BATTERY CURRENT ECONOMY — See Page 83

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Practical Wireless and PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

Oct. 7th, 1939.

Contents

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Practical and Wireless
PRACTICAL TELEVISION
EVERY WEDNESDAY
Vol. XV. No. 368. Oct. 7th, 1939.
EDITED BY F. J. CAMM
Staff: W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Economy Schemes

AS we have already pointed out, it is now necessary to effect economies in various directions, owing either to the shortage of materials or shortage of labour. Apart from a reduction in the number of valves in use, or the introduction of a new simple type of receiver, there are other directions in which economies may be effected. We have already given details for modifying a set, the modification leading to very little inconvenience now that there is only a limited number of B.B.C. stations. There are, however, increased hours of broadcasting, and this may to some extent offset any economy in consumption which might be effected by circuit modifications. The early morning programmes appear to be welcomed by many, not only for the special early morning news, but for the music which provides a good start for the day and which is a feature which has been asked for by listeners for years. However, as in many other directions, it has taken a war to give listeners advantages which they have begged for on many occasions—including dance music on Sundays. In this issue we give another economy article, and also constructional details of a "spare parts" two, and in subsequent issues we shall continue this particular type of material, which has already created considerable interest.

To Relieve the Monotony

IN order to enable troops engaged in A.A. work to pass their time more congenially, it has been decided to supply them with portable wireless receivers. It is stated that so far they have found time to weigh heavily on their hands, and the inactivity has resulted in the need for the supply of some means of entertainment which it is thought radio will adequately fulfil.

Photos by Radio

IT is announced that no further picture illustrations may be sent by radio. It was a regular feature of some newspapers to publish pictures received from abroad by radio, but in future they must be sent by cable, and all photographs must be unretouched and are subject to censorship.

Transatlantic Radiophone

THE first direct radio-telephone service between New York and Italy was recently inaugurated with a 45 per cent. reduction on existing charges for week-day calls by the normal indirect route.

Radio Relays

PERMISSION has been given for certain radio relay systems to be continued, provided that single-channel systems relay the Home Service, and dual channels relay this service on one channel. Air Raid warnings and All Clear warnings may also be given over the system, but this must not be taken as a substitute for the standard official public warning signals. No talks or other spoken items from foreign stations must, however, be relayed over these systems.

Cabinet Research

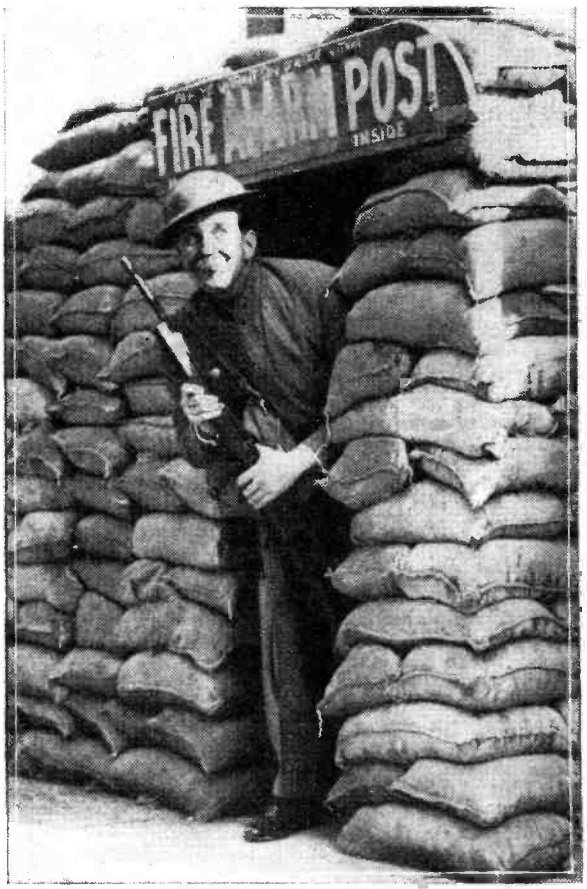
THE President of a well-known American manufacturing concern has recently complained of the effects of price reduction on cabinet design. Changing conditions and the effect of moist climates results in certain woods cupping and warping, and he recommends that all surfaces, even if hidden, should be given a heavy moisture-proof sealer coat and that special attention should be given to the sealing of edges of panels where cut-outs are made. This applies mainly, of course, to receivers for tropical use.

Summer Time Changes

VARIOUS countries are about to change, or have already changed back to standard time, with the end of the summer, and therefore care must be taken when referring to broadcast schedules to see that the time of listening agrees with our present time. Summer Time in this country will not, of course, end until November 18th/19th next.

G.E.C. and Germany

THE General Electric Company state that the Osram companies referred to in lists of enemy concerns are subsidiaries of the Osram G.m.b.H. of Berlin and have no connection of any kind whatsoever, financial or otherwise, with the G.E.C.



Stanley Holloway's amusing portrayal of the character "Sam Small" will soon be entertaining the troops in camp. He has promoted Sam with a steel helmet, and in the above picture he is rehearsing at a Fire Alarm Post in London.

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

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

ROUND THE WORLD OF WIRELESS—Continued

"The Empire's Answer"

A DRAMATIC chronicle of the entry of the British Commonwealth of Nations into the war, entitled "The Empire's Answer," will be broadcast on October 6th, when the story will be told of the method and extent of the British Commonwealth's war effort. The programme will be broadcast from a B.B.C. studio.

New Short-wave Stations for Teheran

TWO of the three short-wave transmitters which have been ordered by the Iranian Government are to be erected in Teheran, the capital.

The familiar voice WLW listeners are noticing on Saturday mornings is that of Minabelle Abbott, who, as the star of the "Life of Mary Southern," attracted one of the largest followings in American radio serial history. After an absence of several years from broadcasting, Miss Abbott has returned to act as commentator on the "WLW Mail Bag" broadcasts. The programmes are scheduled each Saturday at 10 a.m. E.S.T.

New Guinea Radiophone Service

A RADIO-TELEPHONE service was recently put into operation between four towns in New Guinea by Amalgamated Wireless, of Australia. The distances between the towns is only sixty miles, but the roughness of the intervening country makes the use of cables impracticable.

Pacific Island Station

IT is reported that a wireless and meteorological station is to be built at Raoul, on Sunday Island, in the Pacific. It is to be constructed by the New Zealand Public Works Department, and will be brought into service for providing landing-grounds and wireless and meteorological stations on New Zealand's Pacific Island Independencies.

Odd Trick of Transatlantic Radio

A STRANGE trick of transatlantic radio is reported from Paris. A broadcast to America was going out from a studio in Paris when an air-raid warning was sounded. A short-wave listener in Paris heard the warning on his radio set, coming from America, before he heard it in the streets.

B.B.C. News Bulletins

THE B.B.C. has announced that, as from Sunday last a News Bulletin will be broadcast daily at 7 a.m. As from that date the 8 a.m. bulletin will be, in the main, a repetition of the 7 a.m. broadcast.

Phillpotts Play

ON October 7th Barbara Burnham will produce a one-act play by Eden Phillpotts called "A Point of View." It is a short episode in which a kind-hearted publican tries to induce a quarrelsome husband and wife to take each other's point of view. They do; and, as you can imagine, the publican is the one who has most reason to regret his good deed.

Can I Help You?

THE National Council of Social Service has lately set up Advice Bureaux all over the country to deal with the many family and personal problems which everyone has had to face since the outbreak of war. Each fortnight from October 7th onwards, an evening talk will be given which will answer some of the more urgent questions. The B.B.C. will receive reports from the National Council on the type of question that is being asked and take advice from the Council as to the appropriate answer. Then Herbert Hodge or T. Thompson, both favourite broadcasters, will come to the microphone to help listeners "pack up their troubles."

B.B.C Staff Appointment

WE are informed by the B.B.C. that all appointments to the permanent staff are now suspended. With regard to posts advertised in recent weeks and still unfilled, applications already submitted must be regarded as cancelled.

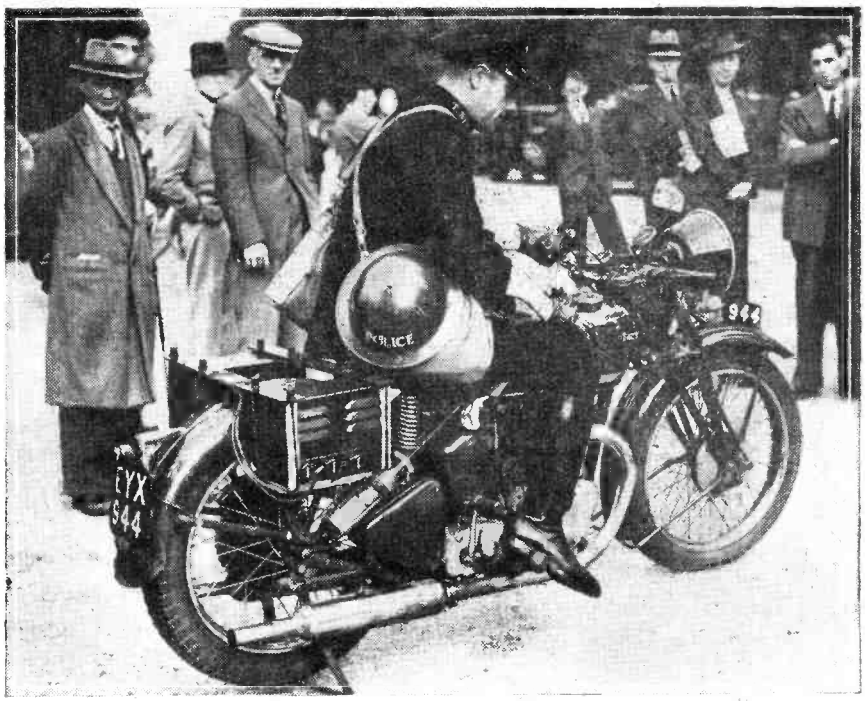
The Corporation is receiving many offers of temporary help from the public. While these are welcomed, and are being scrutinised, they cannot, owing to pressure of work, receive individual acknowledgment. Any person who has made such an offer and whose services are required will be notified in due course.

Sandy Macpherson

LITERALLY thousands of letters have been received by Sandy Macpherson, the B.B.C's popular organist, since war broke out. Presents ranging from flowers to pots of home-made jam have also poured into his office. Sandy has planned and played over fifty programmes in three weeks; these have kept closely to normal lines, his opinion being that in times of stress listeners appreciate music of a non-martial nature. The correctness of this view seems to be made abundantly clear from the appreciative correspondence which he has received.

"Adolf in Blunderland"

MAX KESTER and James Dyrenforth have decided that the proper place for Herr Hitler and his friends is the topsy-turvy world of Lewis Carroll's "Alice In Wonderland." They have accordingly prepared a political parody, to be broadcast on October 6th, in which Herr Hitler will be "Alice" and Field-Marshal Goering the "Duchess." Suitable satirical music has been written by Max Saunders and the cast will include Mabel Constanduros, Doris Owens, Jack Train and Maurice Denham.



A new motor-cycle loudspeaker unit, the only one of its kind, is being used by the Metropolitan Police in London. The loudspeaker is fitted where the headlamp usually is, and the microphone is attached by brackets to the handlebars. The amplifier and batteries are carried each side of the carrier above the rear wheel. Normally, this unit will be used for directing traffic and pedestrians, but during air raid warnings it will be used for giving the alarm and directing people to shelters.

THE RAPID TWO

Many Constructors Require a Simple Receiver Employing Parts which Can be Found in Their Spares-boxes and a Coil which They Can Make Themselves. Here is a Simple Two-valver on These Lines

CONTINUING our series of simple emergency receivers, we introduce this week an efficient battery-operated two-valver which can be constructed quickly and very cheaply. The parts required will, no doubt, be found in most spares-boxes, and as the circuit is in no way critical as regards component values, it offers sufficient latitude to allow practically any parts to be used.

The valve specification is triode for the detector position, and a pentode for the output, but if it is desired to use a power valve in place of the latter, then it will be quite in order to do so, provided one does not mind a slight reduction in the strength of the ultimate output.

The circuit follows the lines of the standard well-tried detector and L.F., as this combination, when a reasonable L.F. transformer is used for the coupling between the two valves, gives something like the maximum efficiency obtainable from such a simple arrangement.

The number of components has been reduced to a minimum, and consequently the wiring involved has been simplified as much as possible, and therefore no difficulty should be experienced by even the veriest beginner.

The Coil

To prevent any unnecessary correspondence, it should be noted that we fully realise that any efficient commercial coil of the aerial plus reaction type could be used in the circuit being described, *but* if such modifications are to be made, we cannot undertake to provide details of the connections necessary for any particular coil which might be on hand. However, the coil which we used was made up on a piece of ordinary postal tubing, measuring 2¼in. in diameter and 2¾in. in length. The coil was wound in two sections, one for the grid winding, and the other for reaction, and 26 S.W.G. enamelled wire was used. The grid winding consists of 45 turns, and the reaction winding 25 turns, the two being wound in the same direction, and separated by ¼in. The junction of the two windings is bared, and is a common earth point. If desired the windings may both be terminated at that point and the bared ends of the wires twisted together and soldered to form the earth point. A tapping is made in the grid winding 16 turns from the "top" end, as shown in the diagram of the coil, Fig. 2.

The coil was mounted horizontally by piercing the ends of the coil, and passing long bolts through from the underside of the baseboard, the necessary spacing being obtained by slipping insulated sleeves from L.T. wander plugs over the bolts. Alternatively, nuts could be used to provide the spacing, or lengths of ebonite tubing, cane, or similar material could be adapted for the purpose.

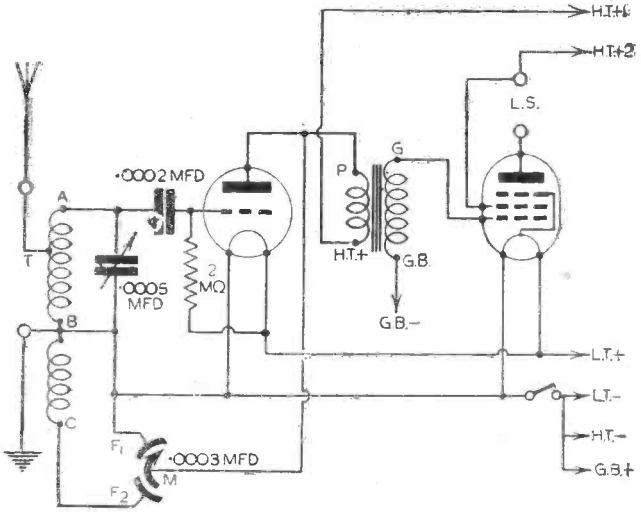
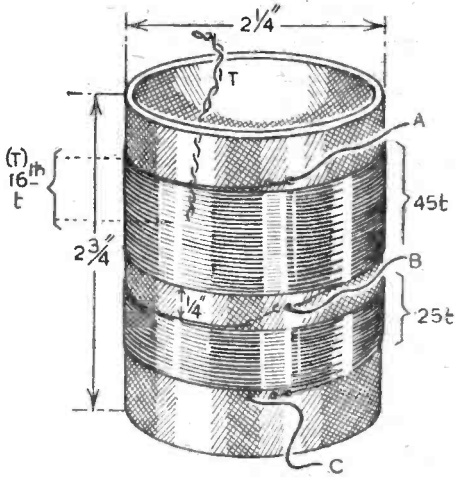


Fig. 1.—(left) Theoretical circuit of the Rapid Two, and Fig. 2.—(right) Constructional details of the tuning coil for medium waves only.



Construction

The baseboard is plywood for preference, although ordinary wood may be used. To avoid warping and consequent risk of short-circuit, however, plywood is preferable, and a thickness of ⅜in. or ½in. is adequate. The overall size of the baseboard is 5½in. by 8in., and the panel, also of plywood, is the same size. The panel need not, however, be so thick as the baseboard and ¼in. is ample. If thicker wood is used you may find difficulty in locking up the components in view of the amount of thread which is left on the fixing bushes. Baseboard mounting valveholders, one 4-pin and one 5-pin, are needed, together with an L.F. transformer. This may be of any make and with any ratio, preferably 3 to 1 or greater. Two short lengths of ebonite 2in. wide should be attached to the rear of the baseboard and two insulated terminals mounted on each. The tuning condenser is a bakelite dielectric .0005 mfd. component and the reaction condenser a .0003 mfd. differential pattern, but a standard air condenser may be used, if desired, for the tuning circuit. In the practical wiring diagram the grid condenser is shown joined to the top of the coil, and this will necessitate soldering. If you are unable to make soldered connections, or feel that your soldering is likely to be inefficient, you can avoid making use of this type of joint in the following manner. Leave sufficient wire at the ends of the various windings so that the beginning of the coil may be connected direct to the fixed-vane terminal of the tuning condenser, and use a wire-end tubular or mica fixed condenser. The ends of this component should then reach from the tuning condenser terminal direct to the grid terminal of the valveholder, and therefore before the latter is screwed in position, carefully measure the overall length of the wire-end condenser so that the valveholder will be placed in a suitable position on the baseboard. The tapping loop on the coil should be left long enough to reach direct to the aerial terminal, and the earth connection on the coil may be also taken direct to the earthed filament terminal on the detector valveholder. The end of the reaction winding may be also taken direct to the reaction condenser, and thus all soldering is avoided.

(*Continued on next page*)

LIST OF COMPONENTS

- One .0005 mfd. solid dielectric condenser.
- One .0003 mfd. differential reaction condenser.
- One .0002 mfd. fixed condenser.
- One 2 megohm grid leak—½watt type.
- One L.F. transformer (see text).
- One 4-pin valveholder, baseboard mounting type.
- One 5-pin valveholder, baseboard mounting type.
- One on-off push-pull switch.
- Four insulated head terminals.
- Two strips of ebonite for terminal mounts.
- One medium-wave tuning coil (see text).
- One plywood baseboard, 8in. by 5½in.
- One plywood panel, 8in. by 5½in.
- One Cossor 210 H.F. valve.
- One Cossor 220 H.P.T. valve.
- Connecting wire, flex, wander plugs, screws, etc.

THE RAPID TWO

(Continued from previous page

Battery Leads

Ordinary lengths of flex may be used for the battery leads, or a commercial set of battery cords may be employed. These will have suitable indicating plugs on the ends, but if ordinary flex is used you will have to purchase named plugs to complete the leads. H.T.1 should be plugged into the H.T. battery at about 60 or 66 volts and H.T.2 at 120 volts. A standard 2-volt accumulator should be used for the filaments, and for G.B. a 9-volt battery will be required, inserting the G.B.— plug into the 4.5 or 6 volt socket, according to the particular valve which you use. The valvemaker's leaflet will indicate the appropriate bias voltage for the H.T. in use. Connect aerial and earth, and a loudspeaker or 'phones to the output terminals, and when the on/off switch is pulled out the receiver is ready for tuning. Remember that reaction will not only increase the strength of signals, but will also sharpen the tuning, so that if a distant station is required, and there is any slight interference, it may be worth while increasing reaction to cut out the interference. A slight readjustment of the tuning condenser must, of course, be made to allow for the slight modification of the tuning which is experienced when reaction is used.

NEXT WEEK!

Another Easy-to-Build 3-Valver—
The 30/- Three

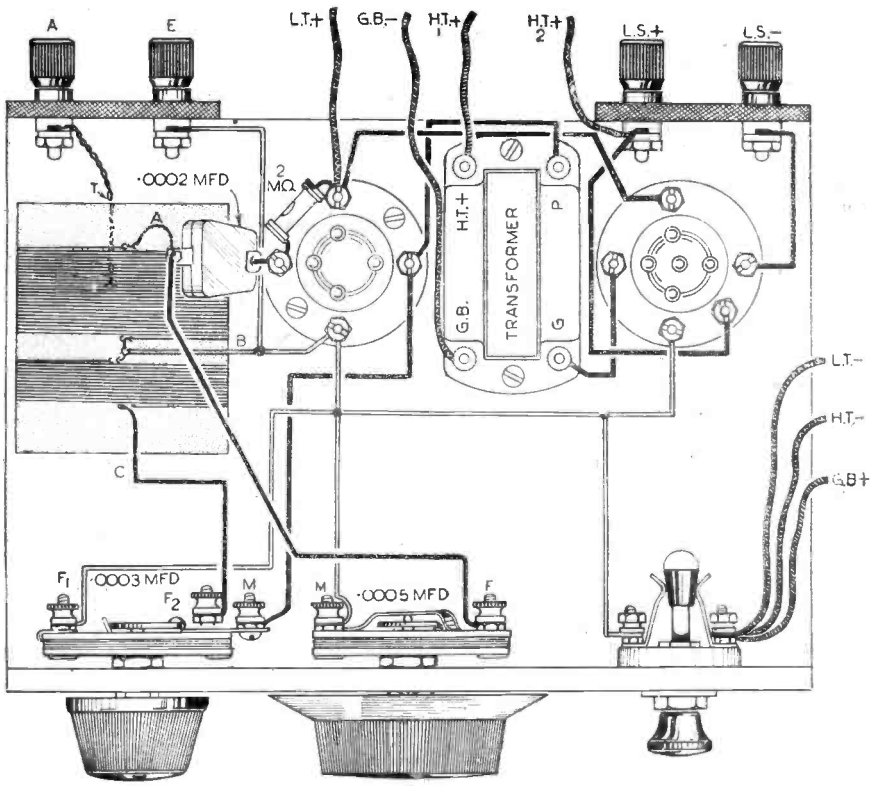


Fig. 3.—Wiring diagram of the Rapid Two.

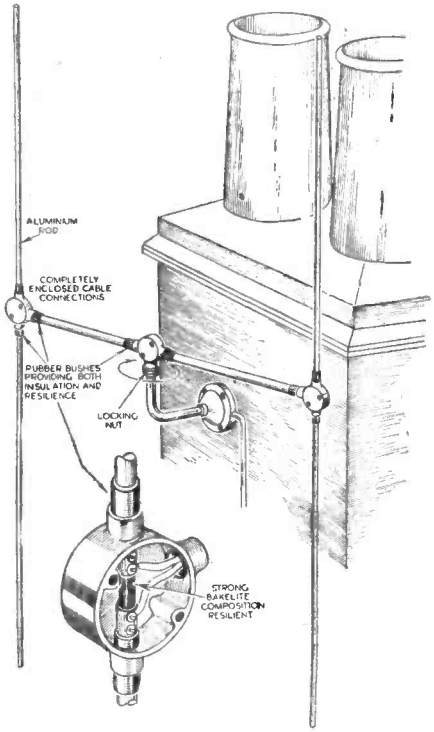
Notes from the Test Bench

Coloured Dial Lights

THE normal method of using a dial light for tuning indications has many interesting developments which form the basis of experiment for those who are interested. One or two commercial receivers have been produced with coloured lamps to indicate the waveband to which the receiver is adjusted, and this is a useful arrangement for the home-built set. Red and green bulbs may be obtained from the popular stores, or ordinary lamps may be used with coloured Cellophane attached to small escutcheons mounted on the panel. Chocolates and other commodities are often wrapped in this transparent Cellophane, and it may be stuck on the panel or other material with ordinary mucilage. The wavechange switch may be adapted to operate the lamps or separate switches may be ganged up.

Cutting Out Terminals

WHEN making a receiver in which it is desired to use soldered connections throughout, it may be thought worth while to cut out any terminals which may be fitted to some components. If this is done a soldering tag will have to be anchored to the component to enable the leads to be attached, and this may be done in many cases by fixing a type of eyelet in the component to hold the tag in place. Small eyelets and a hand-fixing tool are available from stationers, and are used for fixing papers, and they are quite suitable for the purpose mentioned, provided the material from which the component is made is not too thick.



A new and efficient television aerial and reflector fitting, seen at Olympia. Note the method of obtaining a weatherproof connection.

Additional Transformer Winding

TO enable certain small relays to be operated, or special indicator lamps to be operated, a small voltage may often be found useful, but not obtainable with an existing mains transformer. It should be remembered that an extra winding may, however, be placed on a mains transformer without interfering with the general design of the component. This is accomplished by winding the desired number of turns over the entire transformer, making certain that the winding is in the same direction as the remaining windings, and preferably placing a layer of Empire tape over the corners of the core of clamping strips to prevent short-circuits. If the original turns number is not known, it will be desirable to make a trial winding and measure the output with a reliable meter.

WILL THE CRYSTAL NOW COME BACK INTO FAVOUR?

The Crystal as a Detector has been Sadly Neglected, and the Writer Contends that Now is the Time to Make Full Use of its Qualities

By L. O. SPARKS

MANY interesting problems have been created, and much food for thought has been provided by the introduction of the Home Service scheme of B.B.C. transmissions.

While fully realising that the new service affects, to some extent, every listener, it will undoubtedly be left to the constructors to convert the restricted facilities into a golden opportunity for experimental work which, owing to the many other attractions prior to the war, has been sadly neglected or ignored.

For example, many of us are concerned with constructing and/or designing what might be termed emergency or stand-by receivers. Most of us are likely to realise that economy will form one of the governing factors in the future, and the fact that it is not necessary to run a multi-valve receiver for the reception of one of the two medium-wave service transmissions.

Bearing these details in mind, it is natural, therefore, that our thoughts turn to simple, efficient and economical sets which would not only be inexpensive to build, but also simple to operate under the most adverse conditions. One- and two-valve receivers, similar to those already described in these pages, are quite satisfactory, and in the majority of areas would provide headphone and loudspeaker reception when used with quite a small aerial. In many cases, however, there is a desire to construct a receiver even more simple than these and, if possible, dispense with batteries and their associated upkeep.

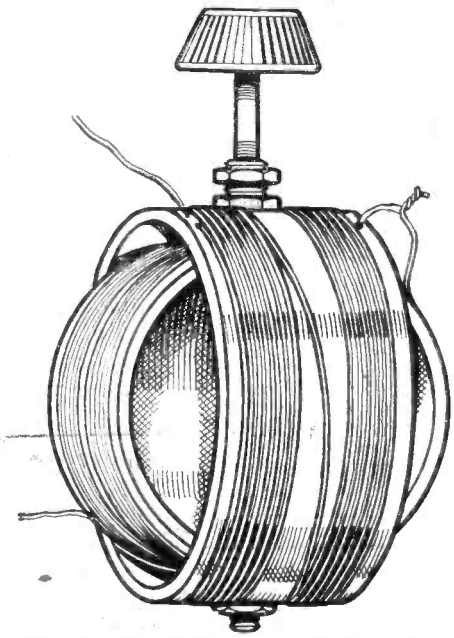


Fig. 2.—One of the most simple forms of variometer formed with two short lengths of ordinary tubing. The windings are connected in series.

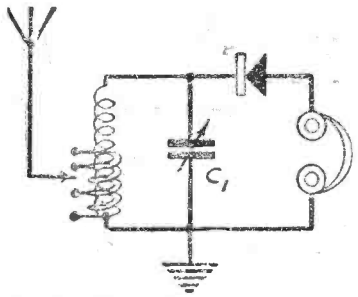


Fig. 1.—The fundamental circuit of a crystal receiver.

Crystal Circuits

The only alternatives to the valve as a detector are the Westinghouse metal rectifier, and the old and well-tried crystal arrangement. Both, under reasonable conditions, are quite satisfactory, and in all fairness to the former, one cannot overlook the fact that it does not call for any adjustment, but against that, it must also be appreciated that the modern type of semi-permanent crystal detector no longer calls for continual adjustment like the earlier cat's-whisker type.

Since the introduction of the numerous Regional and National transmissions, during normal conditions, the chief drawback of the crystal receiver was the poor selectivity obtainable with a simple aerial-tuned circuit. Trouble was sometimes experienced with break-through of medium-wave stations when the circuit was being tuned to long-wave transmissions, but when considering the present Home Services the majority of these troubles are eliminated owing to the absence of Droitwich and several of the medium-wave stations from the air. It is interesting to note, bearing the above details in mind, that the Stand-by Crystal Set, which is fully described in the issue of May 13th, is designed for medium-wave reception only and is, therefore, ideal for the present conditions.

Circuits

The simplest crystal circuit is shown in Fig. 1. The crystal detector can be of the cats-whisker or semi-permanent type while the tuned circuit can consist of a plug-in coil, a modern dual-range type or a simple home constructed component similar to that used in the Stand-by Set, plus, of course, a variable condenser for tuning purposes.

Many and varied experiments can be carried out with tuning circuits. For example, one method which was so popular in the early crystal sets was the variometer which is shown, so far as general constructional principles are concerned, in Fig. 2. It actually consists of two windings connected in series and so arranged that one is located inside the other in such a manner that it can be rotated through 180 degrees, the object of this movement being to allow the total inductance to be the sum of the two windings or, when the inner coil is in the maximum opposite position, to be reduced by the opposition of one to the other.

This variation in inductance allows quite satisfactory tuning to be obtained when a high degree of selectivity is not required, as during the present conditions, and it possesses the advantage of not requiring a tuning condenser, thus simplifying construction and reducing cost. The most elementary form of variometer can be formed from two short pieces of rigid cardboard tubing whose diameters are such that one will just rotate within the other. The larger tube should have a diameter of, say, 3½ins. to 4ins. and carry 25 turns of 26 S.W.G. wire. The inner former must be cut to a length which will just allow it to rotate without fouling the outer coil and should carry the same number of turns as the larger one and wound in the same direction. A simple fixing spindle can be formed out of two short lengths or one long length of threaded rod, the relative positions of the two coils being fixed by suitable nuts

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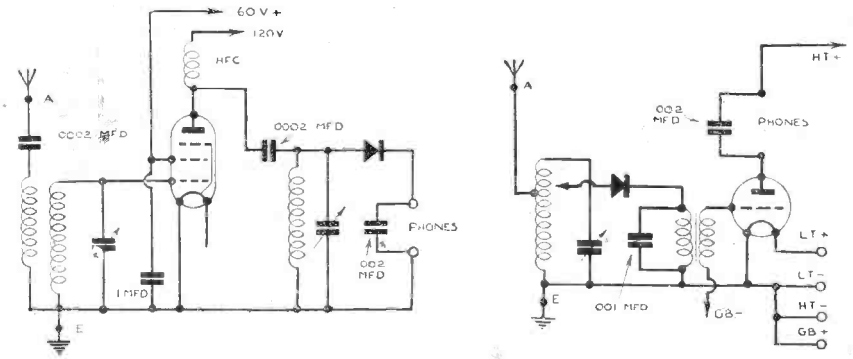
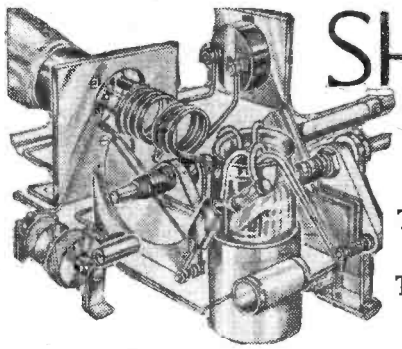


Fig. 3.—The theoretical circuits of suitable H.F. and L.F. arrangements for use with a crystal detector. The H.F. circuit, which is shown on the left, should be used when increased range and selectivity is required, while the L.F. addition increases volume only.



SHORT-WAVE SECTION

THE TUNED H.F. STAGE VERSUS THE SUPERHET.

The Possibilities of the T.R.F. Receiver are Discussed in this Article.

A NOTICEABLE thing relative to short-wave circuits and receivers is that the individual types have a definite following amongst enthusiasts. Financial status, together with variations in the standards of constructional and operating skill are undoubtedly responsible for such diversity of tastes, and whilst everyone desires the best type of receiver obtainable, the majority must compromise and build the best they can afford.

The experimenter of long standing more or less takes everything in his stride. Consequently, some favour the superhet, others the T.R.F. receiver and regard short-wave reception via the loudspeaker as the only means worthy of consideration. Such ideas are, of course, erroneous. We must take a broad view and remember that the headphone-type receiver meets the individual requirements of some, if not of others.

The most satisfactory receiver is that which enables one to obtain results which are equal or surpass those which may reasonably be expected at the price. Sponsored designs are, therefore, a sound investment.

Selectivity and sensitivity are factors of vital importance, and the superhet is undoubtedly the most selective and sensitive type of short-wave receiver available, and in addition, the colossal stage gain of this type of receiver cannot be disregarded.

Superheterodynes, however, have their disadvantages, some of which can be overcome if one is prepared to pay the price.

Many, however, cannot afford to do so, yet desire short-wave reception via the loudspeaker, and consequently the T.R.F. receiver still enjoys a measure of popularity. If carefully designed and used in conjunction with a suitable aerial and earthing system, a reasonable degree of selectivity and sensitivity is obtainable. Selectivity and sensitivity, however, are much below superhet standards, although some improvement is noticeable when modern coils and H.F. pentodes are employed.

Tuned and Untuned H.F. Stages

It is, however, generally realised that in order to obtain the maximum of H.F. amplification, the H.F. stages should be tuned. This, however, does not mean that untuned H.F. stages are absolutely useless. An untuned stage of H.F. has limitations, and so long as such are realised, and definitely understood, can be used to serve a purpose within those limitations. Usually, untuned H.F. stages are associated as buffers between the aerial and the detector stage.

A receiver in which two tuned H.F. stages are used, requires very accurate coil matching and condenser ganging, in order to obtain maximum sensitivity, selectivity and volume. To achieve all this is by no means a simple matter.

The degree of effective H.F. amplification obtained on the higher frequencies falls a long way below broadcast standards, and whilst two tuned stages will obviously prove to be better than one, comparative tests have shown that the difference between a tuned H.F. stage, followed by an untuned H.F. stage as an alternative to the use of two tuned stages, is in many instances not sufficiently marked to justify the extra controls and coil-matching procedure.

Thus it will be appreciated that the use of a tuned H.F. stage, followed by an intermediate untuned stage is, under the circumstances, worthy of consideration, as the loss in selectivity and sensitivity are very slight indeed.

The American President, Franklin D. Roosevelt, broadcasting from the White House, following the news that England and France had declared war on Germany.

An Experimental Receiver

Whilst tuned and untuned H.F. amplification is under discussion, further applications of the latter might form a basis for useful experiment. For example, a carefully designed receiver, employing one or two tuned H.F. stages, is usually comparatively trouble free and simple to operate, especially when ganged tuning is incorporated.

Experimental models, however, sometimes behave in quite a different manner, and one of the most common symptoms experienced is instability due to self oscillation in the H.F. amplifiers, over which the operator has no control, and a definite cure must be found before any useful work can be done.

If, however, controlled oscillation or, to be correct, controlled regeneration in the H.F. stage could be introduced, both sensitivity and selectivity would be considerably improved.

Whilst an attractive proposition, it is by no means a simple one, because the application of reaction during operation to one stage would throw the other into oscillation.

The regenerative stages must, therefore, be effectively isolated, and the inclusion of an untuned intermediate H.F. stage would accomplish this successfully, because whilst allowing signals to pass through the set in the normal way, it would prevent feed back between the detector and regenerative H.F. stage. The complete screening of each stage and separate control of each reaction circuit would be necessary, although there appears to be no reason why the tuned circuits should not be ganged and a drum type dial used.

Experiments along the lines suggested cannot be regarded as straightforward, due to the fact that the method adopted in order to overcome one snag may create others. One fact, however, must be borne in mind, namely, that whilst some means of increasing the selectivity and sensitivity of the T.R.F. receiver is desirable, simplicity of control must not be sacrificed in order to do so.

Providing, however, that the application of high frequency regeneration can be applied, and simplicity of control retained, there is no reason why the T.R.F. receiver should not regain the popularity lost to the benefit of the superheterodyne.

Taking into consideration the ability and adaptability of British research workers and valve designers, such developments are, in the opinion of the writer, within the bounds of possibility.—A.W.M.

ON YOUR WAVELENGTH

By Thermion

Great Demand for Battery Sets

I AM informed there has been an enormous demand during the past month for battery receivers. Apparently, the public are buying these to conserve their mains supply, which will shortly be rationed. A mains set, of course, does not consume a great deal of current, but every little helps. During that same period we have also sold a great number of battery blueprints. I think it is a wise move on the part of the public to make sure that they can listen in. I remarked in an earlier issue that the war has brought back to our ranks large numbers of constructors who had deserted us.

Another factor is the shortage of commercial wireless sets, for many firms are entirely engaged on Government work, and prices of such receivers that are available are being increased. Fortunately, it is still possible to build a first-class receiver at a fraction of the cost of a commercial set, and I would remind readers of our very complete Blueprint Service, which lists blueprints which will cater for almost every need.

In these nights of blackout fresh interest has been given to wireless experiments, and some thousands of receivers are being constructed all over the country. From the point of view of the numbers being built we are back to about 1927. Many new readers have written to say how pleased they are to learn that there is a wireless journal to guide them.

Paper Restrictions

OWING to paper restrictions during the war it is essential to place an order in advance with your newsagent or bookstall for the regular supply weekly of this journal. You should do this immediately on the form printed in this week's issue. This takes effect with all issues published after Saturday, October 7th. If you have joined Newnes' Practical group—*The Cyclist, Practical Motorist, Practical Mechanics*, and PRACTICAL WIRELESS, you must place an order in advance for them.

The War-time Taste

PUBLIC taste changes in normal times very slowly. In war-time it changes overnight, and that is so in connection with wireless programmes. You will recollect that in the last war the Old Bill sketches were greatly appreciated, but they faded after the war. The B.B.C. is doing its best to provide programmes in keeping with public taste. You have noticed that songs of the previous war are being revived. There seems to be a chance here for our lyric writers, authors, and playwrights to produce work in syntony with the public outlook. You cannot catch new birds with old chaff, and it seems to me that material which was popular in the last war has grown stale by constant repetition. Something new is required. We do not want gramophone records all the time. The B.B.C. has its war-time difficulties, and everyone is aware of them, but I am pleased to note that in recent days they have been putting on some merry programmes as an antidote to blackouts, closed cinemas, theatres, and restaurants.

During the last war we were without radio, and should be sufficiently grateful that we have it in this. We do not have to wait for the newspapers. In the early days of wireless, radio followed the newspapers; the situation is now reversed.

From the Limbo

I WAS searching in the attic the other day for some old periodicals and came across a cardboard box in which I had carefully stowed away one of my earliest battery receivers. It employed six-volt bright-emitter valves, filament rheostats, adjustable grid leak, ebonite panel, and baseboard. It was a three-valver. I was minded to see how it would perform under modern conditions, so I passed the vacuum-cleaner over it to remove the cobwebs and dust, coupled up three two-volt accumulators, connected up the H.T. battery, and tuned in. I was amazed at the result and the quality of it. It is true that the valves blue-glowed directly an attempt was made to push up the H.T. voltage, but stations literally rolled in. The selectivity, of course, was not good. I shall endeavour to find some small boy who wishes to experiment and make him a present of it, substituting, of course, some two-volt valves, and scrapping the filament rheostats.

During the search I was amazed at the amount of wireless junk I possessed. There are wonderful variable condensers, most of the gadgets which were claimed to give miraculous results, and specimens of the early work of most of the present component manufacturers. I came across some Xtraudion, and Dextraudion valves. Do you remember them? They were the last word in economy valves. I came across a box of crystal detectors complete with mechanisms for searching for the sensitive spot. Some of them were most ingenious. Nowadays it is a difficult matter to purchase a crystal, but in those days there were dozens of them on the market—most of them galena under fancy names, and sold wrapped in silver paper and a fancy box. It's great fun listening on a crystal receiver even to-day. I expect all over the country a number of these old receivers have been dug out for further service during the war.

Johnson the Quack, and Boswell the Sycophant

I DEBUNKED Johnson and put Boswell in his place the other week. This has inspired the muse of "Torch," who writes the following—er—I won't give it a name:

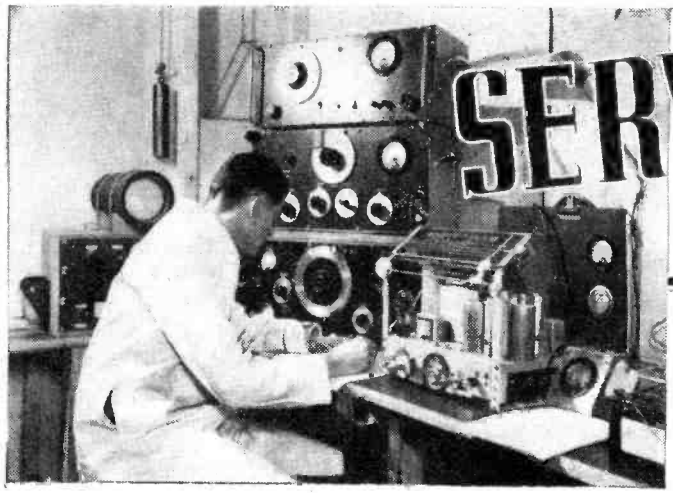
A task too long delayed, by many weakly bunked,
But now at last the "doctor's" well debunked,
And Boswell's sycophancy Thermion bold exposes;
But won't the "culshawed" look straight down their noses!
Their eyebrows arched, their lips in condemnation pursed
To find their idol well and roundly cursed
By some bold journalist whose "wude and vulgah" pen
Makes more appeal to all us lesser men,
Because its point with little fuss or trouble
Lets out the "gas" from affectation's bubble,
And dipped in acid wit to our continual mirth
Brings "highfalutin" quickly back to earth.
He shows us how, endowed with plenteous swank,
Too often tenth-rate persons fill the foremost rank;
His wholesome criticism wilts pretension vain
For which we're thankful; it keeps us others sane.
His reproduction's good, without "distortion"
And helps to keep things in their right proportion.

Readers on Service

I HAVE received a large number of letters from readers on service. They are all receiving the journal regularly, and I have replied individually to each of their letters. One stalwart has built himself a midget portable receiver which he managed to stow away in his kit with a coil of wire for an aerial. Another has sent me a series of circuits of receivers he hopes to build when the war is over, and asking for my criticism. A reader somewhere in Kent is studying "Wireless Transmission for Amateurs." Another is carrying with him the "Wireless Constructors' Encyclopædia." I suggest that all readers on service should endeavour to correspond with one another, and if they are in the same unit, they might have some friendly pow-wows on the subject dear to their heart. We are not permitted to publish the locations of readers on active service, but I shall be glad to publish a list giving the numbers and districts in which readers are serving, so that letters can be forwarded by the proper authorities. I hope readers on service will let me have photographs so that occasionally I can publish a page of pictures.

Back Issues

BACK issues of this journal are becoming scarce. Many of them are entirely out of print, and I continue to receive requests for particular issues. I pointed out once before that we have a limited number of bound volumes, 1, 2, and 3, at 12s. 6d. each. If you desire to take advantage of this offer whilst the going is good, send your remittances to The Publisher, George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.



SERVICING —New Series

How a Receiver Should be Analysed in Order to Locate the Source of a Fault or Defect, and the Use of Special Testers

WE saw last week that, after entry in suitable books, the valves were tested as a first step in servicing the receiver. If the valves pass the tests satisfactorily they should be reinserted in the receiver, taking particular care to place them in their correct holders. This is, in fact, one cause of common trouble in domestic receivers—the listener removes the valves for dusting or some other purpose, and replaces them in the wrong holders. Various troubles may be introduced by this means alone. However, when the valves have been replaced an examination of the wiring should be made. All connections and soldered joints should be examined to make certain that good electrical connection exists. Where insulated sleeving or covered wire is employed, and it is found that this is worn where it passes through a hole in the chassis, the lead should be unsoldered and a new length of insulated sleeving or new wire put in its place. Where a multiple switch of the exposed contact type is fitted this should be operated and examined at the same time to see that all moving parts work as designed, that is, that fingers close or open and that no dirt or grease is present to prevent satisfactory contact. Examine particularly the lead from the aerial terminal to its connecting point, as it may be short-circuiting and thus preventing signals from being fed to the first stage.

Gramophone Circuits

If the receiver has pick-up terminals, switch to gramophone, switch the receiver on and try the pick-up, either with a record or by "picking" the needle. If reproduction can be obtained, then the L.F. (and mains section in the case of a mains receiver) is in order and thus testing is limited to the H.F. and detector stages in a straight set or the frequency changer and I.F. stages in a superhet. It is in the latter that most difficulty is likely to arise, as the straight set is really quite simple in design and should take little time to trace out. As, however, the superhet requires very special treatment to service properly, this will be the subject of a future article. If it is not possible to find a suitable broadcast signal for test purposes, a signal generator or service oscillator should be used to provide some note which may be fed to the aerial for test purposes. The first step is to set any volume control to maximum position and then rotate the tuning control through the entire range. If no signal is obtainable, then obviously a stage-by-stage test is called for, and in this connection the first step is to check all supply voltages. Your general-purpose meter should be suitable for this, as already mentioned in a previous article, and the location of a break in the circuit should be quite a simple matter.

If weak signals are obtainable the probable cause will be wrongly ganged circuits or some other defect in the actual tuning circuits and the coils will thus have to be examined.

Component Tests

If a voltage test at various points indicates that a defective component is in use, the component will, of course, have to be tested to find the trouble. There are various types of test which may be used but the following are probably the most usual.

CHOKES. In the case of both H.F. and L.F. chokes the D.C. resistance should be measured with the resistance meter and at the same time an insulation test should be made between the winding and the core.

CONDENSERS. All types of condenser should be tested for short-circuit and in the case of fixed or solid dielectric components tests for insulation between terminals and casing should be made, assuming, of course, that a metal case is used. In the case of electrolytic condensers the measurement of the actual capacity is not a simple matter, but the leakage current may be measured and will give an indication as to the condition of the condenser. Before making the leakage test, of course, the condenser must be tested for short-circuits so as to avoid damaging the test meter which might be joined across a shorted condenser. Another important point in this connection is that the ohmmeter will provide two different readings when joined across the electrolytic condenser, the probable readings for an 8 mfd. 450 v. working condenser being in the neighbourhood of 22,500 ohms one way round and 750,000 ohms the other way. If the condenser does not indicate a very low resistance or short-circuit the leakage test should be carried out by connecting the condenser to a D.C. supply equal to its actual rating and connect a milliammeter in series for a fairly long period—say about a quarter of an hour. When first joined in circuit the needle will rise to a maximum reading and then slowly fall back to a low value according to the capacity of the condenser and it should remain constant at that value. If it does not give a reading when first connected up, the condenser is open-circuited, and if a high reading is obtained all the time, then the condenser is partially or entirely short-circuited. All other components are, of course, capable of being tested directly with either the ohmmeter or a voltage supply and milliammeter.

Replacement

When a component has been found to be defective it must, of course, be replaced, and in this connection care should be taken to see that the replacement is as nearly as possible an identical item to that which is removed. When an exact replacement is not available the nearest possible equivalent should be obtained, and if this means that a slightly lower resistance is included it may, in some parts of a circuit, be necessary to add resistance to bring the total up to that originally fitted.

Manufacturers go to great pains to make certain that mechanical parts will not break down. Here is a Philips' Tester which operates the push-buttons, pressing each button 160 times at the rate of 23 times a minute.

MIXING INPUT CHANNELS

The Uses of the Double-Triode Valve for Mixing in P.A. Work

IN Public Address work good, independent mixing of a number of input channels—microphones, gramophone pick-ups and sometimes radio—is always needed. It is essential, too, to the production of plays for Home Broadcasting, such as are published in this journal at various intervals.

The methods used for mixing obviously have a great effect on the ultimate quality of the sounds produced. Little attention has in the past been paid to this problem: many seem content with crude methods, others use circuits of scientific accuracy but of low efficiency.

The use of double triodes, i.e., two separate triodes contained inside one envelope, provides a ready means of mixing inputs both efficiently and economically.

Potentiometer Methods

The simplest type of fader is that shown in Fig. 1. This is a straight fade-over system used in cinemas, or with home sound-on-disc talkie equipment for changing over from one input channel to another. With the control at its limit one way, one channel is fully in circuit and the other totally out, and as the control is rotated the first channel is faded down as the second is brought in until the control reaches its limit the other way, when the positions are totally changed. Only one potentiometer is used. This system is not very satisfactory, since the inputs cannot be mixed independently and there is no latitude of control.

Figs. 2 and 3 show other types of potentiometer mixer. Here two independently variable controls are used.

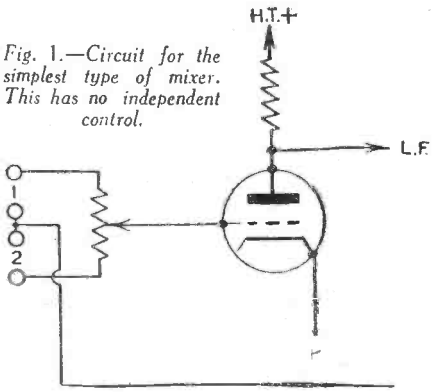


Fig. 1.—Circuit for the simplest type of mixer. This has no independent control.

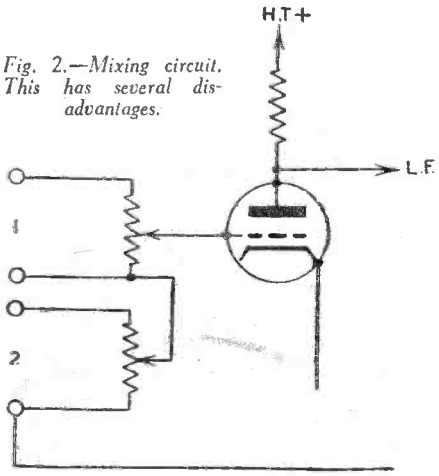


Fig. 2.—Mixing circuit. This has several disadvantages.

Fig. 3 is rather the better of the two, since the arrangement of Fig. 2 suffers from the disadvantage that parts of the potentiometer resistances are "shorted out" as the controls are varied. Since the input of each channel is in series with that of the other, and as the total resistance in circuit changes by virtue of this shorting out as the controls are rotated, when we vary one of the input controls we inevitably cause a variation in the input of the other channel. The tone of each channel is also impaired, since neither of the channels is working all the time into its correct load resistance and varying attenuation occurs.

With the arrangement shown in Fig. 3 the controls are in parallel and so direct interaction is far less noticeable. The high resistances inserted in the output leads to the grid provide for a high resistance path from the grid of the valve to earth even when both controls are set at zero input. This produces a rather high hiss level, due to valve noise or microphony.

This effect may be overcome to a certain extent by having an overall gain control before the next valve as shown. If we have this main control as shown the overall gain can be kept to a minimum and so the noise level may be reduced as much as possible. Where microphones needing pre-amplifiers, such as condenser microphones, are used, the mixing and gain control should be put as late in the circuit as possible to reduce working noise from the controls.

Disadvantages of Potentiometer Mixers

All methods of mixing employing only resistors and potentiometers involve a considerable loss in signal strength. If there are two input channels, the voltage input to the grid of the valve will be halved, with three inputs it is reduced to one-third, and so on. This is the reason for the relatively high hiss level. A considerable amount of the voltage available from the channels is dropped in the resistance network, and so the systems have a very low overall efficiency. Valve noise and hiss also become more evident as efficiency decreases. This is true for all resistance methods, and not only with those given here, which are merely examples.

As mentioned before, interaction is likely to occur between the inputs as the controls are manipulated, and the tone as well as the volume of all the inputs is varied by virtue of the variable attenuation of the network. In addition, the grid to earth resistance of the valve into which the inputs are feeding is varying, and is always below its optimum value. Most of these disadvantages may be eliminated by the use of valve mixing.

Valve Mixers

There are now on the market quite a number of double-triode valves, that is, a valve consisting of two electrically separate triodes within one envelope. All of these are American type valves, three of them, 6C8G, 6F8G, and 6N7G, having Octal type bases. The 6E6 and 6A6 are similar, but have American 7-pin bases. The principle of working is the same for all.

The cathodes of the two triodes are tied externally, and input channels are fed into the separate grids through their own gain controls, as shown in Fig. 4. The mixing takes place in the common anode circuit, and the mixed output is taken off from the anode resistance and fed through the main gain control to the next valve. Since the mixing does not take place until the anode circuit of the system, no detrimental interaction or feedback between the inputs can occur, and, consequently, the overall response and tonal quality are no longer impaired. Varying one input control cannot interfere with the volume or quality of the other channel—the two inputs are entirely independent.

Valve	Base	Filament Volts	Filament Amps.	Anode Volts	Anode mA	Anode Resistance	Load Resistance	Grid Bias
6A6	7	6.3	.8	300	7.0	11,000	20,000	6
6N7G	Octal			As for 6A6				
6C8G	Octal	6.3	.3	250	3.1	26,000	50,000	3
6F8G	Octal	6.3	.6	250	9.0	7,700	15,000	8
6E6	7	6.3	.6	200	11.5	4,300	10,000	20

Typical operating figures for double-triode type valves. Values given are for each separate triode.

In addition each input is working into its correct load resistance potentiometer, and this is not affected by variation of the controls.

The full gain of each part of the double-triode is available for its particular channel, so that as well as providing an excellent method of mixing, the double-triode does

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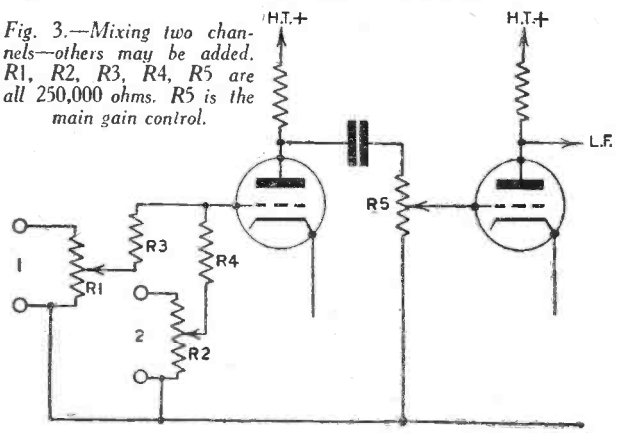


Fig. 3.—Mixing two channels—others may be added. R1, R2, R3, R4, R5 are all 250,000 ohms. R5 is the main gain control.

Ganged Tuning Circuits

A Few of the More Important Points to be Observed in Building and Using a Receiver having Ganged Tuning Circuits are Explained Below

IT is now so commonplace to employ a gang condenser for controlling two or more tuning circuits that the essentials for correct ganging and matching of the circuits are very often overlooked, with the result that the receiver does not give the best performance of which it is capable. A few years ago designers whose chief object was to obtain the greatest possible efficiency made every effort to avoid the use of ganged condensers, but matters are considerably different to-day. For one thing only two, or at the most three, tuning circuits were used in all but the most advanced types of receiver in the past, and it was not a very difficult matter to operate separate tuning condensers for each circuit. Now, however, it is not unusual to employ four tuned circuits, each of which is extremely selective and must be tuned with precision. What is more, nothing would be heard at all if each one of the condensers was not adjusted very near to the precise tuning-point, since modern tuning coils, especially iron-core ones, are so selective. And it is a physical impossibility to operate four different condensers simultaneously and to keep them all "in step," whereas when the condensers are all joined together mechanically they can easily be made to rotate at the same speed.

Inductance and Capacity Matching

It is not sufficient, however, just to take, say, three coils intended for covering a similar band of wavelengths, and to use these in conjunction with a three-gang condenser. The first essential is that the coils must be identical in every way; not only must they have the same number of turns, but the windings should be arranged in the same manner and the turns should be equally spaced. The reason for this is that, as has been pointed out on many previous occasions, the wavelength to which an oscillatory circuit (comprising a coil and condenser) is tuned depends upon the inductance of the coil and the capacity across it. The latter factor is governed mainly by the tuning condenser, but it must never be overlooked that there is capacity between the turns of wire on the coil, and that this fixed capacity should, theoretically, always be added to the capacity of the variable condenser at any particular setting. As the effect of the self-capacity of the coil is comparatively slight it was not referred to when dealing with tuning scales last week; in any case it would have no more effect on the tuning pointer than that of shifting its position by a very small fraction of an inch. Its importance in connection with accurate ganging is much greater for, as most readers are aware, the slightest movement of the tuning knob in a modern highly-selective receiver is sufficient to reduce signal strength to half, and often to introduce a certain amount of distortion.

It is for the reason just given that if two or more tuned circuits are to be ganged in the usual manner the various coils must not only have the same inductance but also the same self-capacity; this means, in effect, that they must be matched coils of the same make and type.

The Effect of Long Leads

There is yet another point which must be considered, this being in connection with the wiring to the coils and to the sections of the gang condenser. The connecting wires have a certain inductance of their own, and also form a small capacity with other wires, components and earthed screens to which they run near. This means, for example, that if the grid lead from one coil is long and covered by screening braid, whilst the corresponding lead from another coil is short and unscreened, there is every possibility of the two circuits being imperfectly matched—even though proper care has been taken in every other respect. To avoid any difficulty in this respect it is wise to make every endeavour to "balance" the connecting leads as far as is mechanically possible.

Care with the Trimmers

It is true that all modern gang condensers are provided with a small pre-set trimming condenser on each section, and that these can be used to balance out stray capacities, but there is no means of balancing the unequal inductances of leads. Perhaps you will say that the inductance is so small as to be negligible; it is in the majority of cases, but it might reach measurable proportions if some of the wires are long, and if they do not follow a straight path. But even the use of the trimming condensers does not overcome every difficulty, because if the capacity is high the tuning range of the receiver is restricted. The reason for this is that the trimmer capacity remains constant whether the tuning condenser is at minimum, maximum or any intermediate capacity. In consequence of this, the ratio of maximum to minimum capacity—upon which the tuning range is dependent—is reduced. As an example, suppose the minimum capacity of a variable condenser to be 20 mmfd. (.00002 mfd.) and the maximum capacity 500 mmfd. (.0005 mfd.), the ratio between maximum and minimum would be 25 to 1. But if the fixed capacity of the trimming condenser were set to, say, 50 mmfd. (.00005 mfd.) the effective minimum and maximum capacity would be 70 mmfd. and 550 mmfd., the ratio being only about 8 to 1.

This explains why it is always advised, when trimming a receiver having ganged tuning circuits, that the trimmers be set to the lowest capacity with which the circuits can be matched accurately. The best procedure is generally to unscrew all the trimmer-adjusting screws and then to turn down each in turn as little as possible.

MIXING INPUT CHANNELS

(Continued from previous page)

its share of the amplifying in addition. It takes the place of one of the ordinary triode voltage amplifiers. If two double-triodes with appropriate anode resistances are used in parallel, four inputs can be perfectly mixed, without any objectionable feedback or loss of signal strength. The efficiency of the system is very high, being only limited by that of the valve.

Two ordinary triodes suitably tied externally could be used instead of a double triode, and would produce just as good mixing, but a double-triode is much more economical since it only takes up the space of one valve, costs as much as one valve and only consumes the heater current of one valve, since the two cathodes are heated by a common heater.

The anodes of the two triodes must not be tied directly together externally, or each triode would be working into a load less than its own A.C. resistance, a condition likely to lead to harmonic distortion unless the inputs were very small indeed. To ensure linear amplification a load impedance on each triode of about twice its A.C. resistance is used. The characteristics supplied by the makers will give the exact values required.

Automatic Biasing

If automatic biasing by a resistance shunted by a large capacity condenser in the cathode-earth lead is used for the double-triode, it must be kept in mind that the anode current passed by the double valve is twice that for one triode, and so the biasing resistor has half the value of that for one triode alone. The characteristics supplied by the makers are usually values for each triode.

Although we have dismissed the cruder potentiometer methods of mixing, we are still using potentiometers in all input channels as gain controls. For good work, especially for Public Address even on a small scale, correctly graded potentiometers must be used. Standard log-law units of a reliable make and of the correct value for the particular instrument—microphone or pick-up—should be used.

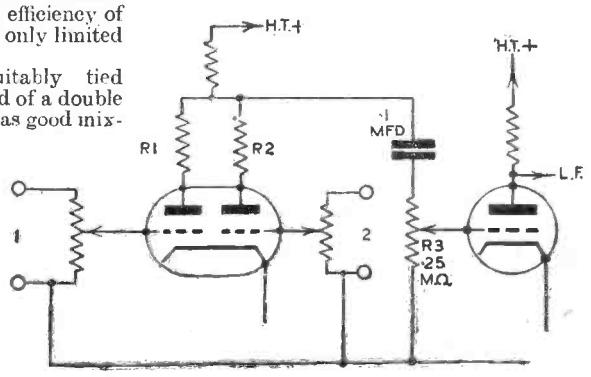


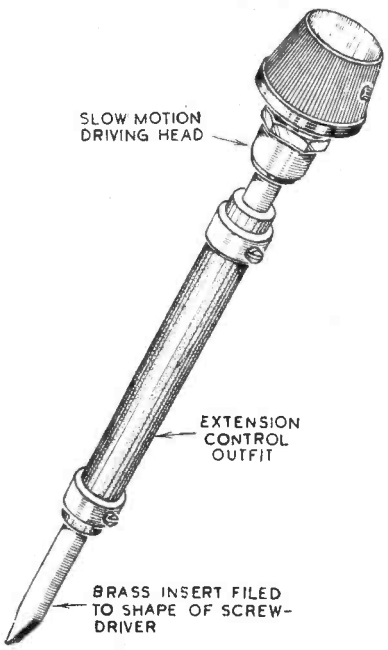
Fig. 4.—Double-triode used for mixing. No interaction can occur. R1 and R2 each twice A.C. resistance of single triode. R3 is the main gain control.

It is well worth while to have calibrated gain control dials on all input potentiometers, and on the main gain control. Several firms, such as Messrs. Bulgin, make suitable dials and knobs for this type of work.

Practical Hints

Slow-motion Trimming Tool

AS I wished to carry out some very fine adjustments in my S.W. receiver, I devised the trimmer here described. The chief components required for this tool are an extension control outfit and a slow-motion drive. As can be seen by the diagram the brass spindle is filed off at the



A novel slow-motion trimming tool.

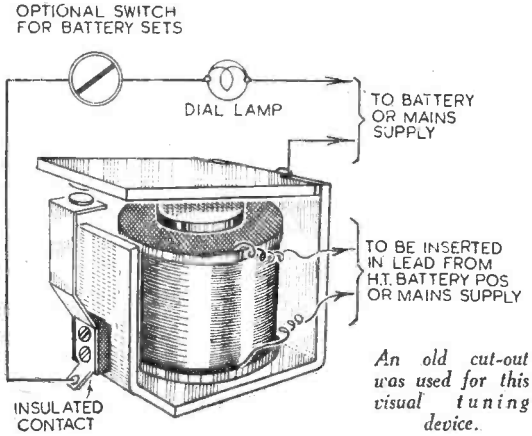
end to the shape of a screwdriver. This is fitted in one end of the insulating tube, to the other end of which is fixed the slow-motion driving head with knob attached.

It will be understood that this control affords a great deal of accuracy in short-wave and ultra short-wave trimming, etc.—J. ROGERS (Golders Green).

Visual Tuning Device

HAVING been troubled in the past by the inaccuracy of station-names printed on the tuning scale, I constructed the device illustrated, which consists of a relay that operates a lamp, indicating when a station is exactly in tune.

An old cut-out was obtained from a car junk-shop, and its winding removed. The bobbin was then re-wound with approximately 3,000 turns of 40-gauge enamelled wire, and the two ends finished off with ordinary lighting flex. The cut-out is placed in the H.T. positive lead, so that the armature will just remain open when the set is switched on, with no signal passing. On tuning-in to a station, when the correct setting has been reached, the H.T. will increase, attracting the armature to the coil, therefore closing the contacts and bringing the lamp into circuit.



An old cut-out was used for this visual tuning device.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Practical Hints." DO NOT enclose Queries with your hints.

SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page 81.

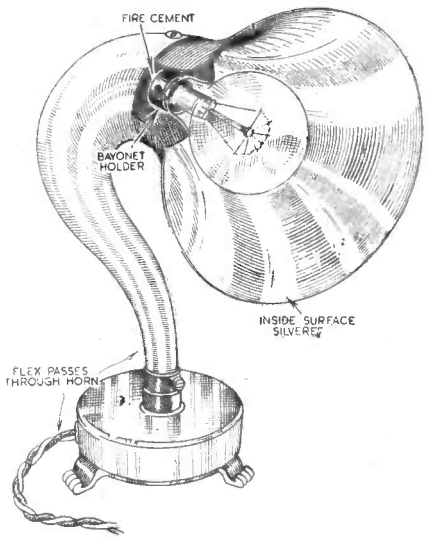
The winding on the cut-out will, of course, vary according to the set in use. In a mains receiver a heavier gauge wire should be used. A refinement for battery sets would be to include a switch in the lamp circuit, thus avoiding waste of current, once the station has been tuned in.—A. G. SPRIGGS (Sanderstead).

Improvised Lamp-shade

BEING the possessor of a "shack" for my wireless experimenting, and learning that this must be effectually "blacked out" at night, I hit upon the following idea for a shaded light. I had, in my junk box, an old "Dinkie" horn speaker of no practical use. I removed the speaker unit and this left me a free passage for a length of flex to be passed through and out through the horn mouth. To this I connected a bayonet holder. Next, I procured some fire cement (6d. a 1lb. tin). With this I cemented the holder in the narrow neck of the horn. All that remained to be done was to silver the reflector, or the inside of the horn, with aluminium paint. I have found this extremely efficient.—V. W. BUDD (Portsmouth).

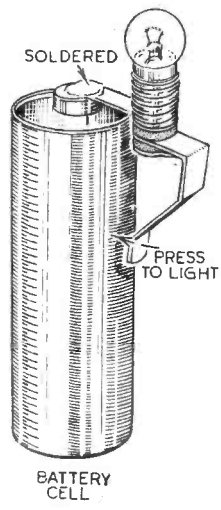
An Emergency Torch

I RECENTLY wanted a small pocket-torch but unfortunately did not have such a thing in the house. After looking



Using a disused speaker horn as a lamp shade.

round for a few minutes I hit upon the idea shown in the accompanying illustration, and this proved so satisfactory that I am sure many will find a use for a similar compact and useful little light. I dismantled an old G.B. battery and removed one of the cells. I then took a dial-light holder from an old tuning dial and connected these as shown. The dial-lamp was used in the holder. To make a more elaborate lamp you can buy the small cells as refills for torches and a suitable lampholder may be obtained from Messrs. Bulgin. If a torch refill is purchased the outer paper covering must, of course, be removed.—A. FRANCOIS (Brixton, S.W.2).



A novel emergency torch.

The Importance of The Output Stage

The Final Link in the Chain of Broadcast Reproduction is the Loudspeaker. Some of the Mistaken Impressions Regarding the Output Circuit are Given Here. By W. J. DELANEY

WE have recently dealt with the question of volume of the output delivered by a receiver, and many listeners still complain that although they are using a valve supposed to give 2 watts, their volume does not appear to be greater than that obtained with a valve rated at only, say, 1 watt. Other listeners wonder why, when they purchase a so-called L.F. valve, they are unable to obtain a good output without distortion. It is often not realised that the output stage is very critical as regards the H.T. voltage and the grid bias which is applied to it, and if wrong values are used it gives evidence of the fact sooner than any other stage in the receiver. It is necessary also to bear in mind that a loudspeaker can only reproduce that which is fed into it, and therefore a weak signal will not receive any further amplification from the speaker, and a distorted signal will not be cleaned up by the reproducer. A bad loudspeaker will, however, probably introduce a loss in amplification and may give rise to troubles, but assuming that a reliable speaker is used, there are several points which must receive attention if the best is to be obtained from it. Firstly, it will be rated to handle a certain volume, and obviously this value should not be exceeded if the speaker is to last for any length of time, or is required to give its best in the way of quality. For the user of battery equipment this fact will not be of much moment as he is unlikely to be able to supply sufficient power to overload the speaker. On the other hand, the user of mains apparatus might very easily be in a position to overload it.

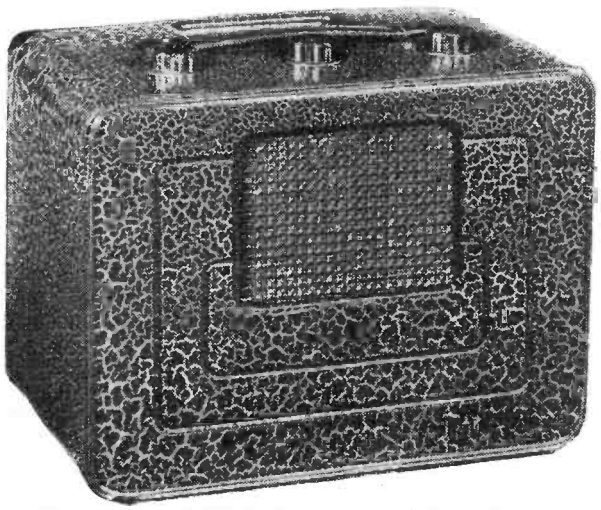
Triode or Pentode?

Many listeners go to the expense of purchasing a pentode valve, having been informed that such a valve delivers a greater output than a triode. When the valve is incorporated in the receiver they find, however, that results are inferior—perhaps giving less volume than their previous valve. There may be two reasons for this—either the valve is taking much more current than the previous valve and their battery supply is inadequate to carry out its full function, or the signal fed to the valve is greater than it will handle and overloading takes place. It is quite true that a pentode will deliver a greater output than a single triode of the normal type, but this is only when properly used. Generally speaking it will not handle such a large signal as a simple triode, and its increased output is due to its amplification factor. Therefore, its greater output is only obtained when it is used with a circuit where a small signal is fed to the output stage. It may be taken as a fairly general rule that a pentode should normally only be used following a detector stage, and if there are two or more L.F. stages the pentode should not be employed. This rule may, of course, be broken if a suitable L.F. volume control is included in the first L.F. stage, as then the loudest signals (such as may be obtained from the local station) may be sufficiently reduced to bring them within the range of the pentode valve, whilst weak signals will receive the benefit of the additional amplification and will afford better loudspeaker results.

Tone Correction

In most circuits the pentode must be used in conjunction with a tone correction circuit, as the reproduction is normally rather high-pitched. This tone corrector is required although the loudspeaker used with the receiver has a pair of terminals or other input arrangement marked "Pentode." Some amateurs appear to be under the impression that if the speaker is designed for use with a pentode, no tone corrector is required, but the fact that the speaker will be suitable for use with a pentode concerns its impedance or resistance and not its tone of reproduction.

In designing the output stage the maximum volume which is desired should be the first consideration, and one should then work backwards to the remainder of the circuit. For the battery user a maximum of 3 watts should be considered for normal circuits, but, of course, this will need a very efficient H.T. supply and will be expensive to maintain. With a single valve a maximum of 1½ watts only is available. The mains user on the other hand can obtain a single valve to deliver an output of 15 watts. Valves of this type are, however, in many cases subject to the same limitations as the pentode valve, namely their inability to handle a very large input. The amplification factor is high, and thus they need only a small input in order to deliver the maximum output. The range of the input signal may be ascertained from the grid bias figures. If a valve is rated for 3 volts grid bias, it will only take half the signal that a valve requiring 6 volts grid bias will accommodate. Thus, if designing the output stage for a simple receiver without any L.F. amplification between it and the detector, one would select a valve with the highest possible amplification factor, and with a low grid bias figure. On the other hand, if one is designing a very powerful receiver to use an output stage delivering 10 watts or so, one would select a low amplification factor output valve with a very high value of grid bias, and each intermediate L.F. stage would have a higher amplification factor and lower grid bias.

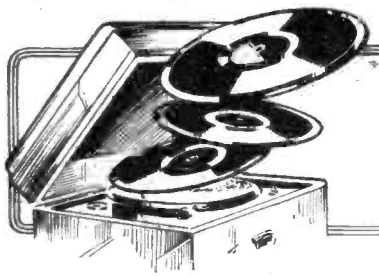


The new Lissen "All Dry" battery operated portable, using the new 1.4v. valves.

Push-pull and Parallel

The push-pull stage will handle slightly more than double the signal which the single valves will handle, and thus such a stage could be used where overloading takes place with the single valve. Obviously, however, the additional anode current and L.T. current strain must be considered at the same time, or the existing supplies may be found inadequate, with the result that the additional gain will not take place. The parallel stage, on the other hand, will not handle any more than the single valves, but the amplification will be greater. Assuming, therefore, that we have a receiver which provides very poor volume, and that the H.T. and L.T. supplies are more than sufficient to supply the set, an improvement could best be effected by fitting a pentode in the output stage, or by using a valve in that stage which has a greater amplification factor than the existing valve. If a pentode is already fitted and the voltage supplies are adequate, an existing stage could be inserted between the last two stages, or an exactly similar valve could be connected in parallel with the output stage. In this case the additional cost would be small, but the running costs would be increased. By adding an intervening L.F. stage the initial cost would be greater but the running costs would be lower.

Where a receiver is fitted with a volume control and it is found that this can never be turned more than a short distance without distortion setting in, the output valve should be replaced by one which requires a much greater grid bias voltage, but with operating conditions more or less the same.



Impressions on the Wax

A REVIEW OF THE LATEST GRAMOPHONE RECORDS

ONE generally associates record albums with highbrow music, but this autumn the Decca Company intend to issue a series of album sets covering collections of the best in lighter music. The albums, instead of being finished in the humbler greys and buffs, are to be brightly coloured.

The first album to be released contains six records by Bing Crosby. Although nearly all the tunes are old favourites, every one is a new recording. The set, complete with album and leaflet, costs 21s., and forms a programme lasting more than half-an-hour. The material ranges from such melodies as "Stardust" and "I Surrender, Dear" to Irving Berlin's new patriotic song success "God Bless America." The numbers of the records are *Brunswick* 02805/10 and they can be obtained separate if required. Other tunes included are "Home on the Range," "Missouri Waltz" and "To You, Sweetheart."

The second album to be released contains favourite Viennese waltzes. Possibly as an antidote to the hectic swing craze, the waltz seems to be destined for another wave of popularity. In America they are having Viennese waltz nights at all the most popular places people attend for dancing. Every waltz included in this album is a firm favourite from "The Blue Danube," "Over the Waves," and "The Dollar Princess" to "Vienna, City of my Dreams." They have been recorded by Harry Horlick and his Orchestra. There are five Decca records *F* 7065/9, price 12s. 6d. in an attractive album.

Vocals

HEADING the new releases are two songs by Deanna Durbin from her film, "Three Smart Girls Grow Up." They are "Because" and "The Last Rose of Summer" on *Brunswick* 02803. Two other favourites, Connie Boswell and Elsie Carlisle, have also made records. Connie has made one of "Sunrise Serenade" and "Wishing" on *Brunswick* 02770, while Elsie has coupled "The Shabby Old Cabby" with "The Moon Remembered But You Forgot," which comes from "Let's be Famous"—*Rex* 9610.

From the new George Black Show at the Palladium comes the amusing "T. R. D. Jones" which is sung by Ella Fitzgerald on *Brunswick* 02818. The other side contains an old favourite in "Little White Lies."

Lovers of close harmony singing must not miss "Hello 'Frisco" and "Chinatown, My Chinatown" sung by The Merry Macs on *Decca F* 7179. Another favourite vocal team is The Ink Spots. These coloured singers made their name in this country when Jack Hylton introduced them to us a few years ago. At that time they were best known as swing singers. Recently they have turned their attention to more sentimental songs such as the plaintive "It's Funny to Every One But Me" which they have coupled with "Just For a Thrill" on *Brunswick* 02812.

A Hit Song

THE hit song of the month is going to be "Boom." Lew Stone and Guy Lombardo have both recorded it. Lew Stone has coupled it with "Transatlantic Lullaby" on *Decca F* 7170, and Guy Lombardo directs his Royal Canadians through an intriguing rendition of it on the reverse side of "Concert in the Park" on *Brunswick* 02799. Bob Crosby with his large Orchestra has made "If I Didn't Care" and "If I Were Sure of You"—*Decca F* 7175, and with his Bob Cats he has recorded two tunes from his brother's film "East Side of Heaven"—"Sing a Song of Sunbeams" and "Hang Your Heart on a Hickory Limb" on *Decca F* 7129.

An interesting and novel dance record is Lew Stone's "Canadian Pacific" on *Decca F* 7131. There have been many musical impressions of trains in the past, but none quite so exciting as the stream-lined monster composed by Lew Stone. From the moment it leaves the station to the time it finally roars out of sight this rip-snorting locomotive leaves you quite breathless.

From the excitement of "Canadian Pacific" we must turn to two new compositions by Sid Phillips. These are "A Burmese Ballet" and "Early Morning Blues" and they have been recorded by Ambrose and His Orchestra on *Decca F* 7136.

Finally, there is a novelty combination led by Paul Whiteman. There are four trumpets and three trumpets and three trombones with guitars, string bass and drums. This unusual instrumental group is called Paul Whiteman's Bouncing Brass, and for its first record has made "Rose Room" and "I've found a New Baby." Both of these evergreens sound most attractive in their new garb—*Brunswick* 02802.

Rex

FOR dancing fans we have a record played in strict dance tempo by Maxwell Stewart's Ballroom Orchestra. He introduces a tango "Summer Evening in Santa Cruz" and a slow fox trot "The Moon Remembered But You Forgot" on *Rex* 9619.

Jay Wilbur and his Band have two records with vocals by Sam Costa and The Cavendish Three. They are "I Get Along Without You Very Well" and "Boom" on *Rex* 9616, and "Sail Along Silvery Moon" and "Only Once" on *Rex* 9617. "La Mulata Rombero" and "Masabi," two rumbas, are played by Oscar Rabin and his Romany Band on *Rex* 9618, whilst the Belgrave Salon Orchestra have recorded "The Blue Danube" and "Moonlight on the Alster" on *Rex* 9624.

FREE ADVICE BUREAU

COUPON

This coupon is available until October 14th, 1939, and must accompany all Queries and Hints.

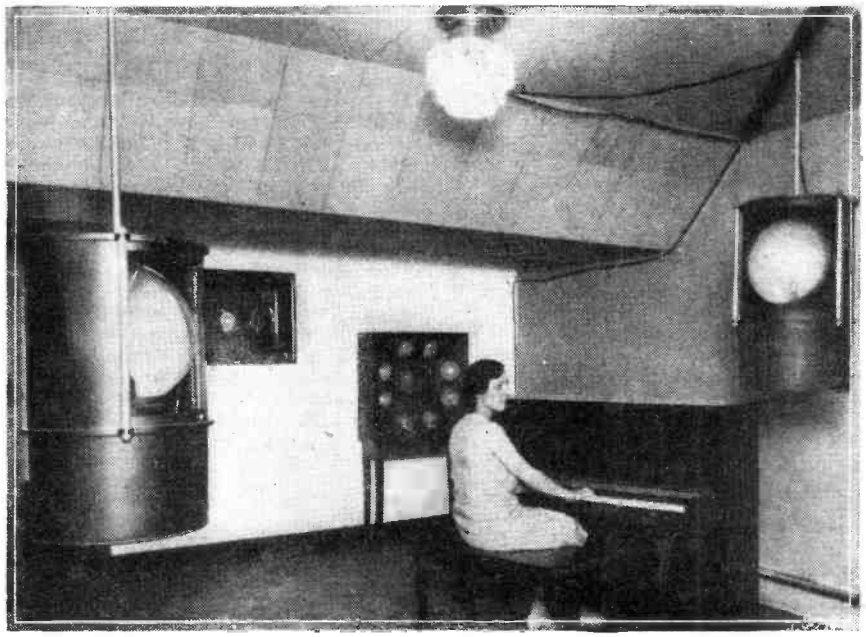
PRACTICAL WIRELESS, 7/10/39

PRACTICAL TELEVISION

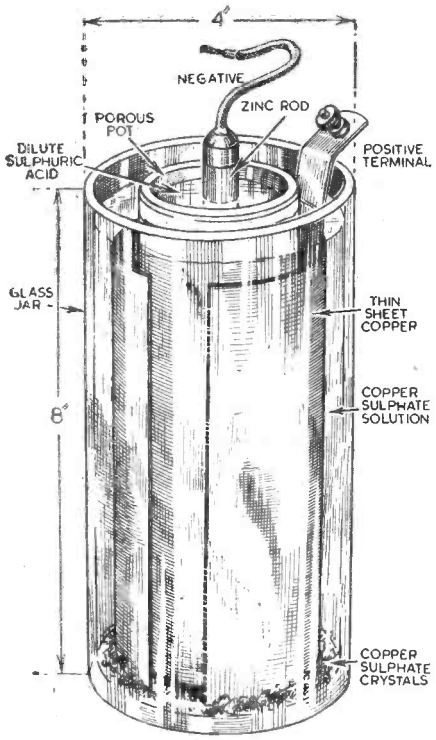
October 7th, 1939. Vol. 4. No. 171.

New American Stations

NOW that the American television service has been in operation for a few months and experience has been gained in transmission, reception and studio technique, an attempt is being made to increase the number of stations capable of providing a service of signals within prescribed areas. For example, the Du Mont laboratories which has a television system working on quite different lines from the other companies is seeking permission from the Federal Communications Commission to erect a station in the New York area. Its present transmitter is located in Passaic, New Jersey, and can only radiate at night time or during the early morning hours and has to use the same wavelength as the N.B.C./R.C.A. transmitter situated on the summit of the New York Empire State Building. Then the Don Lee network television station in Hollywood is installing higher definition equipment than has been used before, and a new station is planned for next year which is to be situated on the top of a mountain. Station WOR of the Mutual Network is anxious to install a one-kilowatt transmitter in New York to provide educational broadcasts and a system of news coverage. In its application to the F.C.C. this station states that it has already been promised the co-operation of many educational institutions in both New York and New Jersey, and in addition to "live" subjects it is proposed to employ film shorts of an instructive character. This wave of television activity and the demand for stations bring to mind a similar phase which existed a few years ago in the same country when low definition television demonstrations were featured in several of the big cities. Making use of the principles of light spot scanning with mechanical equipment, intensive development in photo-electric cells took place in order to provide a really satisfactory signal. The illustration below shows a typical example of a television studio of those days, and in addition to the bank of eight cells used for close-up images, the very large cells for extended shots are seen on each side of the picture. They are enclosed in metal cases with a wire mesh front to act as a screen. With modern light spot methods these forms of cells have been replaced with the multiplier type photo-electric cells which are more compact and give very high degrees of amplification without all the attendant mush troubles in the amplifier networks.



An example of American studio television practice when conditions of service demanded very large photo-electric cells.



Details of a Daniell cell, with approximate dimensions, which must be governed by the size of the porous pot and zinc rod obtained.

BATTERY CURRENT ECONOMY

Temporary Rejuvenation of Dry Batteries: Cutting Down H.T. Current: Eliminating H.F. and L.F. Valves: Dispensing with a Superhet Frequency-changer: Primary Cells for Accumulator Charging

NOW that this country is at war we have been asked to make all reasonable economies. If we do our best to follow this advice there is a good chance that we shall be able to continue to receive sufficient—if only just sufficient—supplies of all essentials. One important essential to the user of a radio receiver is current to operate it. And in spite of the fact that mains-fed receivers have increased in popularity, mainly at the expense of battery sets, during the past few years, large numbers of listeners have recently made or bought a battery set as a stand-by in the possible event of a temporary disconnection of the mains supply.

At the moment, high-tension batteries are not scarce, but readers do not need to be reminded of the difficulties often experienced in buying torch batteries. While batteries of the latter type are being used so extensively there is always a possibility that stocks of radio batteries might occasionally fall. We must at least be prepared for such an eventuality. But there is not a great deal that can be done, directly, to safeguard the position. For one thing, dry batteries cannot satisfactorily be stored for long periods without their efficiency falling to a marked extent. All that can be done to advantage is to obtain or order a new H.T. battery as soon as that in use begins to show a drop in voltage (measured while the set is in use) of, say, 25 per cent. It will probably continue to give sufficient current to operate the receiver for a short time, but not for very long.

Two Methods of "Boosting"

Should the battery become exhausted to such an extent that it will not continue to operate the set, and a replacement is not immediately obtainable, there are one or two methods of "boosting" it to a small degree. These are not always helpful, especially with the lowest-priced components, since with them the zinc cell containers are of such a light gauge that they disintegrate. One method is to warm the battery slightly by placing it in an oven which is warm—*not hot*. This should be done after the gas or electricity has been turned off, and the battery should be left in the oven for about half an hour.

That will sometimes cause the battery to give a small output for a few hours, if no more than that. After "cooking" it is a good plan to check the voltage between the various tapping points. Any set of cells which is "dead" should then be short-circuited so that the voltage from the others is not reduced by the internal resistance. Short-circuiting can be done by means of a short length of wire and two wander plugs, or by wedging the bared ends of the wire in the sockets with pieces of match stick. Although it is worth while only in severe circumstances, there is good justification for removing the short-circuiting lead when the set is switched off; this is because a constant short-circuit often causes the cell to burst, when it might adversely affect adjacent cells.

Another method which sometimes works is to remove the cardboard case from the battery, pierce the bottom of each of the zinc-cased cells with a pricker and stand the complete battery in a shallow tray (a photographer's developing dish is convenient), containing a solution of sal-ammoniac. This chemical can be bought from a chemist or electrical dealer in either crystal or compressed-tablet form. The crystals or tablets should be added to the water until as much as possible has been dissolved and a little remains undissolved; that is, until the solution is saturated. Here, again, "dead" cells should, for preference, be short-circuited. In some instances it has been found that an exhausted battery could be used for several hours by applying this treatment.

Use a Reservoir Condenser

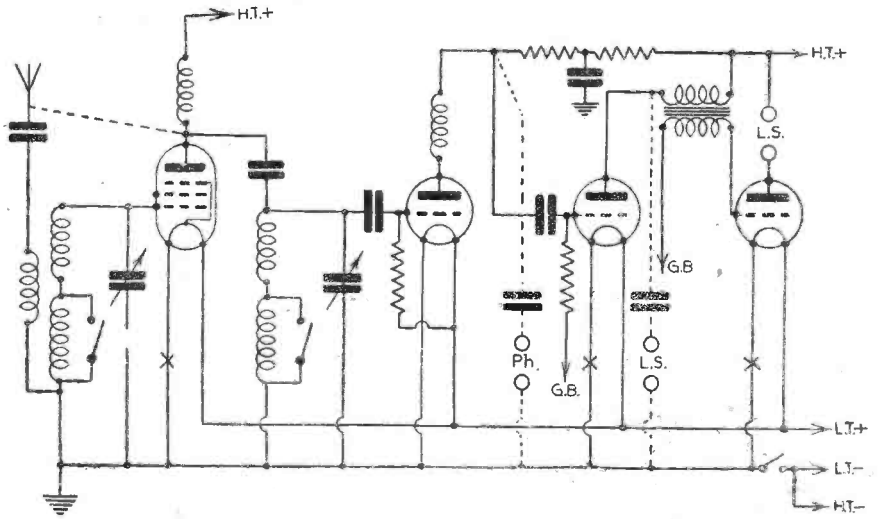
When using a battery that is not in good condition it is often better to connect a 2 mfd. fixed condenser in shunt with it—between the positive and negative terminals, that is—if such a condenser is not already fitted in the set. As most readers are probably aware, it is necessary to reduce the grid-bias voltage when the voltage of the H.T. battery is below its normal value. If this is not done reproduction will generally be "thin" and of poor quality, while volume will be sacrificed.

Reducing the Number of Valves

If the battery output is low, and it is nearly sure to be when being "boosted" as mentioned above, it is often advantageous to cut out one or more valve stages. Not only will this enable the remaining stages to operate more efficiently, but it will prolong the useful life of the battery. In the case of an H.F.-Det.-L.F. set the H.F. stage can be cut out by transferring the aerial lead from the aerial terminal to the anode terminal of the H.F. valve. The valve should, of course, be removed from its holder or its filament circuit should be broken, so that it does not pass unnecessary low-tension current.

L.F. stages can be cut out by joining one side of a large capacity fixed condenser (.5 mfd. upwards) to the "anode" end of the anode-coupling component in the detector or first L.F. stage, and connecting the speaker or a pair of 'phones between the other side of the condenser and earth. An accompanying skeleton diagram shows the methods described. In this case, also, the valve or valves not in use should be removed from the set to effect a saving of L.T.

(Continued on page 84)



In this skeleton H.F.-Det.-2L.F. circuit, broken lines show how the first and either or both of the last stages can be cut out. Crosses indicate how the filament circuits should be broken if the valves are to be left in their holders while out of commission.

Comment, Chat and Criticism

A New Era for Music

Our Music Critic, Maurice Reeve, Discusses the Pros and Cons of Musical Entertainment in War-time

I AM sitting in my "former" music room. It is stripped of all its furniture and professional associations. On the bare boards of the floor lie three suits of anti-gas clothing neatly arranged for instant donning. Various strange and unmusical items stand on the mantelshelf—torches, eyeshades, rattle, bell, notebook, report pads, etc. In fact, I am writing in the post headquarters of post N.4, in the borough of Hitlerville. It is 8 a.m., and as post warden I have started to pen this short article in the belief that I shall not be interrupted by any air-raid warning at such an unlikely hour. If there is, and I have to take up my pen again after duties which all of us fervently hope may never have to be fulfilled, it may become quite an historic piece of literature.

Popular War-time Music

Music has often suffered, and much of the greatest of it has been created in suffering. Its hardships during the present conflict will be particularly severe and testing, owing to the partial closing down of places of entertainment—an entirely new disease which the learned in medicine would find has sprung from the deadly central European germ Hitlerchosis, or itis. It will be a strange war without music, so strange, in fact, that not only will its character be different from that of all past wars, but the effect on morale through its absence may be such as to cause the authorities to pause and seriously think the matter over. And by music I do not mean Beethoven and Mozart only. A long way from it. Goodness gracious!!! Can anyone who experienced the last war forget the "Bing Boys on Broadway," "Chu Chin Chow," or the Palace show that contained the immortal "Let the Great Big World Keep Turning"? What a tremendous part music and the theatre played in our armament then. The Proms themselves never ceased for one night. A few shows like that, for a man and his girl, bless her heart, and he was fortified and re-invigorated for months of toil that lay ahead. Hardly a single show failed to give the tommies a number they could swing along to down the long, long trail, and this characterisation and presentation of the national mood, together with its parody of the grim happenings of the moment, were invaluable tonics and restoratives. It seems impossible to think that we can do without them.

Blow to Private Practice and Academies

The private practice of music, too, is bound to suffer greviously. It was little affected by the mere "waging of hostilities" in 1914, and even the Academics suffered only small losses at the outset. It was the gradual economic strain, and the rise in the cost of living which told on the profession little by little, together with the calling up, in the last year, of most of the young men students as they reached military age. But this time the blow has fallen swiftly, and in my case, with deadly effect. Mothers are not going to let their children walk down the dark streets or take journeys so long as there is the slightest chance of their being caught in even an air-raid warning. As one after the other said this to me I could only answer: "Of course, you are quite right." Any other reply would not only have been fatuous, but plain money grubbing, which if not accompanied by a modicum of common sense, is not worth the candle. Perhaps we will be able to think differently about it when we have "settled down," and taken our bearings. It has all come along so swiftly and suddenly, the air peril has been talked about and dreaded for so long that if "take cover" is now uppermost in everyone's mind, who can wonder? But it stands to reason that we must relieve the tension and the pent-up feelings somehow. We cannot listen to hourly news bulletins "for the duration," and, as they say at cricket, we cannot sit down for a whole day doing nothing but counting runs as they are scored. Something will have to be done, and done on a big scale. I have no doubt that our native genius will find a way out of it. Rapid evacuation of halls and theatres is the problem to be solved. I wonder, in their own interests, that the owners of places of entertainment don't tackle this problem at once by the re-planning of their halls and theatres, short of what could only be done through complete reconstruction. But no doubt they are.

The Proms

The Proms were a great London institution in the last war, and the attendances were little affected even in the period of the intensest aerial warfare in 1918. Even the Monday Wagner night was never interfered with, which reflected great credit on the public's level-headedness for being able to keep two things dis-associated which should never be allowed to come together. Many khaki uniforms were to be seen in the audience nightly, as well as the attractively dressed ladies belonging to the many women's auxiliary corps. Also, it was then that women first made their appearance in a symphony orchestra. Maurice Sons was the famous principal violin. Moiseiwitsch and Mark Hambourg were frequent soloists, and Frank Mullings. Thorpe Bates, Carrie Tubb, and Marie Hall are others whose names come back in my memory. London without the Proms. Can it be true? One might as well imagine the scene without the Lord Mayor's Show or Guy Fawkes. But they will soon be back—they must be back. In the meantime, let us do two things—recall our memories of all the good things stored up in them, and look forward to the resumption of all the things without which life would not be very well worth living. From Horace, who said "O sweet and healing balm of troubles," to Chesterton's:

"Take then you, that smile on strings,
those nobler sounds than mine,
The words that never lie, or bray, or
flatter or malign."

Music has been an indispensable ingredient of the human salad, and we must have plenty of all kinds of it to help us win through.

BATTERY CURRENT ECONOMY

(Continued from page 83)

The idea of eliminating valves from the circuit can be adopted even when the H.T. battery is as good as new, as a means of reducing the drain and prolonging the life of the battery and of the accumulator. The importance of this will be appreciated when it is remembered that the output valve takes by far the greatest amount of both H.T. and L.T. current, and that a modern H.F. pentode takes more H.T. than any of the remaining valves. If it is not wished to alter the receiver by adding the connections mentioned a marked saving of current can be effected by turning the variable-mu volume control to its minimum (maximum bias on the grid of the valve) and by increasing the bias on the L.F. and power valves. This increase in bias voltage will, of course, reduce the volume of reproduction and will have a slightly adverse effect on quality, but one is prepared to accept compromises during time of war!

When using a superhet the method of eliminating an L.F. stage is the same as that already mentioned, but a different system is necessary if I.F. stages are to be cut out. In most instances the most satisfactory procedure is to disconnect the top of the tuning circuit from the control grid of the frequency-changer and connect it to the grid of the second detector, after removing the lead previously taken to this point. Detailed instructions cannot be given for dealing with a set using a diode second detector, because the method varies according to the exact circuit arrangement employed. It is clear that both sensitivity and selectivity must be sacrificed by eliminating the frequency-changer and the I.F. amplifier.

Low-tension Supply

Low-tension current might sometimes present a problem, since there may be difficulty in having the accumulator charged. Those who have a mains supply will, of course, use a trickle charger, and will probably have two batteries so that one can always be kept fully charged. In that event little difficulty should be experienced. When a mains supply is not available it might be worth while to consider the desirability of providing a means of drawing current from a *primary* source; an accumulator is a secondary or storage battery.

It used to be fairly common practice to charge accumulators by means of Daniell cells, which are made as shown in the illustration on page 83. The main container holds a saturated solution of copper-sulphate crystals in water, while dilute sulphuric acid is placed within the porous pot. This solution is made by slowly pouring one part of sulphuric acid into 15 parts by volume of water. *Acid must be added to water; not water to acid*, for that would result in the creation of intense heat with the danger of boiling and injury to the worker. The voltage of a Daniell cell is 1.1, so it is necessary to use two in series for charging a two-volt accumulator. They will give a satisfactory trickle charge, but the porous pot must be removed when the cell is not in use.

Open to Discussion

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

Exchanging S.W.L. Cards

SIR,—With reference to the friendly spirit among amateur radio enthusiasts. For some time, readers have been requesting to exchange S.W.L. cards, through the medium of your paper. I have sent my card to a large number of such readers, and although most of them have QSL'd promptly, there are quite a few who have not replied. I have also written several letters to readers who have asked for correspondence, but so far have received *no* replies.

Having been a reader of your paper for over a year, I will be glad to exchange my S.W.L. card with any reader overseas.

Wishing the new PRACTICAL WIRELESS the best of luck.—PETER A. LOVELOCK, Strathmore, Minster Road, Westgate, Kent.

Correspondents Wanted

SIR,—Like many of your readers, I have been intensely interested in short-wave radio for a considerable time, especially with regard to short-wave antennas, and their design.

If any of your readers would care to write to me concerning these I should be pleased, and I will answer all letters. I will also exchange my S.W.L. card with anyone interested.—LIONEL B. UPHILL, Church Walk, Chilcompton, nr. Bath, Somerset.

SIR,—I have recently been troubled by the squeals of a "det.-L.F." receiver, which shows that there are other S.W. enthusiasts living in my neighbourhood.

I should be very glad to get in touch with any of these listeners.—RAYMOND J. HALL, 45, Herschell Road, Leigh-on-Sea, Essex.

An Appreciation

SIR,—I am one of your younger readers, and have taken your paper for the past two years. I should like to say how much I appreciate the new PRACTICAL WIRELESS, although the paper in its original form seemed very hard to improve on.

I sincerely hope that it will be possible to carry on the good work, in spite of the difficulties arising out of the war, and in particular continue any articles likely to encourage the beginner and home constructor.—E. A. H. CURRIE (Dulwich Common).

Curtailed Activities

SIR,—In reply to the letter from Mr. D. Gordon in your issue dated September 23rd, I think the following experiment will be found interesting and surprising.

Take a standard grid-leak detector circuit with the grid-leak to L.T. positive. Then prepare a table showing: 1. Value of grid-leak. 2. Anode current before signal. 3. Anode current after signal. 4. Rectified current. 5. Volume. 6. Quality. Then under the heading of value of grid-leak place the following values: Accidental (the accidental leak through the valve base and holder, say 50 meg.), 5 meg., 2 meg., 1 meg., 0.5 meg., 0.25 meg., 0.1 meg., 50,000 ohms, 25,000 ohms, 10,000 ohms, 5,000 ohms, 3,000 ohms, 1,000 ohms, 500 ohms, 300 ohms, 200 ohms, 100 ohms, 80 ohms, 60 ohms, 50 ohms, 40 ohms, 30 ohms, 20 ohms, 10 ohms, and short circuit. Apply a steady modulated oscillation to the grid-leak detector and record the results. Personally, I see no objection to using good quality variable but non-inductive resistances.—D'ARCY FORD (Exeter).

"Spares-box Three": Correspondent Wanted

SIR,—I have been a regular reader of your excellent journal for about four years, and it has been of great help to me. I have built numerous sets from the published circuits, and the one that I prefer is the "Spares-box Three," which has been working very satisfactorily. I would like to correspond with a reader in any part of the world.—EURFRYN PICKIN, 16, Michaels Road, Blaenewm, Treorchy.

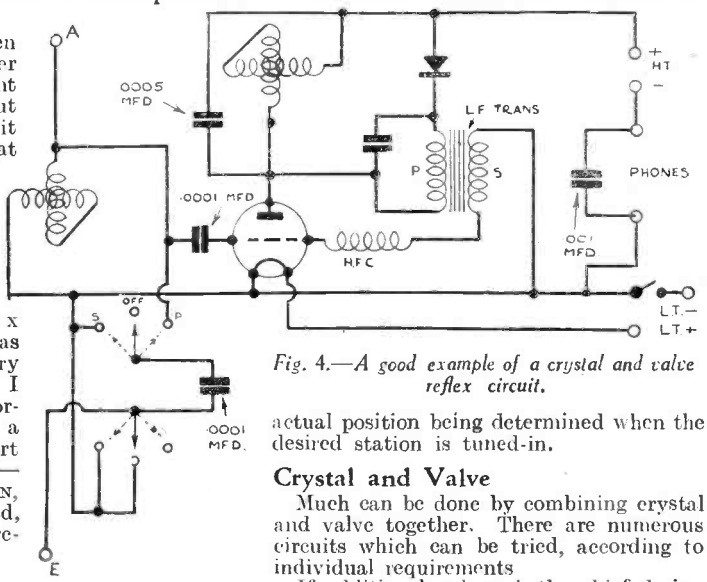


Fig. 4.—A good example of a crystal and valve reflex circuit.

Prize Problems

Problem No. 368

JACKSON had a four-valve battery set which had been in use for some years with satisfaction. Recently he noted that quality was not so good and the accumulator did not last very long between charges. He had the accumulator recharged and made a few tests in the receiver. All these failed to reveal any trouble, and he then disconnected the accumulator and measured the voltage with a good meter. This gave a reading of 2 volts, and he decided that it was in order. Where had he gone wrong? Three books will be awarded for the first three correct solutions opened. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 368 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, October 9th, 1939.

Solution to Problem No. 367

The resistance which Martin used was short-circuited, and thus changes in the condenser failed to make any difference as there was no "H.F. stopper" in the anode circuit.

The following three readers successfully solved Problem No. 366, and books have accordingly been forwarded to them: J. D. Morrice, 55, Jasmine Terrace, Aberdeen; L. T. Wilkinson, School Street, Darton, Nr. Barnsley, Yorkshire; J. P. Cook, c/o 29, Salt Hill Way, Slough, Bucks.

WILL THE CRYSTAL NOW COME BACK INTO FAVOUR?

(*Continued from page 73.*)

and washers. When the assembly is completed, the two coils are connected in series with each other and the two remaining ends, namely, the start of the larger coil and the end of the smaller one, being connected to aerial and earth respectively. A very similar effect to that produced by a variometer can be obtained by winding a coil on a suitable length of tubing, and then varying its inductance by sliding another coil, wound on a former of slightly smaller diameter, inside it, the two coils being connected in series as before.

Another simple tuning device can be formed along the lines used by the famous original Marconi spade-tuning arrangement. This consisted of a flat coil, which can be in the form of a basket coil or a pile or even hank wound coil, connected across aerial and earth in the normal manner. Tuning is then achieved by bringing a piece of thin sheet metal, approximately the size of the coil, which is connected to the earth side of the circuit, close to the winding, the actual position being determined when the desired station is tuned-in.

Crystal and Valve

Much can be done by combining crystal and valve together. There are numerous circuits which can be tried, according to individual requirements

If additional volume is the chief desire, then a simple stage of L.F. amplification will prove most satisfactory, but if local conditions are not too good and greater sensitivity is required, then it would be more advisable to use a stage of tuned H.F. amplification. Both arrangements are depicted in Fig. 3.

Apart from these arrangements, there is always open for most interesting experimental work that wide field of *reflex* circuits which, speaking in a general sense, refer to arrangements which make one or more valves do dual work, such as H.F. and L.F. amplification, while the crystal is used for rectification purposes only.

Space does not allow a detailed description of the numerous circuits which used to be so popular, but Fig. 4 shows a well tried arrangement which was used by the makers of the noted B.T.H. receivers in the early days of broadcasting.

It is hoped that more will be said about such circuits in later issues, when every endeavour will be made to supply all component values, together with constructional details.

LATEST PATENT NEWS

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume or in bound volumes, price 2s. each.

Abstracts Published.

PHOTO-ELECTRIC RADIATION THERMOMETERS; VALVE RELAYS.—Foster Instrument Co., Ltd., and Douglas, A. No. 506596.

An apparatus responsive to heat radiation comprises two photo-electric cells PC1, PC2 (Fig. 1) of the polarised vacuum type arranged in opposition so that ambient temperature affecting both cells equally, is balanced out and the apparatus responds only to radiation received by the cell PC2, the other cell being enclosed in a heat-screening enclosure. As shown, the cells are in series between the terminals of the H.T. supply, and the cell PC1 is shunted across a resistance R in input circuit of thermionic valve V, the anode circuit of which includes the measuring instrument M.

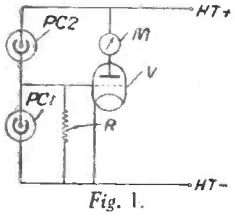


Fig. 1.

CATHODE-RAY TUBES.—Ferranti, Ltd., and Taylor, M. K. No. 506933.

In a cathode-ray tube wherein the beam is focused and has a cross-section which—due to the focusing field or some other cause—is distorted from the circular thereby producing an astigmatic image, an additional magnet or electro-magnet is provided for reducing the distortion. The magnet *c* (Fig. 2) may be carried by a phosphor bronze split-ring *d* which grips the tube *b*; or a rubber band may be used. An electro-magnet may be similarly held and supplied with D.C. from a source used with the tube. The magnet may project into the main focusing coil *a*.

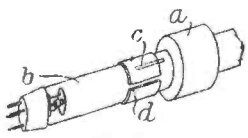


Fig. 2.

DIRECTIVE WIRELESS SYSTEMS.—Marconi's Wireless Telegraph Co., Ltd., and Wright, G. M. No. 507181.

In a rotable-frame aerial direction-finder, quadrantal error is compensated by an auxiliary frame 3 (Fig. 3) geared to the main frame 1 so as to rotate at a 3 : 1 velocity ratio in the same direction. The compensation may be adjusted by varying the relative number of turns on the aerials, by shunting one or each of the aerials by an adjustable impedance, or by coupling one or each of the aerials to the receiver through an adjustable transformer. Variation in the tuning with rotation may be compensated by connecting in series with the combined aerial circuit a mutual inductance comprising two coils which rotate with the frames 1 and 3 respectively. According to the Provisional Specification, the invention is also applicable to the radiogoniometer of a Bellini-Tosi system.

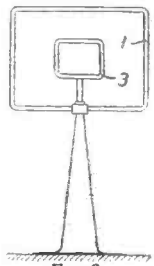


Fig. 3.

NEW PATENTS

These 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. The Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. weekly (annual subscription, £2 10s.).

Latest Patent Applications.

24838.—Hargreaves, L. S.—Television aerials. August 30.

24702.—Hodges, G.—Wireless signalling apparatus. August 28.

24612.—Philips Lamps, Ltd.—Method of producing noiseless sound records. August 26.

24727.—Philips Lamps, Ltd.—Production of sound records. August 28.

24368.—Weiner, W.—Indicating means for use with radio broadcast programmes. August 24.

Specifications Published.

511674.—Strafford, F. R. W., and Belling & Lee, Ltd.—Electric switching devices particularly designed for preventing interference with radio apparatus.

511600.—Murphy Radio, Ltd., and Hawkins, G. F.—Control of cathode-ray tubes in television apparatus.

511852.—Radioakt.-Ges. D.S. Loewe.—Tunable coupling circuit arrangement for ultra-short-waves.

512028.—Percival, W. S.—Thermionic-valve circuits.

511796.—Scophony, Ltd., and Rosenthal, A. H.—Television transmitters. (Cognate Application, 35179/38).

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

ZWORYKIN AND THE ICONOSCOPE

ONE of the most interesting papers given at the British Association meeting held recently in Dundee was provided by Dr. V. Zworykin who, as is well known, made one of the most important contributions to television's development when he produced his iconoscope. His address was mainly concerned with tracing the growth of electron optics and he explained that television's progress to its present practical stage had been very largely due to its transformation from a branch of optics into a branch of electrical engineering. The physicist of to-day after specialised research had succeeded in transferring the most difficult part of the television operation from light to electrons. Now, since it has been found that the control of electrons exhibits a greater degree of flexibility than that of light, it has been possible to make them perform functions which are right outside the scope of light rays and associated glass lenses. In his opinion mechanical television depended on the deflection of rays equivalent to those brought about by two prisms of variable strength. He contended that such prisms or their optical equivalents cannot be made sufficiently rapidly varying in refractive power if they are glass. On the other hand, electric and magnetic fields are capable of producing the equivalents of prism performance with an almost instantaneous speed variation. It was about fifteen years ago that the equivalent refraction and reflection of electron beams was discovered, and one of the great advantages of an electron lens is that it is theoretically capable of focusing the whole of a beam of electrons to a given point along corkscrew paths, whereas an optical glass lens is, as a rule, only able to focus a small percentage of a light beam. It is therefore necessary to have large increases in brightness which is often difficult and expensive, whereas the intensity of an electron beam is increased simply by speeding up the electron movement by high voltages. He then went on to deal with the fundamental principles of operation of the iconoscope which are familiar to readers of this journal, and the final section of his paper was given to explaining the electron microscope.

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

THE MAIDSTONE AMATEUR RADIO SOCIETY

Headquarters: The Clubroom, 244, Upper Fant Road, Maidstone, Kent.

Hon. Sec.: P. S. Hedgeland, "Hill View," 8, Hayle Road, Maidstone, Kent.

OWING to the war it has been found necessary to cancel the programme of lectures, etc., arranged for the Winter Season up to April, 1940. The club room will, however, continue to be open on Tuesday evenings for the use of members, and the club library, receiver, and amplifier will all be available. It is hoped that members will still come along, if only for a chat. If support is sufficient, it may be possible to arrange impromptu talks and demonstrations later on. Subscriptions have been suspended as from the outbreak of war, but members attending are asked to place voluntary contributions towards the upkeep of the clubroom, lighting, etc., in the donations box.

A cordial invitation is extended to any members of H.M. Forces stationed in the Maidstone district who are interested in radio, to come along to the clubroom on Tuesday evenings for a chat.

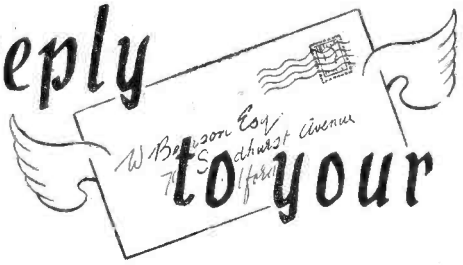
PERSONAL PARAGRAPHS

Owing to the resignation of Mr. W. H. Goodman from the position of managing director of the Dubilier Condenser Company, **Mr. F. H. McCrea** has been appointed in his place, with **Mr. John Goodman** as deputy managing director. Mr. Philip R. Coursey is continuing as technical director.

Mr. A. Clarkson, of the G.E.C., whose job it is to make his firm's products known, possesses the virtue of irrepressibility to a marked degree. He looks longingly at the gas-mask boxes slung from every shoulder and sees, in his imagination, the embossed word "TOP," impressed in outline on every one, rubber-stamped so that the central letter is filled in and under it appears the rest of the slogan "O for an Osram!"

George Taylor has left W.-B., the speaker people.

In reply to your letter



Home-made Panel

"I am making a new set and wish to employ a plywood panel. I know this should be impregnated, but do not know why this should be done, nor how to do it. I wonder if you have published any articles on the subject or could otherwise help me out."—E. D. T. (Harwich).

THE idea of impregnating wood is to prevent it absorbing moisture and thereby offering a leakage surface which would give rise to losses. This problem is not so important if there are no terminals mounted on the panel or no other parts across which a leakage would be dangerous. For instance, if condensers with the bushes earthed are the only parts on the panel, then the leakage would probably not matter. However, to impregnate the wood if you wish to do this, you need some paraffin wax. This should be melted in a flat tin large enough to contain the panel, and care must be taken to avoid the wax catching fire. Use a low gas jet. When thoroughly molten, warm the panel to drive out any moisture which may be in it and then drop it into the molten wax. Leave it until all air bubbles have ceased to rise and then lift it out with a wire hook and hang it up to dry. Rub off the surplus surface wax with a warm rag and an "egg-shell" finish can thereby be obtained.

I.F. Transformer Design

"I have an I.F. transformer which is apparently a Colvern F.C. 110 component. I believe this had some special features when it was introduced which made it different from the standard type of transformer, and I should be glad if you could tell me whether or not this was so and, if possible, what are the connecting points? There are four terminals numbered 1 to 4 and apparently three trimmers."—L. E. (Wolverhampton).

THE transformers had the usual two-coil arrangement, but the two coils were fixed so that a given degree of coupling was obtained, and a small trimming condenser was then joined across the two windings. When this was adjusted it varied the coupling between the coils—a 6 kc/s peak being obtained when the trimmer was screwed up finger tight. In some models there was a centre-tap on the primary and this, numbered 1, was joined to the anode; terminal 2 to H.T. positive; terminal 3 to earth (or grid bias) and terminal 4 to the grid of the I.F. valve.

Full-wave Rectification

"I have two of the old pattern E.G. 50 Ostar Ganz half-wave rectifying valves which I wish to use in a mains set I am making. Could you tell me the proper way to use both of these to obtain full-wave rectification? I have tried one alone but there is too much hum."—F. R. (Sligo).

THE mains leads are joined to the heaters which should be wired in parallel. One mains lead is then joined to the cathode on one of the valves and the anode of the other, whilst the remaining mains lead is taken to the junction of two 4 mfd. fixed condensers. One of these condensers is then joined to the free anode of the rectifying valve, whilst the other condenser is joined to the free cathode of the other rectifier. This forms H.T. positive, and the other condenser lead is H.T. negative but for additional smoothing an 8 mfd. condenser should be joined across H.T.– and H.T.+, and a .0005 mfd. fixed condenser should be joined across the mains.

Screening a Valve

"I have made up a set in which there is a plain glass H.F. valve. I am troubled with instability which, after some tests, I have decided is due to the fact that the H.F. valve is unscreened. Now I should like to screen this valve, but remember reading that aluminium paint is unsuitable for some reason or other. Is there any means I could adopt to screen this valve so as to avoid buying a new one?"—L. B. P. (W.1).

IT may not be necessary to screen the entire valve, but only the lead to the top cap. You can use screened sleeving for the purpose. On the other hand radiation may take place from the top cap and this can be avoided by using a screened top cap connector. Alternatively, the entire valve may be screened, cap as well, by using one of the special cylindrical metal valve screens. These are in two parts, one of which is mounted on the chassis or baseboard and the other pushed over the top after the valve has been inserted into the holder. Both the screen and the screened top cap are obtainable from Messrs. A. F. Bulgin.

RULES

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

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

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

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

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

Electro-musical Instruments

"Can you tell me how the electric piano or organ works? I have seen an advertisement in an American paper for one of these things which is supposed to give a remarkable tone, and I should like to know the principles upon which it works. I forget the trade name of the job, but perhaps you know the thing I refer to."—T. P. (Swansea).

THERE are now several different types of electrical-musical instrument. In one the vibration of strings is picked up by electro-magnets and then amplified; in another microphones are used to pick up the sounds, whilst in yet another the musical sounds are reproduced electrically by means of oscillating valves or toothed metallic discs rotating near electro-magnets. It is claimed that the oscillating valve circuit produces the best tone, and by special tone circuits various effects may be produced. The question of harmonics is receiving special attention.

Car-radio Aerial

"Can you tell me which is the best car-radio aerial to use? I have seen them on top of the cars and also underneath, whilst one car had a vertical rod sticking up from the bonnet. What are the differences between these, and which would you recommend for normal use?"—G. M. C. (Rothesay).

THE under-chassis aerial is supposed to pick up more noise or at least to be in a position to do so, owing to the fact that it is close to the ground beneath which electrical wires and similar cables may be buried. On the other hand, the roof aerial may prove directional and thus give rise to some peculiar effects when on a long journey during which your direction changes frequently and when you are receiving a weak station. The vertical aerial is non-directional, is probably simpler to erect, and if you use a telescopic arrangement with well-connected joints, it may be pulled out to provide adequate pick-up and folded up when not needed.

Meter Correction

"In measuring A.C. with a simple meter plus metal rectifier I understand there is a correction needed. What is the exact amount of this correction? Does it depend upon the resistance of the meter? My meter is 100 ohms and reads 1 milliamp full scale. I have a special 1 mA rectifier for use with it."—F. R. M. (Grays Thurrock).

THE correction needed is due to the fact that the meter will give a deflection proportional to the mean value of the current passing through it, whereas, in the case of an A.C. sinusoidal quantity, the measurement required is the R.M.S. (root-mean-square) value, which is greater than the mean value and bears a constant ratio to it of 1.11. Therefore, your 1 mA meter will read 1.11 mA, R.M.S. A.C., and the increase in the reading is actually 11 per cent.

"Portable" Aerial

"I am trying out a small portable for the air-raid shelter, and have heard that a flexible steel rule may be used for the aerial. There seems to be a good idea behind this, but I wonder if a metal case rule is suitable, as the rule will be electrically connected to this. However, perhaps you can help me in this connection."—R. L. A. (E.6).

THE idea is perfectly sound and we have mentioned it in these pages on several occasions. If the holder is metal you can attach a strip of insulating material to it and use this as an anchoring device, or there may be no need to take such steps—depending upon the method of mounting you intend to adopt.

The coupon on page 81 must be attached to every query.

Practical Wireless
BLUEPRINT SERVICE

These Blueprints are drawn full size.

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

Issues of Practical Wireless ... **4d. Post Paid**
Amateur Wireless ... **4d.** " "
Practical Mechanics ... **7d.** " "
Wireless Magazine ... **1/3** " "

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

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

PRACTICAL WIRELESS	*Date of Issue.*	*No. of Blueprint.*
CRYSTAL SETS.		
Blueprints, 6d. each		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve: Blueprints, 1s. each.		
Four-range Super Mag Two (D,Pen)	—	PW36B
The Signet Two (D & LF)	24.9.38	PW76
Three-valve: Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	12.6.37	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.26	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW81
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve: Blueprints, 1s. each		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
All-Wave "Corona" 4 (HF, Pen D, LF, Pow)	9.10.37	PW79
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC)	3.9.38	PW90
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve: Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Sonvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (R.C.))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
All-World Ace (HF Pen, D, Pen)	28.8.37	PW80
Four-valve: Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF, Pen, D, Push-Pull)	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47
A.C. All-Wave Corona Four	6.11.37	PW81
SUPERHETS.		
Battery Sets: Blueprints, 1s. each.		
£5 Superhet (Three-valve)	6.6.37	PW40
F. J. Camm's 2-valve Superhet	—	PW52
F. J. Camm's "Vitesse" All-Waver (5-valver)	27.2.37	PW75
Mains Sets: Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73
Four-valve: Double-sided Blueprint, 1s. 6d.		
Push-Button 4, Battery Model / Push-Button 4, A.C. Mains Model	22.10.38	PW95
SHORT-WAVE SETS.		
One-valve: Blueprint, 1s.		
Simple S.W. One-valver	9.4.38	PW83
Two-valve: Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve: Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	30.7.38	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	7.8.37	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	1.10.38	PW68
PORTABLES.		
Three-valve: Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve: Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF, Pen)	19.3.38	PW86
MISCELLANEOUS.		
S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE	*Date of Issue.*	*No. of Blueprint.*
CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprint, 1s.		
B.B.C. Special One-valver	—	AW387
Two-valve: Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve: Blueprints, 1s. each.		
Class B Three (D, Trans, Class B)	—	AW386
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve: Blueprints, 1s. 6d. each		
65s. Four (SG, D, RC, Trans)	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen)	*Mar.* '35	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*Apr.* '36	WM404
Five-valve: Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM310
Mains Operated		
Two-valve: Blueprints, 1s. each		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve: Blueprints, 1s. each.		
Home Lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383
Mantovani A.C. Three (HF Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* '36	WM401
Four-valve: Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '33	WM329
Harris' Jubilee Radiogram (HF Pen, D, LF, P)	*May* '35	WM386
SUPERHETS.		
Battery Sets: Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
'Varsity Four	*Oct.* '35	WM395
The Request All-Waver	*June* '36	WM407
1935 Super-Five Battery (Superhet)	—	WM379
Mains Sets: Blueprints, 1s. 6d. each.		
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve: Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS—Battery Operated.		
One-valve: Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
Rome Short-waver	—	AW452
Two-valve: Blueprints, 1s. each.		
Ultra-short Battery Two (SG, det, Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve: Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, R.C. Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen)	30.6.34	AW438
The Carrier Short-waver (SG, D, P)	*July* '35	WM390
Four-valve: Blueprints, 1s. 6d. each.		
A.W. Short-wave World-beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valver Short-waver (SG, D, LF, P)	22.7.39	WM383
Superhet: Blueprint, 1s. 6d.		
Simplified Short-waver Super	*Nov.* '35	WM397
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	—	AW453
"W.M." Long-wave Converter	—	WM380
Three-valve: Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C.	—	WM352
Four-valve: Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug.* '35	WM391
MISCELLANEOUS.		
S.W. One-valve Convertor (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-)	*Nov.* '35	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	*Mar.* '36	WM403
New Style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	*Jan.* 5, '35	AW462
Short-wave Adapter (1/-)	—	AW456
Superhet Converter (1/-)	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	—	WM408

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Surplus, Clearance or Secondhand, etc.

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REPAIRS to moving coil speakers a speciality. New cone assemblies fitted. Speech coils and fields wound or altered. Mains transformers, chokes, eliminators and vacuums repaired, prices quoted. Speaker transformers, Class "B" L.F. transformers and pick ups rewound at 4s. each, post free. Discount trade. Estimates free. Guaranteed satisfaction. L.S. Repair Service, 5, Balham Grove, London, S.W.12. 'Phone: Battersea 1321.

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2 Valve Short-Wave Receiver Kit... ... ... 29/-
3 Valve Short-Wave Screen Grid and Pentode Kit 68/-

PREMIER BATTERY CHARGERS. Westinghouse Rectification. Complete. Ready for use. To charge 2 volts at 1 amp., 11/6; 6 volts at 1 amp., 19/-; 6 volts at 1 amp., 22/6; 12 volts at 1 amp., 24/6; 6 volts at 2 amps., 37/6.

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ARMSTRONG Company can give delivery of practically all 1940 Radio chassis.

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ARMSTRONG Company announce that in accordance with their policy of fair trading, prices of chassis will not be increased until absolutely necessary.

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British Institute of Engineering Technology,
409, Shakespeare House, 17, 18, 19, Stratford Pl., W.1

Viscount Gort on the way to attend a levee at St. James' Palace.

Commander-in-Chief of the British Field Force

VISCOUNT GORT, V.C.

By Beverley Baxter, M.P.

A MAN who can win the Victoria Cross, three D.S.O's and the M.C. should not be alive—by the law of averages he should have been killed half a dozen times! Yet Viscount Gort, the subject of Beverley Baxter's vivid and revealing article in the October STRAND Magazine, won all these decorations, and is to-day Commander-in-Chief of the British Field Force. Stern, brave and purposeful, a soldier and the descendant of soldiers, he has had an adventurous career, and this stirring pen-picture will enthral everyone who reads it.

Fiction in the October STRAND by :

MICHAEL ARLEN. H. C. BAILEY. DALE COLLINS. GILBERT FRANKAU. WILL SCOTT. W. TOWNEND, etc.

Special photogravure supplement :

CHILDHOOD MOMENTS.

Illustrations from etchings by Eileen Soper, with a commentary by Theodora Benson.

IN THE OCTOBER

STRAND MAGAZINE 1/-

Of all Newsagents and Bookstalls

George Newnes, Ltd.

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SHORT-WAVE PORTABLES—

See Page 94

A NEWNES PUBLICATION

Edited by F. J. CAMM

Vol. 15. No. 369.

Practical Wireless

and

PRACTICAL TELEVISION

3D.

EVERY WEDNESDAY

Oct. 14th, 1939.

Contents

Practical and Wireless
PRACTICAL TELEVISION
EVERY WEDNESDAY
Vol. XV. No. 369. Oct. 14th, 1939.
EDITED BY
F. J. CAMM
Staff:
W. J. DELANEY, FRANK PRESTON,
H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Carrying On

THE Radio Manufacturers Association, with a full realisation of the importance of radio in our national life, has given careful consideration to the situation and has decided to do everything in its power to carry on. The various firms who are engaged in Government work will do their best to meet the needs of the industry in the supply of components and receivers, but, it is pointed out, there must inevitably be some increase in price resulting from the shortage of materials and various increases in the price of raw materials. So far as possible, however, every precaution will be taken to keep such increases at a minimum, and it is hoped that the public will realise the reason for such increases.

Home Defence Receivers

REPLYING to a question in the House of Commons recently, the Secretary of State for War announced that the trustees of the Nuffield Trust had agreed to provide a number of broadcast receivers for those in charge of anti-aircraft guns, searchlights and other home-defence units in isolated areas. The distribution of these receivers is being undertaken by the Navy, Army and Air Force Institute. It is understood that the receivers will be battery-operated portables made by two or three well-known manufacturers.

Westinghouse Moves

THE Westinghouse Brake and Signal Company announce that as from October 9th their head office address is Pew Hill House, Chippenham, Wilts. The telephone number is Chippenham 2255-6-7 (three lines) and the telegraphic address is Fouracre, Chippenham. This is yet another firm who have moved their head office to a "safe" area.

Editorial and Advertisement Offices:
"Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363.
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Registered at the G.P.O. as a newspaper and for transmission by Canadian Magazine Post.

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

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

Radio-frequency Warnings

IT is stated that a system developed in France for the sounding of air-raid warnings utilises the normal telephone and other wiring systems, upon which high-frequency carriers are sent, these operating time-switches and other apparatus as desired.

American Call-sign Change

A FURTHER change in the station call-signs of well-known American broadcast stations is announced, this time station W2XE. The new call is WCBS, which should be added to your list of American stations.

Gracie to Broadcast

THE B.B.C. is pleased to announce that Miss Gracie Fields is now sufficiently recovered to arrange a broadcast, and she will be heard in a programme lasting half an hour on Wednesday, October 11th, in the Home Service.

In this programme, Gracie Fields will sing several of her favourite songs, supported by Billy Cotton and his Band.

News from WLW

HAS it been mentioned that: Wilfred Guenther, co-ordinator of television and facsimile at WLW, is in New York City on business having to do with those subjects? . . . that engineers are putting finishing touches on the beam antenna that will funnel the 50,000 watts of Cincinnati's international station, WLWO, into a concentrated signal many times that strength? . . . that Arthur Radkey, of the WLW educational department, is going to have plenty to do in his spare time, as radio instructor at both the University of Cincinnati and the Cincinnati College of Music? . . . that Wilda Hinkle, whose ancestry is part Cherokee Indian, played Pocahontas on WLW's "American Parade" recently?

More Foreign Language Broadcasts

IN addition to news in Greek, from 6.15 to 6.30 on GSC (9.58 mc/s—31.32 metres), directional on Arabia, Near East and East Africa; and GSP (15.31 mc/s—19.50 metres), directional on Arabia, Near East and North, North-West and East Africa, the B.B.C. has also introduced news in Czech and Polish. These are broadcast daily on short waves as follows:

News in Czech: 1.45 to 2 p.m. (G.M.T.), on frequencies GSW (7.23 mc/s—41.49 metres), and GSE (11.86 mc/s—25.29 metres), directional on Europe.

News in Polish: 2.15 to 2.30 p.m. (G.M.T.), on frequencies GSW (7.23 mc/s—41.49 metres), and GSE (11.86 mc/s—25.29 metres), directional on Europe.

British Industries Fair

THE Department of Overseas Trade announces that the British Industries Fair, which was to have been held in London and Birmingham in February, 1940, is cancelled.

The cameraman took this photograph of Peter Grant while the WLW news commentator, jaws clamped on pipe, was deeply occupied with his script. He goes over each sheet carefully, reading and re-reading certain words and sentences, indicating pauses, deciding what reading tone will be most effective. He is heard on daily broadcasts at 11 p.m. E.S.T., and on the weekly "Sunday Evening Newspaper of the Air" at 6.30 p.m., E.S.T.

Institute of Wireless Technology

THE offices of the Institute of Wireless Technology have been removed to 25, Firs Drive, Palmers Green, London, N.13, and it is announced that examinations will be held only once a year.

CONDENSER CALCULATIONS

By the Use of the Tables Compiled in This Article Many Tedious Condenser Calculations will be Avoided

CHOICE of the capacity of fixed condensers in a wireless circuit, though usually not very critical, has to be made with due regard to the function which each condenser has to perform and to the values of the other components with which it is associated. This usually means a small amount of calculation—not of a very elaborate nature—since some very useful rules of thumb have been evolved to simplify these calculations to the lowest terms.

Before dealing with some of these simple rules there are one or two types of calculation which every constructor has to perform on occasion, and which can be further simplified for him in ways to be described. For example, having ascertained that a fixed condenser of a particular capacity is required in a certain position, the constructor may find that he has not just the right size in his possession. If, however, he happens to have a selection of other sizes at hand, it is quite possible that he may be able to make up the required capacity by using two or more condensers of smaller or even larger value.

Combinations

In the case where the condensers available are smaller than the required capacity, all that is necessary is to select two or more condensers whose combined capacities when added together make up the total required, and to connect them all in parallel. For example, a 2 mfd. bypass condenser could be made up of two 1 mfd. condensers in parallel.

But supposing all the condensers available are larger than the desired value—how can a smaller capacity be made up? The answer is, by connecting two or more condensers in series, and it is here that the first small calculations are necessary. The actual formula for finding the capacity of two condensers in series is to multiply the two values together and to divide the result by their sum, and for three condensers the calculation, though no more difficult, is a little more complicated. Moreover, since in order to obtain the desired value it may be necessary to work out the capacities of several different combinations and select the nearest to the required value, the process becomes a little more tedious.

A Helpful Table

The attached Table (1), however, reduces the amount of calculation very considerably. It consists of two columns, the first of which is headed "Capacity in mfd.", and the second "Reciprocal."

TABLE 3.

REACTANCE OF LARGE BYPASS CONDENSERS.

Capacity. (mfd.)	Reactance (ohms). (approx.) at 50 cycles.	at 100 cycles.
.25	13,000	6,500
.5	6,500	3,250
1.0	3,250	1,600
2.0	1,600	800
4.0	800	400
8.0	400	200
12.0	250	120
25.0	120	60
60.0	50	25

To find the capacity of any combination of condensers in series it is first of all necessary to write down the number in the "Reciprocal" column corresponding to each of the condensers. These numbers must then be added together, after which the combined capacity will be found in the first column opposite the number in the "Reciprocal" column corresponding to the sum of the reciprocals already obtained.

For example, suppose that two condensers each of .01 mfd. are connected in series. The reciprocal of .01 from the Table is 100, and as there are two such condensers we must add another 100 giving a total of 200. The capacity in Column 1 corresponding to 200 in the "Reciprocal" column is .005 mfd.

TABLE 1.

Capacity in mfd.	Reciprocal.
.0001	10,000
.00015	6,666
.0002	5,000
.00025	4,000
.0003	3,333
.0004	2,500
.0005	2,000
.0006	1,666
.001	1,000
.0015	666
.002	500
.0025	400
.003	333
.004	250
.005	200
.006	166
.01	100
.02	50
.05	20
.1	10
.2	5
.25	4
.5	2

It will probably happen that when the sum of the reciprocals has been obtained it will be found that there is no number in the "Reciprocal" column exactly corresponding to this figure, but in these circumstances the nearest figure must be taken. This does

TABLE 2.

MINIMUM VALUES OF L.F. COUPLING CONDENSERS FOR VARIOUS GRID LEAK VALUES.

Grid Leak. (Megohms).	Coupling Condenser. (mfd.)
1.0	.006
0.5	.012
0.25	.024
0.1	.06

not very much matter for, as already explained, the values of fixed condensers in wireless circuits are seldom very critical. For example, a .01 and a .02 mfd. condenser in series correspond to reciprocals of 100 and 50 respectively; these two numbers added together give 150. The nearest to this in column 2 is 166, and this corresponds with a condenser of .006. Therefore a condenser of .01 mfd. in series with a condenser of .02 mfd. can be considered as approximately the equivalent of a .006 mfd. condenser, although, if the value were worked out mathematically, their actual capacity would be .0066. The error is only about 10 per cent. which is of the same order as the manufacuring tolerance of these small condensers.

Coupling Condensers

We now come to cases in which a little calculation is required to arrive at the best value for a fixed condenser. This usually occurs in connection with the coupling condenser in a resistance-capacity amplifier. A full discussion of the factors governing

TABLE 4.

REACTANCES OF SMALL COUPLING BYPASS CONDENSERS.

Capacity. (mfd.)	Reactance (ohms). (approx.) at 50 cycles.	at 1,000 cycles.
.001	3,250,000	160,000
.002	1,600,000	80,000
.003	1,100,000	50,000
.004	800,000	40,000
.005	650,000	32,500
.006	500,000	25,000
.01	325,000	16,000
.02	160,000	8,000
.05	65,000	3,250
.1	32,500	1,600

the design of such couplings is outside the scope of the present article, and in any case they have been dealt with before in these columns, and it must suffice to remark that the liability to pass the lower audio frequencies without serious bass attenuation suggests a fairly large capacity, while an upper limit is set by the necessity of avoiding choking the grid circuit due to the inability of the grid leak to discharge the coupling condenser rapidly enough.

There is a fairly generally accepted rule of thumb governing the size of such a condenser. Briefly stated, it is that the capacity of the coupling condenser in microfarads multiplied by the resistance of the grid leak in megohms should not be less than .006, and it may also be added that the grid leak should not be less than four times the value of the anode load of the preceding valve, and not greater than .5 megohm, or such lower value as may be recommended by the valve maker. (See Table 2.)

According to this formula, therefore, the correct size of condenser for use with a .25 megohm grid leak would be .024 mfd. as a minimum, but in actual practice a rather larger value would be chosen such as the standard .05 mfd. component.

Bypass Condensers

The next case is that of the bypass condensers in smoothing and decoupling circuits, and for automatic grid bias arrangements. The requirement is that the condensers shall have a low reactance to the frequencies it is desired to bypass, compared with the impedance to those frequencies

(Continued on page 96.)

TABLE 5.

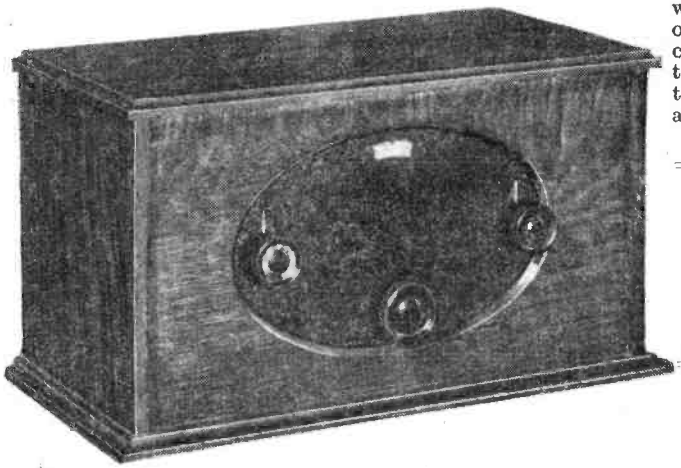
REACTANCE OF CONDENSERS AT RADIO FREQUENCIES.

Capacity (mfd.)	Reactance (ohms) at 1,000 kc/s	at 200 kc/s
.0001	1,600	8,000
.0002	800	4,000
.0003	500	2,500
.0004	400	2,000
.0005	300	1,500
.001	160	800
.002	80	400
.003	50	250
.004	40	200
.005	30	150
.01	16	80

The 30/- Three

A Simple but Efficient Receiver which is Available in a Partially Completed Form with Cabinet

OUR range of inexpensive receivers is obviously fulfilling a long-felt want, and in an endeavour to pursue this policy still further we have been looking round and have found a very useful nucleus for a three-valve receiver of novel design which callers may obtain for the low price of 10s. 6d., inclusive of cabinet. This particular item is in the form of



On the left is the completed receiver in the cabinet supplied with the parts, and on the right (Fig. 2.) the coil winding and connecting data.

parts supplied by Electradix Radios, and consists of a small cabinet, panel and baseboard with three valveholders ready wired. All wiring is completed, with the exception of two very slight modifications, and all that has to be done is to make these two modifications, wind a very simple coil and mount it, and the receiver is ready for use. The total cost, including three suitable valves, is just under thirty shillings, and the receiver is then quite a useful piece of apparatus as it has one or two very novel points.

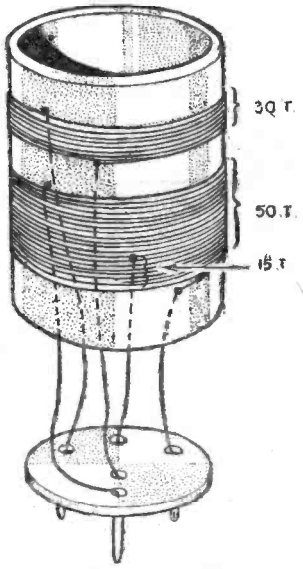
Dealing first of all with the circuit, it will be seen from Fig. 1 that this is a standard R.C. coupled arrangement following the detector-and-two-L.F. lines. A special switch is fitted on the panel by means of which the receiver may not only be switched on and off, but the output stage may also be cut out, so that the receiver is automatically operated as a two-valver. In these days of economy this is, of course, a valuable point, as there are many occasions on which two valves will provide all the volume which is required.

The reaction control is effected by means of a special moving-plate type of condenser using the metal panel as one plate and a sheet of mica is supported to provide the dielectric. A threaded rod gives control over the moving plate and this operates most effectively in providing the reaction effects. The home-made coil has a suitable winding, of course, to ensure that reaction is smooth over the entire band.

Wiring Changes

As the receiver is supplied there is a variable resistance fitted which will not be needed with modern valves. There is a flexible lead connected to the plunger or moving element of this resistance, and to eliminate the device this flex lead should be cut off the plunger and the latter removed. The end of the flex lead should then be soldered to the lead joined to the top of the resistance.

The second alteration which has to be made to the wiring is the incorporation of a grid leak and condenser. It will be seen when a receiver is obtained that two connections are made to the grid socket of the first valveholder, and these must be unsoldered. A .0003 mfd. fixed condenser must then be connected to the grid socket and the other side of the condenser must be joined to the two wires which have been removed. The grid leak is then connected between the grid socket and the L.T. positive socket of the detector stage. These



are the only alterations which have to be made and all that now remains is to fit suitable resistances in the four sets of clips provided and wind the coil, when the receiver is ready for use. The resistances should have values of 75,000 ohms, 100,000 ohms, and two of 1 megohm each, and they are inserted as indicated in the theoretical diagram below.

(*Continued on page 101*).

LIST OF COMPONENTS

One wired chassis and cabinet (Electradix).
Five fixed resistances: 75,000 ohms, 100,000 ohms, two at 1 megohm, and one 2 megohms (Dubilier, 1-watt type).
One .0003 mfd. fixed condenser, wire-end or mica type (Dubilier or similar).
One D.210, one L.210, and one P.220 valve (Hivac).
One 9-volt G.B. battery
One 120-volt H.T. battery } (Exide).
One 2-volt L.T. accumulator
One coil—see text.

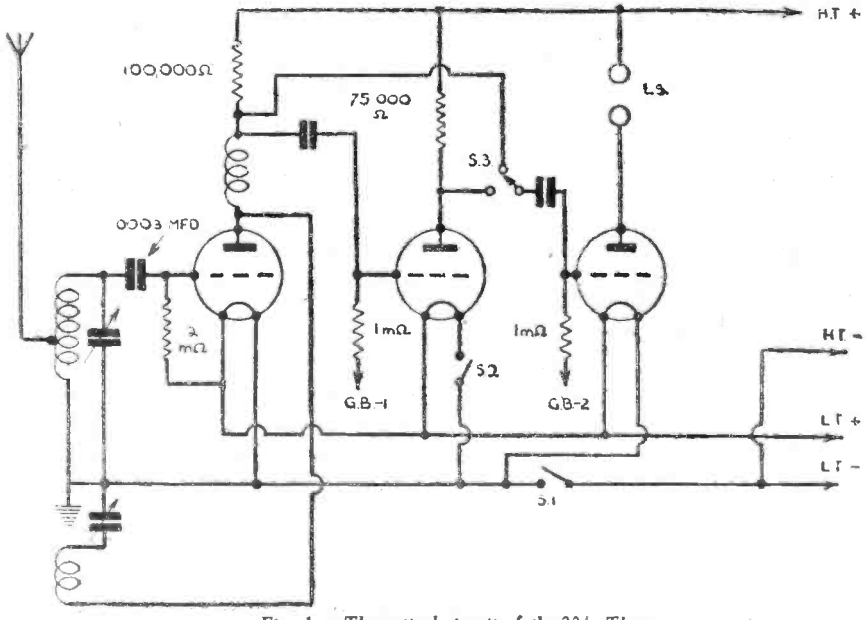


Fig. 1.—Theoretical circuit of the 30/- Three.

SPECIAL REACTION CIRCUITS

Suggestions for Improving the Results Given by the Simpler Types of Reacting Detector Stage. By W. J. DELANEY

IT is well known that the average detector stage is very inefficient unless reaction is employed. Without going into the problems of negative resistance and other technical details, it is sufficient to say that if you eliminate the reaction circuit the results given by the ordinary detector are very little better than those obtained with a good crystal detector. Apart from the low sensitivity it is also found that selectivity is also very poor. As soon, however, as reaction is applied, sensitivity jumps remarkably and selectivity is also improved.

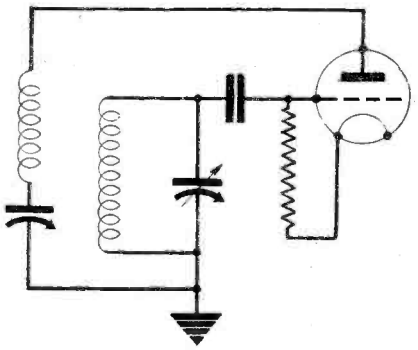


Fig. 1.—This is a standard reaction circuit, with the reaction condenser earthed.

It is therefore desirable in a standard detector stage to take steps to see that the reaction circuit is as efficient as possible. The normal dual-range coil such as is commonly employed has a reaction winding coupled to the grid winding, and a small variable condenser is joined on one side or the other of this reaction winding, the exact position depending upon the design of the coil. In Fig. 1 the reaction condenser is on the earth side of the coil, and in Fig. 2 it is on the anode side. In both cases the results are identical, the first method having the advantage that the condenser may be mounted on a metal panel and a connecting wire thereby dispensed with.

Medium Waves Only

Unfortunately, in many cases the reaction circuit is a compromise, owing to the fact that the coil is wound to cover two wavebands, and the reaction winding is a single coil disposed between the medium and long-wave windings. Another disadvantage is that it is essential to use one of the reaction control methods shown in Figs. 1 or 2. The institution of a single programme only by the B.B.C., however, has led to an increase in the use of medium waves only, and in the special receivers which we have recently described a single waveband coil has been specified. When the tuning circuit is simplified in this manner one is provided with greater scope for experiment in the reaction circuit and there are several interesting schemes which may be tried out in the interests of improved efficiency. With the need for economy in receiver construction and operation, any simple means of increasing efficiency is of great importance and accordingly the following reaction circuits should appeal to those who are experimenting with the single waveband type of receiver. In the first case a differential reaction condenser may often be used to replace a single type of condenser, with a great improvement in results. In Fig. 3 is the usual type of detector stage, with an anode by-pass condenser C. This is in parallel with the reaction circuit, and thus when the reaction condenser is at zero the effective by-pass capacity is that provided by condenser C. As the reaction condenser is operated, however, the capacity of that condenser is applied in parallel with that offered by the condenser just mentioned, and thus the total by-pass capacity is continually altered. With the differential condenser, however, the by-pass capacity is constant, as the moving plates mesh with one section of the condenser as they unmesh from the other set of plates and the total capacity from anode to earth is thus kept constant. This improves efficiency.

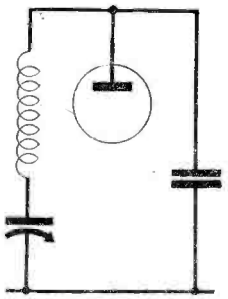


Fig. 3.—The anode bypass condenser is in parallel with the reaction circuit.

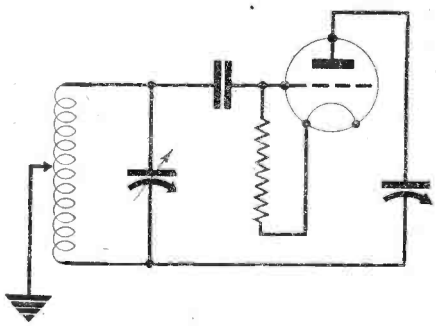


Fig. 4.—The Hartley reaction circuit utilises a tapped coil.

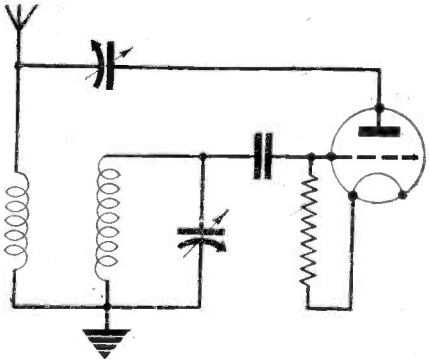


Fig. 5.—A simple reaction circuit which does not need a reaction winding or coil.

Hartley Reaction

A form of reaction which is commonly employed in short-wave receivers, but which cannot be used with standard broadcast coils owing to the absence of the necessary tapping point on the coil, is that known as the Hartley, depicted in Fig. 4.

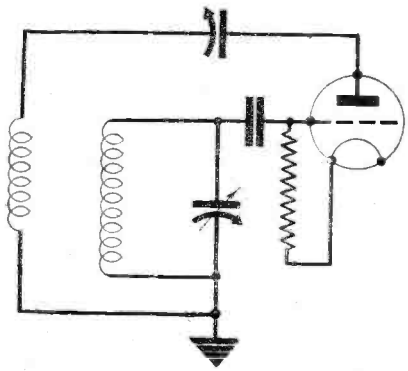


Fig. 2.—In this circuit the reaction condenser is not earthed direct, but the arrangement is identical to Fig. 1.

Here the reaction condenser is joined to the lower end of the tuning circuit and the earth return is taken to a point on the tuning coil. Theoretically this point should be the exact electrical centre of the coil, but it is sometimes possible to use a point slightly off centre with advantage. The coil may be provided with tapping points or a sliding contact may be provided on the coil. The disadvantage of this type of circuit is found in the fact that both the tuning and reaction condensers are "up in the air," or, in other words, cannot be mounted on an earthed metal panel. It may also be found that hand-capacity effects may prove troublesome unless a screened panel is placed between the condensers and the control knobs.

Aerial Reaction

Another reaction circuit which was at one time popular, and which may often be employed when a coil is used which is not provided with a reaction winding, is that shown in Fig. 5. Here the reaction condenser is joined direct between anode and the aerial terminal. This arrangement also suffers from the defect that an earthed metal panel cannot be used unless the reaction condenser is efficiently insulated. The control offered by this type of circuit is very effective, but tuning points will shift on the dial due to the by-passing effect of some of the signals via the anode. This arrangement generally operates most effectively when a separate aerial coil is used, this then performing the dual function of aerial and reaction windings.

(Continued on page 96)

ON YOUR WAVELENGTH

By Thermion

Hire-purchase Problems

JUDGE HILDYARD, in Nottingham County Court, asked the Press to make known the fact that leave to obtain possession of hire-purchase goods must be obtained from the Court. "There are hire-purchase agreements which primarily do not come under the new Act, and primarily the owners of the goods could take possession. They must not do that now without our leave. If they do take them without leave, there will be very serious difficulties." A solicitor pointed out that there was an impression amongst men in the street that they could dodge payment under the new emergency regulations. The public were being led to believe that they could avoid payment of everything and that the Court would protect them because of the war. The whole point of the Act is to protect those who are unable to pay because of the war. Many firms have, of course, revised their hire-purchase arrangements. These reduce the hire period to a maximum of 12 months, and increase the deposit to 15 per cent. of the total hire-purchase price.

There have, of course, been a number of price increases.

The Only Weekly Radio Journal

PRACTICAL WIRELESS is the only weekly journal devoted to amateur radio. It was the last in the field, and it remains the last. It is to carry on. It is not going to be easy in these times of censorship and paper shortage. Readers must become accustomed to thinner issues. We shall maintain our staff of regular contributors, and carry on the free service of PRACTICAL WIRELESS receivers. Notwithstanding rise in costs, it is not our intention to increase the price of the journal. Readers may, therefore, look for PRACTICAL WIRELESS every Wednesday morning as usual, and the only slight duty they have to perform to ensure this is to place a regular order for it with their newsagents. This will avoid waste copies which in war-time everyone is anxious to avoid. PRACTICAL WIRELESS is the only weekly link between the amateurs, the trade, and the latest news. Unless you order it regularly you may find the link which ties you to the journal broken one week. It is a small task which you have to perform. You will assist us as well as yourself if you slip round to the newsagent now and order your copy to be delivered each week.

Winston Churchill

NO living Englishman—perhaps no living man—commands to such an extraordinary degree the ear of the whole world as Winston Churchill—soldier, journalist, author, historian and statesman. He has served in six wars, and held almost every high office Britain can offer to a statesman. He is the author of works which would make him world-famous even if his energies had been confined to authorship alone, and whatever he writes is eagerly read throughout the English-speaking world and then translated into many languages.

It is sometimes forgotten that our new First Lord of the Admiralty served in the South African War—that glorious episode in British history which was illuminated by the individual exploits of many daring and resourceful Britons. Not the least of these was young Winston Churchill who is telling his own story of the campaign in *Tit-Bits*.

Say it by Telephotography

RUSSIA to-day is much in the news. Whilst the newspapers have been busy dealing with the political situation, however, they have omitted to report a scientific development in that country. I refer to telephotography.

It will soon be a common thing for people in Moscow, wishing to send greetings to friends or relatives in other cities, to send a phototelegram reproducing the message in their own writing, judging by the way in which the use of telephotography is developing. Already by the end of July this year 120,000 more phototelegrams had been sent and received in Moscow than the total number for the whole of 1938. All kinds of materials are sent in this way, from the plans drawn up by various People's Commissariats to letters and cartoons. The introduction of telephotography has also facilitated the sending of telegrams in any language, whereas by the standard method they had to be sent in either Russian or Latin script.

To-day it is possible for Moscow to communicate by telephotography with 17 large cities of the Soviet Union; 12 of them are linked with Moscow by wire and five by wireless, these latter being the distant towns of Tashkent, Irkutsk, Khabarovsk, Baku and Tbilisi. An experimental telephotographic system has now been opened from Moscow to Alma-Ata, by wireless, and from Moscow to Kuibyshev, by wire. In addition, the Scientific Research Institute for Communications has perfected a method of employing the photoelectric cell for the transmission of pictures in colour, excluding the colours pale green, pale blue, and yellow. An inspector in the Exploitation Department of the Central Telegraph Office in Moscow, Uarov, has also invented apparatus which renders it possible to reproduce and transmit telephotographic materials to several destinations simultaneously, and this will be of particular value in the transmission of official telegrams, and materials intended for more than one destination.

The Battery Shortage

NOW that we have all returned to the bicycle, one section of our industry, the battery makers, has been hard put to it in supplying the sudden demand for rear-light batteries and head-lamp batteries. In some cases this has meant that labour has been diverted from the manufacture of wireless batteries, thus creating a temporary shortage of them. I now learn, however, that supplies are coming through. The battery set has been a useful stand-by during recent weeks, and I hear from people in the trade that rather more battery sets than mains are being sold. Nearly everyone has now obtained a stand-by receiver, so that in the event of a breakdown of the mains they can still obtain the news. The demand for our cheap battery blueprints continues unabated.

Home Study

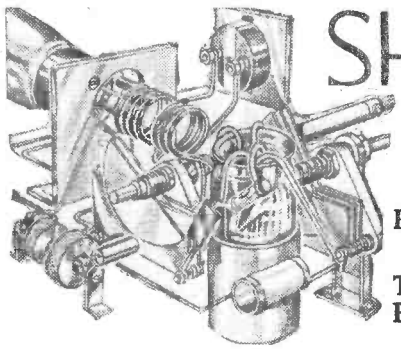
ANOTHER feature of the black-out and restricted entertainment is the fact that thousands of people have now turned to home study as a form of recreation. Correspondence Schools report a great increase in the number of students, and our Book Publisher tells me that there has been a run on our technical books. Just a reminder that we issue a catalogue free to our readers. It seems that now so many people are engaged on making munitions "Practical Mechanics Handbook," and "Workshop Calculations, Tables, and Formulæ," are proving best sellers. It will be noted that the price of these books has not been increased.

Readers' Letters

IN response to my appeal to readers who are in the Forces to write to me, I have received a large number of letters from members of the Navy, the Army, and the Royal Air Force. I have replied to all these letters, each of which is addressed from somewhere in France, somewhere in England, or somewhere on the High Seas.

The Clubs

ONE or two clubs inform me that it is impossible for them to carry on, and that they are closing down for the duration of the war. I hope that they take adequate steps to keep the records of the club intact, and to either refund the bank balance to the members, or to have it banked in the name of trustees. Someone should be deputed to keep track of members' addresses, so that when the war ends an up-to-date list is available. The peaceful times of August seem far away.



SHORT-WAVE SECTION

PORTABLE SHORT-WAVE RECEIVERS.

Technical Details and Constructional Problems Concerning S.W. Portables.

A NOTICEABLE feature of modern short-wave receiver design is compactness. Improvements in the design of individual components and a reduction in their physical dimensions, together with the use of efficient and effective screening, is largely responsible for the improved appearance and performance of present-day sets, and the comparatively large cabinets so familiar in the early days are not now seen.

Experimenters who are fortunate enough to have a number of midget type components to hand are provided with a wider scope so far as the design and construction of what may be termed ultra-compact short-wave receivers are concerned. The majority, however, must remain satisfied with standard components, and plan accordingly.

Using Components on Hand

A most interesting all-the-year-round field of experiment is open to all who care to participate, and who have a sufficient number of modern and suitable components on hand. We refer, of course, to the construction of portable short-wave receivers. Design problems can be studied during the autumn and winter, and constructional work carried out together with tests under home conditions, which will enable modifications, if found desirable, to be carried out.

Standard size components and valves will enforce definite limitations. Nevertheless, it is possible to design and build a suitable receiver, and yet keep the weight down to a reasonable figure.

The subject must, however, be reviewed in the right perspective, and not regarded simply as a matter of building a set and fitting it into a small box, meanwhile hoping for the best. Such procedure usually ends in disappointment.

Technical Requirements

The technical requirements of selectivity, sensitivity, quality and volume are common to all receivers, so also is ease of operation. In the case of the portable, minimum weight is of equal importance, as the task of humping a heavy receiver about the countryside is apt to damp one's enthusiasm. There are, for instance, two sources of dead weight to contend with, i.e., the H.T. battery and L.T. accumulator.

To design a portable receiver with a view to the inclusion of standard size H.T. and L.T. batteries is, on account of excessive weight, absolutely out of the question. It is, therefore, advisable to study the battery problem and find a solution before proceeding, once the type of circuit to be used is decided upon. One of the specially designed midget type H.T. batteries, and a non-spill type L.T. accumulator of the portable type are recommended.

The constructor is then assured as to voltage and current requirements being met, and at one and the same time reducing the weight and physical dimensions of the set to a minimum otherwise impossible.

In addition to current, voltage and weights data, a definite idea as to the physical dimensions is of vital importance.

In the case of the L.T. accumulator, a compromise between amperage and size must be arrived at, not forgetting the total height, including the terminals. Manufacturers are always willing to supply such information.

Choosing a Circuit

Choice of circuit is a matter for individual consideration, but there is a comparatively wide range from which to choose.

For example, a single-valve regenerative detector; detector and L.F. stage, using a power valve or alternatively a low-consumption pentode in the latter; a detector L.F. arrangement using a class B valve; a screen-grid valve as a detector followed by a stage of L.F. amplification; or a more up-to-date circuit incorporating H.F. and L.F. pentodes, etc. Whichever type of circuit is finally chosen will depend to a certain extent upon the components available. The most suitable type L.T. accumulator and H.T. battery should be decided upon, and their respective dimensions noted. There is, however, no need to purchase them straightway, and it is probable that the constructor will desire to use standard batteries on hand, for the initial bench tests, yet rest assured that alterations to the carrying case will not be called for when midget batteries are to be used.

It is advisable to build up with cardboard or wood models of the batteries, including total height to the top of terminals, exactly conforming to the dimensions quoted by the accumulator and H.T. battery manufacturers, remembering in the latter instance to allow for wander plugs, and in both instances to arrange for a reasonable amount of clearance. Such precautions are sometimes overlooked, and carrying case modifications become necessary, or, worse still, a new one has to be made.

Having all the necessary components to hand, together with full size models of the L.T. and H.T. batteries to be purchased later, it is time to get out the drawing-board and a sheet of drawing-paper.

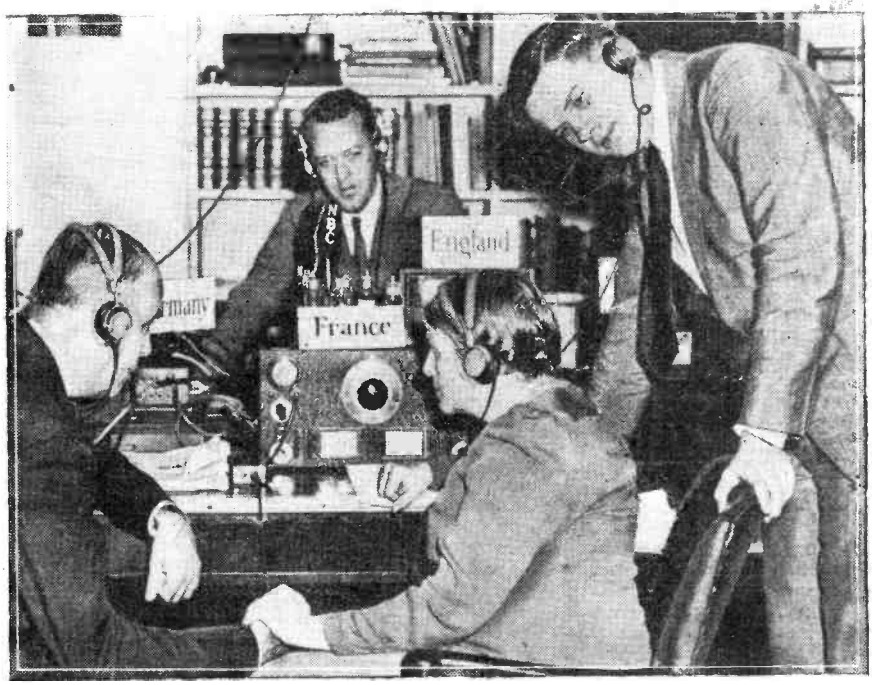
Baseboard or Chassis

We may choose between two methods of construction, i.e., baseboard and chassis. Whilst the baseboard method is suitable, the writer favours the chassis method because it enables us to mount a number of components, as, for instance, decoupling condensers and R.C.C. units or components, underneath.

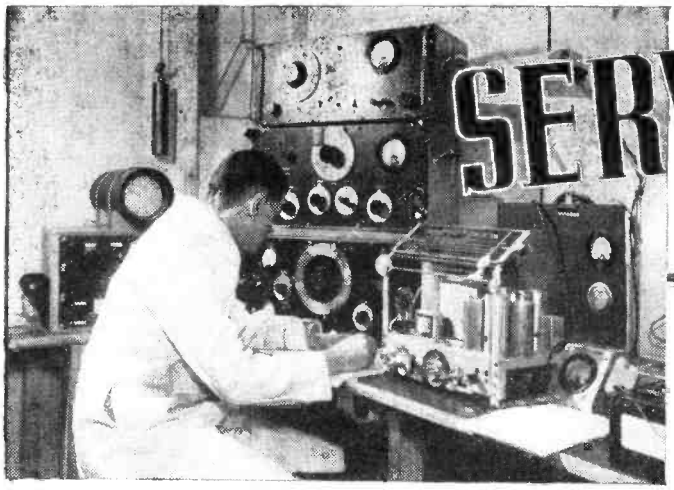
Only a very shallow chassis is necessary, and may be in the form of a shelf let into the sides or ends of the carrying case, the underside being lined with tinfoil. This idea is most suitable when the box camera type carrying case is used.

Before deciding as to the type of carrying case, a few experiments in the form of layout and general arrangement must be undertaken. The chassis components can be laid out, due allowance being made for tuning, reaction and bandspread condensers, clearances, etc.

(*Continued on page 96*)



First-hand news of her safety after having gone through the terrors of the Athenia *sinking was the cheering subject of the broadcast that Miss Barbara Rodman sent over the air from Scotland. Her parents, Mr. and Mrs. Francis C. Rodman and her brother, Clarke Rodman, all of Garden City, Long Island, are here seen in an N.B.C. studio listening to the broadcast. In the background is announcer George Hicks.*



SERVICING —New Series

A Valuable Instrument for Fault Tracing is the Chanalyst or Set Analyser. Here is a Description of One of the Best Known of These Devices

WE have seen in previous articles how a systematic form of fault tracing is to be desired if time is to be saved and reliable repairs effected. The situation regarding a faulty receiver may be summed up in the fact that something has happened to the signal. There is one thing in which the customer is interested, namely the restoration of the signal to its normal condition, and the job of the serviceman is to see that this is done. Obviously, therefore, the ideal plan is to check the signal from the point at which it enters the receiver and trace its path through the various stages until the speaker is reached. If at any point the signal departs from normal, then that part of the set can be identified as the seat of the trouble, and it is this function which is carried out by the device known as an Analyser or similar name. One of the most popular of such pieces of apparatus is undoubtedly the Rider Chanalyst, an American device which may be obtained in this country. To enable the reader to understand the method adopted with this type of apparatus we give below a bare theoretical diagram of the complete circuit, from which it will be seen that it is power-operated and divided into several separate sections.

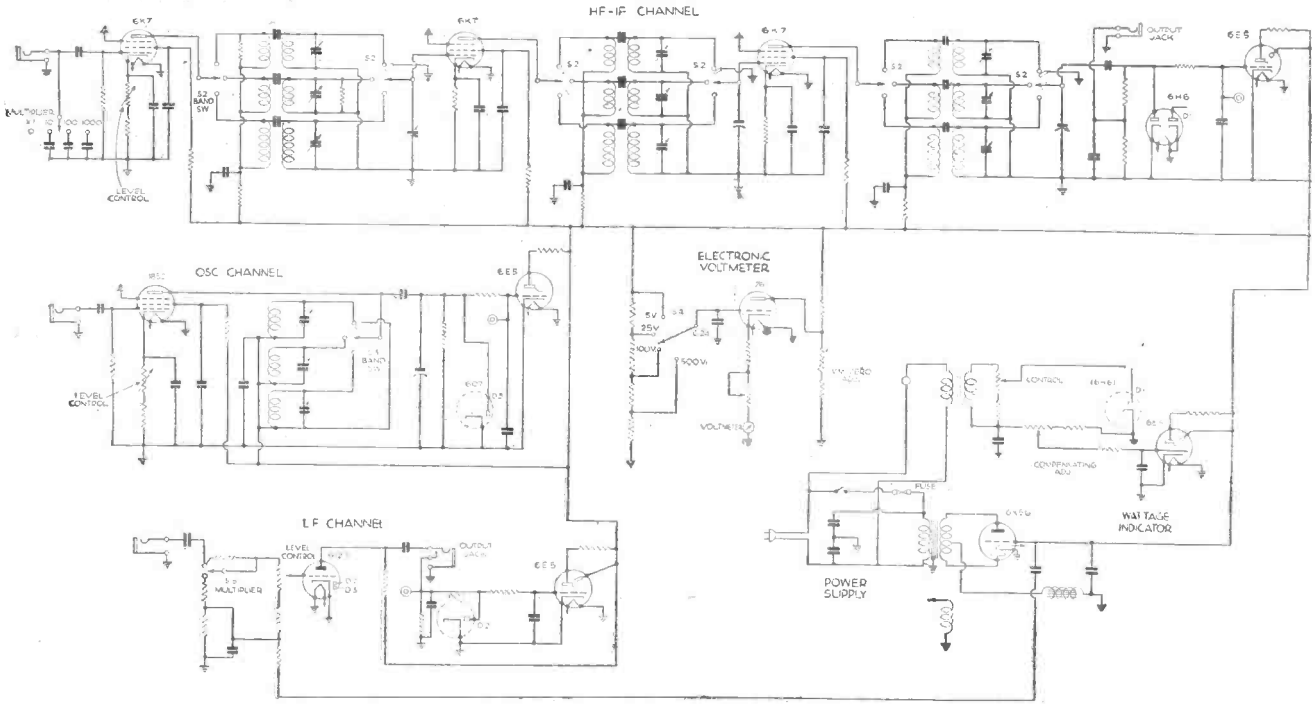
The Circuit

There is an H.F. and I.F. channel; an oscillator channel; an L.F. channel, an electronic voltmeter and a wattage indicator. No matter how complicated the receiver, and irrespective of the valves which are employed, the processes of frequency conversion, rectification and amplification may all be accurately checked. You can tell instantly if the signal is at its proper frequency; if it is being stepped up as it should be; if it is picking up hum or being distorted, and so on. It would take up too much space to explain how each section is used, but those who wish to obtain fuller information may obtain an interesting 70-page book describing this particular instrument from Messrs. Holliday and Hemmerdinger. Suffice it to say that by means of probes various parts of a receiver circuit may be tapped off and applied to the tester, or the output of a given part of the tester may be similarly applied to the receiver, and the various functions thereby accurately followed. As in a superhet the most intricate part of the receiver is the oscillator or mixer stage, it will be worth while explaining fully how this particular stage is checked by means of this individual tester, although it will be appreciated that it may be similarly checked by using a separate signal generator and separate test instruments of the kind which have been previously described in this series. The following notes are taken from the Chanalyst service manual.

The Oscillator Stage

The first step is to see that the oscillator stage is developing the correct intermediate frequency, and this may be measured by means of the Chanalyst or by means of a similarly calibrated unit. Having done this the dial of the tester is examined to see that the I.F. is correctly denoted, if not, then it is known that the oscillator alignment is incorrect, but if the setting is in order, then it is known that dial tracking and alignment of the oscillator are in order.

(Continued on following page)



Theoretical circuit of the well-known Rider Chanalyst, an American fault-finder, which is available in this country.

SERVICING

(Continued from previous page)

If a major discrepancy exists in the I.F. peak at the anode of the mixing stage, then it is necessary to search for the I.F. signal, which will indicate that the padder, trimmer, coil, earth connections, etc., must be examined in the mixing stage. If the I.F. signal is not present at the mixer anode the first step is to establish if the normal signal is present in the mixing stage. If it is, then the operating potentials applied to the mixing portions of the valve elements must be checked. This may be done with a good voltmeter. If the valve is not oscillating this will prevent signals from being properly obtained, and the fact may be ascertained by connecting the voltmeter across the grid leak joined in the grid circuit of the oscillator. There should be a voltage developed across this leak if the valve is oscillating. No voltage will indicate that the valve is not oscillating and accordingly the search for a fault is localised.

Weak Signal

If the signal is weak at the mixer anode the various bias voltages may be checked as well as the oscillator anode voltage, as these materially affect the conversion gain of the mixer valve. If there is no signal at the I.F. control grid, the trouble will almost certainly be in the first I.F. transformer, but the fact that it was present at the mixer anode will indicate that the primary of the transformer is likely to be in order, at least it will not be short-circuited to earth or open-circuited. Misalignment of the primary and secondary will, however, result in a poor transfer, or complete absence of signal at the I.F. stage. This test will also apply to the I.F. anode, should a signal be found there but not in the following stage.

Distortion

It is often found that the signal is present all through the receiver, but at some stage distortion sets in, and although the use of 'phones or speaker following the 2nd detector (or detector stage in a "straight" set) will enable such a source to be traced in most cases, it will not be possible to use these in the H.F. or I.F. stages of a superhet. The special tuning eye in the service instrument being reviewed will show such distortion, however, but there is an additional feature fitted to this particular instrument in the form of output jacks in the H.F., I.F. and L.F. stages so that a cathode-ray oscillograph may be connected and the signal examined visually. A test oscillator is connected to the receiver, and obviously this must be of a type free from distortion, and then the waveform of the signal at each point of the circuit will indicate rapidly where it departs from normal. The cathode-ray oscillograph is, in fact, a very valuable accessory in modern servicing and its operation is not difficult to master if it is at first used on simple circuits. A suitable wave-form is obtained on the tube with the particular input signal device being used and this must be made small enough to take care of the successive amplification which takes place from stage to stage. The height of the wave will increase with these signal increases or successive stages of amplification, and overloading, frequency distortion, drift and various other defects will be seen where they would perhaps be missed if ordinary audible forms of test were adopted.

SHORT-WAVE SECTION

(Continued from page 94)

Carrying Case Dimensions

Having decided on a suitable layout which includes the batteries, and carefully measured the total height of the valves mounted in their holders plus depth of chassis, a definite idea as to the dimensions of the carrying case can be worked out.

The length and width can be marked direct on the drawing-paper, the chassis components marked round also with a sharp pencil, and the position of under-chassis components shown in dotted lines.

Taking into consideration that all components including dimensional models of standard midget type batteries have been arranged as desired, all clearances allowed, and the carrying case dimensions arrived at in a practical manner, it is unlikely that serious errors will arise. In addition, such procedure enables various schemes to be tried out with a view to compactness and general efficiency.

To some constructors the methods of procedure outlined above may appear to be involved, but they are necessary if a satisfactory job is to result.

A portable short-wave set must be designed as a complete unit, and the case must be of comparatively light weight and reasonably small dimensions. It is not just a matter of making the layout to suit a carrying case, or cramping everything and sacrificing efficiency in order to use an existing case.

Testing the Set

The essential thing is, first and foremost, the set. Once having decided on a compact layout which can be housed in a reasonably small case, the experimenter can build the receiver using a temporary panel, the actual chassis and layout, and thus run practical receiving tests. When these are satisfactory the construction of the carrying case can be proceeded with.

At one time, comparatively large tuning dials were fitted to portable receiving apparatus as used by home constructors who had no choice in the matter, as small ones were not available. Tuning condensers also were of large size, but nowadays several makes of midget tuning condensers and dials are available.

Thus it is possible to arrange a main tuning dial with a graduated scale, a reaction condenser, also a bandspreading condenser and on-off switch on a comparatively small panel without undue cramping.

Carrying cases can be made of plywood, or in the form of a strong but light frame covered with aeroplane fabric, the latter form of construction being originated by the Editor of this journal.

Generally, a two-valve straight circuit headphone set will meet portable short-wave requirements, if used in conjunction with a short aerial.

SPECIAL REACTION CIRCUITS

(Continued from page 92)

Portable Reaction

With a portable or other type of frame aerial reaction may be applied direct by using a reaction winding of two or three turns in the same direction as the main

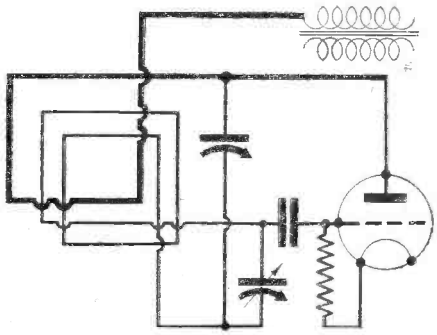


Fig. 6—How reaction may be applied to a frame aerial.

winding, and connecting this between anode and the anode load component. This is, of course, exactly similar to the old form of reaction, where a separate moving reaction coil was employed. In the case of the frame aerial, however, instead of moving the reaction winding the control over reaction is effected by fitting a reaction condenser between the anode and the L.T. or H.T. — line. This idea is also applicable, of course, to any standard form of reaction winding, although the shunting effect of the condenser may not be found so fully effective as when a frame aerial winding is employed.

CONDENSER CALCULATIONS

(Continued from page 90)

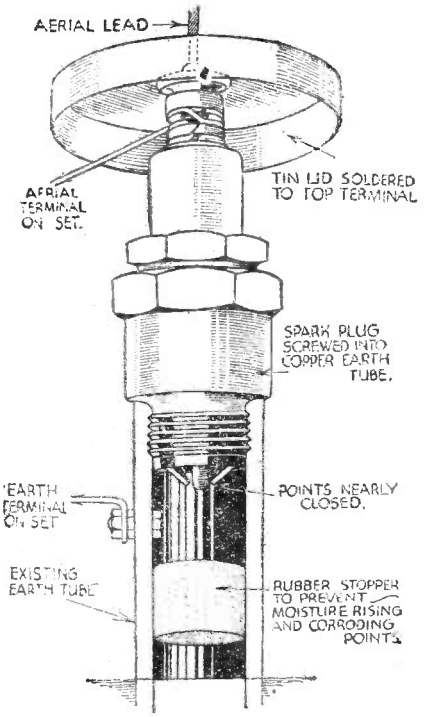
offered by the smoothing choke or decoupling resistance. Now the reactance, or opposition offered by a condenser to an alternating current varies with the frequency, being less at high frequencies than at low frequencies. It is very desirable, therefore, to be able to calculate the reactance of a condenser at any particular frequency. This can be done by multiplying together the capacity of the condenser in mfd., the frequency in question in cycles per second, and the number 6.28 and dividing the result into 1,000,000. The answer will be the reactance of the condenser at that particular frequency, expressed in ohms.

It is true that this calculation involves only simple arithmetic, but in order to reduce the necessity for such calculations as much as possible, a further group of tables has been prepared giving the reactances of commonly used sizes of condenser at frequencies with which they are usually expected to deal. Table 3 gives the reactance of the larger bypass condensers from .25 mfd. upwards at 50 and 100 cycles. Table 4 gives the reactances of smaller coupling and bypass condensers at 50 and 1,000 cycles, the latter being an average kind of audio-frequency, while Table 5 gives the reactances of condensers between .0001 and .01 mfd. at 1,000 kc/s (300 metres) and 200 kc/s (1,500 metres).

Practical Hints

An Efficient Lightning Arrester

A VERY neat and efficient lightning arrester can be made from an old sparking plug in the manner shown in the accompanying sketch. There is no need for any dismantling; I just screwed the threaded end of the sparking plug into the open end of the earth tube, connected the aerial lead on to the terminal, and after thoroughly cleaning and closing the points



An old sparking plug is used in the construction of this novel lightning arrester.

a little, placed a rubber stopper in the tube to stop moisture rising and corroding same. A tin lid soldered to the top terminal completes the job.—R. JAMES (Willesden).

A Simple Calibrating Drum

AS I frequently wind my own coils, a means for very closely determining the characteristics for different gauges of wire in relation to various capacities of condensers, and different diameters of formers, is very acceptable, so I set about making some simple curves and a calibrating drum or former.

The former or drum constituted originally a Badminton shuttlecock container, and as such comprises simply two end cardboard caps "A" fitted freely, but tightly, over a strong cardboard centre tube "t."

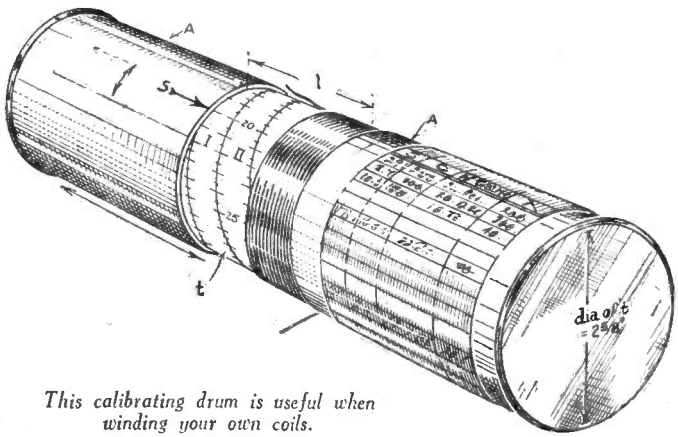
By calibrating in even section, this centre tube, as illustrated, and in spiral manner, any variation in the coil length "Z" is brought about accurately by sliding the end cap with the setting arrow "S" to the desired marking.

To readily ascertain the setting, whilst winding a coil, the spiral calibrations are numerated horizontally, viz.: I, II, III. So it will be seen that a very fine adjustment on the vernier principle is obtained.

A suitable paper chart of coil data can be permanently wrapped round the other end cap, which, by the way, is glued to the centre tube, a coat of colourless varnish protecting this when handling (after a full calibration has been made).

The diameter of the former illustrated is 2⅝in., as shown, but any other smaller tube combination could be made up, possibly out of ebonite or bakelite, giving an even greater degree of efficiency and durability.

The chart is just marked so that there are columns for "S" (setting), "C" (condenser capacity), wire gauge, and 2, resultant resonant wavelength or, preferably, "f" for equivalent frequency."—G. S. DUVANT (Exeter).



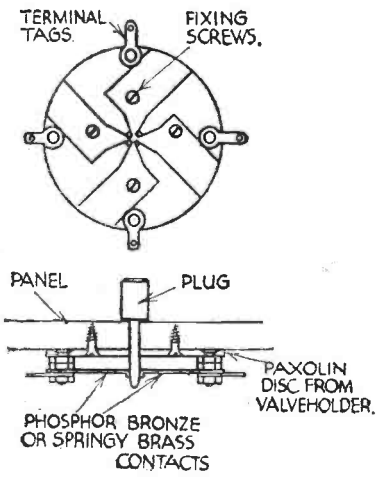
This calibrating drum is useful when winding your own coils.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Practical Hints." DO NOT enclose Queries with your hints.

SPECIAL NOTICE

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

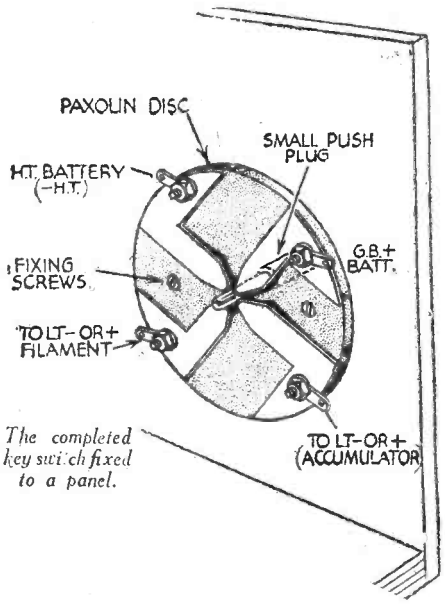


Details of the contact pieces for a simple key switch.

A Neat Key Switch

MOST key switches necessitate the boring of large holes in the front panel. I have worked out one which needs only a hole large enough to take the shank of a pin terminal.

The base consists of a paxolin disc from



The completed key switch fixed to a panel.

an old valveholder, and four pieces of springy brass for contacts (cut to shape as illustrated). Some odd nuts act as spacers to keep the contacts away from the base to allow resilience, the whole assembly being bolted together, incorporating small soldering tags for connections.

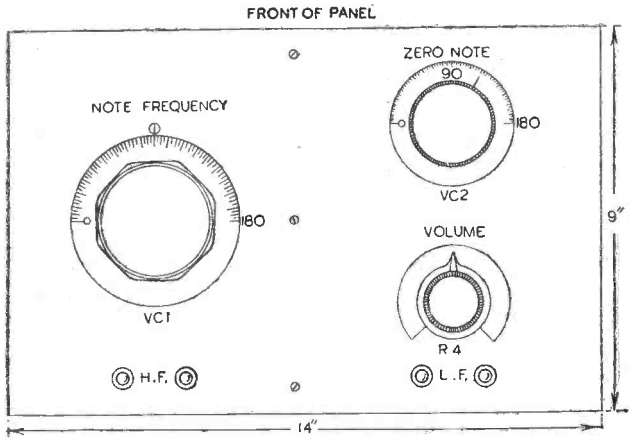
When this switch is in position, a pin terminal, when pushed home, contacts with each of the four strips of brass, thus completing the high- and low-tension circuits. On removal of the pin terminal the set is "dead."—P. THOMPSON (Harrow).

A 2-VALVE BEAT FREQUENCY OSCILLATOR

Constructional Details are Here Given of a Useful Unit for the Experimenter

THIS oscillator covers the entire low-frequency range, from a few cycles per second up to and past the highest audible frequency. Its construction is very simple, and in operation it is quite accurate and stable for all ordinary purposes. It is very useful for testing amplifiers and the low-frequency section of receivers; other uses will suggest themselves to the operator. It is quite portable, and is worked entirely from one nine-volt grid-bias battery.

There is a H.F. output for feeding into the aerial-earth sockets of a set, and a L.F. output for the pick-up sockets of a receiver or amplifier. Tuning is done by a slow-motion condenser fitted with a dial marked in degrees, and a second condenser enables the zero note to be obtained when the main one is at 0 degrees. A volume control is incorporated for attenuating the L.F. output only. An on/off switch can be also incorporated in the volume control to simplify the controls. The whole is contained in a wooden case (or metal if preferred).



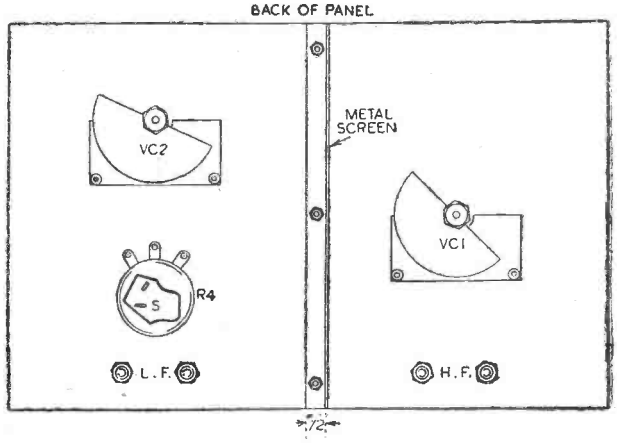


Fig. 1 (left).—Panel layout and dimensions, and Fig. 2 (right), rear view of the panel.

The Panel

The panel is a piece of aluminium 14in. long by 9in. wide, and this is drilled to take the main condenser on the left-hand side, and beneath this two holes are drilled to take two sockets for the H.F. output. On the right-hand side a hole is drilled for the vernier tuning condenser, and below this, one for the volume control-on/off switch, and also holes for the L.F. sockets. These are shown in Fig. 1. The sockets used in both cases must be of the type which are insulated by a bush from the panel. The condensers have their moving vanes earthed by direct contact with the panel, and the volume control must be of the type where the moving contact is not connected directly to the spindle. The panel is divided into two sections at the back by a piece of aluminium 8in. high by 6in. wide, and this has a half-inch flange to attach it to the panel, which is done by three nuts and bolts passed through both. This completes the panel, etc., but the fitting of the condensers should be left until the other component parts are first in place, as the condensers are liable to hamper this work.

Circuit Description

The circuit really employs two separate H.F. oscillators, as shown by the dotted line, and these will be referred to as oscillators 1 and 2. They are inter-connected so that they beat with one another to produce the L.F. note when applied to a set or amplifier. They are both tuned to the same frequency by the combination of fixed and variable condensers which are necessary for simple adjustments to the units. The circuit of each oscillator is similar, and employs a tuned grid with anode reaction which is very tightly coupled to produce a strong reaction effect even when the battery starts to run low. Both the H.F. and L.F. outputs are taken from oscillator 2, and the L.F. output is fed via the volume-control. The switch is in the common negative line, and all earth return leads are connected directly to the screen or panel.

The tuning of the coils is done by one fixed condenser and a pre-set type trimmer, and across these is connected the main tuning condenser. In the case of oscillator 1, a series condenser is also used with the main tuning condenser to reduce the combined capacity if required. The valves used are both Mullard PM1HL metallised.

The Coil

The coils consist of 160 turns, tapped at 80 turns, and are wound with 36 d.s.c. wire pile wound in a slot 1in. long, cut in a ribbed ebonite former 2¼in. diameter and 2in. long. The coils are held in place by a short piece of metal across the top of the former and through which is fixed a screw. This is shown in Fig. 4.

Construction and Layout

The layout of the components is not critical, and the wiring is done with insulated wire or wire covered with sleeving. The valves and coils are raised from the screen by a small wooden platform 6in. long, 2in. wide by 1in. high, and this is fixed in each case on opposite sides of the screen by screws as shown. As far as possible the components are fixed to something to prevent vibration which would vary the note, and in the model described

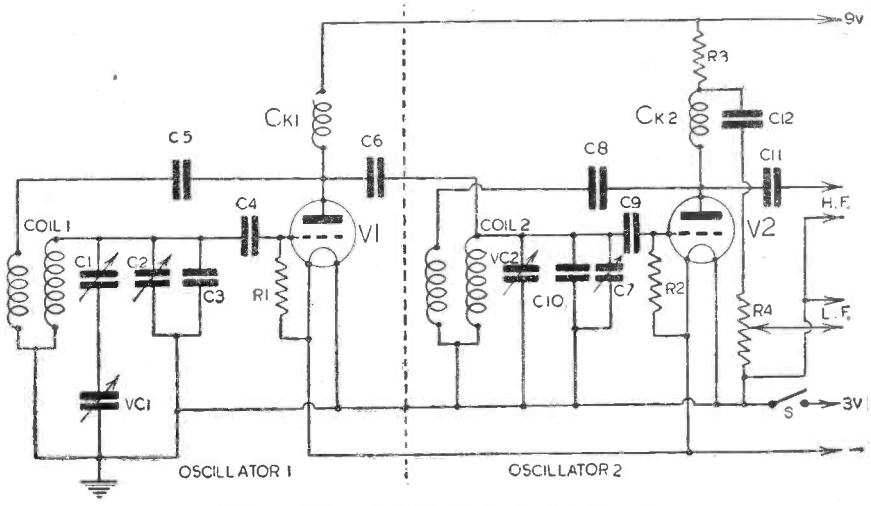


Fig. 3.—Theoretical circuit of the B.F.O. unit.

the various condensers (fixed and pre-set), resistances and chokes are grouped on the wooden platform along with the valve and coil. The chokes must be of the screened type, and they can, if necessary, be screwed directly to any part of the screen. The condensers marked C6 and C11 are merely 1in. of the insulated wire ends twisted to give the required capacity.

Wiring Up

The wiring, as already mentioned, is insulated, and when possible soldered joints are recommended, although terminal connections will do quite well. One end of the coil goes to grid condenser, centre-tap to earth (screen or panel), and other end to reaction condenser. The L.T. positive lead is taken directly from the valveholder of oscillator 2, and a wander plug connected to its end. The common negative lead comes from the switch on the volume control, and its end also terminates in a wander plug. The H.T. positive lead comes from the junction of choke 1 and resistance R3 and is fitted with a third wander plug. Only the high-potential or fixed vanes of the condensers are joined up, as the moving vanes are in direct connection with the common earth (the panel), and one of each pair of output sockets is similarly connected directly to the panel. Needless to remark, all leads should be as short as possible and kept away as far as possible from the screening or panel to prevent losses.

Battery Connections

The leads for the battery are connected as follows: common negative to negative 9 volts, L.T. positive to negative 6 volts, and H.T. positive to positive on the battery. This is connected in this manner because the battery is marked in "negative voltages" with respect to the positive end, and not as an ordinary H.T. battery would be marked: with positive voltages with respect to the common negative.

The Cabinet

The cabinet for the panel may consist either of a metal box or a wooden metal-lined or tin-foil lined box. Its inside measurements are 14in. long, 9in. high, and 6 to 7ins. deep. If made of wood and lined with tin-foil, make certain that any joints in the metal are electrically bonded by bridging them with connecting wires. There is also a lead attached to some convenient point on the metal which is also connected to the panel when this is being placed in position. Small wooden battens are used to attach the panel, which fits flush with the inside of the case. The purpose of the screening is to prevent direct radiation into a set, and also to keep out unwanted outside fields which might cause interference.

Adjusting

For the purpose of adjusting a receiver which is calibrated fairly accurately, the set is switched to the L.W. band and tuned to some point where a strong local station does not come in (to prevent interference with the oscillator when using with the receiver).

Connect the battery to the oscillator, but for the purpose of adjusting, the panel is not yet fitted into the case. Remove valve 1, switch on and connect leads from oscillator to set. Put volume control of oscillator at maximum. The oscillator tunes roughly to the L.W. band, and putting VC2 at 90 degrees (half in) adjust C7 until a maximum signal is received in the set. This is denoted by a loud rushing sound, and if the set is fitted with a tuning indicator this will deflect.

Replace valve 1 and remove valve 2, adjust VC1 to 0 degrees (all out) and again listen on the receiver, meanwhile adjusting C2 until a maximum is again received.

Replace valve 2 and a note should be obtained if either VC1 or VC2 are moved. Leave VC2 at 90 degrees and rotate VC1 to increase the note (the note increased in pitch as oscillator 1 is tuned further away from the point at which it was in tune with oscillator 2). See if the note gradually increases from a very low "pop-pop" noise to a very high whistle or "hiss." If the condenser is at 180 degrees (all in) before the top-note limit is reached, increase C1 until it is reached and just out of the audible range. If on the other hand the top-note frequency is passed and VC1 is only half in (at 90 degrees), it indicates that the capacity is too large and C1 will need reducing. The purpose of this adjustment is to spread out the entire frequency range over as much of the 180 degrees of the dial as possible.

Return VC1 to 0 degrees, and adjust C2 until zero note is obtained. These two adjustments are then repeated until a state is reached where the note is zero at 0 degrees and gradually increases as VC1 is increased until at about 160 degrees it just passes outside the audible range and cannot be heard. Remember that during this adjusting, VC2 *must be at* 90 degrees.

(To be continued)

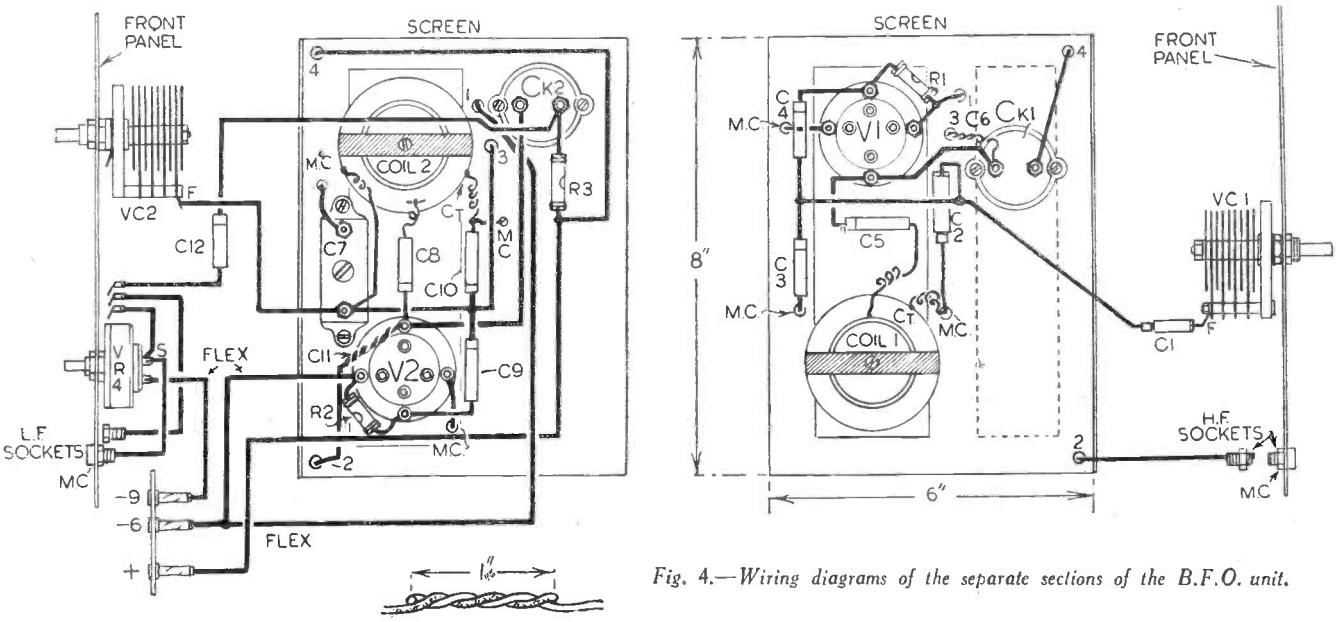


Fig. 4.—Wiring diagrams of the separate sections of the B.F.O. unit.

LIST OF COMPONENTS FOR THE TWO-VALVE BEAT-FREQUENCY OSCILLATOR

Condensers:

C1, pre-set type, .00001-.0002 mfd. Series condenser.
C2, pre-set type, .00001-.0003 mfd. Osc. 1 trimmer.
C3, fixed tubular, .0003 mfd. Osc. 1 tank tuner.
C4, fixed tubular, .0001 mfd. Osc. 1 grid condenser.
C5, fixed tubular, .0003 mfd. Osc. 1 reaction condenser.
C7, pre-set type, .00001-.0003 mfd. Osc. 2 trimmer.
C8, fixed tubular, .0003 mfd. Osc. 2 reaction condenser.
C9, fixed tubular, .0001 mfd. Osc. 2 grid condenser.
C10, fixed tubular, .0003 mfd. Osc. tank tuner.
C12, fixed tubular, .1 mfd. Osc. 2 L.F. coupling.
VC1, variable slow-motion tuning condenser, dial marked in degrees, .0005 mfd.
VC2, variable tuning condenser of small capacity, dial marked in degrees, .00025 mfd.

Resistances:

R1, 3 megohms. Osc. 1 grid leak.
R2, 3 megohms. Osc. 2 grid leak.
R3, 10,000 ohms. Osc. 1 coupling res.
R4, 50,000 ohms. Osc. 1 volume control and on off switch.
V1, Mullard PM1HL valve. Metallised.
V2, Mullard PM1HL valve. Metallised.
1 piece of sheet aluminium, thick gauge, 14in. by 9in.
1 piece of sheet aluminium, thick gauge, 8in. by 6in. with a ½in. flange.
Wire for connecting.
36 d.s.c. wire for winding the coils.
2 baseboard mounting valveholders.
1 9-volt grid-bias battery.
3 wander plugs and flex.
4 insulated type sockets with screened lead wire and plugs.
1 wooden case, 14in. by 9in. by 6-7in. and tinfoil for covering inside of same.
2 ebonite coil formers 2in. long by 2½in. diameter, ribbed.
Quantity of nuts and bolts, wood, and small metal strips.
2 H.F. screened chokes.

High-frequency Amplification

The Purpose of an H.F. Amplifier and of the Systems of Inter-valve Coupling

WHEREAS low-frequency stages amplify the low-frequency voltage which comprises the actual sound impulses, H.F. stages amplify the combined low- and high-frequency voltage in the form in which it strikes the receiving aerial. For present purposes it can be considered that the impulses "handled" by the H.F. valves are of high-frequency only since the low-frequency (or modulation component) is so completely and thoroughly mixed with the so-called carrier wave.

Extending the Range

The L.F. section of a receiver serves to increase the volume of reproduction by magnifying the low-frequency voltage, but the H.F. amplifier does not necessarily provide greater volume, but increases the range of the set. The reason for this is that the detector cannot operate at full efficiency unless the signal voltages fed to it exceed a certain minimum figure. Thus, if the input to the detector were below that minimum satisfactory reproduction could not be obtained however much low-frequency amplification were provided. It is for this reason that the high-frequency amplifier is so useful in extending the range of the receiver: it increases the strength of weak or distant signals to such an extent that they can allow the detector to function. Of course, it must offer a very high impedance to the signal, because if it did not signal currents would simply pass through it, through the high-tension supply and back to earth. In other words, they would be "lost" and would not be passed on to the second valve. The coupling must also provide another function—that of preventing the high-tension voltage from being applied to the grid of the following valve in the form of a very high bias voltage.

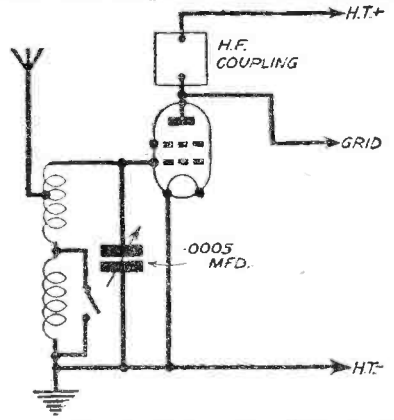
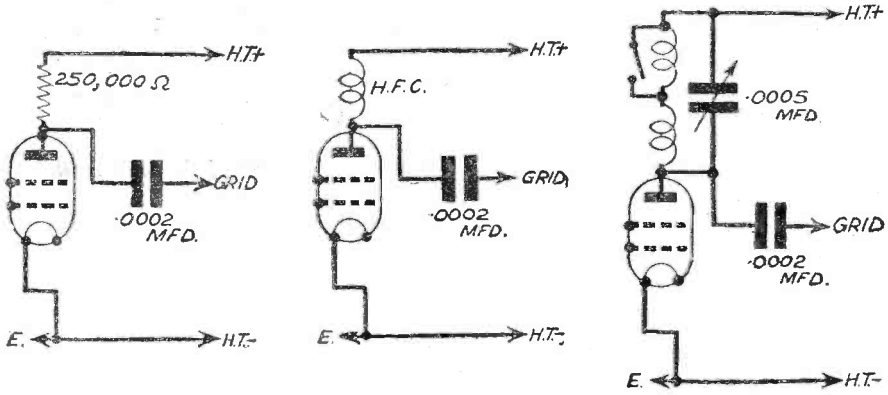


Fig. 1.—Circuit showing the H.F. coupling scheme.



Figs. 2, 3 and 4 (left to right).—Resistance-capacity, choke-capacity, and tuned-anode couplings.

in the case of signals which are above the minimum required by the detector and below the maximum "handling capacity" of the detector, H.F. amplification does provide a certain increase in signal strength. This is a point which is not always fully appreciated.

The Inter-valve Coupling

Let us consider the circuit arrangement of an H.F. amplifying valve, such as that shown in Fig. 1. It can be seen that a tuning circuit is connected between the aerial and earth, and that a lead from this is taken to the grid of the screen-grid valve shown. In the anode circuit of the valve is shown a simple rectangle, this representing the coupling between the first and second valves. Before dealing with the form which this coupling can take, let us consider its purpose. In the first place

Forms of Coupling

The coupling can comprise a fixed resistance, an H.F. choke or a tuned circuit, as well as a condenser and grid leak, as shown in Figs. 2, 3 and 4. It will be seen that all of these are very similar, but they produce differing effects. In the first place, the resistance causes a pronounced voltage drop, especially if it has a sufficiently high value to provide a barrier to the H.F. currents, and therefore it is impracticable. The choke is much better, because it provides the required impedance to H.F. currents, whilst offering a resistance of only 100 ohms or so to the direct, or high-tension current. But it is by no means perfect, due to the fact that its impedance varies according to the wavelength of the signal being received, and is at a maximum only at one particular wavelength or frequency. It is for this reason that so-called aperiodic or untuned coupling is not very efficient, although it can be used with moderate success, especially when it is not required to apply reaction.

A Tuned Circuit

The tuned circuit, shown in Fig. 4, is theoretically ideal, because its impedance is practically constant at all wavelengths to which it is tuned. Moreover, the impedance of a high-frequency circuit is almost infinity to the frequency to which it is tuned. This is the basis of most high-frequency coupling circuits, although the actual connections shown in Fig. 4 are modified in the practical arrangement. The most important alteration concerns the connections to the tuning condenser, which is joined between the anode of the valve and earth, instead of to H.T.+. By using these connections it is possible to employ a gang condenser of which all the moving vanes are earth connected. The alteration does not affect the behaviour of the tuned circuit in most cases because there is a complete circuit from the earth line through to the H.T.+ end of the tuned-anode coil by way of the high-tension supply. In many instances this circuit is made to have a still lower resistance due to the connection of a large-capacity fixed condenser between earth and H.T.+, as shown in Fig. 5.

Tuned Grid

A modification of the Fig. 5 circuit is shown in Fig. 6, where the choke coupling is combined with a tuning circuit joined between the grid of the following valve and earth. This arrangement is known as tuned-grid coupling, due to the fact that the tuning coil and condenser are actually in the grid circuit. The H.F. choke acts as a barrier to high-frequency currents, thus diverting them to the tuning circuit.

Theoretically, this method of coupling is not quite as efficient as the tuned-anode system, but it has the practical advantage of being more stable; that is, unwanted oscillation is not as readily provoked. In this case it must be observed that when the following valve is a leaky-grid detector, two fixed condensers are required: one between the anode of the H.F. valve and the end of the tuning coil,

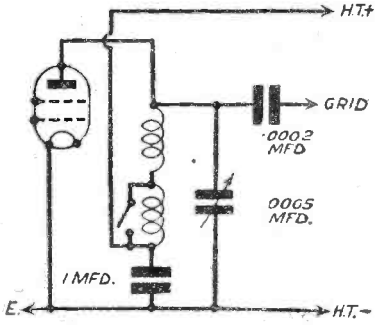


Fig. 5.—A practical modification of the tuned-anode circuit shown in Fig. 4.

HIGH-FREQUENCY AMPLIFICATION

(*Continued from opposite page*)

and another between the coil and the grid of the detector.

The High-frequency Transformer

Another modification of the basic circuit is shown in Fig. 7. Here the choke and tuning coil are replaced by a double-

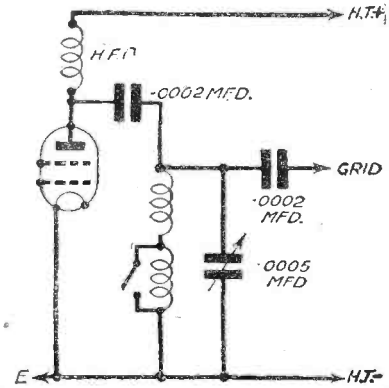


Fig. 6.—The popular tuned-grid circuit, which is a combination of the arrangements shown in Figs. 3 and 5.

wound coil, or high-frequency transformer. In many respects this behaves like the low-frequency transformer which was described last week, and the primary winding is included in the anode circuit of the valve. The secondary circuit is tuned by means of one section of the gang condenser and feeds into the grid of the following valve. It will be clear that by having a greater number of turns on the secondary than on the primary winding, a step-up effect should be produced. And since the secondary must be of such a size that it tunes to the wavelength of the signal being received, the number of turns is definitely regulated. Thus, the step-up effect must be secured by reducing the size of the primary. Because of this there is a limit to the degree of step-up which can be obtained, although by careful design a small extra degree of amplification can be obtained by using fewer turns on the primary than on the secondary winding. The difference in results which can be obtained in this manner is small, and there is little practical difference in efficiency between the amplification obtained when using tuned-grid, tuned-anode or tuned-transformer coupling.

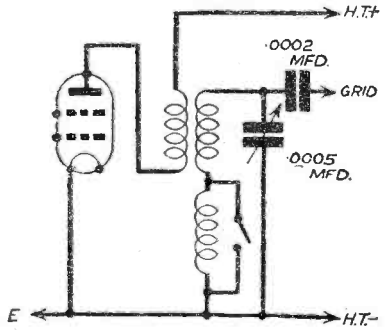


Fig. 7.—Tuned H.F. transformer coupling.

THE 30/- THREE

(*Continued from page 91.*)

The Coil

The coil is wound on a length of suitable former, that used by us being ordinary postal tubing with an over-all diameter of 2¼in. and a length of 3in. A disc of wood should be cut to fit tightly in one end of the tube, and on this wooden disc five valve-pins must be mounted to fit into the sockets provided on the baseboard. The exact measurements may be obtained from the

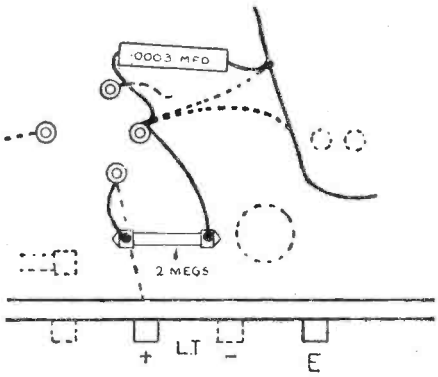


Fig. 3.—This diagram shows the modifications to the connections to the grid of the detector stage.

actual sockets in the receiver. The valve pins are supplied by Messrs. Electradix, and are attached to the wood by means of the nuts provided. The coil is wound with 26 S.W.G. enamelled wire and the full winding data is given on page 91. Make quite certain that the two windings are in the same direction, and that the ends are connected to the correct pins. A 9-volt grid bias battery and a 120-volt H.T. battery are needed in addition to the usual 2-volt accumulator, and the batteries should be connected to the rear terminal strip with ordinary flex and plugs in the usual manner, the terminals being suitably marked. G.B.–1 should be 1.5 volts and G.B.–2 4.5 volts, whilst the total 120 volts are employed for H.T. Connect the 'phones or a loudspeaker to the end pair of terminals and use a medium type of aerial. A large aerial will, of course, introduce selectivity difficulties unless a series aerial condenser is fitted, whilst a small aerial will probably provide insufficient pick up. For preliminary tests, whilst making certain that the coil is in order, it would probably be preferable to turn the right-hand control until it indicates 2, which means that the output valve is cut out of circuit. The tuning condenser should then be turned until the Home Service transmission is picked up (towards the top end of the scale). The reaction control should then be operated and it will be found that there is a gradual build up in strength until oscillation sets in. The control should not, of course, be used so far advanced that signals are distorted or that any substantial noise accompanies the signal, as in that case there is a risk of some interference being caused on receivers in the neighbourhood. Always keep the reaction down as much as possible consistent with good signal strength. When the right-hand switch is turned to indicate 3 all valves are in circuit and volume will be substantially increased. The H.T. and L.T. consumption will, of course, be correspondingly increased and, therefore, the extra valve will, as already mentioned, only be switched in as occasion demands.

Comment, Chat and Criticism

Give Your Own Concert!

A Pleasant Method of Passing Lonely Hours is Here Discussed by Our Music Critic, MAURICE REEVE

I EXPECT there are many people just now who are situated like I am, Micawber-wise, waiting for "something to turn up." Or waiting for something to drop down, whichever way you may prefer to look at it. As I sit in my warden's post, alone with my thoughts, I naturally, even involuntarily, let them roam over a wide expanse of memory and conjecture. I used to do the same in the last war, and many was the time I did a quarter-guard on Salisbury Plain, or even nearer than that to shot and shell, and played through to myself a programme of my favourite music, or worked out a philosophy for righting all the ills of this troubled world once and for all. It is quite good fun, if you can do it, and it at least has the merit of making the time pass much more quickly than it otherwise would, which leads me to suggest what might be an ideal programme for keeping company with on such an occasion. Perhaps you might like to run through it with me. Imagine it is a Symphony Concert you have seen advertised, or perhaps, one of the much-lamented Proms to which you intended listening. You can go to it just the same, if you like, substituting your own choices for mine wherever you care. It is the sort of programme that does its best to make us forget all about little Adolf and Butch Hermann, and which I hope I shall hear in reality before very long.

Overture

Firstly, an overture. An overture is symphonic in character at the same time as it is a concert piece in the programme. There are some glorious works in this category, which are particularly suitable for those to whom a symphony is a little too much to bite and chew. Out of a hundred wonderful examples, I select Mozart's "Magic Flute"—the pure milk of music as it is also of human wisdom. Played under a master's baton, this incomparable work cannot fail to start off any programme with just that zipp that means so much to an evening's music.

An Aria

Secondly, an aria. Here there is an enormous range to choose from. Shall it be for male or female voice? And which voice? Well, I suppose the vast majority would plump for a soprano (and by that I don't necessarily mean a plump soprano), in spite of much magnificent music written for the voice. A Mozart aria? Don't say you have already picked a Mozart overture. I cannot help whether I have or not—we will change it if necessary. For I *must* have "Voi che sapete." And, if sung to perfection, I'll encore it six times. I could reconcile myself to any duty anywhere if I can have that divine thing ringing in my ears.

Concerto

A concerto? Most certainly. Concertos are unique works—symphonies for solo instruments, and, together with the art of a great soloist, it is not to be wondered at that they exercise an irresistible attraction. For two pins I would choose Mozart's in A for piano, and I expect I shall have "heard" it before the evening is over. But I won't put it down on the programme. I am choosing Beethoven's in G. This one *must* have been written for just such an occasion as this, where poetic feeling and brilliant writing would seem to be the qualities most needed. Beethoven's fourth piano concerto has these qualities in superabundance—the sweetest melodies, brilliant orchestration, dazzling virtuosity for the solo instrument, a variety of harmonic invention, and, with it all and permeating the gaiety and *joie de vivre* which is the work's chief characteristic, runs a note of wistful tenderness that culminates in one of the most perfect and peerless slow movements ever penned. In the concert hall, I think I would prefer the fifth, the mighty Emperor; but here, all on my own, to play to myself, I choose the fourth.

To conclude part one of my symphony concert I choose what is variously known as a piece. By that I mean something not in symphonic form nor in any way connected with it. There are many beautiful examples to choose from, like Debussy's "L'après-midi d'un faune," or Wagner's "Siegfried Idyll." But I choose a work born of the soil of England, needless to say from the pen of an Englishman, a work in the direct line of succession, and, in short, a work great alike in conception and execution—Elgar's Enigma Variations. I cannot help loving this great masterpiece more and more each time I hear it. I feel that the soul of the man who wrote it must have been so noble and his mind so lofty. Dorabella, Nimrod and all of them. A mighty work by a great musician.

Symphony

Part 2 of my concert is going to consist of the Eroica symphony. Why? Why not the fifth or the seventh? Why not one by someone else? Well, here is the reason. There are times when even the most flippant of us cannot help thinking of the mystery of life and of things in general, the why and the wherefore, fate, destiny, whatever title you like to call it by. Such moments are as likely to come during "the silent watches of the night" as at any other, and such works as the Eroica and the Jupiter symphonies contain the solution of those mysteries—at least, that is they do to those of us who can translate the abstract code of music to the realities of life. They are life, the whole universe, the very stuff and essence of existence. Man's very soul is wrapped in the funeral march of the Eroica symphony and his liberation from the chains of earthly existence is in the finale. His fears, hopes and realisations are all in this wonderful music, and to ponder over it when one is cut off from most, if not all human contacts, with the stars for company, is a fine experience.

That is how I like to spend the hours when I am compelled to isolate myself on some duty or watch. Some may like to pass such time playing a thrilling game of cricket or football, others in living through the theme of a great play or book. All of us recount our own experiences during part, at any rate, of such time. But I can highly recommend "going to a concert." You can draw up your own programme, it costs you nothing, and, long before it is over, you have relieved yourself of much of the boredom and tension of what can very easily become an insupportable period of time.

Mechanical Film Scanning

IN many quarters it is still felt that a televised talking film picture which is scanned by mechanical methods is superior to any which can be derived through the medium of electron cameras in any form. Any demonstrations which have been undertaken either in this country or on the Continent appear to substantiate this claim and at the recent television Technical Convention the issue was raised once more by those taking part in the discussion. It is emphasised that the detail of the picture produced by an apertured disc scanner is sharp and clear, but above all the annoying flare effects associated with the standard forms of storage tubes during sudden light changes in film frames is completely absent. If it is assumed, however, that for direct studio or outside transmissions the electron camera has very much in its favour due, in particular, to mobility, then any attempt to combine a mechanical film scanner with an electron camera to work off the same synchronising chain at a transmitting station, is fraught with considerable difficulty. That these could be overcome by careful research is certain, however, but even so the alternative suggestion of using a form of image dissector tube for televising films is one which is favoured. On the Continent, however, continued research is being applied to mechanical scanners, and the results achieved so far have justified the confidence of the protagonists of this apparatus. One of the very latest forms of this equipment to be developed is built in twin form so as to enable an instantaneous change-over from one length of film to another. In the centre of the scanner is the main apertured disc for giving an interlace scanned picture, while flanking this on either side is the complete film outfit of double spool chambers, lenses, film gate, synchronising pulse generators, photo-electric cells, etc. The common amplifier racks are arranged on the side of the apparatus and built up in this way the complete film unit is compact and efficient and provides concrete evidence of the ability of mechanical designers to produce apparatus justifying the confidence of those engineers who still believe in mechanical television at the transmitting end.

Open to Discussion

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

A Liverpool Reader's Den : S.W.L.'s Welcome

SIR,—As a regular reader of your very helpful paper, I enclose herewith a photograph of my den, which might be of interest to S.W.L.'s residing in Liverpool. It is a modest affair—but very comfortable. At the rear can be seen an old book-case containing my components, above which is the mains master switch/fuse board. A medium-wave battery set in the course of construction is on the table, and my S.G. and Pen. short-waver is visible protruding into the bottom right-hand corner of the photograph.

Actually my den is at 17, Lingfield Road, Liverpool, 14, and any S.W. listeners are welcome to pay me a visit. I shall be returning to Liverpool in about six weeks time.—W. G. ANDREWS, "Burdett," Castle Street, Montgomery.

"Home-Service" Broadcasting

SIR,—Upon reading T. H. Pettifer's experience, as related in PRACTICAL WIRELESS for September 23rd, I was filled with hope, as I had all the necessary "junk" to construct a set as described. Improved reception, however, did not result. I tried several old two-valve and one-valve circuits, also a crystal set—but still without success. It would be interesting to know your correspondent's circuit, as there must be quite a number of constructors who, like myself, are willing to try anything to get decent reception.—J. S. SMITH (Ketton, Lincs).

A Stand-by Three

SIR,—I have been a regular reader of PRACTICAL WIRELESS since No. 2, and during that time I have constructed many of the fine receivers published in your journal. One was the Super Fury Four. On looking through my PRACTICAL WIRELESS for September 23rd, page 27, I saw the "Home Service" Two using the B.T.S. 6-pin plug-in coil. I would be pleased if you could design a receiver of the S.G. Det., Super Power output type, using the above coils. My junk-box is full of good parts, including one pair of long and medium-wave B.T.S. coils, as mentioned above. I am sure such a receiver would make a good stand-by set.—C. GIBBONS (Chester).

Exchanging S.W.L. Cards

SIR,—In order to keep up the "Home Spirit" in the present situation, I will be glad to exchange S.W.L. cards with anyone interested in radio anywhere in the world. All cards will be acknowledged by my own card.—G. V. HAYLOCK, 28, Longlands Road, Sidcup, Kent.

SIR,—I would be very glad to exchange my S.W.L. card with any S.W.L., A.A., or Full Ticket "hams." All cards will be replied to by return post. I would also like to know if it is still possible to report on the reception of short-wave stations in war-time?—J. ARTER, 32, Brabazon Street, Poplar, E.14.

SIR,—If any readers of PRACTICAL WIRELESS would care to exchange QSL's with Jack Wells, of Phenix City, U.S.A., and/or myself, we would be very pleased to oblige at the QRA below.—JOHN R. TYZACK, 197, S. Eldon Street, South Shields, Co. Durham.

A corner of Mr. W. G. Andrews' den.

Prize Problems

PROBLEM No. 369

MATTHEWS had an A.C./D.C. receiver which suddenly ceased to function. He could not hear even the slightest hum from the speaker, and accordingly suspected a break in the H.T. supply. Deciding that the best plan would be first to test the valves, he removed these one at a time for test purposes. When he took hold of the output valve he found that this was cold. What did this indicate? Three books will be awarded for the first three correct solutions opened. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 369 in the top left-hand corner, and must be posted to reach this office not later than the first post on Monday, October 16th, 1939.

Solution to Problem No. 368

The accumulator which Jackson was using had been in constant use for a considerable period, and the acid was in need of replacement. The cell did not hold its charge and had he tested it with the valves in circuit, which is the proper method of making the test, he would have found that the voltage was low.

The following three readers successfully solved Problem No. 367, and books have accordingly been forwarded to them: G. Greenwood, 55, Hatheron Road, Hampton, Middlesex; M. S. Crothall, 4, Chart Road, Folkestone; A. G. Parks, 24, Ockendon Road, Canonbury, N.1.

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

SLOUGH AND DISTRICT SHORT-WAVE CLUB

Headquarters : Toc H Headquarters, William Street, Slough.

Secretary : K. A. Sly (G4MR), 16, Buckland Avenue, Slough.

Meetings : Alternate Thursdays at 7.30 p.m.

AT the last meeting held on September 28th, it was decided that the club should continue its activities at its present headquarters.

Mr. Maynard gave a report to date on progress made with the correlation of data supplied by members of the research group, and announced that the paucity of results had made the correlation difficult, though results were promising.

The Morse practice was divided into groups as usual, the one for the slow section, and the other for the faster section.

At the next meeting to be held on October 12th, there will be a further talk on Measuring Equipment, and a talk on Receiver Construction. There will also be a junk sale in addition to the usual features.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

European and Colonial Representative : Arthur E. Bear, 100, Adams Gardens Estate, London, S.E.16.

SUBSCRIPTIONS to the above club cannot be accepted until further notice. Members will continue to receive " International Short-Wave Radio " direct from America.

The London Chapter has suspended activities until the end of the war, owing to the black-out conditions, and to the majority of its members having joined radio units in the Services. The Post Office has taken charge of the experimental transmitter 2CLR. The club is still carrying on certain work, such as short-wave propagation. Those members who wish to maintain contact are requested to call at the above address, where they will be welcome.

SIDCUP AND DISTRICT RADIO SOCIETY

Headquarters : Messrs. Kolster Brandes Canteen, Footscray, Kent.

Secretary : G. V. Haylock, 28, Longlands Road, Sidcup, Kent.

OWING to the present situation and the calling up of some of our members, the society has closed down for the present.

EASTBOURNE AND DISTRICT RADIO SOCIETY

Hon. Secretary : T. G. R. Dowsett, 48, Grove Road, Eastbourne, Sussex.

AT the meeting held last Tuesday Mr. R. Bridgeland (2FYP) gave a demonstration of some of his apparatus.

Two small two-valve receivers were shown, and a small battery high tension and low tension unit. A small aerial about 25ft. long at about 20ft. high was slung up in the meeting room and fine results were obtained both on the short-wave and medium-wave receivers working on a low H.T. of 45 volts.

IMPORTANT NOTICE

Owing to the restriction of paper supplies in war-time, readers may find it impossible to get " Practical Wireless " each week unless they give their newsagent a regular order for their favourite paper now.

Wastage of surplus copies in the shops must be avoided, and readers can be of the very greatest help if they will fill up the Order Form given on page iii of Cover and deliver it to their usual newsagent or bookstall. An order of this sort ensures regular delivery during war-time, and the Editor asks every reader to help in this way.

PLEASE ORDER " PRACTICAL WIRELESS " NOW AND USE THE ORDER FORM ON PAGE iii OF COVER.

PRACTICAL TELEVISION

October 14th, 1939. Vol. 4. No. 172.

A Qualitative Term

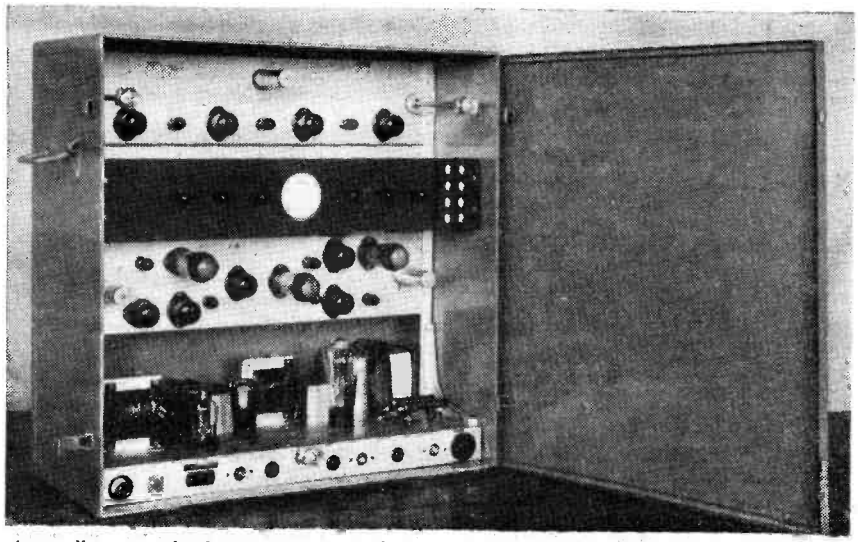
WHENEVER we are brought into contact with either a verbal or written discussion on the merits of a television picture, it is invariably found that the word quality is used. The same thing applies with a picture made by the standard photographic processes, but as soon as any attempt is made to define the word in rather rigid terms many difficulties arise, for the simple reason that it is used in so many different senses. From the television angle we find the term applied to the composition of the scene whether an indoor or an outdoor view is being transmitted; others use the expression in relation to the form of studio lighting for the subject, but the majority try and impart a degree of efficiency in relation to the actual reconstitution of the picture as built up on the cathode-ray tube screen, and take in such terms as detail, brightness, contrast, linearity, etc., so that the term becomes one in its very broadest sense. This practice is one which is deplored by all those who rely so much on quantitative factors as distinct from qualitative, and there is no disguising the fact that there is room for the more general use of defined terms which can brook no misunderstanding when applied to television, especially in so far as the appearance of the received picture is concerned. Standard terms are now used for the main and sub-controls on a television receiving set, and this in conjunction with the B.S.I. glossary has been a substantial contribution, but there is still that atmosphere of indefinitiveness which must be removed if the art is to be assisted, and come more into line with other branches of science. No doubt the average individual has in mind the fidelity of the picture when compared with the original when the term quality is used, but here again difficulty is experienced, for such items as perspective and colour have to be deleted from any mental picture of the original when comparing it with the reproduction.

Photography and Television

IT is not always appreciated that the many and diverse problems involved in the reproduction of the present day television image are very similar in many respects to those of reproduction in a photographic image, although in the case of the former the number of steps involved in the complete process is considerably greater. This similarity in certain sections has enabled those with any photographic experience to understand better what is involved in the make-up of a television picture when it is reproduced on the end of a cathode-ray tube, and such expressions as contrast, gamma, tone values, brightness, etc., are understood better. The term gamma is used quite freely in the television world, but many do not fully appreciate its significance. The conception of gamma and range as applied to television is roughly equivalent to the term as used ordinarily in photography. That is to say, if gamma is unity, then this is the same as saying that the contrast of the picture is identical to that of the original picture, while if below this figure then the resultant picture takes on a somewhat flatter appearance. In the cinema world it is quite common practice to use films having a gamma in excess of unity in order to compensate for certain losses, particularly in the realm of colour. It should be appreciated that in order for a reproduced television picture to have the correct contrast, tone values and gradation it is essential for the whole of the television system to be under control. In this case, however, one is faced with the question of individual tastes in just the same way as for high fidelity sound transmissions. Strictly speaking, if the broadcast transmission of sound is almost perfect then the receiver should be adjusted by the manufacturer before it leaves the works so that the fidelity of the sound can be given full rein. To satisfy the aural needs of those whose ears do not fully appreciate this pander to fidelity, a tone control is provided in the receiver, and it is surprising how many advance this to mellow in order to enjoy the sound in the average home. In many technical quarters the engineering authorities would like to see a limit placed on the control a viewer can exercise over his received picture, and uniformity in the quality of the results would then be achieved. Bearing in mind the human element, however, and knowing that a "soot and whitewash" picture appeals to some in preference to tonal values more in keeping with those of the original scene, a compromise is effected. With the full knowledge of differing home conditions, the viewer has at the input to his television set a high quality signal, and if he mutilates this by the incorrect adjustment of his receiver controls, then the set owner is the sufferer, and only by a gradual process of education will he fully appreciate the significance of gamma, contrast, gradation and tone.

Compact Equipment

ONE of the main difficulties associated with demonstrations of television on a local line circuit in situations outside the range of any radio signals was the bulky nature of all the equipment which used to be essential if really satisfactory results were to accrue. Within the last year or two, however, quite a new order of things has developed. For example, one has only to refer to the B.B.C.'s mobile television unit to realise how compact a space is required for cameras, amplifiers, control apparatus, etc., associated with the camera. This demand for mobility, and small amplifiers, has even been carried a stage further by those firms who desire to give demonstrations in far-lying districts, and the ingenuity of engineers has produced most satisfactory results both in this country and abroad with the equipment housed in easily manageable units. As an example of what can be accomplished reference can be made to the accompanying illustration, which shows a striking example of a first-class television amplifier built completely into a metal screening cabinet with side handles for manual transport.



An excellent example of the compact portable form taken by modern television amplifier equipment.

Multiple Power Pack

IN the base is the multiple power pack furnishing over a dozen valves with their correct currents and voltages. Above this is the double amplifier panel complete with the essential adjusting controls and cathode-ray tube oscillograph, so that the television signal waveform can be checked and made to fulfil local requirements. One or two units of this type together with the appropriate camera or cameras are all that is necessary to give a large scale television demonstration, and there is no doubt that further work on these lines will take place in the laboratories as a means of checking results, as soon as television's provincial development can once more follow on anticipated lines.

LATEST PATENT NEWS

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume or in bound volumes, price 2s. each.

Abstracts Published.

WIRELESS RECEIVING-APPARATUS.—Standard Telephones and Cables, Ltd., Leno, J. A., and Edwards, J. C. No. 507604.

To enable a condenser readily to be combined with a coil to form an interference suppressor, it has a cylindrical casing 1 (Fig. 1), the sides of which are cut away from the top to form two shelves as at 3 so that securing means 5 passing through the shelves may lie within the general cylindrical form and thus enable the condenser to fit snugly within the former of the coil.

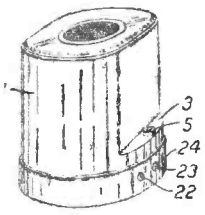


Fig. 1.

VALVE CIRCUITS; TELEVISION RECEIVERS.—Baird Television, Ltd., and Truefitt, E. V. No. 508038.

A circuit for obtaining picture and synchronising impulses of the same polarity from a signal in which they are of opposite polarity comprises a valve having a cathode 1 (Fig. 2), a control grid 2 to which the signals are applied, a screen grid 3, an anode 4, and a secondary-emitting electrode 5, the circuits of electrodes 4, 5 containing impedances 20, 19 from which signals of opposite polarity with respect to the input are taken at terminals 17, 21.

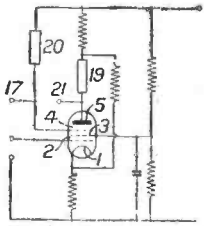


Fig. 2.

TELEVISION.—Baird Television, Ltd., and Baird, J. L. No. 508039.

A series of coloured filter 3, 4 (Fig. 3) move in front of a cathode-ray tube 1, the screen of which is scanned in a plurality of interlaced traversals with the lines of each traversal contiguous. The filters move in the direction 6 of the lower frequency component of scanning. Specification 473,323 is referred to.

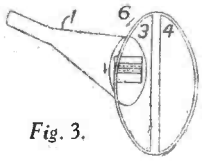


Fig. 3.

NEW PATENTS

These 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. The Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- weekly (annual subscription, £2 10s.).

Latest Patent Applications.

25620.—Harries, J. H. O.—Electron beam valves. Sept. 12th.

25621.—Harries, J. H. O.—Production and control of electron streams. Sept. 12th.

25622.—Harries, J. H. O.—Utilization of electronic streams. Sept. 12th.

25623.—Harries, J. H. O.—Thermionic valves and circuits. Sept. 12th.

25375.—Kramolin, L. L. de—Wireless receiving-sets. Sept. 7th.

25379.—Metcalfe, C.—Radio receivers. Sept. 8th.

25282.—Philco Radio and Television Corporation of Great Britain, Ltd., and Laws, C. A.—Radio-receiving apparatus. Sept. 7th.

Specifications Published.

512327.—Baird Television, Ltd., and Terry, P.E.A.R.—Thermionic valve circuits.

512,253.—Marconi's Wireless Telegraph Co., Ltd., Ramsay, J. F., and Oliver, A. L.—Superheterodyne receivers.

512348.—Cole, Ltd., E. K., and Brooke, H. A.—Tuning of radio-receivers.

512268.—M-O Valve Co., Ltd., and Warren, G. W.—Thermionic valves.

512173.—Mullard Radio Valve Co., Ltd., and Eaglesfield, C. C.—Thermionic-valve circuits.

512085.—Soc. Anon Fimi.—Remote-control of radio-receivers.

512284.—Soc. Anon. Fimi.—Superheterodyne receivers.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

Notes from the Test Bench

Simple Time Switch

AS many listeners are now making a point of listening to the special News Bulletins and are not interested in the programmes which are being given, some type of time switch might prove of value to ensure that the opening news item is not missed. Usually the fresh news is given at the commencement, and therefore if the set is not switched on in time only that news which has been previously given may be heard. We have published numerous wrinkles covering time switches, but the simplest type of switch provided by an alarm clock, where two bare wires are attached to the alarm winding handle, is probably the most useful. When the alarm is released the handle turns and the two leads are thus short-circuited.

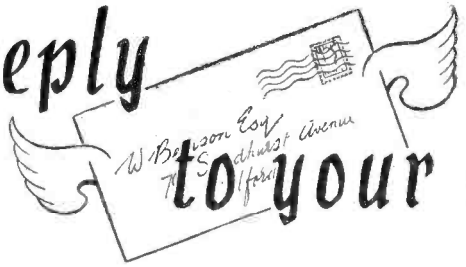
Cleaning Wires

WHEN soldering many of the finer gauges of wire difficulty may be experienced due to rapid oxidation of the wire, and thus although good flux may be used it may be found that the wires will be burnt away before the solder becomes attached. Chemical cleaners should not be used to clean fine wires, and one of the most satisfactory plans is to rub the wire very carefully between a sheet of very fine glass-paper doubled. Emery is probably too coarse and will take away too much of the wire, whereas the finer grades of glass-paper will only remove the enamel covering and will be unlikely to remove any of the actual wire. The iron must be really hot and a drop of solder should be supported on the iron, and the tip of the wire, after dipping in the flux, should be plunged into the molten drop of solder and withdrawn fairly quickly.

Transformer Interaction

WHEN hum is experienced in a mains set it may be found that moving about the mains transformer, L.F. transformer and smoothing choke will not be effective in removing the trouble, but in this connection it should be remembered that it may be necessary to turn one or more of these components on its side or even to mount it at some odd angle—balanced in one leg as it were—in order to ensure that the field does not interact with some other similar field.

In reply to your letter



Servicing Aid

"I am very interested in the articles on servicing which you have been publishing, but it appears to me that to be able to service a modern receiver in an efficient manner an alarming number of test instruments would be required. Is there no complete single unit which would be suitable for my purpose, as I wish to start taking up this branch of the radio trade? If there is such an instrument perhaps you could give me the name and address of the makers."—L. D. (N.W.5).

THERE does not appear to be a single instrument which incorporates all the necessary items for complete servicing, but there is one instrument which embodies quite a number. This is the Chanalyst, or similar item, a full description of which is given in this week's article on servicing. This enables the source of a fault to be accurately located in the minimum of time, but it may still be necessary to possess one or two subsidiary items. However, we suggest that you write to Messrs. Holliday and Hemmerdinger, of 74-78, Hardman Street, Manchester, for full details and prices of this particular instrument.

Radiator Interference

"I was troubled with an intermittent crackling on my set at various intervals, and in an endeavour to locate the trouble I made a large number of tests. Eventually I found that the trouble seemed to come from an ordinary electric radiator, but only when this was first switched on. The noise appears in the set for about three minutes after the fire has been switched on and then ceases. I fail to see, however, how this can cause trouble, as there are no moving parts in the fire and nothing which on the face of it can give trouble. Is it possible for you to help me to find exactly what is making the noise?"—A. S. P. (Birmingham).

ALTHOUGH in theory there is nothing in an ordinary electric fire which can cause trouble there are two possible sources of radiated electrical interference. In the first case a partially fractured element might arc when the fire is first switched on, and as the element heats up the expansion of the wires may close the fracture and thus the arcing would cease. On the other hand, the turns of the wire element may be touching and as the element warms up the turns may open, again giving rise to the small arcs which would cause crackles to be heard on a receiver in the locality.

1940 Air Hawk 9

"Could you tell me the name of any firm supplying the complete kit for the 1940 Air Hawk 9, and what is the price? Also could you supply winding details for coils for the medium-wave band or a suitable commercial set of coils?"—I. B. (Barnsley).

THE kit is obtainable from Messrs. Peto-Scott, and the price is approximately £18. With regard to medium-wave coils the standard Eddystone components could be used, but you would have to make the necessary oscillator coil or use a standard 4-pin coil and tap the secondary, ignoring the primary. The position of the tap is approximately quarter of the total turns, from the earth end. If you wind your own coil use 28 S.W.G. enamelled wire, using 138 turns of wire, tapped at the 34th turn.

A.R.P. One Coil

"I should like to make up the A.R.P. One-valver, and should be glad if you could let me know the address of the makers of the coil used in that receiver."—L. C. (Dawlish).

THE coil is made by Messrs. T. W. Thompson, of 176, Greenwich High Road, London, S.E.10. The price is 2s.

Anode and Decoupling Resistance

"I should like to try the varying effect of anode and decoupling resistances, and wonder if the following idea would be satisfactory. I thought of using a standard volume control with a total value of 100,000 ohms, taking the ends to anode and H.T. and the arm through the decoupling condenser to earth. In this way the total voltage drop would remain constant and I could use various anode loads with suitable decoupling. Is there any snag in this idea, as I have not seen it used by you in any of your circuits?"—B. S. H. (Reading).

THE idea is theoretically sound, but in practice you would find difficulty in obtaining a suitable anode load. Firstly, if you use a wire-wound component you might experience trouble due to the slight inductive value of the decoupling portion, or perhaps noise when it was adjusted due to the arm travelling over the adjacent turns of wire. The inductance of the component might also affect the anode load portion. If you used a non-inductive component this would no doubt be of the chemical or composition type, and may not carry the current which the valve is passing. If, however, you can see that the above points are attended to, then the idea is quite in order.

RULES

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

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

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

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

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

S.W. H.F. Choke

"Could you give me an idea what inductance I should need for a short-wave choke to use in a set designed to cover from about 5 to 70 or 80 metres? I thought a former about 1in. in diameter would be suitable as I have a paxolin former of that size available."—L. P. (Watford).

AN inductance of 170 to 180 μH would be satisfactory, and 100 turns of 26 or 28 enamelled wire close wound would give you a suitable inductance value. If you require a rather high degree of efficiency we would suggest that you split the winding into, say, five sections, each separated by about $\frac{1}{8}$in.

L.F. Interference

"I have a 7-valve superhet which, apart from the fact that it is rather old in design, gives me all that I want in the way of reception. There is just one point about which I should like some advice. At certain times there is considerable morse interference which no amount of tuning will cut out. This only occurs at odd times, but is very loud and cannot be tuned in any way. Could you offer a solution to this?"—E. R. (Harwich).

THE interference may be coming from a nearby source on a wavelength corresponding to the intermediate frequency of your receiver. This is known as I.F. interference and may be overcome by fitting an I.F. filter across the aerial-earth circuit. This filter may consist of a special choke or a commercially-made product designed for the purpose. It is, in effect, a rejection-type wave-trap tuned to the intermediate-frequency.

REPLIES IN BRIEF

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

D. G. W. (E. Barnet). As the coil is a commercial component, we regret that we are unable to give winding details.

J. H. D. D. (Frankwell). We regret that we are unable to assist you in your particular problem, which hardly comes under the heading of radio. In any case, we doubt whether you could make satisfactory springs on the lines mentioned unless you have good workshop facilities.

E. T. (Ramsgate). We regret that we have not published a full size blueprint for the receiver in question.

R. P. D. (Liphook). Full details of a receiver of the type you require will be found in last week's issue. If you require a more elaborate type of set, using a commercial coil, Blueprint PW. 93 would be of use to you.

D. H. (Shoreham-by-Sea). Blueprint PW. 35C would be suitable for the receiver mentioned by you.

V. R. (Coventry). The output terminals are on one side, one terminal being joined to the anode of the output valve and the other to the centre pin of the output valve—H.T. positive.

L. A. L. (Eastney). The process is a patented one and presumably "Kalen" is used.

P. L. (Bedale). No, the details were for 6 volts only.

H. F. (S.W.16). We have no circuit of the commercial set in question and you should therefore communicate with the makers.

L. D. (Norwich). The coil may be used by ignoring the long-wave winding and short-circuiting this to earth.

D. R. (Perth). Either of the valves could be used but the American one mentioned will take just 8 milliamps more H.T. current without giving any increase in volume.

W. Y. (Slough). The transformer is now useless and would have to be dismantled and rewound. You cannot repair the winding without taking it down.

C. D. E. (Cardiff). The extra speaker is totally different in type and must have a separate energising source. You cannot incorporate it in the receiver owing to the small current which would be insufficient to energise the magnet.

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

Practical Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS	Date of Issue.	No. of Blueprint.
CRYSTAL SETS.		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve : Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	—	PW36B
The Signet Two (D & LF)	24.9.38	PW76
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	12.6.37	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.8.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.5.38	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	23.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
All-Wave "Corona" 4 (HF, Pen D, LF, Pow)	9.10.37	PW79
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
All-World Ace (HF Pen, D, Pen)	28.8.37	PW80
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47
A.C. All-Wave Corona Four	6.11.37	PW81
SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-valve)	5.6.37	PW40
F. J. Camm's 2-valve Superhet	—	PW52
F. J. Camm's "Vitesse" All-Waver (5-valver)	27.2.37	PW75
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve)	—	PW43
D.C. £5 Superhet (Three-valve)	1.12.34	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. £4 Superhet 4	31.7.37	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four	16.1.37	PW73
Four-valve : Double-sided Blueprint, 1s. 6d.		
Push-Button 4, Battery Model / Push-Button 4, A.C. Mains Model	22.10.38	PW95
SHORT-WAVE SETS.		
One-valve : Blueprint, 1s.		
Simple S.W. One-valver	9.4.38	PW88
Two-valve : Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	30.7.38	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	7.8.37	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	1.10.38	PW68
PORTABLES.		
Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve : Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF, Pen)	19.3.38	PW86
MISCELLANEOUS.		
S.W. Converter-Adapter (1 valve)	—	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE	Date of Issue.	No. of Blueprint.
CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
E.B.C. Special One-valver	—	AW387
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
Class B Three (D, Trans, Class B)	—	AW386
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '35	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen)	*Mar.* '35	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*Apr.* '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340

These Blueprints are drawn full size.

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

Issues of Practical Wireless ... 4d. Post Paid
Amateur Wireless ... ... 4d. ,, ,,
Practical Mechanics ... 7d. ,, ,,
Wireless Magazine ... ... 1/3 ,, ,,

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

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

	Date of Issue.	No. of Blueprint.
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve : Blueprints, 1s. each.		
Home Lover's New All-electric Three (SG, D, Trans) A.C.	—	AW383
Mantovani A.C. Three (HF Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	*Jan.* '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen)	*July* '35	WM329
Harris' Jubilee Radiogram (HF, Pen, D, LF, P)	*May* '35	WM386
SUPERHETS.		
Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
'Varsity Four	*Oct.* '35	WM395
The Request All-Waver	*June* '36	WM407
1935 Super-Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
Heptode Super Three A.C.	*May* '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two H.F. Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS—Battery Operated.		
One-valve : Blueprints, 1s. each.		
S.W. One-valver for America	15.10.38	AW429
Rome Short-waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-short Battery Two (SG, det, Pen)	*Feb.* '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans. Super-regen)	30.6.34	AW438
The Carrier Short-waver (SG, D, P)	*July* '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World-beater (HF Pen, D, RC, Trans)	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valver Short-waver (SG, D, LF, P)	22.7.39	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-waver Super	*Nov.* '35	WM397
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	—	AW453
"W.M." Long-wave Converter	—	WM380
Three-valve : Blueprint, 1s.		
Enigrator (SG, D, Pen) A.C.	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans)	*Aug.* '35	WM391
MISCELLANEOUS.		
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B.L.D.L.C. Short-wave Converter (1/-)	*May* '36	WM405
Wilson Tone Master (1/-)	*June* '36	WM406
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SELF-CONTAINED A.V.C. UNIT — See Page 119

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Edited by F. J. CAMM

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Practical Wireless and PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

Oct. 21st, 1939.

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RADIO AND THE WAR

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★ PRACTICAL TELEVISION ★
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F. J. CAMM
Staff :
W. J. DELANEY, FRANK PRESTON,
H. J. BARTON CHAPPLE, BSc.

ROUND THE WORLD OF WIRELESS

Radio Economy

MANY interesting schemes have been put forward with a view to effecting economies in the running of domestic radio apparatus. In the case of the battery user there may be an increase in the cost of accumulator charging, and also a shortage of H.T. batteries. These may also increase in price as materials become scarce. Thus the battery user is vitally concerned with economy schemes. In the case of the mains user the rationing of the electricity supply may also result in a need of economising on radio rather than on other equipment. Unfortunately there is very little that can be done with this type of apparatus, but the battery user has a number of interesting schemes available. We have already published certain details and next week shall describe another economy receiver for the Home Service programmes. The use of Westectors in place of valves; of multi-electrode valves in place of two or more standard valves; and the eliminating of certain stages are other features which may be considered and details of these will be given from time to time.

American Broadcast Ban

THE American authorities have decided to ban the selling of space on the air for controversial talks or discussions relating to the international situation. The well-known Radio Priest (Father Charles Cochran) has been hardest hit by this ban, as he was running a series of talks, mainly directed against the repeal of the Arms Embargo Act.

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Oldest Radio Troupers

AMERICAN station WLW claims to have not only the oldest pair of radio "troupers" in the United States, but probably the most hardy. They are Pa and Ma McCormick, who will celebrate their forty-eighth wedding anniversary this autumn. As members of the "Boone County Jamboree" touring unit, Pa and Ma have been appearing continuously at state and county fairs since mid-July, in travels that extended through Ohio, Indiana, Michigan, West Virginia, Kentucky and Illinois. They have performed at fairs and in theatres of forty cities and towns, sometimes putting on their act twice a day. They sing, play and do an old-fashioned schottische for their stage spot.

The veteran radio stars were first heard on WLW's "Top o' the Morning" programme thirteen years ago. Pa is sixty-seven years of age and Ma is sixty-five.

Frequency Modulation Station

THE equipment is now being built for the construction of a new broadcast station in Schenectady that will operate on the recently announced frequency modulation system developed by Major Edwin H. Armstrong. The transmitter will be located in the building now housing the G.E.C.'s television transmitter on top of the Helderberg Mountain, twelve miles from Schenectady. The G.E.C. have been conducting frequency modulation tests for some time on its 150-watt ultra-short-wave station W2XOY at Albany, and F.C.C. officials spent two days in Schenectady and Albany in the spring to witness a demonstration of the new system of radio broadcasting.

Television Development

ALTHOUGH television broadcasts have been suspended in this country, experiments are still being carried on in the laboratories of the various firms interested in this branch of radio. The practical side must, of course, be held in abeyance and there is thus a possibility that the developments in the U.S.A. may take television a step further than it had reached in this country—in spite of our early start.

Honours for Dr. De Forest

AT the end of September Dr. Lee De Forest was honoured by a Lee de Forest Day at the New York World's Fair, and at a later date he was the guest of honour at a reception at the Waldorf-Astoria, New York City.

P.A. in the Trenches

A NEW weapon of war is being tried out on the Western Front. This takes the form of public address equipment used by the Germans to relay extracts from Hitler's speech, given out in French for the "benefit" of the French soldiers. No doubt under suitable conditions this form of contact with opposing forces could be made really effective, although no details have been given concerning the power output which was employed. Presumably all gun-fire ceased during the announcements.

What started as a joke of fun-loving Sally Flowers, Dayton, Ohio, radio artist, has turned into a radio job. Sally heard the hoarse-voiced plea of Denny, rustic comedian with WLW's Drifting Pioneers, for some "handsome widder" to write to him. Sally sat down at her desk and penned a love letter de luxe to the love-smitten Denny, resulting in a new comedy spot on the "Boone County Jamboree," which is broadcast on Saturdays from W.L.W. at 9.30 p.m., E.S.T. So enthralled is Denny that he hangs around while Sally does the washing, lending all the moral support he can.

A 2-VALVE BEAT-FREQUENCY OSCILLATOR

Instructions for Calibrating the Useful Unit Described Last Week.

(Continued from page 99 of October 14th issue).

THE panel and battery are now placed in the cabinet and screwed down, and it will probably be found that the H.F. output into the set has altered slightly in frequency and that the zero note position has changed. This is due to the capacity effects of the metal shielding. In most cases the shift of frequency is not much, and if due allowance has been made to tune well away from a strong local station in the first instance no trouble will be experienced in this. The receiver will need re-tuning to the new oscillator frequency, and by adjusting VC2 it should be possible to obtain zero note when VC1 is at 0 degrees.

It will be found that any change in calibration can be corrected once VC1 is at 0 degrees, and zero note is obtained by adjusting VC2, this being the purpose of the latter control. Once this condition is obtained the calibration will hold constant.

Calibrating

This may be accomplished in either of two ways, and these will be described; the latter method, which is the easier, will appeal to the constructor with limited knowledge, and is quite accurate for most purposes.

1. Take out the panel from the cabinet and remove valve 1 (putting oscillator 1 out of operation). Screw up panel and find the fixed frequency of oscillator 2 when VC2 is at 90 degrees. If a signal generator is available these readings will be simplified.

Remove panel from the cabinet, fit valve 1, and remove valve 2. Screw up panel as before. Rotating VC1, take condenser readings against frequency on the receiver dial. If a signal generator is used the exact frequency can be determined by finding the "zero note" beat between the generator and beat-frequency oscillator. The curve for condenser readings against frequency when plotted will give the frequencies of oscillator 1 for any condenser reading in degrees. The difference between any frequency (corresponding to a particular condenser reading) and the fixed frequency of oscillator 2 (as already determined) will give the beat-note frequency. Suppose, for example, oscillator 2 is fixed tuned to 1,500 metres (200 kc/s) and the wavelength of oscillator 1 being received is 1,550 metres (193.5 kc/s). Then their difference in frequency is 200 – 193.5 kc/s equals 6.5 kc/s or 6.5 x 1,000 = 6,500 cycles. This would be a fairly high-pitched whistle. This, then, is the method employed to obtain the beat-note frequencies corresponding to the various positions of VC1. When the whole is then put back in the cabinet this calibration will remain fairly constant, once zero note is adjusted, as mentioned, with the aid of VC2.

Method 2. This is done with the help of a good piano tuner, and employs tuning forks to give certain notes on the dial, and the octaves (frequencies twice the fundamental) can be determined, and from these a curve can be plotted to give the various beat-note frequencies for various condenser readings in degrees.

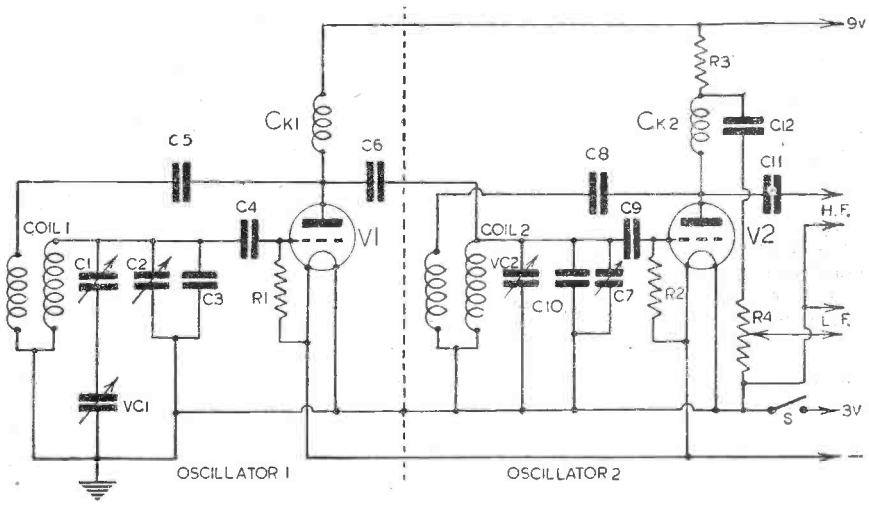
This system is a useful check on the former method in any case and is very simple to do. As previously pointed out, the calibration curve will remain constant once zero note is obtained with VC1 at 0 degrees, and this is done by adjusting VC2.

The curves in each case are practically straight line, and thus a few points are sufficient to plot.

Remarks

The note given is very pure, and will remain so until the battery commences to run down, which takes place in the instrument described when it goes below about 5-6 volts. As the current drain is small for short testing periods the battery lasts quite a long time.

The leads from the oscillator are one earthed screened lead from one socket, and the other goes to the earthed socket in the panel, and also to the set's earth terminal. The condensers (fixed) are small tubular type, and the resistances small wire end type soldered directly into the wiring or across points. The panel must be quite rigid, as any movement will cause the note to vary in pitch, and for this purpose thick gauge is recommended.



Theoretical circuit of the B.F.O. unit.

TELEVISION INTERFERENCE TESTS

WHEN the television programmes were radiated daily, the owner of a television set, whether home-constructed or a commercial product, was generally very loath to have it out of action at any period, as it would deprive the family of entertainment. The closing down of the Alexandra Palace service as a result of the present crisis, however, means that the set cannot be used for the time being, at least. This provides an admirable opportunity, therefore, for a very thorough investigation into any interference problems which were experienced during normal viewing periods. A very large percentage of this could be attributed to the type of aerial used, and also to its location in reference to possible interfering signals. If this was caused by the ignition systems of motor-cars, then very careful tests can now be undertaken to eliminate or reduce this so that when the service is renewed the results will show an improvement. The difference between a simple dipole and a dipole with reflector should be studied in reference to the strength of the interfering signal and, in the case of the latter, orientation should be undertaken, bearing in mind, of course, the direction of the transmitting station, for the dipole aerial should be between the reflector and Alexandra Palace. If roof facilities permit, the effect of moving the aerial from point to point should be studied, and every result carefully recorded for future use when the set can be put into commission once more. It has been found from experience that relatively small alterations in the aerial position will very materially reduce the degree of interfering signal experienced, and this can be judged quite easily on the set when switched on without any incoming television signal. Of course, care will have to be taken to ensure that the reduction of interference does not bring about a loss in television signal strength, and that is why a careful log chart should be kept so that any final repositioning may be checked as soon as the television service is resumed.

Radio and The War

How Radio Will Play its Part in the Conflict, at Home and Overseas

TO the majority of people radio is merely a source of entertainment and its many normal peace-time commercial applications seldom come into the vision of the ordinary man in the street. Apart from the fact that the majority of ships carry radio, and that this has been the means of saving life by sending out the well-known SOS signal, the many other applications are not often mentioned. Now that there is a war being waged, however, pictures published in the Press and communications given by the official news agencies often mention the use of radio, and it should be realised that this is now a vital arm of the modern war machine. In the Great War radio was more or less in its infancy. Certain types of aircraft were fitted with a transmitter and receiver, and were used to control artillery work by communication direct with a gun position. Certain branches of the land forces also made occasional use of the radio, but the equipment was not by any means efficient, and the short waves had not been explored. This meant that aerial difficulties were encountered and such details as secrecy and range could not be fully made use of. To-day, however, the commercial use of short and ultra-short waves has enabled the modern radio installation to be brought into a very high state of efficiency, and every branch of the Services makes use of it.

Short-wave Working

The greatest improvement is undoubtedly the use of the short waves, as this enables a reduction to be made in aerial installation and size, and at the same time directional working is possible. Furthermore, smaller installations are possible, as greater distances may be covered with smaller power, and the portable transceiver is thus an efficient piece of apparatus. Visitors to the Radio Exhibition recently had an opportunity of seeing an Army exhibit which typified a radio station such as is employed by them, with the portable generating station, direction-finding equipment and other associated apparatus. In the Boer War communication over long distances had to be carried out by means of the heliograph, a system which was often capable of being read by the enemy. Flag signalling, lamp signalling, and the use of the flap signaller were widely used for maintaining contact during the Great War, in addition, of course, to the normal land telephone. The use of these devices, however, was accompanied by serious risk of life, and at all times was subject to sudden curtailment. On the other hand, radio may be used without any attendant risk, as the equipment may be used in a bomb-proof shelter or below ground; communication may be reliably maintained over long distances, and by the use of suitable equipment secrecy may be maintained.

Portable Equipment

We have published in these pages from time to time illustrations of soldiers with small portable transceivers carried on their backs. These are battery-operated and work on the ultra-short or short waves, and the necessary aerial is fitted to the side of the containing case. It is only a few feet long and the entire installation is quite light in weight. With one of these units a company of soldiers may be kept in the closest touch with another unit and perfect co-ordination is possible. The use of telephony, of course, speeds up the work of communication and two-way working at the same time avoids all risk of mistakes being made due to a misunderstanding in the message. Co-operation between the various sections of the Army and between the land and air arm is also now more reliable, and the fast-moving motorised units can keep in touch the whole time—a fact which would be practically impossible if there were no radio now to offer a continued form of contact.

There is, of course, another aspect of radio in the war, not connected with the actual fighting forces. This is the maintenance of communication between countries engaged in the war and also between neutrals, and also the supply of information to the people at home. In previous wars the citizens have had to depend upon the newspapers for information regarding the progress of hostilities, and it was not possible for either side to convey information to others regarding certain phases of the war. To-day we are kept informed at very frequent intervals of the course of events, and in addition to this the radio has been pressed into use for the conveyance of important information. For instance, how could the great evacuation of the children have been carried out so efficiently if radio had not been in use? The addresses to the nation by various personages, from His Majesty the King downwards; the personal presentation of various aspects in a way that could not be conveyed by the written word, and various other features will occur to the reader. And finally, the contact between the listener and the actual War front, which it is now understood the B.B.C. will arrange. In the recent Spanish War the Americans often gave front-line broadcasts, and now the B.B.C. announces that its plans for covering the war on both the overseas and the home fronts can now be revealed. In a bomb-proof garage in France there is a B.B.C. recording car waiting for Richard Dimbleby, whom listeners will remember for his News Talks from North America on the occasion of Their Majesties' tour. He will shortly be crossing to France to record accounts of military activity and life behind the lines. The records will be flown back to England and subsequently broadcast in the News Bulletins. Air Force activity in France will be covered by C. J. T. Gardner, the B.B.C.'s air expert, who is also shortly leaving for the overseas front.

The war at home and on the seas will be covered by Bernard Stubbs, who will also have a recording car, and who will report on such matters as Army, Navy and Air Force activity at home, particularly naval activity at ports and dockyards, civil defence and supplementary services, and the hundred and one day to day activities of civilians and serving men and women. Thus radio plays its part in the war.

Motor-cycle combinations fitted with transmitting and receiving sets, being used during Belgian Army manœuvres.

HEADPHONE HINTS

Those with Defective Hearing will Find Some Useful Hints in this Article on the Use of Headphones with Standard Broadcast Receivers, whilst the Ordinary Listener will also Find it of Interest in Regard to Long-distance Reception

WE have had many requests recently for hints on using ordinary headphones in order that members of the family who are hard of hearing or partially deaf may be able to enjoy the broadcast programmes without the necessity of turning the volume-control to the maximum position and thereby causing annoyance to others on account of the very loud signal from the loudspeaker. It is not a difficult matter to arrange for weak headphone reception with the majority of receivers, but there are difficulties in the way of arranging for reception at maximum strength without introducing losses or distortion of the loudspeaker signal which is probably to be enjoyed by other listeners at the same time. Thus the problem of headphone reception falls into two separate classes: either it is required alone, or together with loudspeaker signals. Research has shown that listeners whose hearing is failing lose perception of the upper musical frequencies before the remaining tones and thus one of the first steps in providing for such listeners is to fit a good tone-controlling device—one which boosts the upper frequencies. Special L.F. transformers are available for this purpose, and in designing a circuit every care must be taken to avoid stray capacities between anodes and earth, as these will naturally result in loss of the higher frequencies.

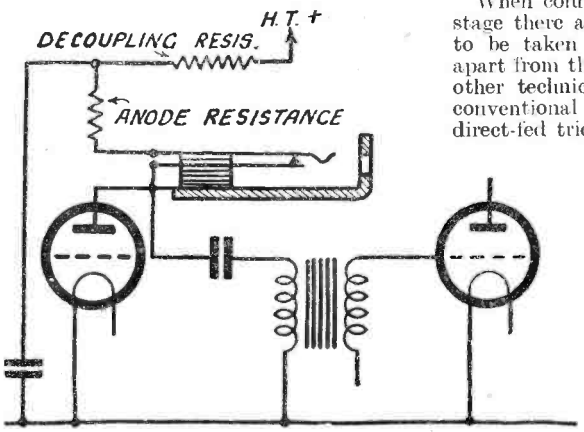


Fig. 1.—One method of using a jack to enable headphones to be used and a stage to be cut out.

Simple Tone-control

The simplest step in the direction of tone-control is to fit an uncompensated pentode output stage. This, together with a transformer which is well-designed and does not have a high-capacity primary winding, will provide, in most cases, ample high-note response when used with good headphones, as the latter will obviously provide a deficiency in the bass register and thus automatically provide a somewhat high-pitched signal which will be audible and entertaining to the listener in question. When the loss of hearing is not acute, or when an ordinary listener desires to preserve the intimacy of headphone reception whilst others are listening to loudspeaker signals, a pair of headphones may be connected in the early L.F. stages of a receiver as shown in Fig. 1. With this arrangement, unless there is a previous L.F. stage, tone-compensation cannot be carried out, and the first valve in this illustration will thus be the detector valve. No undue losses should be experienced owing to the headphone circuit, although it may be found that the reaction control will not be so smooth and regular as before.

The Output Stage

When connecting 'phones in the output stage there are some essential precautions to be taken in the interests of safety—apart from the preservation of quality and other technical points. There are three conventional output stages—(a) a simple direct-fed triode, (b) an output filter, and (c) a push-pull stage. In all of these circuits there is an element of danger when wearing or handling 'phones. Firstly, in circuit (a) the headphones are in direct connection with the high-tension supply, and thus, should a short-circuit develop across the headphones then there may be a serious shock if the 'phones are touched whilst the hands are damp, or when the body is in good contact with the earth. In the case of circuits (b) and (c) there is not a direct connection, but the condensers are "in the air" and this means that there is a risk of discharge through the condensers. Consequently there should be a transformer in the circuit in order to avoid this risk, and the ordinary 1/1 transformer is quite suitable for the purpose when normal high-resistance headphones are used. This may be joined in any of the circuits mentioned and as the 'phones will then be on the secondary side they are completely isolated, and the danger of shocks is thereby removed.

In circuit (b) or (c) the choke which is used may be the primary of a speaker transformer, thus permitting of loudspeaker reception at the same time. To silence the speaker in such a case a switch must be joined on the secondary side of the loudspeaker transformer, and this should not be found a difficult task. If, however, it is preferred to remove the speaker entirely, the standard iron-core choke may be employed and some form of switch must then be incorporated to avoid the trouble of changing speaker and 'phone connections by hand. The simplest and most effective arrangement is to employ plugs and jacks, and this scheme will also enable volume controls to be connected to the appropriate components. For instance, if loudspeaker reception is required at the same time as headphone reception, it will probably be essential that the volume applied to the headphones be reduced in intensity. This may be carried out by means of a potentiometer connected across the 'phone terminals, with the 'phones joined from the arm of the potentiometer to one side of the 'phone connection. If, on the other hand, the loss of hearing is excessive, and a large degree of L.F. amplification is employed in order to make the signal comfortable in the 'phones, the loudspeaker may be too loud for the remaining listeners, and thus a control across the speaker will be required. This, in the majority of cases, should be carried out on the secondary side.

Adapting Headphones

From the preceding remarks it will be seen that it is not a difficult task to make headphone reception available with any type of receiver, and there are many suitable makes of headphone available on the market. As, however, the principal sufferers from loss of hearing are the aged, it is usual that these listeners also find that the wearing of headphones becomes very uncomfortable after a short time. In such cases the headphones of the usual type may be modified to permit of hand operation, or the total weight may be reduced by removing one earpiece entirely. In the latter case the two leads which must be taken from the internal connection of the earpiece must be joined together, and wrapped with a short length of insulation tape. On the end of the head-band a small pad of soft material should be fitted to close the ear and prevent external sounds from distracting from the programme.

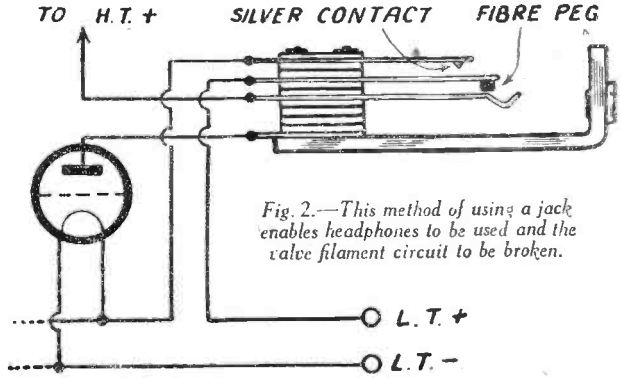


Fig. 2.—This method of using a jack enables headphones to be used and the valve filament circuit to be broken.

Automatic Frequency Correction

A Description of an Interesting Circuit Developed in America

NOW that the British radio industry is turning its attention to the design of push-button receivers employing automatic frequency correction it is interesting to examine the latest circuit from America developed by Garrard Mountjoy, an R.C.A. engineer.

In the diagram, which shows a superheterodyne receiver system of compact and efficient design, there is shown an antenna A feeding signals, which may be in the broadcast range of 500 to 1,500 kc/s, to the signal grid 10 of the converter valve 6. The latter may be of the 6A8 type. The numeral 1 denotes the tuning coil of the signal input circuit, one end of coil 1 being connected to signal grid 10 and the opposite end being connected to the junction of coil 2 and condenser 3. The antenna A is connected to ground through a condenser 1′ and coil 2′ which are in series resonance with the I.F.; the coil and condenser provide a trap for all undesired signals of the I.F. value. The coil 2 is connected to the high potential side of condenser 1′ through a path comprising coil 3′ and condenser 4′ The coil 2 is shunted by a condenser 4 which tunes it to a frequency equal to the highest image frequency of the signal range. The condenser 4′ is a direct current blocking condenser, while coil 3′ functions to choke image frequencies with respect to harmonics of the local oscillator frequency.

The condenser 3 couples the antenna network to coil 1. The numeral 5 designates, in a purely schematic manner, a gang of trimmer condensers of different values. The condensers are selectively connected across coil 1 to tune the circuit to a desired signal carrier frequency. For example, if desired, each trimmer condenser may have its associated push button for selective connection of the trimmer across the coil 1. Each trimmer, when selected, is connected between the grid end of coil 1 and ground.

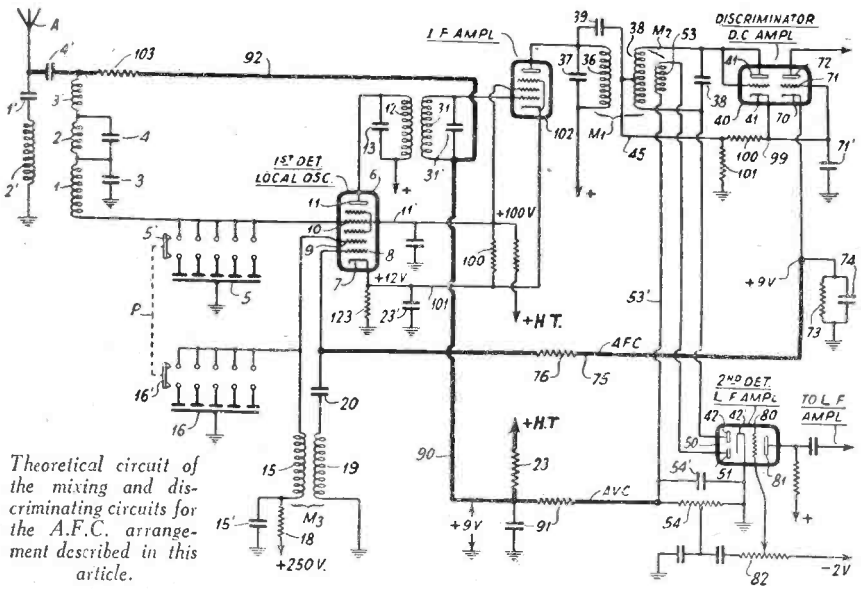
The valve 6 comprises the cathode 7, and the latter is connected to earth by a resistor 123 shunted by the 0.2 mfd. bypass condenser 23′. Between the plate 11 and cathode 7 there are disposed the oscillator grid electrode 8, the oscillator anode electrode 9′ and the signal input grid 10. The screen grids, which surround the signal grid 10, are connected by lead 11′ to the voltage reduction resistor 100; the low potential end of the latter is connected to the cathodes of tubes 6 and 102 by lead 101. The high potential end of resistor 100 is connected to a proper positive potential point on the direct-current voltage supply bleeder of the system.

The Oscillator Circuit

The oscillator tank circuit comprises the coil 15 and a selected one of the gang of trimmer condensers 16. Coil 15 is connected at one end thereof to electrode 9; the other end is connected to earth through a 0.05 mfd. condenser 15′. Each of the trimmer condensers 16 may be connected in shunt across coil 15; it is to be understood that the numerals 16-16′ designate a gang of selectively-operable trimmers similar to the gang 5-5′. The dotted line P denotes a common actuating mechanism for concurrently selecting trimmer condensers in the signal and tank circuits which will produce the desired I.F. of 460 kc/s. Positive potential is applied to electrode 9 from a point (250 volts) on the supply bleeder, the resistor 18 of about 20,000 ohms connecting coil 15 to such positive point.

The oscillator grid 8 is connected to earth through a path including condenser 20, of 10 mmfd., and coil 19. The latter is magnetically coupled, as at M_3, to tank coil 15. The signals and local oscillations produce I.F. energy in the resonant output circuit 13-12; the latter is tuned to the operating I.F. value. The electron stream of the valve is modulated by both the signal and oscillation frequencies; "electronic" coupling is employed to produce the I.F. energy. The coil 12 is coupled to coil 31 in the input circuit of I.F. amplifier tube 102 which may be of the 6K7 type. The input circuit is resonated to the operating I.F. value by condenser 31′.

The plate of amplifier 102 is connected to a source of positive potential through coil 36; the condenser 37 tunes the latter to the operating I.F. Coil 36 is magnetically coupled, as at M_1, to the coil 38 of the discriminator input circuit. Coil 38 has its midpoint connected to the plate side of coil 36 by condenser 39. Condenser 38′ resonates coil 38 to the I.F. value. The discriminator diodes are provided in two valves 40 and 50. Valve 40 is a double triode of the 6F8 type; valve 50 may be a double diode-triode of the 6Q7 type.



Theoretical circuit of the mixing and discriminating circuits for the A.F.C. arrangement described in this article.

Further Circuit Data

The grid and plate of one triode in valve 40 are strapped together, providing an anode 41 which co-operates with cathode 41′ to provide a diode. Cathode 41′ is connected to earth through resistors 100 and 101, each resistor having a value of about 1 megohm. The junction of resistors 100 and 101 is connected to the midpoint on coil 38 by lead 45. The anode 41 is connected to one side of input circuit 38-38′; the opposite side of the input circuit is connected to the anode 42 of valve 50. The cathode 42′ of the latter is earthed; hence, the resistors 100-101 are connected in series between the cathodes 41′ and 42′. Diode 42-42′ provides the second rectifier of the discriminator network.

The remaining triode of valve 40 comprises the cathode 70, control grid 71, and plate 72. The cathode 70 is connected to earth through resistor 73, the latter being by-passed by the 0.1 mfd. condenser 74. The grid 71 is connected to the cathode end of resistor 100, a 0.1 mfd. condenser 71′ by-passing the connection to earth. Plate 72 is connected to a desired positive potential point on the voltage supply bleeder. The resistor 73 is given a magnitude such that the cathode end thereof is approximately 9 volts above earth. The triode 70-71-72 provides a direct current voltage amplifier; the A.F.C. bias developed at point 99 of resistor 100 is amplified by the amplifier 70-71-72, and the variable potential across resistor 73 is applied to grid 8 of the converter valve 6 by lead 75. The latter includes a filter resistor 76, and comprises the A.F.C. connection to the oscillator section of the converter network.

The audio and A.V.C. voltages are developed by the diode 51-42′ of valve 50. The anode 51 is connected to the cathode

AUTOMATIC FREQUENCY CORRECTION

(*Continued from previous page*)

42′ through a path including link coupling coil 53, lead 53′, and resistor 54. The coil 53 is of many turns, and is magnetically coupled, as at M_2, to coil 38 at the midpoint thereof. The anode end of resistor 54 is connected to cathode 42′ by the I.F. bypass condenser 54′. The audio voltage across resistor 54 is impressed on the grid 80 of audio amplifier section 42′-80-81. The grid 80 is adjustably tapped, as at 82, to the load resistor 54; the usual audio potentiometer arrangement is employed in this connection. The amplified audio voltage may be transmitted to one, or more, audio amplifiers and a final reproducer.

The A.V.C. Voltage

The A.V.C. voltage is derived by connecting lead 90, including the pulsation-voltage filter 91, to the anode end of resistor 54. Lead 90 is connected to the low-potential end of coil 31; a second lead 92 connects lead 90 through resistor 103 to the junction of condenser 4′ and coil 3′. Hence, A.V.C. bias is applied to the signal grids of the converter tube 6 and I.F. amplifier 102. Resistor 23 connects lead 90 to H.T.+, and provides + 9 volts between lead 90 and earth. Both signal grids have a minimum negative bias established by potential difference between the cathodes and grids thereof. The minimum negative bias will be —3 volts; as the carrier amplitude increases, the negative bias will increase and reduce the gain of each of valves 6 and 102 so as to maintain the carrier amplitude substantially uniform at the detector-input circuit regardless of fading effects.

The theoretical basis for the production of the A.V.C. voltage across resistors 100-101 is explained in the following manner. The potentials at either end of coil 38, with respect to its midpoint, are 180 degrees out of phase. Hence, if the midpoint is connected to the high-potential side of coil 36, one potential is realised which maximises above the resonant frequency of the I.F. value, and a second potential is realised which maximises below this value. If these two potentials are applied to a pair of rectifiers, such as the diodes 41-42′ and 42-42′, and the resulting direct current voltages are added in opposition, the sum will be equal to zero. In the type of discriminator network shown in the drawing the primary and secondary coils 36 and 38 are so connected that two vector sum potentials of the primary and secondary voltages may be realised. When the I.F. energy departs in frequency value from the assigned operating I.F., then there is developed across resistors 100 and 101 a direct current voltage. The polarity of point 99 depends on the sense of frequency shift of the I.F. energy, and the potential magnitude of point 99 depends on the amount of frequency departure. Since grid 71 is connected to point 99, the cathode end of resistor 73 varies in potential according to the variation of point 99. The cathode end of resistor 73 will vary in a positive or negative sense with respect to the pre-determined +9 volts value. Hence, the grid 8 of the oscillator will vary similarly in potential with respect to its normal —3 volts bias. The +9 volts value of the cathode end of resistor 73 is chosen to correspond to correct tuning of the tank circuit 15-16 to an oscillation frequency which produces the assigned I.F. It will thus be seen that a departure of the I.F. energy from the assigned I.F. value (in this case 460 ke/s) results in a variation of the oscillator grid-bias. Furthermore, the variation of the latter is in a sense such that the oscillator-tank frequency is adjusted to compensate for the departure.

The separate diode rectifier 51-42′, arranged in valve 50, is employed so as to secure adequate selectivity even though but one stage of I.F. amplification is employed. The diode 51-42′ of valve 50 has its input circuit coil 53 coupled to the coil 38, and it will be seen that the input circuit of the second detector diode is really a tertiary circuit coupled to the secondary circuit including coil 38. The coupling between coils 38 and 53 is arranged so that coil 53 is coupled only to coil 38, and not to coil 36. This is done, as schematically shown in the drawing, by coupling turns 53 close to coil 38. In this way, in spite of the use of but a single I.F. amplifier, the selectivity preceding the audio-demodulator is satisfactory.

How it Works

The following is an explanation of the manner in which the changes in bias of oscillator grid 8 are converted to frequency-changes of the oscillator tank circuit: The oscillator produces an oscillatory voltage across the tank circuit 15-16 which is transferred to coil 19 by mutual inductance M_3. In an oscillator the grid draws current so that there is a finite grid impedance, predominantly resistive, if the grid-cathode static capacity can be neglected. For the purposes of explaining the action this capacity will be neglected, and its effect will be shown later. The voltage across the grid coil 19 causes a current to flow through capacity 20 and the input grid resistance of grid 8 of tube 6. Capacity 20 and the grid resistance r_g of the tube rotate the phase of the current relative to the voltage in that circuit. The current flowing through r_g, therefore, has an in-phase and a quadrature component. The in-phase component serves to maintain oscillation, and the quadrature component serves to vary oscillation frequency. These two components of current flowing through r_g produce the grid voltage at oscillator frequency which, by virtue of the mutual conductance of the valve 6, produces an alternating current in the plate circuit thereof. The direction of the mutual inductance M_3 between coils 15 and 19 necessary to maintain oscillation is such that this alternating plate current produces an effect equivalent to a negative resistance and a negative capacity in shunt to the tank circuit.

The negative resistance component is responsible for the oscillation, and the negative capacity component varies the frequency to some value other than that due to the constants of the tank circuit alone. Now, when direct current voltage is applied to grid 8 of valve 6, the effect on valve 6 is to vary the mutual conductance and the grid resistance r_g. If the direct current bias on grid 8 is made more positive, the mutual conductance increases but the grid resistance decreases. The effect of these two factors being opposite, tends to maintain the oscillatory voltage substantially constant unless the bias on grid 8 is made so far positive that the oscillator ceases to function. If the direct current bias on grid 8 is made negative, the negative capacity due to the quadrature component changes. In this case r_g increases and the negative capacity in shunt to the tank circuit decreases, and the oscillatory frequency decreases.

Brighton's Auxiliary Firemen were given a fine evening's entertainment recently when Flanagan and Allen, with Bebe Daniels and Ben Lyon, paid them a visit.

An increase in negative capacity in shunt to a tuned circuit has the same effect on frequency as a decrease in a positive inductance in shunt to the tuned circuit. However, a negative capacity has an impedance which decreases with increasing frequency, whereas a positive inductance has an impedance which increases with increase in frequency. The frequency shift produced by a given change in negative capacity is thus greater at the high frequency end of the tuning spectrum where the tank circuit capacity is low, whereas the effect of a given change in positive inductance is a substantially constant percentage of the frequency over the tuning spectrum since the tank circuit inductance is a constant. It has been shown that making the potential of grid 8 more positive results in an increase in oscillatory frequency. If the direct current potential of grid 8 is made more

(*Continued on page 121*)

ON YOUR WAVELENGTH

By Thermion

The Ration Scheme

DEALERS interested in battery charging were naturally concerned at the early announcement concerning the rationing of electricity. They now learn that the Fuel and Lighting Order, 1939, is intended to apply only to controlled premises, and that the use of electrical energy for charging accumulators does not mean consumption of electricity within the meaning of the Order. It will, of course, apply to the householder who is accustomed to charging his own accumulators.

Servicemen Exempt

I HEAR that the W.R.A. is sending a deputation to the Minister of Labour to discuss the age limit of the reserved occupations as it relates to the wireless trade. There are many service engineers of military age—the present limit is 30 years—and the association has received a letter from the Minister of Labour explaining that the age limit is under review.

The Television Situation

SIR NOEL ASHBRIDGE states that there are three reasons for discontinuing the television service. The first is the interests of national service, the second is that it relieves skilled staff for the maintenance of the existing sound service, and the final one is the high cost of the television service in relation to the comparatively small number who own television sets.

Fresh Fields to Conquer

IN a recent issue it was stated that many amateurs are at a loss to know what to do now that their transmitters have been confiscated. Many must have forgotten television. There are no transmissions nowadays, but experimenters could experiment with home-made transmitters coupled to the receiver by ordinary lines. One of my readers has under construction a modulated tube assembly incorporating a dual time-base. I agree that there is plenty of scope for experiment with a picture transmitter coupled directly to a picture receiver.

A Complaint from Torch

UNDER the title "Keep the Rest but Gimme Back My Stamps." Torch indites the following piece of bad-tempered writing:

"Your suggestion that the present state of things should prove encouraging to new authors, playwrights and lyric writers, is an excellent one, and if it could be put into actual practice it would do much to relieve the present deadly boredom which we are compelled to endure from the Old Gang. Unfortunately, the Old Gang will see to it that no new blood is permitted to infiltrate. It is practically an entire waste of time for any outsider to submit work for, after long waiting, it simply comes back with polite regrets—that is, if it ever comes back at all. It can quite easily become "lost" beyond all trace in some "Mine" where the Old Gang dig for fresh inspiration.

"Some three months ago I sent a number of lyrics to two well-known members of the Old Gang. In each case the lyrics were written specially to conform with the style of the artist concerned, and I asked them to accept the lyrics as a compliment to themselves, and made it quite clear that I did not solicit any payment if they made use of my work. If they did not care to do so, I asked for the return of my lyrics in the stamped addressed envelopes which I sent with them.

"In neither case did I get any acknowledgement, nor were my lyrics returned to me, and repeated further requests, each enclosing a further stamped envelope, have been entirely ignored. All that has happened is that these two well-known artists have kept my lyrics and my postage stamps as well. Unfortunately, and never imagining that such people would be so rude and discourteous as to retain other people's property or postage stamps, I did not take the precaution of keeping copies of my lyrics, and so I have lost the lot. There is nothing I can do about it, but having pinched my ideas, I do wish they had not been so mean and paltry as to pinch my stamps as well. They are quite safe. I dare not even mention their distinguished names or they would have me for libel. Still, what I have written is perfectly true, and should prove a useful warning to other aspirants. I agree that the B.B.C. is not to blame for the petty thieving of any of the artists they employ.

"If one's work is sent to the agents direct, it will probably be laid on one side till some regulation time has expired, and then returned with polite regrets. If it is sent to a particular artist it seems to stand an excellent chance of being stolen outright, and it seems most improbable that there will be any immediate change in this state of affairs. The Old Gang are well dug in, and there is a large sign hung outside their dug-out. It reads like this: OUTSIDERS NEED NOT APPLY."

Measuring Distance by Radio

A NEW device for utilising radio waves to measure distances between invisible or visible points in any weather or locality has been invented by two Soviet scientists, Academicians, L. I. Mandelstam and N. D. Papalexi. The device is a radio telemeter consisting of two special receiving and transmitting sets which are located at the points the distance between which has to be measured.

Radio waves of a determined length (this must be known exactly) are emitted from one set and received by the other, from which they are relayed back to their sources and compared upon reception with the original radiation. It is then possible with the aid of some simple measurements, based on the exact knowledge of the speed with which radio waves travel, to calculate with precision the number of radio waves and the distance between the two sets, and in this way to establish the distance between two points.

The radio telemeter which the Soviet scientists have designed will be of great importance to the future development of several branches of science. It is known, for instance, that in geodesy and navigation the measuring of distances based on optic observations constitutes practically the sole method employed. But this method depends on a number of conditions. Its applications require good visibility, perspective, easily discernible objects, etc. Moreover, the very distances that lend themselves to measurement are limited by the curvation of the earth. Great precision is achieved by geodesists at the cost of tremendous effort. The method requires the building of special towers, and even these do not afford a visibility of more than a few dozen miles.

The development of the telemeter, carried on during the last few years has been accompanied by intensive investigation into the influence of the earth on the speed of radio wave diffusion, and of the altitude at which the surface of the earth ceases to influence the radio waves.

Undertaking the solution of this matter, the Physics Institute of the Academy of Sciences of the U.S.S.R. sent out several expeditions to the Arctic, the Black Sea, and to the desert regions of the Union. With the same aim in view five navigators of the Civil Aviation Fleet of the U.S.S.R., Golyshev, Nevernov, Fomin, Polosukhin, and Belov, in collaboration with the scientists of the Institute, carried out several flights at altitudes varying from 4,921ft. to 9,842ft. in balloons of different dimensions, and also two sub-stratosphere flights which yielded sufficient material for an all-round study of the problem. This material will facilitate a more effective use of the radio telemeter, which so far has been applied experimentally by the Hydrographic Department of the Northern Sea Route Administration.

Readers on War Service

A REMINDER to all those readers on active service that I shall be glad to receive news from them, and to know how they are faring. I shall be delighted to send a personal letter in reply. I have already received some hundreds of letters from keen fans, and it amazes me to think that they can still maintain enthusiasm for home construction under the most difficult conditions. There must be a vast number of midget portable receivers in use in the Army. I offer book prizes to readers on active service who send me details of their devices for listening-in whilst they are under canvas or billeted.

Comment, Chat and Criticism

Two Classes of Music

Our Music Critic, Maurice Reeve, Discusses the Pros and Cons of "Absolute" and "Programme" Music

THE current series of critical causeries is designed to help the listener to a better appreciation of the music he hears on the wireless. Whilst the enjoyment of good music must always be largely dependent on his individual inherent receptiveness to the various ingredients that go to make up a work of music, his ability to understand what he is hearing must be in proportion to what he knows about it. Without suggesting that we must be learned professors unless the glories of a Beethoven Symphony are to pass us right by—an idea which is both absurd and unpractical—we must have at least a rough idea of the plan to which a work is built, and of the materials of which it is made up. Otherwise it becomes a matter of mere chance whether the finished product, when we hear it, is going to hit us in the eye and lay us out, as it were, bored stiff, or whether it strikes us with equally sudden force as a thing of great beauty and wonderful quality. I therefore propose to deal in two short articles with one aspect of this spade work, trusting that it will help those of my readers who would like a little light thrown on the subject—the dividing of music into two great types or classes which are known as "Absolute" and "Programme" respectively.

Absolute Music

Absolute music is music written for itself; nothing else inspires it but the desire to write beautiful sounds; it is music which depends on itself for its effects, and is in no wise dependent on words, scenery, acting or any other extraneous condition (Ousley). Absolute music might also be defined as pure, unconnected, "nothing but" music, the direct opposite to programme music, and dependent for its proper appreciation on the listener's musical taste and perception, and his ability to relish the ingredients of a musical composition without the aid of any one single clue, or mark of identity, being given him as a "help" to its better understanding beforehand. Sufficient unto the day is the evil thereof. I will confine myself to a consideration of this class of music in the present notes, deferring till next week my remarks on its rival.

When I say that by far the greater portion of the finest music comes under the definition of "absolute," I do not infer the slightest belittling of the rival group. I am merely stating facts. All sacred music will at once come to one's mind, the great masterpieces of J. S. Bach, Handel, and a host of others who have adorned our church services with their genius at all periods. Symphonies—those mighty works of Beethoven, Mozart, Schubert, Brahms and many others, several of which are so familiar to us now that they seem as one with other objects of our daily life that have long since ceased to belong to any class or category, so used have we grown to needing them and handling them. Chamber music—sonatas, trios, quartets, etc—sonatas for solo instruments, most overtures, and a host of other works, chief of which are doubtless the many glorious sets of variations that some of the great masters have given us; and also concertos.

With the one notable exception of opera, it will be seen that practically the entire repertory of great music must be classed as "absolute," music which needs no outside influence for its inspiration, and which relies so very much on the listener for its fame and bequeathment to posterity.

And this is not the end of our list by a long way. A vast collection of beautiful works, chiefly written for the piano, and in the smaller musical forms, which all belong to the "absolute" class. Easily the first in importance are the beloved works of Chopin—as pure and absolute as any music ever written, but whose character was greatly influenced by the composer's exotic life.

Programme Music

Furthermore, there are many works, of which we might name Haydn's Clock Symphony or Mozart's "Hunt" Quintet as examples—Beethoven's Pastoral Symphony was definitely written to, and inspired by, a programme—which are definitely members of the "absolute" group, but which did no more than contain a suggestion or an imitation sufficiently potent for it to go down the ages with that tag tied to its tail. But, because in the one work there is a figure reminiscent of a huntsman's horn, and in the other there is one—rhythmic, this time—similar to the ticking of a boudoir clock, doesn't warrant them being classed as "programme" music. The fact that Napoleon Bonaparte is cited as the prototype of a character in a novel doesn't justify us placing that work in the category of historical novels.

There is, of course, a border line between the two families of music—a type of work that is somewhat difficult to classify. I refer to the work that is "suggestive" rather than illustrative. Chopin's Funeral March, for example, is pure "absolute" music. Most readers will recall that it occurs in the third movement of the composer's second piano sonata. What Chopin had in his mind when he wrote the sonata no one knows. For, although the meaning of the Funeral March is pretty clear, it is the whole sonata that counts, and it must, in consequence, be considered as an integral part of a whole, and not as a piece of programme music, unlike Wagner's Funeral March in "Siegfried," which expressly illustrates a definite scene in that opera.

Overtures

Operatic overtures, too, are not programme music. But many of the famous concert overtures, such as "1812" or Elgar's "Cockaigne," are. But a careful distinction must be made. The object of an operatic overture is to give the audience a brief résumé of the music to come—more especially the principal themes about to be sung—and whilst it also sets out to strike the right atmosphere for the plot that is about to be unfolded, it is not necessarily programme music in consequence. Such magnificent examples as Mozart's "Magic Flute" and Wagner's "Meistersingers" Overture are classical instances of how the right mood for a whole evening's entertainment can be created or stimulated by a master hand. The scoring of the immortal Prize Song in common time as the principal theme in the development section of the "Meistersingers" Overture (in the last act of the opera the song is in "three" time) is a beautiful example of how a treat in store is suggested. The song isn't actually sung for some hours afterwards, but as soon as the first notes of it are heard, it at once sounds familiar.

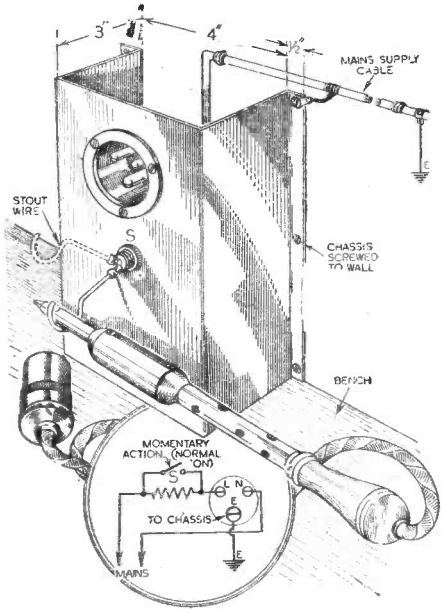
American Developments

THE present crisis is providing America with an excellent opportunity to make good headway with all their television schemes, and there seems every likelihood of that continent getting in front of Europe. This is naturally very regrettable when England had established such a convincing lead, but when the time comes and normality is restored it is certain that Britain will quickly re-establish herself in the forefront of television progress, and in the interim period, as the Editor pointed out in a recent issue, the research laboratories will still be active. In the U.S.A. the television laboratories are still feeling the effects of the "boycott" of films, and a curtailment of this side of the transmission service has occurred. The very vigorous protests by exhibitors dictated this policy, the same argument being used as that against the supply of film stars to radio, namely, that it is aiding a rival industry. It is certain, however, that the short-sightedness of this policy will become evident before many more months have passed. One interesting phase of television's development has become evident, however, and that is the desire of large departmental stores to use this new science as a means of attracting customers inside the buildings. Following on somewhat similar lines to those which have been tried occasionally in London, a programme of mannequin displays and a judicious blending of entertainment and the advertising of wares has been transmitted from one floor to receiving sets placed in various departments throughout the building. Naturally, the signals have been distributed by cable from the central camera site to the receivers, and because of the success which has apparently been met, various heads of stores are said to be interested in the formation of the new company which, as explained recently in these columns, proposes to operate a television relay system in New York on much the same lines as broadcast relay companies in this country.

Practical Hints

Auto-switching for an Electric Soldering Iron

THIS device will be of use to anyone possessing an electric soldering iron and who wishes to economise in electricity consumption. It consists of a "momentary action," normal "on" toggle switch, to which is soldered a strong wire hook. When not in use the iron is rested across this



This simple switching device economises current when using an electric soldering iron.

hook, thus opening the switch and throwing a resistor in series with the iron and reducing the current.

For a 60 w. iron on 240 v. mains a 1,000 ohm 30 w. resistor should be used. This reduces the current to a half, at which current the iron keeps warm enough to take very little time to reach full heat when needed. The metal chassis should be well earthed.—M. FRY (Maida Hill).

An Emergency Communication System

THIS idea is to enable people to know during the "black out" who is "knocking at their door," without opening it.

A transverse current mike (described in PRACTICAL WIRELESS, for September 9th) is coupled to an old two-valver with speaker, a switch being incorporated in the circuit. A switch is included in the H.T.—L.T.—lead. A further circuit, pocket battery and 3.5 v. bulb is also fitted with a switch. All three switches are soldered together, end to end. The switches are controlled by an ordinary bell-push button, which, together with the mike and lamp, was placed outside the front door. The batteries and transformer are placed in the hall, and the receiver in the living-room. The procedure is as follows:

A person presses the luminous button,

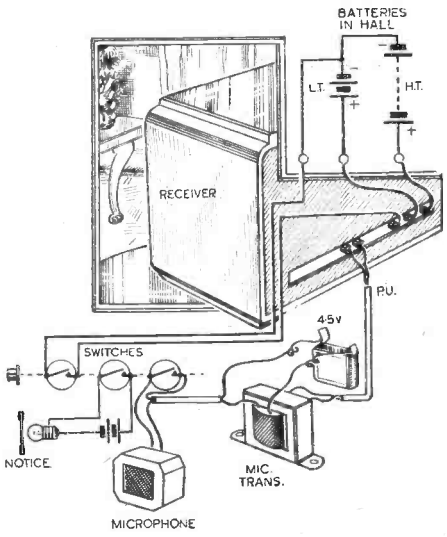
THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Practical Hints." DO NOT enclose Queries with your hints.

SPECIAL NOTICE

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

which switches on the set, mike and lamp, which illuminates the notice telling the caller to keep pressing the button and speak giving name and business. As soon



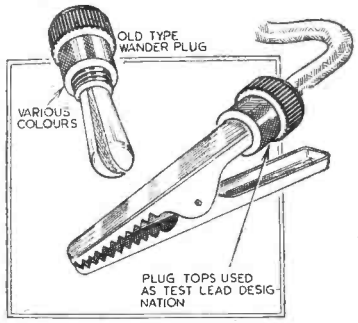
An emergency communication system for use during the "black out."

as pressure is taken off, all switches are off. The lamp is screened to illuminate the notice only.—R. EAST (Twickenham).

Identifying Test Leads

I HAVE a number of leads coming from points above my test bench for use with various pieces of apparatus. As the leads are fitted with crocodile clips, I found some difficulty in identifying them at a distance, especially when some leads were already in use, it was difficult to trace them to their point of origin.

While looking through some old terminals and plugs one day, I came across some old wander-plugs of the type illustrated. By experiment I found that the screw-on insulating body of the plug would exactly fit over the end of the crocodile clip, as shown in the illustration. As I had many of these plugs with the insulating material in



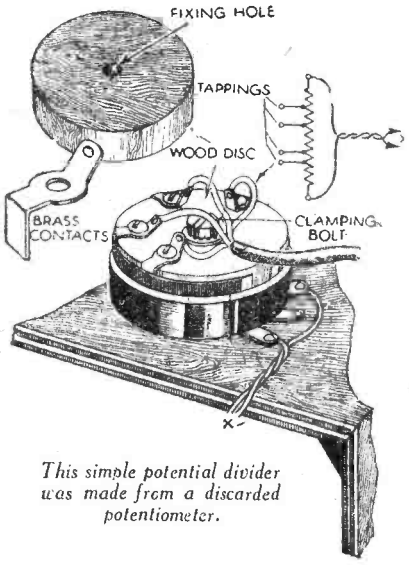
A useful dodge for identifying test leads.

various colours, that were useless because of a defect in the metal portion, I thought this rather a good method of making use of them.—PETER H. C. LEGATE (Ipswich).

A Baseboard-mounting Potential Divider

INSTEAD of discarding a damaged potentiometer of 50,000 ohms, I decided to convert it into a baseboard-mounting type potential divider in the rather novel manner shown in the illustration. After making a number of contact pieces out of thin brass strip, I obtained from a wood shop a disc of wood having a diameter which would provide easy recessing whilst resulting in good contact pressure on the old potentiometer element.

As will be seen from the sketch, the original wiper movement is removed, in my case leaving only a thin bronze slip ring which is disregarded, and in its place is positioned the wood disc, after determining the exact resistance tappings required for



This simple potential divider was made from a discarded potentiometer.

setting the contact pieces. A large bolt secures the disc, clamping the whole assembly to the wood chassis. The inset diagrams clearly show the conversion details.—H. ALLEN (Forest Gate).

INTERESTING EXPERIMENTS

Suggestions are Made in this Article Concerning Some Interesting Experiments Connected with Magnetism and Electricity

By L. O. SPARKS

AS the winter appears to be the recognised time for studying, and as the new conditions necessitate more indoor hobbies to while away the blackout hours, the enthusiastic radio constructor should now map out some plan for the coming months. It is perfectly obvious that one's normal activities cannot go along in the same old style, therefore, a break in the usual run of things will prove not only welcome, but, if due care is taken when selecting subjects, also almost instructive and interesting.

For example, I stressed in my article in the issue of September 30th, 1939, that too little attention is given to verifying many of the fundamental laws and theories connected with electricity and radio. We are all inclined to take too much for granted, and this often proves most annoying when we come up against some problem which cannot apparently be solved by applying formulæ which has been learnt parrot fashion.

It will be readily appreciated by anyone who has taken a recognised Course in, say, magnetism and electricity, that the lectures are usually backed or substantiated by practical experiments to prove the theories expounded by the lecturer. It is this procedure then, that the writer advocates for all constructors who are really interested in their subject, as it is one of the finest ways towards getting a thorough understanding of both theoretical and practical considerations, and what is also very important, the practical verifications help considerably to instill it into one's mind.

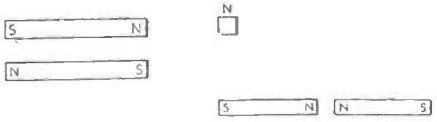
If some of the suggested experiments mentioned in the article should appear to be rather too elementary or simple, don't pass them by with disdain until you can satisfy yourself that you do know what will happen, or what should happen when such experiments are being carried out. Even if you think you know the correct answer it won't take very long to actually carry out the test just to see if you are right.

Magnetism

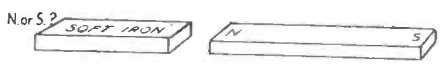
As magnetism is so closely related to electricity there will be no harm done if we start our experiments with one or two simple magnets, as it is quite likely that these will be found amongst most constructors' odds and ends. If it is possible to get hold of two bar magnets and one horseshoe type, so much the better.

All magnets produce magnetic fields, and every constructor should be familiar with the shape of these fields for different types of magnets and different polar arrangements.

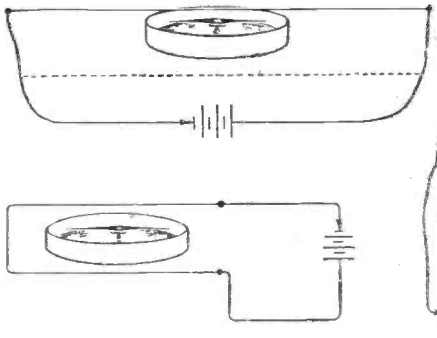
Hold the magnet under test under a piece of smooth paper in such a manner that the paper will not move. Over the paper sprinkle a small quantity of iron filings and



Figs. 1 and 2.—Suggested positions of magnets and iron for experiments Nos. 1 and 3.



then shake off, very gently, the surplus. It will be noted that the filings take up a definite formation, and that they are more dense in certain parts than others. Repeat the experiments with the arrangements shown in Fig. 1, and then draw the magnetic field diagrams produced. The lines which the filings will take up represent what are known as "lines of force."



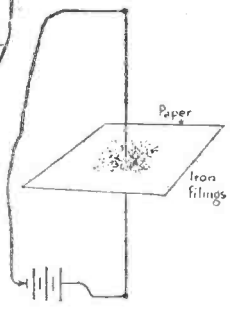
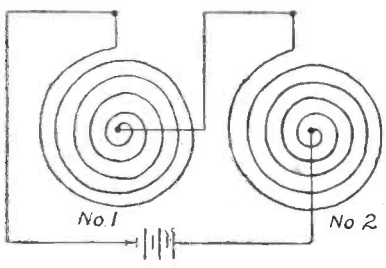


Fig. 3.—Arrange the conductor and compass as shown here for experiment No. 4.

Experiment No. 2

Every magnet has a North and South pole. Supposing that you have two bar magnets, and you place them end on to each other, will the N. pole of one attract the S. pole of the other ? What Law can you prove from this simple experiment ? Similarly, will two magnets, when placed together, lift or hold more metal than one, and if so, must like or unlike poles be together ?



Experiment No. 3

Many constructors might have experienced the unfortunate happening of having their watch stopped or thrown out of gear through bringing it close to a magnet, of, say, a loudspeaker. Why is this ?

If no direct contact has been made between the two articles how has the magnet affected the watch ?

The following little experiment will help to prove what is known as *magnetic induction*.

Bring one pole of a magnet in contact with a piece of soft iron and, after removing it, place the soft iron bar or rod into the iron filings. After removing the filings, repeat the procedure but do not touch the bar with the magnet. Hold them a little distance apart, and then scatter a few filings on the remote end of the bar and see if they are attracted. Place the bar magnet in line with the bar of soft iron, the distance between them being just sufficient to stop attraction, and then note, with the remaining bar magnet, what polarity the remote end of the iron bar takes. What law can you formulate regarding the polarity of induced magnetism ? (Fig. 2.)

There are numerous other experiments which should be carried out with simple magnets, but space prevents more details being given in this article, as it is desired to touch on one or two elementary experiments connected with electric currents.

Electricity

We have seen that magnetic fields are created around magnets, so we are now concerned with what happens around a conductor when it is carrying an electric current.

For these tests, quite simple apparatus is required, and for the ones about to be mentioned a small pocket compass and a little iron filings will be all that are required plus, of course, a small dry battery and a few feet of wire.

Experiment No. 4

Place the wire, after connecting one end of it to one side of the battery, just over and parallel with the compass needle, and then make a "flick" contact with its free end and the other terminal of the battery. Note the result.

Repeat the procedure but with the connections to the battery reversed. After

(Continued on page 124.)

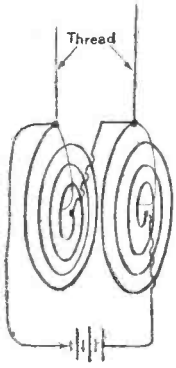


Fig. 4.—The coil mentioned in experiment No. 5 should be connected and suspended like this.

A Self-contained A.V.C. Unit

How to Make a Simple Device for Automatic Volume Control Which May be Added to Any Receiver Employing H.F. Amplification

By W. J. DELANEY

THERE are many receivers in use in which either a straight or superhet circuit is employed, but which do not make use of automatic volume control. Usually this is due to the fact that the circuits are of the simplest type, built on these lines either on account of simplicity of construction or from a point of view of economy. When receiving long-distance stations, however, fading may prove objectionable, and some desire to employ an A.V.C. circuit such as is found in more ambitious circuits may be expressed. There are complete units on the market which may be built into a receiver, but many constructors may have parts on hand which may be suitably employed. A simple Westector may be included in a standard circuit to provide control of the H.F. amplification, but this will necessitate alterations to the wiring and the arrangement will not be elastic. The keen experimenter will be anxious to try the effect of ordinary or delayed A.V.C. and perhaps to try other circuit modifications in conjunction with the A.V.C. circuit. Therefore, a small unit incorporating the necessary components will prove of value and may be removed if not required, or transferred to any particular receiver which is being used or tested.

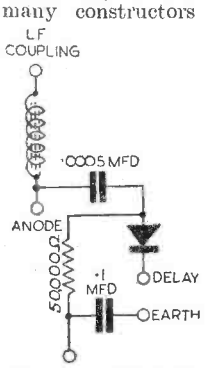


Fig. 1.—Theoretical circuit of the A.V.C. Unit.

The Circuit

Fig. 1 shows the main part of the A.V.C. combination, with other stages omitted, and the parts shown may all be built into a small box or mounted on a small baseboard which may be placed outside a receiver, provided that the wiring to the respective parts of a complete receiver is not too long. As the circuits are decoupled, however, leads may be fairly long without trouble; at least the unit should be suitable for placing behind a normal cabinet without introducing any instability. The choke may be any standard broadcast component, but best results will be obtained with an iron-cored component. The Westector should be the type WX.6 if the receiver is of the simplest kind, but if the H.F. voltage applied to the second detector (or detector in a straight receiver) exceeds 3 volts it may prove more satisfactory to use a type W Westector. The small-capacity fixed condenser should be of the mica type, but the .1-mfd. condenser may be any standard tubular. The fixed resistance is a $\frac{1}{2}$ or 1 watt component and the parts may be wired in any desired manner to enable them to be accommodated in the desired space. In order to incorporate the circuit in a standard receiver, certain parts of the wiring have to be modified, and these are as follows:

Firstly, the lead from the anode of the second detector to the L.F. coupling component must be broken so that the H.F. choke may be inserted. Secondly, the earthed end of the tuned circuits in the H.F. or I.F. stages must be disconnected from the earth-line and connected to the A.V.C. terminal. There is one alternative to this latter connection, but it will also necessitate the disconnection of a lead. This will be the lead connecting the grid of the H.F. or I.F. valves to the tuned circuit, and a .0002-mfd. fixed condenser will have to be inserted between these two points. The A.V.C. terminal on the A.V.C. device is then joined to the grid terminals via a 2-megohm grid-leak. This acts as a decoupling circuit, whilst in the former arrangement it will be necessary to add decoupling if more than one stage is controlled. Figs. 2 and 3 show the arrangements in the respective types of circuit.

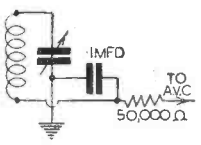


Fig. 2.—Applying the A.V.C. to the tuning coil.

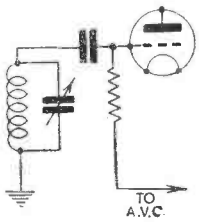


Fig. 3.—Applying the A.V.C. direct to the grid.

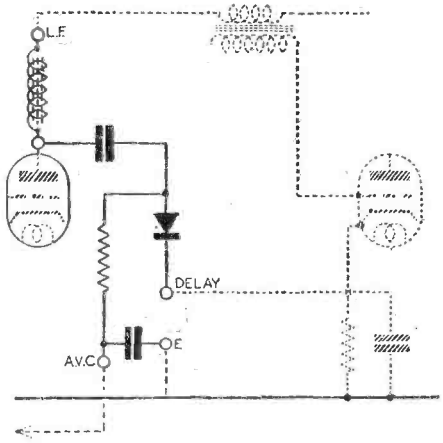


Fig. 5.—Adding the unit to a mains receiver to obtain a delay action.

Modifications

In a simple H.F.-Detector type of receiver the device is connected as shown in Fig. 4, the biasing voltage being between 1.5 and 3 volts. If, however, a superhet is being used, then it may be desirable to modify the circuit, including a delay-biasing circuit for the reasons explained in the recent articles on A.V.C. (see PRACTICAL WIRELESS dated July 15th). This delay voltage may be applied from a bias battery which should preferably be separate from that employed in the first position. If, however, mains indirectly-heated valves are employed, then the scheme outlined in the previously-mentioned article may be employed—in other words, the bias voltage of the L.F. valve may be used as a delay voltage. This is shown in Fig. 5. If the voltage developed across the bias resistance is too great for the delay voltage, then the expedient of using a variable resistance, or rather a potentiometer, for the bias voltage, with the arm joined to the A.V.C. circuit may be adopted, or if a cheaper and simpler scheme is desired, two resistances may be joined in series, and the A.V.C. circuit connected to the junction of the two resistances. The values must, of course, be carefully chosen so that a suitable voltage is applied for the delay, and there are alternative schemes for this purpose.

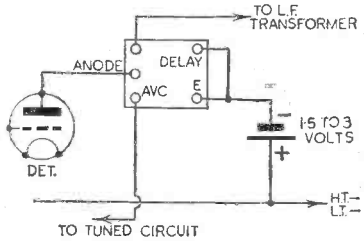


Fig. 4.—How to add the unit to a standard "straight" receiver.

Superhet or Straight

The unit may, of course, be used with a superhet receiver, in which case the effects will be more pronounced, as there is in such a circuit a greater degree of amplification and accordingly a stronger signal is available for rectification and subsequent application as bias voltage. In this type of receiver, too, the H.F. and I.F. stages may be controlled, but the 50,000-ohm resistance and .1-mfd. condenser shown in Fig. 2 must be included in the feed to each tuned circuit to provide a decoupling medium.

PRACTICAL TELEVISION

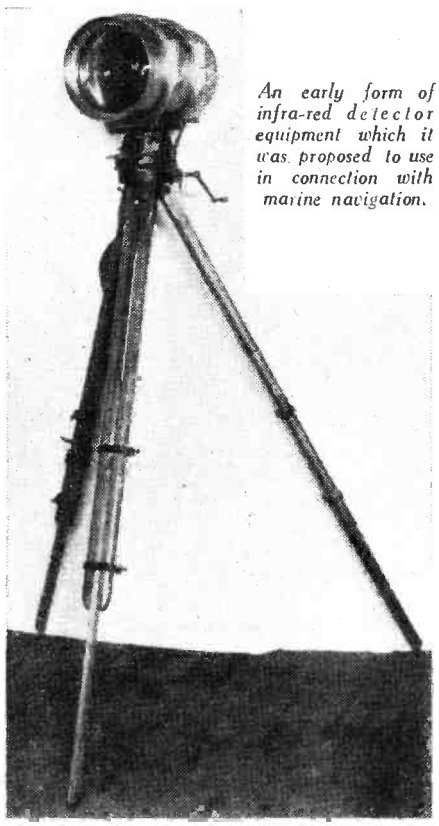
October 21st, 1939. Vol. 4. No. 173.

Projected Pictures

WHEN it is desired to project the picture built up on the fluorescent screen of a cathode-ray tube on to a remote screen for viewing purposes, as is the case with electronic big screen equipment, consideration has always to be given to the loss of light which occurs due to the light rays from the screen being dispersed in all directions. Even when a lens of large aperture is employed, only a small proportion of the available light is collected, and many ingenious suggestions have been put forward to overcome this defect. One of the most recent continental schemes suggests rather a radical alteration in the make-up of the cathode-ray tube screen, and would apply specially to those tubes having an opaque screen, whereby the picture does not have to pass right through the fluorescent material before reaching the projection lens. The idea briefly is to substitute for the normal tube screen a form of mosaic lens which is made up from a very large number of pieces of specially constructed glass elements. These elements, which are shaped hemispherically, are positioned on the back of the tube's fluorescent screen, being held in place by a transparent adhesive having a low refractive index. According to the idea these glass elements should approximate to the size of the modulated electron beam scanning spot, and if this is done the light generated at each tiny area of fluorescence can be formed into a parallel light beam, and all dispersive effects are nullified. The resultant light beam is then projected on to the remote screen in the usual way, and a material increase in overall screen brilliance effected.

Electron Multiplication

UNDER present conditions it is natural to find that certain pieces of equipment tend to assume a greater degree of importance, and this certainly applies to apparatus making use of the principles of electron multiplication. In one well-known type of multiplier there is a chain of secondary amplifying stages, and the electron current passes in sequence down the chain, being amplified at each stage. The stages consist of grids, the surfaces of which are specially prepared and treated to give a high secondary factor. The primary electrons incident upon the first grid liberate secondaries at low velocity which are attracted by a positive potential through the meshes to the second grid. This they strike with sufficient velocity to liberate further secondaries, which are in turn attracted onward down the chain. The grids are arranged as parallel circular discs inside a metal screen with an aperture to allow the electrons from the photo-electric cathode to reach the first grid. A somewhat similar principle is now being used in another type, however, and in this case each mesh grid is replaced by an extremely thin film of metal mounted over a fine mesh wire grid. Due to the extreme thinness of this metal, however, any electron impact on one side brings about a release of secondary electrons from the other side. The stream of electrons generated at the initial photo sensitive cathode, therefore, can in effect pass along the succession of multiplying stages being kept in focus by the use of external coils providing electro-magnetic fields. At the end of the tube, this electron stream can be made to reproduce a picture of high intensity on a fluorescent screen, or alternatively, if it is desired to develop television signals for transmission, then this screen is replaced by the more usual form of mosaic cell assembly so that electron scanning can be undertaken.



An early form of infra-red detector equipment which it was proposed to use in connection with marine navigation.

Improvements in Storage Tubes

THE Radio Corporation of America are losing no time in their efforts to improve the overall performance of the iconoscope camera used by them for all forms of transmission work. According to the latest reports a new patent has been awarded in the United States which aims at reducing the inter-element leakage which takes place on the mosaic during ordinary picture scanning. In the normal type the mosaic is built up by sputtering minute globules of photo-electric silver on a mica sheet. When the optical scene to be televised is focused on to this surface, electric charges corresponding to the light and shade of the picture are acquired by each element, but there is always a tendency for these charges to leak between elements, and this is equivalent to destroying partially the true light and shade of the picture as well as reducing the signal intensity. The suggestion has therefore been put forward that by first of all coating the mica sheet with a thin layer of oxygen compound of manganese, tin, vanadium or chromium, and then placing the photo-sensitive elements in this, the oxide layer will act as an insulator and prevent leakage, and so materially improve the resultant picture signal produced by the scanning operation.

Television and Fog

QUITE recently the television activity in the United States was made still more apparent by a patent which dealt with the application of television to fog or haze penetration. The prime object of this device was for use in conjunction with coastal defences so that it would be difficult for any sea craft to approach near enough to shore to cause damage by gun-fire when a fog or haze made normal visibility impossible. It was suggested that an electron camera with a mosaic screen specially sensitive to the infra-red end of the spectrum would be set up at selected points and continuously pan from left to right and vice-versa in order to cover an objective angle up to the horizon. Any object emitting infra-red rays which came within the camera orbit would then be made visible on a receiver coupled to the camera so that the vertical and horizontal deflecting circuits were common. To meet those cases where the objects do not normally emit the infra-red rays it was proposed to have at the camera location a searchlight with an infra-red filter which could throw out a beam to sweep the horizon synchronously with the camera. How far the practical application of such a scheme has been developed it is not possible to say, but it recalls to mind the early Baird noctovision experiments of nearly ten years ago, when a on low definition basis, similar proposals were made. In the accompanying illustration is shown part of the infra-red detector apparatus which it was hoped to employ in connection with marine navigation, and at a time like this it seems a matter for regret that further work was held up in order to devote the fullest resources to developing high definition television along normal lines. It is probable, however, that these "side-lines" will assume a degree of far greater importance in times such as these.

AUTOMATIC FREQUENCY CORRECTION

(Continued from page 114)

negative the frequency decreases. It has been shown, also, that the effect of capacity 20 is to produce a negative capacity in shunt to the tuned circuit. If capacity 20 is replaced by an inductance the effect would be as if a negative inductance were shunted across the tuned circuit, in which case the amount of shift would be more constant over the tuning spectrum.

The Shunting Effect

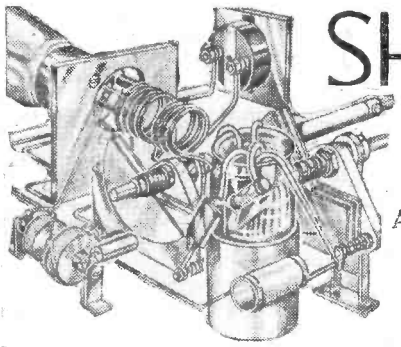
The tank coil and each associated trimmer condenser are made high in reactance (that is, by using a large coil and small condenser) so that the shunting effect of the anode quadrature current will operate across a high impedance and produces a greater percentage shift in tuning of the oscillator tank circuit. The mutual M_3 is sufficiently great to produce vigorous oscillation and increased quadrature current. In general the mutual M_3 has this effect: increase in M_3 produces a greater increase in shift at the low frequencies than the high. Hence, M_3 may be so chosen as to obtain substantially constant shift at all frequencies of the band. As M_3 is increased by increasing the value of coil 19, the latter will tend to approach resonance at the high frequency end of the band through the action of the capacities across it, and shift at the high frequencies will be materially reduced. M_3 may be arranged to provide constant shift; or accentuated shift (with M_3 very large) at the low frequency end of the band; or accentuated shift (with M_3 small) at the high frequency end of the band.

The direct current amplifier has a limiting action. Initially, with the correct station tuning, the amplifier provides a voltage across resistor 73 equal to the normal plate current flow under self-biasing conditions multiplied by the value of resistor 73. With a large negative discriminator voltage applied to its grid 71, the voltage across resistor 73 becomes zero. As a positive discriminator voltage is applied to the grid 71, the drop across resistor 73 increases. However, when the self-bias is exceeded by the AFC voltage, the amplifier grid 71 draws grid current and shunts out the two resistors 100 and 101 which are in series with the grid, the latter elements providing the internal impedance of the discriminator output. Hence, the positive increase of the drop across resistor 73 is limited to a value very near that of resistor 73 multiplied by the zero bias current of the triode 70-71-72.

To explain the receiver operation, and specifically the functioning of the AFC circuit, when an input signal is applied to antenna A, of lower frequency than is necessary to produce by beating with the oscillator frequency an I.F. of predetermined value, an I.F. signal is produced which is higher than the predetermined frequency. Signals of this higher carrier frequency are passed through the discriminator circuit and a discriminator voltage is developed across resistors 100 and 101; the voltage is negative as applied to the control grid 71 of valve 40. A decrease in cathode current in tube 40 results in a decrease in voltage across resistor 73, thus changing the bias on grid 8 of valve 6 and producing a more negative bias on grid 8. This more negative bias shifts the frequency of oscillation as previously explained, and causes a lower frequency to be produced. The lower oscillator frequency beating with the input signal produces a decrease in the I.F. signal frequency, and tends to correct for the assumed condition of I.F. signals higher than the desired I.F. With an input signal to the antenna that is higher in frequency than that necessary to produce the correct I.F. value by beating with the oscillator frequency, the reversal of the above biasing action takes place and the I.F. value is corrected. The control characteristics of the oscillator control circuit were experimentally measured on a receiver from which the schematic diagram was derived.

J. G. G. Noble has been appointed general manager of the Philco radio and television section.

Mr. Alfred Barker will continue as one of the B.B.C.'s orchestral leaders in addition to leading the Hallé Orchestra. It will be recalled that Mr. Barker was to have left his present positions to take up work in London.



SHORT-WAVE SECTION

A 20-METRE SET FROM THE JUNK BOX

Details of a Simple But Useful Receiver which can be Made from Old Parts

By THE EXPERIMENTERS

MANY experimenters must have found the past few weeks very trying. The absence from the air of British amateurs, combined with the lack of programme variety from both the home and foreign stations has had the effect of reducing the interest of DX work. But there is still plenty of good entertainment to be had from receiving the thousands of American amateurs who are as active as ever. The 20-metre band is the best, and if you tune over it on any evening—although Sunday seems most fruitful—from 10.30 p.m. onward you will find plenty of interest. Besides Americans working each other will be found W's working with Hungarian, Esthonian, Italian and Rumanian amateurs.

We had noticed this first on a recent Sunday when we were becoming tired of "kicking our heels." The set in use was a four-valve superhet, but so strongly did the signals come in on the speaker that it was considered that really good 'phone reception would be possible on a two-valve Det.-L.F. outfit. And in discussing this, one of our number suggested that there might be scope for making a receiver for the 20-metre band only from odd parts that could be found in the junk box. This, it was thought, would appeal to many readers who want a change from the war news and temporary scarcity of radio interest.

Standard Spare Parts

There was no difficulty whatever in drawing up a circuit, for you can't go far wrong with a detector-L.F. arrangement if you follow standard practice. Consequently, we drew the circuit shown in Fig. 1, and then considered how a set could most satisfactorily be built round it. The junk box did not provide any special short-wave parts, but there were a few plug-in coils and holders, two or three very ancient variable condensers and the necessary fixed condensers, resistors and other small parts. It was therefore decided to make use of the plug-in coil holders, but the windings themselves were removed from the coils. Some ⅜in. lengths were cut from a 1½in. diameter paxolin former; these were wound with the necessary number of turns and then attached to the coil holders with empire tape.

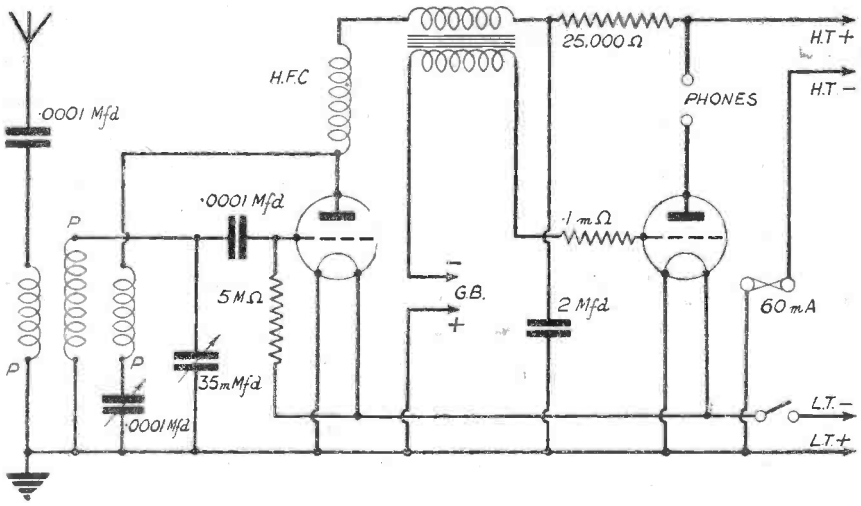


Fig. 1.—The circuit suggested is perfectly straightforward and follows standard practice.

Three coils were wound, with 4, 11 and 8 turns. In each case the wire was 22-gauge enamelled, and the turns were spaced by approximately the diameter of the wire. In winding, the wire was pulled tight and after the finishing-end had been anchored a coat of thin shellac varnish was applied to prevent the turns from slipping. In mounting the coils on the plugs, care was taken that the turns were in the same direction in each case, in relation to the pin and socket.

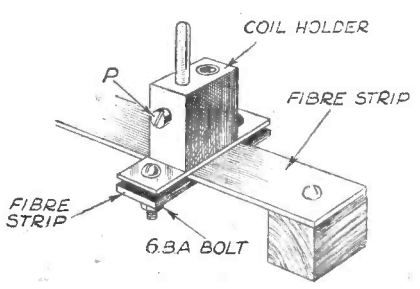


Fig. 2.—How the coil mounts are arranged for easy adjustment.

Coil Mounting

It was decided to mount the coil-holders in such a manner that they could easily be moved to vary the distance between them. This was done as shown in Fig. 2, by mounting a 6in. strip of fibre, 1in. wide on two small wooden blocks and screwing the whole to the baseboard. Other strips of fibre were fitted to the bases of the coil-holders by means of 6 BA screws as shown. Thus, the coil mounts could easily be slid about for experimental purposes or locked when the best positions had been found. It was noticed that best reception was obtained when the grid and reaction coils were spaced by about ¾in., and when the distance between the aerial and grid coils was nearly 2in. This was when using the 4-turn coil for the aerial circuit, the 11-turn coil for grid tuning and the 8-turn coil for reaction. The optimum positions would differ, however, for different valves and aerial-earth systems.

Tuning Condenser and Drive

Our next problem was the tuning condenser. One with a capacity of about 35 mmfd. would be most satisfactory for covering the amateur band, but nothing of the kind was available. Instead, we took a fairly good .0002-mfd. condenser which appeared to be of reasonably low-loss construction and dismantled this to remove all except one of the moving vanes. In re-assembling, a few washers were put on the rotor spindle to make up for the space previously occupied by the vanes.

And now a slow-motion drive had to be contrived. We made one as shown in Fig. 3. The condenser was mounted on a component bracket and a large loose pulley from a mechanical-toy set was drilled out to be a tight fit on the spindle, where it was held by running solder round the spindle and the centre of the pulley. Then a U-shaped bracket was formed from a strip of hard brass and drilled to receive a short spindle carrying a very small fixed pulley locked by means of a grub screw. A rubber band was found which could be stretched tightly over the two pulleys to serve to transmit the reduction drive. Finally, an old 180-degree tuning knob was fitted to the condenser spindle and a small pointer knob was attached to the short spindle.

It must be admitted that the drive was by no means "positive," although it worked fairly well and with only a moderate amount of backlash when the friction of the condenser rotor had been carefully set by attention to the adjusting pivot at the end of the rotor spindle.

After the two main items of the set had been arranged the remainder of the parts were mounted on a baseboard measuring

(*Continued on opposite page*)

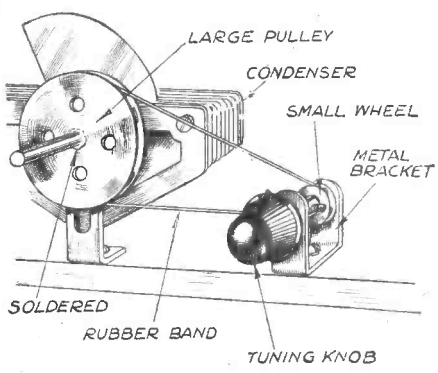


Fig. 3.—A simple, although not ideal, method of providing slow-motion drive for the condenser.

A 20-METRE SET FROM THE JUNK BOX

(Continued from facing page)

10in. by 8in., and wired up. The H.F. choke, by the way, was made by winding 100 turns of the finest wire (about 38 gauge) to be found in the junk box round a ¼in. ebonite rod. If this had not been available we could have used a short piece of wooden curtain rod after warming it and applying a coat of shellac varnish.

Coil Connections

In wiring up the coils care was taken to join the pins of the holders to earth, grid and reaction condenser respectively. If the connections to the grid or reaction coil had been reversed the set would not have oscillated, of course. The connections just mentioned are indicated in Figs. 1 and 2.

The valves were a D.210 for detector and a P.220 for L.F., but an L.210 could have been used for the second stage. With a total of 100 volts H.T. and 7½ volts G.B., reception on 'phones was good, and one broadcasting station on the 19-metre band was audible on a speaker. Tuning was not as easy as we should have wished, due to the rather crude form of slow-motion drive, but we shall look out for a proper condenser drive now and fit that instead. Better control might have been obtained by using a length of thin string treated with resin for the drive, but it is not easy to make a knot that does not cause slipping when it reaches one of the pulleys. Besides, when using string it is generally necessary to fit a spring-loaded jockey pulley to maintain a uniform tension.

Modified Tuner

If any reader who proposes to make a similar set has a proper short-wave tuning condenser with a maximum capacity between 25 and 100 m.mfd., we suggest that it be used, especially if a drive is available for use with it. Those who cannot find any coil plugs and plug-in coil mounts in the junk box can make a tuner by using a paxolin or shellacked-cardboard former 1½in. in diameter by about 6in. long, and wind on the numbers of turns mentioned above for the three windings. In practice it might be necessary to vary the grid winding between 9 and 11 turns to find the size which freely covers the band. It is dependent upon the minimum capacity of the tuning condenser.

Remember that the set is not supposed to be a "world-beater"; it is simply an interesting arrangement that affords scope for a little ingenuity, and which makes a change from normal constructional work.

INTERESTING EXPERIMENTS

(Continued from page 118.)

this, go through the two experiments again with the conducting wire *under* the compass. Now to complete this section, which, incidentally, proves a very interesting law concerning direction of current flow, make a neat loop of the conductor and place the compass within it so that the wire passes underneath and over the compass. Note any difference to the results produced by the previous tests. Additional proof as to why the current affects the magnetic needle of the compass can be secured from the following. Take a smooth piece of paper and hold it in a horizontal position. Pass a conductor up through the centre of it and sprinkle a few iron filings around it on the paper. Connect the conductor to the battery, the circuit being closed by "flicking" one end of the wire on the battery as mentioned before, and lightly tap the paper to assist any movement the filings might make. (Fig. 3.)

Experiment No. 5

Make two spiral windings, as shown in Fig. 4. For each of these 15 to 20ft. of insulated wire will be required; practically any gauge will do, but 28 S.W.G. to 34 S.W.G. will be found most convenient.

The spirals can be fixed to thin cardboard or made self-supporting by means of strips of cardboard fastened to the coils by suitable adhesive.

Connect the end of coil No. 1, i.e., the inner end, to the start of No. 2, i.e., the outer end, so that the current will be flowing through each coil in the same direction. Before connecting the battery, however, suspend each coil by means of short lengths of thread, so that they are free to move and quite close to, but not touching, each other. Connect the battery in the previously mentioned manner and note what happens. The experiment can now be repeated with the connections between the two coils reversed, so that the current will be flowing in opposite directions in each coil. For this, the inner end of No. 1 must be connected to the inner end of No. 2 and the latter taken to the two outer ends.

Before many more experiments can be carried out, it will be necessary to secure or make a sensitive galvanometer which, in its simplest form, is nothing more than a pivoted magnetised needle or pointer, supported within the effective field of a coil or coils which form part of the instrument. Very satisfactory instruments can be purchased quite cheaply from, say, Messrs. Electradix Radios or other firms dealing in surplus material, but if, on the other hand, the experimenter would rather make his own apparatus, then reference should be made to the issues of April 6th and 13th, 1935, wherein will be found complete details of the construction of a very efficient instrument. Rather than hold up the experiments, use can be made of the compass already mentioned, it only being necessary to arrange around it two small coils to provide a field which will cause the needle to give visual indication of current in the circuit.

The coils should be wound in a rectangular shape and consist of, say, 50 turns of 34 or 36 S.W.G. insulated wire, the two coils being connected in series, care being taken to see that each winding adds to the resultant effect. The compass should be so located that a coil is each side of it and slightly over the scale, thus allowing the greatest effect to be obtained from the field produced.

Short-wave Tuning

WITH some short-wave receivers, separate plug-in coils are used, and if the receiver is put to serious use a calibration chart has to be drawn up for each coil or set of coils. A very good plan is embodied in a well-known American receiver to ensure that the necessary calibration curves are kept with each set of coils. They are mounted on a plug-in base which is inserted from the front of the receiver, and the front panel carries small holders on which the charts are inserted. Thus the readings are visible at all times and as the coil range is changed so the tuning charts are also replaced. This idea may be applied to any home-made short-wave receiver.

Easier Meter Readings

IN some types of test equipment a normal type of panel-mounting meter is employed and the scale is accordingly restricted in size. If the instrument is being used for various ranges it may be desirable to draw up a new scale with all the ranges clearly marked. This cannot be done on the existing meter dial and in such a case it is worth while modifying the meter in the following manner. Remove the front and make the necessary arrangements for mounting the meter slightly behind the panel. A suitable aperture should then be cut in the panel and covered with glass, celluloid or similar material. The appropriate scale should be then drawn up and the pointer extended to the necessary length. To avoid upsetting the meter movement by altering the balance of the needle the ideal plan is to lengthen it by sticking on a bristle taken from a broom or brush, the bristle being of a suitable thickness to provide easy reading.

Soldering Iron Heating

MANY constructors use gas for heating a soldering iron, usually making the domestic gas-ring serve the purpose. To make this process economical, however, it is desirable to concentrate the heat from the ring and a metal hood should therefore be made to fit over the ring so that the iron may be inserted in the hood and waste of gas thereby avoided.

LATEST PATENT NEWS

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Abstracts Published

TELEVISION RECEIVERS.—Berry, R. J. (Lorenz Akt.-Ges., C.). No. 506709.

Mixed signals are applied over a transformer 26, Fig. 1, to a rectifier 22 which is biased in dependence upon the mean

Fig. 1.

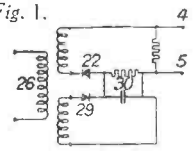
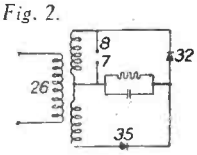


Fig. 2.



picture signal so that synchronising pulses only occur at terminals 4, 5. The bias is developed by a suitably poled rectifier 29 which passes the picture signals only to the resistance-capacity combination 30. An alternative circuit, Fig. 2, has the rectifier 32 biased by the output of rectifier 35, the synchronising signals occurring at 7, 8. The rectifiers may be thermionic diodes, and both may be contained in one envelope.

VALVE CIRCUITS FOR MODULATION AND WIRELESS RECEPTION.—Radio-akt.-Ges. D. S. Loewe. No. 507495.

A tunable coupling circuit for television signals comprises an inductance 1 arranged in series with the inter-electrode valve capacity 3 and the variable tuning condenser 2. The inductance is preferably shunted by a damping resistance equal to half the impedance of the inter-electrode capacity at the maximum modulation frequency. Fig. 3 shows a grid modulating arrangement in which the carrier source is coupled to the inductance 1 and the modulating potential is applied through a choke 9 of small reactance compared with the reactance of the tuning condenser 2. Fig. 4 shows a push-pull arrangement in which the damping resistances may equal the impedance of the inter-electrode capacity 3 at the highest modulating frequency and the tuning condenser 2 is isolated from earth. Fig. 5 shows a superheterodyne receiver. The coupling between the amplifier 8 and the frequency-changer 18 comprises a band-pass filter, utilising two series resonant circuits so tightly coupled as to give the necessary band width and with the windings so arranged that the capacitative coupling assists the magnetic coupling so that the band width is maintained throughout the tuning range. A double-humped characteristic may be produced and compensated for by the use of a single series resonant circuit in cascade. The condensers of the band filter and of the additional circuit may be gang tuned with, if desired, the condenser 19 of the local oscillator.

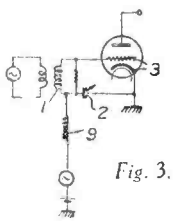


Fig. 3.

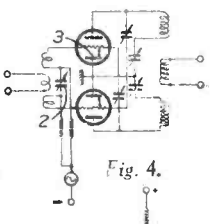


Fig. 4.

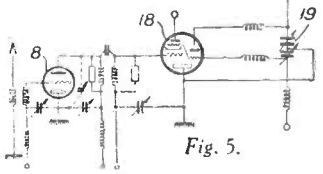
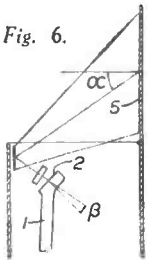


Fig. 5.

TELEVISION RECEIVERS.—Fernseh Akt-Ges. No. 507582.

Distortion, due to the image of the fluorescent screen 2 (Fig. 6) of a cathode-ray tube 1 being projected on a viewing screen 5 at an angle β to the normal, is compensated by distorting the image produced on the screen of the tube, which is inclined at an angle α to the optical axis. The normal to the fluorescent screen is inclined to the direction of the undeflected electronic beam. The angle β is a fraction of the angle α equal to the inverse of the magnification of the optical system. The tube is so mounted as to be movable about a horizontal axis. Elliptical distortion of the spot of light is avoided by a compensating elliptical focusing field. The electronic beam is maintained in focus by variation of the focusing field. According to modifications, the fluorescent screen is deposited on a reflecting surface, and the light passes through an optically flat surface forming part of the envelope of the tube, the light from the fluorescent screen is reflected from a mirror in the tube, and the fluorescent screen is on a carrier which is adjusted by an external control.

Fig. 6.



NEW PATENTS

These 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. The Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications.

26235.—Baird Television, Ltd., and Baird, J. L.—Methods of and apparatus for the transmission of signals. September 20th.

25863.—Fabbrica Italiana Magneti Marelli.—Key-operated tuning devices for wireless broadcast receiving apparatus. September 14th.

25864.—Fabbrica Italiana Magneti Marelli.—Key-operated tuning devices for wireless broadcast receiving apparatus. (Cognate with 25863.) September 14th.

25998.—Hazeltine Corporation.—Television receiving system. September 16th.

26268.—Murphy Radio, Ltd., and Hawkins, G. F.—Noise suppression in radio-receivers. September 20th.

26067.—Philips Lamps, Ltd.—Remote-control mechanism for wireless receiving sets. September 18th.

Specifications Published.

512489.—Fernseh Akt.-Ges.—Methods of obtaining image signals in television and like systems.

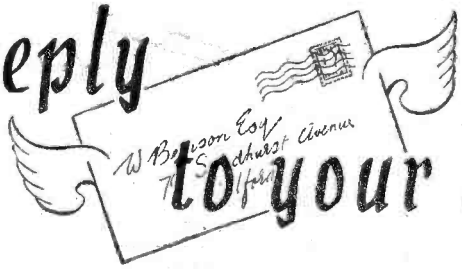
512508.—Toulon, R.M.G.—Method of and means for projecting televised images. (Cognate Application, 12009/38.)

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, at the uniform price of 1s. each.

AMERICAN OUTSIDE BROADCASTS

IN May of this year the Princeton-Columbia baseball match was televised as an outside broadcast feature in America, but only one camera was employed to cover the whole field of play. In consequence of this the reports pointed out that the ball could not be seen, while the players were just tiny white dots on the small receiver screen. Quite recently, however, the experiment was repeated for another baseball game, and two cameras were employed, one of which used a telephoto lens. The difference in the results was quite marked, not only from the technical point of view, but also in the method of presentation. There is now a demand for this type of programme, it being stated that scientifically the baseball television problem has been solved, but economically it is still a riddle. Before any scheme of this character goes forward the promoters say that the "gate" must be protected. The public have been made to realise that with outside television brought into the home and provided three or four cameras are employed, there is an intimacy which brings to its audience features which the spectator on the spot misses. Close-ups of the batsmen and pitchers when they are off the field, explanations of how the bat is gripped or the ball flighted. In this manner television adds interest to the game by small but important details which the spectator in the ground must supply for himself. The big problem, as was the case here, is who is going to pay for the broadcast and protect the promoter. The answer is nearly always sponsors, as is done with ordinary sound broadcasting. The difficulty here is, however, the advertising ban enforced by the Federal Communications Commission. Even so, it has been suggested that by focusing the camera on large scale advertisements on hoardings round the ground this should meet the case, for it will convey clearly the message concerning special products without savouring of blatant advertising. As an addition or an alternative the announcer can come within the camera's field of vision, and display certain wares or actually perform functions with different types of goods without violating the F.C.C. regulations. In any case it is pointed out that a good announcer is essential for he adds life and interest to the picture by his racy comments. The action seen on the screen is clarified aurally and the action enlivened, particularly when there is a long shot of the field, and identification of the players becomes a little difficult.

In reply to your letter



Home Recording

"I should like to do some home-recording and home-broadcasting, but am uncertain regarding the type of apparatus, bearing in mind the set I am using. This is very old, but answers our normal broadcast requirements, although it has no pick-up terminals. I believe the microphone should be joined to such terminals, and I wonder whether they could be fitted to the receiver or if it would be desirable rather to make a special set for my purpose. If you advise the latter, could you specify a blueprint of circuit for battery operation at minimum cost of construction and maintenance?"—F. D. A. (Norwich).

WE think that as the receiver is old and not fitted with pick-up arrangements, it might be unsuitable for your particular ideas, and a special small amplifier would be more useful. We have no suitable blueprint of such a unit, but in our issue dated June 18th, 1938, we described a small battery amplifier with a push-pull output stage rated at 2½ watts, and this should be ideal for your purpose. The back number may be obtained from this office, price 4d.

How Many I.F. Transformers?

"I wonder if you could tell me whether it is essential to have two I.F. transformers in a superhet, or how many are really necessary in this type of circuit?"—T. T. S. (Margate).

IN the normal superhet receiver one I.F. transformer is used to couple the frequency-changer to the I.F. stage, and this is coupled to the next stage by a further similar transformer. Thus the minimum is two I.F. transformers, but if more than one I.F. stage of amplification is employed, then additional transformers are used to couple the successive stages. It is also sometimes found that two I.F. transformers are used between frequency-changer and I.F. stage, these being coupled to provide special band-pass effects or used with a crystal filter.

Remote Speaker Control

"I have fitted up a remote loudspeaker at an extension listening point, but wish to fit a volume control to this. I have found two circuits, both different, and wonder if you can tell me which is the better or which is correct. In one circuit a variable resistance was connected in series with the speaker, but in the other a resistance was joined across the speaker. What are the merits of these two systems?"—L. G. (Godalming).

IN the first system the matching of the output circuit would be upset as the load provided would be varied as the series resistance was adjusted. The same thing would apply to the second scheme, except that there would be a further disadvantage that when the resistance was short-circuited the output is also shorted. The best scheme is to use a potentiometer, connecting this across the output terminals and joining the speaker to the arm of the potentiometer and to one side of the control. Thus the impedance is more or less constant, but the speaker is progressively short-circuited and thus volume is smoothly controlled.

Short-wave Coils

"I have found some data for the winding of short-wave coils, but these are for a condenser of .00015 mfd. capacity. I have a .00025 mfd. condenser which I wish to use, and wonder if you can tell me whether to make any modification to the coil-winding data given, or whether it will still be applicable."—T. R. (Willesden).

THE coil data should be adhered to, but the maximum tuning range of the coils will be increased slightly. The actual increase will not make a great deal of difference, except that a slightly wider band will be covered and thus stations will be brought closer together. With a good slow-motion dial and the condenser mentioned, this should not make a lot of difference. If, however, the condenser in question is not a well-made component the minimum capacity may be greater than the minimum of a .00015 mfd. component, and thus the minimum wavelength of the coils will also be raised. In that case, one or two turns less should be used in winding the coils from the data given.

RULES

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

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

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

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

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

Damaged Valve

"I was cleaning my set and found one of the valves is loose in its socket. The glass turns fairly freely, and I wonder if this will have led to any inefficiency in the valve, and, if not, how I should restick it. Can you tell me the cause of it coming loose?"—F. T. C. (St. Albans).

THE valve may have been loosened through running too hot, either due to the wrong voltage applied to it or because it is placed near a component or other valve which also runs hot. On the other hand, if the valve is very old the cement may have cracked through age. Usually the loosening of the glass will not affect the valve, provided that the glass portion has not been rotated and thus shorted or weakened the leading-out wires in the base. If the valve has been overrun it will have been damaged. Ordinary Chatterton's Compound or any good glass cement may be used to restick the bulb, or a wide rubber band may be slipped over the glass and valve base for the purpose.

Lightning Arrester

"I have a small device which is to be fitted to the aerial lead-in to prevent lightning damage. This appears to have across the aerial/earth terminals two pieces of thick metal with saw-tooth edges. These are very close together, and I wonder if they will affect signal strength. I believe they form the arrester, although I cannot see how they perform this function."—O. F. R. (Norwich).

THE accumulation of static on the aerial will result in a discharge across the small air-gap provided between the adjacent teeth, thus ridding the aerial of an accumulated charge which might otherwise damage a coil or other component in the aerial circuit. The capacity existing across the teeth is not sufficient to cause loss of signal strength, but the gap must be kept dry and should preferably be covered to avoid the accumulation of moisture or soot or similar deposits.

H.F. Instability

"I recently built a four-valve receiver with an H.F. Pentode H.F. stage, transformer-coupled to the detector. I am experiencing severe H.F. instability, which all my tests and trials have failed to obviate. I have modified the screen voltage, changed decoupling values and screened various parts without avail. I wonder if you could suggest anything which I have not tried, but which would prevent this trouble?"—V. W. E. (Slough).

THE instability may be due to the particular H.F. coupling provided in the transformer, provided that all other tests and modifications have been correctly carried out. We therefore suggest that you shunt the primary of the H.F. transformer with a fixed resistance—the most effective value being found by trial. An alternative scheme would be to reduce the coupling between primary and secondary, which is presumably too tight now.

REPLIES IN BRIEF

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

L. R. W. (Portsmouth). We would not advise the alteration as it will necessitate new coils and transformer. It would be better to consider a new receiver design.

K. D. S. (Reading). The valve is ideal for the purpose and you may fit it with confidence.

Y. R. (Harringay). The aerial may be responsible but more elaborate tests must be made and we suggest a small portable with frame aerial as a possible source of test for the purpose.

C. C. (West Wickham). We have not published details of a unit of the type mentioned.

C. V. (Selby). The brushes may need cleaning, or the commutator may have worn. We suggest that you communicate with the makers of the radiogram.

L. R. O. S. (Nr. Romsey). We have no details of the particular coil and regret that they are not now obtainable.

R. W. P. (W.5). We have not described a set of the type mentioned, and the nearest is the A.C. Hall-Mark Four.

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

Open to Discussion

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

German Station on a Crystal Set

SIR,—As a result of an article on A.R.P. wireless sets in a recent issue of PRACTICAL WIRELESS, I bought a crystal set, price 3s. 6d. I was unable to obtain the accessories recommended in the article, and I think it may be of interest to other readers to know that whilst fiddling with it at about 8.45 p.m., I distinctly heard the German station that broadcasts below the 449 metres wave-band used by the Home Service.

Does this constitute a record for crystal sets ?—C. G. WILLSON PEPPER (Leatherhead).

Exchanging S.W.L. Cards. A 14 mc/s Log

SIR,—I shall be glad to get in touch with any reader in my locality or any other district with a view to exchanging cards and correspondence.

I also submit my 14 mc/s log from September 5th to September 7th, between the hours of 8 and 9 p.m. All are W districts. PY(8), VE(6), YV(2), OA(2), ZB(2), CRGAF, VQ4TB, FA3JY, KA1LZ, CX2CO, SU1MW, K4UG, CE3AT, and EK1AF.

Has anybody heard a station with the call letters K2HS ? By the way, I have never seen a 5-metre log from any reader.—L. HUDSON, 12, Devon Terrace, Pontefract Lane, Leeds, 9.

Station JZW : Hungarian " Hams"

SIR,—It might interest readers to know that the transmissions from JZK, Japan (19.79 metres) have, from October 1st, been altered. They now use the call JZW on 41.34 metres 7,257.5 kc/s. Also the English speaking period is from 20.00-21.00 G.M.T. Other languages from 19.00-20.00. The English period of TAP, Ankara, on Saturday nights is at 20.15 G.M.T. instead of 20.00 as formerly. Hungarian " Hams " are now on the 19-metre band, about 19.8 or 19.81 metres. HA3P, HA2B, have been sorted out from Zeesen about the wavelength mentioned. Veris received the last fortnight are LU8AB, XGOY, OAX4Z, TFJ, and QSOs from Japan and Ankara. —T. H. PLATER (Leicester).

Correspondent Wanted

SIR,—I am an evacuee, and am in need of a correspondent. I have been a reader of your journal for nearly two years, and must congratulate you on its production. I would like to correspond with any young reader interested in short-wave and medium-wave reception.—PAUL HARRIS, c/o Mr. A. T. Varcoe, 12, Park Street, Ivybridge, South Devon.

The British Short-Wave League

SIR,—May I use the medium of your valuable magazine to inform the British Short-Wave League members as to the future of the League ?

In a letter to me the secretary says that the *Short Wave Magazine*, incorporating B.S.W.L., has ceased publication owing to war conditions, but will recommence should circumstances improve. The future of the B.S.W.L. is therefore in doubt, and is under earnest consideration. The secretary will circularise all members in due course as to its future.

I should like to mention that I think PRACTICAL WIRELESS is more distinctive in its present form.—R. W. IBULL (Worksop).

Prize Problems

PROBLEM No. 370

MARTIN had a commercial four-valver which incorporated a three-gang tuning condenser. He was dusting the set and in cleaning between the vanes of the condenser he used undue force and bent those on one section. He found that as a result tuning was upset, and at one part of the dial certain stations previously heard could not be obtained. He therefore readjusted the trimmer on the section in question, and although he could get these stations, he found that the remaining stations were not tunable. What should he have done ? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 370 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, October 23rd, 1939.

Solution to Problem No. 369

The fact that the valve in question was cold indicated that it was the heater of that valve which had failed and as the heaters of an A.C./D.C. set are in series, this was the cause of the breakdown of the receiver.

The following three readers successfully solved Problem No. 368 and books have accordingly been forwarded to them: P. Solomon, Woodland View, Harrogate Road, Rawden, Nr. Leeds. F. R. Enoch, 19, West Avenue, Rawmarsh, Rotherham, Yorks. W. W. Llewellyn, 29, Ramsbury Drive, Earley, Reading.

IMPORTANT NOTICE

Owing to the restriction of paper supplies in war-time, readers may find it impossible to get " Practical Wireless " each week unless they give their newsagent a regular order for their favourite paper, now.

Wastage of surplus copies in the shops must be avoided, and readers can be of the very greatest help if they will fill up the Order Form given on page ii of Cover and deliver it to their usual newsagent or bookstall. An order of this sort ensures regular delivery during war-time, and the Editor asks every reader to help in this way.

PLEASE ORDER " PRACTICAL WIRELESS " NOW AND USE THE ORDER FORM ON PAGE ii OF COVER.

Practical Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS	Date of Issue.	No. of Blueprint.
CRYSTAL SETS.		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprints, 1s. each.		
All-Wave Unipen (Pentode)	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
Two-valve: Blueprints, 1s. each.		
Four-range Super Mag Two (D, Pen)	—	PW36B
The Signet Two (D & LF)	24.9.38	PW76
Three-valve: Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	12.6.37	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen)	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve: Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P)	1.5.37	PW4
Fury Four (2 SG, D, Pen)	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P)	26.9.36	PW67
All-Wave "Corona" 4 (HF, Pen D, LF, Pow)	9.10.37	PW79
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated.		
Two-valve: Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen)	—	PW18
A.C.-D.C. Two (SG, Pow)	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve: Blueprints 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
All-World Ace (HF Pen, D, Pen)	28.8.37	PW80
Four-valve: Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47
A.C. All-Wave Corona Four	6.11.37	PW81
SHORT-WAVE SETS. (Battery Operated.)		
One-valve: Blueprint, 1s.		
Simple S.W. One-valver	9.4.38	PW88
Two-valve: Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve: Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	30.7.38	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	7.8.37	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen)	1.10.38	PW68
PORTABLES.		
Three-valve: Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen)	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve: Blueprint, 1s.		
"Imp" Portable 4 (D, LF, Pen)	19.3.38	PW86

These Blueprints are drawn full size.

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

Issues of Practical Wireless	4d. Post Paid
Amateur Wireless	4d. " "
Practical Mechanics	7d. " "
Wireless Magazine	1/3 " "

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

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

MISCELLANEOUS.		
S.W. Converter-Adapter (1 valve)	—	PW48A
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Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve: Blueprint, 1s.		
B.B.C. Special One-valver	—	AW387
Two-valve: Blueprints, 1s. each.		
Melody Ranger Two (D, Trans)	—	AW388
Full-volume Two (SG det, Pen)	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve: Blueprints, 1s. each.		
Class B Three (D, Trans, Class B)	—	AW386
£5 5s. S.G.3 (SG, D, Trans)	2.12.33	AW412
Lucerne Ranger (SG, D, Trans)	—	AW422
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen)	*June* '33	WM327
Economy-Pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans)	*Mar.* '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen)	—	WM389
Certainty Three (SG, D, Pen)	—	WM393
Minitube Three (SG, D, Trans)	*Oct.* '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve: Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans)	—	AW370
2HF Four (2 SG, D, Pen)	—	AW421
Self-contained Four (SG, D, LF, Class B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	*Feb.* '35	WM381
The H.K. Four (SG, SG, D, Pen)	*Mar.* '35	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen)	*Apr.* '36	WM404
Five-valve: Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340

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). Display lines are charged at 4/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, Strand, London, W.C.2.

RECEIVERS, COMPONENTS AND ACCESSORIES
Surplus, Clearance or Secondhand, etc.

SOUTHERN RADIO'S Bargains.

ALL Articles Fully Guaranteed. Postage extra.

5/—Parcel of useful components, comprising condensers, resistances, volume controls, coils, wire, circuits, etc., etc., value 25/-. 5/- per parcel.

10/—Parcel of useful components, comprising 100 articles, including electrolytics, valveholders, etc., etc., value 55/-. 10/- per parcel.

21/—Small traders' parcel of components, comprising at least 150 articles, including 24 assorted tubular condensers, 24 valveholders, 36 resistances, 12 Mainsbridge type condensers, 6 electrolytics, etc., etc., value 85/-. 21/- per parcel.

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BUZZERS, 1/6; crystal detectors, 2/-; crystal sets, 5/6; crystals, 6d.

2/6—Ormond loudspeaker units, 2/6; A.C. eliminators, with trickle charger, 37/6.

IN Spite of Increased Costs of Production, whilst our present stock lasts no increase will be made in prices. It is, however, advisable to buy now. Thousands of bargains for callers.

SOUTHERN RADIO, 46, Lisle Street, London, W.C. Gerrard 6653.

VAUXHALL.—All goods previously advertised are still available; send now for latest price list, free.—Vauxhall Utilities, 163a, Strand, W.C.2.

NEW RECEIVERS, COMPONENTS AND ACCESSORIES

GALPIN'S ELECTRICAL STORES offer as follows: Shunt wound charging or lighting dynamos, 220v-10a., £4/10/-; 100v.-45a., £7; 100v.-10a., 450 r.p.m., £5; 50/75v.-25a., £5/10/-; 50/75v.-15a., £4/10/-; 50v.-4a., 35/-; 20v.-8a., 32/6; Shunt regulators or charging resistances, 7/6 to 15/-; volt-meters, large size, 7/6 to 15/-; ampmeters, large size, all readings, 7/6 to 15/-; milliamp meters by Turner or Weston, 2in. dia., moving coil, sizes 0-5 m/a., 0-50 m/a., etc., 17/6 each; moving-coil movements for recallibration into multirange meters, complete in case, 5/-; large size, 5in. scale, 7/-; X-ray transformers, 120/150v. input, 50-cycle single phase, 70,000v. output, 3 KVA, £10; also other sizes; H.T. transformers, mains input, 5/7,000v. out, 6/-; 10,000v. out, 10/-; G.P.O. multi contact relays, single coil, 3/6; twin coil, 4/6; triple coil, 5/6; all separate working, various resistances; wire, single 23 s.w.g. enam. and heavy cotton covered, approx. 300yd. coils, 3/6 per coil; ditto twin, approx. 150yd. coils, 4/6 per coil; 18 s.w.g. single, approx. 250yd. coils, 6/- per coil; push back wire, standard telephone, approx. 250yd. coils, 10/- per coil; all above wire is new, double output hand-driven generators, 800v. and 6v., 25/-; T.C.C. electrolytic condensers, 2,000mf., 50v. working, new, 5/6; large mains transformers, 250–0–250, 200 m/a, three 4v. windings and a 50v. winding, new, 12/6; ½ h.p. A.C. motor for rewinding, ball bearing, D.E. shaft, induction type, 17/6; also large stocks of electrical goods too numerous to mention. Please write stating requirements. All goods guaranteed; all goods three days approval from date of delivery. Terms strictly cash with order or C.O.D. (C.O.D. is post only and charges extra).

GALPIN'S ELECTRICAL STORES, 75, Lee High Rd., Lewisham, London, S.E.13.

"STAND-BY" Crystal Set. Specified coil 2s., case 9d., or complete kit of parts, 10s. 3d., post free.—T. W. Thompson and Co., 176, Greenwich High Road, S.E.10.

BANKRUPT BARGAINS. Brand new 1938-9 models, makers' sealed cartons, with guarantees, at less 40% below listed prices. Also Portables and Midget Radio. Send 1½d. stamp for lists.—Radio Bargains, Dept. A.W., 261-3, Lichfield Road, Aston, Birmingham.

LOUDSPEAKER REPAIRS

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

L.S. REPAIR AND REWINDING SERVICE: 24-hour service. See below:—

REPAIRS to moving coil speakers a speciality. New cone assemblies fitted. Speech coils and fields wound or altered. Mains transformers, chokes, eliminators and vacuums repaired, prices quoted. Speaker transformers, Class "B" L.F. transformers and pick ups rewound at 4s. each, post free. Discount trade. Estimates free. Guaranteed satisfaction. **L.S. Repair Service**, 5, Balham Grove, London, S.W.12. 'Phone: Battersea 1321.

NEW LOUDSPEAKERS

3,000 SPEAKERS from 6/6 each, P.M. and energised 4in. to 14in. including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

CABINETS

A CABINET for Every Radio Purpose.

CONVERT Your Set into a Radiogram at Minimum Cost; surplus cabinets from noted makers under cost of manufacture (undrilled), 30/- upwards; motors at wholesale price.

UNDRILLED Table, console and loudspeaker cabinets from 4/6.

INSPECTION Invited; photos loaned to country customers.

H. L. SMITH and Co., Ltd., 289, Edgware Road, W.2. Tel.: Pad. 5891.

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FULL range of Transmitting Keys, Practice Sets, Oscillators, Recorders and other Radio Telegraph Apparatus, designed and manufactured by T. R. McElroy, World Champion Telegraphist. Absolutely first-class construction. Send 2d. for 60-page general catalogue.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

FULL range of British-made Tapping Keys, Practice Sets, Morse Recorders and Telegraph Sets. Apparatus designed and manufactured in England. Dynamos, Instruments and Laboratory apparatus.—Leslie Dixon Co., 218, Upper Thames Street, London, E.C.4.

SHORT-WAVE TRANSMITTERS

LARGEST range of Transmitters, Exciters and Speech Amplifiers. Sole Agents for famous HALLICRAFTERS productions. Transmitter models from £8 to £220. Full stock of components, including complete range of Eddystone Condensers, etc. 60-page catalogue 2d.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

COMMUNICATION RECEIVERS

FINEST selection in the country. Sole Agents for famous HALLICRAFTERS Receivers, ranging in price from £10 to £150. Attractive easy terms. Demonstrations at our London Showrooms, 60-page Catalogue post free 2d.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

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ECONOMY IN CONSTRUCTION — See Page 142

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Practical Wireless and PRACTICAL TELEVISION

3D.

EVERY WEDNESDAY

Oct. 28th, 1939.

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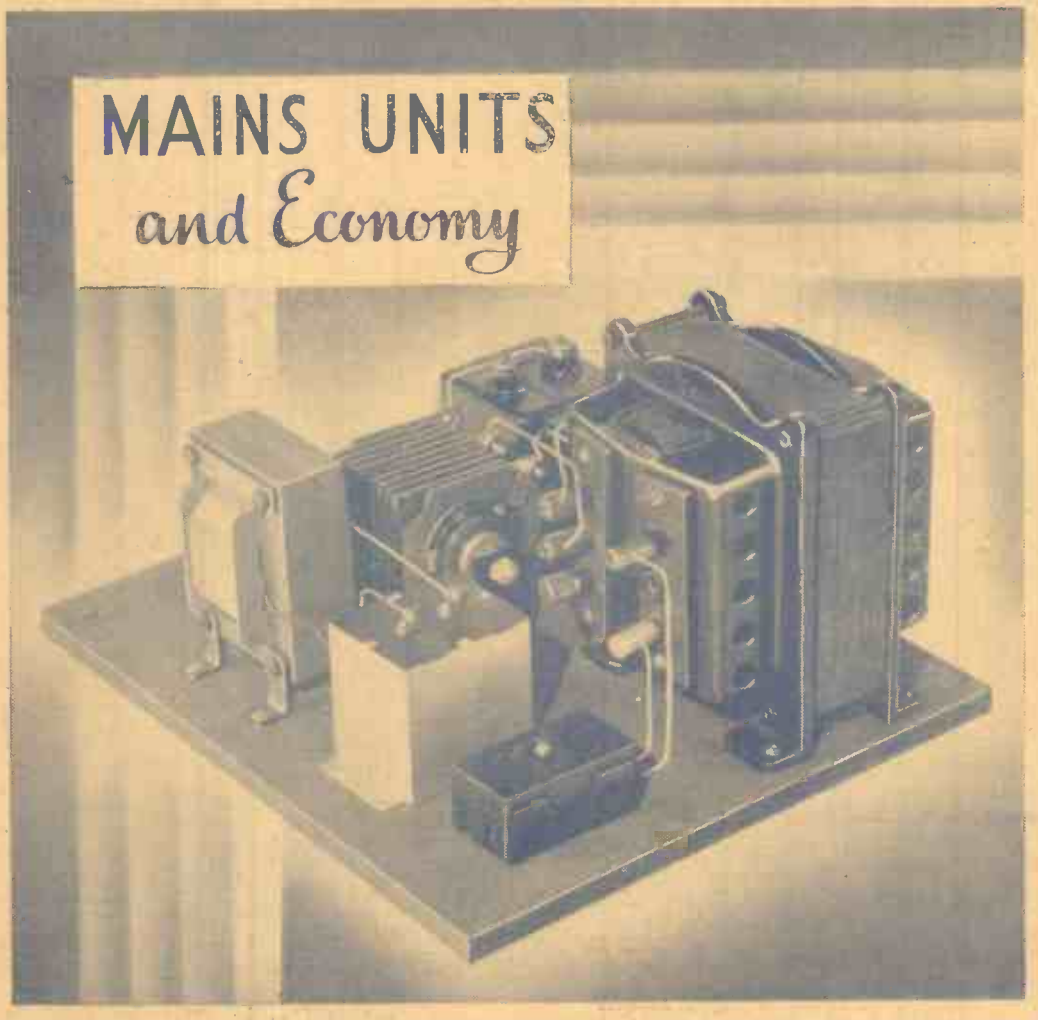

Practical and Wireless
★ PRACTICAL TELEVISION ★
EVERY WEDNESDAY
Vol. XV. No. 371. Oct. 28th, 1939.
EDITED BY
F. J. CAMM
Staff:
W. J. DELANEY, FRANK PRESTON,
H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Mains Units

THE battery eliminator, as it is so often called, does not now seem to have the popularity which it at one time attained. Of course, one argument against this type of H.T. supply is that if the mains are available one might just as well have a mains receiver and thereby obtain the increased efficiency and power which mains valves can give. But this necessitates a much greater expenditure than is needed for the acquisition of a small mains unit, and where economy is to be effected a small unit may prove more economical to maintain than standard H.T. batteries. A great deal depends upon the cost of electricity in the district, and in some cases upon whether it is operated from the lighting circuit or the power circuit—the two supplies being separately charged in most cases. The main features of the A.C. and the D.C. mains units are described in this issue, together with details as to the modification of certain types to obtain additional H.T. outputs, or to enable one type of unit to be used on mains of a type different from that for which it was designed. Where, however, the unit is enclosed in a sealed metal box, no attempt should be made to tamper with the inside unless it may be ascertained that in doing so no damage will be done to the wiring, and also that the maker's guarantee no longer applies.

Mr. Alfred Barker

THE B.B.C. announces that for the time being Mr. Alfred Barker will continue as one of its orchestral leaders in addition to leading the Hallé Orchestra. It will be recalled that Mr. Barker was to have left his present positions to take up work in London.

WLW Programmes Shift

TIME changes of several WLW-originated programmes have gone into effect with the addition of more network programmes to the station's schedule. With the return of Guy Lombardo via NBC at 9 p.m., E.S.T., each Friday, "Unsolved Mysteries," oldest detective drama on the air, moves to a new spot, Sundays at 4 p.m., E.S.T. The "American Parade" series will be heard in future on Tuesdays at 7.30 p.m., E.S.T. Formerly it was heard Mondays at 8 p.m., E.S.T., a spot now occupied by "Doctor I.Q.," NBC quiz programme, featuring Lew Valentine, former WLW staff member, as master of ceremonies. The 9 p.m., E.S.T., spot on Mondays presents Tommy Riggs, whose mythical Betty Lou was featured on WLW before she and her creator moved to NBC in New York. The cast also includes Freddy Rich and his orchestra, and David Ross, announcer.

"Summertime Concert," featuring Josef Cherniavsky and the WLW concert orchestra and previously heard at 4 p.m., E.S.T., each Sunday, is now scheduled at 9.30 p.m., E.S.T., the same day. A special performance will be fed to the Mutual network at 5 p.m., E.S.T., but will not be heard on WLW. The programme format, with its "Musical Chance of a Lifetime" for aspiring young soloists, remains the same. "Front Page Parade," news dramatisation, which was presented in the form of three fifteen-minute broadcasts weekly, has resumed as a weekly feature lasting a half-hour. It is now heard at 7 p.m., E.S.T., Fridays.

News commentaries by Michael Hinn, which started several weeks ago on Mondays, Wednesdays and Fridays at 6.15 p.m., E.S.T., will be aired also on Tuesdays, Thursdays and Saturdays.

The world of sports is covered for WLW listeners by two experts, Roger Baker, left, and Nixson Denton, who are heard Monday through Friday at 6 p.m., E.S.T. In addition to reporting news on the sports fronts, they interpret it from alternately serious and humorous viewpoints. Baker, formerly with a Buffalo, N.Y., station, joined the WLW staff this spring. Denton has been heard by Mid-west audiences for several years.

"Just Back"

THE B.B.C. announces that Philip Knowling from Bessarabia and Ronald Seth from Estonia inaugurated as from Sunday morning, October 15th, what, it is hoped, will be a series of broadcasts by people who have just returned from "countries in the news."

Knowling has just completed a cycling-trip through the territory about which he talked, and Ronald Seth, with his family, has just got back from Estonia.

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MUSICAL FREQUENCIES

Why it is Essential to Take Precautions to Obtain Good Reproduction of the High Notes in the Musical Scale

THIS article has been inspired by a chance remark overheard in a tube train, when a man was heard to say: "I think my set cuts off at about 6,000, but I hate violins and screechy instruments, anyway!" Should this gentleman read these lines, the writer craves his forgiveness, and pleads justification for using his words to introduce these notes.

Do not let us dwell on whether or not the violin is a screechy instrument, this is obviously a matter of opinion. The gentleman in the train has expressed his opinion, the writer has another and different opinion, and various readers will in turn also have, and are entitled to, their own views; but let us attack the implied suggestion that if a receiver cuts off at 6,000 cycles it will adequately handle those instruments whose fundamental notes are limited to the middle or lower end of the musical scale, or, better still, let us investigate this whole tangle of fundamentals and harmonics, of top cuts and base cuts: also, the portions of the musical scale required by various instruments for their faithful reproduction in the home of the listener. In passing, it may not be thought out of place to mention that any consideration of the audible frequency scale as applying to an individual is to some extent limited by physical factors within the ear of the person concerned, as, quite apart from the fact that there are many characteristics in hearing between one person and another, there are some, particularly people getting on in life, whose ears have a natural top cut, and for their especial needs it is obvious that there is no point in arranging for an amplifier and loudspeaker to handle these frequencies which bring about no response in their hearing.

Low Frequencies

Anybody who has heard the deep boom of the tympani would know that the fundamental note from these instruments is very low in the musical scale. Actually it is in the second octave from the bass end of the piano, but the incidental harmonics on which it depends for its characteristic tone extends well up towards 3,000 cycles. It should be thoroughly understood that these remarks do not refer to the actual range of notes obtainable from various instruments, but the harmonics which accompany the note, and which give it a characteristic individuality. The frequency range required by the bass drum is similar to that of the tympani, but the familiar small drum played with sticks and brushes, usually known as the "snare" drum, requires, rather surprisingly, the almost entire frequency band, starting way down at 100 cycles up to round about 10,000 cycles, i.e., over an octave above the top note on the piano. The double bass, 'cello, viola and violin take up between them a frequency band from 35 cycles to the upper limits of the human ear, say in the region of 14,000 cycles, which is nearly two octaves above the top note of the piano.

Above 5,000 Cycles

It is not intended to deal with each instrument individually, but it may be said that such instruments as the bass tuba, trombone, French horn, bass saxophone, bassoon, flute and the like can be faithfully accommodated where the loudspeaker and amplifier are incapable of reproducing above, say, 5,000 cycles, although such amplifier needs necessarily to reach down to 25 cycles, its characteristic response curve being flat to at least 50 cycles. Incidentally, it is common practice in America to make an amplifier dip violently at the 100-cycle mark to avoid excessive amplification of any mains hum that may be present. Where the curve rises again immediately below 100 cycles it is doubtful whether anybody would notice it. At the other end of the scale such instruments as the snare drum, referred to above, the soprano saxophone, clarinet, and particularly the oboe, require a reproducer capable of going up to at least 10,000 cycles, as all these instruments are capable of producing harmonics at a strength comparable to the fundamental note up in the regions of the upper limit of audibility. It is suggested, however, that as already intimated, 10,000 cycles is adequate for all practical considerations.

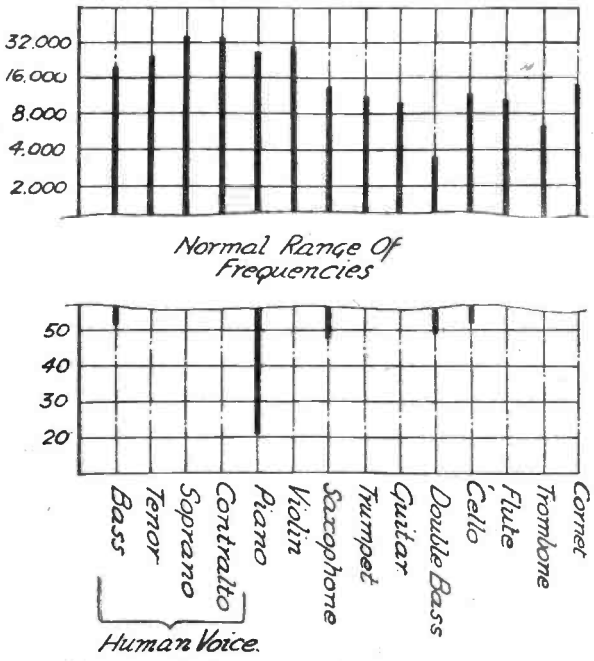


Diagram indicating the range of frequencies covered by instruments and human voices.

Acoustic Peculiarities

Listeners to plays will have noticed the very unconvincing noise which footsteps make on the radio. In fact, it will be noticed that it is common practice to-day to say, "Here comes so-and-so" before the footsteps are heard; otherwise it is doubtful if they would be recognised as such. The reason for this is astounding, the harmonics of such sounds extend up to the region of 10,000 cycles, and all the harmonics which characterise this particular sound are high. As the majority of sets (whether their owners care to admit it or not) start cutting off in the interest of selectivity at about 5,000 or 6,000 cycles, the reason is apparent why footsteps should sound so unreal. The same remarks apply to hand-clapping, as a distinct drop in the realism of this applause is noticeable in an amplifier that cuts off at 9,000 cycles. Here again this is undoubtedly the reason why so many people have remarked from time to time that hand-clapping on the radio sounds mechanical. It would be possible to go on almost indefinitely enumerating the peculiar requirements of various sections of sounds and noises, but the foregoing remarks are representative, and indicate not only various acoustic peculiarities which are in themselves interesting, but also the requirements of a radio reproducer, if faithful reproduction is aimed at. Many people no doubt prefer what is colloquially termed "soft tone," and unquestionably people are entitled to listen to such incomplete music if they so desire, but this is not true reproduction. Then again, investigation shows that the key clatter of wind instruments and the sucking noises of the brass instruments, and so on, are reproduced only by the very high frequencies, and it is again a matter of personal taste whether such noises should or should not be reproduced.

BETTER QUALITY FROM THE "HOME SERVICE"

Details of a Simple Battery Receiver Which Gives Good Reproduction, and Some Suggestions for Improving an Existing Receiver and Loudspeaker

By "THE EXPERIMENTERS"

ONE interesting effect of the present conditions is that listeners are beginning to be rather more critical of the quality of reproduction. One reason is, no doubt, that the radio is used for entertainment purposes to a greater extent to-day than ever before. Another is that there is no choice of programmes and therefore only the "local" station (it is not quite as "local" as before the war in many instances) is used. When the set is in use for many hours a day—partly for entertainment and partly so that no news bulletin is missed—any lack of quality is more easily detected. These conditions are an asset to the designer of a quality receiver, because he does not have to make an attempt to combine quality with selectivity and sensitivity.

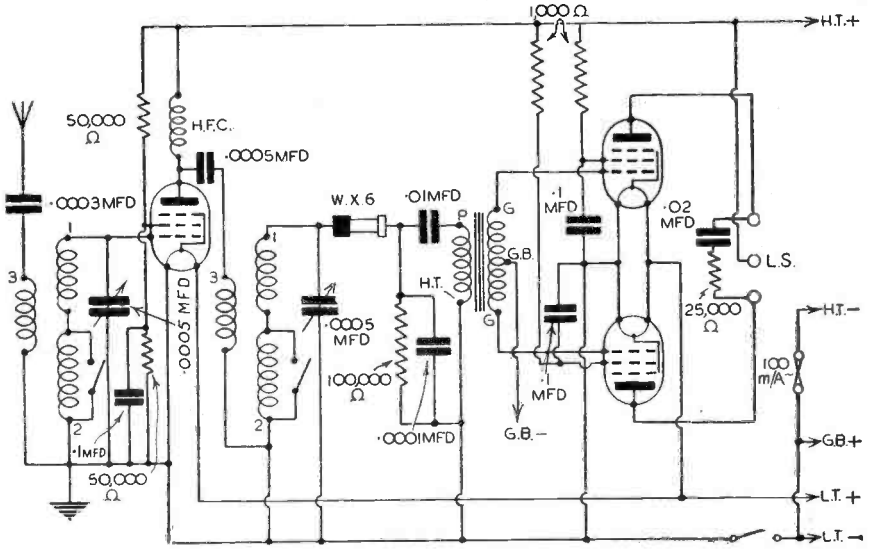


Fig. 1.—A good three-valve "semi-quality" circuit, using a Westector for detection.

Battery Operation

Because of the conditions referred to, there are probably many readers who will seriously consider the modification of the existing set, with a view to improving quality, whilst others might be inclined to re-model it, or even to make an entirely new one, perhaps in addition to the normal home set. For the benefit of people in this category a good circuit is given in Fig. 1. As will be seen, it is for battery operation. Most readers will prefer this, because there is always the chance that the mains supply might be temporarily disconnected and because a battery set can be used in rooms where a mains point is not available. It is not claimed that a receiver built to this circuit would give perfect reproduction, nor that it is the best "quality" circuit available. The object in drafting the circuit was to keep to a reasonably simple arrangement, to produce a set that can be operated at low current expenditure (especially L.T.), and that will give reproduction better than that of the average inexpensive battery receiver.

Modest H.T. Consumption

By using a screened pentode taking .1 amp. filament current in the H.F. stage, and by employing a couple of high-efficiency output pentodes having a filament consumption of .2 amp. each, the total drain on the accumulator is kept down to half an amp. This is no more than the current taken by a very simple three-valver of more conventional type. Current is saved, of course, by using a W.X.6 "Westector" as detector.

When a Cossor 210 S.P.T. valve is used in the first stage, with two Cossor 220 H.P.T. valves in the push-pull output stage, the current consumption can be kept down to about 8 mA., although for best results the total current would be about 12 mA. when employing a 120-volt high-tension battery. To work at the lower current it would be necessary to reduce the H.T. voltage to 100 or so or to increase the bias voltage applied to the two pentodes from 3 to 4.5 or 6 volts.

Brief Circuit Details

None of the components is critical, although the values should not vary very much from those indicated on the circuit. Coils can be of any available type, preferably having grid and aerial windings, and both can be of the kind primarily intended for aerial-circuit tuning, since reaction is not employed. Alternatively, of course, a single-wound coil could be used for the inter-valve position when an ordinary tuned-grid—instead of choke-capacity-fed tuned-transformer arrangement shown—should be adopted.

Both coils could well be home-made, as shown in Fig. 2. In this case they would cover the medium-waveband only; this is all that is required in most cases. If not screened, the coils should be mounted not less than 6in. apart and with their axes at right-angles. When using dual-range coils, a three-point switch could be employed for wave-changing. In either case, the tuning condenser could be of the two-gang type.

Push-Pull Output

The two pentodes in push-pull are fed through a standard push-pull transformer, which may be of the small and comparatively inexpensive type, in view of the fact that the primary winding does not have to carry any D.C. current. No output transformer is shown, since the transformer fitted to the speaker will probably have tappings for use after a push-pull stage. If would be possible to reduce current consumption still further by using a Q.P.P. transformer to feed the output valves, when the G.B.

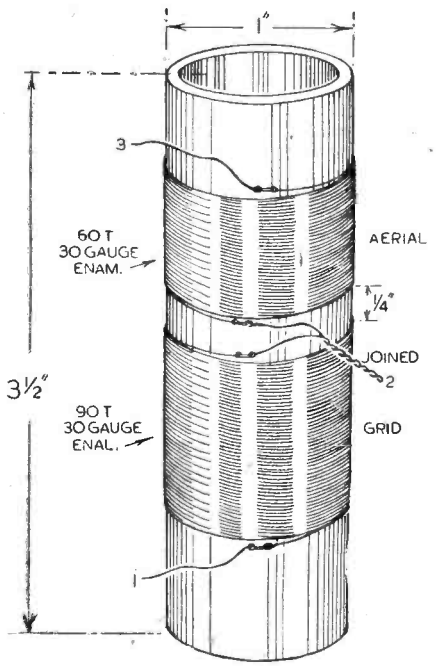


Fig. 2.—A suitable coil for use in the circuit shown in Fig. 1 when only medium-wave reception is required. Figures correspond to the connections shown in Fig. 1.

(Continued on next page)

BETTER QUALITY FROM THE "HOME SERVICE"

(*Continued from previous page*)

voltage could be increased to about 7.5 volts. In that case it would be better to replace the two 1,000-ohm fixed resistors used to feed the auxiliary grids by a 2,000-ohm potentiometer; the slider would be taken to H.T.+, the two ends being joined to the grids. The object in using the potentiometer is to "balance" the two valves, which is an important matter if the best results are to be obtained from the Q.P.P. circuit. As another alternative, the pentodes may be replaced by two small high-efficiency power valves similar to the Cossor 220 P.A. This would simplify the circuit to a certain extent, rendering unnecessary the auxiliary-grid feed resistors and by-pass condensers and also the fixed tone-control across the speaker, but there would be less amplification and a somewhat heavier consumption of H.T. current.

Improving "Quality"

For those who do not propose to rebuild the present receiver or make a new one there are various measures that can be taken to improve reproduction. In this respect it should be mentioned that the quality of the B.B.C transmissions is still not up to pre-war standard, although much better than they were immediately after war broke out, and continue to improve. No doubt they will be back to the original high standard very soon, if not by the time this article is in print.

One of the simplest methods of improving quality is by dispensing with reaction, which is not necessary when an H.F. stage precedes the detector. Another method is by increasing the H.T. voltage to the detector and by reducing the value of the grid leak to .25 or .5 megohm, and of the grid condenser to .0001 mfd. Such a change is often erroneously described as making the valve act as a power-grid detector; it does not do this, but it will often be found to have a satisfactory effect. When the detector anode circuit is not taken to a separate tapping on the H.T. battery, the voltage may be increased by using a decoupling resistor of lower value; incidentally, decoupling is not quite as important when the reaction circuit is cut out.

Reduced Selectivity

Reproduction can also be improved by making the receiver slightly less selective. This can be done by shorting-out the aerial-series condenser or by increasing its value. A corresponding method, which helps also to increase signal strength, is to use a longer aerial than before. When using some types of coil it is possible to increase the coupling between the primary and secondary windings by moving one winding closer to the other, by increasing the number of turns on the primary. Selectivity can also be reduced, and sensitivity increased, by dispensing with tappings for the aerial and grid connections. Just how far it is possible to go in reducing selectivity is largely dependent upon local conditions. In some parts of the country interference by foreign transmissions might be troublesome if selectivity were reduced to any marked extent, while in others very flat tuning will suffice to bring in the B.B.C. Home Service free from interference.

As many readers are aware, reproduction can often be improved by slightly reducing the G.B. applied to the output valve, or even by obtaining a more accurate control of G.B. voltage by connecting a potentiometer across the battery and taking the centre terminal to the G.B. — lead. If this is done a switch must be provided to break the potentiometer circuit when the set is switched off.

Simple Tone Control

It is often found that a form of tone control is valuable when the set is widely used for both speech and music, since a slightly more "mellow" effect is often better for speech. The tone control might consist of the conventional .01 mfd. condenser in series with a 25,000 ohm variable resistor between the speaker terminals or between the anode of the output valve and the earth line. Another method which might be better in some circumstances, and which has the advantage of simplicity, is to connect a .0005 mfd. bakelite dielectric variable condenser between the grid of the first L.F. valve and earth. After a few tests it will be possible to find at which setting of the control the most pleasing reproduction is obtained on speech, string music, and "brass"; marks could then be made on the panel to show the appropriate positions on the control knob pointer.

Sometimes it is found that better results are obtained by wiring the resistor-condenser type of tone control across the primary winding of the first L.F. transformer or between the "anode" end of the transformer and earth.

Reproduction can nearly always be improved when the speaker unit is mounted in a small cabinet by mounting it instead on a 3ft. square baffle board made from 9mm. plywood and with a sheet of soft cardboard glued to the back. This is best mounted in the corner of the room, where it gives excellent distribution of sound.

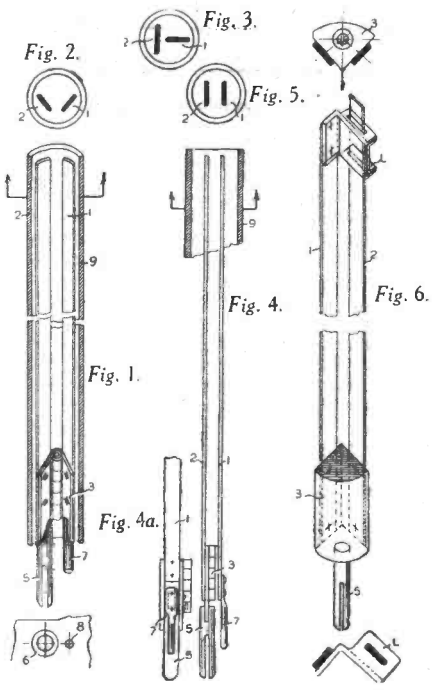
A Collapsible Aerial

FOR small portable sets aerials are required which must have a certain rigidity when in use, as they are not suspended but have to be fitted to the set, for instance, in the form of a self-supporting rod aerial. For transport purposes such aerials have to be collapsible so that they require as little space as possible, and can be easily packed. In the past, telescopic tubes have been used for this purpose which have, however, certain disadvantages, in so far as they are rather sensitive when they are knocked about, or handled roughly, so that their use with portable sets was only possible within limits. The apparatus to be described has none of these disadvantages.

Constructional Details

Figure 1 shows an aerial in which the two elastic metal bands 1 and 2, which may consist of steel, are connected at one end by a hinge 3. One steel band is provided at its lower end with a pin 5 which is used to plug the aerial into the plug socket 6 of the small transmitter or receiver in conjunction with which it has to be used. The other steel band is provided with an arresting pin 7 which fits into a corresponding socket in the set 8. The two sockets 6 and 8 are arranged in such distance from each other that when the plug pins 5 and 7 are inserted into the sockets, the two steel bands form a right-angle with each other such as is shown in Fig. 2. The whole aerial is embedded in a tube of elastic insulating material, for instance, a rubber tube 9 of sufficient width.

Fig. 3 shows a modification of the aerial in which the centre of rotation of the hinge is arranged in the centre of one steel band



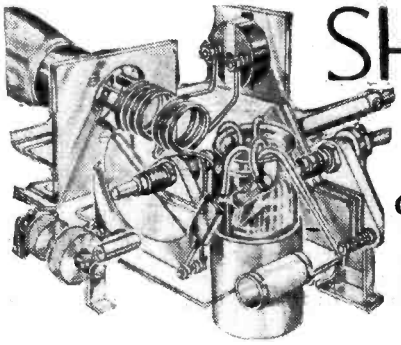
Details of the collapsible aerial referred to in the accompanying paragraphs.

so that the two steel bands are T-shaped under operating conditions.

Fig. 4 shows the aerial in a condition ready for dispatch. The hinge 3 is folded together so that the two steel bands 1 and 2 are parallel to each other, as will be seen in the cross-section of Fig. 5. In this position the aerial can be easily rolled together and requires very little space in this condition. In view of the fact that the aerial is enclosed in a rubber tube, it is possible for the two steel bands to give way so that under a strong breaking stress the steel bands may evade, while the rubber tube is deformed so that the aerial is bent without being destroyed. As soon as the breaking stress ceases the aerial returns into its original position. This type of aerial is not limited to the described example, but may be applied in all such cases where a conductor has to be used either in rigid and relatively unelastic condition, or in a flexible condition.

A Modification

A further form of the aerial is shown in Fig. 6, in which no hinges are used, and the two rectangularly arranged steel bands 1 and 2 are firmly connected with a block 3 at which the plug pin 5 is arranged. A guide piece 4 keeps the two steel bands at the upper end in their rectangular position. This guide piece is firmly connected, for instance, by soldering or riveting with the one steel band 1 whereas the other steel band 2 is movable in slots, so that it can give way when the aerial is rolled together. This kind of aerial may also be rolled together, in view of the fact that the rectangularly arranged steel bands give way, so that only a little space is required. The two steel bands get into a parallel position when the aerial is rolled together.



SHORT-WAVE SECTION

CALIBRATING A S.W. RECEIVER

To Assist in Station Searching, or to Tune-in Known Stations, a Calibrated Receiver is Essential. The Various Methods of Doing This are Given in This Article.

THE average home-made receiver utilises an arbitrarily-marked tuning scale, due generally to the difficulty of obtaining coils of a known inductance value and to the stray circuit capacities introduced by individual designs. Consequently, when it is desired to tune-in a station of known frequency it may be difficult to find the station unless one has previously heard a station on a wavelength very close to the required setting. If this has been done, then the receiver has been calibrated to a certain extent, and thus calibration merely consists in the identification of certain tuning points on the scale, by means of which the tuned circuits may be set to any given point.

As an alternative to this method of calibration a special tuned device known as a wavemeter may be used, and this may be calibrated and used in conjunction with the receiver. Each listener will have his own ideas as to which of these methods is most suitable for his particular case, but it should be remembered that in the former case, changes in the coil or circuit may completely upset the calibrations which have been obtained, whilst the wavemeter will hold good for any type of receiver and may be regarded, therefore, as a piece of standard equipment for installation along with test meters or other incidental apparatus.

With the first scheme, however, no additional outlay is necessary, and for this reason it will appeal to the majority of listeners. There are, however, various snags associated with it.

If the receiver is a battery-operated, detector-low-frequency combination, a fair measure of accuracy may be obtained. The application of reaction, however, is apt to call for a slight readjustment in tuning, and this brings to mind the fact that H.T. voltages, when varied, also affect tuning. To obtain at least a fair standard of accuracy it is most desirable to check voltages and adhere to them.

It is appreciated that when a screen-grid valve is used as a detector, the relations between the plate and screen-grid voltages are critical, and careful adjustment is necessary in order to obtain smooth reaction and freedom from dead spots. From the foregoing it will be realised that direct calibration, whilst undoubtedly an advantage, must be carefully carried out in order to be a real help and not a hindrance when adapted to simple apparatus.

Applications

Now let us consider the application of this principle to mains, or battery-operated T.R.F. receivers in which one or more stages of screen-grid high, or radio frequency, are employed together with the detector-volume control.

The volume control is a variable potentiometer, which regulates or controls the screen voltage of the S.G. H.F. valves. When tuning for weak signals, sensitivity may be increased by reducing the screen voltage and readjusting the reaction control. These adjustments, however, cause a variation in dial readings, and it will be understood that dial readings will vary according to whether a given transmission is received at maximum or minimum volume. Low and high sensitivity respectively.

Careful consideration of the various points outlined in the case of T.R.F. receivers clearly indicate that accurate calibration under varying conditions of operation, that is technical as well as climatic conditions, is more or less impossible, using the direct dial reading to graph method.

We are aware that manufacturers calibrate their single control superheterodynes

One of the new McMichael all-wave superhets with push-button tuning.

directly, i.e., the tuning scale is marked in frequencies, wavelengths or megacycles. Viewed from the constructors' point of view, this is not a difficult undertaking, but for various reasons cannot be adopted by home constructors. In any case, a high standard of accuracy is difficult to obtain, errors of .05 megacycles on the six-megacycles band are not unknown.

This discrepancy is indeed small, nevertheless, it calls for correction. When tuning, the operator must take this error into account, in addition to similar ones on other bands. Thus direct calibration is not dead accurate, but is simply a means whereby an approximate idea of wavelength may be obtained without reference to graphs.

One thing must not be overlooked, namely, that the usefulness of signal measuring and checking apparatus is governed by the accuracy of its calibration.

Independent Measuring Apparatus

With this fact in mind, together with a definite and practical understanding of amateur working conditions and individual limitations, it is clear that in order to achieve a reasonable standard of accuracy with reference to frequency measurement, the most satisfactory thing to do is to build independent measuring apparatus, check up on crystal or other drive-controlled transmitters of known accuracy, and carefully plot suitable tuning graphs from the data thus obtained.

The triode and dynatron type wavemeters, are gaining popularity. We do not propose to comment upon the comparative advantages of the respective types, but merely to point out to those who are interested, that wavemeters of these types are ideal instruments for use in conjunction with modern short and all-wave receivers

Irrespective of circuit considerations, the main feature is that a source of constant and modulated signal generation is always to hand, which apart from frequency measuring, has many other applications.

Various factors must, however, be taken into consideration when constructing this type of wavemeter. For example, the valve used must be a good one, and new for preference. An old, out-of-date valve on hand is no excuse for undertaking the construction of an oscillating wavemeter. When emission is faulty, calibration is difficult, inaccurate, and consequently useless.

The tuning dial and associated variable condenser must be of rigid construction and smooth in operation. Mechanical and electrical efficiency are most desirable, and special short wave types should be used. Internal wiring should be carried out with heavy gauge wire, and thus assure that accurate calibration will be maintained within reasonable limits.

Tuning Coil Windings

Tuning coils may be wound on standard commercial formers, or alternatively, on valve bases or Paxolin formers. Windings may be spaced or close wound. The main point is to avoid any chance of coil winding being displaced due to constant handling.

Low-loss principles are quite unnecessary in wavemeter coil construction, and there is absolutely nothing against close winding of turns followed by the application of two or more coats of shellac varnish, in order to avoid displacement of windings.

Screening

Modern practice in wavemeter design favours complete screening, which is to be strongly recommended. Even though completely screened, a strong sharply-tuned signal may be obtained, using but a comparatively low plate voltage on the plate of a triode valve. About 16 volts, and in some instances less, is all that is necessary, but this depends upon the relation of one winding to the other. One quarter-inch between grid and reaction is ample. A standard type power valve is also quite suitable, other types, of course, may be used if of comparatively low impedance.

A sheet metal or foil-lined cabinet can be made at low cost, and whilst it is common practice to include the coils inside, along with the other components, the writer favours the practice of mounting the coil base on top of the cabinet, and screening the coil with a standard screening can. If this procedure is adopted, the cabinet can be closed up once and for all, and thus the chances of altering the original calibration due to the displacement of internal wiring is avoided. Batteries may be accommodated in a separate compartment or clipped on the back of the cabinet.

PRACTICAL TELEVISION

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Neon Lamp Effects

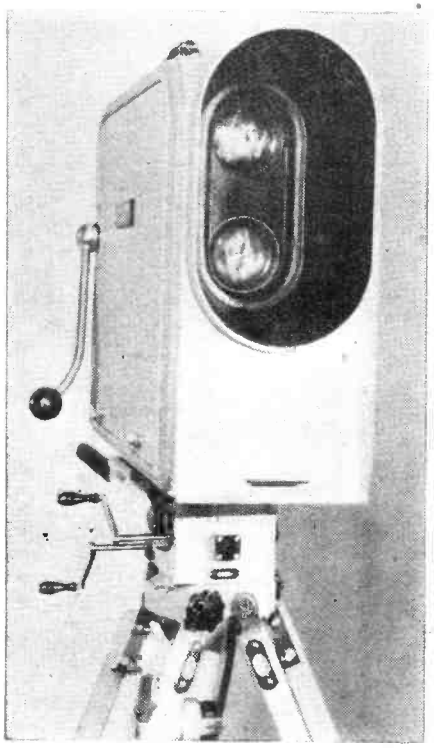
THERE are many occasions when it is found desirable to use a neon lamp or tube as a simple oscillator. In the basic circuit a fixed or variable condenser is charged through a high resistance, and when it has reached a certain voltage this same condenser is discharged rapidly by the ionisation action of the neon lamp connected across its terminals. The idea is by no means a new one, and as a simple piece of laboratory equipment has found divers applications for bridge measurements where an oscillator whose frequency could be adjusted was necessary, while due to the fairly close approach of the oscillations to a saw-tooth waveform, this same form of oscillator has done service as a time-base generator, being connected to the deflector plates of an electrostatically-operated cathode-ray tube. There is a tendency for an oscillator of this nature to be slightly erratic in its functioning and also non-linear, but it is only of comparatively recent date that this lack of uniformity has at least been partly traceable to a photo-electric effect which is exhibited by the neon tube under certain conditions. If the apparatus is used in such a position that the neon lamp is exposed to increasing amounts of light, then the frequency of the oscillations will increase, and this increase is found to exhibit a measure of proportionality to the amount of light which falls on the lamp. It has been shown by experiment that if the voltage across the lamp is maintained at a value which is a little less than that necessary for the lamp to strike, then it will exhibit photo-electric properties equal to that of a rather insensitive photo-electric cell. When used in oscillator apparatus, therefore, constancy of operation is achieved if the level of illumination in the neighbourhood of the lamp is kept steady, or it is a better plan to coat the glass envelope of the lamp with some opaque material so that it is immune from the light changes.

American Receiver Design

IN spite of the fact that before producing television receivers on any large scale the American industry had ample opportunity of examining the latest models produced for the English market, it would appear that on the question of controls there has been very little attempt at simplification in the operation of the set as has taken place here. This may be due to the fact that the American set-owner is more at home with a broadcast set which veritably bristles with knobs, but in any case it brings about a measure of complication that must react on the final quality of the observed picture, since the average user has not yet been educated into all the mysteries of television reception. For example, in one set it is found that there is a total of sixteen controls and the nomenclature used to describe each one's function is in many cases widely different from that which has become more or less standardised English practice. The only similarity or at least common practice is the use of the terms "focus," "contrast" and "brightness." In the case of the sixteen-control set referred to, it was said that nine of them required only occasional adjustment, but the remaining seven needed re-setting daily. When readers recall that the "pre-war" practice of English viewing only required the set to be switched on with an occasional contrast adjustment, it will be seen that the Americans have a lot of leeway to make up on this aspect of television reception, an aspect which must be regarded of extreme importance if consistently good results are to be obtained without annoying multitudinous adjustments.

An Interesting Experiment

THE immediate cessation of the B.B.C. television service on the outbreak of war came as a bitter blow to all those families who had installed receiving sets



A storage type television camera as used by the Italians.

in their homes and taken advantage of the entertaining programmes radiated from Alexandra Palace. As far as Europe is concerned the only known signals now being radiated are those provided by the equipment at Monte Mario, Rome. Although far distant it has been established that in certain parts of the country, particularly on high ground, the signals have been received with sufficient strength to enable the cathode ray tube to be modulated. There are certain differences in the nature of the signal that must be allowed for. Intensity modulation is employed and the signal direction is the same as the B.B.C., that is to say an increase in modulation corresponds to an increase in picture brightness. There is a slight difference in the percentage of the modulation allocated to the synchronising pulses, but 50 frames per second interlaced to give 25 pictures per second is identical, and the main feature to be catered for is the difference of line definition, namely, 441 lines in lieu of 405. In many television receivers it is possible to increase the line speed of the time-base generator to take cognisance of this change, while in addition since the carrier frequency is not yet definitely settled it will also be necessary to change this slightly from the British standard of 45 megacycles for vision. Where these controls are available for individual adjustment, and still better where there is a reflector aerial capable of being beamed in the direction of Rome, the experimenter can make an effort to pick up the Rome transmissions. It is easily possible to recognise the station for the caption card reads EIAR, TRASMISSIONI, SPERIMENTALI, RADIOVISIONE. The camera employed for transmission purposes by the Italians in their studio is shown in the accompanying illustration. It incorporates a modern storage tube based on the Iconoscope principles and is provided with the usual dolly truck facilities, panning head handle and adjustments. Two lenses are used, one mounted above the other and operated by a single control. One lens focuses the scene to be televised on to the mosaic signal plate in the usual way, while the second lens focuses the same scene on to an observation plate at the rear of the camera housing, so that the camera man can be sure of keeping the picture in exact focus and within the plate area limits.

Film Testing

THE suitability or otherwise of films for transmission by television in the normal service of the radiated signals has always been a problem requiring careful attention. If prints are used indiscriminately, then the pictures observed will exhibit an inadequate contrast range, while any sudden light changes will bring about those annoying flares which characterise the use of such material. The Americans were quick to recognise this feature, and since film matter is employed wherever possible it was found essential to develop some method whereby the merits or demerits of motion-picture prints could be judged carefully before a decision was made to include the material in one or more programmes. The R.C.A. have therefore produced a simplified version of transmitter and receiver, for it was realised that the only satisfactory way to carry out the examination was to make observations under conditions approaching an actual television broadcast. The apparatus is compact and portable, and one synchronising pulse-generator feeds both the camera and receiver. In general terms the best class film designed for cinema projection purposes is satisfactory for television, but any scenes having very dark backgrounds should be avoided. Where possible close-ups should be generously interspersed with long shots, for it is necessary to take into account the limits of resolution of present-

(Continued in column 3, page 136.)

ON YOUR WAVELENGTH

By Thermion

The Bright Spot

G. S. U. of Southampton, otherwise 2HCD, expresses a view typical of some hundreds I have received since war commenced. I will, therefore, allow him to speak for the rest of my correspondents. This is what he says, apropos our policy of carrying on during the war. After congratulating us on being the only weekly technical journal he continues: "Wednesday to all wireless fans is the one bright spot in the week, and it is quite a treat to us to know that we can continue to get practical information concerning our hobby. Although not in the Forces, numbers of readers must be, like myself, unable to see our homes for any length of time, or to get busy in our wireless dens." It is very true that many thousands of readers in and out of the Forces are separated from their homes. PRACTICAL WIRELESS, however, links them with a common interest.

A Hint About Fading

THE same reader offers a hint to those suffering from the effects of fading on the Home Service stations. He has quite cured the blasting effects on his all-wave A.C. model by erecting a 33ft. long Windom with the tapping at 11ft. The height is roughly 15ft. and the aerial itself is horizontal. It runs east to west with the tapping on the east end coming off at right angles.

Wanted—Midget Short-waver

I HAVE received a request from N. O. F. for the name of a firm that will provide him with a short-wave midget receiver, or even a crystal set, which he can use whilst he is in the Army. Where he is located wireless sets are not. The military authorities do not encourage soldiers to take lumpy kit about with them. I therefore invite readers to help another on active service. If they have experimented with any tiny pocket receivers, perhaps they will be good enough to send the details along, and I will forward them to N. O. F.

The I.R.E. and National Service

THE I.R.E. (not I.R.A.) are the initials of the British Institution of Radio Engineers. The general council of this institution has been devoting time to devising methods whereby their membership and the facilities of the institution might be utilised for national service work. The President, Sir Arrol Moir, has made suggestions that have been favourably received by the War Office. In these discussions and negotiations it has been borne in mind that radio engineers over 30 years of age are scheduled in the list of reserved occupations. From the letters received from members, however, it is apparent that a very large number of men below this age, and a number above the age, are anxious to take part in national service work. The institution has now been officially requested to compile a register which is not confined to members of the institution, for they have been asked by the authorities to incorporate on the register as many interested and qualified radio engineers as possible.

It has been decided to continue holding the examinations conducted by the institution and the next Associate Membership and Radio Servicing Certification Examinations will be held on November 18th next, and provisional arrangements have been made for the holding of both examinations on May 18th, 1940. Candidates who wish to take the Associate Membership examination must submit a completed form for the Council's consideration, since election depends on practical, as well as theoretical knowledge. The approval on an application form of membership is, therefore, a necessary preliminary to be given permission to sit for the examination. Exemption from the examination may only be granted to applicants who have had responsible experience, and extensive training in radio engineering, and who have passed a recognised examination. The existing syllabus of the Associate Membership Examination will continue until May, 1941, for students registered prior to May 1st, 1940. Further details regarding the activities and membership of the institution are given in a booklet available free to readers from the British Institution of Radio Engineers, Duke Street House, Duke Street, London, W.1.

I invite readers with the necessary qualifications to support this scheme. As a matter of fact I do not subscribe to the system of reserving people in particular trades according to their age. I know many extremely smart youngsters of 20 who are far more knowledgeable and practical than some over the age of 30. Age will never be an index of knowledge and experience. It ought to be, but there are many who can crowd into a couple of years, because of a quicker brain, and a more receptive and retentive mind, the experience which some may take ten years to accumulate. I believe that in all these reserved occupations ability should come before age. During the last war conscription took some thousands of skilled people from the workshops. A few months later they were brought back. In this war we have made the same mistake of calling up skilled people, for I see that 50,000 of them are being sent back from the Army to the workshop.

Battery Valves

I WONDER how long it will be before the economy type of valve operating with a battery-type filament will be available to the home-constructor? These valves, as you probably remember, enable very neat portables to be built up as a single dry-cell takes the place of the usual accumulator. Special batteries have already been produced by various firms, in which the H.T. and L.T. are combined, and these are readily available. Unfortunately, however, only one or two firms have been able to obtain the valves and have produced special receivers and portables. Judging by my post-bag many constructors are interested in this new type of valve and have looked in vain for an announcement concerning their general release.

"Carry On"

APROPOS my first paragraph on this page, I have received the following lines from our old friend "Torch":

We'll carry on! The war shan't beat us!
We only ask that you'll respond
And by a little wise precaution
Will help preserve the happy bond
That binds us with our many thousand readers
In Britain and the lands across the sea,
The brotherhood of radio knows no frontiers.
The pathway of the ether still is free.
How can you help us? Why, the answer's simple!
Just place your order definite and firm,
Make sure on Wednesday mornings of your copy,
And non-delivery shall never make you squirm.
'Tis "dogged does it" when conditions worsen,
And "sees it through" until the trouble's gone
We hear again the cry of "Stick it, Jerry."
You bet we will—we mean to carry on!

European News Broadcasts from WLW

STATION WLW (Cincinnati) will remain on the air 24 hours a day to bring European news when American press associations and networks indicate their plans to function past the normal time, James D. Shouse, vice-president of the Crosley Corporation in charge of broadcasting, announced recently.

During the time of the European crisis and its culmination in warfare, WLW stayed on the air constantly. The cost of the extra work involved, together with commercial broadcast cancellations for war news, approximated $25,000.

Mr. Shouse also announced a policy to govern references to the war on commercial programmes. Under the terms of this policy, extreme caution must be exercised in making such allusions on sponsored programmes, when the intent of the reference is to promote a commercial product. It is also interesting to note that the functions of WLWO, Crosley-operated international station in Cincinnati, may be of increasing importance while war lasts. WLWO, formerly known as W8XAL, is scheduled to shift from 10,000 to 50,000 watts this autumn, and will have access to six different frequencies.

The new station will use two transmitters, enabling engineers to change from one frequency to another without loss of time. A directional beam antenna will provide a signal strength of approximately 600,000 watts, the most powerful in the world.

Comment, Chat and Criticism

Programme Music

Some of the Best Music in this Class is Discussed by Our Music Critic, Maurice Reeve

THE opposite class of music to that discussed last week is programme music, music suggested or inspired by an impression, incident, emotional experience, a scene in nature, or a work of art, and the subject of which is not left to the imagination, as in Beethoven's so-called Moonlight Sonata, but is set out in a title at the head.

It stands to reason that such music covers the widest range of feeling, and, in quality, passes from the sublime to the ridiculous. Ranging from "Parsifal" and "L'après-midi d'un faune" to "Her Golden Hair hung down her Back" and "The Whistler and his Dog," it cannot be said, as with absolute music, to always be inspired by the loftiest thought and emotion. For no matter how small and insignificant a piece of absolute music may seem—as in the case, say, of a Bach two-part invention, its creation was at least disinterested. But, although frequently debased and rendered ignoble in profane hands, programme music contains many glorious works. And in surveying the enormous territory it covers in its journeys, our thoughts would naturally first turn to opera.

Opera

In opera, of course, programme music reaches its greatest heights, and in opera it has recorded its noblest triumphs. Never at a loss for a *raison d'être*, it can, during the course of one single work, seek inspiration from a hundred different sources. As the story unfolds, it can produce works which take on the character and individuality of separately created pieces, as any one familiar with the Wagner nights at the Promenade Concerts will know. "Siegfried's Journey to the Rhine," or "The Ride of the Valkyries," are known almost note for note by scores of people who have never been to the opera in their lives.

"Motifs" or "Motto Themes"

At the same time as the libretto of an opera deals with a definite story, with the whole plot under review by the author at any given moment, so should the music take on a character throughout its length, suitable to the character of the story it sets out to illustrate, although it will be constantly changing and alternating in mood and tempo as the various scenes are enacted. This has reached the highest state of perfection in the works of Wagner which, by the way, are "music dramas" and not "operas," in the Verdi or Rossini meaning of the word. By the magical use of "motifs" or "motto themes," introduced every time a given character steps into the scene or an emotional or spiritual experience enters the story, Wagner unfolds his story in his music with as great a realism and fidelity as he does in his plots. Hence their title "music dramas," and the reason why excerpts from them are so adored in the concert where, although divorced from all contacts with the realities of the stage and the spoken word, the meaning of the music is equally vivid when on its own. This is programme music at his highest pitch of perfection. No scenery, costume or libretto are needed to help us understand the story conveyed by the music, so powerful is its power of suggestion. Out of a legion of "motifs" I need only mention such famous ones as the "Grail" theme in Parsifal, Siegfried's Magic Horn, or the Fire Music motto. Sometimes only a few notes of it are sounded, but they are amply sufficient to paint the whole scene for us. It is going on the whole time the story is being told, the one being the complement of the other.

Songs of Schubert

Song comes next. Here again, though in a microscopic form of comparison, a composer has a rich field for using music to illustrate definite meaning, and paint pictures or create illusion. We need not wander from the scenes of Schubert to see this art carried to perfection. By the merest suggestion he can create a mood for the background to the poem, whether it be the rustic tranquillity of "The Trout" and "Whither," or the tempestuous passion of "The Erl King" or "Impatience." In each and every case the music strikes the mood of the words and expresses their meaning in a matchless way. Confirmation of this can be obtained by listening to the better transcriptions by Liszt or Godowsky, for piano solo, where, as with Wagner in the concert room, a little story is unfolded by the music without any aid from poet or vocalist. All we need is the title. This is the world of imagery, a dream world, which only the abstract language of music can reveal. It is music's divine gift to be able to blend its tones and arrange their sequences so that they convey a meaning just as potent and convincing as a painter's colours or a poet's words, at the same time as they leave that margin for our own contemplation to roam in.

Beethoven's Pastoral Symphony

We can all see a pastoral scene any time we care to go into the country and look at one. We can see a representation of one on canvas by popping into an art gallery and viewing any one of a hundred, from Constable or Watteau onwards. But only Beethoven, or a worker in the same medium, can bring one before our gaze just as faithfully and forcefully but without presenting us with the actual mundane reality which we may or may not like, according to the example put before us. The wonder and the magic of Beethoven's countryside (the Pastoral Symphony) have never yet been disputed, but it is also the countryside of our own choice, to fashion to our own pattern and to browse in at our own pleasure. Beethoven stimulates a train of thought in our minds—we do the rest. That is music's miracle, as exemplified in the finest samples of programme music.

Imaginative Music

Then we have the great masterpieces of imaginative music, such as those by Debussy, Richard Strauss, Stravinsky, and many others—all of which have Beethoven's Pastoral Symphony and earlier masterpieces as prototypes. These works might be classed as operatic in inspiration inasmuch as that they tell a story which might well have been used as the subject of an opera libretto but which stand on their own and rely entirely upon their own powers of description. Strauss's picture of Don Quixote tilting at the mill, and the humorous capers of Sancho Panza are so realistically drawn in tone colours as to render backcloths and librettos superfluous, so far as those adjuncts are needed in the story telling. Although such sound effects as the braying of a donkey and thunder are not too difficult to portray realistically, such human emotions as love or hate, and such natural phenomena as sunshine and shadow, are; and they require the utmost skill of harmonic blending and tonal nuance before they can convince the listener that they are what they are meant to be. When Mr. Newman said that Debussy must have written his famous "Gardens in the Rain" whilst standing under an umbrella, he was paying tribute to the genius of one of the greatest tone painters of all time. Debussy achieved this art to as great a degree of skill as Wagner himself, though he painted on a much smaller canvas. I will conclude these two discussions with some definitive remarks next week.

PRACTICAL TELEVISION

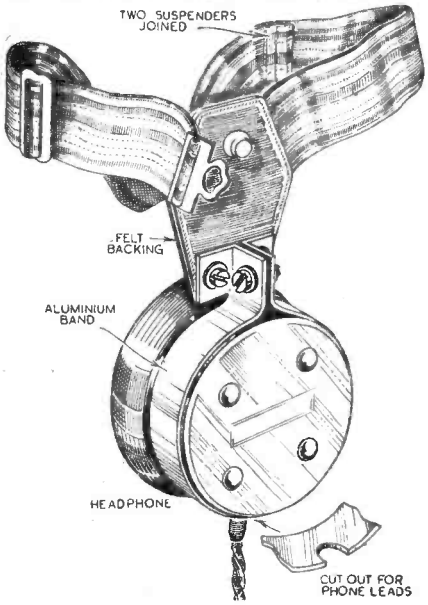
(Continued from page 134.)

day television standards. From tests already undertaken it would seem that any colour film photographed from real life gives a reasonable television result but quite often difficulties are experienced when coloured cartoons are used. The value of these R.C.A. tests will become evident in the announcement made recently by the National Broadcasting Company of America to the effect that they are planning an extensive series of programmes bearing on the war. This has been done with the idea of stimulating sales, which so far have been most disappointing, and it is intended to let the broadcasts deal with the economic background, the inner meaning of the struggle and the significance which can be applied to strategic military moves. Not only will maps be used, but it is the company's avowed intention of exploiting to the full motion-picture sequences specially selected to show the nature of the country where war operations are being carried out and the character of the people engaged in the struggle. By making the most of this opportunity the industry hopes to increase the number of viewers very materially, and so establish the service as a vital factor for the provision of world news in the home.

Practical Hints

A Novel Earphone Band

I WEAR headphones a great deal and I was desirous of hearing anyone speak without having to remove the phones, and also to be able to lie on my side in bed without the metal headband proving uncomfortable. Having in my possession a single ear-piece I hit upon the following idea, which may be of interest to other readers. I obtained a cheap pair of black sock suspenders and removed the elastic from one, and cut the elastic in the other. I then inserted the piece of elastic obtained from the first suspender in the break, making one large band complete with fastener and means to adjust the size for the head. The ear-piece I fixed to the leather by means of two small nuts and bolts through an aluminium band fixed around the ear piece, as shown in the sketch. Washers are placed on the bolts to prevent them being pulled through the leather, and a small piece of felt is glued on the inside over the bolt heads. The whole assembly is neat in appearance and serves its purpose quite well.—T. LEWIS (Sully, Glam).

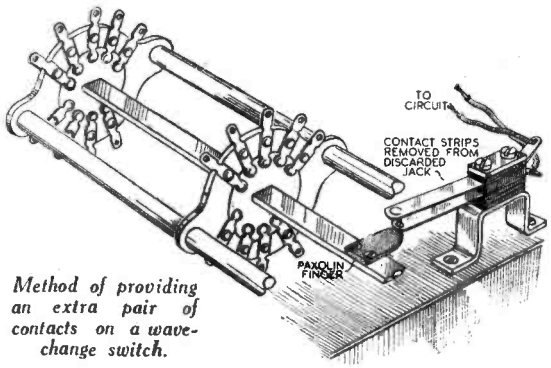


A novel earphone band for ensuring comfortable listening while in bed.

A Waveband-Switch Improvement

RECENTLY I found it necessary in my "all-wave" receiver to have an extra pair of contacts brought into circuit on the long-wave band in order to short-circuit a component out of action which was not required in this particular band.

It was not possible to add another wafer to the wave-change switch, so use was made of an old jack. The two contacts were mounted on a brass strip bolted to the chassis, and a small paxolin "finger" was likewise bolted to the operating rod of the switch in such a manner that the contacts were closed on the jack when the operating rod reached the limit of its movement. The accompanying diagram "explains" the idea in pictorial form.—R. A. COATES (Whitby).



Method of providing an extra pair of contacts on a wave-change switch.

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Practical Hints." DO NOT enclose Queries with your hints.

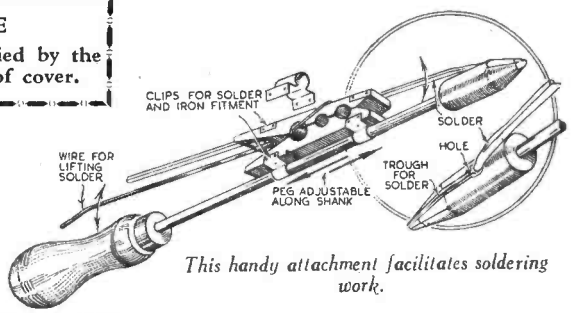
SPECIAL NOTICE

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

A Dodge to Facilitate Soldering

TO facilitate soldering, I devised the simple dodge illustrated in the accompanying sketch. While holding the work to be soldered in one hand, and the iron in the other, solder can be applied without taking the iron away from joint.

All that is needed is an ordinary spring clothes peg, a piece of stiff wire and some pieces of thin strip brass. Assemble these parts according to the sketch and then with a drill make a shallow hole in centre of one side of the iron, and from this file a small groove to the tip along which solder can run.—T. R. GREGORY (Sherborne).



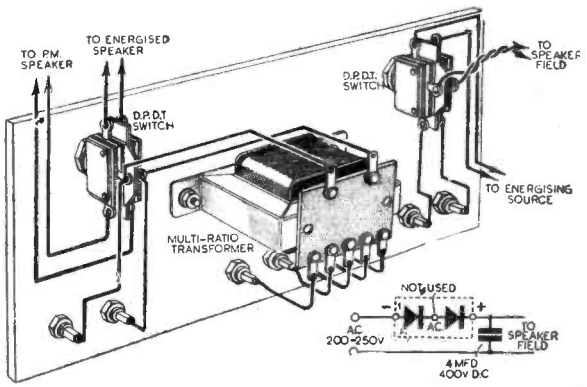
This handy attachment facilitates soldering work.

A Useful Speaker Input Panel

THE accompanying sketch shows a speaker input panel which I have recently constructed. I find that it is very useful when testing various receivers and amplifiers.

As will be seen, any type of receiver, mains or battery, with any output valve or valves, whether it has an output transformer or not, can be coupled to either speaker. A source of energising current is also available for the energised speaker, but if it is desirable that the field be used as a smoothing choke in a power supply, this can be done by connecting to the appropriate terminals.

The local power supply for the speaker field consists of a metal rectifier (type H.T.15) and a 4-mfd. condenser for 400 volt D.C. working; these are connected as shown in the circuit diagram.—K. C. KING (Bromley).



Arrangement of components on a speaker input panel intended for testing purposes.

MAINS UNITS

Points of Interest and Importance Regard

MANY listeners are now fitting battery eliminators in an endeavour to economise and also in view of the difficulty of obtaining replacement batteries. In other cases listeners have unfortunately had to change their place of residence and it may prove that in doing so their type of mains supply may also change—from A.C. to D.C. or vice versa. There are thus difficulties to be met in such cases. For the benefit of those who are not familiar with battery units it may be stated that a D.C. mains unit consists mainly of a smoothing circuit, whereas an A.C. mains unit consists of the same circuits and components plus a mains transformer and rectifying source. This latter may be a valve or metal rectifier, but the circuit following the rectifier is identical with the D.C. unit. The latter is shown in Fig. 1, and Fig. 2 shows a metal rectifier D.C. unit and Fig. 3 a valve rectifier mains unit. To enable the similarity to be more easily discerned the smoothing section which corresponds to the D.C. unit has been shown in heavy lines in these two latter units. It should thus be apparent that a listener who moves from one type of supply to the other will not be seriously affected so far as concerns changes in the unit, except where the A.C. section is made to deliver a high voltage. This will seldom be found, however, in a normal type of battery eliminator.

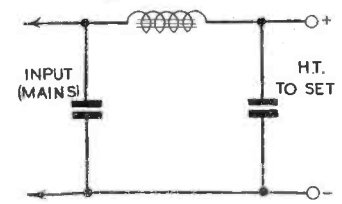


Fig. 1.—D.C. mains unit circuit arrangement.

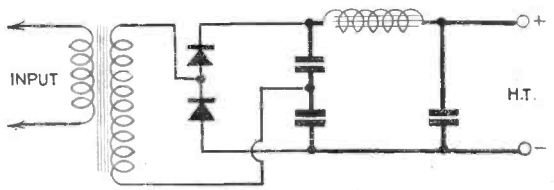


Fig. 2.—A.C. mains unit, showing the additions required to Fig. 1.

D.C. Units

In this type of unit there are two important points. Firstly, the negative mains lead is joined direct to the H.T. negative lead in the wireless receiver, and as in practically every circuit the H.T. negative lead is in turn connected to earth, this means that the negative mains lead is also earthed. In certain districts, however, the positive lead is earthed, or some other scheme is adopted, and thus, should the unit be used in the form indicated without any precautions, the mains supply may be short-circuited. Furthermore, in the usual type of receiver employing an accumulator for the L.T. supply, there is also a risk that the short-circuiting of one of the L.T. leads to earth may introduce the complete mains voltage across the L.T. wiring and thus damage the valves. The first precaution with a D.C. unit is, therefore, to prevent the mains from being short-circuited, and this may conveniently be accomplished by connecting a reliable fixed condenser in the earth lead. It is usual to fit this in the mains unit, joining one side to the H.T. negative lead and the other side to earth, and then omitting the earth connection on the receiver. To avoid the risk of the above-mentioned L.T. short-circuit it is recommended that this procedure is adopted, and that the unit is totally enclosed, whilst an insulated earth lead is employed. A further safeguard is to include a small fixed condenser in the aerial lead, placing this condenser inside the receiver cabinet, and joining it to the aerial terminal, thus isolating the aerial lead-in wire. This condenser should be of the mica type, and it should, together with the previously mentioned condenser, be of the type designed for use on voltages of 250 or more.

Voltage Dropping

To obtain the necessary reduced voltage from the D.C. supply a resistance may be inserted in the positive lead. This, however, will carry the full current of the receiver (that is, the total of all the valves in use) and thus it is necessary to guard carefully against overheating, and the wattage rating of the resistance must be carefully chosen. This value may be ascertained by adding together the total anode current of all of the valves, squaring this figure, and multiplying the resultant figure by the value of the resistance. Expressed mathematically, this is: Wattage equals $I^2 \times R$. To obtain various intermediate voltages for the detector stage or the S.G. stage, a potentiometer device is to be preferred, as this may also be arranged to act as a decoupling circuit and thus prevent instability. In Fig. 4 a simple method of obtaining one intermediate voltage is shown, whilst in Fig. 5 the method to be adopted where more than one voltage is required is shown. From the latter diagram it is obvious that any number of tappings may be taken by adopting the same scheme, but the total current still passes through the resistance in the positive lead.

Hum Difficulties

The voltage-dropping schemes may, of course, be applied to either the D.C. or the A.C. units, and the points marked positive and negative apply to Fig. 1 or Fig. 2. Where a D.C. unit is being employed and hum is experienced, it is generally attributable to the fact that the smoothing is insufficient, and the remedy is to increase the inductance of the smoothing choke. In some cases also, an increase in the capacity of the fixed condensers should be tried. If these steps are taken and hum is still experienced, it may be due to inductance between the choke and the L.F. components in the actual receiver. The only effective remedy is to enclose the unit in an iron box, and this is a precaution which should always be taken in the interests of safety with any type of

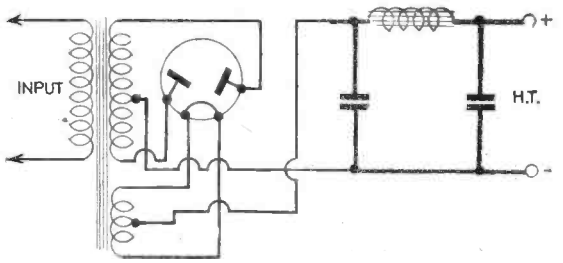


Fig. 3.—Similar unit to Fig. 2, but with valve rectification.

Notes from the Test Bench

Lamp Sockets

A CASE of serious crackling noise interference was recently investigated and found to be due to a loose lamp fitted as a bench light. The ordinary lamp-holder intended for suspension by means of flex is a fairly common component, but the bakelite type of holder possesses the drawback that the portion carrying the plungers may be placed in various positions, according to the amount of thread which is inserted in the rear portion of the holder. Thus it may be found that the lamp may be inserted and will fail to light owing to the plungers not touching the lamp base. If, however, the holder is screwed far enough it may be found that the plungers only just make contact with the soldered contacts on the lamp base and the lamp will thus be free to vibrate and contact will be made and broken thus giving rise to noise. The resistance of the springs on the plungers should be felt as the lamp is inserted and if it goes in easily the holder should be examined to make certain that correct contact is made.

Lining Up Spindles

WHEN using an extension control or a sub-panel for short-wave or similar apparatus, difficulty is sometimes experienced in accurately drilling the front panel so that control spindles will turn smoothly. This difficulty may usually be overcome by making use of the flexible couplers which will take care of any small displacement and at the same time permit the slow-motion drive to operate.

AND ECONOMY

H.T. Battery Eliminators by W. J. DELANEY

mains unit. The iron effectively screens the L.F. radiation (provided, of course, that it is effectively earthed) and it also prevents the risk of a short-circuit or a shock. If hum is experienced after screening a D.C. unit in this manner, the difficulty may be traced to the actual receiver and the usual steps should be taken here.

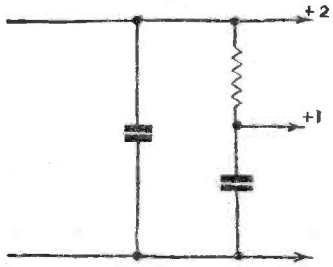


Fig. 4.—How to obtain a lower voltage output from a single output mains unit.

In the case of A.C. units, the same steps may be taken, but the condenser mounted between the valve and the smoothing choke should not be increased in capacity above 4 mfds. as the output from the rectifier will be modified in such a case. A difficulty sometimes experienced with an A.C. unit is a type of hum which is actually acoustic as distinct from electrical, and is found to be due to the vibration of the laminations in the mains transformer or the smoothing choke. A remedy is sometimes effected by turning the unit on its side and thus permitting the weight of the component to pull on the holding-down bolts and thus keep the laminations together. If the bolts cannot be further tightened, a certain cure is to be found in the simple device of pouring molten Chatterton's compound over the core, after finding the offending component by gripping the choke and transformer core tightly with the fingers. The usual precautions against a shock due to touching two points of different potential should be taken.

Varying Periodicity

The standard mains transformer is designed for use on A.C. mains having a periodicity of 50 cycles. Thus, unless a mains unit has been purchased especially it must be used on mains rated at 50 cycles. There is no objection to using it on mains having a periodicity higher than this figure (up to 100 cycles), but on no account should it be connected to mains below 50 cycles. If a transformer is used on low period mains, when it has not been designed especially for it, it will speedily break down, and hum will be almost impossible to eradicate.

Switching

A combination switch is desirable with a D.C. unit so as to avoid the risk of leaving the L.T. battery in circuit. Where the unit incorporates a trickle charger this is unimportant, as the switch is generally operated to put the battery on charge when the receiver is switched off. If, however, no such scheme is incorporated, the L.T. supply should be switched on first, and the H.T. last. When switching off, the reverse takes place, namely, the H.T. is switched off first, and the L.T. last.

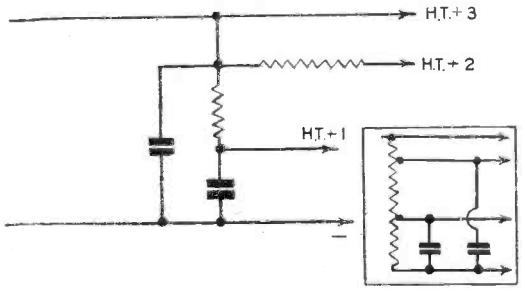


Fig. 5.—How to obtain two or more separate voltages, and inset, an alternative scheme.

Increasing Output

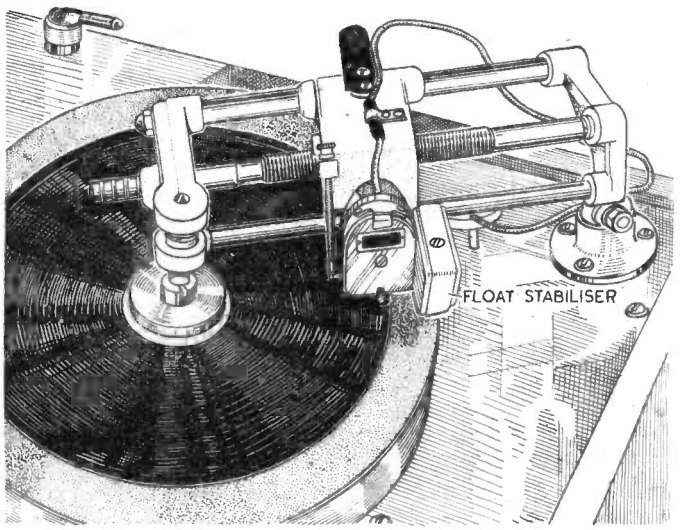
If a D.C. unit of commercial make is being employed, and the output is between 100 and 120 volts, the extra voltage necessary to apply a full 150 volts to the output stage may be obtained by including an ordinary small H.T. battery in series with the mains unit.

RECORDING AND PLAY-BACK EQUIPMENT

THE process of home-recording is a fascinating one, and many amateurs have already made up recorders which give very good results. There is, however, a market for records made at dances and other public functions, where individuals may make records to keep as souvenirs, and for this purpose something more elaborate is required. One of the main features is constancy of turntable speed, and the cutting head must be really well designed if the results are to be worth while. We have reviewed several types of apparatus for this purpose from time to time, and it would appear that in America this type of equipment has reached some rather high levels. One such is illustrated on this page and is an R.C.A. Victor unit. It is complete in itself, containing in the unit all the components necessary for making recordings of professional quality and playing them back immediately after completion. The turntable may be set for either 78 or 33⅓ r.p.m. The cutting head is provided with a float stabiliser which acts as a shock absorber on the cutting head and thereby assures utmost smoothness and freedom from surface noise in recording. Other features in the equipment are a high-fidelity ribbon type microphone with floor stand, motor and turntable assembly, together with amplifier for the recording function. A high-fidelity speaker, reproducing pick-up and tone arm are also incorporated within the cabinet. A visual volume indicator assists control and regulation of the recording level, and a jack is provided so that headphones or a remote speaker may be used for monitoring.

Other models

There are several similar pieces of apparatus available in the U.S.A., and they all appear to make use of the micrometer rod which guides the recording head along the disc. This is the most critical part of the apparatus and absolute smoothness of movement is essential. Furthermore, the recording head must also be free from shake or the effects of vibration and yet at the same time should be capable of being lifted at any part of the record where it may be necessary to interrupt the recording. In an instrument produced by the Federal Recorder Company two buttons are mounted on the head, and by pressing these the drive mechanism is released and the head may be slid back and forth to any desired point. In this particular model also smoothness of running the turntable is assured by using a steel turntable weighing 35lbs. Another idea for turntable reliability is the provision of a rim drive, enabling a really sound pivotal system to be used in the centre of the disc and at the same time providing a high-speed motor with a very small disc drive bearing on the wide rim of the turntable, without the introduction of a series of gears which might give rise to shake.



A general view of the R.C.A.-Victor Recorder, showing the float stabiliser.

INTERESTING EXPERIMENTS—2

Details of the Results to be Expected from the Experiments Mentioned Last Week are Given Below, Together with Further Suggestions.

By L. O. SPARKS

IT is hoped that the experiments outlined last week have been the means of creating interest in some of the fundamental facts connected with Magnetism and Electricity, though the writer hopes that it is appreciated that it is impossible to deal with the two subjects in minute detail, and that the suggestions offered are only intended to whet the appetite of the keen experimenter.

Before discussing any further practical proofs of some of the fundamental theories, a little attention must be given to the simple experiments suggested last week, if only to see if the results obtained correspond to those which should be produced. For example, there were the tests to determine the magnetic fields produced by different magnetic arrangements. If these were carried out in the manner mentioned, the iron filings should have taken up the formations shown in Fig. 1, these representing the magnets and positions depicted in Fig. 1 of the first of these articles.

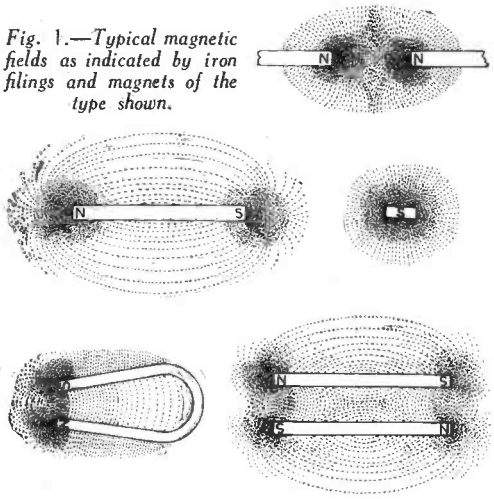


Fig. 1.—Typical magnetic fields as indicated by iron filings and magnets of the type shown.

"Field" Diagrams

What facts do these "*field*" diagrams reveal? How does the study of them help one as regards electricity and radio?

In answer to the first question, it will be noted that the filings take up very definite lines and these lines actually represent the area or position of the *magnetic lines of force* produced by the magnet. It will also be noted that these lines are more dense in certain parts than others, and this gives actual proof that the magnetic field is stronger in those parts. In each case it will be observed that the lines of force are *strongest nearest* the poles and gradually *weakens* as the distance is increased from the poles.

The lines take up a symmetrical formation from one pole to another, showing that attraction takes place between the two poles. There is, however, an exception to this, and it is one which proves one of the elementary rules connected with magnetism. Did you notice the field produced when two bar magnets are placed end on to each other with *like* poles adjacent? The diagram is shown in Fig. 1, and it should be noted with care as it is an example of the exception mentioned above. It will be seen that the magnetic lines of force tend to repel each other; the iron filings do not take up a symmetrical path from one north pole to the other but the field of each tries to force the other away and practically produces a neutral zone in the centre.

This, then, is but one example of the Law that "*like poles repel one another and unlike poles attract one another.*" This Law is also verified by the suggestions given for experiment No. 2, only in this instance a physical indication is given, as it will be possible to feel the attraction or repulsion between two magnets according to whether their adjacent poles are alike or unlike.

There was another item with No. 2, namely, the force or rather the attraction offered by two similar magnets compared with one. Without going into details, at this stage, the following approximate results should have been obtained. When two similar magnets, alongside each other and with their like poles together, are used to pick up a metal object, it will be found that they will lift roughly 1.5 times the weight of one alone. More about this later.

Experiment No. 3

This dealt with the first step towards *magnetic induction*, and the following results should have been obtained.

When the bar magnet and the soft iron bar were located as shown in Fig. 2 of last week's issue, iron filings should be attracted to the iron bar without the magnet actually touching it, thus indicating that magnetism had been induced in the iron through the lines of force of the magnetic field produced by the magnet. What happened as regards the polarity of the iron bar? Did you prove or formulate the Law which states that "a magnet induces *opposite* polarity in the end of the metal bar nearest to it, and similar polarity at the far end"? For example, if the *north pole* of the magnet is *nearest the iron bar*, then the other end of the bar will become a *north pole*.

Fig. 3.—This experiment should be treated seriously, as it will have an important bearing on future work.

Electrical Experiments

The suggestions made under this heading were intended to make the experimenter observe some practical indications of the magnetic field produced around a conductor when it is carrying an electric current, and to show the relation between the field produced and the direction of the current flow. There is a very old rule,

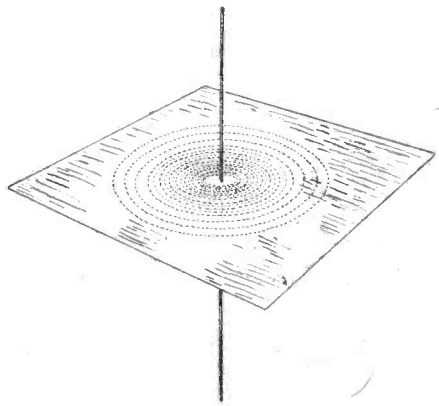


Fig. 2.—The field produced around a conductor when carrying an electric current.

which was expounded by the noted scientist Ampère, which read something like this. "If an observer can imagine himself to be swimming in the conductor in the direction of the current flow, with his face turned towards the compass needle (that is, when carrying out the suggested experiment with the wire over the compass), then the north-seeking pole will turn towards his left hand." Did you get actual indication of Ampère's statement? Of course, when the wire was placed under the compass, you must imagine that you are swimming on your back.

When the conductor is placed in a loop over and under the compass, the Law still holds good, but it will be found that as both paths produce the same resultant effect, the needle deflection is greatly increased.

The remaining suggestion in No. 4 was one which would prove the presence and formation of the magnetic field produced around a conductor as soon as a current was flowing through it. If the filings were small and the paper lightly tapped, they should take up the formation shown in Fig. 2, which is a series of concentric circles around the wire.

We are now only left with experiment No. 5, which concerned the two spiral coils of wire. From the previous experiments we have seen that an electro-magnetic field is produced around a conductor when it is carrying a current, therefore, with the two coils in question, it is possible to observe other resultant effects which ultimately play a very important part in electrical and radio work.

When the coils are connected in series in such a manner that the current is flowing in the same direction in each coil, it should be possible to notice that *attraction* takes place between the two windings. If, however, as suggested last week, the con-

(Continued on page 144)

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ECONOMY IN CONSTRUCTION

Economy in the Purchase of Components Can Often be Practised Without Sacrificing Efficiency. How this May be Done is Explained in This Article

THE question of cost is always an important one with the constructor, and he is always prepared to study means of reducing it. Trouble is the inevitable outcome of thoughtless "economy," but it is frequently possible to prune the component specification without any consequent loss in efficiency of the finished receiver. It should be made perfectly clear that this does not apply to PRACTICAL WIRELESS Guaranteed Designs,

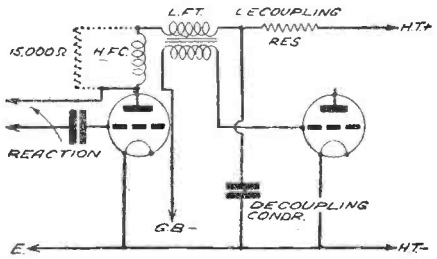


Fig. 1.—It is sometimes an advantage to replace the det. H.F. choke with a fixed resistance as shown by the dotted lines.

since these are always prepared with the question of economy well in mind. But when making a receiver to a conventional circuit it is generally well worth while to study it with care with the idea of eliminating non-essential parts.

The Reaction Choke

A good, though very simple and well-known example, is in connection with the H.F. choke used in the anode circuit of the detector valve. This is frequently referred to as a reaction choke, because its main purpose is to prevent high-frequency currents from flowing into the low-frequency circuits, so that they can be usefully employed for feeding-back into the grid circuit. A skeleton circuit diagram to illustrate this point is given in Fig. 1. In this case ordinary L.F.-transformer coupling is used between the detector and L.F. valves, and the primary winding of this frequently has a sufficiently high inductance to provide an effective barrier to H.F. currents. In consequence, it might be found that results are unchanged if the choke is short-circuited or removed from the circuit.

This might not be the case if the transformer is a cheap one having a fairly high self-capacity, or even if it is a good one with a fixed condenser permanently connected in parallel with the primary, and built into the case. In building the set, however, the choke might be omitted unless and until it is found that reaction control is very erratic or that oscillation cannot be obtained.

A Resistance "Stopper"

Even then it is very often sufficient to replace the choke by a non-inductive resistance (which can be a sixpenny ½-watt type). This is shown in broken lines in Fig. 1, where the resistance has a value of 15,000 ohms. The arrangement is nearly always satisfactory because the resistance provides a sufficiently high impedance to H.F. When this idea is employed it should be remembered that the resistance will reduce the voltage normally applied to the anode of the detector valve; to compensate for this it might be necessary to reduce the value of the decoupling resistance by 15,000 ohms, or to use a higher voltage tapping for the detector H.T. lead.

When a resistance-fed transformer is used for coupling purposes, as in Fig. 2, the choke is generally unnecessary, and can simply be omitted, because the coupling resistance provides the necessary impedance. In the case of a superhet, where reaction is not employed, it might be found better to connect a .0003 mfd. fixed condenser between the anode and earth, as shown in broken lines. When reaction is employed, a condenser in this position, but with a lower capacity, should be tried.

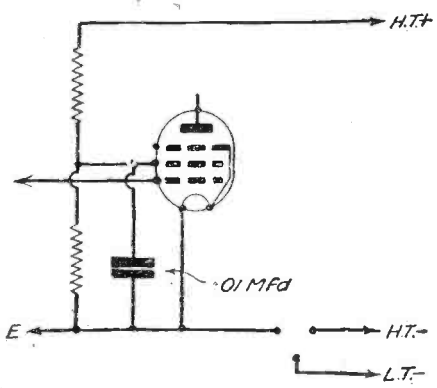


Fig. 3.—The usual method of feeding the screening grid.

The S.G. Potentiometer

Another case where a small but not insignificant saving can be effected is in the case of the fixed potentiometer used to feed the screening grid of an S.G. or variable-mu valve. The usual arrangement is as shown in Fig. 3, where two fixed resistances are connected in series between H.T.+ and H.T.—, the feed to the valve being from the junction of the resistances. A fixed condenser is also used between the screening grid and earth, to act as an H.F. by-pass. Yet another practical essential is that a three-point on-off switch is required to cut the potentiometer out of circuit when the set is not in use.

The simplification to which reference is being made is illustrated in Fig. 4. Here it can be seen that the detector valve and its decoupling resistance are together used as the S.G. potentiometer, whilst the S.G. by-pass condenser also serves to decouple the detector. Furthermore, the three-point switch is replaced by a two-point com-

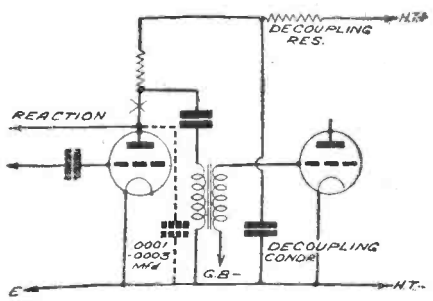


Fig. 2.—It is possible sometimes to dispense with the H.F. choke—especially when using R.C. or resistance-fed transformer coupling. The choke may be placed at the point marked X.

ponent, because there can be no passage of current through the "artificial" potentiometer when the L.T. current to the valves is disconnected. In nearly every case this arrangement proves perfectly satisfactory, provided that the detector valve and decoupling resistance can be chosen to provide the correct screening-grid voltage. It is generally satisfactory to apply a voltage of about one-half the anode voltage to the screening grid, which means that if the A.C. resistance of the valve and its decoupling resistance are approximately equal, the correct conditions apply. Actually, the valve should provide rather a greater resistance than the decoupling resistance to allow for the current passed by the screening grid. Consequently, when using a typical detector valve having an A.C. resistance (often referred to as impedance) of 18,000 ohms, it would be correct to use a decoupling resistance of 15,000 ohms, although the difference in performance will rarely be very great if the value is increased up to 20,000 ohms.

A practical point which should be noted is that the combined decoupling and by-pass condenser should be placed close to the S.G. terminal of the H.F. valve-holder, and should have a value of not less than 1 mfd. The condenser should, of course, be of the non-inductive type.

By-pass Condenser Capacities

Whilst dealing with H.F. by-passing and decoupling it is worthy of note that condensers of unnecessarily high value are often used, with the result that the cost is made higher than it need be. All by-pass condensers in the H.F. circuits (S.G., variable-mu potentiometer, grid bias and anode circuit) can be of .01 mfd. This might come as a surprise to many of those constructors who habitually use components of about 1 mfd. But when it is remembered that a .01 mfd. condenser offers a resistance of only about 25 ohms

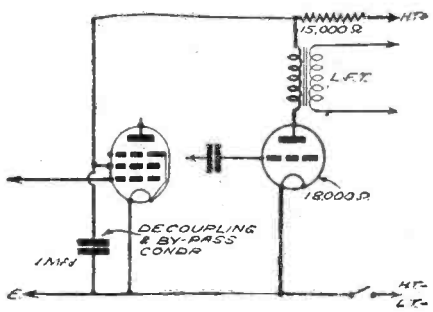


Fig. 4.—A detector valve and its decoupling resistance may provide a potentiometer as shown here.

at 600 kilocycles (equivalent to 500 metres), or of about 11 ohms at 1,500 kilocycles (200 metres), it is evident that such a capacity is adequate. It is important, however, that the condensers be almost completely non-inductive, for otherwise the effective resistance will be considerably greater.

This explanation should not be considered as applying to the detector decoupling condenser, which has to deal with low frequencies, because the effective resistance of a condenser increases very rapidly as the frequency is reduced. For example, the resistance offered by a .01-mfd. condenser to a current at an audio frequency of 1,000 cycles is something like 16,000 ohms. A 1-mfd. condenser, on the other hand, shows a resistance of only 160 ohms in the same conditions, and this is low by comparison with the resistance of the decoupling resistance—as it should be if the condenser is to act as an easy by-pass.

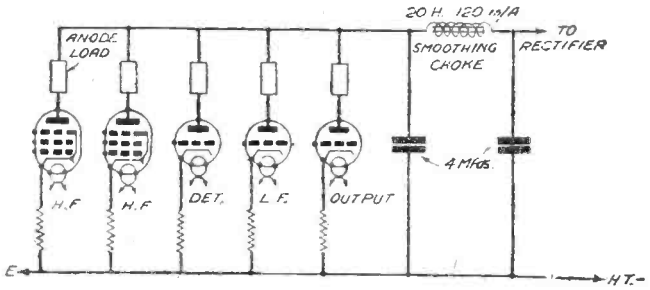


Fig. 5.—An effective simple smoothing scheme, using a good L.F. choke.

High-tension Smoothing

The H.T. supply section of a powerful mains receiver or amplifier is, of necessity, expensive, but a saving can often be effected here without any loss of efficiency. One of the most expensive components is the smoothing choke shown in Fig. 5. If this is to provide adequate smoothing for the H.F. and detector circuits it must have an inductance of not less than about 20 henries. But a choke having this inductance and capable of carrying a current of, say, 120mA is very costly. In many instances the choke can be replaced by the field winding of an energised moving-coil speaker, when the question under consideration scarcely arises. But when for any reason it is proposed to use a permanent-magnet speaker, or when the resistance of the speaker coil is too high, it is cheaper to use two chokes, as shown in Fig. 6. One of these is used simply to supply current for the L.F. stages, whilst the other is for the other valves in the set.

The first-mentioned choke must carry a comparatively heavy current, but need provide only a modest degree of smoothing; thus it can have a low inductance. The second choke, on the other hand, must have a high inductance, but need carry only a light current. Thus it would be possible to employ one choke rated at, say, 10 henries, 100 mA, and another rated at about 30 henries, 15-20 mA. The two components can generally be bought more cheaply than a single one rated at 30 henries, 120 mA.

An alternative system which is often valuable consists of using a single low-inductance, high-current choke for smoothing the whole supply, and using resistances for smoothing the supplies to the individual pre-L.F. valves. This arrangement is doubly useful when a considerable voltage drop is required in the supply lines to the earlier valve stages. Separate resistances and condensers are used for each of the valves, but these would probably be less expensive than a good choke, whilst proving equally effective, and sometimes noticeably more so.

There are many other parts of the circuit in which economy can safely be practised, if the principles outlined above are studied before construction is commenced.

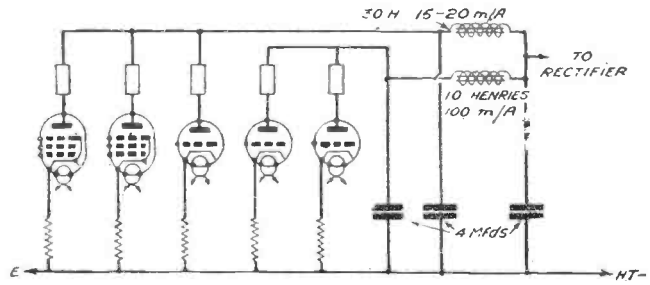


Fig. 6.—By using two chokes, as shown here, cost is reduced but efficiency is not impaired.

INTERESTING EXPERIMENTS—2

(Continued from page 140)

nections are now modified so that the current is flowing in different directions in the coils, then it will be noted that *repulsion* is produced and the coils try to force themselves away from each other.

For this simple experiment, the following can be deduced: "When two parallel currents flow in the *same direction* through conductors, they *attract* one another but, when two parallel currents flow in *opposite directions*, then they tend to *repel* one another."

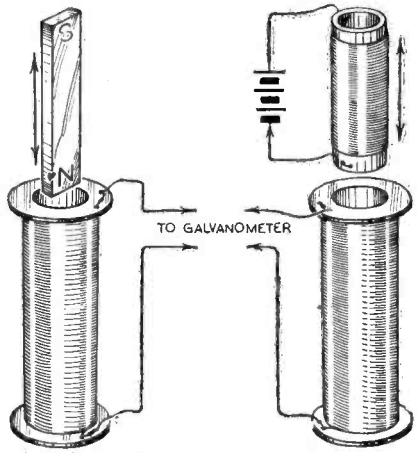


Fig. 4.—These two experiments should be carried out carefully and every consideration given to the results produced.

Induction—Experiment No. 6

From the above, it is quite a simple matter to take the experiments a step further to bring us into close contact with an application which is widely used.

With some soft iron wire, which can be bought by weight in different lengths, form an iron ring having a diameter of, say, 3½ to 4in. with a thickness of ½in. Bind the metal ring with strips of paper or insulating tape and then wind on it two separate coils as shown in Fig. 3. Wire in the neighbourhood of 34 S.W.G. (insulated) should be used, and each coil should consist of two or more layers. The actual number of turns is not critical so long as each coil is approximately the same.

To one winding connect a simple galvanometer or low-reading mA meter, and to the other the dry battery used in the previous experiments. Contact to the battery should be made by *flicking* one of the connecting wires on to one of the terminals and the behaviour of the meter should be noted. If a set of laminations from an old L.F. transformer is handy, they can be used in place of the iron wire provided that the two coils are wound on suitable bobbins to fit. Proceed further with the above test by making one coil larger or smaller than the primary, i.e., the one connected to the battery, and note different results.

Experiment No. 7

Wind a small solenoid coil on a piece of cardboard tubing which has a diameter sufficient to allow one of the bar magnets to be lowered into it as shown in Fig. 4, and connect the two ends to the galvanometer. Lower the magnet slowly into the coil; remove it slowly and then repeat these two movements with the magnet reversed, i.e. the other pole entering first, and note the galvanometer readings.

With the same solenoid coil, repeat these experiments with the magnet *replaced* with another solenoid wound on a coil former which will pass freely into the first. Connect as shown in the second diagram of Fig. 4.

The results produced by the above practical experiments should be noted with care as the full purpose of the tests will be important in the future understanding of many components most intimately connected with radio.

RADIO CLUBS & SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

STOURBRIDGE AND DISTRICT RADIO SOCIETY

Hon Sec.: Donald Rock (G8PR), 4, Linton Road, Old Hill, Staffs.

THE above society is now temporarily QRT, the reason being that several members are serving in the R.A.F. Notice will be given when the society re-starts its activities.

SLOUGH AND DISTRICT SHORT-WAVE SOCIETY

Secretary: K. A. Sly (G4MR), 16, Buckland Avenue, Slough.

Headquarters: Toc H Headquarters, William Street Slough.

Meetings: Alternate Thursdays at 7.30 p.m.

AT the last meeting held on October 12th, 1939, a talk was given by Mr. Gilbert (2DDG) on Life in the Royal Corps of Signals. Members still continue to produce logs for the research group which is concentrating its activities on the 28 Mc/s band. It was proposed at the meeting that members should make a point of listening to WGEA regularly, with a view to recording the period of fading, etc., on that transmission. Morse practice was held as usual, and proved very interesting. A very successful junk sale was held and provided some very lively bidding.

At future meetings we hope to continue the series of lectures on "Measuring Equipment," and also talks on receiving equipment. New members are still wanted, and will be given a great welcome. Our membership is still increasing steadily despite unfavourable conditions.

LATEST PATENT NEWS

Group Abridgments can he obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume or in bound volumes, price 2s. each.

Abstracts Published.

BUILT-IN FURNITURE.—Campling, G., and Radio Furniture and Fittings, Ltd. No. 507285.

Service hatches, wireless receivers, refrigerators, sets of drawers, and other domestic appliances are in the form of rectangular units which are removably

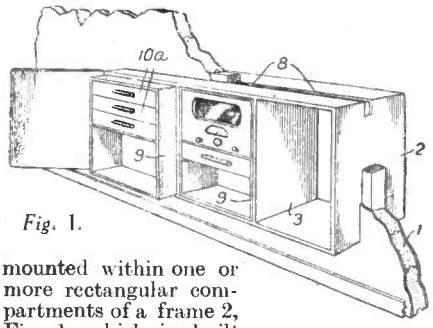


Fig. 1.

mounted within one or more rectangular compartments of a frame 2, Fig. 1, which is built into a wall 1 and which projects into the rooms on both sides of the wall. The frame shown is divided into three compartments by partitions 3, and each compartment is adapted to receive a unit 9 which may be fitted with drawers 10*a*, or other equipment. Each unit may be divided by partitions into a number of rectangular compartments employed for different purposes. Sockets 8 may be fitted to the frame 2 for power supply and for the aerial when the frame is fitted with a wireless or television receiver. As shown in Fig. 2, a wireless set 30 is mounted within a unit 9 in rollers of slides 16 which are mounted to slide within guides 45 fitted to the inner walls of the unit 9.

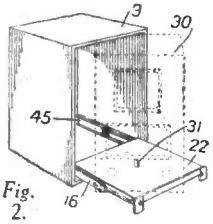


Fig. 2.

THERMIONIC VALVES.—M-O Valve Co., Ltd., and Aldous, W. H. No. 507119.

In a thermionic valve wherein separate anodes 3, 4 (Fig. 3) surround a common elongated cathode 1, the anodes are supported by four or more wires 5, 6, 7, 8 (Fig. 4); each anode is supported by at least two wires, but no wire is attached to both anodes. As shown each anode is attached to two wires on one side of the cathode but each anode may be supported by diagonally disposed wires. A mica spacer 9 is provided between the anodes to brace all the wires and end spacers 14, 15 are also used. A plurality of such systems may be mounted in one envelope.

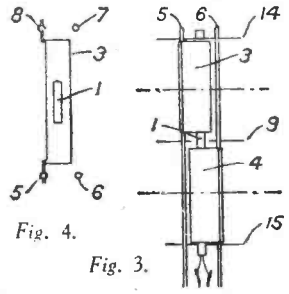


Fig. 4. *Fig. 3.*

AERIALS.—Marconi's Wireless Telegraph Co., Ltd., and Bohm, O. No. 508048.

A directive aerial consists of two adjacent conductors, closely coupled by the radiation and energised not in phase-opposition but in phase-quadrature at one end, the far

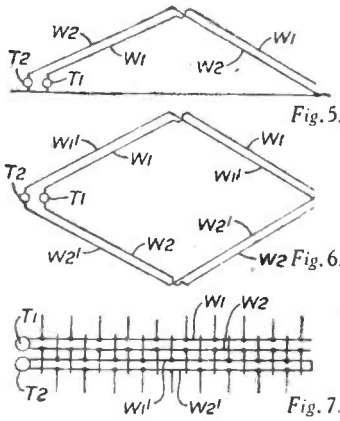


Fig. 5. *Fig. 6.* *Fig. 7.*

end of one conductor being directly earthed, whilst the far end of the other is left "open." As shown in Fig. 5, the parallel wire W2 takes the place of the surge impedance, through which the known type of aerial W1 is usually earthed. In Fig. 6, the wires W1 and W2 similarly replace the surge impedance which usually bridges the two ends of the "diamond" type of aerial $W1^1$, $W2^1$, the ends now being directly connected together. In Fig. 7, the lower "herring-bone" leads $W1^1$ and $W2^1$ are directly connected together, instead of through the usual surge impedance, the place of which is taken by the upper pair of leads W1, W2 with "open" ends. The wires are energised at T1, T2 in phase-quadrature. The arrangement avoids the ohmic losses which occur when the aerial circuit includes a terminating surge impedance.

NEW PATENTS

These 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. The Official Journal of Patents can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. weekly (annual subscription £2 10s.).

Latest Patent Applications.

26687.—Electrolux, Ltd.—Devices for preventing interference with radio. Sept. 27th.

26435.—Hewett, A. B., and Head, A. G.—Aerials, etc., and earth systems for television. Sept. 22nd.

26627.—International Broadcasting Co., Ltd., and Modrey, H. J.—Loudspeaker projectile. Sept. 26th.

26441.—Lemon, C. G.—Wireless-transmitting and receiving aerials. Sept. 22nd.

26515.—Philips Lamps, Ltd.—Tuning mechanism of radio-receivers. Sept. 23rd.

26608.—Philips Lamps, Ltd.—Devices for controlling the speed of a rotating body. Sept. 25th.

Specifications Published.

512716.—Murphy Radio, Ltd., and Wedge, H. F.—Construction of television receivers.

512575.—Lajta, M., and Nekolny, K.—Method of and apparatus for signalling the nature of the place of origin of radio-broadcast transmissions.

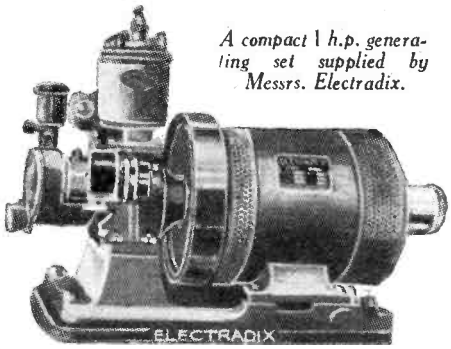
512576.—Lajta, M., and Nekolny, K.—System for signalling and indicating the nature of radio-broadcast transmissions.

512741.—Fabbrica Italiana Magneti Marelli.—Non-spilling electrical accumulators.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

A.R.P. GENERATING SET

INCLUDED in the various schemes for Air Raid Precautions are emergency lighting plants. There are several systems available in this direction, and many people are using battery or similar storage plants for the purpose. A petrol or gas-driven generating plant is obviously a very useful piece of apparatus, and Messrs. Electradix have a number of these for sale. The illustration shows a 500 watt set which delivers 50 volts at 10 amps. This has a 1 h.p. engine running at 1,000 r.p.m. and the consumption is 7-8 hrs. per gallon of petrol. The overall dimensions of the base are 30in. by 15in. and the height is 30in. the total weight is 325 lbs. Lubrication is by the petroil system using ¼ to ½ pint of



A compact 1 h.p. generating set supplied by Messrs. Electradix.

oil per 2 gallons of petrol, and this lubricates every part of the engine without attention. A silencer is fitted and the dynamo is of the direct-coupled type, shunt wound and rated at 500 watts, giving 50 volts up to 10 amps, or 70 volts for charging purposes up to 7 amps, 1,000 revs.

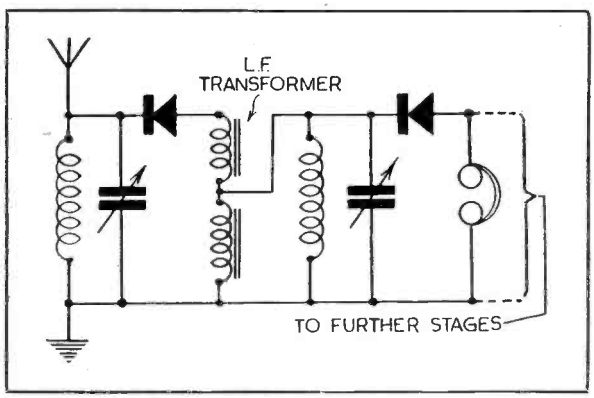
Open to Discussion

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

"Home Service" Broadcasting: A Double-detector Circuit

SIR,—In reply to the letter from Mr. J. S. Smith in your issue dated October 14th, I should like to say that on my simple battery receiver, with a not-too-good aerial, I am getting reasonably good reception without any form of A.V.C. I am aware that my set is not an ordinary one, as it is of the double-detector type, which has been in use by me for many years. Of course I cannot say that the double-detector system is solely responsible, but I have found in the past that it will give good-quality reproduction combined with good selectivity, but without the necessity for low-frequency tone correction—the results being judged by ear. I will give particulars of my double-detector circuit if any readers are interested.

In the meantime, I enclose a circuit of a crystal set working on this system, by which it will be seen that it consists essentially of two crystal sets joined together as one. Three or more stages can be used, and it would be interesting to know when any reader has succeeded in working a loudspeaker from the crystal set. The coils can, of course, be tapped for greater selectivity if desired, but increasing the number of stages should have the same result without the disadvantage of loss of signal strength. As there is no H.T. to short, any pet schemes can be tried, but of course they will not all be successful. The tuning coils can be deliberately placed so as to interact with each other if desired.—D'ARCY FORD (Exeter).



A double crystal-detector circuit referred to by Mr. D'Arcy Ford.

Friendly Help Required

SIR,—I have been a regular reader of PRACTICAL WIRELESS for a number of years, and must say that my knowledge of circuits has greatly improved as a result.

There is one part of the work, however, with which I have always had trouble, and that is the short waves. Whenever I have constructed a set the results received left a lot to be desired.

I should like, therefore, to get in touch with another short-wave enthusiast who perhaps can help me.

I sincerely hope you will be able to continue publishing this fine journal every week.—GEO. B. COTTON, 37, Copy Lane, Netherton, Liverpool, 10.

S.W.L. Cards

SIR,—As I have been called up for military service any S.W.L. cards received by me will not be answered until I am granted leave. As far as possible I will QSL 100 per cent. I wish the magazine and all its readers the best of luck.—G. V. HAYLOCK (Sidcup).

That Friendly Spirit: Correspondent Wanted

SIR,—As a regular reader of your excellent journal for some time, and a member of the B.L.D.L.C., I have noticed the number of views regarding friendly spirit among amateurs.

May I say that *all* that I have met have been most friendly to me and have helped me out with any problems which I put before them.

I would like to get in touch with any young reader anywhere in the Empire interested in short-wave listening.—WILLIAM J. OMER, 1, Waterbeach Road, Slough, Bucks.

Prize Problems

PROBLEM No. 371.

JACKSON purchased some manufacturers' surplus which included some medium and long-wave broadcast coils. He made up a set using these parts and although it worked satisfactorily on some stations he found that he had to regang the tuning condenser at various parts of the dial. He was using a brand-new two-gang condenser with calibrated dial to match. What was wrong? Three books will be awarded for the first three correct solutions opened. Entries must be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 371 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, October 30th, 1939.

Solution to Problem No. 370.

When Martin straightened the bent vane in the condenser he upset the ganging, and the variation at that one point would not be corrected by the trimmer which only modifies the total capacity of the section. It was necessary to adjust the vane so that the capacity at the point was in line with the other sections of the condenser.

The following three readers successfully solved Problem No. 369 and books have accordingly been forwarded to them: W. Borland, Millport, Victoria Road, Tamworth; S. R. Anderson, 30, Woodside Green, South Norwood, S.E.25; J. D. Baxter, 4, Regent Street, Dunstable, Beds.

S.W.L. Cards from S. Africa

SIR,—I would like to inform readers of PRACTICAL WIRELESS that S.W.L. cards may be obtained from Jack Leven, 13, Salt River Road, Salt River, Union of South Africa, by sending their own cards.

I would like to correspond with a S.W.L. in Holland or America.—W. HOUSEMAN, 99, Runcorn Road, Barnton, Northwich, Cheshire, England.

Home Recording

SIR,—In your issue of PRACTICAL WIRELESS dated September 30th, 1939, you published an article under the heading "Fresh Fields for Experimental Work." I thought the suggestion of home recording was very good, and think it would be a good idea to publish an article giving circuits and diagrams for recording, as books on this subject are hard to obtain.—E. A. HEBRON (Manchester).

S.W. Correspondent Wanted

SIR,—I am very interested in short-wave reception and should be very pleased to get in touch with any reader who is interested in S.W. work and who is about my own age—16 years.—LESLIE STRATTON, 28, St. John's Road, Sandown, I.O.W.

PERSONAL PARAGRAPH

Reginald Dixon, the popular organist of the Tower Ballroom, Blackpool, may shortly become Special Constable R. Dixon, of the Mobile Police. He says he prefers the mobile section and is going into training with a newly-purchased bicycle.

The other day Dixon received a letter from a Belgian listener, asking if he was still in Blackpool or if he was in the "militaire." Dixon replied, "No, but when they arrive at the 33's I shall be ready, as we all intend to be."

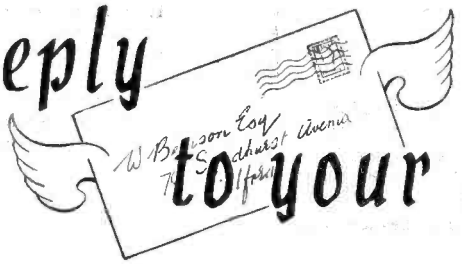
IMPORTANT NOTICE

Owing to the restriction of paper supplies in war-time, readers may find it impossible to get "Practical Wireless" each week unless they give their newsagent a regular order for their favourite paper now.

Wastage of surplus copies in the shops must be avoided, and readers can be of the very greatest help if they will fill up the Order Form given on page 141 and deliver it to their usual newsagent or bookstall. An order of this sort ensures regular delivery during war-time, and the Editor asks every reader to help in this way.

PLEASE ORDER "PRACTICAL WIRELESS" NOW AND USE THE ORDER FORM ON PAGE 141

In reply to your letter



H.F. Choke

"I note that the majority of standard types of short-wave choke are merely small inductance coils, with turns of wire lying side by side. On the other hand, those broadcast-band chokes which I have taken to pieces seem to consist of pile or section-wound windings. Is there any particular reason for the differences in these windings, and which in your opinion is the most efficient?"—M. G. P. (Birkenhead).

THE purpose of the choke is to prevent the flow of H.F. currents, which are diverted for reaction purposes. Obviously, therefore, the choke should have a suitable inductance value and negligible capacity. On the short waves (high frequencies) a lower inductance may be used than is required on the medium waves and thus a smaller winding is possible. The self-capacity of the small solenoid mentioned is of no importance, but when the larger winding required for a suitable inductance on medium waves is used, the self-capacity would rise unless a special form of winding were adopted, and furthermore, the amount of wire which is needed would lead to a cumbersome component if sectionalised windings were not employed.

Metal Rectifier

"I have an old metal rectifier which has apparently been dismantled from a set. There are three tags on this and I should be glad if you could tell me what type of instrument this is. Am I right in assuming that it is a voltage doubler, and if so, which are the A.C. terminals?"—M. M. (Teddington).

IT is not possible to state definitely what type of instrument this is, and you should communicate with the makers. Special rectifiers have been made from time to time for set makers, and these may not be standard. Usually, three terminals would indicate a component for voltage doubling, one terminal being A.C. and the others positive and negative.

Open Cathode Circuit

"In testing a faulty receiver I have found that there is H.T. at the anode of a valve, but no current when the meter is inserted in the anode circuit. The heaters are working and the valve is warm. Could you therefore tell me what this is likely to indicate?"—L. E. (Brondesbury).

THE H.T. circuit is completed through the cathode with an indirectly-heated valve, and therefore, if the cathode is not joined to H.T. negative you will not obtain any anode current, although H.T. may be applied to the anode. In the usual valve circuit there is a bias resistance in the cathode lead and if this is open-circuited the valve will fail to function. We therefore suggest that you test the bias resistance and think you will find this is faulty.

Air Hawk 9

"In the circuit of the Air Hawk, new version, I see that you cut out A.V.C. by short-circuiting the A.V.C. line. Is there no other way of carrying out this method of switching as I do not like the idea of shorting the line? If there is any better way of doing this perhaps you will let me know."—F. G. (Weston-super-Mare).

THE lower end of the tuning circuits to which A.V.C. is applied must be connected to earth and, therefore, if the A.V.C. is not employed the tuned circuits have to be switched to the earth line. By short-circuiting the A.V.C. line this is accomplished, and no harm or loss of efficiency results from this scheme. The ideal arrangement would, of course, be to open the connection from the I.F. transformer to the A.V.C. diode and to separately switch each tuned circuit so that the decoupling components in the A.V.C. line are taken out of circuit, but this elaboration is totally unnecessary.

RULES

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

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

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

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

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

1940 All-wave Three

"I have started to build the All-wave Three described in your August issues, but should prefer to replace one of the R.C. couplings by a really good L.F. transformer. If this is in order, perhaps you would indicate which stage would be most suitable for the purpose? I know you do not guarantee your sets which are modified, but I am prepared to try the modification on my own responsibility."—D. E. (West Bridgford).

AS there are two L.F. stages in this particular receiver the incorporation of an L.F. transformer will result in higher gain and therefore on a powerful station there will be some risk of overloading the output valve, which is a pentode. If you make the change, therefore, an L.F. volume control will have to be incorporated. As the first L.F. coupling in the published circuit consists of a volume control arrangement this should be left, and that means that the transformer should precede the output stage. This is also preferable, as any distortion introduced by the transformer will not receive additional amplification such as would be given if it were included in the first stage.

Record Wear

"I am using a fairly well-known make of gramophone pick-up, although it is a fairly old model. I find that my records begin to sound scratchy after only a comparatively few playings and I wonder if you can say the reason for this and how the noise can be avoided?"—O. R. (Newcastle).

THERE can be two reasons for the noise. It is undoubtedly due to wear on the grooves and this may be caused by a pick-up in which the needle movement is not sufficiently free, or by undue weight on the record. In the former case, the trouble may have arisen owing to perishing of the rubber surrounding the armature. This may have hardened and thus is holding the needle rigid. If the pick-up is bearing too heavy on the disc it should be counter-weighted by fixing an arm to the carrier arm, and putting a weight at the far end to take off the pick-up weight. We presume, of course, that the pick-up is properly mounted, as it is essential to see that it tracks correctly, otherwise the record will be damaged.

H.F. Transformer Design

"I am carrying out some experiments with H.F. stages and have wound up two or three H.F. transformers with remarkable differences in results. I believe there is a standard to which these should be wound, and I am unable to find it in my handbooks. Could you please give me the correct details, and formulæ, if any?"—P. E. R. (Perth).

THE correct ratio for an H.F. transformer is $\sqrt{\frac{R}{Ro}}$ where R is the dynamic resistance of the tuned secondary, and Ro is the impedance of the preceding valve. We presume that you are carrying out quantitative tests and require detailed formulæ such as the above.

REPLIES IN BRIEF

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

G. R. H. (Winchester). There is probably no other type of indoor aerial you can fit, but a vertical aerial outside, suspended about 1ft. from the walls, may prove practicable in your case.

J. B. (Clydebank). Probably when the leads were shorted the transformer radiated, somewhat after the manner of a spark gap, the secondary stepping up the voltage for the production of the spark. This would radiate and be picked up by the set. For details of the transformer write to the Marconiphone Company.

V. W. O. (Richmond). Your idea is quite in order, and separate batteries may be used.

G. W. (New Malden). We regret we are unable to supply a blueprint of the particular set referred to. Use an accumulator for the L.T., unless you can obtain the special battery type valves.

T. H. (Rugeley). Our Encyclopædia and the various articles published from time to time should be of use to you. Your idea is not practical, and there are reasons for the twist.

W. B. S. (Newcastle-on-Tyne). The reference is to a solid dielectric, but any type of condenser may be used. The type specified was for reasons of cheapness.

H. A. G. (Walthamstow, E.17). The Erie Resistor Company can supply the items mentioned.

J. C. H. (Nottingham). The firm in question appear to be no longer in business.

G. H. (Bradford). Messrs. Peto-Scott can still supply parts and we shall, of course, only specify parts which are still available to the home-constructor.

R. D. T. (Shirley, Croydon). The resistance will depend upon the current taken by the set, and also other factors. We cannot give exact values without a full circuit diagram.

E. W. (Hammersmith, W.6). The converter may work, but some commercial superhets are unsuitable for this particular type of instrument and the makers should, therefore, be consulted.

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

Practical Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS	Date of Issue.	No. of Blueprint.
CRYSTAL SETS		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
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Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
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Four-range Super Mag Two (D, Pen)	—	PW36B
The Signet Two (D & LF)	24.9.38	PW76
Three-valve: Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (Trans))	—	PW10
Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow)	22.5.37	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow)	12.6.37	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen)	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P)	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen)	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans))	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans))	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen)	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen)	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen)	30.4.38	PW89
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D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow)	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Ubique (HF Pen, D (Pen), Pen)	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
All-World Ace (HF Pen, D, Pen)	28.8.37	PW80
Four-valve: Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	24.7.37	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47
A.C. All-Wave Corona Four	6.11.37	PW81

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

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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). Display lines are charged at 4/- per line. All advertisements must be prepaid. All communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, Strand, London, W.C.2.

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Higher National Certificate in Electrical Engineering;

Certificate of City and Guilds of London Institute in Radio Service work;

or similar qualifications.

Or (b) be able to pass an examination on the following syllabus:—

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ALTERNATING Currents.—General principles; effects of resistance, inductance and capacity; resonance.

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APPLICATION forms, obtainable by postcard from the Under Secretary of State, War Office (T.O.1), Whitehall, S.W.1, to be lodged by November 6th, 1939.

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