A.C. Three (D, Pen, D, Push-Pull)
  - A.C. Four (D, Pen, D, Push-Pull)

- **Four-valve, 6s. each:**
  - A.C. Four (D, Pen, D, Push-Pull)
  - A.C. Four Super (D, Pen, D, Push-Pull)

**Mains Operated.**

- **Two-valve, 6s. each:**
  - A.C. Two (D Pen, Pen)

**Short-wave Sets, Operated.**

- **Two-valve, 6s. each:**
  - Four-valve (D, Pen, D, Push-Pull)
  - Superhet (D, Pen, D, Push-Pull)

- **Four-valve, 6s. each:**
  - Superhet (D, Pen, D, Push-Pull)

**Superhet Sets:**

- **Three-valve:** Blueprints, 1s. each.
  - Battery Superhet (D, Pen, D, Push-Pull)
  - Universal Superhet (D, Pen, D, Push-Pull)

- **Four-valve:** Blueprints, 1s. each.
  - Battery Superhet (D, Pen, D, Push-Pull)

**Miscellaneous:**

- **Blueprint, 1s:**
- **SW Converter-Adapter (1 valve):** P848A

December 23rd, 1939

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These Blueprints are drawn full size. Copies at nominal charge, including descriptive details of apparatus and method of operation, are available at the following prices, which are additional to the cost of the Blueprints. A dash before the price mark indicates that the copy is in print.

**Cost of Crystal Wireless Blueprints:**
- A.C. Two: Full print, 1s.; Half print, 10d.; Copy, 5d.
- A.C. Three (D, Pen): Full print, 1s.; Copy, 5d.
- A.C. Four: Full print, 1s.; Copy, 5d.
- A.C. Four Super: Full print, 1s.; Copy, 5d.

**Wireless Magazine.**

- The number indicates which page the blueprint number is located. The description gives the price of the blueprint and the number of pages that precede it in the magazine.

**Mains Operated:**

- **Two-valve:** Blueprints, 6s. each.
  - A.C. Two (D, Pen, D, Push-Pull)
  - A.C. Three (D, Pen, D, Push-Pull)

- **Three-valve:** Blueprints, 6s. each.
  - A.C. Three (D, Pen, D, Push-Pull)
  - A.C. Four (D, Pen, D, Push-Pull)

- **Four-valve:** Blueprints, 6s. each.
  - A.C. Four Super (D, Pen, D, Push-Pull)

- **Miscellaneous:**
  - A.C. Two: Full print, 1s.; Copy, 5d.
  - A.C. Three (D, Pen): Full print, 1s.; Copy, 5d.

**S.W. Converter-Adapter (1 valve):**

- **Two-valve:** Blueprints, 6s. each.
  - A.C. Two (D, Pen, D, Push-Pull)
  - A.C. Three (D, Pen, D, Push-Pull)

- **Miscellaneous:**
  - A.C. Two: Full print, 1s.; Copy, 5d.
  - A.C. Three (D, Pen): Full print, 1s.; Copy, 5d.

**Short-wave Sets, Operated.**

- **Two-valve:** Blueprints, 6s. each.
  - Four-valve (D, Pen, D, Push-Pull)
  - Superhet (D, Pen, D, Push-Pull)

- **Miscellaneous:**
  - A.C. Two: Full print, 1s.; Copy, 5d.
  - A.C. Three (D, Pen): Full print, 1s.; Copy, 5d.

**Superhet Sets:**

- **Three-valve:** Blueprints, 1s. each.
  - Battery Superhet (D, Pen, D, Push-Pull)
  - Universal Superhet (D, Pen, D, Push-Pull)

- **Four-valve:** Blueprints, 1s. each.
  - Battery Superhet (D, Pen, D, Push-Pull)

**Miscellaneous:**

- **Blueprint, 1s:**
- **SW Converter-Adapter (1 valve):** P848A

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Note: The description of the blueprint indicates the price of the blueprint and the number of pages that precede it in the magazine.
Operating Mains Sets

"We are unfortunately not on the mains, but have our own electric-lighting set consisting of a petrol engine driving a dynamo which charges about 25 cells from which we get 50 volts. Is there any way in which this could be made use of for using mains apparatus as I have often wished to make up a motor for the Air Harvester, but have so far been unable to do so."—P. H. (Harrow-on-the-Hill).

PROBABLY the simplest and most satisfactory way to do it would be to obtain one of the vibratory rectifiers designed to operate from 6 or 12 volts D.C. and in conjunction with a suitable transformer, would deliver 290 volts at sufficient current to operate a reasonable mains receiver, but the transformer may be the limiting factor. A rectifier and transformer may be obtained from Messrs. Bulgin.

Aerial Position

"I have read an article on airmail and am desirous of knowing whether my aerial, of which I enclose a diagram, would be suitable for short-wave reception as in the article it mentions about screening. The house is well clear of other buildings and except for possible roof screening is ideally situated."—R. D. (S.E.5).

The effective height of the aerial is the height above the nearest earthed body. As your aerial runs parallel with the roof and is supported on 8ft. poles, then the effective height is only 8ft. This is especially so as the roof immediately below the aerial is low sheeting. However, as many radio problems, theory and practice may not run hand in hand, and the effective height of the aerial may be much better than those you would obtain if you used the same aerial on the 8ft. poles down in the garden. We would suggest, however, that a single wire, rather than a double wire system, would be preferable, especially if your wires are not widely spaced.

Choke Coupling

"I noted a recent reply by you regarding choke capacity coupling, but in looking up some old circuits I have found a scheme which does not appear to agree with your remarks and should like to know whether you can explain the idea. It appears that the aerial circuit includes a resistance, but the anode is then joined to a condenser which is fed to a centre-tap on a choke and I am not clear how this particular arrangement works."—L. E. (Bath).

The circuit may have been drawn in the order of the symbols and the choke is no doubt a standard L.F. transformer with primary and secondary joined in series. The condenser is fed to the junction and thus we have an auto-transformer coupling, the exact ratio of the transformer depending upon the relationship between primary and secondary and the method of joining of the two windings, i.e., in phase or out of phase. Thus the circuit in question is merely a parallel-fed auto-transformer arrangement.

Bias By-pass Condenser

"Is the value of the by-pass condenser across the bias resistance included in a cathode circuit critical? I have seen 32 mfd. used in some circuits and 25 or even 50 mfd. in other circuits, and I am building a set and wish to have the correct type of condenser."—F. C. V. (Birmingham, 9).

The capacity will govern the degree of bias, and whilst simple types of circuit a 2 mfd. may be suitable the higher capacities are preferable. If, however, small valves and inadequate H.T. are used, it may not be worth having this extra capacity, and while to go to the trouble of using the larger capacity as the low-noise reproduction will be poor in any case.

Heater Leads

"I am making up an A.C. receiver and am rather anxious regarding the wire to be used for wiring up the heaters. In some receivers which I have looked at I find that solid wire is used, whilst in others flex has been employed. Does it matter what type of wire is used, provided that the current-carrying capacity is ample for the heater circuit?"—H. R. A. (Teddington).

The usual reason for using flex in that it is more easily bent to follow the run of wiring. If solid wire is employed, for a given current rating it will be heavier than the stranded or flexible wire, and therefore more awkward to twist and bend. Furthermore, the flex must be bared at the points where it makes contact with the various valveholders in the wiring and this means that there are two junctions at each valve heater pin. This may lead to difficulties as there will be an undue thickness of wire at that point. By using solid wire of suitable diameter it may be soldered to a valve pin, insulated sleeving slipped over ready cut to a suitable length, and thus only one joint has to be made and this is generally simpler for the amateur.

Three-range Coils

"I wish to build up an all-wave receiver as published some time ago in your paper. I am told, however, that the coils are not made now and I should therefore like to know if you can recommend a substitute."—B. D. (N.W.9).

The coils in question have been withdrawn and there are no exact replicas now available. However, in the Bulgin range you will find some all-wave coils which you may prefer to use, or alternatively you could build up an all-wave unit with the small individual coils which Bulgin are now marketing. Therefore it would have to be arranged at right-angles to each other and with suitable switching.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because of general interest.

M. H. S. (Harlington). In view of the various types of circuit which can be made up, it is not possible to reply to the type mentioned.

H. R. B. (Thornton Heath). Selectivity is bound to be low, but a simple arrangement would adequately be effected by including an ordinary small variable condenser in the cathode circuit. This, however, tends to indicate that there may be some mistake in your coil wires.

A. S. (Edinburgh). Hamburg is a not short-wave station. There is nothing peculiar about the crystal set, and much depends upon local conditions.

E. J. (Newark). The name of the man is given in our issue dated December 9th, which you have not. G. B. S. (W.J.P.). We regret that we cannot insert your request, and suggest you take a small advertisement for the purpose.

H. H. (Edinburgh). Without a type number, it is not possible to give connections as the firm in question have made many coils of the type described.

J. B. (Warshall). We regret that we cannot give connections from the details given in your letter.

C. T. (Leicester). We regret that we cannot supply a blueprint of the type mentioned.

E. E. (Chester). As this is a commercial model, we can only suggest you communicate with the makers.

J. E. (Cardiff). The condenser may be faulty, but there may be no need to alter the coil. If, however, reactions do not prove effective add about 20 to 30 turns to the reaction winding.

We regret that we cannot identify the apparatus and thus are unable to give you information.

E. W. W. (Gigimda). The aerial would probably be better than a simple flat wire, or a short-wave wire, as a coiled aerial.

R. R. (High Wycombe). The radiator cost £0.10 each.

F. B. (Manchester). The general advice is that the valve be taken over-run. We cannot reply more fully to your detailed letter in the absence of a stamped addressed envelope.

R. N. P. (Old Betchley). It is necessary to trace the fault before you can effect a cure. There are dozens of faults which could give rise to the effect and a stage-by-stage test is indicated.

E. A. (London). The resistance generally has a value of 20 to 50 ohms. It is not critical.

P. A. (Hilbrow Road). A defective valve could give rise to the symptoms mentioned. Have the valve checked.

F. R. (Smethwick). We have no details of the coils or circuits mentioned and the paper in which these were originally described is not now on the market.

A. T. W. (Sanderstead). We regret that we have not described a portable of the type mentioned. We have no further details of particular local conditions and therefore cannot give a guarantee as to reception on a set of type mentioned in your letter.

O. P. A. (Lisburn). There are two or three different ways of curing an oil leak in the absence of a drain, but the idea utilizing a valve beneath carpeting, etc., and a small pick-up frame is included in the usual knowledge.

The coupon on page iii of cover must be attached to every query.
THE POCKET TWO
(Continued from page 202)

condenser is then desirable to enable certain stations to be separated. The addition of a lead will in some cases improve signal strength, but in many cases will not prove essential. Remember, however, that your complete system can sometimes be removed if an earth connection is used, whilst in other cases the earth lead will result in improved signal strength. A list of the parts used is given below.

LIST OF COMPONENTS

Two Variable Condenser, 0.001 mfd type C.V 19 (Bulgin).
One Mosed Capacitor type C.40 (Bulgin).
One Midget L.F. Transformer, type L.F 58 (Brook). 
Two Valveholders, type V.H.19 (Bulgin).
Two 250/120 H.T. Condenser, 1 mfd (Bulgin).
One 0.001 mfd Mica Condenser (Dadlecil). 
One 0.01 mfd Tubular Condenser (Dadlecil). 
One 0.0005 mfd Micro Condenser (Dadlecil). 
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PRACTICAL WIRELESS

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PRACTICAL WIRELESS

EDITED BY
F. J. CAMM

STAFF: W. J. DALANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Home-made Test Equipment

We have often described items of interest for the constructor who is anxious to make up test equipment for various purposes. Unfortunately, many such items have to be calibrated against some standard and this often renders such items useless owing to the fact that suitable standards may not be easily available for the calibration process. Outside of such items, however, there are many which may be calibrated by ready-made parts, and when completed they form a valuable addition to the home workshop or even the service's bench. In this issue, for instance, we describe a resistance-capacity bridge, in which standard parts are fitted. The dial has, of course, to be marked off or calibrated according to the components which are used in the instrument, but when completed it forms a ready and accurate instrument for the measurement of components which may be suspected or which are being tested before use in a receiver. With instruments such as these it is worth while remembering that the normal tolerances which the manufacturer allows will have to be taken into account, or special components obtained which have a guaranteed accuracy. Usually there is an additional charge for such components, but this is considered worth while by those who are making an instrument upon which they intend to place great reliability.

Radio Sermon Hits Home

A SERMON broadcast from WLW by the Rev. E. Howard Cadle, of Indianapolis, was recently credited for the surrender and alleged confession of Floyd Waters of Newport, Kentucky. To charges of participating in a hold-up last June, he gave himself up to Indianapolis police. The hold-up occurred at Beverly Hills Country Club in Kentucky, located across the Ohio River from Cincinnati. Tearfully Waters declared that he wished to "pay my debt to society." The message which Waters heard was broadcast from WLW on Sunday, November 12th, and prompted him to see the Rev. Mr. Cadle in Indianapolis and confess. Waters was reported to have heard the sermon in Dayton, Ohio. His wife is employed at Wright Field army airport located there.

Waters, aged 37, and a former boxer, was one of five men wanted in the hold-up, Newport, Ky, officials said. Three others, Gus Fiech, Sam Schwaecker and Warren McHugh, are still at large.

Whodunnit?

DICKSON CARR has written a detective thriller for production by John Chestle on December 27th, under the title of "Whodunnit?" The play is to be produced in three episodes. In the first, his character, John Chestle, from the Daily News,enna, through the eyes of a witness, in the second instalment a suspect will be put on trial, and in the third instalment the crime will be reconstructed as it actually took place.

C'est Magnifique!

The sub-title, "A Collection of War-time Absurdities," is given to the programme called "C'est Magnifique," compiled by John Midgley and M. H. Allen, which is to be broadcast on December 30th. The programme is designed to show some of the more ridiculous aspects of the war, and, "W. H. Allen, who wanted to know what was wrong with the clock. Hinn looked around, but couldn't see it. A ticking beneath his pillow disclosed the whereabouts. True to his plan, Hinn had risen at 4.40, shut off the clock—and then taken it back to bed with him!"
WHILST conditions have slightly improved since the declaration of war—they could not possibly have gone below the zero mark reached in the first few weeks of the conflict—it cannot yet be said that the performance and broadcasting of good music is in a satisfactory condition. Bad music, yes—all. But as I make it my job to write wholly about good music, my remarks must be confined to those parts of the wireless programmes provided by the symphony orchestras and the artists who co-operate with them.

When I wrote about the Promenade Concert programmes, it was my intention to review future wireless programmes, and to help readers to attend those occasions that they devoted to listening-in. I'm afraid this is no longer possible, as I do not now have as much time for music and may not be able to read information as heretofore. Whether conditions will so improve in the near future as to permit of their resumption I cannot yet say. In the meantime a short analysis of existing circumstances, with some suggestions for improvement, may be of interest.

Slump in Good Music

I will take what I consider to be the most important aspect of the present situation first. The slump in the performance of good music is most probably furnishing the chief cause of the lamentable decline in study that is reported from all parts and all classes. It is also reflected in the remarkable decrease in the sales of music which the big publishers are forced to record. It is the most natural thing in the world for a student who was expecting, or at least working to take a place in the musical world during the next year or two, to abandon his studies "for the duration." He sees that, there is little or no chance of his talents being engaged owing to the lack of demand in the concert world, and his only prospect is to be compelled to continue his studies, with their attendant expenses, at Hitler's pleasure. There is also the war's immediate aftermath—to continue—a very unpredictable period. It is no wonder then, even if private circumstances don't compel him to call a halt, he should voluntarily do so, and to reside where and when conditions are more propitious. The air-raid scare has been a big factor, too, in cancellation of study, more especially with children. But I don't think the economic factor has yet entered into it at all a high degree. But the absence of so much good music, and the inferior quality of the performance of much that we do produce, is bound to act as a deterrent to study, and the consequent replenishment of the market, which is as important for the sale of music as it is to anything else. Music needs a shop window and advertising, just the same as any other commercial article. And this has been almost in the form of the symphony concert, the open, and the recital. It is very important for the future of the profession that they be restored, both as to quantity as well as quality, as soon as possible.

Lack of Broadcast Programmes

Another reason for the decline is the broadcasting of only a single programme. But this concerns only the quantity of music given us at the present time. The quality of it is really much more important, whilst the decrease in the size of the R.B.C.'s main symphony orchestra might be explained and defended from different angles not visible to the average listener; it is difficult for anyone of average intelligence to understand why the Bournemouth Borough Council should find it necessary to reduce its famous orchestra of over seventy players to a beggarly eighteen. No wonder their popular name is now missing from the Radio Times. It makes the performance of symphonic music absolutely impossible, and even of lighter genres very insidious. And the story has to be repeated all round the country, though seldom to such a drastic degree. The Bournemouth people have been long a splendid body of musicians, and the privileged accompanists of a long line of renowned soloists, which makes this sad decline in their fortunes greatly to be deplored.

Eroneous Theories

Those of us who remember the last war cannot recall any such catastrophic avalanche overwhelming music. Why has it happened this time? So far as the public performance of music is concerned, with the attendant concentration of large numbers of people in buildings and their dispersion afterwards, the air-raid bogey must be held responsible. What is it not responsible for? The proccedings of YOUR have a lot to answer for. We all know that anything may yet happen. But there is now no doubt whatever that the forecasts that "Mr. Knowall" and "Mr. Wisdom" have been making for years past were quite erroneously based on the above theory that what happened to Spain, Abyssinia and China would happen to London on the outbreak of war—all war being alike to them. Just in the same way that a shower of rain will wet the roof of London houses like it does in Madrid, Addis Ababa and Pekin. What a thousand pities. The people cannot be wholly blamed, because the belief entered all classes and was tenaciously clung to by high and low alike. But its barnful influence and results can now be seen in the virtual extinguition of the entertainment world, which presents a spectacle com-parable to that of a dying man being kept alive by means of artificial respiration. None of these deplorable consequences need have resulted, but had a rational and calm point of view been accepted side by side with the obvious precautions which both producers and listeners alike did take. But in saying, in effect: "Friends, Romans, countrymen; aerial warfare is possible, and this is such a moment as requires such and ample reasons. Although you might be bombed whilst listening to a concert or watching a cinema, we think it extremely improbable. We only mention it as a matter of curiosity because it is our duty to look after you, and in the pursuit of that duty we are placing at your disposal such and ample measures of a precautionary character. But go about as usual, enjoy yourselves, and keep a sharp look out." They said, in spirit and meaning: "Good people and eminent victims; war has begun, and we are working to find a new solution of your assumption that, to-night, you will all be blown up sky-high. Consequently, we should treat it as a great delusion of our responsibilities if we allowed you to assemble in any place of entertainment. Public houses excepted. Nor may you mind not being able to see where you are going, catching the wrong train, or being knocked down in the black-out and perhaps killed. What does it matter, we are all going to be killed anyway. YOUR cheerfulness, YOUR courage, YOUR fortitude will bring us VICTORY." The results are for everyone to see.

A Few Good Concerts

There are a few good concerts on, notably the Philharmonia under Sir Thomas Beecham. But they are at awkward hours, which doubtless prevents many from attending them who would otherwise have done so: and few of them are broadcast. The E.B.C. with its reduced forces are giving their famous series of symphony concerts in the Columbia Hall, Bristol. But only half the programmes is now put on the air. In listening to orchestral music over the wireless it is easy to tell where the reduction in size of the engagement—in the brass and wood-wind. I suppose these departments are almost impossible to recruit from the many small musicians who practise nowadays. Were the diminu- tion in the strings there would be little or no trouble. There are some good women flautists and oboists, but I have no idea how many are available for regular orchestral work. It was, of course, the last war which saw the first appearance of a woman in a symphony orchestra—the then Queen's Hall Orchestra, under Sir Henry Wood.
An All-wave H.F. Unit
A Simple Unit which Will Improve the Range and Selectivity of “Straight” Receivers
By L O SPARKS

RECEIVERS of the detector and “L.F.” type are still quite extensively used, and their degree of popularity is, no doubt, due to the fact that if they are well designed, they are capable of giving very satisfactory results. Their general capabilities are, however, limited, as every user discovers sooner or later, and the purpose of this article is to show how a simple unit can be made which will give an over-all increase in efficiency and likewise eliminate the major limitations.

With an aerial feeding straight into a detector stage, it is not possible to obtain, in all areas, a degree of selectivity sufficient to ensure that when a wave is received will be entirely free from interference caused by other transmissions. Similarly, the sensitivity of a detector cannot be increased beyond certain limits and, when these are reached, the addition of further stages of L.F. amplification will not compensate the inability of the detector to pull in a very weak signal.

Fortunately, both of these defects can be overcome to a very great extent by the same remedy, and that is by the introduction of a stage of tuned high-frequency amplification.

While many constructors appreciate these details already, they have refrained from adding the H.F. stage because they did not wish to rebuild or enlarge their existing receiver. These quite sound reasons have been borne in mind when constructing the unit described below, and it will be seen that there is not the slightest need to modify the receiver in any way, as the H.F. stage is made up as a separate item so that it can be placed alongside practically any receiver of the “straight” type, whether designed for short or normal broadcast wavelengths.

The Circuit

The theoretical circuit is shown in Fig. 1. This in itself calls for little explanation, but for the benefit of those not too familiar with H.F. amplification, a few words might not be amiss.

The aerial circuit utilizes a coil of the plug-in type, such as those used for short-wave reception, thus allowing the tuning band which the unit will cover to range over the short, medium and long waves according to the coil used. With the specified tuning condenser, a .0005 mfd capacitor, it will be necessary to use the B.T.S. “One Shot Inductors,” as these are designed to tune over all the wavebands concerned with a condenser of that value.

Although the primary winding of the coil is used as a coupling coil for the aerial, a small variable condenser is provided in series with the aerial connection to provide an additional means of getting the highest possible degree of selectivity on all wavebands.

The valve recommended is the Cossor 210VPT, of the four-pin type, and as this has variable mu characteristics, it enables a very fine form of pre-detector volume control to be secured by the simple procedure of varying the bias applied to the grid via the tuning coil. A potential at the anode of the H.F. valve through a small fixed condenser. The purpose of this condenser is to pass on the signal to the second tuned circuit connected to the grid of the detector, without allowing the passage of any of the high tension which has to be applied to the anode of the H.F. valve via the H.F. choke and the resistance of 10,000 ohms. If an all-wave H.F. choke is to hand, the resistance can be omitted, as it is only included to take care of the higher frequencies of the short waves if these are to be received, and if an ordinary H.F. choke is used. The tuned-grid coupling is the method used in this unit, but in place of the second coil shown in Fig. 2, use is made of the aerial coil in the receiver to which the unit is connected, therefore the only components required for the additional H.F. stage are those shown in the wiring plan.

The output from the unit is taken from the free end of the fixed coupling condenser, as shown in Fig. 1, and fed into the receiver via the normal aerial terminal, the aerial proper being joined to the aerial terminal on the H.F. unit.

Construction

As the circuit is so simple, and as so few parts are required, there is no necessity to use chassis construction, so a five-ply baseboard 8in. x 5in. was used. All the components shown thereon were cut from a piece of three-ply, oak-faced, and after the holes for the aerial series condenser, the potentialmeter, the control spool plate and the tuning spindle have been drilled as indicated on the panel plan, the surface can be smoothed, stained and polished to suit individual tastes. Once the panel is screwed to the baseboard, the remainder of the wiring can be completed and the unit made ready for test.

Flexible leads must be fixed for the battery supplies to the anode and screening grid of the H.F. valve, namely, 120 volts and 60 to 70 volts, respectively.

(Continued on next page)
AN ALL-WAVE H.F. UNIT.
(Continued from previous page)

filament will require two more leads, which can be connected to the accumulator supplying the receiver, while two more will also have to be fitted for the positive and negative sockets of a 9-volt G.B. battery.

Regarding the battery supplies, there is one point which must be watched, although it is hardly likely to crop up in the majority of modern receivers. It is essential that the H.T. and L.T. negatives of the batteries feeding the receiver are common with the earth connection.

Operation

With the appropriate coil in the H.F. unit, connect the output socket to the aerial terminal of the receiver, after removing the aerial from that point and connecting it to the aerial terminal on the unit. The earth connection can remain on the set in the ordinary way.

When all battery leads have been connected and the set switched on, tune the receiver to the known setting of a station and then tune the H.F. unit, setting the H.F. volume-control at maximum and the reaction at minimum. Now experiment with the last two controls until the best result is obtained. It will be noted that reaction will be more smooth, and it will not be necessary to use so much of it for a given result, compared with the original circuit.

Five Ways of Electron Emission

THE recent intensified development of all forms of electronic devices has brought to the fore the fact that there are five practical ways in which electrons can be produced, or released from conductors, by supplying them with sufficient energy to break through the surface of the conductor. Many readers may only be familiar with two or three of these, so in view of the present-day importance of electronic engineering in all its various aspects, it will be interesting to recapitulate the five popular methods. In the first place, the action of a thermionic valve depends on the emission of electrons from the cathode, and this is brought about by heating this electrode either directly or indirectly, by the passage of a current of electricity. The cathode of the valve is made from a substance which has the property of releasing electrons through the agency of heat, and their subsequent action under the influence of other electrodes inside the glass bulb is familiar to every reader of PRACTICAL WIRELESS. Next comes the emission of electrons from such surfaces as caesium, rubidium, potassium, etc., as a result of their being brought under the influence of light. This conversion process is the method by which every photocell is made to function, and depending on the chemical nature of the substance used for the cathode, the cell will have a definite colour response to the light which activates. Then we have the cold emission of electrons which occurs under certain specified conditions when the surface of a metal is subjected to the presence of a very intense electric field of force. The fourth method depends for its action upon the ionisation of gases. That is to say, an electron impacting or colliding with a molecule of gas causes it to release a further free electron which in turn will perform a similar function, so that the effect is cumulative. It is this principle which is employed so effectively in gas-filled photo-electric cells in order to increase the output current for normal working purposes. The final, and in many respects perhaps the most important, scheme for releasing electrons is that known as secondary emission, whereby the impact on a conductor of an electron travelling at a very high velocity dislodges one or more electrons from the surface of that conductor. According to the method used for preparing the secondary emissive surface, and the nature of the substance employed (caesium appears to be the most generally used at the moment), so the number of secondary electrons released by the impact of a primary electron will vary from one to ten.
A GREAT deal of interest has been aroused by articles recently published in these pages regarding loudspeaker design. It is obvious that the problem is one which has the greatest attraction for the average listener, and in view of this, the following details, which are a reprint of part of a paper allocated for reading before the Institution of Electrical Engineers, will undoubtedly prove of value to those who are studying this section of the modern radio receiver. The paper is by W. West, B.A., and D. McMillan, B.Sc. After dealing with the various principles which are introduced into design and into the general features which are necessary in order to obtain high quality reproduction, the authors go on to say that advantage was taken of the great skill and experience which has been acquired by manufacturers, in order that a cheap and efficient product could become available, without necessary avoidance for laying down expensive additional plant. Departures from usual constructions have, therefore, been made only where experiment indicated that sufficiently improved quality of performance would result therefrom, and where the modifications involved appeared to be feasible from the constructional point of view.

In this article are summarised the influences, affecting quality of performance, of the various parts which make up a moving-coil loudspeaker, as they have been confirmed or revealed by the experiments. No modifications have been made which affect appreciably the sensitivity, except that any elimination of pronounced resonances tends to reduce the sensation of loudness of transmitted sounds. The dissonance is concentrated on frequency distortion, since no evidence has been found that the internal distortions of well-designed modern loudspeakers exert any comparable adverse influence on the quality, at volume levels suitable for an ordinary living-room.

**Magnet**

No unexpected features of the effects of magnet design have been sought or encountered. Most of the experiments were made using a permanent magnet of about 170 cm.³ overall size, generating about 6,000 lines per cm² in an air-gap of 1.075 in. external and 0.98 in. internal diameter and 0.25 in. deep.

**Coil and Coil-former**

No substantial evidence was found that commercial methods of construction of coil and coil-former impose any limitation on the performance of the loudspeaker. Additional stiffness of the coil former was not found to make any appreciable change in the frequency characteristic.

Simple auxiliary precautions towards ensuring the movement of the coil in the air-gap are: (1) taking out the leads to the coil at opposite ends of a diameter, to ensure symmetry of the mechanical load due to the leads; and (2) taking out the leads at the same winding level, i.e., at an even number of layers. This eliminates any resultant current in the coil, in the direction of the axis, which could set up forces tending to twist the coil.

**Centring Devices**

Both centring devices, commonly known as the "spider" and the "surround," add to the moving system a very small mass and a stiffness which may be, but need not be, appreciable. It is common practice so to adjust the combined stiffness that the main resonance of the moving system lies at the lower extremity of the frequency range which it is desired to transmit. At lower frequencies the effective width of the air-gap up to at least 4 in. distance is of about 2 in. With a rather small enclosed case, limiting at about 100 c/sec. many types of external spider in current use introduce a stiffness which is not very appreciable. With a larger case, however, limiting at 40 or 60 c/sec. a spider of reduced stiffness, e.g., of thinner material, is required.

Under the influences of the forces vibrating between the spider and the diaphragm, at certain impressed frequencies, in a mode of vibration, having a natural frequency other than the impressed frequency, this gives rise to audible false tones from the loudspeaker at the particular frequencies concerned. The effect appears to be more marked when there is tension in the spider.

**Framework**

This part should not affect the performance of the loudspeaker, but with some commercial constructions it has been found that the apertures in the framework are insufficient to provide complete freedom of movement of the air behind the diaphragm. In such cases it appears that the resonator formed by the air cavity between the diaphragm and the frame in conjunction with the apertures in the frame acts as an anti-resonator on a part of sound by the diaphragm. This can reduce the efficiency of the loudspeaker somewhat over a range of frequencies, say, 1,000 to 2,000 c/sec., where there is generally some difficulty in maintaining the efficiency of radiation of sound by the diaphragm.

In the design which results from these investigations the effect has been eliminated by limiting the part of the framework between the inner rim of the magnet and the outer rim to four strips, each 2 in. wide.

**Casing**

For various reasons the investigations have been concentrated mainly upon loudspeakers with an enclosed case. The influence of the size of the case on the response at low frequencies was very marked. The compromise between size of loudspeaker and limitation of response at low frequencies, having been decided, it remains to devise a construction of the case which is adequate for soundproofing and at the same time economical in space and cost.

Two main principles for soundproofing are generally recognised: one is the use of massive non-porous walls, preferably of a

(Continued on page 332)
Recording the Signals

Quite naturally, all the important television developments that are taking place in this country, in so far as they apply to war purposes, are being kept secret. The only suggestions of how this special science is likely to be used in schemes of attack and defence emanate from those countries who are as yet not actively involved in the present international situation. In this connection, it is learned that the intermediate-film method of transmission and reception is finding special applications, because it has the double function of furnishing the requisite television signal at the moment it is required, apart from the few seconds delay between the enactment of any scene and its ultimate conversion into modulated electromagnetic wave, and in addition provides a valuable record on the celluloid film for subsequent examination when such a need arises. The intricacies of this scheme are all centred on the photographic side, and a reference to Fig. 1 will show one form taken by the equipment for this purpose. The camera—one of the intermittent type—is seated on the bellows, and above this is the compartment housing the new film spool. Three lenses on a slide carrier are provided to enable the proper form of focusing to be undertaken irrespective of the scene to be recorded and transmitted, while the panning handle to the left enables the operator to encompass the whole field of view. After photographing the scene on the film the latter passes through a sound-recording head so that any sound may be photographed on the appropriate track provided. Cog-wheel drives then feed the film through developing, washing, fixing and final washing tanks, guides ensuring that it passes along wards dipping into the appropriate chemical fluid. The mechanism for this is clearly seen in the rectangular container which runs from left to right under the camera bellows. The finished film negative in its dry or wet state, as the case may be, is then passed through the television camera in the ordinary way for conversion to a television signal and the film is stored for future reference purposes. This type of equipment has been improved so enormously that the whole apparatus can now be accommodated in a very small compass so that it is readily portable and may, therefore, be set up on sites or in machines in a way which a few years ago was thought impossible. It has been stated in various sources that the compactness is such that a modern aero-plane can be fitted out with a transmitter and modulator to give the complete picture without any additional apparatus such a construction is unnecessary. The section of the time-base generator providing the frame scan motion is omitted, with the result that each individual line of the picture is traced consecutively over a thin strip of fluorescent running horizontally across the centre of the screen. In front of this is placed a constant speed drive camera, the film being fed in turn through a film sprocket drive chamber, and this film is fed over sprocket-drive drums (seen inside the camera, since one face has been removed for inspection). The line trace is focused on to the celluloid film, and since the speed with which the film moves across the back of the lens is such that it corresponds to the picture-frame speed, the picture lines are recorded one after the other and displaced from each other by a line width. The film is then wound into the bottom take-up chamber, and therefore, a true record of the radiated television picture which can subsequently be developed, fixed and dried, and passed through a standard 35 mm. film projector for observation purposes at any time it is required. Here again, the apparatus, which in Fig. 2 is shown laid out on a bench, has been improved to such a degree that it can be assembled in a very compact and neat unit so that it can be employed in quite out-of-the-way places.

Several Forms

Irrespective of the source of the radiated signals, whether in the air or on the ground, the next point that arises is what will happen at the point of reception. Here, again, one is confronted with a dual aspect, and the solution will depend entirely upon the purposes for which the transmitted television signals have been provided. Assuming that some form of military or naval activity is made apparent by this television signal, it is of great advantage to be able to refer at any time to what has happened, this being additional to any observations undertaken at the instant the signals are received. Several schemes may be used for this purpose, but the most promising is one which again resorts to the intermediate-film method of working, developments on which have been undertaken both in this country and abroad. The most promising scheme uses a cathode-ray tube working in conjunction with a constant speed drive camera. The details of this apparatus are shown in Fig. 2, where separate units are laid out on a bench as distinct from being housed in rack form. The incoming television signals are received and processed in the normal manner by an efficient dipole-aerial array and passed to the television receiver. The output of the set is fed to the cathode-ray tube shown mounted horizontally in a frame support in Fig. 2. In ordinary circumstances a complete picture would be traced out on the screen within the available scanning field of the tube, but with this particular arrangement such a course is unnecessary. The section of the time-base generator providing the frame scan motion is omitted, with the result that each individual line of the picture is traced consecutively over a thin strip of fluorescent running horizontally across the centre of the screen. In front of this is placed a constant speed drive camera, the film being fed in turn through a film sprocket drive chamber, and this film is fed over sprocket-drive drums (seen inside the camera, since one face has been removed for inspection). The line trace is focused on to the celluloid film, and since the speed with which the film moves across the back of the lens is such that it corresponds to the picture-frame speed, the picture lines are recorded one after the other and displaced from each other by a line width. The film is then wound into the bottom take-up chamber, and therefore, a true record of the radiated television picture which can subsequently be developed, fixed and dried, and passed through a standard 35 mm. film projector for observation purposes at any time it is required. Here again, the apparatus, which in Fig. 2 is shown laid out on a bench, has been improved to such a degree that it can be assembled in a very compact and neat unit so that it can be employed in quite out-of-the-way places.

TELEVISION & SHORT-WAVE HANDBOOK

Price 5/-, by post 5/6
ON YOUR WAVELENGTH

Is English Irish, Scottish or Welsh?
O IVE ad a letter from Oireland which as you might nay is one of ye brufftous spous of the British Oils. It is a little bit of haven which as the song siz, fell out from the skoi, and got cracked in the process. Irishmen deny that it is a little bit of 'ell, and I agree.

The preceding paragraph is another way of letting you know that I have had a letter from an Oirishman who thinks that the best English comes from Ireland! Notice the refined English of my second sentence. Why, the Irish did not know our language till we taught it to them, and they have not learned it yet. Now it is the turn of the Scots and the Welsh. And a Happy New Year to all of you!

The New Encyclopaedia
I SEE that the seventh edition of the old "Wireless Constructors' Encyclopaedia" makes its appearance under the new title of the "Practical Wireless Encyclopaedia." As I have remarked before, it is a remarkable work. At 6s. it represents value unobtainable elsewhere for a guinea. Over 200,000 copies of it have been sold and it circulates in every country in the world. The seventh edition has been fully revised and contains a large amount of new matter and many new definitions. It is attractively bound in dark-blue cloth with gold lettering.

Our New Year's Set
I UNDERSTAND that the brains are at work devising the 1940 Boom Receiver. I have been unable to get into the Editor's sanctum because of the slide rules and the reams of calculation. If you have a particular hunch as to features the new set should contain, drop the Editor, not me, a line and let him know. The new design is expected to be released to the public some time in March.

Requests for Old Sets
SOME of our readers now in France want to know if readers at home have any old battery sets in working order which they would like to give to them. I have carefully filed these requests, and if you have any battery set for which you have no further use I should be glad to act as a distributor. Please mark your envelopes "Sets for France."

Other readers are asking for copies of periodicals, and here again I shall be glad to forward any which are sent to me.

Power Grid Detection
A READER asks me to define the advantages of this particular form of detection. The essential features are a large standing anode current with a lucky signal applied to the valve so as to produce a drop in current of about 15 per cent. Owing to this large anode current, it is necessary to use a valve with an impedance of between 10,000 and 25,000 ohms, and it is also impracticable to use the majority of L.F. transformers owing to saturation troubles. This means that either resistance-capacity coupling or a parallel fed transformer must be used, and it is quite obvious that a large current through a resistance to match an impedance of the order stated will result in a very heavy voltage drop.

Owing to the convenience of A.C. mains it is possible to use between 400 and 500 volts for H.T., and the drop through a suitable anode resistance still permits the valve to receive its maximum H.T. voltage. An alternative method is to use an iron-cored choke with a very high inductance value. Small values are chosen for the grid leak and condenser, usually about 0.001 mfd. and 25 megohm. The detector circuit is standard except for these latter values.

Musical Frequencies
A NOTHER reader wishes to know the usual musical frequencies. They are as follow as relating to the piano: A 26, B 30, C 34, D 36, E 40, F 42, G 48, A 53, B 60, C 64, D 72, E 80, F 85, G 96, A 106, B 120, C 128, D 144, E 160, F 170, G 192, A 213, B 240, C 256, D 288, E 320, F 341, G 384, A 426, B 480, C 512, D 576, E 640, F 684, G 768, A 853, B 960, C 1,024, D 1,152, E 1,280, F 1,365, G 1,536, A 1,766, B 1,920, C 2,048, D 2,304, E 2,560, F 2,730, G 3,072, A 3,413, B 3,840, C 4,096.

Jelly Electrolyte
T HE battery and accumulator shortage finds its reflection in the large number of letters I am receiving relating to accumulators and batteries. Requests for the formula for the jelly electrolyte used in unspillable accumulators have reached me by the score. I give it now in the hope that it will stave off a further number.

Prepare jelly electrolyte by adding sodium silicate to the acid (never add acid to silicate) in the proportion of 1 to 3, and immediately pour the mixture into the cell until the usual acid level is reached. Take care not to overflow the cell as this is difficult to rectify once jellification has taken place. If some slight shrinking of the electrolyte occurs, thus exposing the top of the plates, it should be made good by preparing and adding a little more of the mixture.

After filling, the cell should be inverted for six to eight hours to allow any free acid to drain off. It is advisable to give the cell a freshening charge before putting it into service. Pour off any free acid. If the jelly hardens add three or four spoonfuls of distilled water before every recharge.

Carrying On
T HANKS to the hundreds of readers who have written expressing their gratitude that the proprietors of this journal intend to carry on. This is the only wireless weekly, and in spite of increasing costs, particularly on the paper side, readers will note that we have not increased the price of the journal. All readers for their part can help us by placing an order for the regular delivery of this journal. It helps the newsagents, and it helps us, for it prevents us printing more copies than are actually required in these days of paper shortage.
Tone Control by Negative Feedback

How the Negative Feedback Feature May Be Made Use Of to Control the Tone of Reproduction

The idea of effecting tone control in a low-frequency amplifier by means of an adjustable negative feedback for the higher audio frequencies is already well known. These arrangements, however, have the disadvantage that the feedback is not effective for the middle and lower audio frequencies, so that reduction of amplitude distortion does not take place for these frequencies, which usually contain the components of greatest amplitude which are most likely to be distorted.

Variable Grid Bias
In order to avoid an undesirably large variation of the grid bias, the resistance $R$ may be selected much smaller than the sum of $R_k$ and $R_s$. If such ratio of dimension cannot be obtained for reasons of a sufficient control range an additional current, for instance from the screen grid potential divider of the pre-stage valve, may be sent through $R_x$ in the case of small resistances $R_x$ and $R_s$ which current increases the potential drop at this resistance so that the grid bias is less influenced by the control at $R$. The sliding contact $S$ and the right-hand end of the resistance $R$ are connected with each other by a parallel circuit $LC$ tuned to about 800-1,000 cycles, i.e., the medium frequency of the frequency band to be transmitted. This parallel circuit is permeable for the very low frequencies (from zero to about 200 cycles) and for very high frequencies (from about 2,000-10,000 cycles) (compared with the resistance $R$) whereas it offers a comparatively high resistance for the medium frequencies (from about 200 to 2,000 cycles). When the sliding contact $S$ is at the point $b$, the filter circuit is out of action, and the counter coupling is at its maximum, uniformly for all frequencies. This gives an amplification curve which corresponds with the curve marked $b$ in Fig. 2, in which the amplification $V$ is drawn in relation to the frequency $f$. When, however, the sliding contact is at the point $a$ this results in an amplification curve such as shown by $a$. In this curve the amplification for the very high and very low frequencies has only increased very little, because as before, almost the entire output A.C. potential is present at the ohmic resistance connected in the cathode lead. The medium frequencies, however, are subject to a considerable potential drop at the parallel connection $R_C, L$, so that the counter coupling becomes considerably less, and the amplification therefore considerably higher. The amplification is almost of such value as would be obtained if no counter coupling was present, which is marked in Fig. 2 by a dotted line.

The circuit shown in Fig. 1, which supplies the control curve according to Fig. 2, is particularly suitable for such receiving sets in which no completely effective automatic fading circuits are provided, and in which the tone-control has to be used at the same time as amplification control by hand to compensate different intensities of reception of different transmitters. In this arrangement the local transmitter is reproduced with comparatively small amplification, less distortion factor, and even amplification for all frequencies whereas a remote transmitter is reproduced with more amplification.

This disadvantage can be overcome in a manner which will now be described. Fig. 1 shows the circuit diagram of a two-stage resistance-coupled low-frequency amplifier of a receiver. The oscillations to be amplified are supplied to the control grid of the valve $V_1$, and are led after amplification from the output of the output amplifier valve $V_2$, through the output transformer $T$ to the loudspeaker $L$. The potential at the loudspeaker is connected at the same time to the series connection of a blocking condenser $C_1$ and three ohmic resistances $R_1$, $R_2$, and $R_3$. The resistance $R_1$ is designed as an adjustable potential divider the sliding contact $S$ of which is connected to the cathode of the valve $V_1$. As the lower end of the resistance $R_1$ is connected with the earthed return lead, the part of the resistance $R$ between the left-hand end and $a$, and the sliding contact $S$, and also the resistances $R_2$ and $R_3$ are in the cathode lead of the valve $V_2$. Therefore, a counter coupling of the output A.C. potential to the cathode of the input valve is caused, as only the resistance $R_3$ which is mainly dimensioned for the supply of the medium grid bias of the valve $V_2$ is bridged by capacity.

Fig. 1.—A two-stage amplifier with negative feedback.

Fig. 2.—Curve showing effects of adjustment of resistance $R$ in Fig. 1.

Fig. 3.—A modification of the scheme in Fig. 1.

Fig. 4.—Results obtained by the circuit of Fig. 3.
A Soldering Dodge

IN a recent paragraph in "Notes from the Test Bench," mention was made of the difficulty of getting a large blob of solder on the iron. I overcame the difficulty by taking the spout of an old oil-can, and filling it with solder, as shown in the sketch. By placing the heated iron against the tip of the spout, which had been previously filled with solder, a large blob of solder falls on the place required.—D. B. Mack (Airdrie).

Heat-treatment for Components

ON constructing several receivers, I have found that they would not function properly owing to the fact that there was no reaction. This I found to be caused by the damp atmosphere affecting the coils, so I devised the following simple method of treating the coils. First, I obtained a large biscuit tin, soldered in a shelf of zinc, and mounted a pair of lamp as shown in the sketch. The lamps used were 60-watt type. When current is applied the lamps become hot, thus heating the coils till all the dampness is extracted, this taking about one hour. The coils should then be shellacked.—W. Flower (Lincoln).

An Insulation Stripping Tool

MANY constructors find difficulty in removing the rubber insulation from single or multi-strand wire. The usual method adopted is to cut and scrape off the covering with a pen-knife, but this often leads to trouble, due to the wire being partly cut through. A pair of tinman's shears, costing sixpence, will, when converted as shown, enable the constructor to strip the insulation without harming the copper strands.

A useful device when trimming I.F. transformers.

On each blade, about one inch from the rivet, file a notch, using a three-cornered file. These two notches should be of such a depth so that, when the cutters are closed, the apex of each notch just covers the other. Both must be carefully bevelled to leave sharp cutting edges. In the side of one handle, about two inches from the rivet, drill a hole and tap 4BA. A two-inch length of 4BA screwed rod, which can have a terminal head locked on one end, is screwed into the hole. To use the cutters, adjust the screw so that the notches in the blades are open sufficient to clear the diameter of the wire. Place the insulation in the notches and close the cutters. Hold the wire firmly with the left hand, and give the cutters a quarter of a turn round to make certain that the insulation has been cut through. Pulling the cutters sideways will bring the insulation off and leave the wire unharmed.

Finally, if much wiring is to be done with the same gauge wire, a lock-nut can be run on the screw at A to prevent movement.—ALEX DAVIE (Edmonton, N.).

A Trimming Hint

IN most intermediate-frequency transformers one of the trimmers is connected to the H.T. positive line, whilst the metal screen surrounding the transformer is earthed to prevent interference. Thus, when carrying out the adjustment of the trimmer, should a metal screwdriver come into contact with both screen and trimming screw the H.T. supply is short-circuited. An insulated tool may be employed, but a simple solution is to remove the insulated sleeve from a wander plug or spade end, and drop this in the hole in the transformer screen. It will be found to make an almost perfect fit, and a small screwdriver may then be inserted in the insulated bush thus formed for trimming purposes with perfect safety. To avoid unwanted static capacities the screwdriver should be as thin as possible. The illustration makes the idea perfectly clear, and as the trimming is only to be carried out when the receiver is first installed the bush may be removed from one of the leads to the receiver and afterwards replaced, thus avoiding expense and the necessity for purchasing a component especially for the single use—D. W. J. (Hendon).

WORKSHOP CALCULATIONS, TABLES AND FORMULÆ

By F. J. CAMM

2½/- in post 3½/-, from George Newnes, Ltd., Tower House, Southwark St., London, W.C.2.
AN instrument which will measure capacity and resistance values accurately, and with little trouble, is essential to the keen experimenter, and the bridge meter fulfills these conditions exactly. The bridge meter is a modification of the well-known Wheatstone resistance network for determining the value of an unknown resistance when compared with certain known values of resistance, and as no current is passed through the indicator or indicating device at the point of correct value, this method is very accurate in use.

The Wheatstone network is illustrated in Fig. 1 and r1 and r2 is the variable resistance, and X the unknown. It is the known resistance, which must be very accurate in value.

The bridge about to be described is based on this circuit, and is adapted to read capacity values as well as resistance values, as above mentioned. It is quite easy to construct and is not expensive.

Description and Circuit

The principle has already been described, and the bridge measures capacity values between 00001 mfd. and 10 mfd. The resistance range covers from 1 ohm to 10 megohms. Either a low-frequency oscillator (similar to that given recently in this journal) or a signal from the mains (obtained from the secondary of a bell transformer) is necessary to give the signal for operating the instrument. The best-frequency oscillator is the better instrument to use as, due to the higher frequencies which are available for measuring small capacities, a better indication is given. A small-capacity condenser has a high reactance, and therefore a higher frequency will be more easily passed. The main frequency of 50 cycles would mean that on small-capacity condensers only a very weak indicating current would flow.

Headphones are used in conjunction with the L.F. source to indicate the “null point” of the pointer on the scale. A 10,000 ohm wire-wound potentiometer is employed with a series of condensers and resistances of fixed values, and these are selected according to the range desired by a double-pole double-throw and a rotary switch, the former being to change from capacity to resistance or vice versa.

There is an attenuator at the input to control the strength of the input signal, and there is also provision for testing electrolytic type condensers. By using a neon tester with this instrument the complete state of a condenser can be found, and by the addition of an amplifier and a cathode-ray "electric eye," amplification for tube stoves, a visual indication is also possible.

The Panel

The panel may be of ebonite, wood, or aluminium, and the writer recommends the latter as it can be earthed and gives the instrument stability. The size is not critical, but if a scale is being used, and in all the for the addition of the "electric eye," it would be necessary to make it about 14 ins. long by 9 ins. high. The sockets are of the bushed type, which must be insulated from the metal if a metal panel is being used, and the spindles of the variable resistances and switches must not be attached to the moving contacts, or they would short-circuit. The components are fitted to the panel as shown, and there is room later to drill a hole to take the electric eye; this is shown in the Fig. 2 by the dotted lines. A baseboard will also be required if the electric eye unit is being made up, and this can be of wood and can be 14 ins. long by 6 ins. deep. The front view is given in Fig. 2 and the back in Fig. 3.

Mounting Resistances and Condensers

A piece of cardboard 4 ins. long by 3 ins. wide is used for mounting the resistances and a similar piece for the condensers, and these components are fixed to the cardboard by boring two small holes at the ends of the cardboard to take the wire ends of the components; this is shown clearly in Fig. 4. The two panels are then fixed side by side on a block of wood 4 ins. long by 1 in. square, and this, in turn, is screwed to the panel by screws running in at the panel front. The wire ends of both the row of resistances and condensers must not come too close to the panel. One side of all the resistances is connected together, and the same with the condensers.

Wiring Up

The wiring is done with insulated wire or sleeve-covered wire, and soldered joints will be necessary. It is essential that all joints are really well made or trouble will be experienced. The making of wood soldered joints is not a very hard job, and therefore no trouble should be experienced in this connection.

From the diagram, Fig. 2, it will be seen that the rotary switch is viewed from the front and numbered accordingly, and this is to give the constructor an exact picture of the circuit, but on the panel this will be reversed when seen from the back and will be as shown in Fig. 3. The condensers are wired in order of capacity value from contact 1 to contact 5, and will therefore be 0.001 to contact 1, 0.01 to contact 2, 0.1 to contact 3, 1 to contact 4 and 1 mfd. to contact 5 (all the readings being anti-clockwise). The 1 mfd. condenser is mounted on the panel as it is of the non-dissipative type.

The free ends of the resistances are likewise connected to the bottom section of the switch, and these are joined up so that when the switch arm is on the contact of the 0.001 mfd. condenser the bottom switch arm is on the contact of the 10 megohms.

The battery B1 is an ordinary 4-volt dry cell, and is connected so that its positive side is attached to the positive terminal socket for the testing of electrolytic condensers. This battery is left in the containing case or cabinet. The rest of the wiring is very simple, and can be done from the circuit diagram. It is only necessary to point out that one side of the input sockets, each volume control, and the two sides of the "unknown sockets" are all connected together, and also to the panel, if this is metal, and these can be earthed in this way.

The Dial Scale

To make the dial, take a piece of stiff paper or thin white cardboard and with a compass draw a circle of radius 3 or 4 ins. and between the outside of the potentiometer knob and this circle draw in 10 other circles, this will give a total of 11 circles. Each of these circles can then be divided up into resistances or condenser values, six of the circles for resistance and five for condensers, this is shown in Fig. 2. In this way not only can the value be determined from a graph, but plenty of direct values may be taken by the pointer position.

Two lines are then marked at the bottom parts of the circles where the pointer would be.
Aance-bridge Meter

Construction are Given of a
the Experimenter

The swing will end, and the potentiometer may
need to be turned round to get this effect;
the scale is slipped over the spindle during
this operation and the knob marked if not
already done. The scale is then removed
from the potentiometer, and is cut out
around the outside of the outer circle in
order to give room to mark in the values
later. The lines at the bottom are then
ensued, and this gives a number of three-
quarter circles with two ending lines to
indicate the termination of the pointer
swing.

A piece of celluloid is next cut to fit over
the scale, and this, together with the scale,
is held in place over the potentiometer
bushing with the screw nut which holds this
in place. The celluloid is not, of course,
placed in position until the instrument is
calibrated.

The pointer is constructed from a piece
of stiff wire, and can be soldered to the
potentiometer spindle or soldered to a
small strip of tin which can then be clipped
to the spindle.

The Cabinet

The cabinet is best constructed of wood,
and it is made so that the panel, and base-
board if required, can fit in flush with the
inside. Small battens are fitted to
allow the panel to be secured, and it is
recommended that the inside be lined with
tin-foil, which can be electrically connected
to the panel with a short length of wire.

Calibrating

After the wiring has been completed and
the panel placed in the cabinet, including
the small battery, the calibrating of the
instrument can be undertaken. Two
methods are recommended; the graphical,
for the subsequent reading of small inter-
mediate values of resistance or capacity,
and the direct readings marked on the dial
for quick selection of standard values.

Connect up the external L.F. source (a
beat-frequency generator will be assumed to
be in use) and plug in the phones to the
proper sockets. Commencing on the resist-
ances, first put the selector switch at the
resistance position (this can be determined
before assembly) and the range switch at
position 1; then, taking a number of
known values of resistances from 1 ohm to
100 ohms connect these in turn in the sockets
of the unknown element, and by rotating
the pointer take readings for the points
where minimum signal is heard in the
phones. If the signal is too loud, then it
can be reduced slightly by the input
volume control, and this enables a sharp
minimum to be found. These readings can
then be marked on the first circle of the
dial, and a graph can be also constructed
by dividing up the rest of the circle between
the known marks into equal divisions,
e.g., if we have a number of positions for
resistances of values 10, 20, 50, 80, 100
ohms, then these positions are marked on
the dial, and from them the intermediate
divisions can be marked, and a curve can
then be plotted on squared paper.

When the first scale and curve are made,
the switch is put at position 2, and
commencing with a number of values between
100 and 1,000 ohms a second scale and
curve are drawn, and the same procedure
is employed with the small scale of the
resistances and condensers until all the
scales and curves have been constructed.
Then the ranges will be for the range
switch at positions as shown, and with the
selector switch at resistance and capacity
in turn:

Selector switch at resistance. Range
switch 1. 1-100 ohms.

Selector switch at resistance. Range
switch 2. 10-1,000 ohms.

Selector switch at resistance. Range
switch 3. 100-1,000 ohms.

Selector switch at resistance. Range
switch 4. 1,000-10,000 ohms.

Selector switch at resistance. Range
switch 5. 10,000-1,000,000 ohms.

Selector switch at resistance. Range
switch 6. 1 m. ohm-10 meg.

Selector switch at capacity. Range
switch 1. .00001-1 mfd.

Selector switch at capacity. Range
switch 2. .0001-0.1 mfd.

Selector switch at capacity. Range
switch 3. .001-1 mfd.

Selector switch at capacity. Range
switch 4. .01-1 mfd.

Selector switch at capacity. Range
switch 5. .01-10 mfd.

From the above tabulated list it will be seen
that the ranges slightly overlap, and
this is found convenient in use, as one is
sometimes saved the trouble of switching
over from one range to another when the
two values, or more, are in the same
range. Actually, it will be found that the
instrument reads lower values than the
minimum values given above, and these
can be marked in, but the above values
are taken from the nearest correct calcu-
lated value and will be found to be correct
in use. A small scale similar to that for
the pointer can be used with the range
switch to indicate the range covered in
different positions.

Once calibrated, the values of other
unknown resistances or condensers are
easily and quickly found.

Operation

To use the instrument connect as already
instructed and, taking the unknown resis-
tance or condenser, put the selector switch
in the appropriate position. Put the range
switch at the highest reading if the operator
has no idea of the value required, and
swing the pointer knob slowly over the
scale. If there is no reduction in the
strength of the signal, then the range switch
must be put at the next lowest position,
and the operation repeated until a range is
found at which the signal weakens and
fades almost out. Reference to the scale
or graph will then give the required value.

Should no signal be heard on any range at
all, then the components must have an
open circuit, and if the signal cannot be
reduced to minimum, then the value must

(Concluded on page 112)
**Reaction Distortion**

This Article Explains How Auto-tone Balance Can Be Provided

Most experimenters know that when the sound emanating from a loudspeaker differs from that performed in the studio, "distortion" has been introduced. Distortion can occur in almost every stage of a receiver, but in most cases it is a simple matter to guard against it by using components of good design and high quality and by keeping a careful watch on operating conditions in order to ensure that valves and other apparatus are not overloaded, and that correct bias and anode voltages are applied.

There are, however, certain conditions under which a definite amount of distortion is inevitable. It cannot be prevented from occurring, and until recently distortion of this kind has had to be endured with what patience the listener could command.

The Use of Reaction

Distortion of the kind referred to is due to the effects of reaction. Practically every receiver of reasonable efficiency is capable of reproducing at good volume the programme radiated by the local station without recourse to reaction, and a modern set employing a screened grid high-frequency stage should be able to give a fairly wide choice of programme without the user's control knob requiring attention. If the more elusive foreigner are to be picked up at comfortable strength, however, the additional fluff to sensitivity given by wisely applied reaction is of great assistance.

As most listeners know, reaction is a process in which part of the energy in the anode circuit or "output" circuit of the detector valve is returned to the grid circuit and is re-amplified. The amount of energy so fed back is controlled in a modern set by a variable condenser, which passes more or less energy, according to the adjustment of the variac, back to a reaction coil, the normal scheme of connections being indicated simply in Fig. 1.

Now not only does reaction greatly increase the volume of sound from the loudspeaker, but it adds also to the apparent selectivity of the set, that is to say, the receiver can be more sharply tuned when a fair amount of reaction is applied than when the reaction control is turned back to zero. But undue sharpening of the tuning has the effect of cutting off some of those all-important side-bands which represent the higher tones of the musical scale. The reproduction, therefore, tends to become gruff and "drummy"; the brilliance of the treble notes and the tone colour due to the higher harmonics are reduced, and the programme quality becomes decidedly unpleasant.

**Distortion With Distant Reception**

How serious this distortion can be is realised by anyone who has ever tried to pick up a very weak and distant signal by pushing reaction to the critical point. The hoarse, croaking voices and the travesty of music issuing from the loudspeaker are scarcely distinguishable as the programme quality becomes decidedly unpleasant.

There are many methods of reducing or eliminating a large part of the undesirable effects of reaction, and for some years past there have been on the market various "tone balance" accessories to deal with these; some are based on the principle of the "mono-aural" valve, others on that of the "monaural" transformer.

One of the best known of these devices is the "Auto-tone" or "Auto-tone" transformer, which is assumed to be responsible for the increased volume and tone quality obtained from the auto-tone receiver.

In the following paragraphs an attempt will be made to explain more clearly how auto-tone and similar devices work, and why and how they can be made effective. It is intended to show that it is not necessary to use a specially designed or new apparatus for improving the tone quality of an average receiver.

The three main factors responsible for the undesirable effects of reaction are:

1. **Overloading**
2. **Frequency Distortion**
3. **Harmonic Distortion**

**Overloading**

This is due to the fact that the valve is working at a power level which corresponds to a loudness which is too loud for the particular type of valve used. The "Auto-tone" transformer, which is based on the "mono-aural" valve principle, works on the assumption that the valve can only handle a certain amount of power and will give its best performance within certain limits of volume. If the volume is increased beyond these limits, the valve will begin to distort and the programme quality will suffer.

**Frequency Distortion**

This is due to the fact that the valve is not able to reproduce all the frequencies of the musical scale with equal accuracy. The high-frequency notes are reproduced more accurately than the low-frequency notes, and vice versa. The "Auto-tone" transformer, which is based on the "monaural" transformer principle, works on the assumption that the valve is able to reproduce all the frequencies of the musical scale with equal accuracy. By means of a high-frequency transformer, the high-frequency notes are boosted and the low-frequency notes are cut off to some extent, and the programme quality is improved.

**Harmonic Distortion**

This is due to the fact that the valve is not able to reproduce all the harmonics of the musical scale with equal accuracy. The high-frequency harmonics are reproduced more accurately than the low-frequency harmonics, and vice versa. The "Auto-tone" transformer, which is based on the "monaural" transformer principle, works on the assumption that the valve is able to reproduce all the harmonics of the musical scale with equal accuracy. By means of a high-frequency transformer, the high-frequency harmonics are boosted and the low-frequency harmonics are cut off to some extent, and the programme quality is improved.

**Conclusion**

In conclusion, it can be said that the "Auto-tone" transformer, which is based on the "monaural" transformer principle, is a very effective device for improving the tone quality of an average receiver. By means of a high-frequency transformer, the high-frequency notes are boosted and the low-frequency notes are cut off to some extent, and the programme quality is improved.

(Continued on opposite page)
It will be clear that, if due to reaction, the detector stage creates losses in the higher register while the interstage transformer produces an increased upper register response, there will be one setting of the reaction control at which the high note will be balanced, and the note gain.

At all other settings of the reaction condenser, however, the response will not occur—smaller settings will result in a more high-frequency response, with consequent shrillness of reaction, and an increase in the high frequencies and the reproduction will be gruff.

Automatic compensation, or equalization, can be arranged without a great deal of difficulty. It is achieved by shunting a condenser arrangement across the primary winding of the low-frequency transformer, and so designing the circuit that the value of this capacitance shunt is varied simultaneously with the adjustment of the reaction setting. The effect of a fairly large capacitance shunted across the transformer would be to reduce the high-note response and, while if the capacitance were decreased the high-note response would be correspondingly increased. As the capacitance is increased, the capacity of the condenser is augmented by the use of a differential reaction condenser of somewhat special design, and an automatic equalizer which differs slightly from the normal.

Reaction Control

The conventional way of connecting a differential condenser for the control of reaction is shown in Fig 2. The moving vanes are joined to the detector anode, one set of fixed vanes to the reaction coil, and the other set of fixed vanes to earth. When the moving vanes A are fully meshed with the earthed vanes B, little or no energy can be transferred to the reaction coil. As the position of the moving vanes is altered by turning the knob, their coupling with the earthed vanes B is reduced and the coupling with the moving coil O increased. More energy will therefore pass to the reaction coil but both B and C being at earth potential the sensitivity between the anode and earth will be constant, so that tuning will not be affected by adjustment of reaction.

The automatic tone balance arrangement is shown in Fig. 3. Here the anode is connected to one of the fixed vanes and to the earth end of the reaction coil at the other end of the reaction coil is joined to the second set of fixed vanes, and the moving vanes and connected to earth. Further, a fixed condenser of fairly high capacity, say, 0.1 mf, is interposed between the anode and the differential condenser, while the reaction condenser is so constructed that, when the moving vanes are fully meshed with the "anode" vanes (i.e., when zero reaction is applied), there is a direct connection between the moving vanes and the "anode" vanes—in other words, half of the reaction condenser is shorted to earth.

Examining the circuit when adjusted to zero reaction, as indicated in Fig. 4, it will be admitted that, in effect, the 0.1 mfd condenser is connected across the transformer primary. Actually, the shunt consists of the 0.1 mfd condenser, the high-frequency choke and the high tension battery in series, but from the audiofrequency and capacity point of view we may neglect the high-frequency choke and the battery.

Now if the reaction control is moved over so that a certain amount of reaction is applied, as in Fig. 3, a certain amount of capacity, i.e., that due to the "anode" and moving vanes of the reaction condenser, is placed in series with the 0.1 condenser. As most listeners are aware, two condensers in series have together a smaller capacity than either one of the single condensers, so that, as the reaction is increased, and the capacity between "B" and "D" decreases, so the capacity shunted across the transformer is decreased, and the more nearly the frequency response of the transformer approaches its true characteristic. As this characteristic is a rising one, the high-response will increase in proportion as reaction is increased, thus giving automatic control.

The perfection of this control depends upon two things: first, the actual frequency characteristic of the transformer, and then the correct choice of capacities and condenser characteristics to give the correct balance. It is for this reason that specially designed automatic tone-control transformers need to be used, and while the other essentials of the circuit must follow religiously the types and sizes specified.
Transformers H.F., L.F., and Mains

These General Notes Will Help to Clear Up Many of the Points which are Often Misunderstood. Principles of Transformer Operation are Briefly Explained, Along With Practical Limitations.

MOST readers are so familiar with the use of transformers that they have never stopped to consider how they operate and how their performance is affected by the soundness of design. The type of transformer best known is that employed for coupling in an L.F. amplifier. Essentially, it consists of two windings (having, perhaps, something like 20,000 turns between primes). But it is a laminated iron core. In most cases there are fewer turns on the primary winding than on the secondary, for it is the ratio between the numbers of turns which governs the voltage step-up provided.

![Diagram of transformer circuit](image)

These diagrams show how an auto-transformer used on A.C. can be compared with a potentiometer used on D.C.

Thus, if there were 6,000 turns on the primary winding and 12,000 turns on the step-up ratio would be one to two. The ratio is often described as—in the example quoted—two to one, but it is better practice to give the ratio as that of the primary to the secondary, so that there can be no confusion. This point is made clear when it is mentioned that output transformers, used to feed the speech coil of a moving-coil speaker, almost invariably have a step-down ratio and are therefore correctly described as two to one, 15 to one, and so on.

More Voltage—Less Current

We have often been asked how a transformer can amplify, "for surely," it is stated, "a transformer cannot increase the amount of power supplied to it." That is perfectly true. All an L.F. transformer does is to increase, or step up, the voltage applied to it. But if the voltage obtained from the secondary is greater than that applied to the primary, the current must be proportionately lower. For example, if the input were 5 volts at 2 mA (the current has no connection with the D.C. which might be flowing through the primary) and the step-up ratio were two to one, the secondary output would be 10 volts at 1 mA. This is not strictly correct, for it assumes that the transformer is 100 per cent. efficient, which it is not, nor can it be.

In the case of an output or step-down transformer an input of 20 volts at 2 mA would be changed to 2 volts, 29 mA if the ratio were 10 to one—again neglecting losses. Whether or not we step up or step down the original voltage depends upon whether or not we are supplying a voltage-actuated or a current-actuated device. As you are aware, a thermionic valve is, in most of the methods in which it is used, a voltage-actuated device, since it is the fluctuating voltage applied to its control grid which regulates the corresponding flow of anode current, and hence the amplification produced and the output made available in the anode circuit.

Voltage and Power

But in one form of amplification, class B, the valve is a power-operated device, and current is required to flow in the grid circuits of the double valve. That is why a step-down or sometimes an even-ratio (one to one) transformer is used to feed it. In almost every other case an attempt is made to reduce grid current to zero. It will be remembered that in class B amplification a so-called driver valve precedes the class B valve; it is the purpose of this valve to provide the power required. This should not be confused with the nomenclature generally applied to a large L.F. or output valve. This is a voltage-actuated valve, the purpose of which is to provide power (to operate the speaker) in its output or anode circuit.

The principle of operation of all transformers is the same. An alternating or high-frequency current is passed through the primary winding. This causes a magnetic field to be built up around the winding and the core (which consists of air in the case of an H.F. transformer). The magnetic field also surrounds the secondary winding, with the result that a current is induced in it. The secondary voltage is governed by the number of times that the magnetic field is "cut," and thus by the number of turns.

The Auto-transformer

Mention has been made above of primary and secondary windings, but a transformer need not necessarily have two distinct windings. It might consist of a single tapped winding. The component is then known as an auto-transformer. If an alternating current is applied between the ends of the winding, the voltage between one end and a tapping is less than the applied voltage. Whereas, if the input is applied between one end and a tapping, a higher voltage can be obtained by making connections between the two ends. So, in tapping-off a voltage is concerned the auto-transformer can be compared with a potentiometer in a D.C. circuit. The comparison is illustrated in accompanying diagrams. The principle of the auto-transformer is employed in the case of many resistance-feed L.F. transformers, in which case it is possible to effect a saving in the total amount of wire used because the "primary" winding is also a part of the "secondary."

The principle of the auto-transformer can be used in an A.C. mains circuit, but such a transformer should not be employed to supply a mains receiver. It is contrary to L.F. regulations, since the output (used to feed the rectifier) is not isolated from the A.C. mains.

Mains-transformer Design

In designing a mains transformer of the double-wound type it is first necessary to determine the number of turns required per volt. This is dependent upon the shape, weight and dimensions of the core, and must be such that no primary current flows when the secondary windings are not connected to a closed circuit. In that case the primary can be said to be "tuned" to the supply, just as a coil-condenser circuit is tuned to a signal. When tuning is accurate, the resistance or impedance of the circuit is infinitely high.

Once the number of primary turns has been decided, the number required for each of the secondary windings can be found by multiplying the turns-per-volt figure by the output voltage wanted. After that it is necessary to find the total secondary...
Overcoming Television Flicker

The experiments which have been taken on the 3/6 or more" vertical to bring about different forms of improvement in television receivers are being tried out in those countries to which the results of this work will, where possible, be applied to British equipment at some subsequent date. For example, a close study is being given to various methods for overcoming flicker. It is known that a high picture repetition frequency will achieve the desired aim, but this means an increased frequency of different forms of intercarrier or simultaneous flicker, but here again the circuit requirements are apt to be rather rigid, and if not complied with line pairing will result and the picture definition suffer very considerably. In the early days of low definition television, when the flicker frequency was only 10 per second, and eyestrain, in consequence, rather pernicious unless the scene enacted was of a sufficiently entertaining character to take the mind off picture defects, attempts were made to supplement persistence of vision with persistence of illumination. The well-known Baird lamp screen was a case in point, for the intensity of illumination of each individual lamp persisted for so long after the signal governing the degree of brightness had ceased to exist. The improvement achieved by this scheme was most marked and subsequent inventors have tried to apply the same principle to modern high-definition television technique in an attempt to provide an alternative solution to the flicker problem. One idea which has been proposed is an attempt to simulate the afterglow results on the fluorescent screen of a cathode-ray tube, an idea which has long been known to achieve the desired effect but which has proved difficult to obtain in practice. In this scheme each individual line of scan is made to persist or afterglow for a few milliseconds when that line is due to be scanned again during the next frame.

Positive Grid

Near the back of the cathode-ray tube's fluorescent screen is placed a positively charged grid, and an auxiliary cathode, in the form of a loop so as not to impede the progress of the main electron stream, is arranged to spray the back of the fluorescent screen with a diffused stream of electrons which must pass through the charged grid. In this way the fluorescent screen area which glow at a certain intensity as a result of the electron impact from the main modulated cathode-ray beam are maintained active or glowing, for the simple reason that they emit more secondary electrons than they acquire from the auxiliary looped cathode. Similarly, the darker sections remain so because the emission is less than the number of electrons received. By this means it is claimed that the picture is kept glowing uniformly at each and every area within the field of scan until the new conditions are set up by the advent of the scanning beam of electrons in its next frame traverse when the whole scheme is repeated once more. The idea is a very ingenious one, and worthy of close investigation.

NEW PATENTS

These particulars of New Patents of interest are extracted from the Official Journal of Patents and are published by permission of the Controller of HMSO. The Official Journal of Patents can be obtained at the Patent Office, 25 Southampton Buildings, London, W.C.2., price 1s. weekly (annual subscription, £2 15s.)

514729.—Marconi's Wireless Telegraph Co., Ltd.—Superheterodyne wireless receivers.
514775.—Scophony, Ltd., and Rosenberg, A. H.—Natural colour television systems.
514640.—Johnson Laboratories, Inc.—Image suppression system for wireless receivers.
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Printed copies of full published Specifications may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.
SHORT-WAVE SECTION

IMPROVED SHORT-WAVE RESULTS
How to Make Certain of Getting Those News Bulletins Satisfactorily
By W. J. DELANEY

Many listeners own all-wave receivers, but in the past have not made a great deal of use of the short-wave section owing to its unsatisfactory performance. Now that there are many interesting news bulletins being broadcast on the short waves, however, they express a desire to operate on the short waves but do not know why the receiver fails to give the desired performance. If the receiver is a commercial model it may be inadvisable to attempt to find what the trouble is. If the components are satisfactory and the poor performance may thus be due to the use of a faulty transformer, the receiver may be turned over to a shop where it can be examined. Remember that short waves call for higher insulation than is needed for normal broadcast reception on the medium and long waves, and therefore overhaul your aerial if your set is not bringing in the short-wave stations. Don’t make the aerial box and high in an endeavor to improve results. Rather cut down the length of the aerial so that a total of about 15 to 20 ft. is in use, and improve the insulation at each end. If there are any joints in the aerial or lead-in, solder them and wrap with insulation-tape to improve the weather-resistant properties. Remember, also, that the receiver must be handled much more gently on the short waves. You cannot expect to run round the dial and pick out a suitable station as you can on the medium wave.

Turn the tuning-knob very slowly and listen for every sound as the needle travels across the scale. At the slightest sign of a signal stop, and then operate the knob so that the pointer travels very slowly backwards and forwards over that spot, at the same time adjusting the gain or receiver controls which are fitted. Of course, when once a good station has been located the exact position will be noted and it will be possible to return to that setting, but I am dealing now with the operation of a receiver which has not been used for short-wave reception.

Suitable Components
If, on the other hand, the receiver is a home-made model, then it may be quite possible that one or more parts are unsuitable for satisfactory short-wave working and some change will have to be made. For instance, the reaction may be found insufficient, and then operate the knob so that the pointer travels very slowly backwards and forwards over that spot, at the same time adjusting the gain or receiver controls which are fitted. Of course, when once a good station has been located the exact position will be noted and it will be possible to return to that setting, but I am dealing now with the operation of a receiver which has not been used for short-wave reception.

When the wave-change switch is opened, whilst in others portions of a coil are short-circuited as the receiver is switched to lower wavelengths, and therefore the H.F. choke modification is preferable as this will not affect the medium- or long-wave performance. In some cases a change in the value of the grid-leak or condenser or both may be found desirable. A common trouble experienced on the short waves is that known as hand-capacity effects, and these are evidenced by the fact of a signal as soon as the hand is removed from the tuning control or from the reaction control. In some cases this is due only to the fact that the fixed vanes of these two condensers of coils when the wave-change switch is opened, whilst in others portions of a coil are short-circuited as the receiver is switched to lower wavelengths, and therefore the H.F. choke modification is preferable as this will not affect the medium- or long-wave performance. In some cases a change in the value of the grid-leak or condenser or both may be found desirable. A common trouble experienced on the short waves is that known as hand-capacity effects, and these are evidenced by the fact of a signal as soon as the hand is removed from the tuning control or from the reaction control. In some cases this is due only to the fact that the fixed vanes of these two condensers

For example, you may find, when you tune in a known station, that it cannot be heard. Wait a few minutes and it will return to normal. Some commercial receivers are fitted with automatic volume control to compensate for fading, but when switched to short waves the A.V.C. circuit may be cut out on the ground that there is a form of fading present on certain short wavelengths which is so rapid that normal A.V.C. circuits cannot cope with it, and the trouble may be accentuated. Do not be disappointed, therefore, and think that the receiver is out of order if you find that your short-wave signals fade. They may pass right out into inaudibility, but this is a perfectly natural function which can only be overcome by a specially designed receiver, but if you want to play your part in your mind concerning this fact, your dealer or the makers of your receiver will inform you whether or not the A.V.C. is effective on the short waves on the particular model which you are using.

Battery Connections
Certain plugs are manufactured for battery leads in which the end of a length of wire has to be inserted. Usually a small part of the wire is bare, rolled up and this is passed through the central part of the plug then being screwed up tightly. A case of trouble was recently investigated where on the L.T. side of this plug a new edge has to be put on it, be careful that the proper shape is obtained. Some amateurs sharpen the tool on a grind-stone or oil-stone, with the result that in future when a screw becomes tight the driver slips and cuts the head. The working edge of a screwdriver is not sharp, but should be blunt and wedge-shaped so that it fits into the parallel-sided slot of the screw. A taper is necessary on the driver, however, to accommodate different sizes of screws.

Notes from the Test Bench
Re-grinding a Screwdriver
When a screwdriver has become damaged and a new edge is to be put on it, be careful that the proper shape is obtained. Some amateurs sharpen the tool on a grind-stone or oil-stone, with the result that in future when a screw becomes tight the driver slips and cuts the head. The working edge of a screwdriver is not sharp, but should be blunt and wedge-shaped so that it fits into the parallel-sided slot of the screw. A taper therefore, there will be some modification in the capacity when the hand is removed, and therefore the first step in the cure of such a trouble is to earth the moving vanes.

Earth Screens
If, however, the spindles are earthed, then the usual cause of hand-capacity effects may be found to be an incorrect earth connection and an improvement here should be effected. If this does not cure the trouble then a metal plate should be placed behind the panel and connected to earth. Clearance holes should be drilled in it to clear all components mounted on the panel, and it should be fixed to the panel by bolts at two or three places to prevent it from moving and perhaps short-circuit some vital point to earth. If desired, however, the lock-nuts which hold on the tuning and reaction condensers, provided these are already properly earthed, may be used for fixing the screening plate in place.

Fading
Finally, remember that short-wave signals fade rather more noticeably than those on other wavebands, and do not be disappointed if you find, when you tune in a known station, that it cannot be heard. Wait a few minutes and it will return to normal. Some commercial receivers are fitted with automatic volume control to compensate for fading, but when switched to short waves the A.V.C. circuit may be cut out on the ground that there is a form of fading present on certain short wavelengths which is so rapid that normal A.V.C. circuits cannot cope with it, and the trouble may be accentuated. Do not be disappointed, therefore, and think that the receiver is out of order if you find that your short-wave signals fade. They may pass right out into inaudibility, but this is a perfectly natural function which can only be overcome by a specially designed receiver, but if you want to play your part in your mind concerning this fact, your dealer or the makers of your receiver will inform you whether or not the A.V.C. is effective on the short waves on the particular model which you are using.

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

**Solus Specifications**

SIR,—Many thanks for a very fine journal. It is extremely instructive to a newcomer to wireless like myself (I have only been experimenting for three years), and I wish it every success. There, however, one small "grousse" which I would like to make. With most of the sets described in your paper you specify definite components made by well-known makers, with the result, I think, that quite a number of experimenters like myself who have neither the exact parts or the means of getting them are swayed from building the sets which I think of the name, and standard to this. I think, this could be quite easily overcome by suggesting alternatives or other ways of achieving the same object perhaps, say you specify an H.F. pentode for the H.F. stage of a certain set. Now, I, like many others, haven't got such a pentode, and therefore, cannot build that set as it stands. If, however, you suggested a screen-grid or a triode for that stage, and gave the modifications necessary I should feel greatly encouraged.—S. W. Brooks (Edgware).

**A DX Log from Nottingham**

SIR,—In view of the fine 10-metre conditions prevailing, I am enclosing a list of stations heard here from November 15th to November 29th:

- Teu-meter: OQ5AB, W5JKR, W5JZK, W5KRB, W5HGN, W6KDR, W6DL, W6KDM.
- 20-meter: PY1DA, PY7AI, PK10J, KACOS, W30UY, W5IKEK, W5BEW, and K1AF.
- 40 meters: GW2F, W6RU, W4QA-X, W5IJD, 2WMT.

I should like to exchange my S.W.L. card with any reader.—L. Streeton (74, Raleigh Street, Nottingham).

**Stations KZRF and VONG**

SIR,—The following information may be of interest to other readers of Practical Wireless and concerns stations KZRF and VONG (Newfoundland).

This station operates on 6,533 kc.s (approximately), 1600 G.M.T. and gives the call “Far Eastern Broadcasting, KZRF (Z) pronounced as Zen, Radio, Philippines, Manila, the capital of the Philippines,” followed by several musical notes. Programme is usually request dance music, and listeners are invited to send their messages in from 1500 to 1600. At 1600 G.M.T., the call is given and the time 12 midnight, Manila time at the sound of the clock, their clock.

The second transmission starts at 21.28 G.M.T., with musical notes till 21.30, then “Far Eastern Broadcasting KZRF Radio Philippine, and KZRM Radio Manila, Manila the capital of the Philippines.” This in English is given at 22.00 to 22.15 G.M.T., the rest of the programme is mainly light music.

The news is given in the Bisayan tongue from 22.15 to 22.30. It is believed that KZRF and KZRM close at 00.00 G.M.T., but I have not heard them at that time owing to general QRM and weak signal. The latest time to be heard by me is 23.30 G.M.T. No other English short-wave magazine has yet reported this station. No frequency or address has been mentioned, but I have no doubt reports will reach them this time. I am the only Manilla stations: P.O. Box 119, Manila.

A verification just received from VONG states that it operates on 6,570 kc.s, with 300 watts power. VONG has also been heard at 17.45 G.M.T. on 31.6 m. (approximation) at 65,575a, St Johns, Newfoundland. Thanks for an excellent weekly.—R. W. Hall (Workshop).

**The Hartley Circuit**

SIR,—I have been reading your journal each week for a year now, and being a S.W. fan, I have followed the "Short-wave Section" page with great interest and advantage. Unfortunately, you do not feel inclined to favour the Hartley type of circuit which I, am told, possesses many advantages. May I suggest that you publish at least one example of this type of circuit and its uses on short waves above 5 metres. No doubt many amateur experimenters will agree with me that such an article would serve as a jumping-off point for experiments with unconventional tuned circuits. K. L. Photo (Blackheath).

We, of course, included the Hartley, as well as other special circuits in the S.W. Section from time to time. However, the circuit will be included shortly in a construction article.—Ed.

**Radio Problems**

**PROBLEM NO. 380**

Attire has a three-valve battery set which had given poor results over a long period. One day he noticed that signals were slightly weaker, and the following day they seemed still weaker, and finally, after about a week, signals were practically impossible. He had batteries and valves tested and these were found to be in order. The loudspeaker was tested on a friend’s set and was found to be in good working order. Then what was wrong? Three books will be awarded for the first three correct solutions. Entries, must be addressed to The Editor, Practical Wireless, George Square, Ltd., Tower House, Southwark Street, Strand, London, W.C. 1. Envelope must be marked Problem No. 380 and must reach the Editor not later than the first post day on Monday, January 14th, 1934.

**Solution to Problem No. 379**

The serial which was described was defective and did not make contact in the second position, and thus failed to bring the pick-up into circuit.

The following three readers have solved Problems No. 378 and books have accordingly been forwarded to the winners:

K. E. E. Isaac, 114, Tynecliff Road, Penymarg, Ebbwside.

K. E. Keary, St. Andrew’s Street, Droitwich Spa.

C. H. Flood, 50, St. John’s Avenue, Wigan.

**Shortening an Aerial: Correspondent Wanted**

SIR,—I have much enjoyed reading Practical Wireless and am particularly interested in other readers’ experiences and experiments. Recently my aerial fell down, and I needed a new one to put up about a quarter of the old aerial. Imagine my surprise at now being able to give ‘Home Service’ a station much better. I found that reducing is being done by a considerable extent, although I must add that the results is also reduced.

Finally, I should like to correspond with any S.W. listener about my own age, which is 18 years. I will answer all letters received. Writing Practical Wireless continued success.—J. F. Potter (3, Council Houses, Ducklington, Witney, Oxon).

**Correspondents Wanted**

SIR,—I have been a reader of your excellent journal for 15 months, and find it very helpful indeed to begin with myself. I should be greatly pleased if any of your readers would care to correspond with me concerning S.W. listening and transmitting. Also I would be very glad to exchange my S.W.L. card with any full ticket holder. A.A. or in the U.S.A. abroad.—John Hunter (49, Twist Lane, Leigh, Lancs, England).

**PRACTICAL WIRELESS SERVICE MANUAL**

By F. J. CAMM.

From a 251st (December 1st) 1939 issue of Practical Wireless of importance, and of 12th December 1938, and on pages 5-13 of the December issue of Practical Wireless.
## Practical Wireless Blueprints, 6d. each.

**1927 Crystal Receiver**

The 1927 Crystal Receiver is a classic example of early radio equipment. It was designed for simplicity and ease of use, making it accessible to a wider audience. The blueprint includes detailed instructions and assembly diagrams to help users construct their own receivers.

### STRAIGHT SETS. Battery Operated.

<table>
<thead>
<tr>
<th>One-valve: Blueprints, 1s. each.</th>
<th>All-Wave Unipen (Penode)</th>
<th>BW37</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Two-valve</strong>: Blueprints, 1s. each.</td>
<td>Four-valve Super High (Pen, D).</td>
<td>PW64</td>
</tr>
<tr>
<td><strong>The Signet Two (D &amp; D)</strong></td>
<td></td>
<td>PW10</td>
</tr>
<tr>
<td><strong>Three-valve</strong>: Blueprints, 1s. each.</td>
<td>Selection Battery Three (D, Pen).</td>
<td>PW15</td>
</tr>
<tr>
<td><strong>Four-valve Super High (D, Pen)</strong></td>
<td></td>
<td>PW30</td>
</tr>
<tr>
<td><strong>Universal Hall-Mark (HF Pen, D, Push-Pull)</strong></td>
<td></td>
<td>PW47</td>
</tr>
</tbody>
</table>

### SHORT-WAVE SETS. Battery Operated.

<table>
<thead>
<tr>
<th>Two-valve: Blueprints, 1s. each.</th>
<th>AC All-Wave Crystal Four.</th>
<th>PW18</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Three-valve</strong>: Blueprints, 1s. each.</td>
<td>Universal Super (Three-valve).</td>
<td>PW47</td>
</tr>
<tr>
<td><strong>Four-valve</strong>: Blueprints, 1s. each.</td>
<td>F.J. Cann's Universal Four Super (Three-valve).</td>
<td>PW64</td>
</tr>
<tr>
<td><strong>Five-valve</strong>: Blueprints, 1s. each.</td>
<td>F. J. Cann's Universal 6 Super (Three-valve).</td>
<td>PW74</td>
</tr>
</tbody>
</table>

### PORTABLES.

<table>
<thead>
<tr>
<th>Three-valve: Blueprints, 1s. each.</th>
<th>Portable (HF Pen, D, Pen).</th>
<th>PW64</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Four-valve</strong>: Blueprints, 1s. each.</td>
<td>Portable (HF Pen, D, Pen).</td>
<td>PW74</td>
</tr>
<tr>
<td><strong>Five-valve</strong>: Blueprints, 1s. each.</td>
<td>Portable (HF Pen, D, Pen).</td>
<td>PW84</td>
</tr>
</tbody>
</table>

### MISCELLANEOUS.

<table>
<thead>
<tr>
<th>Blueprints, 6s. each.</th>
<th>Universal Hall-Mark (HF Pen, D, Push-Pull).</th>
<th>PW18</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Five-valve</strong>: Blueprints, 1s. each.</td>
<td>A.C. All-Wave Crystal Four.</td>
<td>PW47</td>
</tr>
</tbody>
</table>

### Bibliography

The document includes a variety of blueprints covering different types of radio equipment, from simple one-valve receivers to more complex systems. Each blueprint is accompanied by detailed instructions and diagrams to aid in the construction and operation of the devices. The blueprints cover a range of frequencies, from short-wave to long-wave, and are suitable for hobbyists and professionals alike.

### Data of Issue.

- **No.** PW15
- **Date:** Dec. 30th, 1939

These blueprints are a testament to the ingenuity of early radio engineers and the rapid pace of technological advancement in the field. They provide a valuable resource for those interested in the history of radio and the development of early electronic devices.
Screening a Valve

"I have built an A.C. set in which the detector is of the plain glass variety. I am troubled with hum and have done practically everything I can think of to cure it without result. I believe that screening the valve would prove useful, but I am uncertain whether this is so, and if it is, how to do it. Could you help me in this problem?"—S. R. (Leominster).

Although the screening of a detector valve will probably result in a reduction in hum, and perhaps in its complete removal, there is one point to watch. In some types of mains valves the screen must be a certain distance away from the electrons inside the tube, if it is of the type with a top-grid cap, that the grid condenser should be included inside the screen, probably 1 inch right on the screen. Special valve screens may be obtained from advertisers in these pages.

Coupling Winding

"I have some home-made 4-pin short-wave coils but am now rather interested in modifying them to include a coupling winding for aerial—the present windings giving secondary and reaction only. I believe you once published details in which you stated that the aerial winding could be put inside the grid winding, but I cannot find the article although I have looked all through my back numbers. Can you give me any reference to this subject?"—L. E. R. (W.C.I.).

We think you probably refer to a general article on aerial coupling in which three or four different methods of arranging for Westinghouse were described. A small former is needed, round which the primary winding may be wound, and this is inserted inside the former carrying the other windings. To ensure that the new winding will be held central and rigid inside the outer former, 1 or 3 small pieces of cork are cut and fixed to the outside of the former, the size of these corks being adjusted so that the former is not too tight fit. The same idea may be applied to standard 4-pin coil formers.

S.G. Valve for L.F.

"I am making a small amplifier which I need for a deaf-aid, and I wish to get as much gain as possible into the small amount of equipment which will be used in a very small box. I think it is possible to use an S.G. valve in such an amplifier in order to obtain high gain, but I am not sure whether the standard method of feeding the screening grid in a simple amplifier is the best. It is certainly possible to use S.G. valves in such an amplifier, and a good design would be to use such valves feeding a good L.F. valve. In view of the limited H.T. which would be used in a portable deaf-aid amplifier, R.C. coupling would be employed, and with the valves in question an appreciable gain at low H.T. consumption would be obtained. We suggest the Osram Midget valves, types S.I.2 for the S.G.'s, two being employed with a gain-control in the form of a variable grid-leak, and for the output an L.12. Forty-five volts should be ample for H.T.

Quality Amplifier

"I wish to build a really good quality amplifier for A.C. work, and for domestic purposes. I believe that a really high output is needed for quality, and am uncer-
certain regarding the best arrangement. I have collected quite a nice array of valves and odd parts and now only need the circuit. Could you help me to arrive at a suitable design?"—J. H. (Hove).

If you have suitable valves, then undoubtedly a good push-pull circuit is the best. This should preferably be of the all-resistance type, and a separate phase reverser is desirable. You would need really good valves for such an amplifier, and the final stage should be capable of about 8 or more watts. This will give good handling capabilities without needing to be turned full on, and if a suitable input is provided to the L.F. and phase-reverser stage you should find nothing to complain about from the quality point of view. Do not, however, forget the requirements of H.T. for such an amplifier.

Replenishing Batteries

"Is there any way of renewing torch cells or similar cells such as are used in G.B. batteries? I find that when these are run out they will give a fairly weak light on a torch, but if I could strengthen them in any way they would be useful. Have you published anywhere circuits for making such batteries?"—H. G., and others.

Q.M.A. cells may be given a new span of life, provided the zinc cases are not eaten away. To do this pierce a number of small holes round the lower part of the cell and then stand it in a solution of sal-ammoniac. This will give a certain amount of improvement, but generally speaking a replacement is the most satisfactory plan. We published analytical data on batteries, and as previously pointed out, it is not an econ-
ómical plan to make them. Formulae will, however, be found in our handbook on Accumulators, price is.

Repairing a Valve

"I have pulled the top of an S.G. valve and wonder if it means nothing or another, or whether I can mend this valve?"—H. B. (Perth).

If the small leading-out wire is not broken off flush with the glass, then a satisfactory repair can be made. The small metal rod on top of the threaded cap, if found to be hollow and a hot iron should be applied to the top, and it should then be shaken hard when the small solder blob should come away and leave a clean hole. Failing this, piece it carefully with a needle so that a clean hole is left. Carefully clean and tin the leading-out wire, but if this has been broken off short, another length of wire must be soldered to it. Do this carefully and then push the cap over the wire so that it projects through the hole in the threaded rod. Solder this and cut off surplus. The top of the valve by Chatterton's Compound or any other adhesive.

REPLIES IN BRIEF

The following replies to queries are given at abbreviated form either because of non-compliance with our rules, or because of general interest.

C. F. (Oxley). You should communicate with the makers of the sets as the pickup may not be usable with the particular combination. The single output stage may provide inadequate amplification, and this may not be fitted in a receiver, or without the interference of the local or nearby stations, unless you can contact the nearest local or district stations.

J. F. G. S. (Aberfeldie). You presumably need a straight H.F. amplifier, and interest may be shown to H.F. stage may, therefore, be used.

H. W. A. (Glasnevin). We regret that we have no details of the makers of the particular make of set mentioned by you.

J. D. (Newport). It would appear that there is a space in this question, perhaps in one of the electronic components. On the other hand, remember that as the leads are long, H.T. there is bound to be a spark if this circuit is made and broken, and thus the effect of the circuit is unlikely.

B. W. C. (Wellingborg). The speaker may be used direct to the grid of the nearest particular type of unit. On the other hand, it cannot give construction details in the form of a reply, and therefore refer you to your dealer's "Technical Specifications", price 8s. 6d.

T. M. (Leeds). The set may have auto-grid bias which will add to the load, or alternatively there may be an auto-grid bias from the transistor to the battery in series with the H.T. We suggest you speak to the makers regarding the matter.

C. J. B. (Norwich). We have given several articles on this subject, but the matter is by no means fully dealt with in our new "Short-Wave Handbook." K. E. (Romney). The serial is unattainable and we suggest a small square frame, about 2½ in. square, used with good light.

C. W. R. (Perth). The transmitter is of the 7 to 1 ratio type and is not now obtainable.

F. S. (Southend-on-Sea). We would not advise the building of the set. Some difficulty may be experienced in obtaining components.

L. S. (Bromley). The firm is no longer in business.

R. A. S. (Harpenden). The wavelength is in the wire and hand, which you can find marked on the dial of your set.

W. T. (Raglan). Not less than 150 volts should be used. The G.B. is 15 volts.

If you think the second alternative desirable and the speaker may be made up on the lines indicated, this is possible.

K. R. T. (Co. Antrim). Not less than 90 ft. should be used and the stranded wire is best. Solder all joints.

The coupon on page III of cover must be attached to every query.
tone control by negative feedback

(Continued from page 210)

The circuit L, C is provided between the sliding contact S and the right-hand end of the resistance R. This leads to such amplification curves in relation to the position of the sliding contact S, as is shown in Fig. 4 for the two extreme positions. In this circuit the counter-coupling for the medium frequencies remains always large, resulting over the whole range in a great reduction of the non-linear distortions. It is merely in the one extreme position (a) that the counter-coupling for the high and low tones is equal to that for the medium tones, whereas in the other extreme position (b) the counter-coupling for the high and low tones is greater than for the medium tones, so that counter-coupling for the latter is only increased very slightly.

The circuit shown is particularly suitable for use as a complete fading compensator, or for low-frequency amplifiers for record reproduction in which the medium input A.C. potential is mainly the same, and in which large non-linear medium volume is required. The effect in this case is that of a pure tone-control.

LOUDSPEAKER DESIGN

(Continued from page 117)

material of a non-resonant nature, such as lead. The other is the use of composite woofers, consisting of alternate layers of non-porous material and separating layers or pads of vibration-insulating material, such as cork, rubber, or felt, the mechanical properties of the different layers being very dissimilar.

A number of different constructions were tried, of which the following (see Fig. 1) was considered to be the most generally satisfactory for a reasonably inexpensive practical loudspeaker. It is of the suspended type, and is held on the first Sunday in January at the same time and venue as in previous years. The listener then makes his own "Resolution" and come along and meet many of the personalities of the radio world.

BRITISH SOUND RECORDING ASSOCIATION


THE suspension of the B.S.R. Television Service, which was due to start on July 5th, has been put over until further notice. The B.S.R. cannot at the moment obtain the necessary licences on terms which would justify the expenditure involved.

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SOUTHERN RADIO'S BARGAINS

ALL GUARANTEED. POSTAGE EXTRA.

5/- Parcel of Useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 5s. - 8/- per parcel.

Serve Man's Component Kit. Electrolytic Condensers, Volume Controls, Resistances, Tinfoil, Paper Condensers, Valve Holders, etc. 120 articles contained in strong carrying case, 9d x 3d.

2/- Small Trader's Parcel of Components. 350 assorted radio components. 1/- per box!

5/- 100 Wire-end Resistors, assorted capacities in 4 and 6p. per 100.

3/- Valve Condensers, 5s.


2/- Tool or Instrument Carrying Cases, ex-Government Stock; Wood 9" x 7" x 7." 2½ S.P.E.D.A. Others, Leather, 1½,s., 1½, 2½, 2½, 2½.

SOUND RECORDS. 3½, 7½, 1½, 2½, 2½, 2½, 2½.

SOUND RECORDS, 3½, 7½, 1½, 2½, 2½, 2½, 2½.

W. G. Gerrard 6632.

VAUXHALL.—All goods previously advertised are still available; send enclosed price list, free. Vauxhall Utilities, 10s. Stroud, W.O.

BANKRUPT BARGAINS. Brand new 1935 models, complete, with cardboard, with guarantees, at from 40 per cent. below listed prices; also Midgets, portable, etc., complete, and in good working order. For direct manufacturers of wireless sets. Prices quoted, Tape recorder, 4/-; Manley, 5/-; Raftery, 4½; Loudspeakers, G. F. Thomas, D.P.W., 2½, £1.25, £5.


LOUDSPEAKER REPAIRS


REPAIRS for moving coil speakers. Cones ½d. each. 7½ or 1½ in., 4½ or 5½ in. Prices quoted, including condensers. Pumps and owners. Guaranteed satisfaction. Prompt service. 13, Rutland Street, S.W.1. 2½, 2½. Bolling, Barking.

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