THE MOST UP-TO-DATE CONSTRUCTOR'S WEEKLY

Practical Wireless

3D

AND PRACTICAL TELEVISION

EDITED BY F.J.CAMM

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Building the MASTER MIDGET 2

THE FINEST BATTERY SET YET PRODUCED!

5 VALVES

Mains set performance without an Electricity Supply

THE NEW COLUMBIA SUPERHET BATTERY GRAND

Model No. 1006

that do the work of 9

15 GUINEAS

OR BY HIRE PURCHASE

One invention alone has lifted this set above comparison with all portable battery sets of the kind. Though you only see five valves, *one* of these valves, which is of a special type, actually does the work of *three*! As a result, this new Columbia Model has a performance finer than any battery set has ever had before. The clarity and accuracy of its reproduction is equal in every way to that of an expensive mains set. Its range is phenomonal, and every station is kept distinct.

The design of this new Model is not the result of some happy accident that effected a small improvement. It is the fruit of years of experiment and accumulated knowledge. It is the triumphant achievement of some of the foremost radio engineers of the day. It gives to those who have no electricity supply, or an electricity supply that is unsuited to mains-reception, a quality of reproduction they never expected to hear.

HEAR IT—Or write for full particulars to-day. The more you know of this Set the more positive you will be that here, at last, is the instrument you have been waiting for—the instrument you want! Hear the Columbia Battery Grand at any Columbia Dealer's to-day, or write for the descriptive leaflet, "Hearing is Believing."

Columbia

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COUPON. Please send me particulars of the New Columbia Superhet Battery Grand **Model No. 1006, without obligation.**

To the Columbia Graphophone Co., Ltd.,
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(Prices do not apply in I.F.S.)

P.W. 12/5/34

OUR BIFOCAL COMPETITION CLOSES ON MAY 14th!

ROUND *the* WORLD *of* WIRELESS

A New Home Recorder

WE were recently privileged to witness a demonstration of a new home recorder which is shortly to be placed on the market by Ronnie Engineering, Crewdson Road, London, S.W.9. This recorder is the outcome of intensive experimental work which has been carried out over a period of about fifteen months, and, judging by the results obtained during the demonstration at which we were present, it shows a definite advance upon other recorders produced for home use.

The Ronnie Record Recorder, as it is called, comprises in the main a microphone of the moving-coil type, supported on a floor stand, and a parallel-tracking, energized head. The volume control is obtained by varying the energizing current, and there is a sensitivity control calibrated in "feet." The latter gives a direct relationship between the correct position of the control and the distance of the performer from the microphone. The recording blank is made of an aluminium alloy which appears to be harder than the metal usually adopted for this form of disc. The groove is noticeably deep, and from inspection it appears to be as deep as that on a standard record.

During our visit to the Ronnie works we saw several records made, and the subsequent reproduction revealed a remarkable freedom from surface noise; tone was of good quality. Built to be used with A.C. mains, the Ronnie Record Recorder will sell complete for recording and reproducing at £52 10s.

B.B.C. Promenade Concerts, 1934

ACCORDING to a B.B.C. announcement, the Promenade Concerts at Queen's Hall will begin on Saturday, August 11th, and will run for eight weeks, finishing on Saturday, October 6th. This will be the fortieth summer season under the conductorship of Sir Henry Wood, and the eighth under the auspices of the B.B.C.

Finnish Orchestra comes to London

A VISIT to Great Britain will be paid by the Finnish National Orchestra under the direction of Georg Schneevoigt in June, when a concert, given at the Queen's Hall on the fourth of that month, will be re-broadcast in the National programme.

Royal Opening of Droitwich

IT is hoped that the King may perform the opening ceremony of the B.B.C.'s new high-power station at Droitwich, when it is ready to go on the air. Every effort is to be made to complete it in time to exhibit it to the foreign delegates when they arrive in London in June next to take part in the International Broadcasting Conference, which, amongst other matters, is to deal drastically with the long-wave "muddle."

Radio Lisboa to Open Shortly

THE 20-kilowatt Lisbon (Portugal) transmitter is now testing every other night towards 22.00 B.S.T. on 476.9 metres. It is reported that the official opening will take place on May 28th.

Read the Special Announcement on Page 233

Both French and German

AS it is anticipated that the conversion of the Beromünster (Switzerland) transmitter to a 100 kilowatter may necessitate the closing down of the station during the month of August, the Sottens station will broadcast programmes in both French and German. Later, this transmitter will also be re-equipped for higher power.

Langenberg (Cologne) off the Air

ANOTHER German station to close down temporarily is that of Langenberg, which is now being converted to a 100 kilowatter. The transmitter will cease working towards middle May and will remain silent for three to four weeks. The Cologne broadcasts during that period will be made through the old 15-kilowatt station.

A New Lease for Eiffel Tower?

AS innumerable pleas have been put forward by French listeners for the retention of the Eiffel Tower broadcasts, there is a possibility that the Ministry of Posts and Telegraphs may agree to its transmissions on the higher portion of the medium-wave band. According to a Paris paper every attempt is to be made to secure authority to use 545 metres, which, if the statement is true, would seriously jeopardize the positions of Beromünster and Budapest.

Proposed New Czech Stations

WITH a view to a further development of the Czech broadcasting network, plans have been drawn up for the construction of a new 30-kilowatt transmitter to work on 765 metres (392 kc/s); although the site is not yet definitely fixed, it is expected that it will be installed in the neighbourhood of Banska Bystrica. It is also proposed to build a 100-kilowatt station at a spot some fifty to sixty miles north-west of Bratislava, and later to replace the Kosice transmitter by one of much greater power.

Osram "K" Type Valves

A NEW series of valves for the battery user is announced by the General Electric Company. The valves are unusual in appearance, the general form taking on the appearance of the catkin type of valve, although the glass envelope is retained. As a matter of fact, the catkin method of electrode assembly, etc., is employed, with the exception of the cooled anode, and this has led to a remarkable reduction in overall dimensions. The S.G. valve, for instance, is only just 4in. in height and the widest part is the ebonite valve base. The triode is under 3½in. in height, and of this total one half is occupied by the valve base and valve pins. The initial releases in this series consist of the V.S.24/K which is a variable-mu H.F. screen tetrode having a 2-volt .15 amp. filament and is designed to operate with 150 volts on the anode and 75 volts on the screen. The second type is known as H.L.2/K and has a 2-volt .1 amp. filament, an impedance of 18,000 ohms, an amplification factor of 25, and is rated for 150 volts maximum H.T. The third is an output pentode. No release date has been announced for the S.G. and the pentode valve, but the H.L. is ready for immediate release, and readers should apply direct to the General Electric Company at Magnet House, Kingsway, W.C.2.

ROUND *the* WORLD *of* WIRELESS *(Continued)*

Toulouse PTT.

THE first of France's high-power provincial transmitters is being built at Muret, near Toulouse, and will be ready to go on the air towards the end of the year. The station will have a power of 120 kilowatts.

Italy Relays from Tripoli

THE Italian Colony at Tripoli (North Africa) is now in possession of a short-wave transmitter installed at Mellaha, which permits the broadcast of special programmes, *via* Rome, through all Italian stations. The power is 2 kilowatts, and the channel to be used is one between 16 and 18 metres. A small local station has also been opened at Tripoli for the re-broadcast of news and sporting results received from the Italian capital. It is expected that the Italian studios will mako a regular feature of colonial concerts in their programmes.

Queen's Hall "Proms."

THE B.B.C. announces that an eight week season of "proms." will begin on Saturday, August 11th, and finish on Saturday, October 6th. This will be the fortieth series under the conductorship of Sir Henry Wood, and the eighth season organized by the B.B.C.

A "Mike" on the Jungfrau

THE National Broadcasting Company this year proposes to broadcast a running commentary of an ascent of the Jungfrau, one of the highest mountains of Switzerland. The Swiss broadcasting associations will co-operate, and it is expected that this sensational stunt will be transmitted through both Beromünster and Sottens.

Beromünster, 100 Kilowatts

IT is reported from Berne (Switzerland) that the Swiss Telegraphs Administration has entrusted the work of increasing the power of the Beromünster transmitter to the Marconi Company. Possibly during reconstruction the station may close down for approximately one month from the middle of August. When completed, it will reappear on the air as a 100 kilowatter.

Electric Tramways Interference

STUTTGART papers publish in all seriousness a statement made by the Chief Engineer of the Baden Baden Tramway System, in which he is said to have admitted that after trying a number of gadgets for the elimination of interference with broadcast programmes, a simple means was discovered by one of the workmen. Both cables and trolley were well greased, and thus sparking in wet weather was obviated!

Listen to Australia

IN celebration of Empire Day (May 24th), the B.B.C. will re-transmit in the National programme a radio entertainment presented by the Australian Broadcasting Commission. It will open with the chimes of the G.P.O. clock at Sydney, and will include the new familiar Kookaburra call. The programme will include three dramatic cameos illustrating the historical side of the Commonwealth. In collaboration with the Colonies and Dominions overseas, the B.B.C. hope to relay special entertainments from each in turn. Provisional schedule includes Canada and Newfoundland (1935), India and Ceylon (1936), the Irish Free State (1937), New Zealand (1938) and South and East Africa (1939). On these exceptional occasions the broadcasts will be made available to listeners throughout the British Empire.

INTERESTING and TOPICAL PARAGRAPHS

New Interval Signal

ALTHOUGH of relatively low power, broadcasts from the Geneva station (Switzerland) can now be well heard on 748 metres (401 kilocycles). The station can be easily recognised by the fact that it opens and closes its transmissions with the morse letters R S R (.—. ... .—.), followed by a short excerpt from an old Swiss melody, *Charles Emanuel a Etrembieres*, played on a musical-box. RSR stands for the initials of the *Radio Suisse Romande*, the Swiss organization controlling the Lausanne and Geneva studios of which the entertainments are radiated through Sottens on 443.1 metres (677 kilocycles).

New American Station

WNEW is the call-sign of the latest transmitter to go on the air in the United States; it is situated at Carlstadt (New Jersey) with studios in Newark (N.J.) and New York. It operates on 240 metres (1,250 kc/s) with a power of 2½ kilowatts during the day, reduced to 1 kilowatt at night. Programmes will be broadcast from early morning until midnight, Eastern Standard Time.

Poland's New High-Power Station

MOKRE, near Torun, has been selected as the site of the second high-power station to be erected in Poland. The construction of this 100-kilowatt transmitter has already been started, and it is expected that the building may be completed this year. As, however, the Geneva allocation of 986 kilocycles for a station in that district is a channel shared with Genoa, it is anticipated that it would take on the exclusive wavelength and duties of the Poznan station, which, in its turn, would be dismantled and transferred to Pinsk. Torun was ceded to Poland by Germany in 1918; it is roughly ninety-two miles from Danzig.

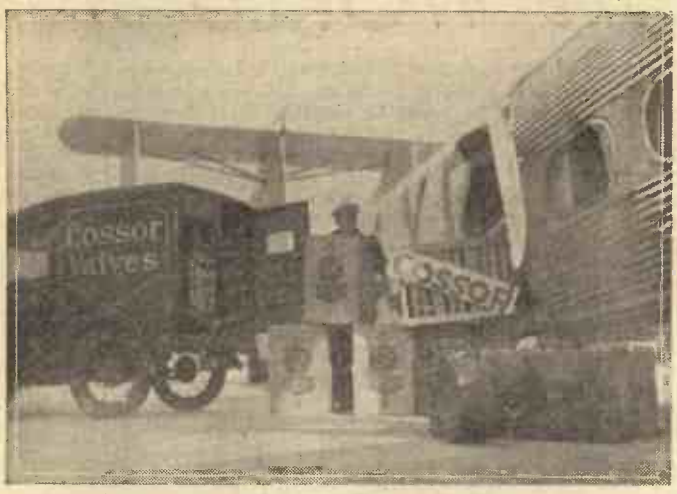
Radio-Lisboa Calling!

THE new Lisbon transmitter is on the air and you may hear it almost nightly testing on 476.9 metres, between 22.00 and 23.00 B.S.T.

Village Players' Broadcast

ONE of the most interesting groups of village players in the country is that at Worthen, in Shropshire. It was formed about ten years ago, and is directed by the village schoolmaster, W. N. L. Richardson, who selects and produces the plays, which have included the traditional mumming play, *Twelfth Night*, *The Little Plays of St. Francis*, Lord Dunsany's *A Night at an Inn*, mimed ballads, and a play in the Chinese theatre idiom. The Worthen players visit the Birmingham studio on May 12th, to give Midland Regional listeners some genuine Shropshire character studies and episodes drawn from three novels by Mary Webb—"Armour Wherein he Trusted," "The Golden Arrow," and "Precious Bane." Worthen is in the heart of the Mary Webb country. The scenes are arranged and adapted by Mr. Richardson.

TELEVISION APPARATUS BEING DESPATCHED BY AEROPLANE.



A consignment of Cossor cathode-ray tubes and receivers being taken aboard an Imperial Airways air liner at Croydon to fill a rush order on the Continent.

SOLVE THIS!

PROBLEM No. 86.

Davis built a three-stage L.F. amplifier employing resistance-capacity coupling for the first part of the circuit and a push-pull stage for the output. After connecting this to the mains he found that it was very unstable, volume having to be kept very low to prevent motor-boating. He increased decoupling components, and spent a lot of time in varying the capacity of the anode by-pass condensers and anode decoupling resistances, but was unable to prevent the noise. What was wrong? Three books will be awarded for the first three correct solutions opened. Address your attempts to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 86 and must be posted to reach here not later than the first post Monday, May 14th, 1934.

SOLUTION TO PROBLEM No. 85:

Smith overlooked the fact that the larger super-power valve would not only require a greater input to deliver its maximum output, but it required a higher H.T. voltage and consumed more H.T. current. Hence his original valve would deliver more volume with the small input and lower voltage.

The following three readers correctly solved Problem No. 84 and books have accordingly been forwarded to them:—

M. D. Armitage, 194, Boothferry Road, Goole, Yorkshire. C. R. Willis, 53, Salisbury Road, Everton, Liverpool, 5. J. F. Shore, 1, Pallas Terrace, Eltham, S.E.9.

AMATEUR TRANSMISSION

This Article Explains the Principal Conditions Which Must be Fulfilled in Order to Take Out a Transmitting Licence

By FRANK PRESTON

THE publication, on page 1174 of PRACTICAL WIRELESS, dated March 17th, 1934, of details concerning the construction of a simple single-valve transmitter for amateur use, has led to the receipt of a large number of inquiries in respect of amateur transmitting generally. Since there is apparently a good deal of misunderstanding on the part of readers in regard to the possibilities of amateur transmission, it is felt that the matter should be clarified.

Quite a few readers have asked if the simple transmitter which was briefly described would be suitable for use as a means of communication with friends a few miles away. This question makes it quite evident that the inquirers do not appreciate the fact that under no circumstances must a wireless transmitting station be used for private and personal purposes; it is a strict condition of the granting of a transmitting licence that the station shall be used purely and simply for *bona fide* experimental purposes.

The above photograph shows a typical amateur transmitting station; the photograph was taken a few years ago, and this accounts for the use of plug-in coils.

The Licence Question

This brings us to another point, because it is apparently not clearly understood that it is illegal to operate a transmitter of any kind without first taking out an appropriate licence. The ordinary broadcast licence gives permission to the owner to *receive* broadcast matter only. Before a transmitting equipment may be set up, even for use with a non-radiating aerial (one which confines the "transmission" as far as possible to the walls of the house), it is absolutely essential to obtain a licence from The Secretary, G.P.O., London, E.C.1. In the first place the applicant should write to the above address, asking for an application form for a transmitting licence. This will shortly be received, accompanied by a "Summary of Conditions of Issue," which should be studied very carefully. It is unnecessary to repeat all those conditions here, but it will be helpful to give abstracts from the more important ones, along with brief explanations.

Scientific Experiment Necessary

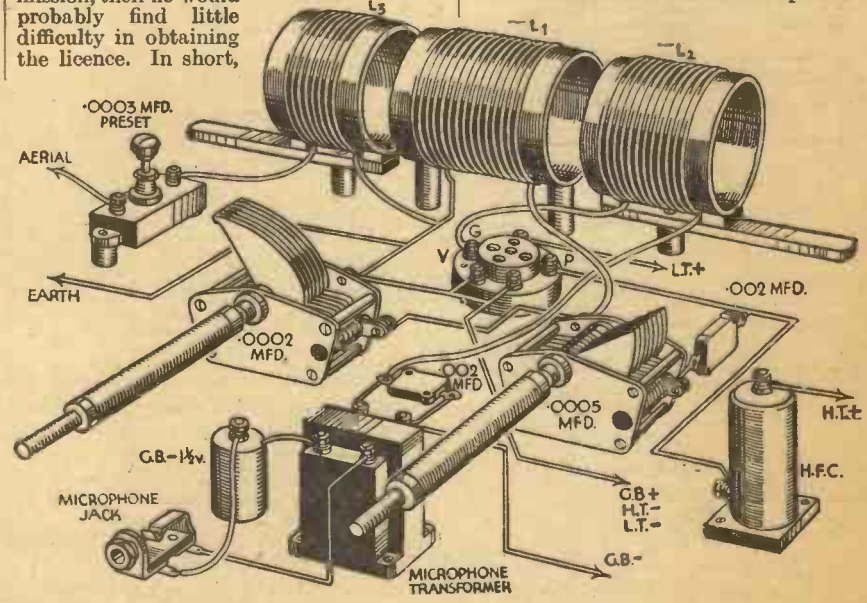
The first condition of great importance is number (4), which reads: "Applicants must satisfy the Postmaster-General that they are qualified to conduct experiments of scientific value or public utility. If scientific research is intended they should be certified as competent investigators by a Government Department or some recognized scientific body. Authority to use wireless-sending apparatus, even with an 'artificial' aerial (i.e., a practically non-radiating aerial), can be granted only if the nature of the proposed experiments and other circumstances warrant that course."

It will be clear from this that it is useless to apply for a licence merely because one wishes to talk, by wireless, to a fellow enthusiast. On the other hand, if the amateur has some definite line of experiment in view, and if this is of a novel nature, he will stand a good chance of securing the necessary licence provided that he can comply with the other conditions. It is no use trying to secure a licence simply because it is desired to see how far signals can be transmitted with a very limited power and on various wavelengths, but if the applicant has some novel ideas for a special directional aerial system, or if he wishes to experiment with some means of making two transmissions on a single wavelength, or if he proves that he has made a new discovery in respect of a method of television transmission, then he would probably find little difficulty in obtaining the licence. In short, anyone who can prove that he has really discovered some new principle that might prove of value to the science stands a very good chance of being granted a licence. It is essential, however, that in making application, the fullest possible particulars be given; they will be treated in the strictest confidence.

Morse Qualifications

The condition just dealt with is equally applicable whether the applicant wishes to employ an "artificial" or "radiating" aerial, but if the latter is desired there are many other conditions to fulfil. For example, condition number (5) reads: "Each radiating station must be under the charge of a person who has satisfied the Postmaster-General, by examination or otherwise, that he has attained: (*a*) An adequate knowledge of the adjustment and operation of the apparatus he wishes to work; (*b*) an operating speed of at least twelve words (morse) a minute, sending and receiving. This qualification is necessary under international regulations, even when wireless telephony only is to be used. The person in charge of the station must be in a position to act upon instructions in the morse code issued by Government and commercial stations. . . ."

There is no doubt that this particular condition proves a greater stumbling block than any other to a multitude of would-be transmitters, chiefly because they will not go to the trouble of learning the morse code. Morse need present no very great difficulty, provided that the learner can spend about



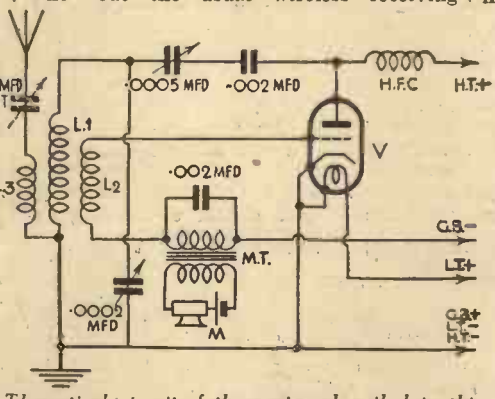
A pictorial diagram of the specimen circuit shown on page 232.

half an hour a day at regular practice—preferably in conjunction with a friend. Some kind of tapping key and buzzer will be required for practice purposes, but these can be bought cheaply from a number of firms which specialize in Government surplus materials. Various simplified methods of learning the morse code have been described in previous issues of PRACTICAL WIRELESS.

The authorized power for amateur transmitting stations is normally limited to 10 watts, but in special cases an increase will be allowed if considered desirable by the Postmaster-General. When a radiating aerial is employed the following bands of wavelengths can be used: 173.4 to 151.1 metres; 42.7 to 41.24 metres; 21.38 to 20.88 metres, but when any special justification can be shown the wavelengths of 10.7 to 10.02 metres and 5.35 to 5.005 metres will also be allowed.

Licence Fees

The foregoing remarks will give the potential transmitter an idea of the conditions which must be fulfilled before he can obtain a licence. At first sight they may appear rather formidable, but in practice they prove to be very reasonable, provided that the amateur wishes to carry out some *bona fide* and worth-while experiments. It might be added that the licence fee for an "artificial" aerial licence is 10s. per year inclusive, and that for a "radiating" aerial, 20s. per year, plus an initial licencing fee of 10s. If a normal broadcast receiver is to be used for entertainment, in addition to the experimental apparatus, it is necessary to take out the usual wireless receiving licence besides the special transmitting one.



Theoretical circuit of the receiver described in this article.

A Simple Circuit

For the benefit of those readers who propose to go farther into the question of amateur transmission, a simple circuit which will prove very suitable for the beginner is given on this page. It makes use of the popular Hartley circuit (with grid modulation), and is battery operated. For, approximately, 170 metres, the coils L.1, L.2 and L.3 should consist of 15, 12 and 8 turns respectively of 16-gauge bare copper wire on paxolin formers, 4in. in diameter. It is best to mount L.1 between the other two, making L.2 and L.3 movable in respect to it. The microphone (M) and microphone transformer (M.T.) may be of the types now sold for so-called home broadcasting, and which were dealt with in PRACTICAL WIRELESS dated December 23rd, 1933. When using a super-power valve (of the indirectly-heated type), such as the Cossor 41 MXP with an H.T. voltage of 200, a G.B. battery (G.B.) of 24 volts, and a 4-volt accumulator, the power dissipation will be about 4 watts, this being sufficient for the initial experiments. It would, of course, be an easy matter to modify the suggested circuit for all-mains operation.

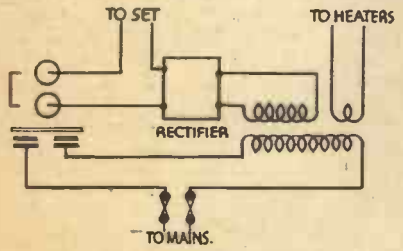
A MECHANICAL DELAYING DEVICE

WISHING to fit a delaying device, but not wanting to interfere with the loading of the mains transformer by introducing a relay on the H.T. supply or inserting a thermal device on the heater windings both being in circuit continuously whilst the set is working, I made a mechanical device from an old alarm clock, using five of the wheels and mainspring, three contacts from an old change-over switch and small brass coupling pieces.

Method of Operation

Operation takes place as follows: Knob A—in off position blade B in clip C, fork arm D—in backward position, spring being at rest. On sharply turning knob A to ON, blade B makes contact across E, thus closing the circuit to the transformer, the contacts holding the arm in position.

This operation has charged the spring which slowly brings over fork arm D into the mercury cups and closes the circuit between the eliminator and the set; by this time the spring has come to rest again.

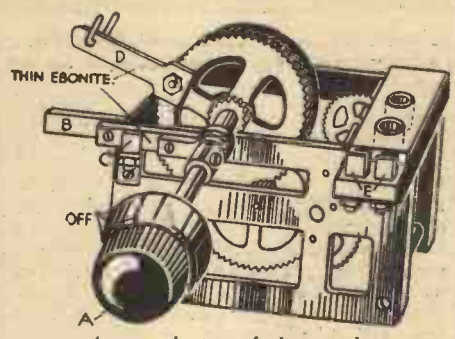


Wiring for the switch.

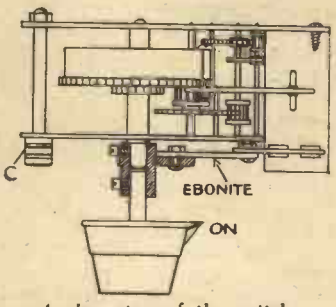
When switching off, the operation is reversed, blade B is turned over and held by clip C, the fork arm returns to back position, and the spring comes to rest. The train of wheels may be varied to alter the speed of the fork arm, the more wheels there are in the train the slower the speed. After procuring an alarm clock and stripping it, retain the frame, mainspring, spring spindle and wheel, and also four of the other successive wheels.

Modifying the Spring

Remove the pawl from the small ratchet wheel and make the large wheel quite free to revolve on the spindle. From the centre of the spring count about eight or nine turns, and snap off. Soften the end in a flame and bend round a ⅛in. screw, for securing the end of the spring to the large wheel and also to hold the ebonite arm D. The centre of the spring is securely fixed to the spindle by a brass collar, as shown at F. A piece of wire bent to the shape of an inverted ⊔ is fixed to arm D by sealing-wax to form the bridge across the mercury cups.



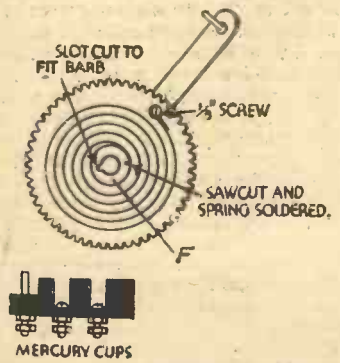
A general view of the switch.



A plan view of the switch.

The Contacts

Across the frame a piece of ⅜in. ebonite is fixed, for holding contacts E, and by drilling two ⅛in. holes about ⅛in. deep the cups are formed. A small hole is drilled in the bottom of each cup and a small screw inserted for connections. The extension spindle and coupling consists of a flanged wheel with part of the flange cut away, the remaining portion being drilled, and the ebonite strip is bolted on; to this strip blade B is fixed. Twenty to thirty seconds delay can be obtained, and still more if a small fan is fitted to one of the revolving spindles. The switching device above described might appear to be somewhat complicated, but it forms a very reliable unit, whilst providing some interesting work for the mechanically inclined amateur—G. HODGSON (Lancaster).



Method of re-mounting the spring.

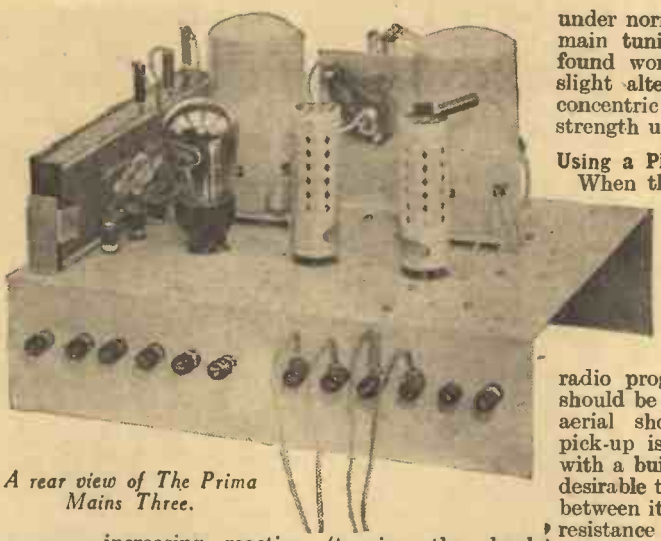
TELEVISION—THE NEXT MOVE

In the House of Commons last week the Postmaster-General, Sir Kingsley Wood, stated that a committee is to be set up to consider Television as a public service. He said the committee would be asked to consider the development of Television, and to advise on the conditions under which a public service could be provided.

THE PRIMA MAINS THREE

How to Connect Up and Use this Simple All-Mains Three-Valve Receiver.

IT has already been explained that this simple receiver is designed to operate in conjunction with a special mains unit. This unit may be seen on the centre pages of last week's issue, and there should be no difficulty in making the necessary connections between mains, unit, and receiver. On top of the unit will be seen five sockets, two black and three red. At the right of these is a simple on-off switch, and projecting from the casing near the switch are two leads coloured red and black. These are fitted at their ends with ordinary spade tags, and they are intended for connection to the two terminals on the receiver marked L.T.A.C. They may be joined to the two terminals in any order, there being no necessity to preserve polarity in view of the fact that the supply at this point is of an alternating nature. In the article given last week you were instructed to attach four leads to the H.T. terminals, and fit wander plugs to these. The markings on the terminals will assist you in inserting the plugs in the correct sockets. On page 214 last week the plugs attached to these leads were marked with the words "Screen," "Detector," and "Power," and these words are marked on the red sockets on the unit. Actual connection is, therefore, extremely simple and will occasion no difficulty.



A rear view of The Prima Mains Three.

After the mains unit has been wired up it only remains to connect the aerial, earth, and loud-speaker leads and to switch on. Before doing so, however, make sure that the G.B.—2 plug is inserted into the appropriate G.B. socket. No particular loud-speaker is specified, but any good moving-coil unit will be found to give excellent results. If a new speaker is to be bought, it should be provided with an input transformer of the multi-ratio or pentode type, so that correct matching can be secured between it and the last valve.

Simple Operation

The operation of the Prima is simplicity itself, and presents no difficulties whatever. There are only three important control knobs, these being on the tuning condenser, reaction condenser, and volume-control potentiometer respectively. Before attempting to tune in a station, set both wave-change switches to the same wavelength range; clockwise rotation brings in the medium-wave band and anti-clockwise the long waves. For preliminary tests the volume-control knob (on the left) should be turned to its full-on position and the reaction condenser (left-hand knob) should be turned right off. After that it is only necessary to rotate the main tuning knob until signals are received. When a station has been tuned in, signal strength can be increased by adjustment of the smaller knob, which is fitted to the tuning condenser and is concentric with the knob that drives the scale.

Selectivity Control

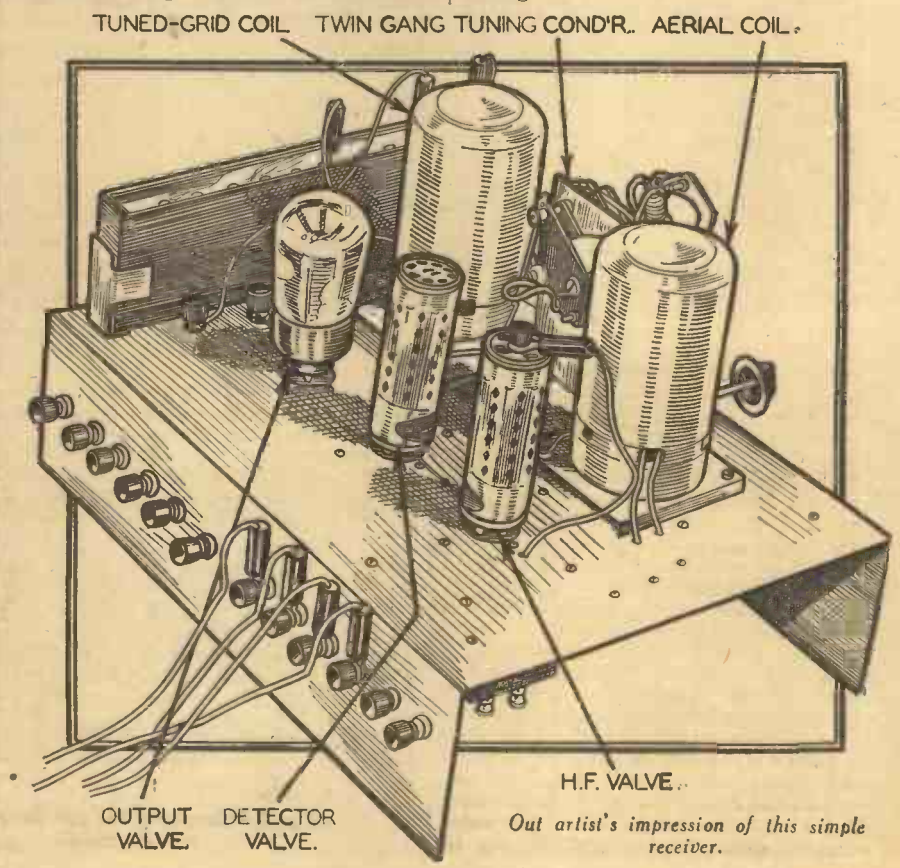
It will probably be found at first that there is apparently insufficient selectivity. This can easily be remedied either by increasing reaction (turning the knob clockwise) or by turning the volume-control knob to the left. After a little experience it will be found that optimum results can be obtained by using these two controls in conjunction with each other. For example, if selectivity is increased by turning down the volume control—in other words, increasing the grid-bias voltage to the first valve—volume can be brought back to its previous level and tuning still further sharpened by turning the reaction knob a little to the right.

All the principal stations can be received under normal conditions by operating the main tuning knob alone, but it will be found worth while in every case to try slight alterations in the position of the concentric trimmer in order to bring signal strength up to its maximum.

Using a Pick-up

When the set is to be used for gramophone record reproduction along with a pick-up, it is only necessary to join the latter to the two terminals which are appropriately marked and to insert plug G.B.—1 into the 1½- or 3-volt socket on the G.B. battery. To prevent "break through" of radio programmes the tuning condenser should be set to zero or, better still, the aerial should be disconnected. If the pick-up is of a type which is not fitted with a built-in volume control it might be desirable to insert a suitable potentiometer between it and the set; the most suitable resistance value depends entirely upon the pick-up, but particulars will be found on the maker's instruction sheet. In many instances, where long connecting leads are used between the pick-up and the set, there might be a trace of L.F. instability unless the leads are screened, the screening being earth-connected.

In view of the fact that the detector valve is of the Catkin type there will be no objection to mounting the receiver in a cabinet together with the loud-speaker, no trouble from microphony thereby arising.



Our artist's impression of this simple receiver.

ELECTRON-COUPLED OSCILLATORS FOR WAVEMETERS

A Practical Article Dealing with the Construction of an Interesting Type of Wavemeter.

By K. E. BRIAN JAY

IN a recent article dealing with dynatron oscillators mention was made of their suitability for heterodyne wavemeter use; any stable oscillator can be used for a heterodyne wavemeter, but the dynatron has the particular advantage that its calibration is less upset by changes in H.T. voltages than most oscillators. Unfortunately it shares with all the usual oscillator circuits the disadvantage that its calibration is seriously disturbed if a circuit is coupled to it either inductively, capacitatively, or conductively, so that one has to rely on the radiation from the coil to produce a signal by which to take a reading on a receiver.

Consequently, the wavemeter must be unscreened, with the result that it is likely to be affected by neighbouring metallic objects, instruments, etc., and furthermore the signal picked up on the fundamental wavelength range of the meter will be very much stronger than the harmonics, which are used for the shorter waves in order to avoid having several coils.

Overcoming Oscillator Defects

An arrangement which avoids these defects is the so-called electron-coupled oscillator, devised by the American, J. B. Dow. The oscillator part of this arrangement is coupled to the external circuits (receiver, etc.) solely by an electron stream in a valve, on the same principle as that of the pentagrid converter, recently introduced for superheterodynes. The working of the circuit can better be explained with the aid of Fig. 1, which shows a practical arrangement using a mains screen-grid valve. The cathode, control grid, and screen grid are used as the three electrodes of a triode operating in the Hartley circuit. The plate of the valve is coupled to this circuit by the electron stream in the valve and to the external circuit through the small condenser C_6. In order to minimize the effect of this circuit on the cathode to screen-grid electron stream the screen-grid must be at earth potential in respect of H.F. voltages. This is done by connecting the screen to earth through the mica by-pass condenser C_2. The result of this is that the other two points on the tuned circuit, viz., grid and cathode, must both be at H.F. potential above earth. When indirectly-heated valves are used this is unimportant because the cathode is well insulated from the heater circuit, but the position is different when using directly-heated valves. We have then a Hartley oscillator formed by the cathode and two grids of a screen-grid valve, whose stability is ensured by careful choice of components and adjustment of the screen voltage, coupled to external circuits solely by means of the electron stream inside the valve between cathode and anode. It may be objected that the condenser C_6 represents capacitative coupling, but this is required to confine the plate voltage to the oscillator, control the amount of power supplied to the external circuit, and minimize the effect of unavoidable imperfections in the layout.

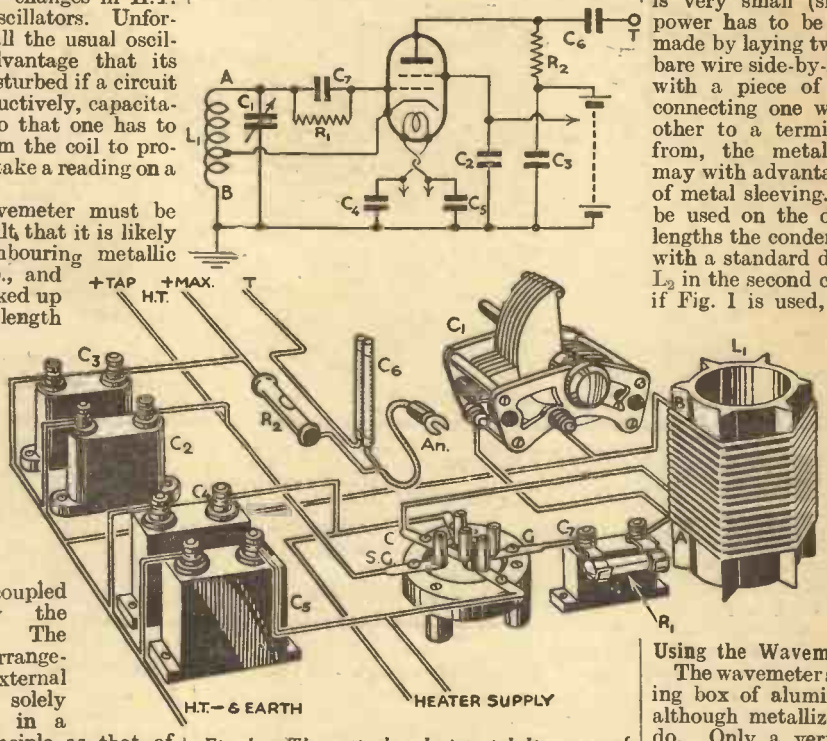


Fig. 1.—Theoretical and pictorial diagrams of an electron-coupled oscillator.

Practical Details

Although the only circuit so far discussed is the Hartley, any other arrangement can be adapted, including the usual reaction coil method, as shown in Fig. 2. The circuit looks rather odd, but it works and enables one to test out with the coils most likely to be at hand. Most component values are the same in both circuits, but depend to some extent on the wavelength band to be covered. If the oscillator is to be used on ordinary broadcast waves, the by-pass condensers C_2 and C_3 should be 1 mfd. non-inductive instruments, but on short waves .01 mfd. mica condensers are more suitable. The heater by-pass condensers C_3 and C_5 can be 1 mfd. on any wave, although they may not be essential. C_7 is a .0003 mfd. grid condenser and R_1 a 100,000 ohm grid leak; R_2 is a 50,000 ohm resistance, or an H.F. choke may be used here. For wavemeters the condenser C_6 is very small (since comparatively little power has to be supplied) and it can be made by laying two 2in. lengths of 16 s.w.g. bare wire side-by-side, insulating them each with a piece of insulating sleeving, and connecting one wire to the plate and the other to a terminal T on, but insulated from, the metal panel. The condenser may with advantage be screened by a piece of metal sleeving. If the instrument is to be used on the ordinary broadcast wavelengths the condenser C_1 may be .0005 mfd., with a standard dual-range coil for L_1 and L_2 in the second circuit. On short waves, if Fig. 1 is used, L_1 can consist of fifteen turns on a 2in. former, tapped a quarter of the way along from the end B for the cathode tap; such a coil when tuned with a .0002 mfd. condenser will cover from about 45 to 100 metres, with harmonic ranges on the second harmonic of 22.5 to 50 metres, 15 to 33.3 on the third, and 11.25 to 25 on the fourth.

Using the Wavemeter

The wavemeter should be built in a screening box of aluminium at least ¼in. thick, although metallized wood would probably do. Only a very reliable, rigid variable condenser should be used for C_1, with a good slow motion dial, and the coil must be wound very firmly on ebonite—or Keramot if the last ounce of accuracy is desired. In use the meter is placed near the receiver and tuned until a signal is picked up from it. If the pick-up is insufficient, a few inches of stiff wire connected to T will form an aerial that will give loud enough signals even on high harmonics. The stability of the oscillator is clearly demonstrated by touching T, when the wavelength will be found to change so little that the beat note heard in the receiver hardly alters, and the harmonics are all remarkably loud, the second being little, if any, weaker than the fundamental.

(Continued overleaf)

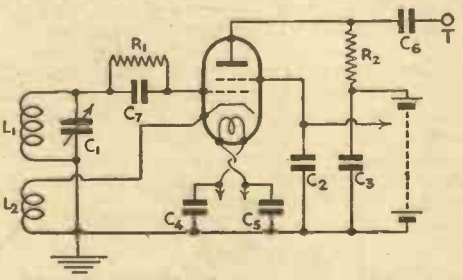
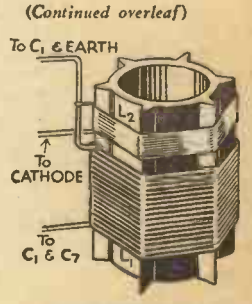


Fig. 2.—Details of the coil for a special reaction circuit.



ALTERNATIVE COIL CONNECTIONS (SEE FIG 2)

(*Continued from previous page*)

Owing to the high H.F. potential of the filament the circuit is not easily adapted to battery-heated valves but a workable arrangement is shown in Fig. 3. The grid part L_1 of the tuning coil is wound in the usual way but the plate part L_2 has inter-wound with it a second coil L_2^1, which forms one filament lead, the other connection being made through L_2. Otherwise, the circuit values are the same as in the previous figures. A coil for the 45 to 100-metre band requires twelve turns for L_1 and three turns each for L_2 and L_2^1, wound with twenty-two enamelled or d.c.c. wire on a 2in. former. With from 20 to 25 volts on the screen grid of a 2-volt valve and 60 volts on the plate this gives strong harmonics down to 15 metres, and takes only from .25 to .4 m/A. total H.T. current, depending on the valve used. Even mains valves only take a total current of under a milliampere with the same H.T. voltages—yet another point of superiority over the dynatron. The electron-coupled oscillator cannot, however, be used in the same way for comparing coils, etc.

The uses of electron-coupled oscillators are by no means confined to wavemeters; they can be made to deliver quite a lot of power and so employed as master oscillators in transmitters. The circuit can also be adapted for use as an oscillator in a superhet and as a reacting detector, especially on short waves.

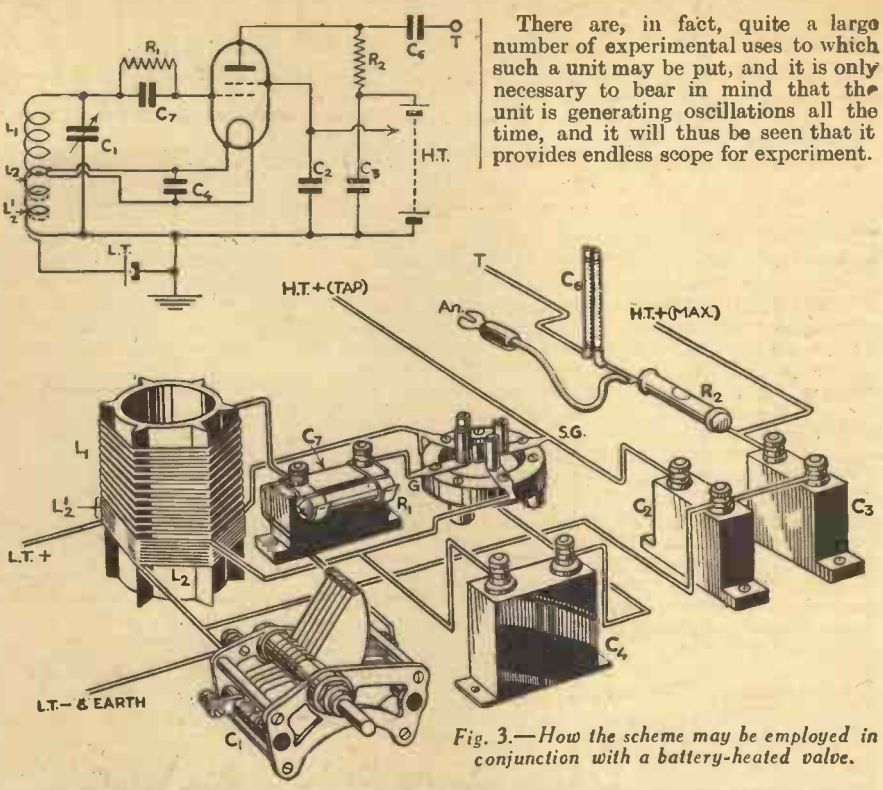


Fig. 3.—How the scheme may be employed in conjunction with a battery-heated valve.

There are, in fact, quite a large number of experimental uses to which such a unit may be put, and it is only necessary to bear in mind that the unit is generating oscillations all the time, and it will thus be seen that it provides endless scope for experiment.

EXPERIMENTS WITH DUAL SPEAKERS

Practical Details of a Method of Improving Reproduction by Using Two Speakers.

By G. W. DAVEY.

At the present time the practice of using two moving-coil units on a common baffle is becoming more general, and examination of one of these combinations will generally reveal one large speaker and one smaller one, each arranged to cover the lower and higher parts of the register respectively. We have not all got access to a selection of moving-coil speakers from which to pick two to arrange as a dual-unit speaker, but moving-iron units are cheap and an astonishing amount can be done with them. It will be realized, of course, that we cannot merely take two speakers, connect them together and hope for the best. Each one must be adjusted for its own particular portion of the register, and it is purposed to give a few hints on how this may be arranged.

It is assumed that the reader has had experience of making cone diaphragms and fitting up a simple cone speaker or, failing this, that he can turn up previous articles on this subject. The first requirement will be a fairly large oblong or square baffle board about ½in. thick (5-ply is excellent). In this must be cut a hole 12in. in diameter with, above or beside it, and about 2in. away, another one 5in. diameter. The next operation is the making of the respective cones. They may be made from cartridge paper, good stiff brown paper or thick quality "Kraft" paper or thin cardboard, but oiled paper such as is used for stencil and lamp-shade making, is particularly to be recommended. This is stiff yet light, and impervious to damp and temperature changes. The larger cone to be made should have a diameter at the mouth of 11in., and the smaller one of 6in., both being 5in. deep. The larger cone must now be attached to the baffle behind the larger hole by means of a suspension of chamois leather, oiled silk, very thin rubber, or similar materials. Around the edge of the smaller hole glue, at the back, a strip of felt 1in. wide.

Mounting the Units

Some method of mounting the speaker units must next be devised, and this is best left to each reader's own particular case and ingenuity. Suffice it to say that the mounting must be rigid and of sufficiently thick wood to prevent vibration. The units being mounted, they must next each be affixed to their respective cones. Screw the apex of the larger cone just so far down the reed of the unit that the cone is neither tightly pushed forward nor pulled back, but is free to move as required. The smaller cone should be allowed to rest lightly against the felt glued around the back of the smaller hole. Make sure all screws in the cone-fixing and the mounting are well driven home so that all is rigid, otherwise a distressing rattle will soon make itself heard. Try the leads from each unit in both series and in parallel to see which method gives the better results. If the units are both of the same make the sensitivity may be similar, but if they are of different makes it may be found that one is more sensitive and so "drowns" the effect of the other one. If this is the case a variable resistance (about 25,000 to 50,000 ohms) may be connected across the more sensitive one.

Adjusting the Frequency Response

It may be found that the reproduction is not all that can be desired, and if this is the case, some further adjustments may be necessary. The most likely thing is that the top register of the "bass" unit and the lower register of the "high" unit come around the same point, so causing a resonance about the middle of the register. I this is the case, it is quite easy to cut off either high or low notes. To reduce the high-note response a condenser of .002 mfd. up to .1 mfd. may be connected across the terminals of the particular unit to be so treated, and, of course, the higher the capacity of the condenser, the more the high notes will be by-passed.

Should the reader have on hand several loud-speakers from which he can select two, having good high and low-note responses respectively, he can connect them up together and, with a little experimenting as described, make up a composite speaker giving better results than one of the speakers alone. Much in this connection can be done where one has a "boomy" moving-coil speaker (particularly such as were popular a few years back), for, using a simple cone unit or even an old horn loud-speaker together with it, an astonishingly realistic result can be obtained. Finally, as a word to those thinking of trying out the experiments mentioned, it might be added that, for real bass notes, a large flat or "non-boom" box-baffle is essential, las also is a good power output.

THAMES PILOT SERVICE BROADCAST.

On May 23rd a relay and descriptive commentary of one of the most important branches of the British Pilot Service will be heard by London Regional listeners. The microphone will be installed at Gravesend Pilot Station, Royal Terrace Pier, to enable three pilots to recall some of their thrilling experiences at sea. Their talks will be followed by the assembly of pilots at The Pier Head, preparatory to taking their ships through the mouth of the River Thames and out to sea. A background of river noises will add to the realism of this broadcast which has been arranged with the co-operation of the London Trinity House Channel Pilots Committee.

DEVELOPMENTS IN THE LAST DECADE (2)

An Article of Interest Both to Those Whose Wireless Experience Goes Back to the Early Days of Broadcasting, as Well as to Newcomers to Radio.

A WARM welcome was extended to the "Primax" patent which was taken out by a French research worker. This patent was in respect to a hornless loud-speaker in which the sound was distributed by means of a large diaphragm made of pleated paper. (A sketch of a "Primax" speaker was given last week.) The new type of speaker was found to be far more satisfactory than the small horn speaker, and gave much better response to the low notes; it was the forerunner of the "cone" speaker which later entirely ousted the horn for home reproduction.

Fig. 6.—Showing the construction of the electrodes in an indirectly-heated valve.

The S.G. Valve

After the general adoption of dull emitters, baseboard construction, the cone speaker, and dual-range coils, there were not many more drastic changes in design until about 1928 or 1929, when the screened-grid valve first made its bow. Excellent results had been obtained from the neutralized three-electrode valve, but the difficulties associated with it were fairly great. And it was found that the effective valve capacity could be reduced to very small limits by inserting an electrostatic screen between the grid and anode, and that in consequence the necessity for neutralizing need exist no longer. The screen-grid valve would give as much, or possibly more, amplification than would the neutralized triode, and by far simpler means, and it therefore achieved almost instantaneous success. When first made the S.G. valve was vastly different from the one we know to-day, in general appearance it was not unlike the very early "V.24."

Further Changes in Coil Design

After a very short space of time the S.G. valve had been brought to an amazing state of efficiency, and was capable of amplifying signals to a hundred times their original intensity. This was naturally a very welcome improvement, but it introduced certain complications in tuning-coil design because, with the highly-efficient tuners then in use, it was a difficult matter to obtain complete stability whilst retaining the full amplification of the valve. As a result, the tuners had to be made rather less efficient by winding them with finer wire on smaller diameter formers and screening them still more closely. This was a blessing in disguise, for it made possible an appreciable reduction in the size of the complete receiver and enabled the wiring to be kept much shorter. It also produced a further increase in selectivity because it prevented the coils themselves from picking up signals from near-by transmitters.

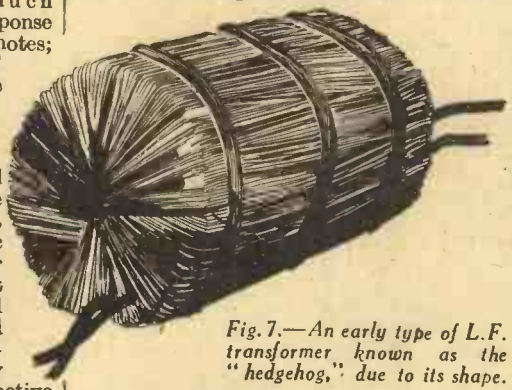


Fig. 7.—An early type of L.F. transformer, known as the "hedgehog," due to its shape.

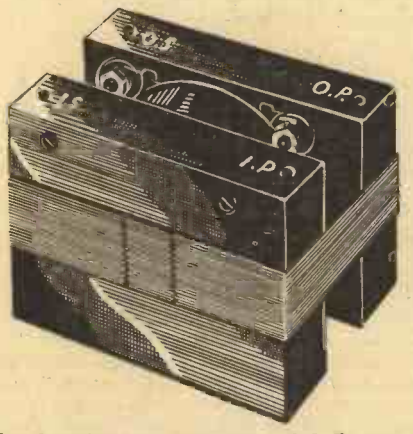


Fig. 8.—Another early type of L.F. transformer.

Fig. 9.—A well-known transformer of modern design; the Ferranti.

The First Pentodes

At about the same time as the four-electrode (screen-grid) high-frequency amplifier came into use, another highly-important development occurred in respect to low-frequency amplification. I refer to the pentode. It was found that by employing three grids (of which one served the usual purpose of controlling the electron flow, another was connected to H.T. positive and the third to the filament) a much higher degree of low-frequency amplification could be obtained from a single valve than had ever before been possible. The first pentodes had the rather serious disadvantage of consuming a considerable amount of high-tension current, and were therefore unsuitable for use with ordinary batteries, but this difficulty was eventually overcome and the consumption reduced to the same level as that of ordinary small-power valves.

Fig. 11.—A permanent-magnet moving-coil speaker.

All-mains Receivers

Up to about 1924 the high-tension supply had been obtained principally from dry batteries, although high-tension accumulators and wet Leclanché batteries had gained a certain hold due to their lower running costs. But in the latter year definite and successful attempts were made to obtain high-tension supply from the lighting mains. Eliminators were made in increasing numbers and later models were so designed that the accumulator could also be charged through them. Later, still further modifications were made so that a supply of low-tension current and grid bias could also be obtained from the same eliminator. But this was only a prelude to the design of all-mains receivers of the type using special indirectly-heated valves whose low-tension supply could consist of alternating current obtained directly from a mains step-down transformer. The

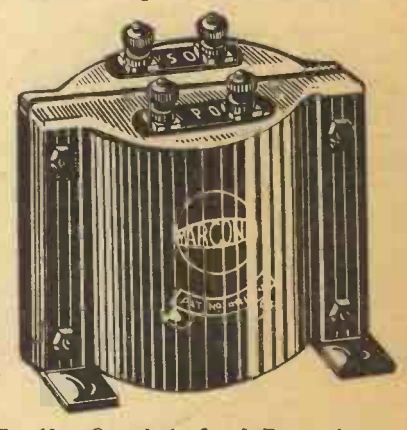


Fig. 10.—One of the first L.F. transformers of the shrouded type.

general form of construction of the indirectly-heated valve is shown in Fig. 6, from which it will be seen that the filament (or more correctly, heater) is used only to heat up the porcelain tube which is coated with an oxide of some "rare earth" in the same way as was the filament of the early dull emitters. It is the porcelain tube, called the cathode, that emits the electron stream, and not the filament itself, as is the case with battery valves. Besides being much more convenient when a mains supply is available, the indirectly-heated valves are also appreciably more efficient than those of the battery type.

Moving Coils

Even before the time when the mains were used for power supply, moving-coil speakers had been employed, but the high cost of supplying their field current had prohibited their general use. But when mains-operated receivers became popular the moving coil came into greater use than ever before. This type of speaker was capable of much better "quality" than previous ones, provided that it was supplied with a large input of signal energy, and was at the same time capable of handling much larger volumes of sound without becoming overloaded; it was therefore ideal for use with the comparatively powerful mains receiver. I scarcely need add that from that time the moving coil has come to be recognized as the *par excellence* in the loud-speaker field. For a while the only types available were those which required the application of some external voltage (mains or battery) for energizing the magnet system, but eventually the permanent magnet type which is so popular at the present time was evolved.

Band-pass Tuning

By about 1930 the selectivity question had become more vital than ever. Stations both in this country and on the Continent were increasing in number by leaps and bounds, whilst they were using more and more power. Something had to be done to avoid confusion, and representatives of the various European broadcasting organizations met and decided that a wavelength, or frequency, separation scheme must be set on foot. Thus it was arranged that all the more powerful stations must be separated in frequency by no less than 9 kilocycles. But even this did not put an end to the difficulties of reception, because very few sets were sufficiently selective to tune accurately within the limits imposed.

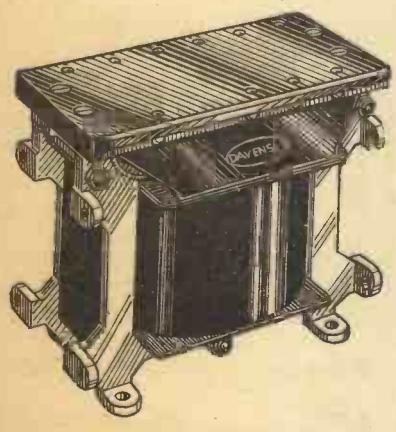


Fig. 12.—A typical mains transformer of sound construction.

All those dodges you know so well, such as shortening the aerial, tapping the tuning coils, using a series aerial condenser, sharpening the degree of reaction and so on, were tried, but none of them was really effective. It is true that a sufficiently high degree of selectivity could be obtained by some of the methods, but the very fact of achieving selectivity militated against the quality of reproduction by "cutting" the high notes.

These things led to the evolution of a new tuning system known as band-pass. This name was given because the tuning circuits were so designed that, although they were extremely selective, they would pass a band of frequencies, generally 9 kilocycles wide. In other words, selectivity was obtained without the introduction of high-note loss. In this series of articles I have carefully refrained from technicalities, so I will not enter into the theory of band-pass here, but will leave the subject after having explained the practical points involved.

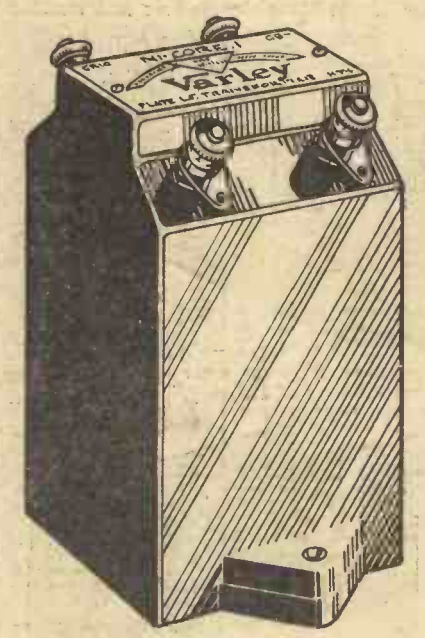


Fig. 13.—The Varley Nicore L.F. transformer which has a high-permeability core of nickel alloy.

Re-enter the Superhet

Between the time of the introduction of band-pass tuning and 1932 there are not very many important developments to relate. Changes were made, but they were principally in relation to minor points in design and to the perfection of previous improvements. Before passing on to the events of more recent occurrence, however, we must mark the renewed interest in the super-heterodyne which was aroused during 1931. The increasing demand for selectivity was chiefly responsible for the popularity of the superhet at this time, and consequent upon improvements in various other directions it was found to be possible to make a set of the latter type which was capable of giving a quality of reproduction in keeping with that to be obtained from a straight set. Moreover the super-heterodyne could now be made to cover both long- and short-wave tuning ranges, whilst "single-knob" tuning could be provided by the use of special gang condensers. From this time until the present, the super-heterodyne and "straight 2 S.G." types of receiver have been struggling for pride of place, and

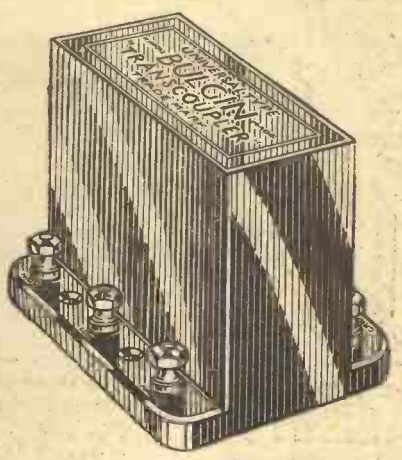
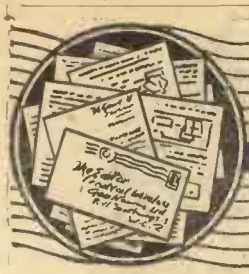


Fig. 14.—An L.F. coupling unit, which comprises a transformer, coupling condenser, and feed resistances.

it now appears that the superhet will be the victor.

And now, having traced the paths of progress since about 1923, we come to the year 1932. Despite former pessimism and rumours that radio developments had reached a stage of finality, 1932 marked the advent of many innovations in design and principles. Probably the most important of these was the introduction to the general public of the variable-mu screen-grid valve. This was a modified form of the previous screen-grid valve, over which it showed several notable advantages. The first of these was that the new valve could accept a larger input of signal current without overloading and without producing that peculiar interference effect known as "cross modulation." The latter was caused by the ordinary screen-grid valve when a powerful signal was applied to it, and was due to the valve acting partly as an amplifier and partly as a detector. Another important advantage of the V.M. valve is that it can be employed as a perfectly distortionless pre-detector volume control by varying its grid-bias voltage. Due to the latter fact it is possible to devise a circuit arrangement of such a nature that automatic volume control is provided and with which the volume from every station, near or distant, is substantially the same. This is achieved by so designing the circuit that the grid bias to the V.M. valves is increased as the intensity of the received signal increases; the higher bias voltage reduces the amplification of the V.M. valves, and this effect counteracts that of the more powerful signal. It can be seen that with an arrangement of this kind the most annoying factor in long-distance reception, fading, can be overcome to a very great extent. Just as screen-grid valves entirely displaced their earlier three-electrode brethren, so is the variable-mu rendering obsolete its screen-grid counterpart, and it might be only a short time before the ordinary S.G. valve is a thing of the past.

Besides ushering in the V.M. valve, 1932 saw the improvement in design of nearly all our receiver components.

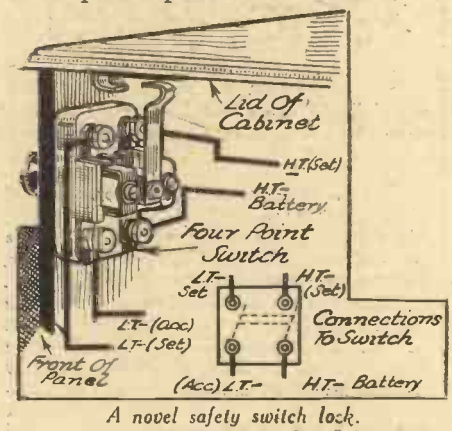


READERS' WRINKLES

THE HALF-GUINEA PAGE

A Safety Switch Lock

THE accompanying sketch shows a switch lock I recently fitted to my receiver cabinet so that it could not be opened while set was switched on, thus eliminating the possibility of blowing a fuse while making adjustments. Most of the parts required can be obtained from

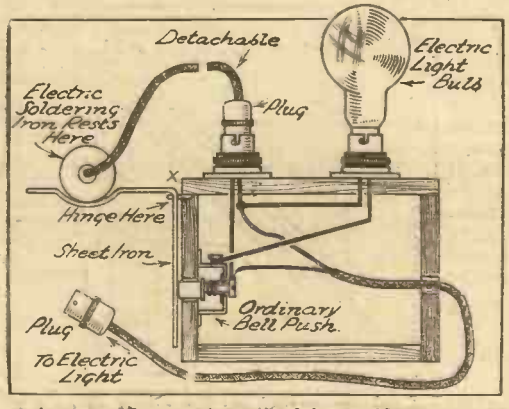


A novel safety switch lock.

the scrap box, and consist of one four-point switch, two grid-leak clips, and two wood screws. The switch is fixed near the top of the cabinet and takes the place of the L.T. switch. The two grid-leak clips are straightened out, as shown in the sketch, and the nut holding the switch assembly clamps one of the clips in place, while the other is screwed to the lid of the cabinet. This clip is fixed so that its hook engages with the other clip when the switch is out, and disengages when the switch is off. The reason why a four-point switch is used is that one side will act as L.T. switch while if the other is inserted in the H.T. — lead both H.T. and L.T. will be disconnected before the set can be opened.—A. HODGETTS (Smethwick).

Automatic Switching Stand for a Soldering Iron

THE accompanying sketch shows a device which enables one to leave an electric soldering iron switched on without



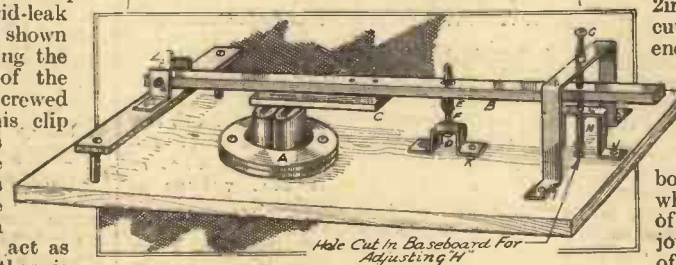
An automatic switching stand for a soldering iron.

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 wrinkle 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., 8-11, 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 "Radio Wrinkles." Do NOT enclose Queries with your Wrinkles.

getting too hot, although it is kept quite warm all the time and takes but a few seconds to get properly hot. The materials required are as follows: 1 wooden box 6in. long, 3in. wide and 3in. high (approximately); 1 electric light bulb (220 volts); 1 bell push button; 2 bulb holders, and 2 plugs.

The rest for the "iron" is bent as shown and hinged by boring two holes at x and threading a piece of thick wire through these holes. The wire can then be hammered into the wood to keep it firm.—D. R. CHAMBERLAIN (Solihull).



A simple sensitive relay.

A Sensitive Relay

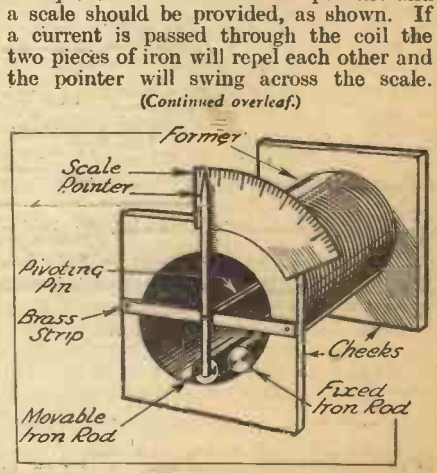
A SIMPLE and sensitive relay can be made at negligible cost, the materials required being as follows:—

The magnet assembly of an old pair of headphones; a length of square brass rod; a few scraps of sheet aluminium, or copper; some nuts and bolts; a small spring, and the iron armature of an electric bell. The armature (C) is bolted to the brass bar (B), and B is hinged by means of a bolt and locking nuts to a pair of brackets (L), which are mounted on an ebonite strip, raised above the baseboard by two pillars. The magnet (A) is screwed to the baseboard underneath (C), and must be adjusted so its pole-pieces are parallel to (C). A slot is cut in (B) by drilling two holes close together and filing away the metal in between; a fairly long bolt (D) is fixed to a small bracket (K), a nut and washer (F) being placed on (D), and the spring (E) on top of them. The bracket (K) is screwed down to the baseboard so that (D) projects through the slot in (B). The two contacts of the relay are formed by the two screws (G) and (H), which are fixed to two brackets (I) and (J) respectively; each screw being fixed to its bracket by means of two nuts, one on each bracket. To use the relay, the weak current (from an amplifier, or line-circuit) is passed through the coils of the telephone, and if the spring has been properly adjusted, the bar is easily attracted, so that it makes contact with the lower contact (H), which should be high enough to prevent (C) from actually touching the pole-pieces. When the current is interrupted, the bar springs back to make contact with (G); (G) must be adjusted until (C) is close enough to the pole-pieces for the smallest current to operate the relay. The third contact of the relay can be made to (B) through one of the brackets (L). When adjusted properly this relay will respond to about 10 milliamps.—P. MORCOM (Penarth).

A Home-made Ammeter

THE accompanying sketch shows a handy form of ammeter which can be made in a short time. A hollow cylindrical former 1¼in. diameter and 1½in. long is first made by wrapping several layers of thick paper round a suitable cylindrical object and gluing. Two cardboard cheeks 2in. square with 1¼in. diameter holes cut in them are then glued to the ends of the former, and 200 turns of 24-gauge copper wire are wound on the bobbin thus formed. Two strips of brass with holes drilled in their centres are then fixed across the ends of the bobbin, as shown. A pivoting pin which has a pointer (made of a strip of brass) soldered to one end of it, is journalled in these holes. A 1in. length of ⅛in. wrought iron rod is also soldered to the lower end of the pointer, and another 1in. length is glued or fastened along the inside of the bobbin so that it almost touches the other piece on the pointer when the latter is hanging vertically. The two pieces of rod should be parallel and a scale should be provided, as shown. If a current is passed through the coil the two pieces of iron will repel each other and the pointer will swing across the scale.

(Continued overleaf.)

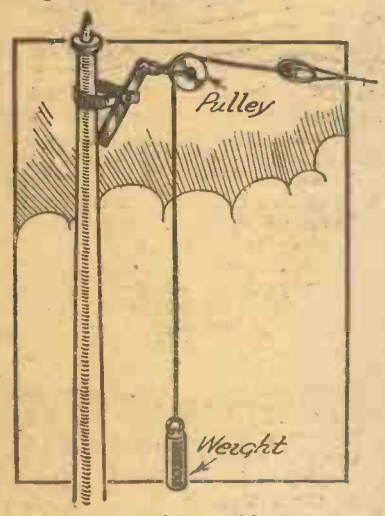


A handy home-made ammeter.

READERS' WRINKLES

(Continued from previous page)

The instrument may be calibrated by comparison with another ammeter. It is particularly useful for measuring the filament current of a receiver.—W. REAY (Brampton, Cumberland).



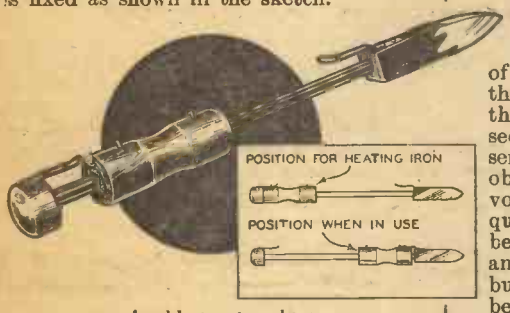
A useful aerial hint.

An Aerial Hint

AN easy way to refix an aerial to the mast is shown in the sketch. The aerial is simply attached to the bracket device, which is pushed up the mast by means of a stick. This bracket will fall down again should the aerial break, and will be ready for use again. The clip must fit loosely round the mast and the hole in the arm should be drilled on the large side.—E. DOHERTY (Salford).

A Soldering-iron Hint

HERE is a method by which a soldering iron may be shortened when in use, so enabling the user to place the point of the iron more accurately upon the work. The handle is drilled right through, and the hole, which is about ⅛in. greater than the diameter of the rod of the iron, is lined with a piece of asbestos glued into position. The handle is thus made to fit firmly over the rod of the iron. On the extreme end of the rod a wooden knob is fixed as shown in the sketch.

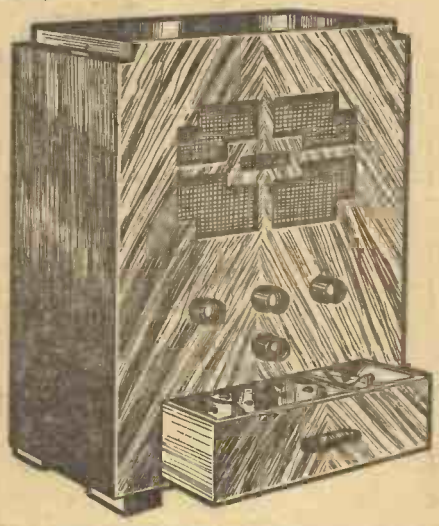


A soldering-iron hint.

Two clips of springy brass hold the iron in the desired position by engaging with pins fixed in the handle, one clip being riveted on to the copper head. When heating the iron the handle is pulled right back and when in use is pushed forward. —A. G. ACKROYD (Forest Gate).

Improved Cabinet Construction

MANY constructors who make their own wireless cabinets, and like to have easy access to H.T. and grid-bias batteries, may find the following hint useful. The drawer is made to accommodate one or two H.T. and the grid-bias batteries. This drawer slides in and out and rests on the bottom board of the cabinet to which is screwed two strips of wood which serve as guides or runners. The bottom moulding is cut and serves as a handle for operating the drawer. Leads from the batteries go through holes in the baseboard (above the drawer) to different points of the set. The wooden front of the drawer is cut from the original cabinet front with a very fine fretsaw, thus making a pleasing fine-line design without spoiling the appearance of the grain. The drawer is also a useful place to keep the wavelength chart.—ARTHUR TAYLOR (Knutsford).



A radio cabinet with a drawer for batteries.

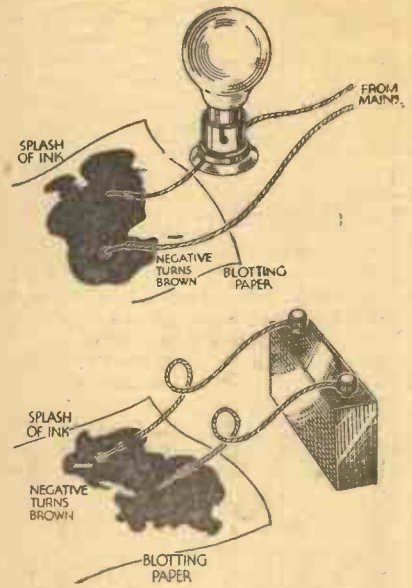
A Simple Home-made A.C. Voltmeter

IT is sometimes necessary for the amateur to measure A.C. voltages, but A.C. voltmeters are expensive instruments, and few amateurs are fortunate enough to possess one. The following dodge affords a handy means of measuring the L.T. voltage of an unmarked mains transformer.

The components required are: a 30-ohm resistance and a 3.5 volt flashlight bulb. The resistance and bulb are joined in series with a cell of 1.5 volts, and the resistance is adjusted until the bulb just fails to glow; this point is then marked on the resistance. A battery of 3 volts is now joined in the circuit, the resistance being readjusted until the bulb again just fails to glow; this second point is then marked, and a series of points on the resistance can be obtained by this method for various voltages, until the measuring range required is obtained. The A.C. voltage to be measured is substituted for the cells, and the resistance adjusted until the bulb just darkens; the voltage can then be read off the resistance. In measuring the A.C. voltages of mains transformers, it is important to connect the device across the source to be measured when the transformer is working under full load as, unless loaded, the transformer voltage rises, and the readings taken will not be accurate.—G. T. CRABB (Liverpool).

Simple Polarity Indicator

A GOOD way to find the polarity of wires is to dip a piece of blotting paper in ordinary blue ink, apply the ends of the wires to the paper and the negative



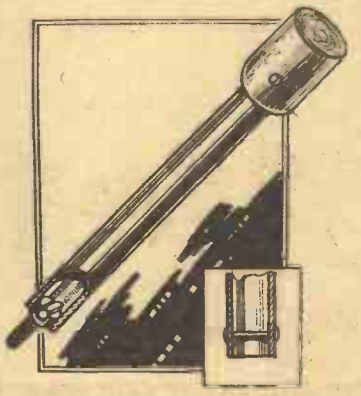
A simple polarity indicator.

will turn light brown in colour. There is no chance of mistaking the poles this way, and the materials are usually lying handy. A lamp should be inserted between the wires when testing mains to avoid a short circuit. It is desirable that the blotting paper should be allowed to dry slightly after it has been dipped in ink, for otherwise it will pass too great a current. For the same reason the contacts should be as far apart as possible; commence with them about 3ins. apart, and then, if necessary, bring them nearer. As a matter of fact, it will be found that a separation of about 1in. is suitable for voltages of about 100, whilst this distance should be varied in inverse proportion to the voltage.—J. WILSON (Leven).

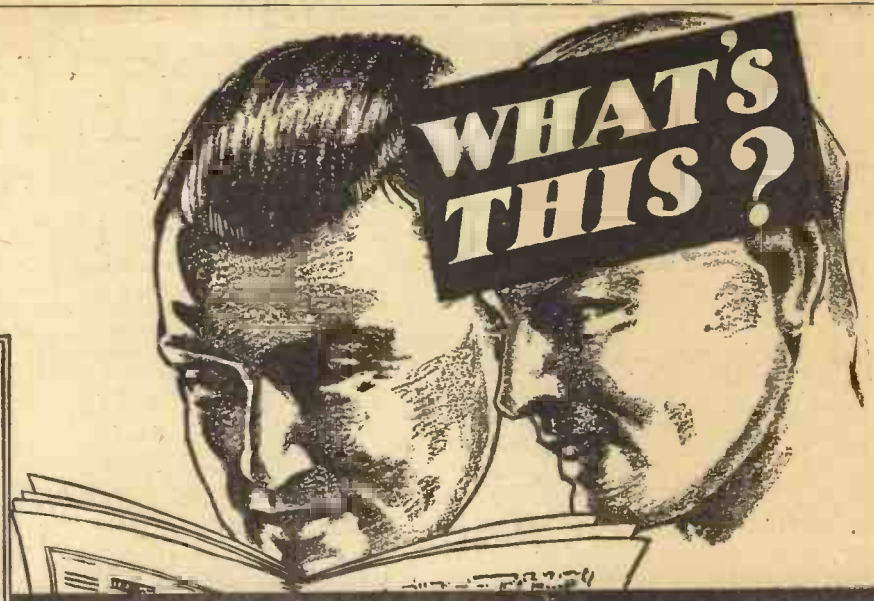
A Handy Screwdriver

THE screwdriver illustrated is handy for cheese-headed screws in awkward positions. The piece of tube used is slightly larger than the head of the screw. A pin is riveted in the position shown, and enters the slot of the screw for turning. Any suitable shaped handle is attached to the opposite end and fixed with a pin also, or, if possible, screwed on to the tube and pinned.

Brass tube can be used, but steel is much better for small screws.—W. H. GRAYLING (Cambridge).



A tubular screwdriver for screws in awkward places.



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FOR A YEAR
10/- A WEEK
FOR A YEAR
£10 CASH
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THE MAST

Full Constructional Details are Given Below of a

The compactness and small dimensions of the set described can be judged from this picture.

THE Master Midget has been specially designed for those readers who demand a receiver that is small and inconspicuous in everything but performance.

In conforms to these requirements in every particular. It is small (little larger than two standard 100-volt H.T. batteries), of refined appearance, entirely self-contained, and it gives excellent speaker volume with surprising range and selectivity. Moreover, being battery operated, it can be used anywhere where the most primitive aerial is available. It is, of course, quite independent of electric mains, and can, therefore, be used where electricity is not installed, or in rooms where electric points are not provided.

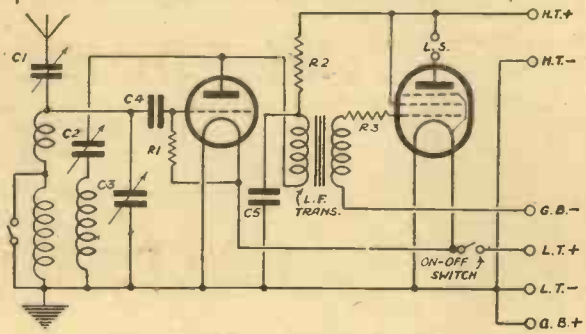
In this respect it is unique. Hitherto, the accommodation of batteries of adequate capacity within a receiver of really small dimensions has been considered impossible. This is one of the reasons why the few midget receivers on the market are all mains-operated.

A list of the components used in the original set is given elsewhere, but, provided that parts of suitable size are chosen, there is no reason why the constructor should not use up some of the materials which he has on hand.

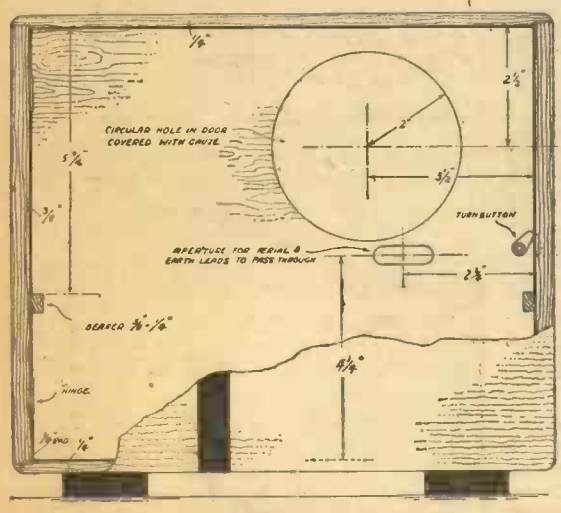
Easy to Build

It is best to start construction by marking out and drilling the panel according to the measurements given in the panel-drilling diagram. If components other than those specified are employed it might be necessary slightly to modify the dimensions given. The best method of cutting the hole for the speaker diaphragm is to use a fret-saw, but a keyhole saw will answer the purpose quite well. The holes for the panel bracket bolts are most easily marked by using the brackets themselves as templates. Place the panel and baseboard temporarily in position, with the brackets in place, and mark through the holes with a pencil.

Having completed the panel glue a sheet of tinfoil, approximately 4in. by 4in. on the back to cover the four control spindle holes. When the glue has set, cut away the foil round the hole for the reaction-condenser spindle—that is, the hole on the extreme left-hand looking at the back of the panel—and also round the hole for the wave-change switch spindle at the bottom. This is done to prevent the spindles making contact with the foil when the reaction condenser and the tuning coil are mounted in position. It is purposely intended that the tuning-condenser bush should connect with the foil, as this is in connection with the earthed or moving vanes of the condenser. In this way the foil is earthed, and it acts as a shield, thus preventing any hand-capacity effects.



Simplicity is the keynote of this theoretical diagram.



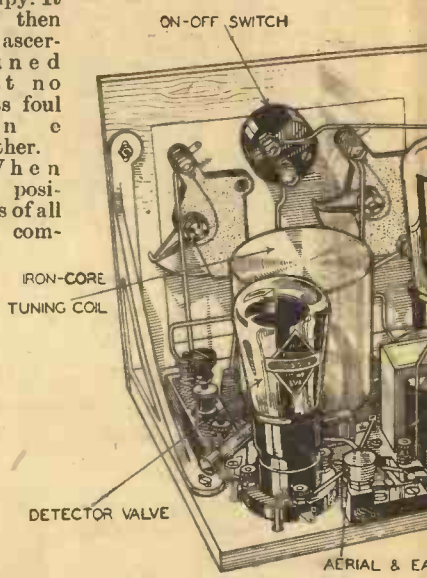
Further constructional details of the cabinet.

Mounting the Components

Now mount all the components on the panel, including the speaker and the panel brackets. See that the controls work freely and then put the panel aside until the baseboard is completed. The next job is to mount all the parts on the baseboard in the positions shown on the wiring plan; here again slight variations will be necessary if the components are of different size from those given in the list.

It is a good plan to fix each component temporarily in position with one screw, and then to place the panel and baseboard together once more in the position they will finally occupy. It can then be ascertained that no parts foul one another.

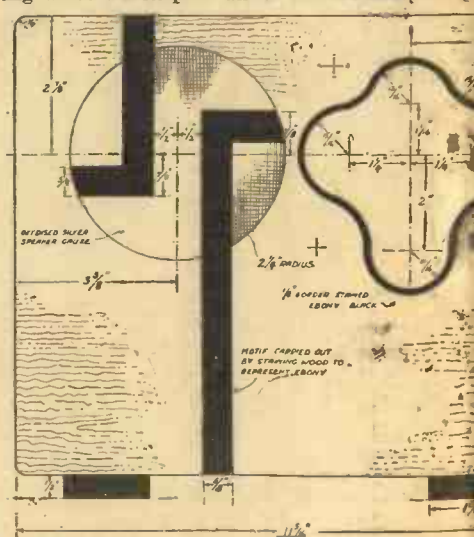
When the positions of all the components have been checked remove the panel and screw all the parts firmly to the baseboard.



Three-quarter rear view of the re

Wiring Quite Straightforward

Before commencing to wire up the set, drill eight small holes in the baseboard as shown; these are to take the four connecting wires which pass under the baseboard.



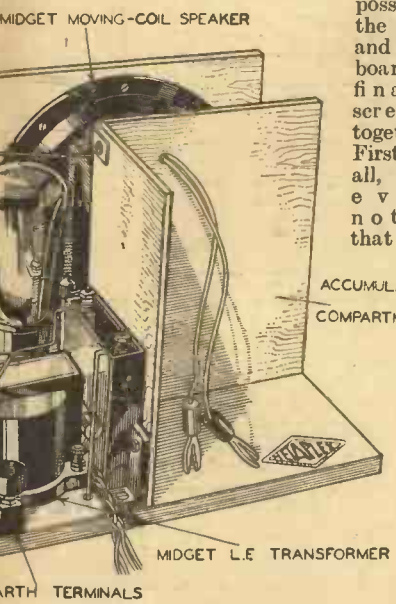
Dimensions and principal constructional details

...ER MIDGET

...emarkably Efficient Two-Valve Receiver of Diminutive Size

Practically the whole of the wiring of the set can be completed before the panel is finally fixed to the baseboard. The wiring is carried out with Glazite or similar insulated connecting wire, with the exception of the battery leads for which ordinary "flex" is used.

When wiring is completed as far as possible the panel and baseboard are finally screwed together. First of all, however, notice that one

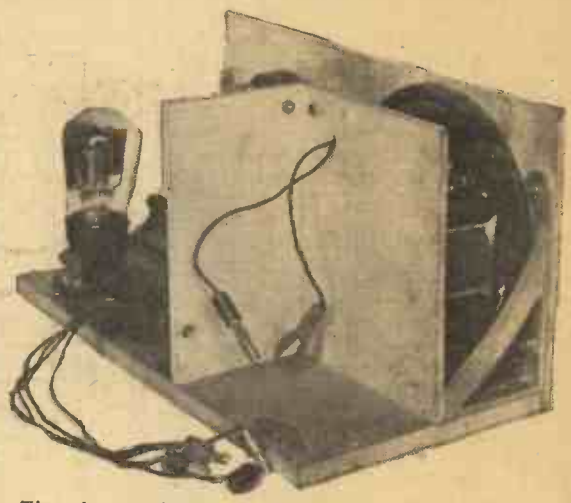


...ceiver; removed from its cabinet.

panel bracket is cut short to clear the accumulator compartment. This one, therefore, must be removed from the panel and have part of one arm sawn off.

There are one or two points about the wiring which must be mentioned. For instance, there is no connection to either terminal 1 or terminal 5 on the tuning coil. The only soldered connections necessary are the two connections to the speaker and those to the little .0001 mfd. grid condenser.

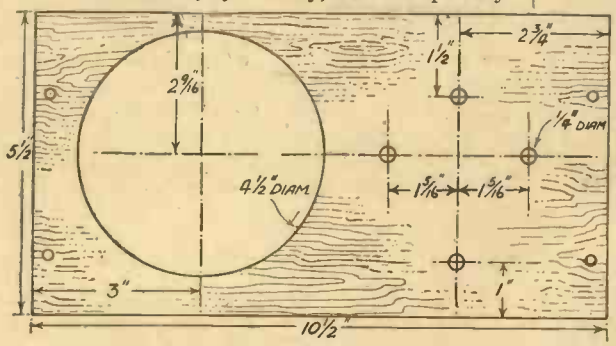
The final part of the construction is the erection of the accumulator compartment. This consists of two plywood partitions mounted on the baseboard. They should first be joined together by using very fine brads supplemented by gluing, or else two small angle brackets, such as are supplied in sets of "Trix," may be used. When joined together, the partitions are mounted on the baseboard by gluing along the bottom edges. Additional strength is provided by a couple of bolts passed through the alternative fixing holes in the flanges of the 1 mfd. coupling condenser and the side of the partition next to the condenser. A small angle-bracket may also be used between the other partition and the baseboard.



This photograph shows the accumulator compartment of the "Master Midget."

Operating Notes

The set may now be inserted in the cabinet and the batteries connected up. This cabinet, by the way, has been specially designed for the "Master Midget," and contributes in no small measure to the general appearance and efficiency of the receiver. Apart from its neat design it provides a definite baffle effect, and thus ensures proper reproduction from the moving-coil speaker. *The set is not intended to be operated without the cabinet.*



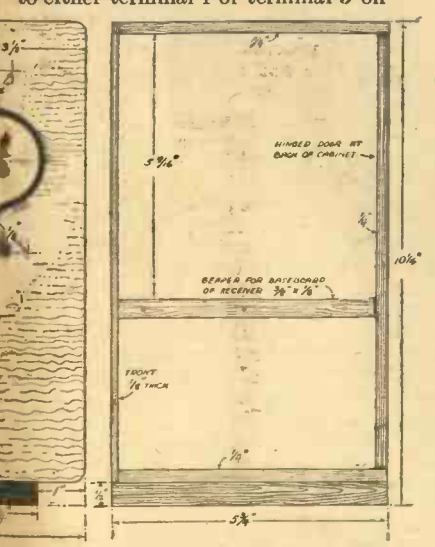
Panel dimensions for the "Master Midget."

To work the receiver the valves are inserted, and the aerial, earth, and batteries connected up in the usual way. The H.T. and G.B. batteries slide neatly into the space provided under the baseboard. There is only one H.T.+ tapping, and this is inserted in the maximum voltage socket on the battery, namely, 99 volts. The G.B.— lead is plugged in at about 4½ volts, but it is wise to remember to plug in at the *highest* voltage consistent with good reproduction, in the interests of economy. As an example, when on test the changing of the bias from 3 volts to 4½ volts reduced the H.T. consumption by nearly a third without any noticeable reduction in quality. Just one warning—don't make alterations in the bias connections without switching off the set.

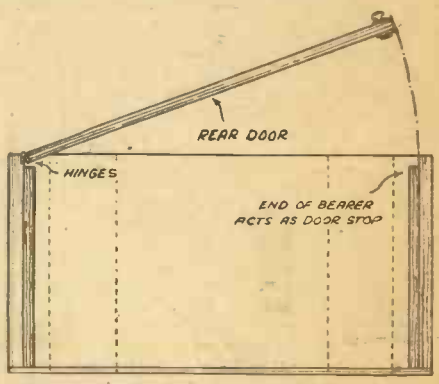
For the initial test the knob on the pre-set condenser inside the receiver should be screwed down after loosening the locking nut. This setting gives the maximum sensitivity but least selectivity. If increased selectivity is found necessary—that is, if stations are inclined to overlap—the knob should be unscrewed slightly until the

LIST OF PARTS FOR THE "MASTER MIDGET"

One tuning coil.
One "Formodenser" pre-set condenser, .0003 mfd.
One midget L.F. transformer 3—1.
One Bulgin 4-pin valve-holder, baseboard mounting type.
One Bulgin 5-pin valve-holder.
One Bulgin on-off switch, type S 85.
One Telsen terminal block.
One Telsen fixed condenser, type 234, 1 mfd.
One Hellesen fixed condenser, type "000." .0001 mfd.
One Polar midget variable condenser, .0003 mfd.
One Polar midget variable condenser, .0005 mfd.
Dubilier metallized resistances:—20,000 ohms (1-Watt type) ;, 100,000 ohms ;, 1 megohm
Sonochord midget speaker, pentode type.
Metaplex baseboard, 10½in. by 5½in.
¼in. plywood panel, 10½in. by 5½in.
¼in. plywood for accumulator compartment, 5½in. by 3⅜in. and 5½in. by 2⅞in.
Connecting wire, screws, etc.
Valves: Cossor 210 Det., and 220 PT.
One pair "Keystone" panel brackets (Peto-Scott, Ltd.).
One Exide accumulator, type PY 4.
One Drydex Red Triangle H.T. battery, 99 volts.
One Drydex 9-volt grid-bias battery.
Four Clix wander plugs engraved: H.T.+, H.T.—, G.B.+, G.B.—.
One red and one black spade terminal (Clix).
Peto-Scott "Master Midget" cabinet.



...of the cabinet are given in these drawings.



This drawing shows how the lid is fitted.

THE MASTER MIDGET

(Continued from previous page)

desired selectivity is obtained. It can then be set in this position with the locking nut.

The "Master Midget" on Test

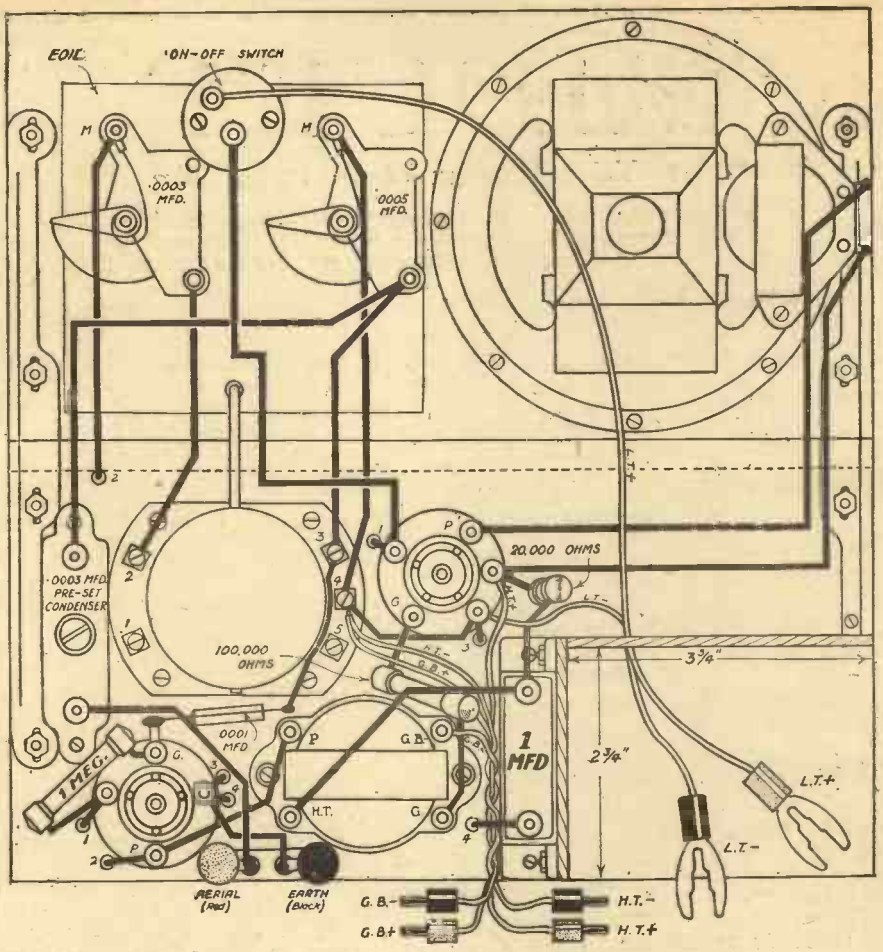
The first test was made about fifteen miles S.W. of Brookmans Park, with an aerial consisting of 12ft. of cotton covered wire draped along the picture rail, the earth consisting of a short wire connected to a wire mattress. Even with this primitive arrangement the London National and London Regional stations were received at full speaker strength. The pre-set condenser was screwed right down and judicious use made of the reaction control, and under these conditions Daventry National, on the long waves, was also received at good strength.

An Indoor Aerial

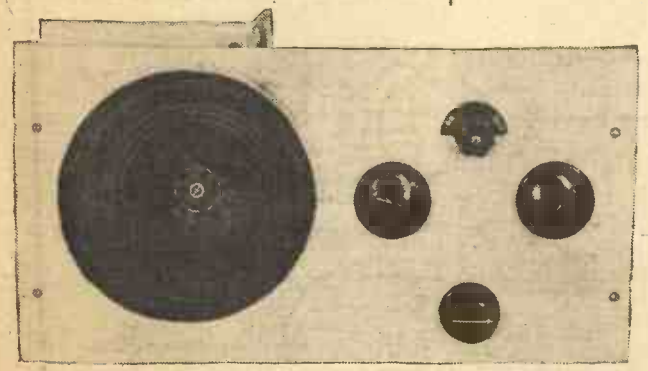
By using an "L" shaped aerial running along two walls of the room (about 25ft. of wire), and making the earth connection to a nearby water pipe the range was increased so as to bring in the Midland Regional at fair strength, together with one or two foreigners. Incidentally, the reproduction from the London National and London Regional stations under these conditions was all that could be desired in the way of volume and clarity.

An Outdoor Aerial

On testing the "Master Midget" under favourable conditions, on an outdoor aerial 50ft. long and 25ft. high in an "open" locality about thirty miles S.W. of Brookmans Park, a large number of both British and foreign stations were tuned-in at full speaker strength. This time the pre-set condenser was unscrewed about three turns



Wiring diagram of the "Master Midget."



This front view of the set (removed from its containing cabinet) shows the neat arrangement of the controls.

—just sufficient to increase the selectivity to meet the new conditions and prevent overlapping of the louder transmissions, but not so much as to lose the weaker stations.

During one sitting the following stations were definitely identified:—

Medium Waves

Trieste, London National, Bordeaux, Scottish National, Heilsberg, North National, West Regional, Poste Parisien, Hamburg, London Regional, Berlin, Midland Regional, Rome, Sottens, North Regional, Langenberg, Prague, Mühlacker, Athlone.

Long Waves

Warsaw, Daventry National, Radio-Paris.

It should be pointed out that the signals from all the above-mentioned stations were sufficiently loud to provide enjoyable entertainment, and were not simply just audible.

ROUND THE WORLD OF WIRELESS

(Continued from page 230.)

Military Band Concert

A MILITARY Band, which has given ten broadcasts in India and played in a command performance for the Viceroy, will be heard by Midland Regional listeners on May 19th. This is the Band of the 2nd Battalion The Royal Warwickshire Regiment, conducted by Mr. Sidney Henwood. The Band and the Male Voice Choir, which is to sing, consist almost entirely of Warwickshire men. For a hundred and fifty-two years the regiment, which is one of the oldest in the Army, has been directly associated with the county.

"Travellers Return" Series of Broadcasts

TALKS to be given during the week are an account of a Californian mining camp by Margaret Dangerfield, in the "Travellers Return" series, from the Midland Regional, on May 15th; impressions of the beautiful tulip fields of Lincolnshire are to be broadcast the same day (speaker not yet fixed); and on May 17th, "Raspberry Growing and Marketing in the Midlands," by Mr. Ralph Dixon, the leading authority on this subject. Mrs. Dangerfield has had many radio plays and stories included in the Midland Children's Hour since 1927.

"First Time Here"

DARE LEA and his Band, who made their radio debut in "First Time Here," and have since featured in three films, provide an hour of dance music in the Midland Regional programme on May 16th.

Famous Trials Broadcast

THE second in the series of famous trials will be broadcast in the Regional programmes on May 17th, and Nationally the following night. The trial chosen is that of Simon, Lord Fraser of Lovat, the famous Jacobite Rebellionist of 1745. He revolted against George II with Bonnie Prince Charlie, and was captured at Culloden in April, 1746. The essential points of the trial have been adapted from the records for broadcasting by Whitaker-Wilson, author of the play about Sir Christopher Wren, broadcast at the time of the tercentenary of the architect, in October, 1932. *Wren* was actually the first radio play to be recorded for Empire use. It has now been heard all over the English-speaking world. *Mozart* was another play by the same author, who played the part of Haydn in it. As Lord Lovat was a Scot, James Gibson will come down from Glasgow specially to play the part. Whitaker-Wilson is to be Narrator.

THE EASY ROAD TO RADIO

THE BEGINNER'S SUPPLEMENT

How to Read a Circuit Diagram—2

This Concludes the Article which Commenced in Last Week's Issue by describing some Complete Receiver Circuits.

NOW we must learn how to dissect a theoretical circuit and to gather as much information as possible from it. To begin with, we will take portions of actual diagrams and discuss them in detail, afterwards turning our attention to some complete circuits.

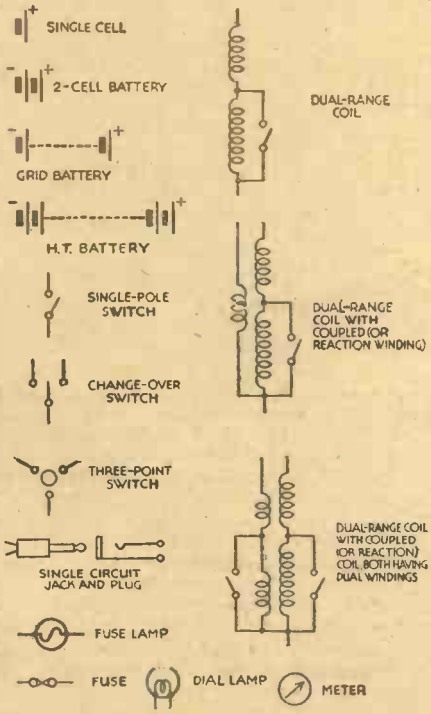


Fig. 1.—These symbols will assist you in reading circuit diagrams.

Dealing first with a few typical cases of tuned circuits, Fig. 2 shows a simple aerial coil arranged for wave-change switching. Actually, this is the tuning circuit of a simple battery set with no high-frequency amplification. The reaction arrangement is quite normal, one coil serving for both wave ranges; reaction control is by a differential condenser, the connections to which you should compare with those given in the previous article, where an ordinary single condenser was shown.

Band-pass

A single reaction condenser is also shown in Fig. 3. This diagram is also of interest, because it shows a case in which different aerial tappings are used for long- and medium-wave working, the switch for changing over the tappings being, of course, "ganged" with the switch which shorts out the long-wave coil.

Most modern receivers incorporate at least one "band-pass" circuit. This is a device in which two tuned circuits

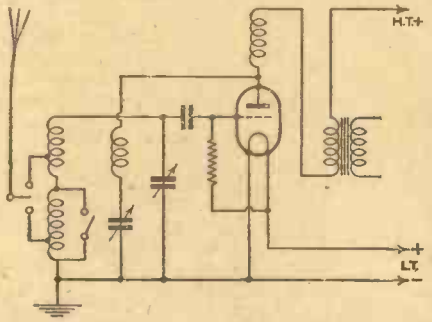


Fig. 3.—Circuit of a tuning coil having an aerial transfer tapping.

follow each other, only very small coupling existing between them. A properly adjusted band-pass arrangement brings about a very high degree of selectivity, because it gives a very definite "cut off" for all frequencies other than a narrow band of some nine kilocycles, corresponding to the normal separation between neighbouring stations in the broadcasting range of frequencies. In Fig. 4 is indicated the most usual band-pass arrangement, the coupling between the two circuits being of the "mixed" type, i.e., partially inductive by means of the two small cross-connected coils L_1, L_2, and partly capacitative through the

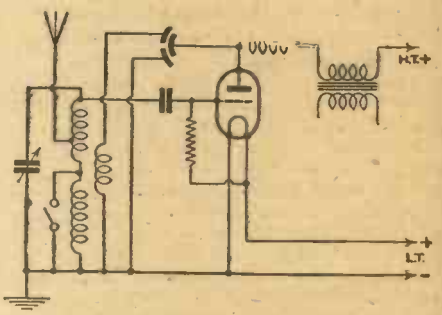


Fig. 2.—A typical tuning circuit combined with a differential-controlled reaction arrangement.

small condenser C_1. The resistance R_1, usually of 1,000 ohms, is necessary for completing the grid circuit of the variable-mu H.F. valve.

A Complete Receiver Circuit

Fig. 5 shows the 1934 Fury Four Super, which has two ordinary screened-grid stages, leaky-grid detector, and pentode-output valve. Only two of the three tuning condensers are "ganged," namely, those tuning the aerial and first H.F. coupling circuits, the third condenser which tunes the detector-grid coil being independently operated.

This arrangement makes the preliminary adjustment of the set much simpler, for it is much easier to gang up two condensers than three; yet, by careful design and the use of standard and high grade components, the actual settings of the two tuning dials are remarkably accurate.

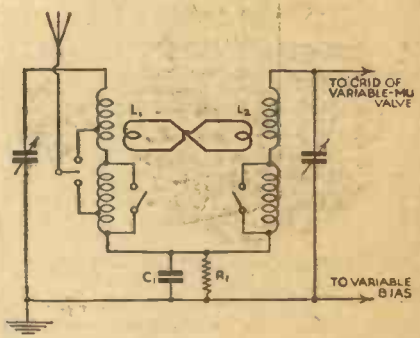


Fig. 4.—A band-pass circuit of the "mixed-coupling" type.

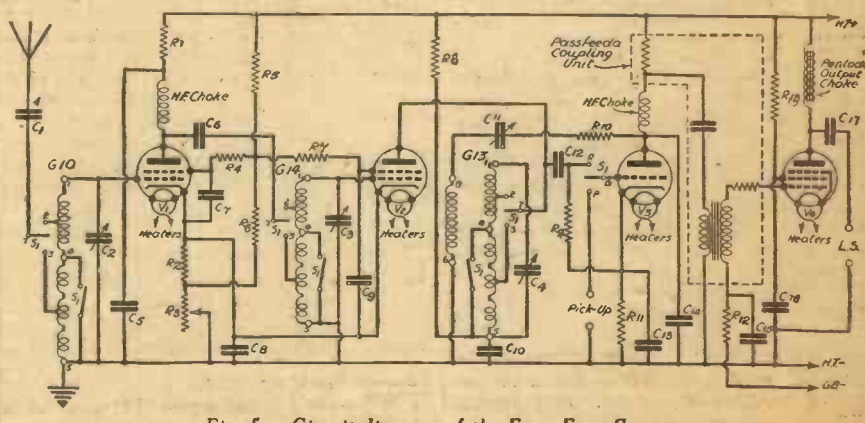


Fig. 5.—Circuit diagram of the Fury Four Super.

Turning to the output stage of this set, for which a pentode valve V_4 is indicated, it will be observed that the auxiliary grid of this valve is decoupled by a 5,000 ohms resistance R_9, by-passed to earth by a .1 mfd. condenser C_{15}. Auxiliary grid decoupling is frequently omitted on the score of economy, but this little refinement is really worth the slight extra expense.

Further points worth studying in Fig. 4 are first the position of the fuse—in the lead joining H.T.— and L.T.—. This is *always* the correct position for the fuse—*not* in the lead between L.T.— and the filament switch.

The final point worthy of attention is the on-off switch, which is of the "three point" type. When it is placed in the "off" position it not only disconnects the filament circuit but also breaks the circuit of the H.F. screen potentiometer, thus avoiding waste of H.T. current, which would occur if this potentiometer were connected permanently.

Fig. 6 shows the circuit of the A.C. Three, described in PRACTICAL WIRELESS dated Sept. 9th, 1933.

Dealing first with the coils, which, in the original set, were of the iron-core type, it will be noted that in each case these are arranged as high-frequency transformers with tuned secondaries, that coupling the high-frequency valve to the detector stage also having a reaction winding. For the high-frequency stage a variable mu screened grid valve

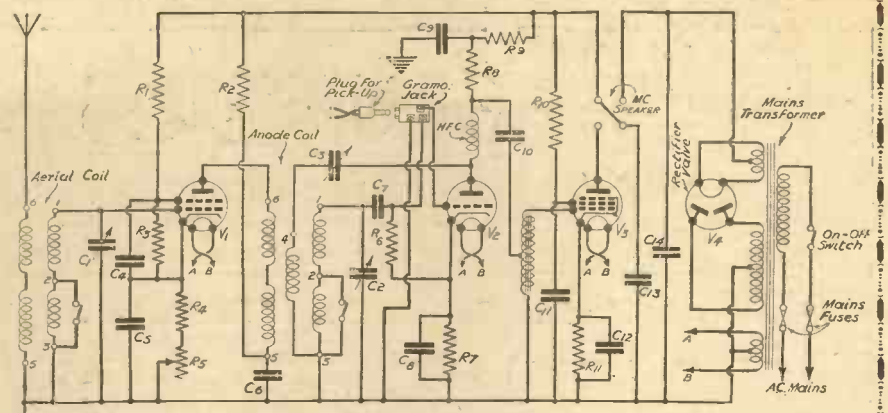
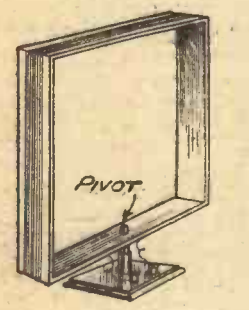


Fig. 6.—Theoretical circuit of the "A.C. Three," which is referred to in the text.

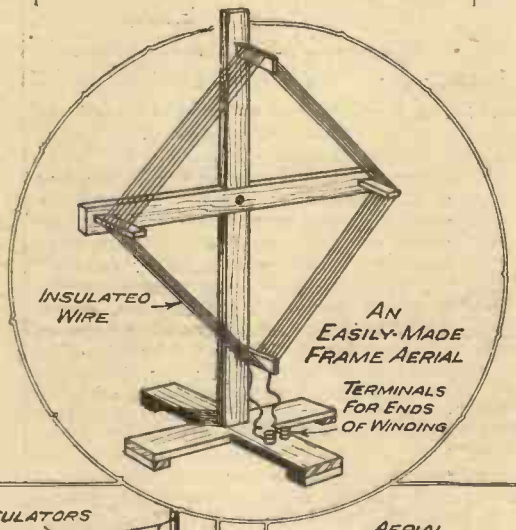
is employed as a contrast to the "straight" screened grid stages shown in Fig. 5. Variable bias to this valve is obtained by the popularly called "automatic bias" arrangement, whereby a resistance is included in the cathode lead of the indirectly-heated screened grid valve, thus raising the potential of the cathode above that of the grid by an amount equal to the voltage drop across the bias resistance. In this case the bias resistance is in two parts, R_4 and R_5, the former being of fixed value and calculated to provide the minimum bias required by the valve when operated at maximum sensitivity, while R_5 is variable for adjusting the sensitivity of the valve.

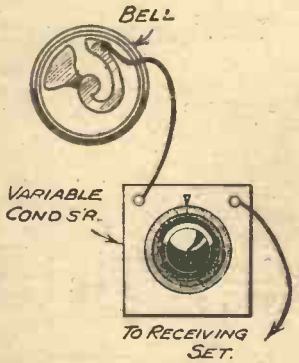
This drawing contains an example of lines being omitted for the sake of simplicity. It will be observed that the connections to the heaters of the various valves are broken short and lettered "A.B." This means that in actual practice each of these connections is taken to the two terminals marked A and B, indicating the L.T. winding of the mains transformer.

AERIALS—3

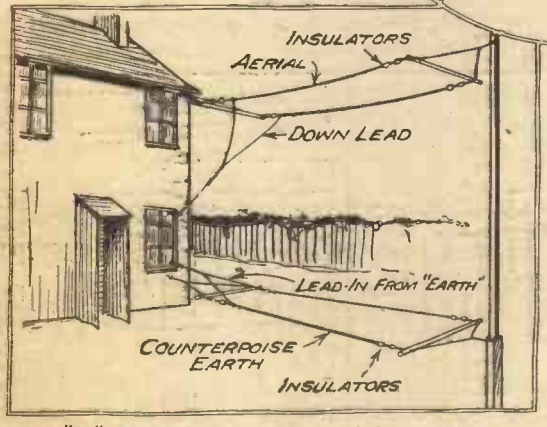


DIRECTION-FINDING TYPE OF FRAME AERIAL.

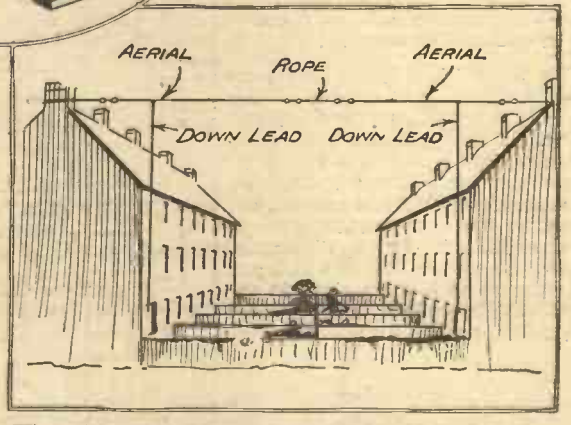




UTILISING A BELL CIRCUIT AS AN AERIAL.



AN "L" TYPE AERIAL WITH A COUNTERPOISE EARTH.



TWO AERIALS ERECTED AS SHOWN ABOVE, OBVIATE THE USE OF A MAST.

SUPPLEMENT TO PRACTICAL WIRELESS

Practical Television

MAY 12th, 1934. Vol. 1. No. 19.

NOTES OF THE WEEK

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc., A.M.I.E.E.

Flexible Couplings

"HUNTING" in a mechanically-built television receiver—that is, the movement or swaying of the received image about a mean position—is always a most objectionable feature to anyone looking in. It is brought about by the scanning device (mirror drum, disc, mirror screw, etc) "overshooting" the mark when there is a restoring force exerted by the synchronizing mechanism for the purpose of correcting any tendency for the apparatus to go out of synchronism.

Many forms of damping device have been used to correct this, but one of the most effective, and incidentally one of the simplest, is to employ a flexible coupling between the scanning member and driving motor. This elastic member or link will then exert a torque that increases with the angle of displacement, and oscillation tendencies are therefore reduced or completely eliminated.

The accompanying diagram shows one form in which this device may be fitted in the case of a mirror-drum scanner. A bush having a centre hole in which fits the driving motor shaft, and to which it is secured by one or more grub screws, has fitted over it a second bush complete with flange. The flange is screwed to the web supporting the cylindrical surface holding the mirrors so that there is free movement between the two bushes. Connection between the first bush and the mirror drum is effected by a coil spring, the drive from the motor shaft being transmitted to the drum via the spring.

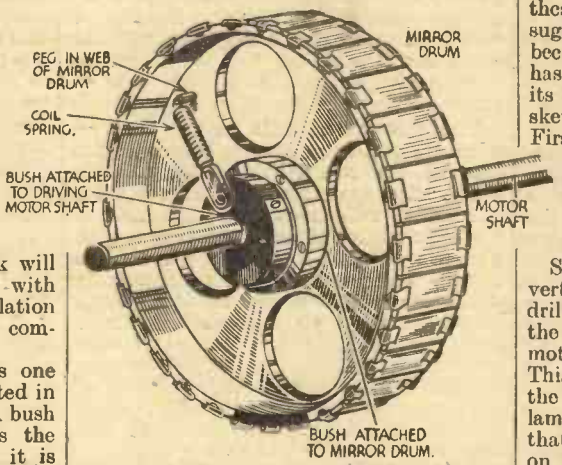


Fig. 1.—Showing one form of flexible coupling which may be used between the driving motor shaft and the mirror drum.

Television In France

There have been many television transmissions in France and considerable activity exists in that country for the purpose of investigating the many systems which have been suggested. It is therefore interesting to learn details of one type of apparatus used very successfully in Paris. The radio station responsible for radiating the signals on a wavelength of 447 metres was P.T.T., the power employed being 6 kilowatts.

The television transmitter itself bears a close resemblance to that now used by the B.B.C. for their service transmissions. It is mounted on a rigid pedestal and may be turned horizontally through a large angle to allow the operator to follow subject movement.

A mirror drum is used and the rear end of the transmitter houses the arc lamp, the carbons of which feed automatically. A large control is fitted at the end for vertical framing; this acts as an adjustable mask allowing the field of scansion to be raised or lowered according to the height of the scene or subject being scanned. The light is kept in focus upon the subject by making the optical system adjustable, in which case the subject was able to move through any distance from 2 to 30 feet, remaining the whole time in focus.

Associated with this machine were four "A" amplifiers linked with four separate banks of photo-electric cells. Each amplifier consisted of two stages, resistance-capacity coupled and built into lead boxes suspended by rubber inside an aluminium-lined wooden case. This, together with suitable valves, reduced microphony to a minimum.

In the control room was the main amplifier rack and control desk, the latter being the junction for the *input* and *output* of each amplifier. This permitted any combination of amplifiers and also the mixing of the various outputs of the cell amplifiers to give different lighting and relief effects, depending upon the subject being transmitted. As each input and output of the amplifiers had to be taken to the control desk, the connecting lines were of considerable length and a special screened low-capacity cable had to be employed. Furthermore, the length of cable between each cell box and its associated amplifier was about 20 feet, and this was also of the low-capacity screened type, having a larger section than that used between the amplifiers.

In spite of all these difficulties the picture quality did not seem to be affected, the very high frequencies being reproduced satisfactorily, thus demonstrating the high standard now attained in modern amplifier design.

On the same control panel were arranged two "B" amplifiers for amplifying the signal directly after the cell amplifier, one "B" always being in use, while the other acted as a standby. Finally came three "C" amplifiers, two being for wireless and control purposes respectively, while the last served as a standby. Included in the input of each "C" amplifier was a corrector to correct for the aperture distortion of the scanning system and to some extent compensate for any loss in the amplifiers and associated wiring.

All the amplifiers were housed in lead cases, or, to be more accurate, the valves, coupling condensers, and grid wiring; the anode and decoupling resistances and condensers being installed in separate cases on the rear side of the panel. This gave a high degree of screening, which is, of course, very necessary when it is considered that there were virtually eight stages of amplification in cascade. Incidentally, each group of amplifiers was supplied by separate high- and low-tension accumulators, this reducing still further the possibility of instability.

A Novel Television Receiver Design

While it is admittedly difficult to deviate from the three essentials of a simple television receiver, namely disc, motor and neon lamp, it is possible to assemble these in a variety of ways. The following suggestion is quite a novel one and has not been put forward before. Furthermore, it has the important point of cheapness in its favour. A reference to the perspective sketch gives a fair idea of the scheme. First of all obtain a piece of five-ply wood and shape it to a circular top and straight bottom. The actual size will depend on the disc diameter, but it can be cut conveniently from a square four inches larger than the disc diameter.

Secure this piece of wood in a rigid vertical position on a wooden base and, drilling a hole in the centre to just clear the motor spindle diameter, support the motor at the back on a shelf as shown. This same shelf will serve to accommodate the batten lamp-holder holding the neon lamp (bechive or flat plate variety) so that the centre of the neon lamp glow is on the same horizontal line as the motor shaft centre. The lamp will be on the left of the motor facing the back as indicated, and a rectangular aperture should be cut in the five ply-wood so that an adequate area of incandescence will be observed through the holes of the scanning disc when it is made to rotate.

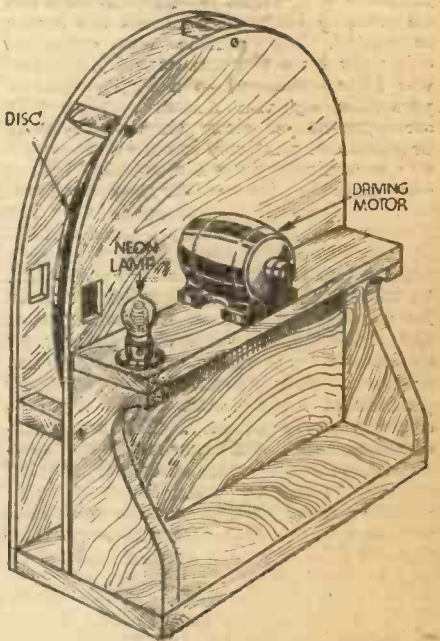


Fig. 2.—A novel form of television receiver design which has the advantage of being quite cheap to build.

The disc can now be mounted on the side of the five ply-wood section remote from the motor, and if the very simplest arrangement is desired the assembly will be complete. It is far better completely to encase the disc, however, and so protect it from damage, as well as removing the possibility of dust clogging the scanning holes. For this purpose cut out a second piece of five (or three) ply-wood to the same dimension as the first and glue or screw it to the first wood section with the aid of wooden separating blocks (seen in the sketch) so that there is a space of about 1½ inches in which the disc can rotate freely. Now soak a strip of thin wood in hot water and bend it round the outer edges of the two ply-woods and tack, glue or screw in place. Finally, cut out a rectangular hole or mask on the front piece of wood so that the glowing neon lamp area can be observed. If desired, a single lens to magnify the image can be mounted on the front vertical wood section, and the television receiver is then complete and ready for use.

Cathode-ray Tube Modulation

The cathode-ray tube has come very much to the fore of late in connection with high-definition television demonstrations. A certain amount of confusion seems to exist amongst readers, however, as to the way in which the electron beam striking the fluorescent screen at the front of the tube is modulated in order to produce the resultant image. Electrical time base circuits control the separate scanning movements to trace out the field of horizontal or vertical scanning lines, but the variation in intensity which builds up the resultant image is dependent upon other factors.

There are two main methods of modulation and these are known respectively as intensity and velocity modulation. In the first-named the number of electrons which form the ray and strike the screen is varied continuously, and the light and dark sections of the image built up. With velocity modulation, however, the light intensity of the spot remains constant but its velocity of traverse across the screen is varied. The scheme was suggested originally by a German named Thun and was later developed to a high degree of perfection by von Ardenne. With this arrangement a slow traverse velocity brings about relatively intense fluorescence and accordingly gives a relatively brilliant element in the picture. On the other hand, a high velocity of scanning gives less response and consequently a dark element in the received picture.

One of the difficulties is that the extent to which the ray is deflected depends on its velocity as well as the intensity of the deflecting. Instead of obtaining an even scanning, therefore, entirely controlled by the scanning potentials, the momentary position of impingement of the ray also depends on its velocity. This was overcome in one series of experiments by superimposing the picture signal on the scanning oscillations so that when the velocity of the ray was reduced, the scanning potential was also reduced in order to counteract the deflectional error otherwise introduced.

Correcting Cogged-wheel Synchronizing Faults

Even when the constructor has taken steps to incorporate cogged-wheel synchronizing gear in his home-made television receiver in order to hold the image steady, he may find that it fails to function in the manner expected. This can arise from a variety of causes, but as a general rule the reasons which follow will be found to include the defects, and they can be remedied very readily.

Fig. 1.—A standard form of cathode-ray tube, showing clearly the front fluoreseent screen where the television image is built up.

The first criterion is to see that an adequate steady polarizing current is fed through the two synchronizing coils in series. The current should have a value of about 25 milliamperes, and if a meter is available or can be borrowed it is a good plan to check this up. If, in spite of this current being correct (the synchronizing signal extant in the normal received picture is superimposed on the steady current during reception), the mechanism still refuses to exhibit any image-holding tendencies, it is possible that the pair of field coils are of wrong polarity. They should be respectively north and south, and the simplest way to test this is to pass a small current (furnished by an H.T. battery) through the two coils in series and note the registering of the compass needle. If not of opposite polarity reverse one of the windings and the fault will be rectified.

Another factor which needs to be checked is the 0.1 mfd. fixed condenser which is in parallel with the extremities of the synchronizing coils. The object of including this condenser is for it to act as an H.F. by-pass to the television signal, and if it has developed a complete or partial short circuit, obviously the coils will not be fed with the correct signal. Remove the connections to the condenser and test this in the normal way, replacing it with a new one if it is found to be even slightly defective.

Continuing the possible causes of synchronizing inefficiency, examine very carefully the cogwheel and pair of pole pieces. There are thirty teeth on the wheel and, in consequence, if correctly lined up every opposite pair of teeth in the wheel should be in a direct line with the pole pieces. If this is not the case the restoring force of the synchronizing signal will be erratic and image hunting result. Also the pole tip length and depth should be exactly the same as each tooth facet. If not, correct this with a very fine jeweller's file. Incidentally, the same file will remove any burrs that happen to be on the cogwheel teeth, for even this upsets the proper magnetic flux distribution.

The ratio of the gap between each individual tooth and the tooth width must not be less than three to one. Here again the jeweller's file will come in handy if the dimensions do not conform to the figures just mentioned. The wheel must rotate dead true between the poles, otherwise the clearance between the pole-tip and tooth-edge will vary continuously. Rectify immediately any inaccuracies in this connection for they will upset considerably the performance of the mechanism and materially reduce the efficiency.

Synchronizing gear is of little value unless it has a framing adjustment to move bodily the field magnet system with reference to the cogwheel. The action of this should be quite smooth, and if there is any tendency to exhibit stickiness, backlash or erratic movement, dismantle the framework holding the coils to the bearing surface and clean up the sliding surfaces. Replace, tighten up the binding screw, and check carefully to see that the rotational movement is perfectly central about the cogwheel or motor shaft.

FASCICULATION

RECENT developments in television have brought the cathode-ray tube very much to the fore as a piece of apparatus eminently suitable for the purpose of projecting the received images on to its fluorescent screen. In the tube a filament or cathode is rendered "active" by passing a current through it just the same as with an ordinary radio valve, and the electrons emitted from the filament surface are "guided" towards a screen of fluorescent material covering the front "belled" out portion of the tube. A standard tube of this character is seen in Fig. 1, the white end held in the left hand being the fluorescent screen.

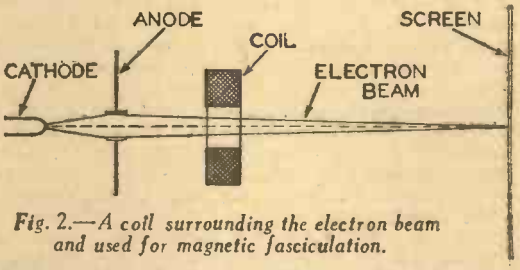
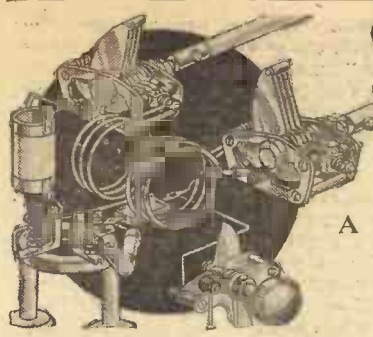


Fig. 2.—A coil surrounding the electron beam and used for magnetic fasciculation.

For television purposes it is extremely desirable to concentrate the beam of electrons passing from the cathode into a narrow pencil of substantially uniform intensity at all parts of its cross section and to bring this pencil down to a sharply defined small spot upon the screen of fluorescent material. This process of concentration is called *fasciculation*, and it may be carried out in a number of ways.

In magnetic fasciculation a process somewhat analogous to that of magnetic focusing takes place, except that by a suitable arrangement of the length of the magnetic field and its position with respect to the cathode and the screen, a very small sharp spot is obtained. In one arrangement, shown in Fig. 2, a coil, through which is passed a steady current, surrounds the electron beam and the field strength is

(Continued on page 254)



Short Wave Section

A SET FOR ULTRA-SHORT-WAVE RECEPTION

DURING the last few months a considerable amount of attention has been focused upon the use of wavelengths below 10 metres for wireless transmission and reception and we, in the PRACTICAL WIRELESS laboratories, have devoted not a little time to this aspect of radio. We have not previously described a complete receiver for the ultra-short waves because we felt that our readers would not wish to go to the expense of such an outfit at a time when there was little or nothing to be heard on it. But numerous amateur and "professional" transmitters are now sending out more or less regular tests on wavelengths of about five metres, and so we give herewith a suitable design. The circuit shown below can easily be made by the home constructor. It will not be expensive and can be built from standard readily obtainable parts. Neither will the set be difficult to handle, for the question of simple control has been carefully considered.

Advantages of the Ultra-S.W.

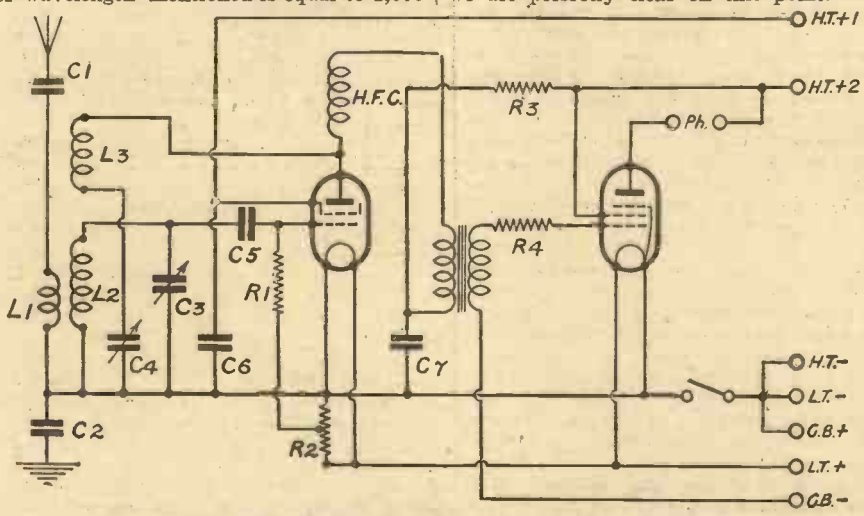
There is no doubt that the principal benefit to be derived from the use of "ultra shorts" is that a considerably greater number of transmitting stations can be accommodated within the tuning range of a single coil and variable condenser. This point can most easily be appreciated by considering first of all the number of "wavelengths" which are available between, say, 200 and 600 metres. Before we can calculate the figure we must change our "wavelengths" to the more useful notation of "frequencies." Two hundred metres is equivalent to 1,500 kilocycles per second, and six hundred metres correspond to 500 kilocycles per second. In other words the "frequency band" between the two limits of wavelength mentioned is equal to 1,000 kilocycles. Now it is well known that the frequency separation allowed between European broadcasting stations is 9 kilocycles, so it is easy to see that the maximum number of stations which could operate on the lower broadcasting waveband is only just over a hundred.

If we now take a parallel case on the waveband between 5 and 6 metres—and such a range can easily be covered by means of a single coil and condenser—we find that the upper and lower frequency limits are 60,000 and 50,000 kc/s per second respectively. Expressed in different terms this means that the frequency band is equal to 10,000 kc/s, or just ten times as great as that provided by the medium waveband. Consequently ten times as many stations can be accommodated. It can thus be seen that the aggravating problem of interference between different stations is not likely to occur on the ultra-short wavelengths for a very long time to come, even if it ever does occur at all.

Easy and Cheap to Build

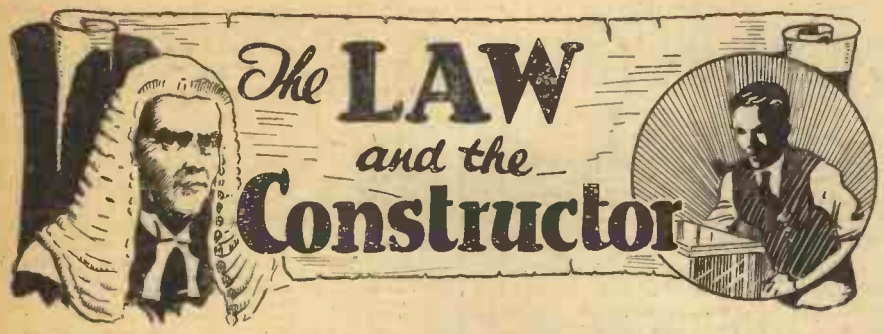
The short waver is tuned rather differently to a set made for broadcast reception, but to say that the mode of operation is *different* is quite another matter to saying that it is more *difficult*. With a well-designed ultra-short-wave receiver the operation can be just as easy as with any ordinary type of set.

The only objection I can think of to the wavelengths below 10 metres is that at present they can only be transmitted with certainty over "visible" distances. This means that the transmitting and receiving aerials must be within "sight" of each other. At least that is true in theory, but experiments have in some cases had a tendency to disprove this idea, and it will probably be some little time before we are perfectly clear on this point.



A circuit which will give splendid results on the ultra-short waves.

C1:—12 mmfd.; C2:—.0002 mfd.; C3:—35 mmfd.; C4:—100 mmfd; C5:—.0001 mfd.; C6:—.01 mfd.; C7:—1 mfd.; R1:—5 megs.; R2:—400 ohms (C.T.); R3:—10,000 ohms; R4:—250,000; L1:—1; L2:—4; and L3:—3 turns No. 16 tinned copper wire on a 1" former.



Points to Bear in Mind When Purchasing Radio Components

By "LAMBDA"

CAN you imagine a small shop window with a somewhat dusty and decrepit exterior? The windows show signs of needing a polish, possibly the local window cleaner had forgotten to call! Arranged inside the window on somewhat dusty shelves lie sundry radio components. Sometimes placed in an orderly manner, with large price tickets standing out like a regiment of soldiers, but often more than not they are just "dumped"—no other term is quite so expressive. What a sight to behold! Two-pin coil-holders for swinging-coil reaction, transformers, coils of all kinds, and sometimes in the background, as if to give tone to the "ensemble," recline a few radio receivers. Wonderful contraptions, with panels simply exuding knobs and dials, together with two, three or even more "lamps" on the panel—in all probability bright emitters.

Is there one in your neighbourhood? Have you not pondered in front of the window looking for bargains? Possibly you enter, purchasing at a ridiculously low price a component of a past age, but looking O.K. You hurry home anxious to incorporate it in your *latest* set. It refuses to function, and in post haste you write to the poor Editor expressing your opinion in no uncertain language on the merits of the design. Never once did you suspect the "bargain" which you obtained. However, this specimen of bygone days now rests in the bottom of the junk box, telling its own story of a few more shillings thrown away. It may or may not have been in working order, but there is no doubt it was unsuitable for the receiver under construction. How many constructors have been in the same boat? Why do we all persist in deluding ourselves that we can either get something for practically nothing or considerably below list prices, and yet get a really satisfactory article?

Now what has all this to do with the subject of this article—"The Law and the Constructor?"

Behind every commercial transaction, every purchase or sale of an article, there are certain legal rights and obligations imposed upon seller and buyer. These obligations exist whether the deal be a packet of pins or a motor car. In the great majority of transactions these rights and obligations lie dormant, and we are not even aware of their existence. Fortunately for us the vast majority of people are essentially honest and they do not need to invoke the aid of the law. Have you ever considered, however, that many lawsuits are the result not of either fraud or dishonesty, but merely due to the fact that possibly one person meant one thing and perhaps the seller intended something slightly different? To this you may reply that is all very well when buying a cargo of grain or coal, or some other commodity which is sold by sample, but this does not apply to purchasing such a simple article as a wireless component.

However, let us take a concrete case. I want an L.F. transformer for my new receiver. Do I take my copy of PRACTICAL WIRELESS to the retailer, show him the specification and ask for the article by manufacturer's name and type number? No. I simply ask for an L.F. transformer, and as there is one in the window very cheap I buy it. It refuses to function. To prove that it was not in order when purchased is a very difficult matter. It is not a branded type, the name of the manufacturer is not mentioned, and therefore my chances of obtaining redress are rather small.

There is an enactment on the Statute Book entitled The Sale of Goods Act, 1893, which deals very fully with the law relating to the sale of all kinds of goods. These are described as anything capable of being moved, such as a motor car, radio receivers and components, and all the usual commodities usually offered for sale in the shops in your locality. This Act is our guide, and a slight knowledge of it cannot but be of considerable assistance to every constructor, who, naturally, desires to get the best value for his money, and also avoid making mistakes which are sometimes very expensive.

There is just one word which we must define as it is not used in the ordinary, everyday sense. It is rather important that we should really understand the meaning of the word "property." The usually accepted meaning refers to houses, land, etc., but in this case it means the *right of ownership in goods*. The distinction between "property in goods" and "ownership of goods" is very important, especially if goods have been paid for and left to be called for later. If a man pawns his watch he parts with the possession of it, but the *property* in the watch remains his until such a time as the pawnbroker lawfully disposes of it.

Now let us go a step farther. A component is exhibited in a dealer's window and marked at 10s. You walk into the shop, place your ten shillings on the counter and ask for the article in question, which the shopkeeper supplies. This simple transaction we will now analyse, converting it into legal phraseology. "The dealer is offering for sale, in consideration of the sum of ten shillings, to anyone who cares to accept his offer (during ordinary business hours) a certain radio component. You accept his offer by asking for the component and placing your money on the counter." Quite simple—the deal is completed, and the dealer is bound to sell. This example serves to illustrate one of the fundamental principles of the Law of Contract, namely, Offer and Acceptance. If the price is not marked on the goods, or such phrases are used as "Special Line," "Few Only," or "Large Variety Within," you may not have the right to demand the particular article in question. The rule is—there must be a definite offer (no ifs or buts), and it must be accepted as it stands. Of course, if the shopkeeper can prove that the price shown is incorrect, and an error has been made, this rule could not be enforced. As an example: If you saw a receiver which was normally listed at, say, ten pounds shown at five shillings you would naturally think that this was an error, and you would have considerable difficulty in holding the dealer to the transaction if this was the case.

Goods Wanted for a Particular Purpose

Where a buyer expressly or by implication makes it known to the seller that the goods are wanted for a particular purpose, so as to show that he relies on the seller's skill or judgment, and the seller in the ordinary course of business is accustomed to sell goods of the description in question, there is implied a condition that they are reasonably fit for the intended purpose.

Let us take an example: You require, say, a pair of band-pass coils and you ask the dealer for them. It appears that he would be at liberty to supply you with a pair of band-pass coils of any make and also either inductive capacity or any other type of coupling, and you would have very little redress if they were either not what you wanted or failed to function satisfactorily. It is simply useless asking your dealer to give you a transformer, a valve, or coil, and then complain to the dealer or manufacturer that they fail to function satisfactorily. Decide upon what you require and insist upon it. You will be saved time, money, and worry, and be sure of getting satisfaction.

Take another example: A customer calls on a dealer, and asks for a quality receiver capable of receiving at loud-speaker strength a fairly large number of foreign stations without interference. He had heard a receiver of this type, but could give no further details. Actually, what the customer required was a sensitive super-heterodyne receiver. The dealer sells him, say, a two-valve receiver and, in his ignorance, the customer takes delivery and pays for it. In this instance the receiver cannot be said to be reasonably fit for the purpose made known to the dealer, and the customer is entitled either to have his money refunded or be supplied with a receiver suitable to his needs. In this instance the implied condition that the receiver shall be reasonably fit for the purpose declared had been broken. If a person is ignorant of radio, and asks a dealer for a component for a certain set or circuit, relying upon the dealer's skill or judgment, the customer is entitled to refuse to accept any component except that specified for the receiver in question.

If a dealer or manufacturer supplies goods to order, knowing the purpose for which they are required, he thereby impliedly undertakes to supply goods fit for the purpose in view, and a member of the public may indicate his acceptance in compliance with an advertisement, provided that the advertised goods exist when acceptance is intimated, and the offer has not been withdrawn.

Sale or Return

When goods are supplied on sale or return, or on approval, and a special period is named, if they are not returned at the

expiration of the period, it is assumed that the person receiving them intends to purchase, and he may be held liable for the purchase price.

Caveat Emptor

Where goods are offered for sale below list prices caution is necessary. There is a legal maxim *caveat emptor*, which means let the buyer beware, and it behoves everyone to exercise a certain amount of prudence in purchasing goods of any kind. It is certainly not the intention of the writer to suggest that traders as a whole are dishonest, nevertheless, it is always wise to examine goods before purchase, as very often innocent mistakes occur which could have been obviated by a little thought. Remember you are entitled to examine goods before purchase, and it is up to you to see, as far as possible, that they are satisfactory and of the correct type.

Stolen Goods

If goods are stolen, and the owner prosecutes the thief to conviction, the property in the goods revests in the original owner, irrespective of any intermediate dealing in them. You may be an innocent purchaser of goods which may not have been obtained through legitimate channels, and if the rightful owner proves that they have been stolen you lose the goods and possibly your money, so remember the injunction—*caveat emptor*.

No one would think of calling on a motor agent and asking for a car costing, say, £175 or £200, and then leaving it to the agent to supply whatever make he likes. Of course, in buying an article such as a radio component it does not need all the forethought that purchasing a motor car demands, but, nevertheless, it is really worth while deciding upon what you want before purchase. If you are building a receiver described in PRACTICAL WIRELESS, it is easy for you. Take your copy of the specification to your dealer, and insist on obtaining the specified components, then no difficulty should be experienced.

In reconstructing your receiver along your own lines, study the advertisement columns of this paper and buy branded goods if additional components are necessary. If a manufacturer believes in his components he will arrange in some manner for his name and address to appear either on them or on the container.

Complaints

If you find it necessary to communicate with the manufacturer or return a component for examination, nothing will be gained by abusing the manufacturer concerned. Manufacturers know the capabilities of their components, and they would not remain in business very long if their goods did not give satisfaction. The constructor is very critical and discriminating in these days, therefore manufacturers are not likely to be frightened by invectives, and they are well acquainted with the psychology of this type of person. A brief, tactful letter is more likely to receive prompt attention than one containing a lot of irrelevant matter.

Now to sum up:

1. Decide upon the article you wish to purchase, ascertain its price, code number, and name of manufacturer.
2. Buy goods at list prices; you then have a remedy, and the manufacturer will always put matters right for you.
3. Buy branded and advertised components.

By the Editor.

New Formo Products

CONSTRUCTORS will be interested to know that an entirely new range of components and accessories bearing the famous Formo trade mark will shortly be available again through the new Formo Products, Limited, of Bromley, Kent. We understand that Mr. Graham Farish is Managing Director of the new Formo concern.

Marconi's Birthday

READERS may be interested to note that on April 25th H.E. Marchese Marconi celebrated his 60th birthday, and in connection with this memorable occasion Marconi's Wireless Telegraph Company, Ltd., prepared an approved biography of Marchese Marconi, which is now available.

Mains Hum Conquered

GOING back over the history of valve development, it will be remembered that the very first A.C. valves were directly heated—as many of the popular output types are to this day. It was soon found, however, that the preceding valves not only caused hum, but themselves amplified it. The cure was found in the indirectly-heated cathode, and this form of construction has been standardized not only for A.C. valves—which can be regarded to all intents as perfectly free from mains noises—but also for the D.C. valves which followed in due course. And yet D.C. sets have been regarded as notorious for mains hum, owing partly to the fact that the smoothing which can be applied is limited. When Mullard were designing their new Universal series this was the problem they had to contend with, and which they solved so brilliantly. The Mullard Universal valves function equally well on either alternating or direct current mains, and *mains hum has been conquered*. This problem was concerned with the fact that the heaters of the Universal valves have a higher voltage than those of the A.C. series, and therefore the A.C. field is increased. In addition, as mains transformers are not used in universal receivers, it is not possible to adopt the procedure usual with A.C. valves, and to return the cathode to the effective centre of the heater—that is, the centre-tap of the heater winding on the mains transformer. This, of course, is one of the best known methods for eliminating hum.

The solution was found in keeping the lead to the control grid well away from the field of the heater wires, and connecting it to the top cap of the valve, in the position usually occupied in S.G. valves by the anode terminal. The internal screening of the valve electrodes has also been made very complete in order further to minimize hum troubles and effectively to reduce the inter-electrode capacity. But perhaps the most important innovation is that the valves are pin-less, the connections being taken to side contacts. New valve-holders have been designed for use with the new valves, and electrically the connections are excellent.

The reason for the new system is two-fold. Firstly, much better contact is possible between valve-base and valve-holder, and secondly—this having bearing on the subject we are discussing—greater clearance is possible between the base contacts, and also between the wires inside the base. Instead of the connecting wires from the inside of the valve being brought down to a cluster of pins, they are widely separated and taken out to the contacts on the side of the base. Summing up, Mullard have reduced unwanted capacity between the valve electrodes to a minimum, and full advantage can be taken of the efficiency of the Universal valves without interference from mains hum.

We must state here that the new series are not yet available for the general public, although an announcement is expected from Mullard on this point during the next month.

Reduction in Price of K.B. Set

KOLSTER-BRANDES, LTD., have reduced the price of their four-valve Class B battery-operated receiver, K-B 363—one of their seven new models offered to the public early this year—by two guineas. The new price, which came into operation in April, is £10 10s. instead of £12 12s. Hire-purchase terms have been adjusted accordingly. There will be a deposit of 23s. (including 3s. insurance) and ten monthly payments of 21s.

New Marconi Aircraft Equipment

THE two "Scylla" type air liners, which are now being built for Imperial Airways, Limited, at Rochester, are being fitted with a new type of Marconi wireless equipment known as the A.D.41A/42A. This new equipment follows very closely the design of the medium-wave portion of the well-known A.D.37A/38A combined medium- and short-wave set which is installed in the whole of the Imperial Airways fleet of "Atalanta" class aircraft. The transmitter and receiver can be installed either as one unit or as two separate units to suit the accommodation available in any type of aircraft.

The wave-range of both transmitter and receiver is 500-1,000 metres, and to facilitate the operation of the set quick wave switching is provided for on four wavelengths, namely, on 600 metres and on any three predetermined wavelengths in the band of 850-950 metres. The instruments are also calibrated in metres throughout their range. The transmitter, which employs two magnifier valves with a power to the anodes of approximately 160 watts, is suitable for working on both telephony and telegraphy (continuous wave and interrupted continuous wave) on either fixed or trailing aerials.

The weight of the complete transmitting and receiving equipment is approximately 45 kilogrammes (99 pounds). Arrangements have been made whereby the instrument can be readily interchanged with the A.D.37A/38A installation should short-wave working be at any time required. Provision has also been allowed for the installation of wing-coil apparatus for "homing" as an aid to navigation.

PRACTICAL TELEVISION

(Continued from page ii, Television Supplement.)

adjusted for the particular value of accelerating potential employed on the anode, and also for the distance between screen and cathode to give a spot of minimum size and maximum sharpness.

It will be noted that in the previous reasoning the effect of any residual gas molecules has been ignored and the stream of electrons considered virtually to be passing through empty space. In practice, however, pressures below about one ten-millionth of a millimetre of mercury are seldom attained, and in most so-called "hard" cathode-ray tubes the pressures range from about one-hundred-thousandth to one-millionth of a millimetre of mercury.

By still further reducing the quality of the vacuum and using pressures of about one-thousandth of a millimetre of mercury an entirely different set of phenomena supervene. Ions are formed by the collision of the electrons with gas molecules within the tube and the formation of these has been very ingeniously put to the good use of maintaining a concentration of the beam. When the tube is in operation, the molecules ionized along the path of the beam form a kind of sheath or tunnel through which the ray passes, causing it to remain substantially parallel instead of becoming divergent. The number of ionizations per second, and hence the ionic concentration in the neighbourhood of the beam, depends upon the current density in the beam.

The Wehnelt Cylinder

An extremely important method of cathode-ray tube fasciculation which, strictly speaking, can be called an electro-static method, makes use of what has now come to be called the Wehnelt cylinder. The relative position of this electrode in the assembly of the tube is indicated in Fig. 3.

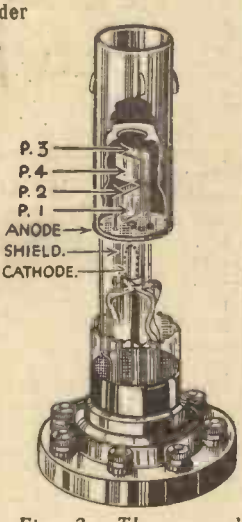


Fig. 3.—The normal electrode system of a cathode-ray tube in which the Wehnelt cylinder is indicated as the shield.

With a U-shaped cathode it was found that the lines of force diverge in all directions before proceeding to the anode. To overcome this and also to concentrate the rays before they pass through the orifice in the anode, Wehnelt suggested the use of an auxiliary electrode in the form of a hollow cylinder surrounding the cathode.

When the potential of this cylinder is varied the arrangement of the lines of force between the cathode and the anode becomes very considerably modified. If the cylinder potential is greatly negative with respect to the filament, all the lines of force originating at the anode go to it and none pass to the filament. As the cylinder potential is made less negative, however (or in some cases actually positive), a value is reached when a large number of lines of force exist between the anode and the filament. At some intermediate potential, all or a large proportion of the lines of force from the filament itself pass through the anode orifice, and in this way a concentration of the beam is effected.

Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

SHORT WAVES SIMPLIFIED

MANY listeners are desirous of converting their existing receivers into short-wave sets, but are rather dubious concerning the best method of conversion. Messrs. J. J. Eastick and Sons, of 118, Bunhill Row, London, E.C.1, have produced some interesting converters and coils at various times, and we now have before us a new type Duplex short-wave coil and base which, whilst it appears at first sight similar to the original model, has received careful attention and modification to bring it more up to date and to simplify its use. The illustration on this page gives an idea of the arrangement, although this is of the original model. The only external difference in appearance is the inclusion of two terminals in front of the change-over switch instead of the single one shown in the illustration. As may be seen, the base is fitted on its upper surface with a coil socket (the arrangement of the pins being as shown in the upper illustration), a valve-holder and the change-over switch. The base is hollow and contains, in addition to all the necessary wiring, three fixed condensers, a grid-leak and a soundly-made H.F. choke. The valve-holder is of the 5-pin type, and is wired in such a manner that it may be employed for a battery-operated or an indirectly-heated A.C. mains valve. The grid leak is internally wired so that when the battery type of valve is employed, and the switch is placed over to "battery," the grid is returned to L.T. positive, but with A.C. valves the grid is returned to the cathode. The other necessary changes are also carried out when the switch is operated. The base is intended for inclusion inside an existing receiver, when certain alterations are made to the wiring, and it then becomes a simple matter to change over from broadcast to short-wave reception. The coil is of ingenious design, incorporating two separate windings on the one former. These are joined to the eight pins in such a manner that by merely reversing the coil former the range is changed. The top of the former is suitably engraved to indicate the band which is covered at any one moment. With a .0002 mfd. variable condenser the two standard ranges are 15 to 30 metres and 28 to 60 metres, the slight overlap in the two bands permitting of continuous tuning from 15 up to 60 metres.

The Eelex short-wave 8-pin reversible coil and base.

The Eelex short-wave converter chassis.

Readers who are interested in this apparatus should obtain a copy of the Eelex catalogue in which full descriptions and connections are given. The Duplex chassis, complete with coil, costs £1 15s. 0d., and the coil with base as shown in the upper illustration costs 7s. 6d.

The Lissen Q.P.P. transformer.

A USEFUL TRANSFORMER

READERS who are desirous of trying out the quiescent push-pull arrangement incorporating the recently introduced double pentode valves will be interested in the Lissen transformer illustrated herewith. This has a ratio of 1 to 8, and the primary has a D.C. resistance of only 370 ohms. The inductance has a value of 35 henries with no D.C., and this falls to 20 henries with 4 mA. For the normal method of working, therefore, a really good inductance should be obtainable, as it is unlikely that a valve will be employed to feed the output stage, in which a higher current than 4 mA. is taken. There would, of course, be no objection to using the parallel-feed coupling if there was any possibility of a higher current being passed. The resistance of the secondary winding is 15,000 ohms. The core is of nickel alloy which enables the high inductance figures to be obtained without unduly increasing the overall size of the component. Although primarily designed for the Q.P.P. circuit the transformer may, of course, be used in ordinary push-pull or straight circuits. The price is 12s. 6d.

A NEW OVERSEAS RECEIVER

THE General Electric Company have recently introduced a receiver designed especially for use overseas. This is a 7-valve superheterodyne, covering a range from 12 to 550 metres, the selector switch being of the five-position type. A single tuning control is fitted and no coil changing is required. The receiver is designed for A.C. mains operation and the moving-coil loud-speaker which is fitted is mains energized. It is a very compact receiver, measuring just over 23in. in width, 13in. in height and 11¾in. in depth. The cost is £24.

COIL SCREENS

MESSRS. MAINS POWER RADIO, LTD., of Broadway Works, Eastern Road, Romford, Essex, have been appointed sole distributors to the trade of the coil-screening covers manufactured by Messrs. White Bros. and Jacobs, Ltd. These screens are made in various sizes with a diameter of 2⅜in., and are complete with base. The normal finish is of the type known as "frosted." Prompt deliveries are available to all factors and retailers, and the cost of a screen, complete with base, is 1s.

KABI POTENTIOMETERS

THERE are several points which have to receive attention in a potentiometer which is designed to operate with a heavy current and which must give smooth and noiseless operation. The Kabi precision potentiometers offered by F. W. Lechner and Co., of 61, Spencer Street, Clerkenwell, London, W.C.1, have several interesting points, the first being in the method of taking off the connection from the moving arm. In many types friction is relied upon to provide the contact between the arm and the external connection, but in these particular instruments a hair-spring device is employed which, of course, provides direct connection between the actual arm and the apparatus with which it is employed. The resistance element is of the wire-wound type, and to prevent variation due to movement of the wire it is embedded in bakelite shielding. The operating spindle is insulated, and the wattage rating of the potentiometers, in values up to 50,000 ohms, is 3. The price is 6s. each, or 8s. with combined mainss witch.

NEW TUNGSRAM UNIVERSAL VALVES

THE popular range of Tungsram Universal valves has now been augmented by two new types, one a single diode (D418) and one double diode (DD818). The former has a filament rating of 4 volts .18 amps, and the latter an 8 volt .18 amp. filament. The maximum diode rating in each case is 100 volts. These valves are of the latest small pattern, the D418, for instance, having an overall height of 2¾in., and a bulb diameter of only ¾in.; the bases are of the 3- and 4-pin European type. The valves are intended for A.V.C. and linear rectification purposes and may be used, if desired, in normal A.C. receivers where a 4-volt A.C. supply is available.

OSRAM M.X. 40 HEPTODE

THE use of the combined controlled detector oscillator, or heptode type of valve, is becoming increasingly popular, and the following characteristics of the Osram valve in this class will, no doubt, be of great use to readers who are desirous of experimenting with this type of circuit. The valve is of the standard 7-pin base, and has, in addition, a connection brought out to the top of the glass bulb. This latter connection is the control grid. The seven pins are joined to the oscillator anode, the oscillator grid, the screening grid, the cathode, the normal anode and the heater. The latter is of the 4-volt 1-amp. type, and the normal voltage for the anode is 250. Outer and inner screens are designed to operate with 100 volts (maximum), whilst the oscillator anode should receive a potential of 150 volts maximum. The conductance of the oscillator section is comparatively low, so that the reaction coil will have to be provided with a fairly tight coupling. The valve makers recommend about 1 to 1½ times as many turns as in the case of a normal separate triode oscillator. Care will, of course, have to be taken with regard to the long-wave constants. Experiments should be carried out with the screen voltage in order to find the optimum value for the particular set of conditions under which the valve is used.

The Osram heptode valve (M.X.40.)

PRACTICAL LETTERS FROM READERS

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

"Are Crystal Detectors Worth While?"

SIR,—Since reading an article in PRACTICAL WIRELESS, entitled "Are Crystal Detectors Worth While?" I have been listening in on a very old type of crystal set, consisting of a coil about 5in. long by 3in. diam. with about 250 turns of wire, and a slider along the top. There is no amplification and I was really surprised at the result. A few evenings ago I was listening from 10.45 p.m. to midnight, during which time I picked up three English stations, one low down the scale, probably one of the London stations, North Regional, and National, one foreign station about 300 metres, Athlone, and Stuttgart, all at good strength and beautifully clear, and one or two others that were too low to bother with. I was really amazed, considering that I live in Darlington, at least thirty-five miles from the nearest B.B.C. station. I have come to the conclusion that there is only one answer to the question, "Are Crystal Detectors Worth While?" and that is "Yes." I have just had another half-hour with this crystal set, and found five stations that were very good, two German, that closed down at 11.30 p.m., and three English stations that were sending out dance music. I think this is proof that there is still something in crystal detection.—R. W. (Darlington).

A Universal A.C.D.C. Set with Midget Components

SIR,—Referring to Mr. Preston's articles about midget components, I am of the opinion that a large number of readers would welcome a Universal A.C.D.C. set of the five or even six-valve type having three tuned circuits and ganged I.C. coils. Using coils of a good make with a three-gang condenser and other midget components, a set of extremely small dimensions could be designed.—J. WESTNOTT (Dukinfield).

A Leader A.C. Superhet Wanted

SIR,—The "Leader" sets that PRACTICAL WIRELESS has recently published will be welcomed by many wireless constructors all over the country as a step towards cheaper home-constructed radio, and I think many readers would also welcome a "Leader A.C. Superhet" incorporating such refinements as A.V.C. and, perhaps, tone control, etc., at a price that compares with similar commercial sets.

When we look at the range of well-known commercial sets and see the splendid value offered in A.C. superhets, at prices of 11½ or 12 gns., we realize your task is not an easy one, as these prices include speaker and cabinet; but, nevertheless, it is hoped that PRACTICAL WIRELESS will design a superhet that will compete with any on the market, both for price and quality.—J. L. CRAIGS (Hendon).

Low-tension Supply

SIR,—The article on Low-tension Supply in the April 14th issue, by A. E. Oakley, is extremely interesting and useful to many of us who are fed up with being at the mercy of local charging stations where small and large accumulators are treated the same, and the charge rate is an unknown quantity. Mr. Oakley did not mention the excellent trickle charger for A.C. mains, which was described by Mr. Champion in PRACTICAL WIRELESS dated January 21st, 1933, consisting of a bell transformer, a jam jar of acid, a strip of lead, and a strip of tantalum. I made this up over twelve months ago at a total cost of 7s., and my charging has not cost me a penny since (except, of course, for the infinitesimal cost of A.C. current). It is articles such as this that have made PRACTICAL WIRELESS what it richly deserves to be, the foremost radio journal published.—W. E. RYAN (Honor Oak Park).

From an Indian Reader

SIR,—I have taken PRACTICAL WIRELESS from the first volume and think it is the best weekly paper on wireless I have ever read. Please don't forget that listeners in India want short-wave sets, and would welcome a good receiver of 4 to 5 valves, not including rectifier.—C. L. JOHNSTONE (Longhyr, India).

"Made like a Gun"

SIR,—I beg to acknowledge with many thanks, the receipt of the tool-kit. I suppose I am only repeating the statements of thousands when I say that the kit is the most marvellous value I have ever met. They are really instruments of precision, "made like a gun," and will have many uses beyond tinkering with wireless. The packing is decidedly ingenious. With the "Encyclopædia of Practical Mechanics," the "Home Constructors' Encyclopædia" (3rd edition), and the "Everyman's Wireless" book, I am very well equipped, and count myself very fortunate that PRACTICAL WIRELESS and "Practical Mechanics" put them in my way.—EAMONN MACSEARRAIGH (Dunmanway, Co. Cork).

CUT THIS OUT EACH WEEK.

Do you know

—THAT a treble-diode-triode has been added to the already extensive range of multi-valves now on the market.

—THAT the additional diode in this particular valve is employed as a between-station noise suppressor.

—THAT the total current consumption of a receiver should carefully be noted before choosing an eliminator to work with it.

—THAT special transformers are now available to assist in accurately synchronizing a television motor.

—THAT tuned windings resonating at 375 c.p.s. are employed in this type of transformer.

—THAT the glass of a window-pane will serve admirably as the dielectric of a series-aerial condenser.

—THAT an electrolytic condenser must be joined in circuit with the correct polarity, otherwise it may be permanently damaged.

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, *Geo. Newnes, Ltd., 8-11, 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.

DX Broadcasts from KDKA and W8XK

SIR,—It may prove of some interest to your readers to know that the American stations KDKA and W8XK of Pittsburgh have a special DX club broadcast every Monday morning at 05.30 to 06.00 G.M.T., both broadcast band 550 kcs. to 1,500 kcs., and short-wave DX tips and news are given. Reports and DX tips, etc., are welcomed on the above transmissions, and these should be addressed as follows: Edward C. Lips, KDKA-W8XK, DX Club, William Penn Hotel, Pittsburgh, Pa., U.S.A. W8XK operates on 6,140 kcs. and sometimes on 11,870 kcs. for these transmissions.—F. G. SADLER (Stamford Hill, N.16).

Wavelength of New Cape Town Transmitter: A Correction

SIR,—In your issue of PRACTICAL WIRELESS, dated Feb. 10th, 1934, on the top of page 976, you state that the wavelength and frequency of the new Cape Town transmitter are 371 metres and 810 kilocycles respectively. May I inform you that these facts are not correct? The wavelength of the station concerned is 500 metres and the frequency is 600 kilocycles.—D. A. S. SICHEH (Claremont, nr. Cape Town, S. Africa).

A Bournemouth Reader's Thanks

SIR,—Many thanks for the "Everyman's Book of Wireless," and also the pocket tool-kit. I am greatly pleased with the book, and it will be a very great help to me, and I congratulate you on its production. The pocket tool-kit will be more than useful and I am delighted with it.—K. BOOTH (Bournemouth).

Schedule of W3XAL

SIR,—With reference to the letter of Mr. Barnes (Faversham), *re* the schedule of W3XAL. Whilst thanking him for new schedule, I wish to point out that the schedule given by me was in operation at the time of writing, and was sent to me by N.B.C. officials with a request to send details of same to the press. Upon arrival, W3XAL was checked against his schedule and found to be correct, otherwise it would not have been forwarded for publication. In point of accuracy it required no correction during the period mentioned. The microphone announcement of new schedule heard by your correspondent automatically cancels the original schedule.—A. W. MANN (Middlesbrough).

The "Leader 3": "Exceeds All Expectations"

SIR,—Many thanks for the "Everyman's Wireless Book," which I have received, and with which I am highly delighted. It is just the thing I've been waiting for as regards the testing instructions. I already have an elementary idea as to how a wireless set works as I've been experimenting for the past four years, and have taken PRACTICAL WIRELESS since Sept. 30th, 1933. I also congratulate you on the Leader 3, which I have built. It has exceeded all expectations.—J. W. SIM (Morpeth).

IMPRESSIONS ON THE WAX

By TONEARM.

30,000 Recordings a Year

AT a conservative estimate 30,000 new recordings are issued during each year by all the gramophone companies in England. It is, therefore, impossible to review the merits of all the new records, and in future I propose to deal with a selection of them as they are sent to me for criticism.

The "His Master's Voice Company" have many interesting records in their latest list, especially to readers who have radiograms. Pride of place must be given to the record of the *Triumphal March* from Elgar's *Caractacus, H.M.V. DB* 2142. *Caractacus* was one of Elgar's earlier works, and a few months ago he expressed a wish that an adequate recording of it should be made. For more than twenty years he had conducted the orchestra for the recordings of his own compositions. As Sir Edward was confined to his bed at his home at Worcester, he suggested that his bedroom should be connected to the large H.M.V. studio at St. John's Wood, London, by two telephone lines. His novel idea was carried out, and two of his works were played by the London Symphony Orchestra, conducted by Lawrence Collingwood. The veteran composer heard the orchestra playing his march through a loud-speaker, which had been installed at his bedside. He commented on their performance through a microphone, and his remarks were clearly audible to the conductor and musicians in the studio. They played the work again and again until Elgar was satisfied with their interpretation. The finished record is a fine memorial to England's greatest composer since Purcell. The music is stirring and ranks with the famous *Pomp and Circumstance* marches, which endeared Elgar to the hearts of the most humble Englishman. The fine quality of the recording makes this record a standard for comparison with other orchestral discs.

Popular Melodies by Star Artists

Kreisler, king of violinists, and Pablo Casals, probably the finest living 'cellist, both return to the gramophone lists, after two years' absence, with records of popular melodies. The former displays his mastery of technique with his performances of the *Londonderry Air* and Mendelssohn's *A May Breeze* from *Songs Without Words*. The Irish air has often been called "the most beautiful melody in the world." They are both on *H.M.V. DB* 2117. Casals plays not quite such well-known compositions; Valentini's *Gavotte*, De Laserna's *Tonadilla*, and Vivaldi's *Largo* on *H.M.V. DA* 1118. It is worth getting for the *Largo* alone, for he plays it with a caressing warmth that is impossible to describe in words. Richard Crooks, the American tenor, is still in his thirties, but has recently become the leading tenor at the Metropolitan Opera House, New York. On *H.M.V. DA* 1360 he sings the old film hit, *Smilin' Through*, from the film of the same name, and one of the popular dance tunes of the moment, *My song goes round the World*. It is not often that we have the opportunity of hearing a singer of Crooks calibre singing these types of ditties; his rich tones and excellent breath control makes the songs seem masterpieces. Another vocal record of note is Derek Oldham's contribution with two favourite ballads, *Fleurette* and *Maire, my girl*, on *H.M.V. B* 8121. He adds a touch of novelty to his interpretation of the former song by rhythmically speaking one chorus to the accompaniment.

Light Orchestral Discs

Among the new light-orchestral discs Marek Weber and his orchestra's record, *H.M.V. C* 2646, of the overture to *Fledermaus* in my opinion takes pride of place. Even if you are averse to overtures to operas you must hear this record, for it contains some of the most tuneful music written by Strauss. The famous waltz which is the main theme to this opera is equal, if not superior, to any waltz which was created by the Viennese composer. Weber's nationality makes him an ideal interpreter of this overture. John Barbirroli, the English conductor, who has been making such a name for himself with the Scottish National Orchestra this season, directs his own orchestra in *Berceuse* and *Praeludium* on *H.M.V. B* 8112. This is a plum-label disc and a bargain not to be missed.

Dance Records

I pick *Oceans of time* as being the most "catchy" dance tune of the moment, and Ray Noble's orchestra have made a really good recording of it, coupled with *The sun is round the corner*, on *H.M.V. B* 6450. They are both fox-trots and are from Jack Buchanan's show, *Mr. Whittington*. Ray makes his own arrangements for his records, and this no doubt contributes to the success he always seems to achieve. I heard from a friend who has just returned from America that this English band's records are now the rage in U.S.A. Up to a couple of years ago no English-recorded dance records had been issued over there, as it was considered absurd that any other country's dance bands could compare with those of the home of jazz. The recording engineers deserve a pat on the back also for they invariably manage to invest Noble's records with a "stereoscopic" quality, which makes each instrument apparently "stand out" from the others.

There has recently been a revival of interest in old-time dances; at Christmas we had records of the "Lancers," "Polka," and "Valeta" and now, on *H.M.V. B.* 6429, there is a new version of "The Maxina" and a "Schottische," "Twiggez-vous," by Sidney Baynes' orchestra.

From the old we pass to the ultra-modern where Cab Calloway's band plays four numbers, *Zaz Zun Zaz*, and *Harlem Camp Meeting* on *H.M.V. B* 6460, and *I learned about love from her* and *Father's got his glasses on* on *H.M.V. B* 6451. They are all fox-trots, and the first named of each record is a slow one. Calloway is one of the most prominent American Negro "hot" dance-band leaders.

This Week's Radiogram Hint

You can ensure that the adjustment of the reed of your pick-up is correct by gently stroking the left hand and then the right-hand sides of the needle point with the tip of a finger. If one "plonk" is louder than the other, when equal pressure is being used, it shows that the damping at the top of the reed requires adjustment until both "plonks" are of equal strength.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

ELECTRADIX COMPONENTS

A VERY comprehensive range of meters and other radio instruments and components is given in the latest list (No. 80) just issued by Electradix Radios. The list, which runs to 80 pages, is packed with illustrations and particulars of measuring instruments of all kinds, wavemeters, dynamos and motors, switches and switchboards, relays, morse apparatus, aerial equipment, and accumulators. Various superhet receivers, amplifiers, mains units, and an extensive range of small components are also listed, together with a variety of microphones for all purposes. Many of the items listed are unique and unobtainable elsewhere. Copies of the list can be obtained for 4d., post free, from Electradix House, 218, Upper Thames Street, London, E.C.4.

THE UNIGRAM

BY means of the Unigram, recently placed on the market by Cosmocord, Ltd., a radio receiver is easily converted into a high-class radiogram. The new unit consists of a motor-driven turntable with pick-up, etc., mounted in a very neat and compact cabinet on which the receiver is placed, and the necessary connections made. An automatic combined switch and stop are provided, and when the record is played through, the turn-table is stopped automatically. The motor is adjusted for use on 200/250 volts, but is easily adjusted to operate on 100/130 volts. Model T1 includes a high-class electric motor, fully automatic stop, Universe pick-up and rest, and potentiometer-type volume control. Housed in an attractive cabinet it is priced at £4 19s. 6d.

Model P.1 is of similar specification, but has several additional features, including record retainer, internal illumination with automatically operated switch when cabinet is opened, and built-in tone control. This model is housed in a light walnut cabinet of modern design, and is priced at £9 9s. Copies of a neat folder giving further particulars of both these models can be obtained from Cosmocord, Ltd., Cambridge Arterial Road, Enfield, Middlesex. In another folder, which can be obtained from the same address, particulars are given of the new Universe pick-ups. Two models are shown, the Standard, which is listed at 20s., and the Super Model at 22s. 6d. Both pick-ups are high-class instruments embodying the latest refinements. Particulars are also given of a noiseless wire-wound potentiometer which is priced at 3s. 6d.

RAWSWOOD TRANSFORMERS

THE finest quality of raw materials and modern machinery combine to make Rawswood mains transformers high-class and dependable components. They undergo stringent stage by stage tests, leaving an ample margin of safety against overload and breakdown. Windings carrying normal loads are wound with enamelled copper wire, the windings of high potential are of enamelled S.S.C. copper wire, whilst the low-tension windings conveying heating current to wireless valves are of D.D.C. wire. A full range of these transformers is given in an attractive folder, in which filter chokes, power packs, H.T. eliminators, and trickle chargers are also listed. Interested readers are advised to write for a copy of this folder to The Rawswood Electrical Coy., Preston New Road, Blackpool.

REPLIES TO BROADCAST QUERIES.

EDITOR'S NOTE: Querists must limit their queries to three per letter.

J. ELPHICK (Consett): WJX, Sayville (New York), 20.44 m.; ON4CN, M. Libert, 18, Rue des Croix, Flenu (Belgium); F8NW, A. Guillaume, Villa Saint-Jean, Hardelot-Plage (near Calais) (France); You hear the R.A.F. transmissions (ground to traffic) on 65-70 m. 17, Rue Mayet, Paris, is the address of the French Amateur Wireless Association; the personal address for F8NK was correctly given. R. BUTLER (Old Kent Road): G5NW, E. Allan, 8, Westfield Place, Dundee; G2GW, G. White, "Moonrakers," Hardenhnish, Chippenham, Wilts; W1CA, W. Skilling, 29, Lloyd Street, Winchester (Mass.); W1ZA, S. Taggart, 70, Pine Street, Chicopee Falls (Mass.). N. R. KINGSTON (Northampton): (1) Regret, cannot trace; (2) Yes, this was OXY, Skamlebaek, relaying the Copenhagen programme. J. EASTON (Watford): Poste Parisien (Paris); not the *Last Post* but a few bars of an operatic song.

RADIO CLUBS AND 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.

ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY

At the twenty-first meeting of the Uxbridge District Branch of this Society members heard many short-wave stations upon the club receiver. They included POG, Brazil, LCJ, Norway, RW59 and RW75, Moscow, DJC, Zeesen and GSA, Daventry. A morse-learning class was formed, Mr. Minassian (2AAL), a qualified operator, being the "master." Full particulars of the branch may be obtained from Mr. Leslie W. Orton, 11, Hawthorn Drive, Willowbank, Uxbridge.

SLADE RADIO

There was an evening of entertainment at the last meeting of this Society, consisting chiefly of a recital of gramophone records. A play, "Flags on the Matterhorn," which was specially written for broadcasting by two German authors, Gasbarra and Pfiel, was particularly interesting, and was based on the first ascent of the Matterhorn in 1865 by Edward Whymper, an Englishman who had previously spent five years in endeavouring to climb the mountain. The records were loaned by The Marconiphone Co., Ltd. —Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

OXFORD SHORT-WAVE CLUB

The above club was inaugurated on April 17, 1934 with G2DU, G2CL, G5LO and G6QQ among its members. Anyone who is interested in short-wave radio is invited to get in touch, either by writing, or calling any evening between the hour of 18.00 and 19.00, on the Secretary, Mr. W. H. Rawlings, 47, Randolph Street, Cowley Road, Oxford.

TELEVISION IN THE HOME

IN an interview, Captain A. G. D. West, M.A., B.Sc., Technical Director of Baird Television, Ltd., emphatically repudiated the statements that have appeared in certain sections of the Press recently that there is no future for Television. "Television will be *well* established in the home within the next two years," said Captain West, "and in three years there will be Television in the cinema on a full size screen.

"Moreover, Television as a home entertainment will be within the means of all who at present are willing to spend on good radio aural reception. I strongly advise the public to be prepared for this by reading and understanding the principles as explained in the new edition of Pitman's book "Television: To-day and To-morrow," by Sydney A. Moseley and H. J. Barton Chapple. This book answers the critics much more easily than I can. Modern high-definition methods have been demonstrated to the Press during March and April. These methods are a natural development of principles discovered by Mr. John L. Baird, the inventor of Television, and this book, partly historical and partly technical, describes the early struggles and progress of Mr. Baird."

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

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

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE.

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.

Please note also, that all sketches and drawings which are sent to us should bear the name and address of the sender.

ADAPTING A METER

"I intend to purchase a multiple meter, but have noticed that the design includes resistances for reading volts, milliamps, and ohms but not for amperes. Could you therefore tell me of a firm which supplies such resistances so that I can use them as the required shunts?"—A. J. M. W. (Wellington College).

As you will probably wish to use the instrument on ranges not covered by the shunts, etc., which are supplied, you will probably find it more useful to purchase a very low reading milliammeter and to build up a complete instrument to cover the ranges you require. If you look up the article on the Multi-Meter which was described in PRACTICAL WIRELESS, dated 11/2/33 you will find how to calculate the various resistance values, and you should be able to build an instrument for any range you desire.

USING AN ELIMINATOR

"I have a Universal model eliminator, but when I connect this to my 4-valve set I get a terrific hum. Can you suggest any way to smooth this down?"—J. S. (Blackpool).

The hum may be instability caused owing to lack of decoupling in the receiver. In this case, of course, it will be necessary to insert decoupling arrangements in the anode circuits of the various valves to stabilize the set. On the other hand, the hum may be due to the fact that the receiver is overloading the eliminator, and it will, therefore, be necessary to fit a larger-capacity mains unit. Without precise details and figures, we cannot suggest anything more definite.

DIFFERENT COILS FOR THE "LEADER"

"I have all the parts used for the A.C. 'Leader' except the coils. I have, however, two well-known coils (pamphlets enclosed) and should like to use these if possible. Could you give me the necessary connections?"—T. C. K. (Forest Hill, S.E.).

The coils used in the "Leader" are of the H.F. transformer type, but the coils which you have are fitted with a transfer tapping and no primary winding. Whilst it would be possible to use the reaction winding as a primary winding for the aerial coil, the transfer tapping would render the use of the coil impracticable in the present "Leader" circuit arrangement. You could, of course, obtain an H.F. transformer coil to match your present one, but as we have before pointed out, although they would undoubtedly work, you would not be building the "Leader," and, therefore, we could not guarantee the result.

USING A MILLIAMMETER

"I have just bought a good volt-milliammeter, and have connected it in the H.T. negative lead in the usual way. I find that on radio I get good signals and a correct reading, but when I switch over to gramophone I get a very bad hum which completely disappears when I remove the meter. I can also stop it by giving the pentode 7.5 volts bias, but this spoils the tone; 4.5 volts is the correct bias. Can you give me any explanation of the cause of this hum?"—W. C. G. (Barnsbury).

It would appear that the resistance of the meter is being included in some way in the output of your last valve, although you do not state the type of receiver or give circuit details. It will no doubt be found that the inclusion of a large capacity condenser (say 2 mfds.) across the meter will stabilize the circuit and enable the meter to be left in position.

DATA SHEET No. 78.

Cut this out each week and paste it in a notebook.

GRAMOPHONE RECORD CLASSIFICATION.

Size	Label	Type No.	Price	Name
12in.	Purple	—	2s. 6d.	Sterno
10in.	Red	—	1s. 3d.	
10in.	Red	—	1s. 0d.	Homochord
8in.	Blue	P	6d.	Plaza
10in.	Dark Blue	DB	2s. 6d.	
10in.	" "	CB	2s. 6d.	
12in.	" "	DX	4s. 0d.	Columbia
10in.	Light Blue	LB	4s. 0d.	
12in.	" "	LX	6s. 0d.	
10in.	" "	—	1s. 6d.	Regal Zonophone
10in.	Red	—	1s. 6d.	Imperial
12in.	Red	—	2s. 0d.	
12in.	Blue	K	2s. 6d.	
10in.	Red	LY	2s. 6d.	Decca
10in.	Blue	F	1s. 6d.	
10in.	Gold	DE	2s. 6d.	
12in.	Gold	CA	4s. 0d.	

(To be continued)

A SIMPLE MISTAKE

"I have a 3-valve set, S.G., detector, and power, with a screening plate between H.F. and detector stages. I get a humming sound most of the time, and on long waves, the set oscillates without any reaction. With very careful tuning it is possible to get one or two stations, but the slightest movement of the dials and a 'plop' is heard, and the set oscillates. Can you explain, please?"—J. F. H. (Manchester).

The examination of your circuit diagram which you enclosed shows that you have no voltage applied to the screening grid. The condenser which should be used as a by-pass between screening grid and earth has been inserted between the screening grid and the H.T. positive supply. Thus, no voltage is being applied to the screen. You will have to alter the connections to the condenser so that one side of the condenser is connected to earth, and the other side to the screening grid, and then make a connection from the screening grid to H.T. positive. The voltage to apply will be some valve between 60 and 80, and experiment will show the most suitable value for stable results.

REDUCING THE WAVELENGTH

"I have a commercial three-valve set to which I have now fitted an outdoor aerial, the total length of which, including lead-in, is about 60ft. I thought I should be able to tune down to Fécamp by using this aerial, but I find that the dial settings have hardly altered. I should like to get down to this low wavelength and should be glad if you would tell me how."—F. C. G. (Cardiff).

If the new aerial is longer than the previous one it will have made matters worse. The only satisfactory way to tune down to the wavelength in question is to remove one or two turns at a time from the tuning coils, testing the receiver as you proceed, so that you can just get the station in question. You will, of course, affect the maximum tuning limit by doing this, but the minimum wavelength to which the receiver is tuned is obviously too high for the 200-meter transmission.

COIL CANS

"In December you gave an article on making your own screened coils. I wish to make these, but want to use cans of 3in. diameter. Will this require any alteration to the coil windings?"—J. C. W. (Cricklewood).

It will make a very slight difference to the inductance of the coils if you employ the larger can, but if desired this could be compensated for by removing two turns from the medium-wave windings and five from the long-wave windings.

UNDER-POWERED

"I have built an all-mains 3-valve set, circuit enclosed. This employs S.G., detector, and pentode output valves, and derives its H.T. from a mains eliminator giving 150 volts at 60 milliamps. The filaments are heated from a separate mains transformer. Volume and quality are very poor on both radio and gramophone. As there is a pentode in the output stage which should give 4 watts, and I doubt whether it gives ¼ watt, I should like some indication of where to look for the cause of the trouble."—B. M. F. J. (Swansea).

We think the principal fault lies in the mains unit which you are using. The circuit and values are quite in order, but as you state that the output valve is supposed to deliver 4 watts, we should imagine that this is a mains valve rated to work with 250 volts H.T. Therefore, you are not operating it at its best condition, and cannot expect the maximum output. The values of decoupling and coupling resistances which you show would be quite suitable for a 250-volt supply and we would suggest that you increase this in order to operate all the valves at their optimum points.

FREE ADVICE BUREAU.

COUPON

This coupon is available until May 19th, 1934, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 12/5/34.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word prepaid — minimum charge 3/- per paragraph—and must reach this office not later than Tuesday for the following week's issue. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8 Southampton Street, Strand, London.

PREMIER SUPPLY STORES

offer the following Set Manufacturers' Surplus New Goods at a fraction of the original cost; all goods guaranteed perfect; carriage paid over 5/-, under 5/- postage 6d. extra (Ireland, carriage forward).

PREMIER SUPPLY STORES announce the purchase of the entire stock of a world-famous Continental valve manufacturer. All the following types of standard mains valves at 4/6 each. H. HL. L. Power. Directly heated 6-watt Pentode. Directly-heated 9-watt Pentode. High magnification Screen-grid, low magnification Screen-grid. Variable-Mu Screen-grid. 250 volt 60 milliamp, full-wave rectifiers.

THE following type 5/6 each. Indirectly heated Pentode, 350 volt 120 milliamp, full-wave Rectifier. 500v. 120 ditto, 6/6. Dario Battery Valves 4v. filament, Set of 3, consisting of Screen-Grid, Detector and Power or Super-Power, 6/6 the lot. Power or Super-Power, 2/6.

ELIMINATOR Kits, including Transformer, choke, Westinghouse metal rectifier, Dubilier condensers, resistances and diagram, 120v, 20 m.a., 20/-; trickle charger 8/- extra; 150v. 30 milliamps, with 4v. 2-4 amps. C.T. L.T., 25/-, trickle charger 6/6 extra; 250v. 60 milliamps, with 4v., 3-5 amps. C.T. L.T., 30/-; 300v. 60 m.a., with 4 volts 3-5 amps. C.T. L.T., 37/6; 150 volts 50 milliamps, 27/6.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Premier chokes, 25 milliamps. 20 henries, 2/9; 40 milliamps, 25 hys., 4/-; 65 milliamps. 30 hys., 5/6; 150 milliamps. 30 hys., 10/6; 60 milliamps, 80 hys., 2,500 ohms, 5/6.

HARLEY Pick-up, complete with arm and volume control, 12/6.

BRITISH RADIOPHONE Wire Wound Potentiometers, with mains switch incorporated, 10,000 ohms, 3/6.

PREMIER British-made Meters, moving-iron, flush mounting, accurate, 0-10, 0-15, 0-50, 0-100, 0-250 ma., 0-1, 0-3, 0-5 amps.; all at 6/-.

SPECIAL offer of Mains Transformers, manufactured by Phillips, input 100-120v. or 200-250v. output 180-0-180 volts 40 m.a., 4 v. 1 amp., 4 v. 3 amp., 4/6; 200-0-200v., 4v. 1a., 4v. 3a., 4 6.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips with terminal connections, input 200-250v. 40-100 cycles, all windings paper interleaved.

PREMIER H.T.8. Transformers, 250v. 60 m.a., rectified with 4v. 3-5a. and 4v. 1a. C.T. L.T., screen primary, 15/-; with Westinghouse rectifier, 25/-.

4V. 3a. C.T., 6v. 2a C.T., 9v. 1a., 12v. 1a., 7/6 each; 4v. 3-5a., 22v. 1a., 8/6 each; 10v. 3a., 14v. 4a., 10/- each.

PREMIER H.T.9 Transformer, 300 v. 60 m.a., with 4v. 3-5a. and 4v. 1a. C.T., L.T., and screened primary, 15/-; with Westinghouse rectifier, 26/-.

PREMIER H.T.10 Transformer, 200v. 100 m.a., rectified, with 4v. 3-5a. and 4v. 1a. C.T., L.T. and screened primary 15/-; with Westinghouse rectifier, 26/-.

PREMIER Mains Transformers, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., C.T., L.T., 2/- extra; Westinghouse rectifier for above, giving 200v. 30 m.a., 8/6.

PREMIER Mains Transformers, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.); with screened primary, 15/-.

PREMIER Mains Transformers, output 350-0-350v. 90 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.), with screened primary, 15/-.

PREMIER Mains Transformers, output 400-0-400v., 100 m.a., 4v. 4-5a., 4v. 2-3a., with screened primary, 15/-

PREMIER Auto Transformers, 100-110/200-250v., or vice versa, 100-watt, 10/-.

MULTI Radio Output Transformers, 4/6. Twin Screened Wire 3d. per yard.

CENTRALAB Potentiometers, 50,000, 250,000 half meg., any value, 2/-; 200 and 400 ohms, 1/-.

RELIABLE Canned Coils with Circuit, accurately matched dual range, 3/- per coil. Please state whether Aerial or H.F. required. Ditto iron core, 3/6.

PREMIER L.T. supply Units, consisting of Premier Transformer and Westinghouse rectifier, input 200-250v. A.C., output 2v. ½ amp., 11/-; 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 15v. 1 amp., 19/-; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C. 152 Magna, 2,500 ohms, 37/6; all complete with humbucking coils; please state whether power or pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M., 7in. cone, 18/6. Ditto 9in. cone, 29/6.

POLAR 3-Gang STAR, .0005, manufacturers type. Fully screened, 7/6, with trimmers, 1/6 extra.

WESTERN ELECTRIC Condensers, 250v. working, 2 mfd., 1/-; 1 mfd., 6d.; 4 mfd., 2/-; 1 mfd., 400v., 1/-; 2 mfd., 1/6.

B.T.H. Truespeed Induction Type (A.C. only) Electric Gramophone Motors, 100-250v., 30/-; complete. Type YH 100/250v. A.C. or D.C., 42/-.

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RELIABLE Intervalve Transformers 3-1 or 5-1, 2/-. Dubilier, .05 mica, 1/9.

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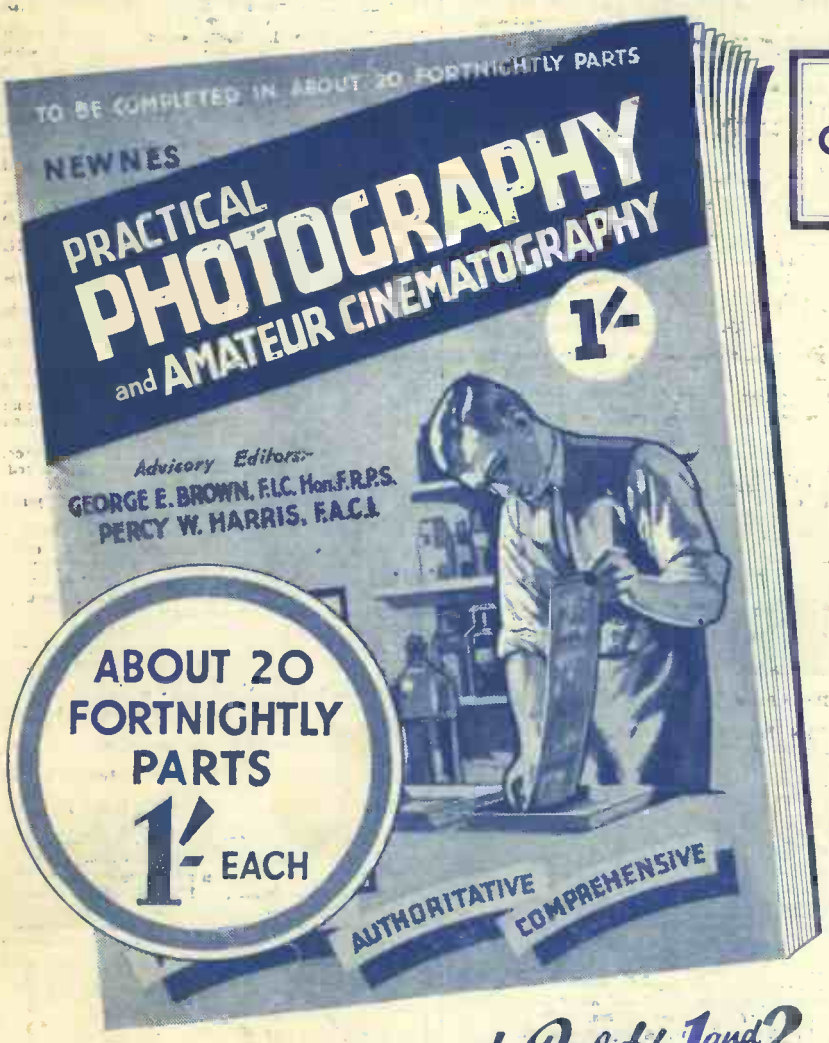

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